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(54) **WHITE LIGHT DEVICES USING NON-POLAR OR SEMIPOLAR GALLIUM CONTAINING MATERIALS AND PHOSPHORS**

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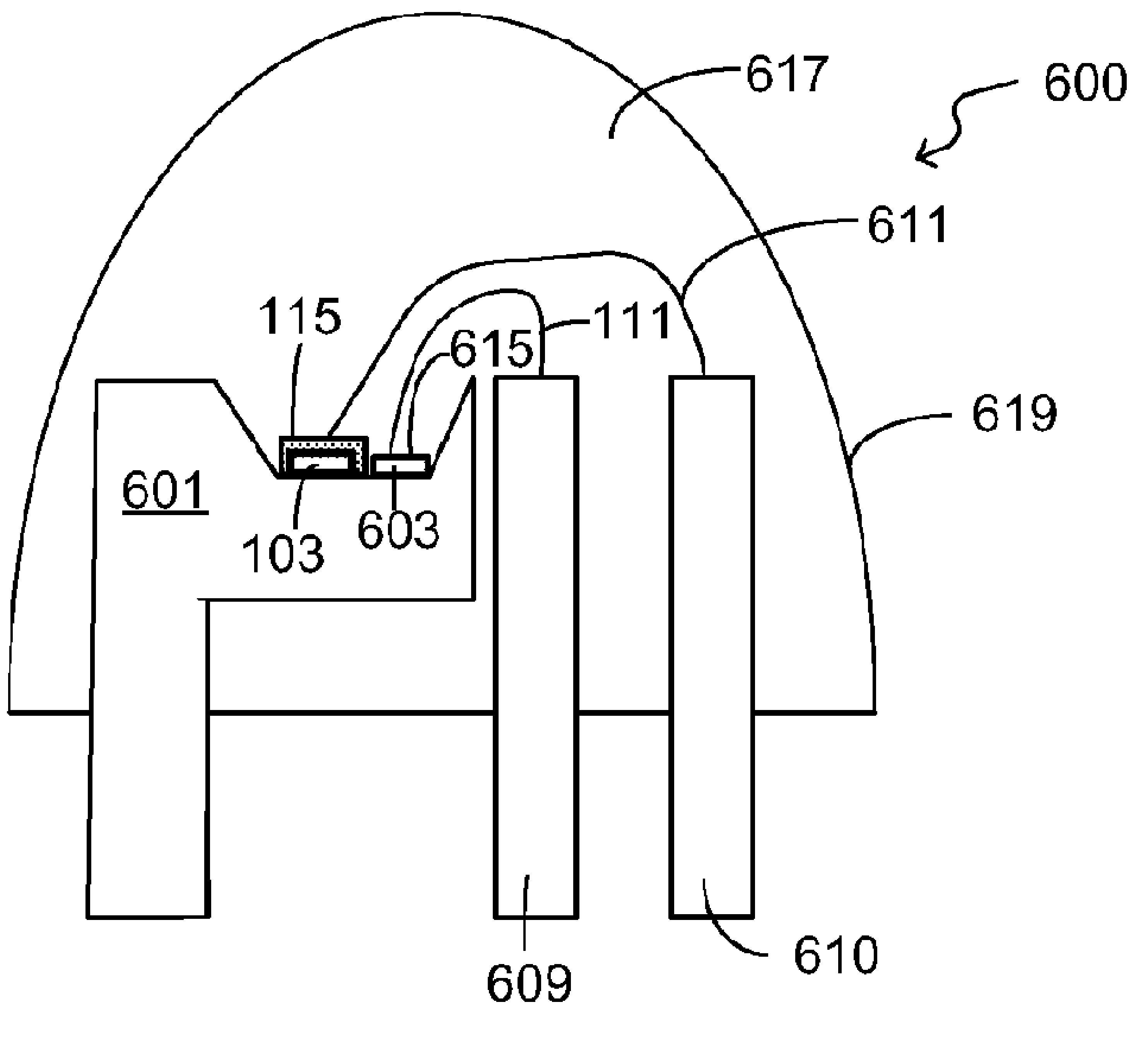
(57) **ABSTRACT**

A packaged optical device includes a substrate having a surface region with light emitting diode devices fabricated on a semipolar or nonpolar GaN substrate. The LEDs emit polarized light and are characterized by an overlapped electron wave function and a hole wave function. Phosphors within the package are excited by the polarized light and, in response, emit electromagnetic radiation of a second wavelength.

93 Claims, 6 Drawing Sheets



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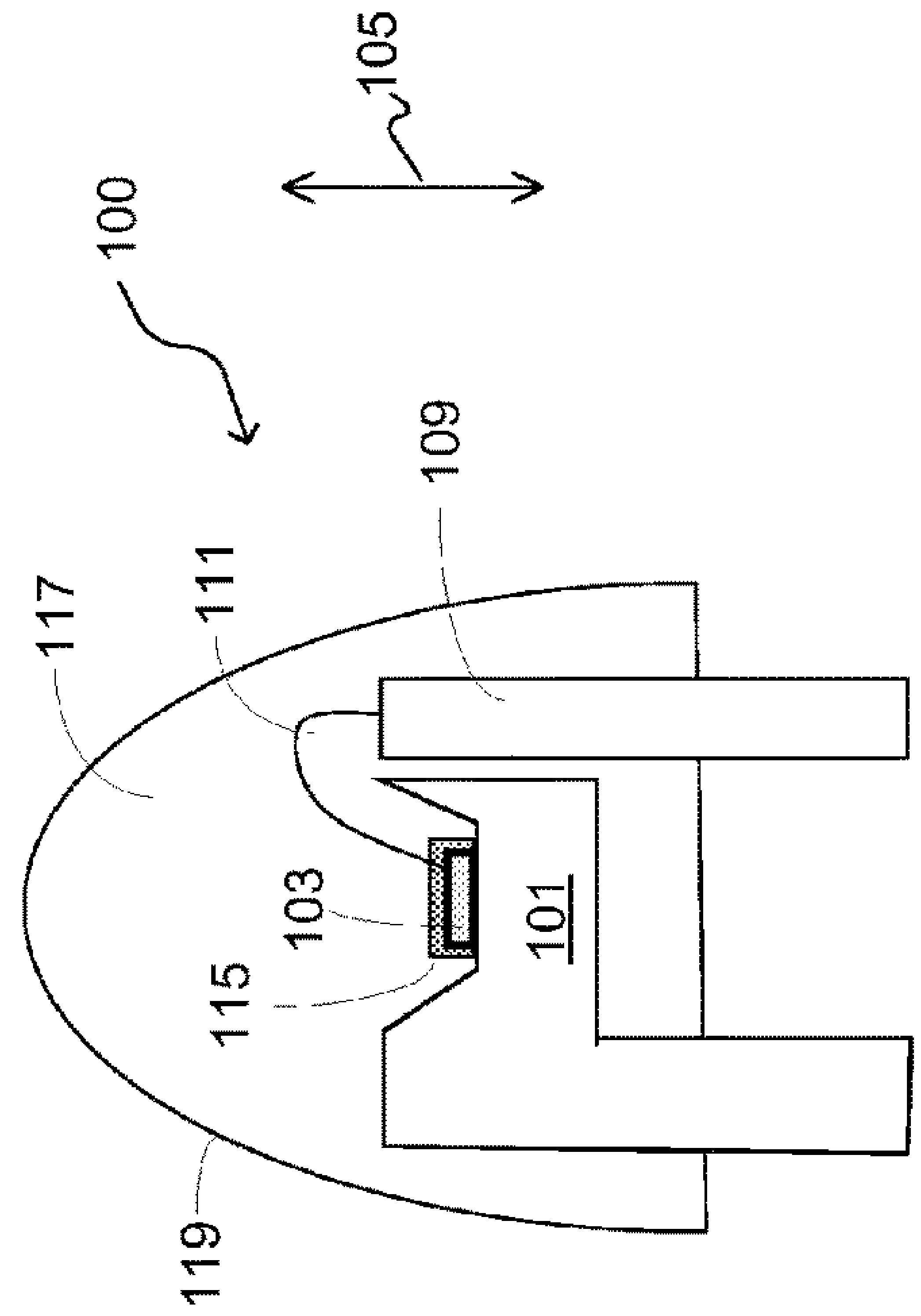

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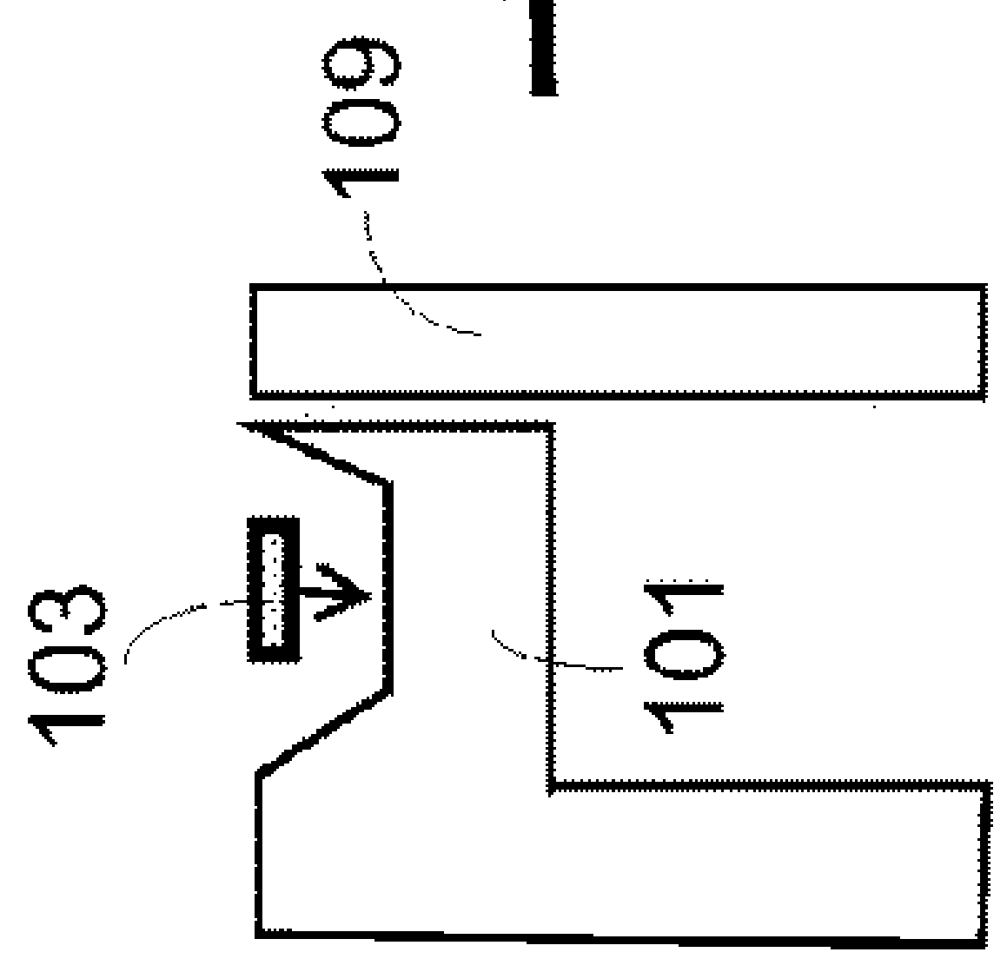

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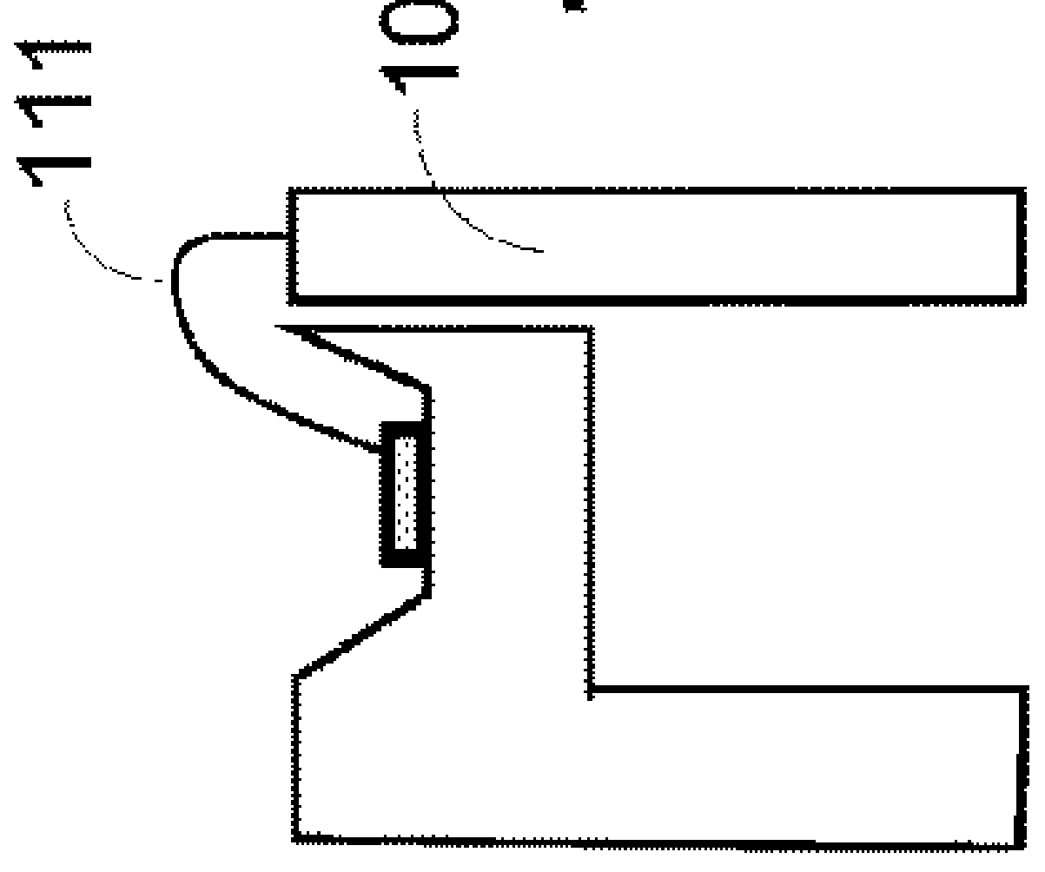

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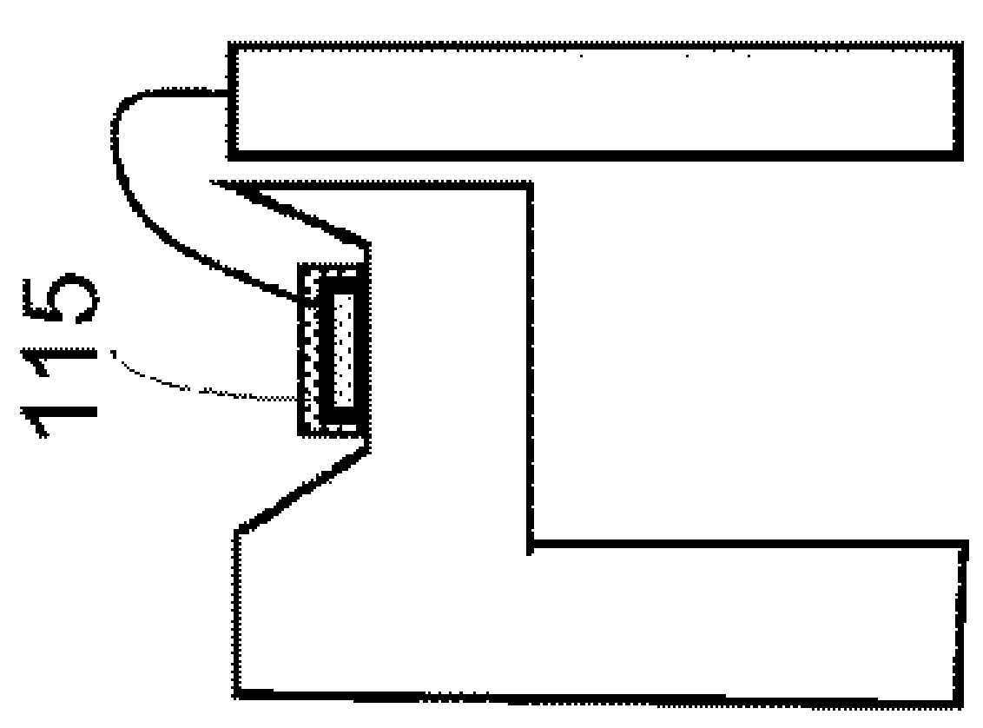

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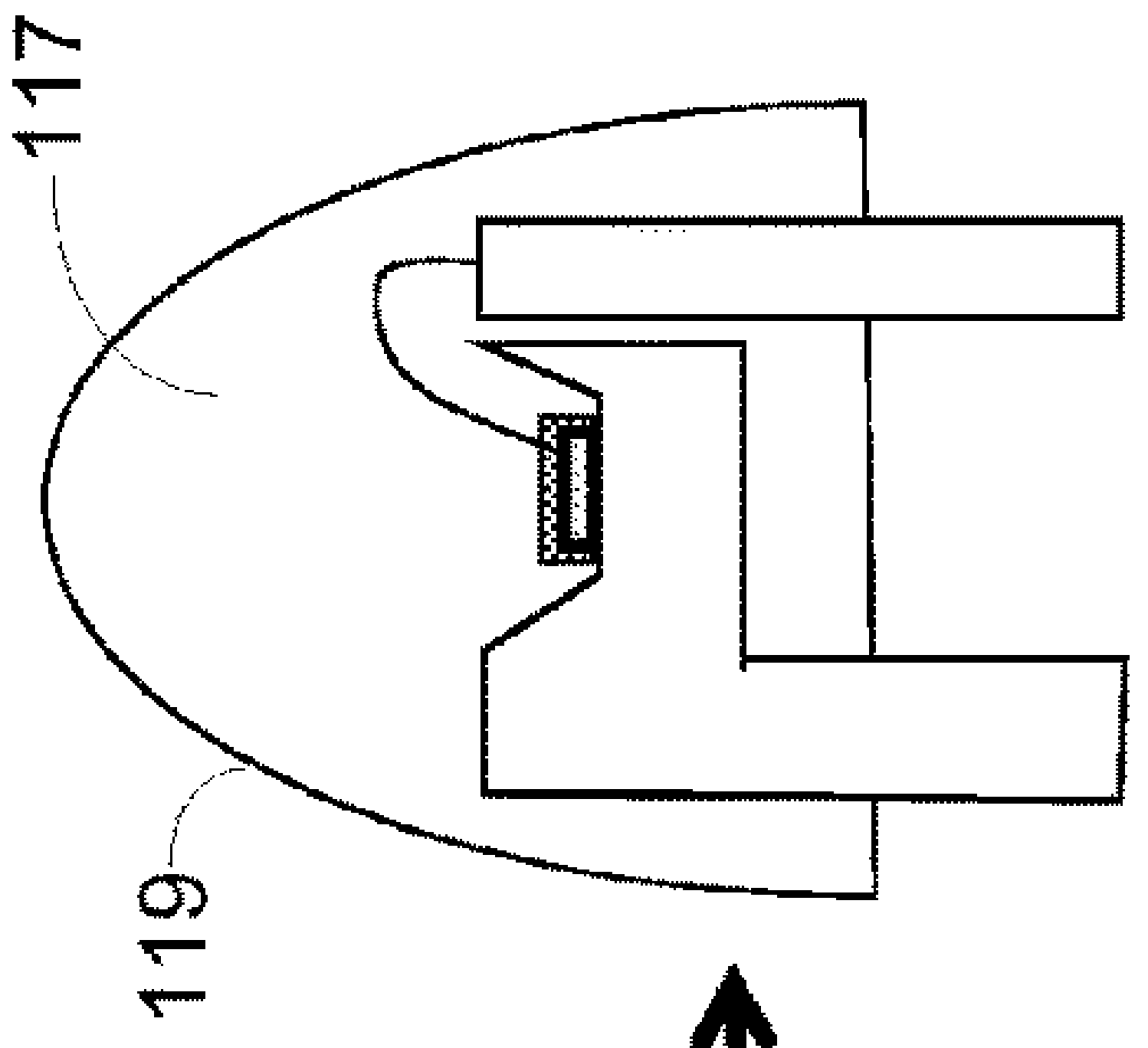

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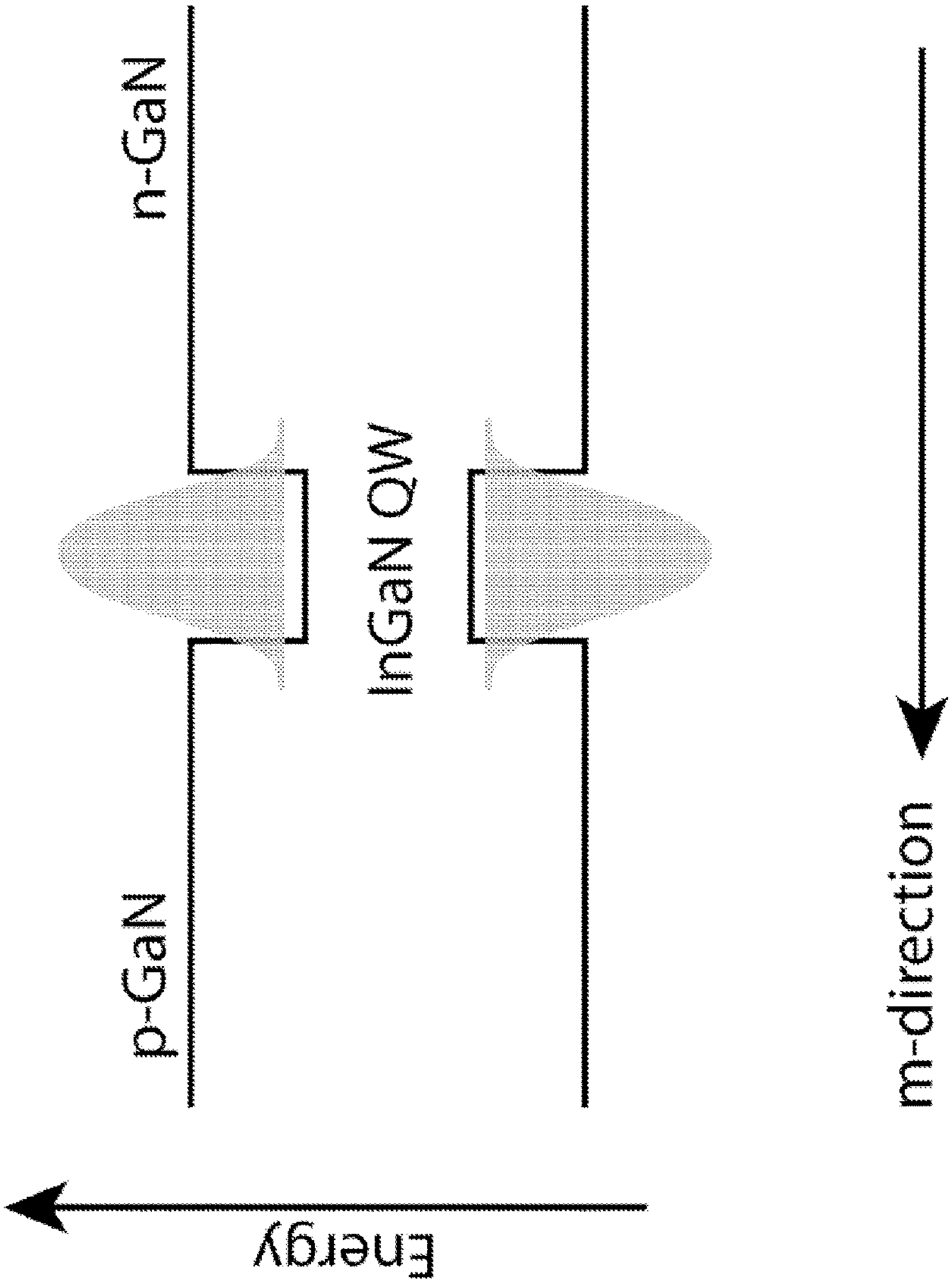

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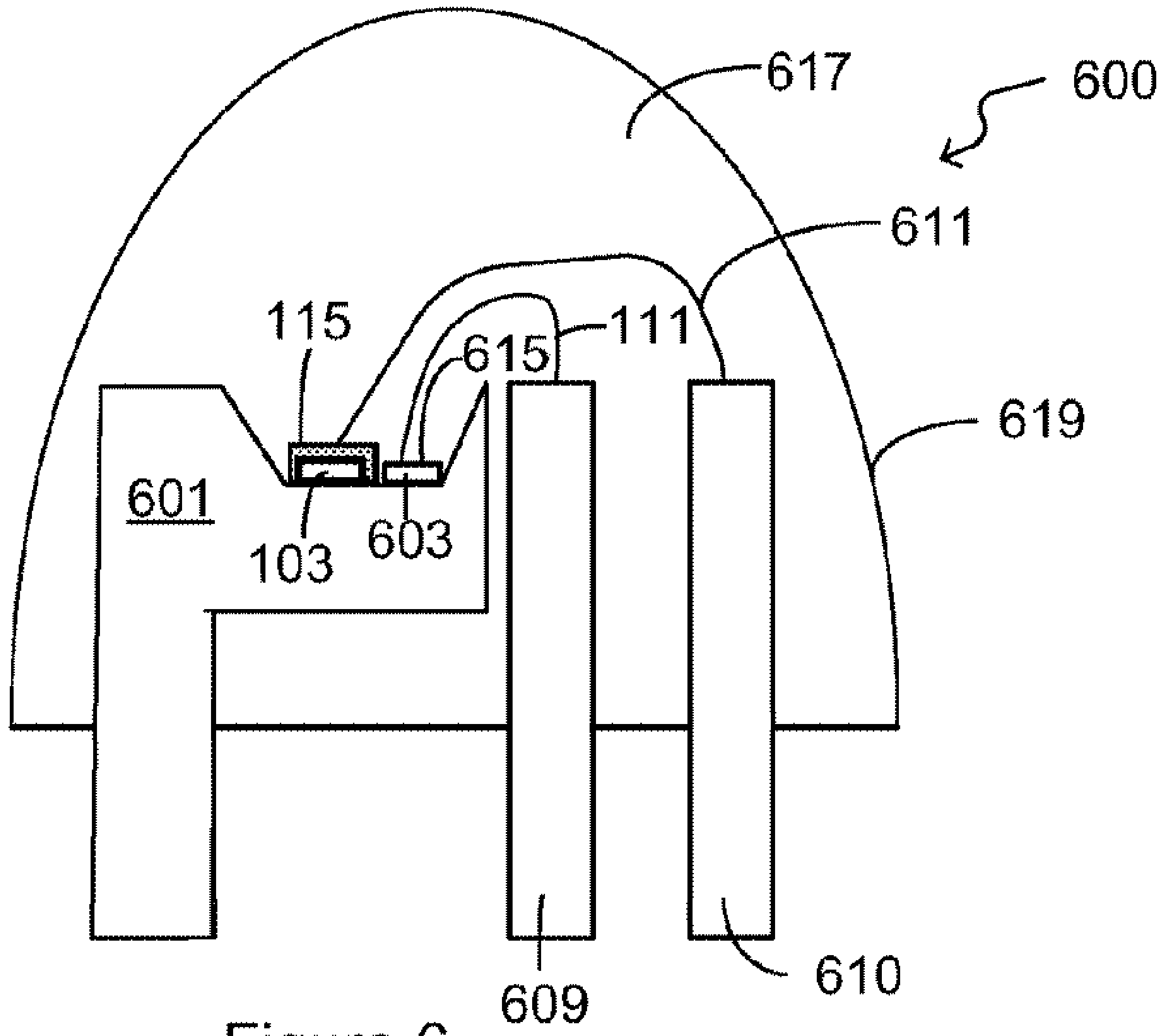

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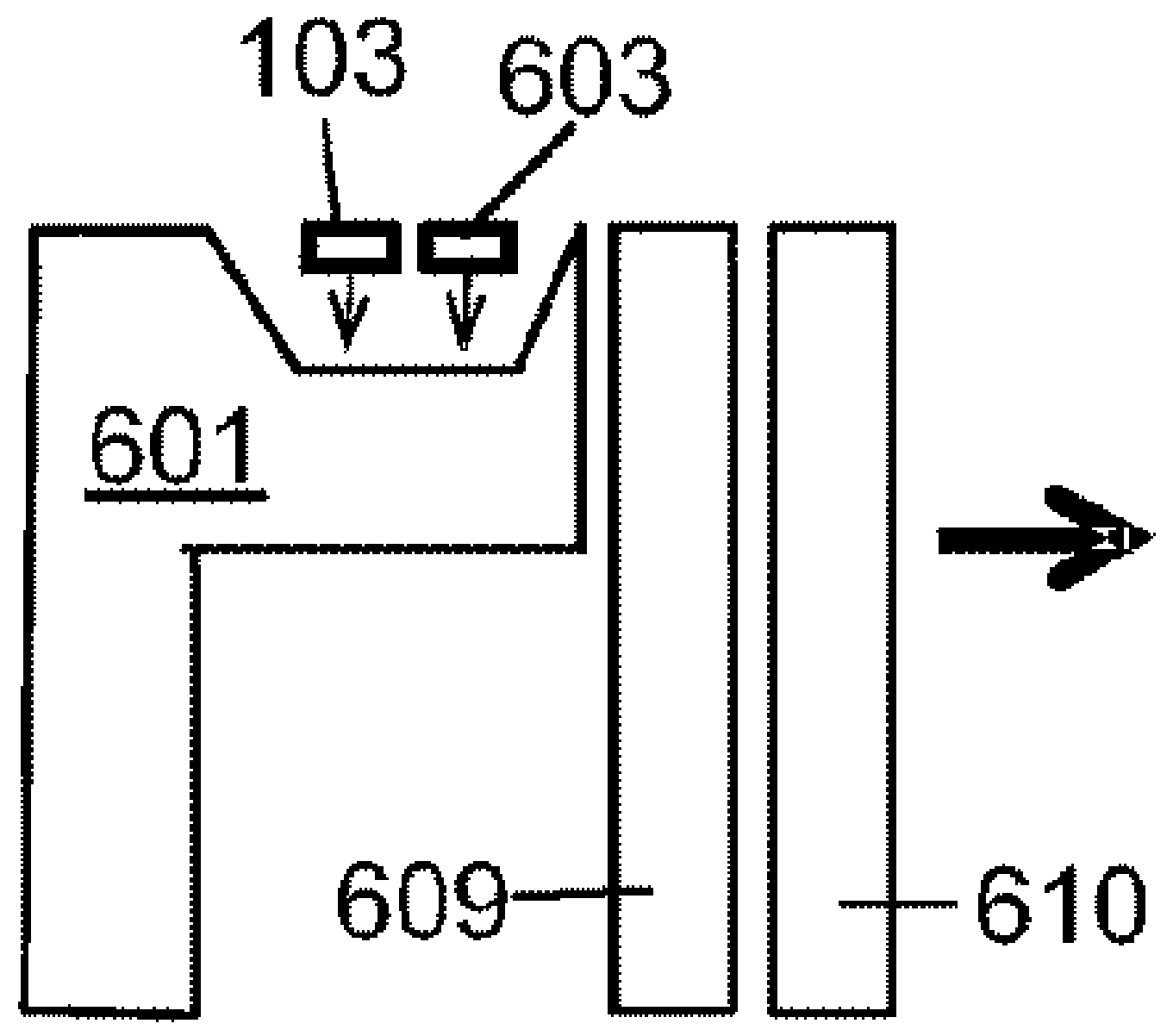

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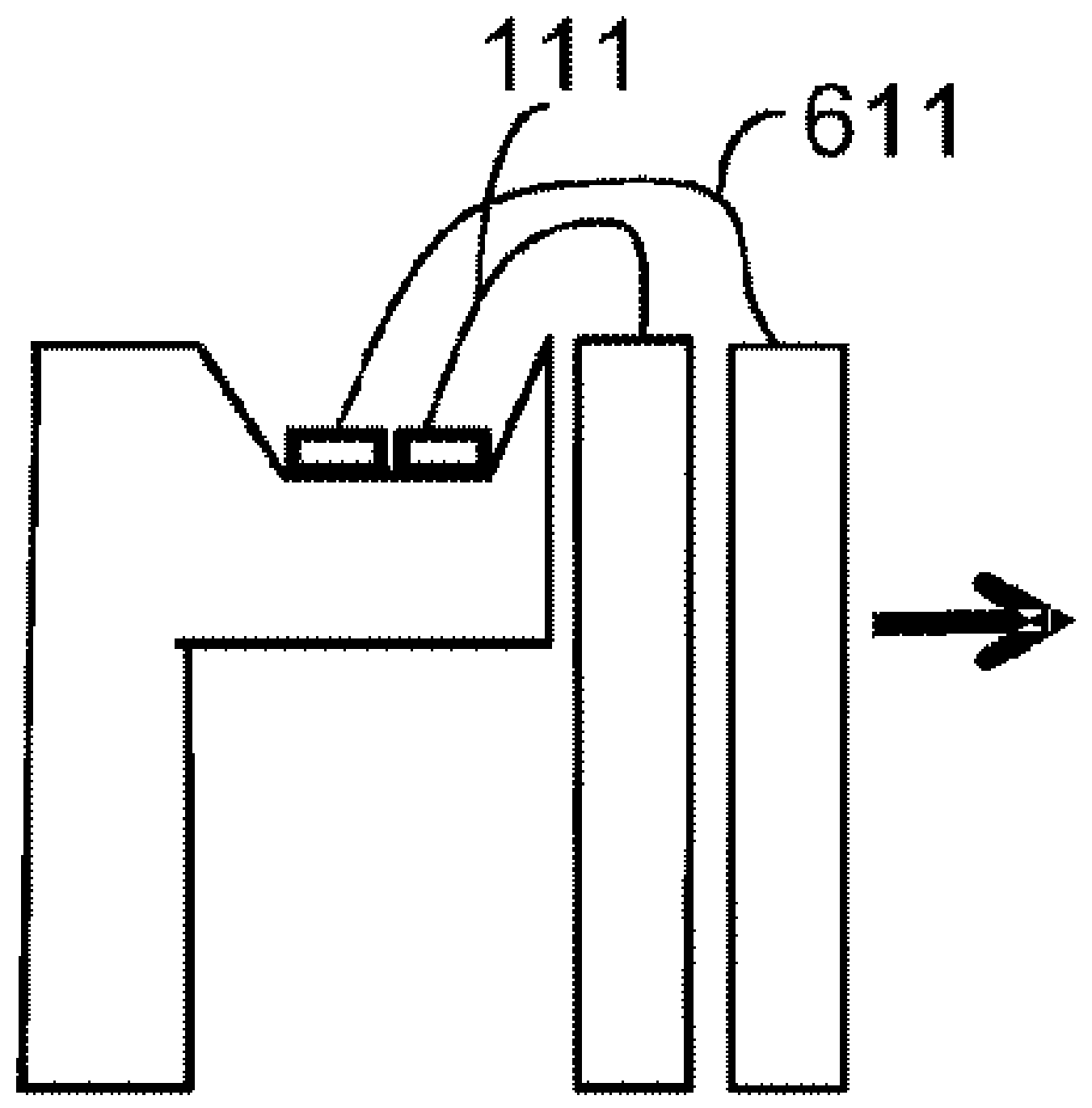

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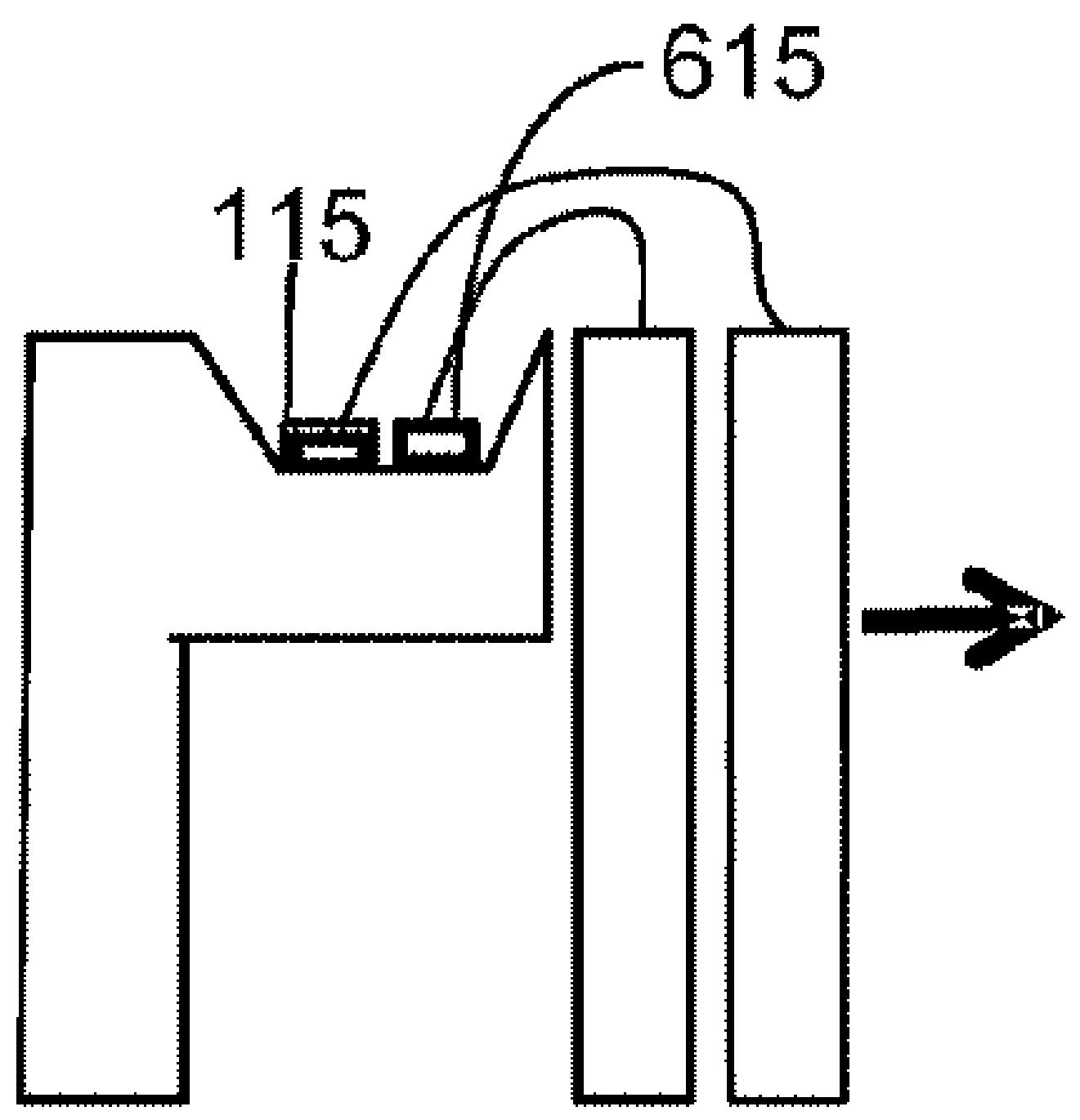

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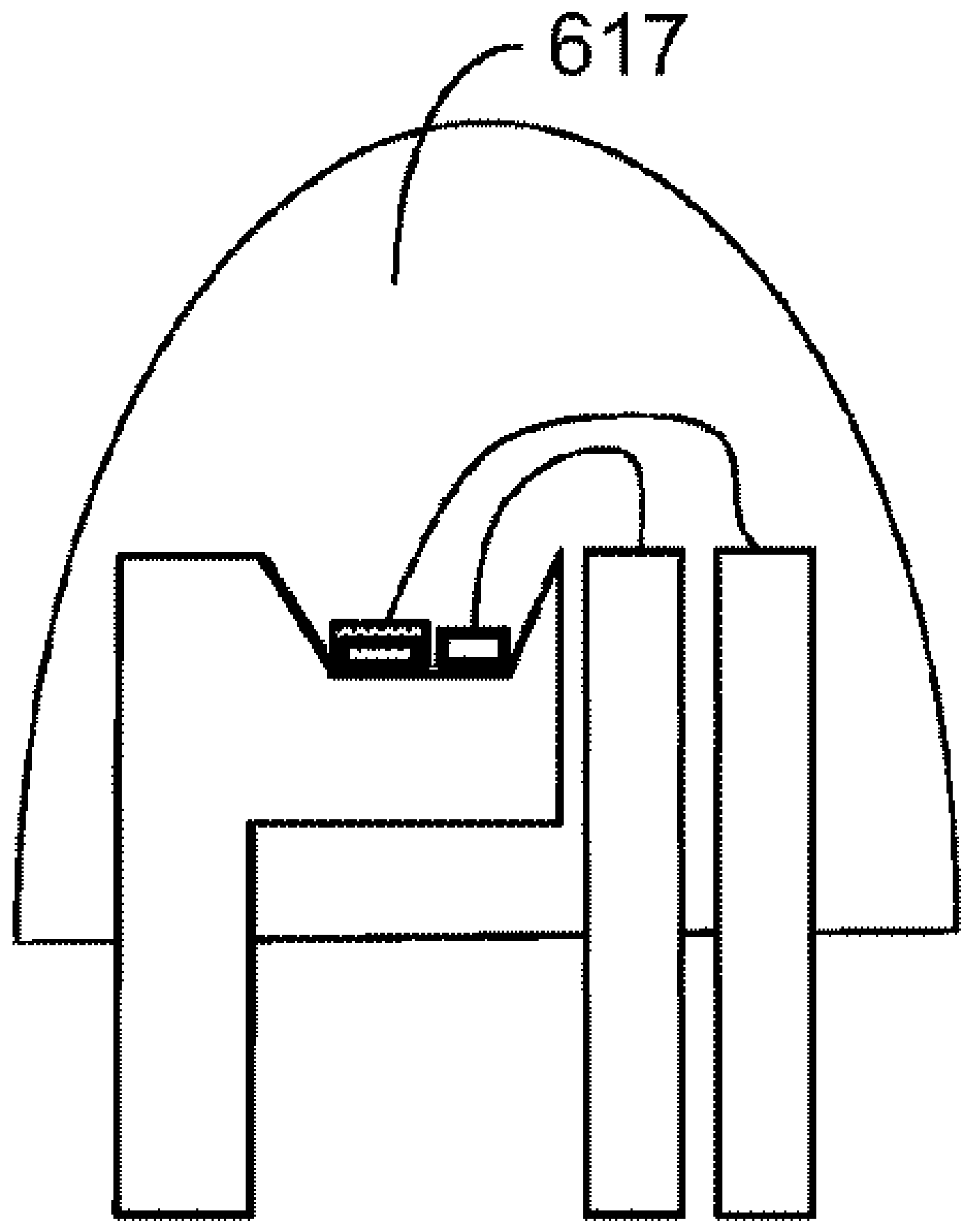


Figure 10

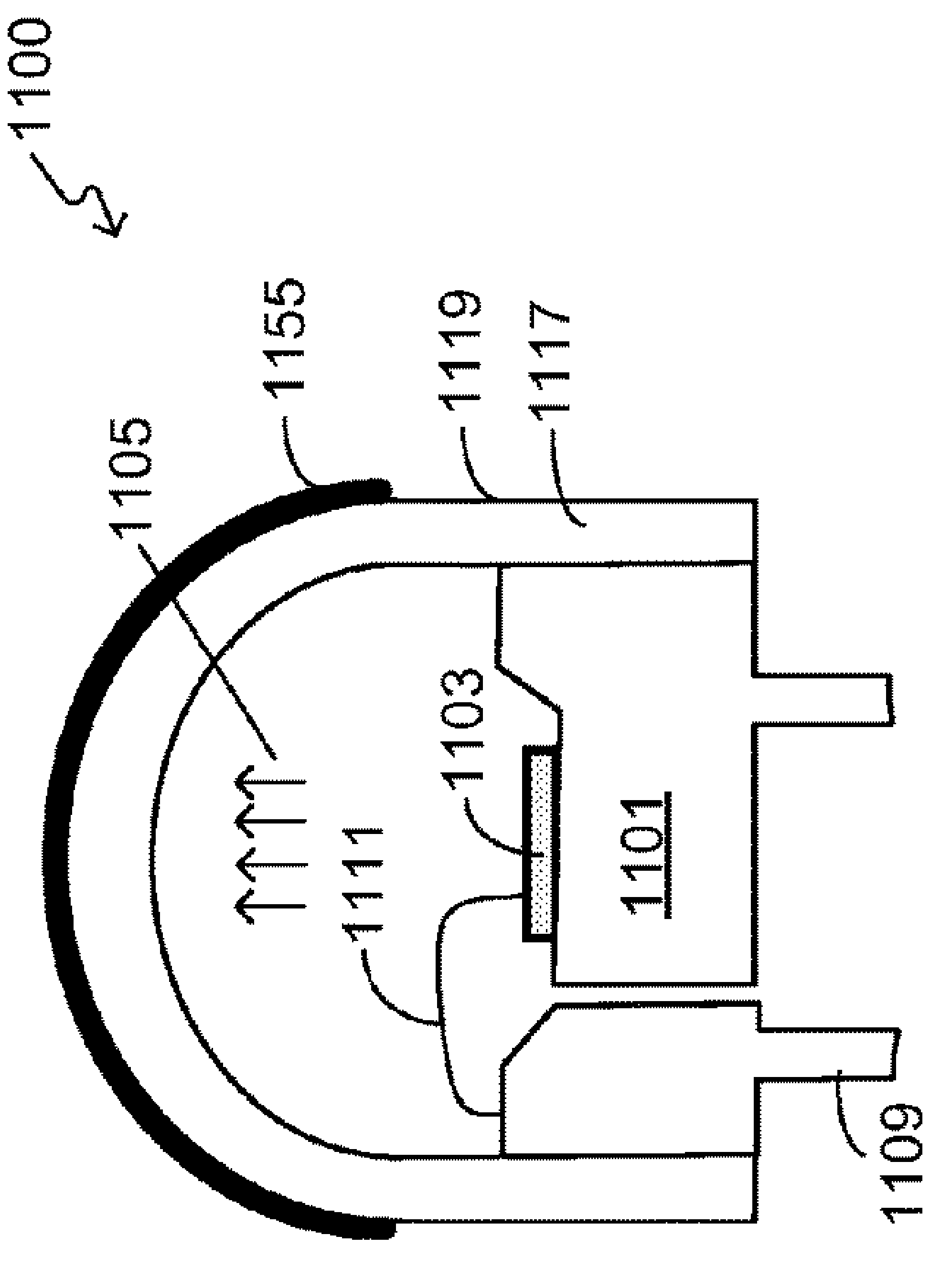


Figure 11

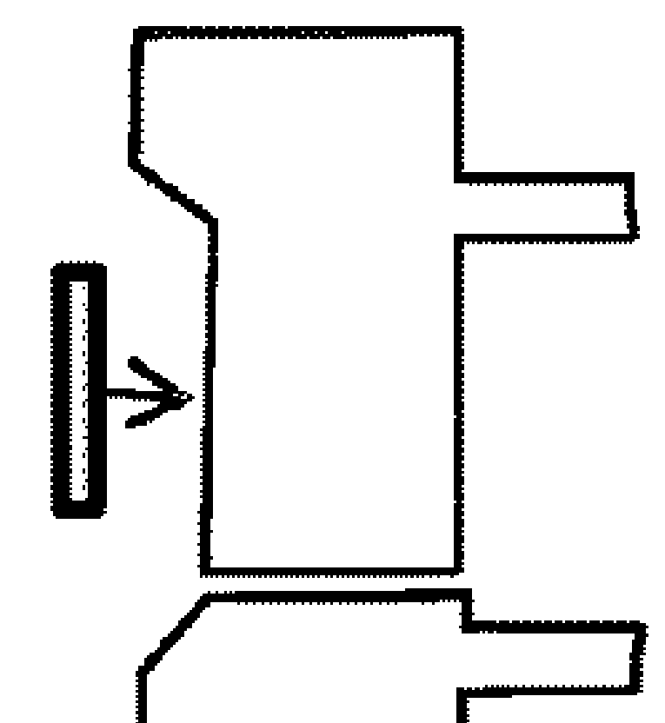
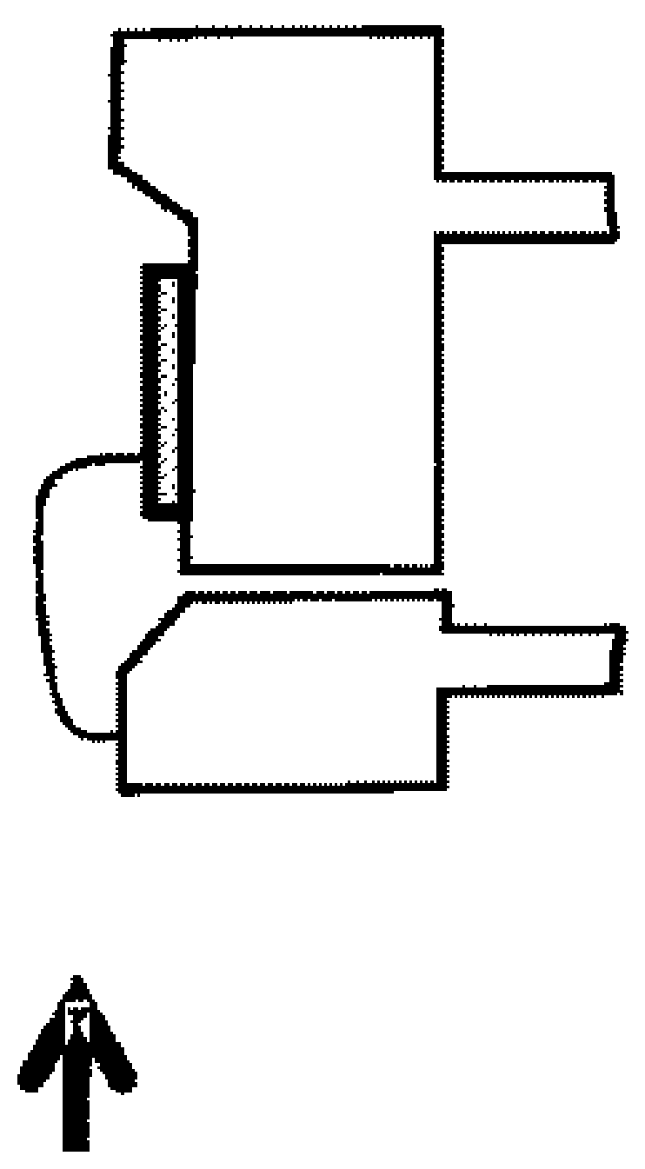


Figure 12



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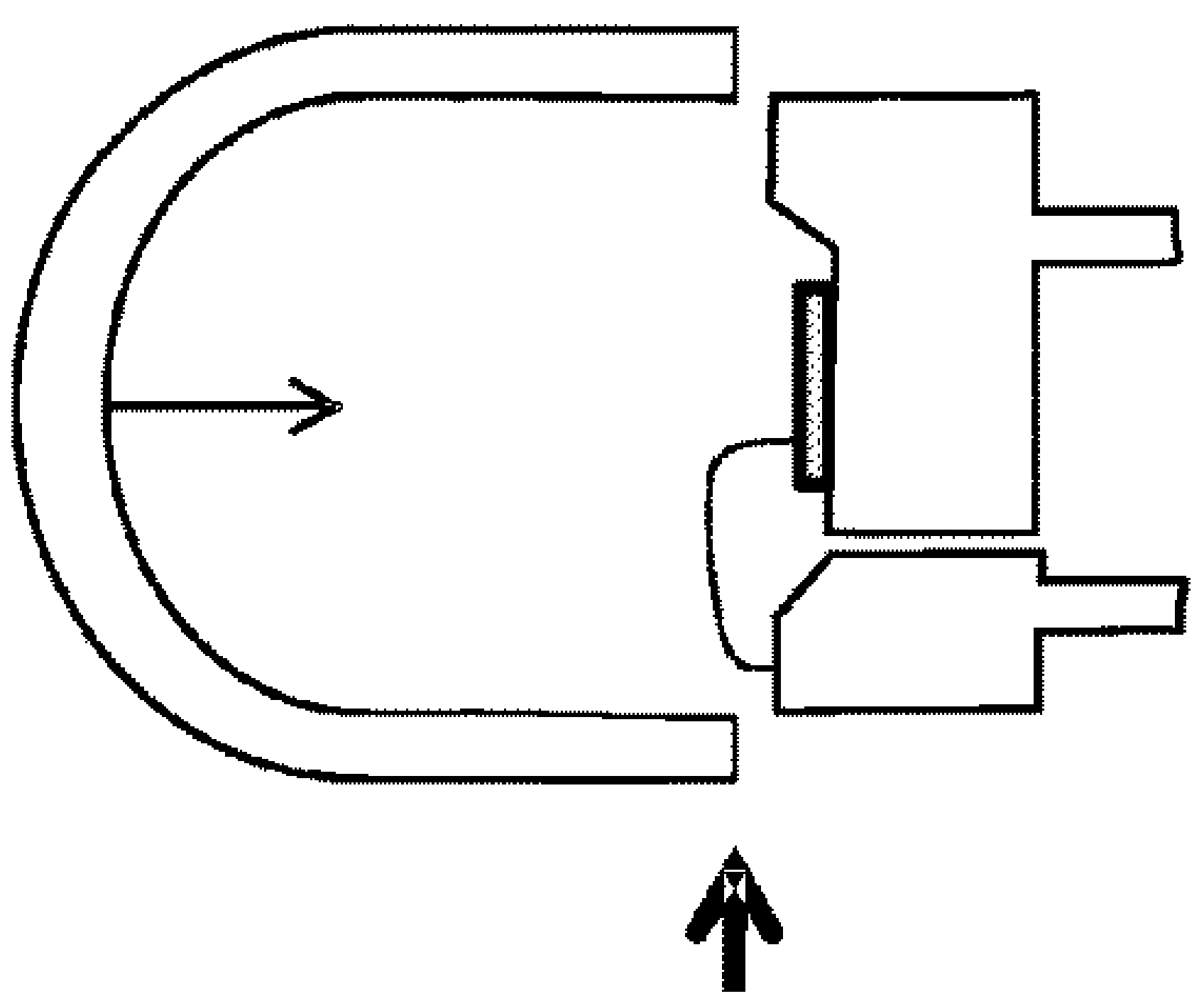

Figure 14

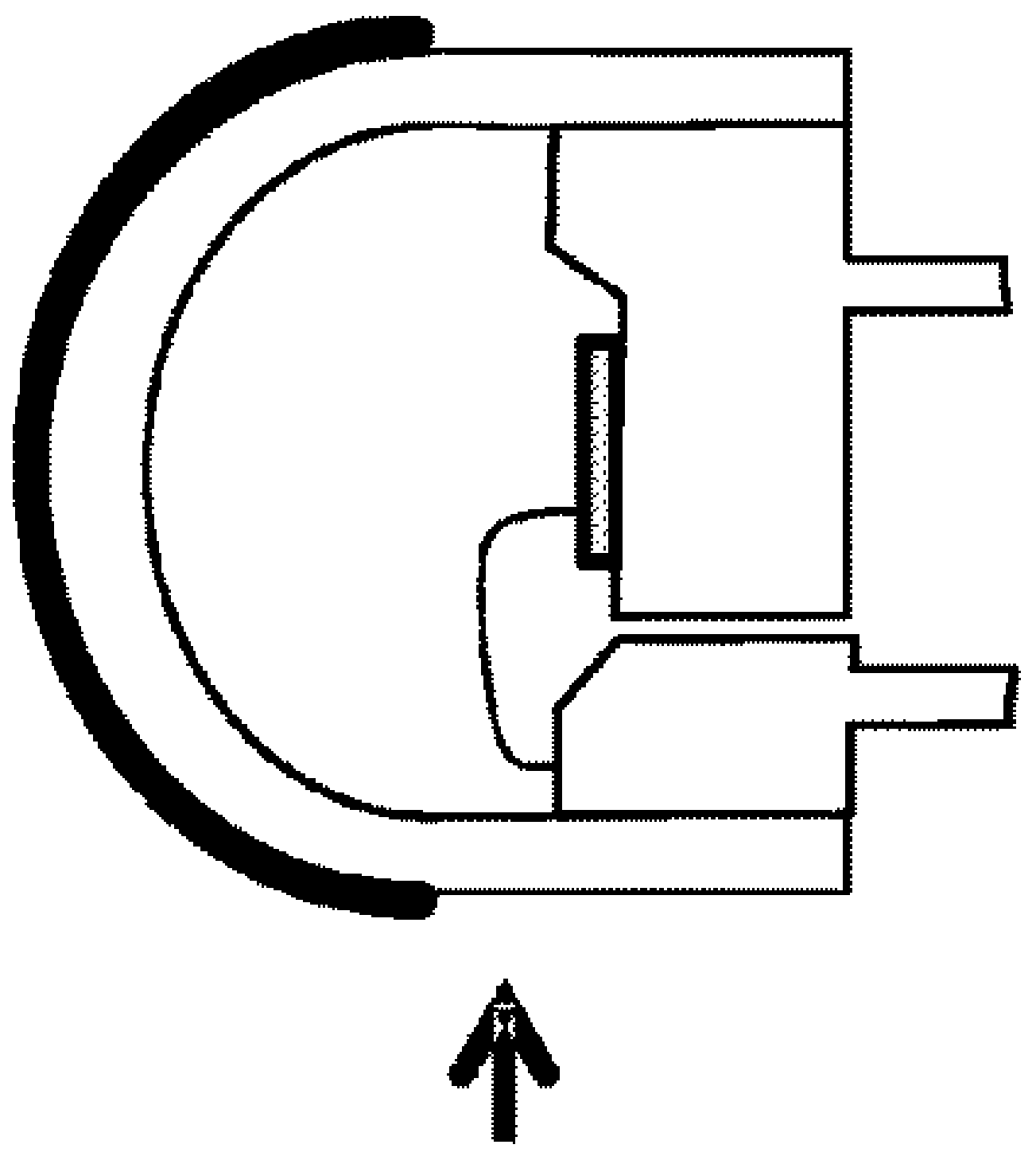

Figure 15

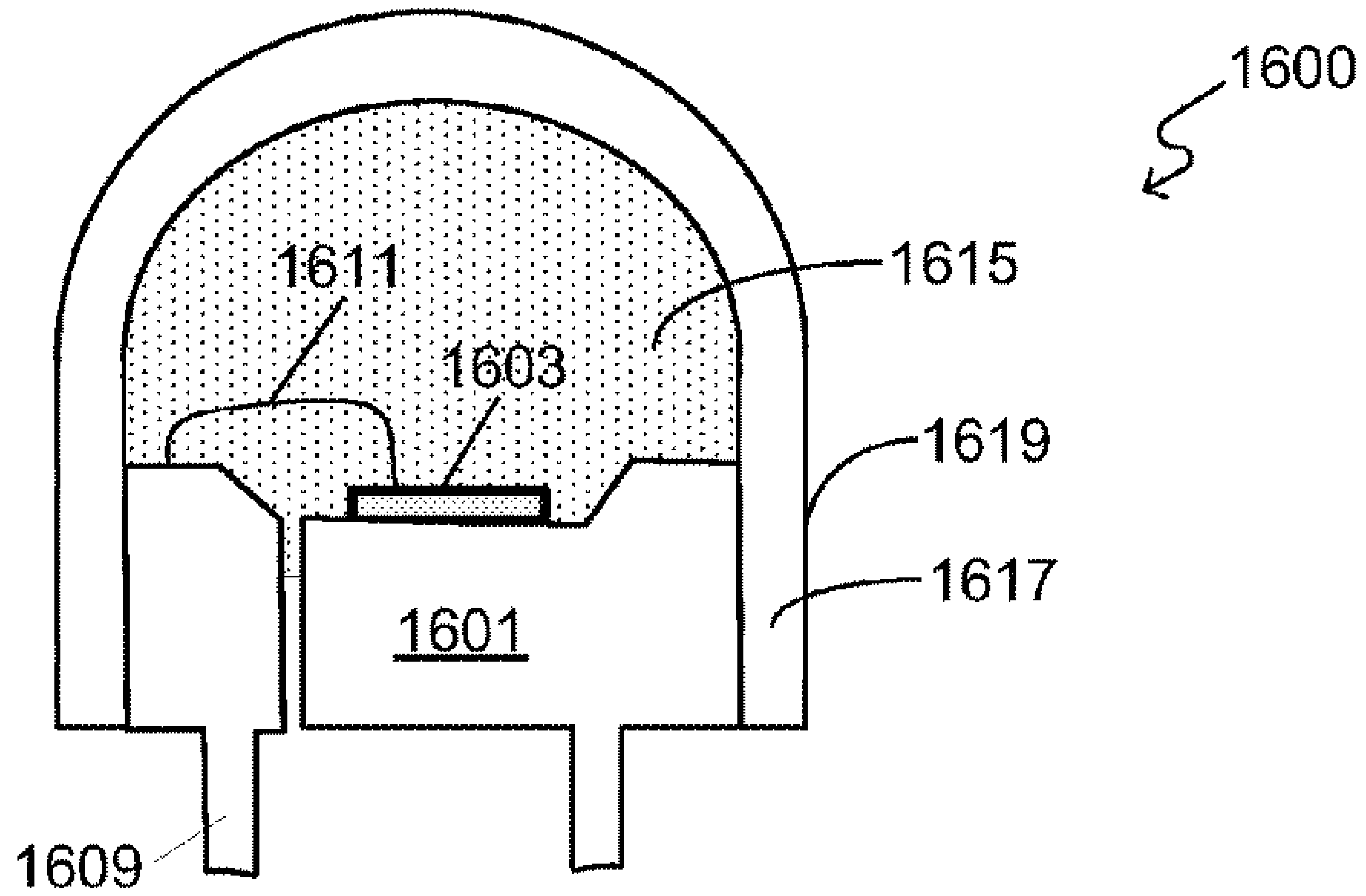

Figure 16

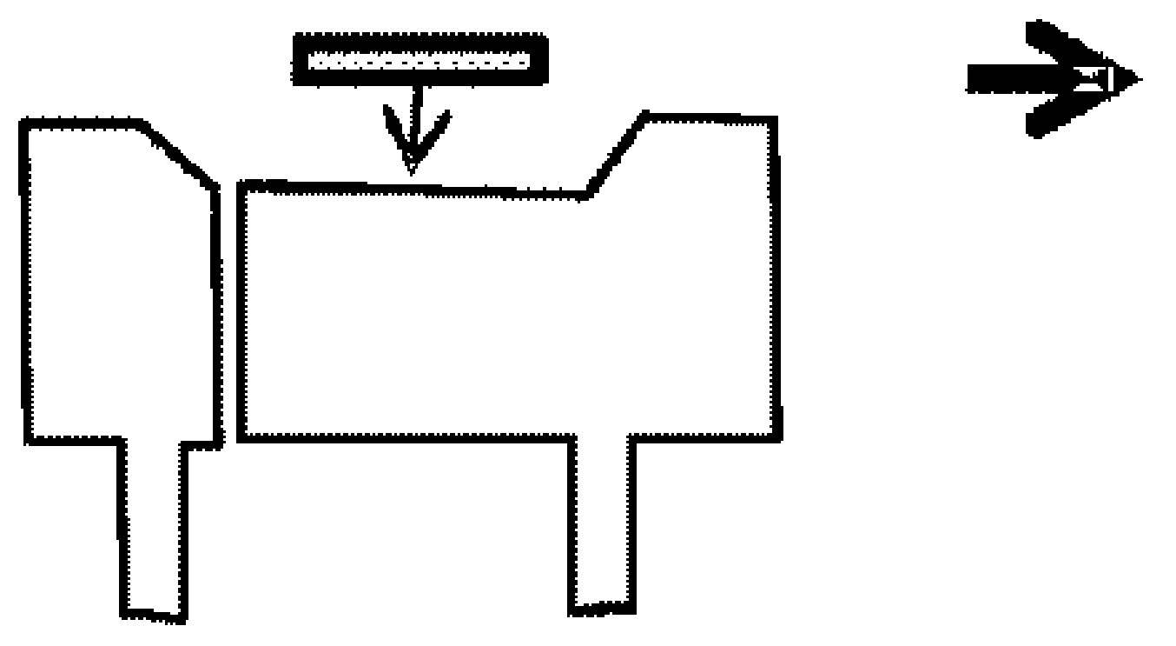

Figure 17

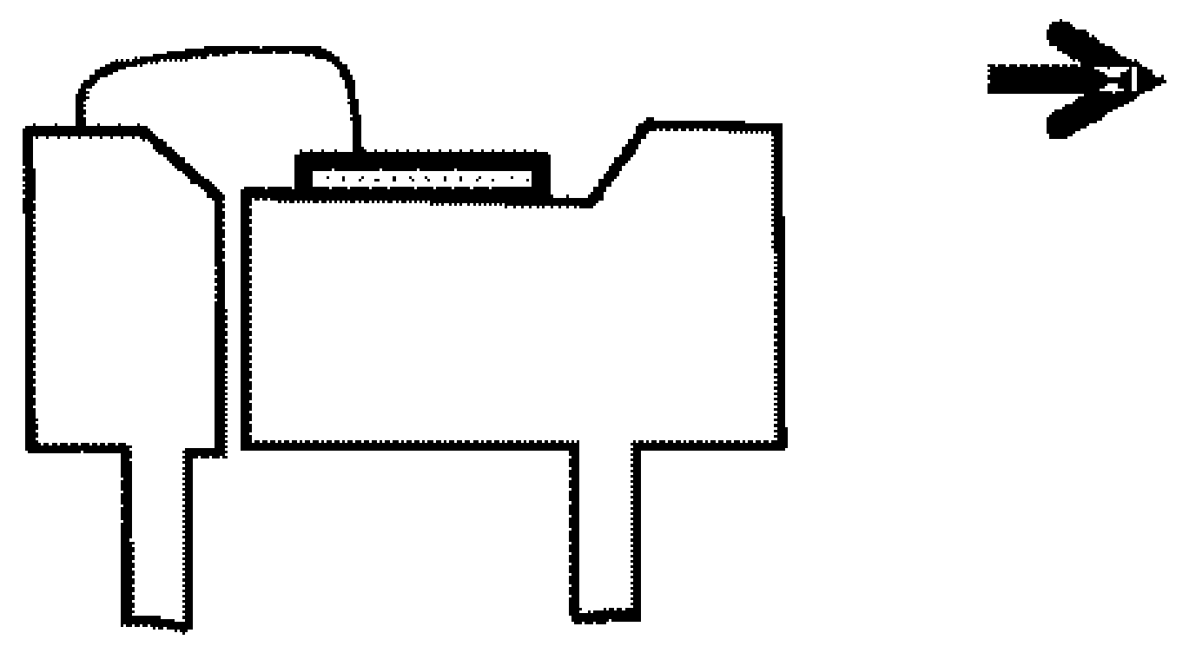

Figure 18

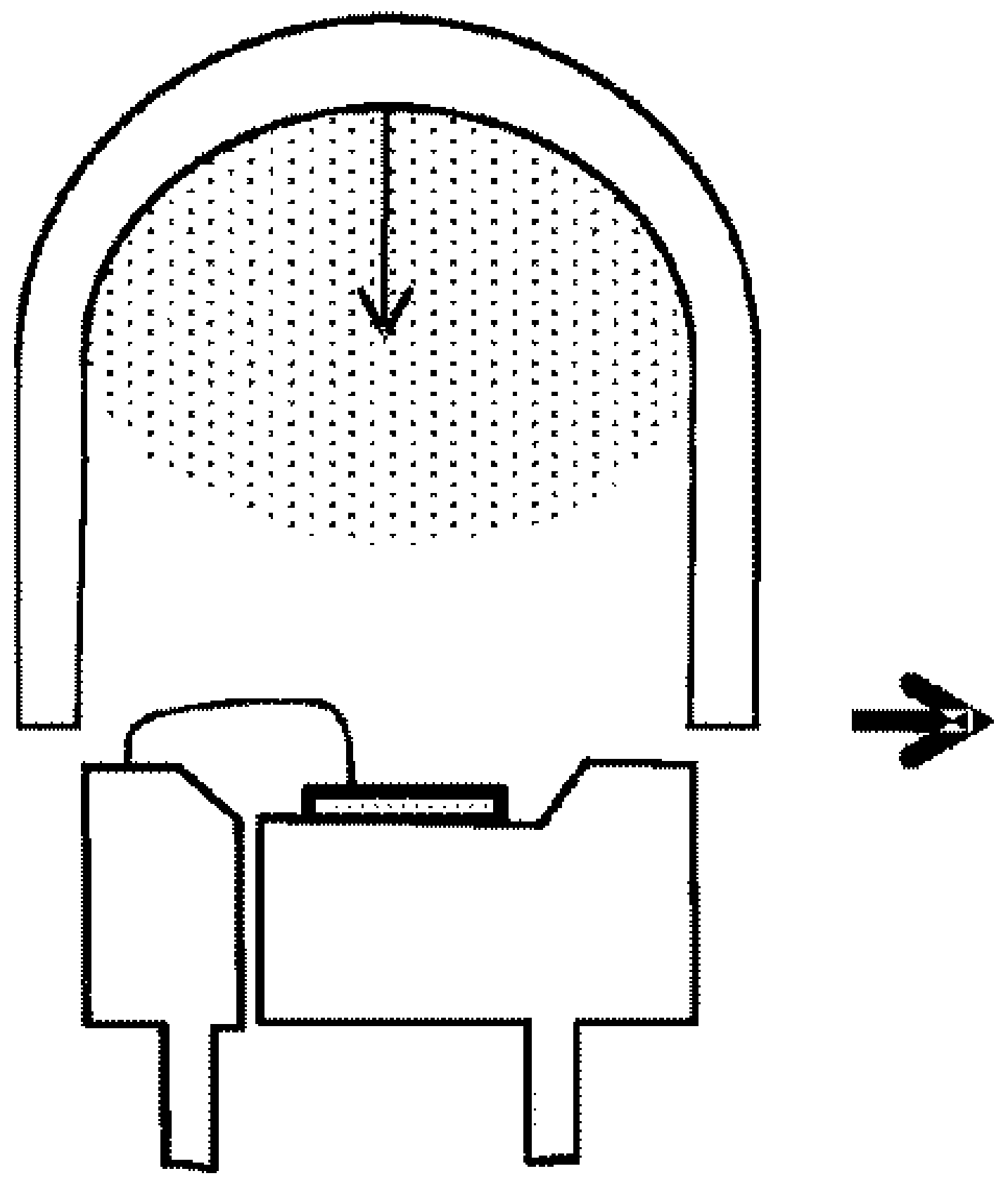

Figure 19

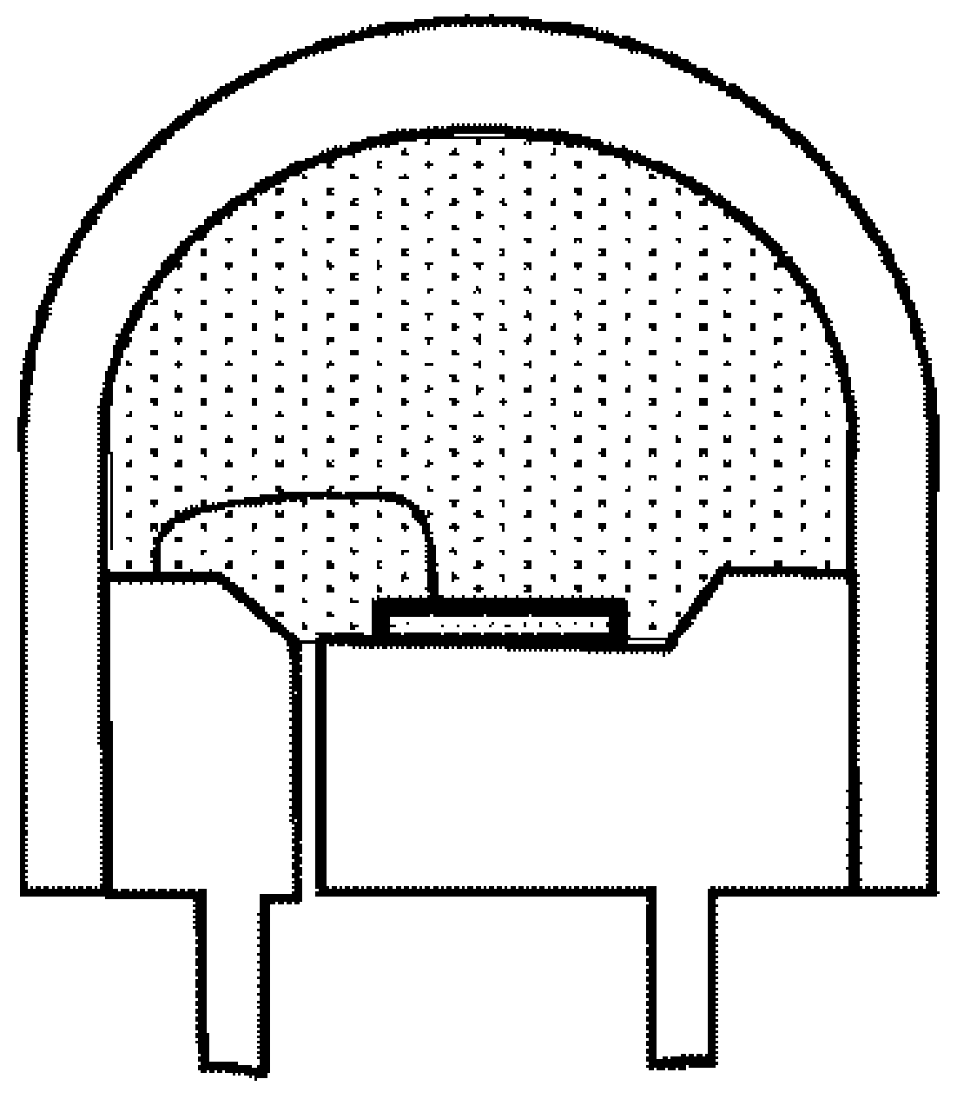

Figure 20

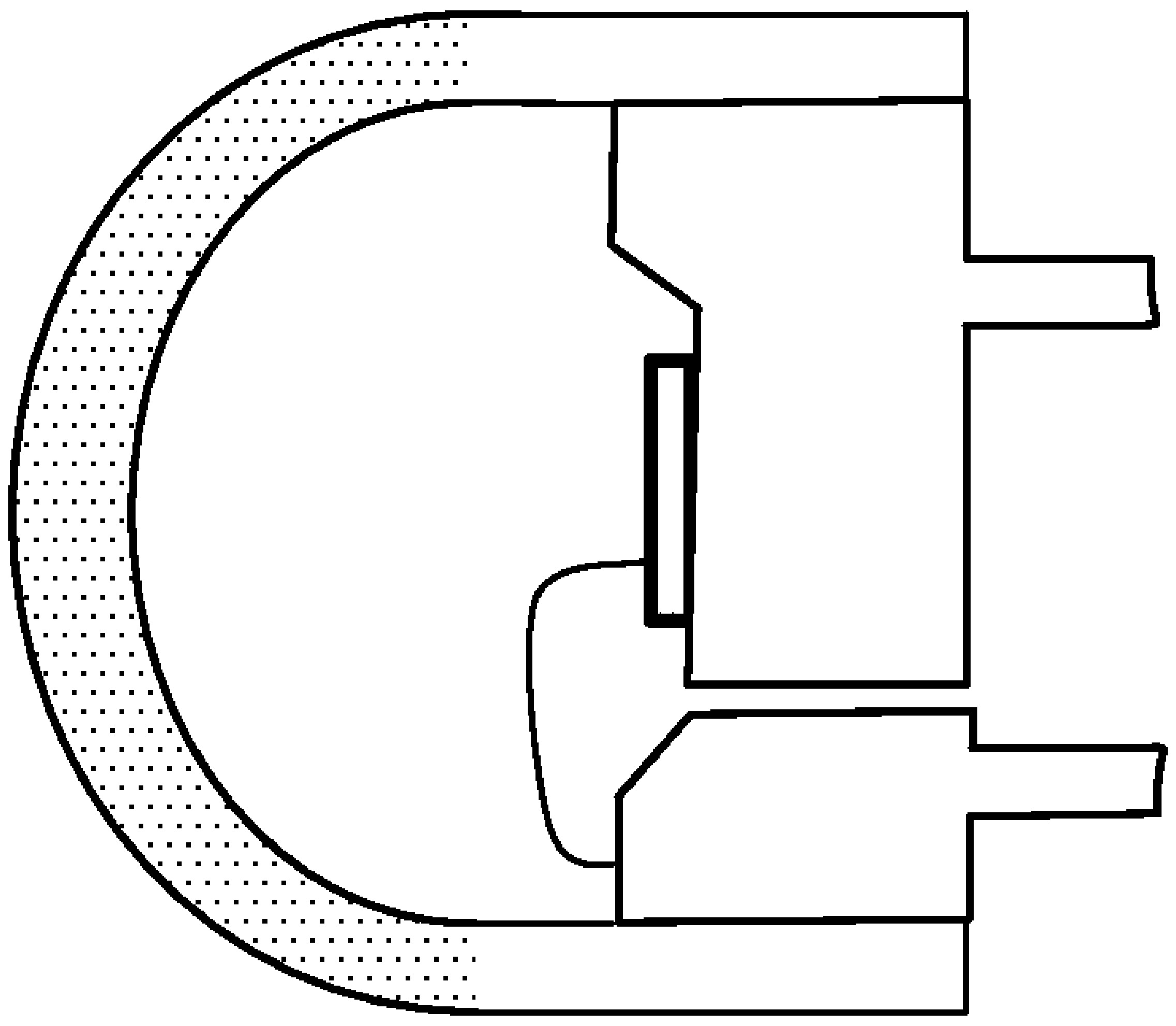

Figure 22

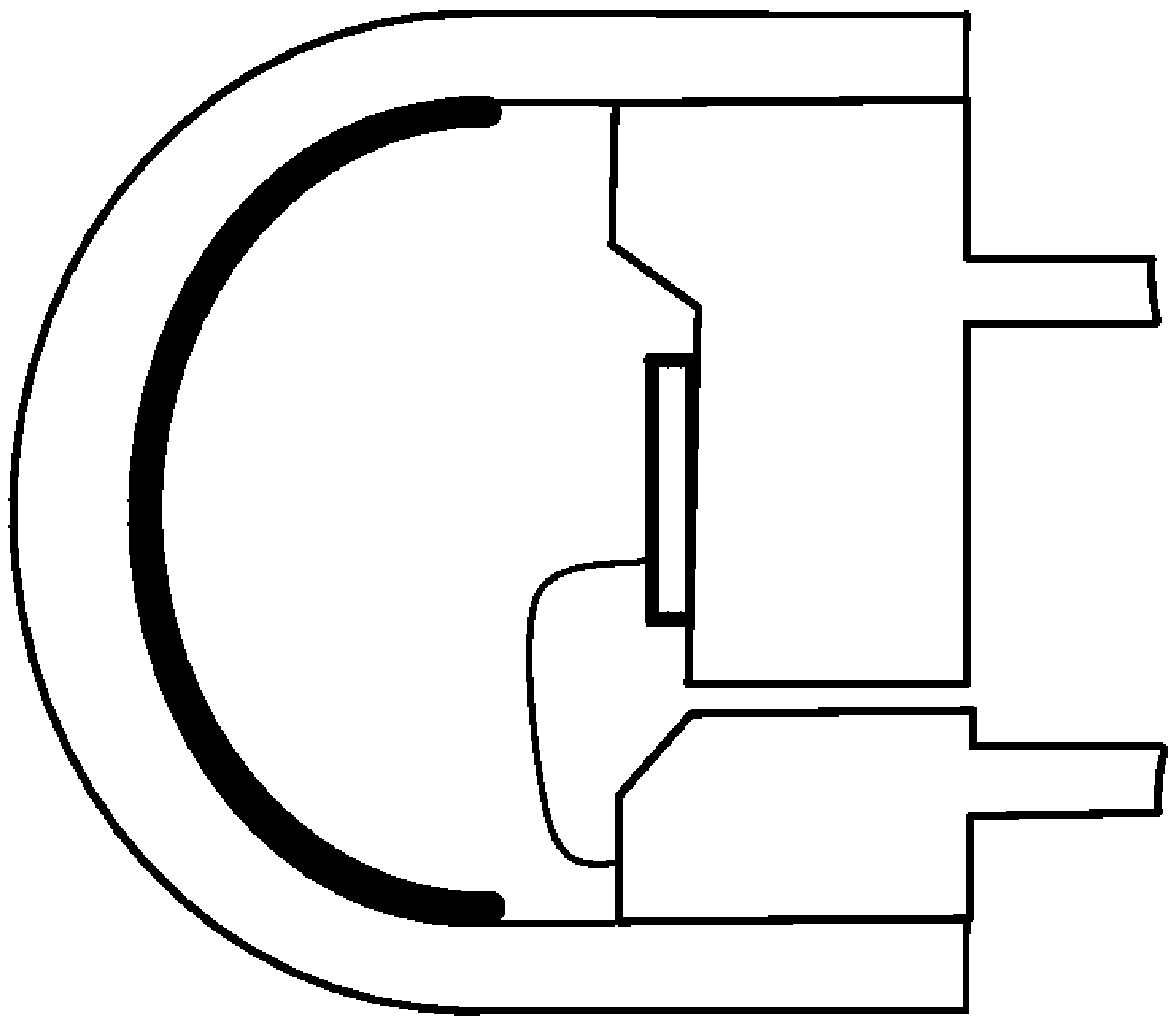

Figure 21

WHITE LIGHT DEVICES USING NON-POLAR OR SEMIPOLAR GALLIUM CONTAINING MATERIALS AND PHOSPHORS

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue; a claim printed with strikethrough indicates that the claim was canceled, disclaimed, or held invalid by a prior post-patent action or proceeding.

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation of U.S. application Ser. No. 12/534,829, filed Aug. 3, 2009, now U.S. Pat. No. 8,124,996 and to U.S. Provisional Application No. 61/086,139, filed Aug. 4, 2008, commonly assigned, and incorporated by reference herein in its entirety for all purposes.

BACKGROUND OF THE INVENTION

The present invention relates generally to lighting techniques. More specifically, embodiments of the invention include techniques for combining colored LED devices, such as violet, blue, blue and yellow, or blue and green, fabricated on bulk semipolar or nonpolar materials with use of entities such as phosphors, which emit light. Merely by way of example, the invention can be applied to applications such as white lighting, multi-colored lighting, general illumination, decorative lighting, automotive and aircraft lamps, street lights, lighting for plant growth, indicator lights, lighting for flat panel displays, other optoelectronic devices, and the like.

In the late 1800's, Thomas Edison invented the light bulb. The conventional light bulb, commonly called the "Edison bulb," has been used for over one hundred years. The conventional light bulb uses a tungsten filament enclosed in a glass bulb sealed in a base, which is screwed into a socket. The socket is coupled to an AC power or DC power source. The conventional light bulb can be found commonly in houses, buildings, and outdoor lightings, and other areas requiring light. Unfortunately, drawbacks exist with the conventional Edison light bulb. That is, the conventional light bulb dissipates much thermal energy. More than 90% of the energy used for the conventional light bulb dissipates as thermal energy. Additionally, the conventional light bulb routinely fails often due to thermal expansion and contraction of the filament element.

To overcome some of the drawbacks of the conventional light bulb, fluorescent lighting has been developed. Fluorescent lighting uses an optically clear tube structure filled with a halogen gas and, which typically also contains mercury. A pair of electrodes is coupled between the halogen gas and couples to an alternating power source through a ballast. Once the gas has been excited, it discharges to emit light. Typically, the optically clear tube is coated with phosphors, which are excited by the light. Many building structures use fluorescent lighting and, more recently, fluorescent lighting has been fitted onto a base structure, which couples into a standard socket.

Solid state lighting techniques have also been used. Solid state lighting relies upon semiconductor materials to produce light emitting diodes, commonly called LEDs. At first, red LEDs were demonstrated and introduced into commerce. Red LEDs use Aluminum Indium Gallium Phosphide or AlInGaP semiconductor materials. Most recently, Shuji Nakamura pioneered the use of InGaN materials to produce LEDs emitting light in the blue color range for blue LEDs. The blue colored LEDs led to innovations such as solid state white lighting, the blue laser diode, which in turn enabled the Blu-Ray™ (trademark of the Blu-Ray Disc Association) DVD player, and other developments. Other colored LEDs have also been proposed.

High intensity UV, blue, and green LEDs based on GaN have been proposed and even demonstrated with some success. Efficiencies have typically been highest in the UV-violet, dropping off as the emission wavelength increases to blue or green. Unfortunately, achieving high intensity, high-efficiency GaN-based green LEDs has been particularly problematic. The performance of optoelectronic devices fabricated on conventional c-plane GaN suffer from strong internal polarization fields, which spatially separate the electron and hole wave functions and lead to poor radiative recombination efficiency. Since this phenomenon becomes more pronounced in InGaN layers with increased indium content for increased wavelength emission, extending the performance of UV or blue GaN-based LEDs to the blue-green or green regime has been difficult. Furthermore, since increased indium content films often require reduced growth temperature, the crystal quality of the InGaN films is degraded. The difficulty of achieving a high intensity green LED has lead scientists and engineers to the term "green gap" to describe the unavailability of such green LED. In addition, the light emission efficiency of typical GaN-based LEDs drops off significantly at higher current densities, as are required for general illumination applications, a phenomenon known as "roll-over." Other limitations with blue LEDs using c-plane GaN exist. These limitations include poor yields, low efficiencies, and reliability issues. Although highly successful, solid state lighting techniques must be improved for full exploitation of their potential. These and other limitations may be described throughout the present specification and more particularly below.

From the above, it is seen that techniques for improving optical devices is highly desired.

BRIEF SUMMARY OF THE INVENTION

The present invention provides a packaged light emitting device which includes a substrate member having a surface region. One or more light emitting diode devices are overlying the surface region. At least one of the light emitting diode device is fabricated on a semipolar or nonpolar gallium and nitrogen (e.g., GaN) containing substrate. The light emitting diode devices are fabricated on the semipolar or nonpolar gallium and nitrogen (e.g., GaN) containing substrate and emit substantially polarized emission of first wavelengths. In a specific embodiment, the device also has an optically transparent member coupled to the light emitting diode devices. An optical path is provided between the light emitting diode devices and the optically transparent member. In a specific embodiment, the phosphors are formed near or overlying the optically transparent member. Alternatively, the phosphors are formed within the optically transparent member or underlying the optically transparent member or any combination of these configurations. The entities are excited by the substantially polarized emission, which is direct or reflected or a combination to emit electromagnetic radiation second wavelengths.

In a specific embodiment, the present invention includes device configurations having different spatial locations for the thickness of the entities. The thickness of the entities is formed within the optically transparent member. Alternatively, the thickness of the entities is formed underlying the optically transparent member according to a specific embodiment. In yet an alternative specific embodiment, the thickness of the entities is formed within a spatial region of the light path between the light emitting diode devices and the optically transparent member.

In yet an alternative specific embodiment, the present invention provides a packaged light emitting device. The device includes a substrate member having a surface region and light emitting diode devices overlying the surface region. At least one of the light emitting diode device is fabricated on a semipolar or nonpolar gallium and nitrogen (e.g., GaN) containing substrate. The light emitting diode devices are fabricated on the semipolar or nonpolar gallium and nitrogen (e.g., GaN) containing substrate and emit substantially polarized emission of first wavelengths. At least one of the light emitting diode devices comprises a quantum well region, which is characterized by an electron wave function and a hole wave function. In a specific embodiment, the electron wave function and the hole wave function are substantially overlapped within a predetermined spatial region of the quantum well region. The device has a thickness of entities formed overlying the light emitting diode devices. The entities are excited by the substantially polarized emission to emit electromagnetic radiation of second wavelengths.

Still further, the present invention provides a packaged light emitting device. The device includes a substrate member having a surface region. The device includes light emitting diode devices overlying the surface region. At least one of the light emitting diode device is fabricated on a semipolar or nonpolar gallium and nitrogen (e.g., GaN) containing substrate and emit substantially polarized emissions of first wavelengths. At least one of the light emitting diode devices includes a quantum well region, which is characterized by an electron wave function and a hole wave. The electron wave function and the hole wave function are substantially overlapped within a predetermined spatial region of the quantum well region. The device also has a thickness of entities operably coupled to the light emitting diode devices. In a specific embodiment, the entities are excited by the substantially polarized emission and emit electromagnetic radiation of second wavelengths. Depending upon the embodiment, the entities are formed overlying the light emitting diode devices, or within a vicinity of the light emitting devices. The electromagnetic radiation is characterized by reflected emission, direct emission, or a combination of reflected and direct emission.

In yet an alternative embodiment, the present invention provides a method of assembling a light emitting device. The method includes providing a substrate member comprising a surface region. The method also includes providing light emitting diode devices overlying the surface region. At least one of the light emitting diode device is fabricated on a semipolar or nonpolar gallium and nitrogen containing substrate. The light emitting diode devices are fabricated on the semipolar or nonpolar gallium and nitrogen containing substrate and emit substantially polarized emission of first wavelengths. At least one of the light emitting diode devices comprises a quantum well region, which is characterized by an electron wave function and a hole wave function. The electron wave function and the hole wave function are substantially overlapped within a predetermined spatial region of the quantum well region. The method includes coupling a thickness of entities to the light emitting diode devices. The entities are excited by the substantially polarized emission, and emit electromagnetic radiation of second wavelengths.

The present device and method provides for an improved lighting technique with improved efficiencies. The present method and resulting structure are easier to implement using conventional technologies. In some embodiments, the present device and method provide a mix of polarized and unpolarized light that are useful in displays and in conjunction with polarizing transmission filters. In a specific embodiment, the blue LED device is capable of emitting electromagnetic radiation at a wavelength range from about 450 nanometers to about 495 nanometers, and the yellow-green LED device is capable of emitting electromagnetic radiation at a wavelength range from about 495 nanometers to about 590 nanometers, although there can also be some variations.

A further understanding of the nature and advantages of the present invention may be realized by reference to the latter portions of the specification and attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a simplified diagram of a packaged light emitting device using a recessed configuration according to an embodiment of the present invention;

FIG. **1**A illustrates an electron/hole wave functions according to an embodiment of the present invention;

FIGS. **2** through **5** illustrate a simplified method of assembling the light emitting device of FIG. **1** according to an embodiment of the present invention;

FIG. **6** is a simplified diagram of an alternative packaged light emitting device using multiple devices according to an embodiment of the present invention;

FIGS. **7** through **10** illustrate a simplified method of assembling the light emitting device of FIG. **6** according to an embodiment of the present invention;

FIG. **11** is a simplified diagram of yet an alternative packaged light emitting device using an optical path to a plane region according to an embodiment of the present invention;

FIGS. **12** through **15** illustrate a simplified method of assembling the light emitting device of FIG. **11** according to an embodiment of the present invention;

FIG. **16** is a simplified diagram of a yet an alternative packaged light emitting device using an optical path to a plane region and filler material according to an embodiment of the present invention;

FIGS. **17** through **20** illustrate a simplified method of assembling the light emitting device of FIG. **16** according to an embodiment of the present invention;

FIG. **21** is a simplified diagram of a yet an alternative packaged light emitting device using an optical path to a plane region according to an embodiment of the present invention; and

FIG. **22** is a simplified diagram of a yet an alternative packaged light emitting device using an optical path to a plane region according to an embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Recent breakthroughs in the field of GaN-based optoelectronics have demonstrated the great potential of devices fabricated on bulk nonpolar and semipolar GaN substrates. The lack of strong polarization induced electric fields that plague conventional devices on c-plane GaN leads to a greatly enhanced radiative recombination efficiency in the light emitting InGaN layers. Furthermore, the nature of the electronic band structure and the anisotropic in-plane strain leads to highly polarized light emission, which will offer several advantages in applications such as display backlighting.

Of particular importance to the field of lighting is the progress of light emitting diodes (LED) fabricated on non-polar and semipolar GaN substrates. Such devices making use of InGaN light emitting layers have exhibited record output powers at extended operation wavelengths into the violet region (390-430 nm), the blue region (430-490 nm), the green region (490-560 nm), and the yellow region (560-600 nm). For example, a violet LED, with a peak emission wavelength of 402 nm, was recently fabricated on an m-plane (1-100) GaN substrate and demonstrated greater than 45% external quantum efficiency, despite having no light extraction enhancement features, and showed excellent performance at high current densities, with minimal roll-over [K.-C. Kim, M. C. Schmidt, H. Sato, F. Wu, N. Fellows, M. Saito, K. Fujito, J. S. Speck, S, Nakamura, and S. P. DenBaars, "Improved electroluminescence on nonpolar m-plane InGaN/GaN quantum well LEDs", Phys. Stat. Sol. (RRL) 1, No. 3, 125 (2007).]. Similarly, a blue LED, with a peak emission wavelength of 468 nm, exhibited excellent efficiency at high power densities and significantly less roll-over than is typically observed with c-plane LEDs [K. Iso, H. Yamada, H. Hirasawa, N. Fellows, M. Saito, K. Fujito, S. P. DenBaars, J. S. Speck, and S, Nakamura, "High brightness blue InGaN/GaN light emitting diode on nonpolar m-plane bulk GaN substrate", Japanese Journal of Applied Physics 46, L960 (2007).]. Two promising semi-polar orientations are the (10-1-1) and (11-22) planes. These planes are inclined by 62.0 degrees and by 58.4 degrees, respectively, with respect to the c-plane. University of California, Santa Barbara (UCSB) has produced highly efficient LEDs on (10-1-1) GaN with over 65 mW output power at 100 mA for blue-emitting devices [H. Zhong, A. Tyagi, N. Fellows, F. Wu, R. B. Chung, M. Saito, K. Fujito, J. S. Speck, S. P. DenBaars, and S, Nakamura, "High power and high efficiency blue light emitting diode on freestanding semipolar (1011) bulk GaN substrate", Applied Physics Letters 90, 233504 (2007)] and on (11-22) GaN with over 35 mW output power at 100 mA for blue-green emitting devices [H. Zhong, A. Tyagi, N. N. Fellows, R. B. Chung, M. Saito, K. Fujito, J. S. Speck, S. P. DenBaars, and S, Nakamura, Electronics Lett. 43, 825 (2007)], over 15 mW of power at 100 mA for green-emitting devices [H. Sato, A. Tyagi, H. Zhong, N. Fellows, R. B. Chung, M. Saito, K. Fujito, J. S. Speck, S. P. DenBaars, and S, Nakamura, "High power and high efficiency green light emitting diode on free-standing semipolar (1122) bulk GaN substrate", Physical Status Solidi—Rapid Research Letters 1, 162 (2007)] and over 15 mW for yellow devices [H. Sato, R. B. Chung, H. Hirasawa, N. Fellows, H. Masui, F. Wu, M. Saito, K. Fujito, J. S. Speck, S. P. DenBaars, and S, Nakamura, "Optical properties of yellow light-emitting diodes grown on semipolar (1122) bulk GaN substrates," Applied Physics Letters 92, 221110 (2008).]. The UCSB group has shown that the indium incorporation on semipolar (11-22) GaN is comparable to or greater than that of c-plane GaN, which provides further promise for achieving high crystal quality extended wavelength emitting InGaN layers.

With high-performance single-color non-polar and semi-polar LEDs, several types of white light sources are now possible. In one embodiment, a violet non-polar or semi-polar LED is packaged together with at least one phosphor. In a preferred embodiment, the phosphor comprises a blend of three phosphors, emitting in the blue, the green, and the red. In another embodiment, a blue non-polar or semi-polar LED is packaged together with at least one phosphor. In a preferred embodiment, the phosphor comprises a blend of two phosphors, emitting in the green and the red. In still another embodiment, a green or yellow non-polar or semi-polar LED is packaged together with a blue LED and at least one phosphor. In a preferred embodiment, the phosphor emits in the red. In a preferred embodiment, the blue LED constitutes a blue non-polar or semi-polar LED.

A non-polar or semi-polar LED may be fabricated on a bulk gallium nitride substrate. The gallium nitride substrate may be sliced from a boule that was grown by hydride vapor phase epitaxy or ammonothermally, according to methods known in the art. In one specific embodiment, the gallium nitride substrate is fabricated by a combination of hydride vapor phase epitaxy and ammonothermal growth, as disclosed in U.S. Patent Application *Publication* No. **[**61/078,704**]** *US 2010/0003492 A1*, commonly assigned, and hereby incorporated by reference herein. The boule may be grown in the c-direction, the m-direction, the a-direction, or in a semi-polar direction on a single-crystal seed crystal. Semi-polar planes may be designated by (hkil) Miller indices, where i=−(h+k), l is nonzero and at least one of h and k are nonzero. The gallium nitride substrate may be cut, lapped, polished, and chemical-mechanically polished. The gallium nitride substrate orientation may be within ±5 degrees, ±2 degrees, ±1 degree, or ±0.5 degrees of the {1 −1 0 0} m plane, the {1 1 −2 0} a plane, the {1 1 −2 2} plane, the {2 0 −2±1} plane, the {1 −1 0±1} plane, the {1 −1 0 −±2} plane, or the {1 −1 0±3} plane. The gallium nitride substrate may have a dislocation density in the plane of the large-area surface that can be less than 10^6 cm^{-2} and is usually less than 10^3 cm^{-2}. The gallium nitride substrate may have a dislocation density in the c plane that can be less than 10^6 cm^{-2} and is preferably less than 10^3 cm^{-2}.

A homoepitaxial non-polar or semi-polar LED is fabricated on the gallium nitride substrate according to methods that are known in the art, for example, following the method disclosed in U.S. Pat. No. 7,053,413, which is hereby incorporated by reference in its entirety. At least one $Al_xIn_yGa_{1-x-y}N$ layer, where $0 \leq x \leq 1$, $0 \leq y \leq 1$, and $0 \leq x+y \leq 1$, is deposited on the substrate, for example, following the methods disclosed by U.S. Pat. Nos. 7,338,828 and 7,220,324, which are hereby incorporated by reference in their entirety. The at least one $Al_xIn_yGa_{1-x-y}N$ layer may be deposited by metal-organic chemical vapor deposition, by molecular beam epitaxy, by hydride vapor phase epitaxy, or by a combination thereof. In one embodiment, the $Al_xIn_yGa_{1-x-y}N$ layer comprises an active layer that preferentially emits light when an electrical current is passed through it. In one specific embodiment, the active layer comprises a single quantum well, with a thickness between about 0.5 nm and about 40 nm. In a specific embodiment, the active layer comprises a single quantum well with a thickness between about 1 nm and about 5 nm. In other embodiments, the active layer comprises a single quantum well with a thickness between about 5 nm and about 10 nm, between about 10 nm and about 15 nm, between about 15 nm and about 20 nm, between about 20 nm and about 25 nm, between about 25 nm and about 30 nm, between about 30 nm and about 35 nm, or between about 35 nm and about 40 nm. In another set of embodiments, the active layer comprises a multiple quantum well. In still another embodiment, the active region comprises a double heterostructure, with a thickness between about 40 nm and about 500 nm. In one specific embodiment, the active layer comprises an $In_yGa_{1-y}N$ layer, where $0 \leq y \leq 1$.

In a specific embodiment, the present invention provides novel packages and devices including at least one non-polar or at least one semi-polar homoepitaxial LED placed on a substrate. The present packages and devices are combined with phosphors to discharge white light.

FIG. **1** is a simplified diagram of a packaged light emitting device **100** using a recessed configuration according to an embodiment of the present invention. In a specific embodiment, the present invention provides a packaged light emitting device **100**. As shown, the device has a substrate member having a surface region made of a suitable material such a metal including, but not limited to, Alloy 42, copper, plastics, dielectrics, and the like. The substrate is generally a lead frame member such as metal alloy.

The substrate, which holds the LED, can come in various shapes, sizes, and configurations. In a specific embodiment, the surface region of substrate **101** is cupped. Alternatively, the surface region **101** is recessed. The surface region generally comprises a smooth surface, plating, or coating. Such plating or coating can be gold, silver, platinum, aluminum, or any pure or alloy material, which is suitable for bonding to an overlying semiconductor material, but can be others.

Referring again to FIG. **1**, the device has light emitting diode devices overlying the surface region. At least one of the light emitting diode devices **103** is fabricated on a semipolar or nonpolar GaN containing substrate. In a specific embodiment, the device emits polarized electromagnetic radiation **105**. As shown, the light emitting device is coupled to a first potential, which is attached to the substrate, and a second potential **109**, which is coupled to wire or lead **111** bonded to a light emitting diode. Preferably at least one of the light emitting diode devices includes a quantum well region characterized by an electron wave function and a hole wave function. The electron wave function and the hole wave function are substantially overlapped within a predetermined spatial region of the quantum well region. An example of the electron wave function and the hole wave function is provided by FIG. **1**A, but can be others.

In a preferred embodiment, the light emitting diode devices comprise at least a blue LED device which emits substantially polarized emission is blue light at a range from about 430 nanometers to about 490 nanometers. In a specific embodiment, a {1 −1 0 0} m-plane bulk substrate is provided for the nonpolar blue LED. In another specific embodiment, a {1 0 −1 −1} semi-polar bulk substrate is provided for the semipolar blue LED. The substrate has a flat surface, with a root-mean-square (RMS) roughness of about 0.1 nm, a threading dislocation density less than 5×10^6 cm^{-2}, and a carrier concentration of about 1×10^{17} cm^{-3}. Epitaxial layers are deposited on the substrate by metalorganic chemical vapor deposition (MOCVD) at atmospheric pressure. The ratio of the flow rate of the group V precursor (ammonia) to that of the group III precursor (trimethyl gallium, trimethyl indium, trimethyl aluminum) during growth is between about 3000 and about 12000. First, a contact layer of n-type (silicon-doped) GaN is deposited on the substrate, with a thickness of about 5 microns and a doping level of about 2×10^{18} cm^{-3}. Next, an undoped InGaN/GaN multiple quantum well (MQW) is deposited as the active layer. The MQW superlattice has six periods, comprising alternating layers of 8 nm of InGaN and 37.5 nm of GaN as the barrier layers. Next, a 10 nm undoped AlGaN electron blocking layer is deposited. Finally, a p-type GaN contact layer is deposited, with a thickness of about 200 nm and a hole concentration of about 7×10^{17} cm^{-3}. Indium tin oxide (ITO) is e-beam evaporated onto the p-type contact layer as the p-type contact and rapid-thermal-annealed. LED mesas, with a size of about 300×300 μm^2, are formed by photolithography and dry etching using a chlorine-based inductively-coupled plasma (ICP) technique. Ti/Al/Ni/Au is e-beam evaporated onto the exposed n-GaN layer to form the n-type contact, Ti/Au is e-beam evaporated onto a portion of the ITO layer to form a p-contact pad, and the wafer is diced into discrete LED dies. Electrical contacts are formed by conventional wire bonding. In a specific embodiment, the present device also has a thickness **115** of preferably phosphor entities formed overlying light emitting diode devices. The entities are excited by the substantially polarized emission and emit electromagnetic radiation of second wavelengths. In a preferred embodiment, the emit substantially yellow light from an interaction with the substantially polarized emission of blue light. Preferably the entities are phosphor entities about five microns or less thick.

In a specific embodiment, the entities comprises a phosphor or phosphor blend selected from one or more of $(Y, Gd, Tb, Sc, Lu, La)_3(Al, Ga, In)_5O_{12}:Ce^{3+}$, $SrGa_2S_4:Eu^{2+}$, $SrS:Eu^{2+}$, and colloidal quantum dot thin films comprising CdTe, ZnS, ZnSe, ZnTe, CdSe, or CdTe. In other embodiments, the device may include a phosphor capable of emitting substantially red light. Such phosphor is selected from one or more of $(Gd,Y,Lu,La)_2O_3:Eu^{3+}$, Bi^{3+}; $(Gd,Y,Lu,La)_2O_2S:Eu^{3+}$, Bi^{3+}; $(Gd,Y,Lu,La)VO_4:Eu^{3+}$, Bi^{3+}; $Y_2(O,S)_3:Eu^{3+}$; $Ca_{1-x}Mo_{1-y}Si_yO_4$: where $0.05 \leq x \leq 0.5$, $0 \leq y \leq 0.1$; $(Li,Na,K)_5Eu(W,Mo)O_4$; $(Ca,Sr)S:Eu^{2+}$; $SrY_2S_4:Eu^{2+}$; $CaLa_2S_4:Ce^{3+}$; $(Ca,Sr)S:Eu^{2+}$; $3.5MgO*0.5MgF_2*GeO_2:Mn^{4+}$ (MFG); $(Ba,Sr,Ca)Mg_xP_2O_7:Eu^{2+}$, Mn^{2+}; $(Y,Lu)_2WO_6:Eu^{3+}$, Mo^{6+}; $(Ba,Sr,Ca)_3Mg_xSi_2O_8:Eu^{2+}$, Mn^{2+}, wherein $1<x \leq 2$; $(RE_{1-y}Ce_y)Mg_{2-x}Li_xSi_{3-x}PxO_{12}$, where RE is at least one of Sc, Lu, Gd, Y, and Tb, $0.0001<x<0.1$ and $0.001<y<0.1$; $(Y, Gd, Lu, La)_{2-x}Eu_xW_{1-y}Mo_yO_6$, where $0.5 \leq x \leq 1.0$, $0.01 \leq y \leq 1.0$; $(Sr Ca)_{1-x}Eu_xSi_5N_8$, where $0.01 \leq x \leq 0.3$; $SrZnO_2:Sm^{+3}$; M_mO_nX wherein M is selected from the group of Sc, Y, a lanthanide, an alkali earth metal and mixtures thereof; X is a halogen; $1 \leq m \leq 3$; and $1 \leq n \leq 4$, and wherein the lanthanide doping level can range from 0.1 to 40% spectral weight; and Eu^{3+} activated phosphate or borate phosphors; and mixtures thereof.

In a specific embodiment, the light emitting diode device includes at least a violet LED device capable of emitting electromagnetic radiation at a range from about 380 nanometers to about 440 nanometers and the one or more entities are capable of emitting substantially white light, the substantially polarized emission being violet light. In a specific embodiment, a (1 −1 0 0) m-plane bulk substrate is provided for the nonpolar violet LED. The substrate has a flat surface, with a root-mean-square (RMS) roughness of about 0.1 nm, a threading dislocation density less than 5×10^6 cm^{-2}, and a carrier concentration of about 1×10^{17} cm^{-3}. Epitaxial layers are deposited on the substrate by metalorganic chemical vapor deposition (MOCVD) at atmospheric pressure. The ratio of the flow rate of the group V precursor (ammonia) to that of the group III precursor (trimethyl gallium, trimethyl indium, trimethyl aluminum) during growth is between about 3000 and about 12000. First, a contact layer of n-type (silicon-doped) GaN is deposited on the substrate, with a thickness of about 5 microns and a doping level of about 2×10^{18} cm^{-3}. Next, an undoped InGaN/GaN multiple quantum well (MQW) is deposited as the active layer. The MQW superlattice has six periods, comprising alternating layers of

16 nm of InGaN and 18 nm of GaN as the barrier layers. Next, a 10 nm undoped AlGaN electron blocking layer is deposited. Finally, a p-type GaN contact layer is deposited, with a thickness of about 160 nm and a hole concentration of about 7×10^{17} cm^{-3}. Indium tin oxide (ITO) is e-beam evaporated onto the p-type contact layer as the p-type contact and rapid-thermal-annealed. LED mesas, with a size of about 300×300 μm^2, are formed by photolithography and dry etching. Ti/Al/Ni/Au is e-beam evaporated onto the exposed n-GaN layer to form the n-type contact, Ti/Au is e-beam evaporated onto a portion of the ITO layer to form a contact pad, and the wafer is diced into discrete LED dies. Electrical contacts are formed by conventional wire bonding. Other colored LEDs may also be used or combined according to a specific embodiment.

In a specific embodiment, a (1 1 −2 2} bulk substrate is provided for a semipolar green LED. The substrate has a flat surface, with a root-mean-square (RMS) roughness of about 0.1 nm, a threading dislocation density less than 5×10^6 cm^{-2}, and a carrier concentration of about 1×10^{17} cm^{-3}. Epitaxial layers are deposited on the substrate by metalorganic chemical vapor deposition (MOCVD) at atmospheric pressure. The ratio of the flow rate of the group V precursor (ammonia) to that of the group III precursor (trimethyl gallium, trimethyl indium, trimethyl aluminum) during growth between about 3000 and about 12000. First, a contact layer of n-type (silicon-doped) GaN is deposited on the substrate, with a thickness of about 1 micron and a doping level of about 2×10^{18} cm^{-3}. Next, an InGaN/GaN multiple quantum well (MQW) is deposited as the active layer. The MQW superlattice has six periods, comprising alternating layers of 4 nm of InGaN and 20 nm of Si-doped GaN as the barrier layers and ending with an undoped 16 nm GaN barrier layer and a 10 nm undoped $Al_{0.15}Ga_{0.85}N$ electron blocking layer. Finally, a p-type GaN contact layer is deposited, with a thickness of about 200 nm and a hole concentration of about 7×10^{17} cm^{-3}. Indium tin oxide (ITO) is e-beam evaporated onto the p-type contact layer as the p-type contact and rapid-thermal-annealed. LED mesas, with a size of about 200×550 μm^2, are formed by photolithography and dry etching. Ti/Al/Ni/Au is e-beam evaporated onto the exposed n-GaN layer to form the n-type contact, Ti/Au is e-beam evaporated onto a portion of the ITO layer to form a contact pad, and the wafer is diced into discrete LED dies. Electrical contacts are formed by conventional wire bonding.

In another specific embodiment, a (1 1 −2 2} bulk substrate is provided for a semipolar yellow LED. The substrate has a flat surface, with a root-mean-square (RMS) roughness of about 0.1 nm, a threading dislocation density less than 5×10^6 cm^{-2}, and a carrier concentration of about 1×10^{17} cm^{-3}. Epitaxial layers are deposited on the substrate by metalorganic chemical vapor deposition (MOCVD) at atmospheric pressure. The ratio of the flow rate of the group V precursor (ammonia) to that of the group III precursor (trimethyl gallium, trimethyl indium, trimethyl aluminum) during growth between about 3000 and about 12000. First, a contact layer of n-type (silicon-doped) GaN is deposited on the substrate, with a thickness of about 2 microns and a doping level of about 2×10^{18} cm^{-3}. Next, a single quantum well (SQW) is deposited as the active layer. The SQW comprises a 3.5 nm InGaN layer and is terminated by an undoped 16 nm GaN barrier layer and a 7 nm undoped $Al_{0.15}Ga_{0.85}N$ electron blocking layer. Finally, a Mg-doped p-type GaN contact layer is deposited, with a thickness of about 200 nm and a hole concentration of about 7×10^{17} cm^{-3}. Indium tin oxide (ITO) is e-beam evaporated onto the p-type contact layer as the p-type contact and rapid-thermal-annealed. LED mesas, with a size of about 600×450 μm^2, are formed by photolithography and dry etching. Ti/Al/Ni/Au is e-beam evaporated onto the exposed n-GaN layer to form the n-type contact, Ti/Au is e-beam evaporated onto a portion of the ITO layer to form a contact pad, and the wafer is diced into discrete LED dies. Electrical contacts are formed by conventional wire bonding.

In a specific embodiment, the one or more entities comprise a blend of phosphors capable of emitting substantially blue light, substantially green light, and substantially red light. As an example, the blue emitting phosphor is selected from the group consisting of $(Ba,Sr,Ca)_5(PO_4)_3(Cl,F,Br,OH):Eu^{2+}$, Mn^{2+}; Sb^{3+},$(Ba,Sr,Ca)MgAl_{10}O_{17}:Eu^{2+}$, Mn^{2+}; $(Ba,Sr,Ca)BPO_5:Eu^{2+}$, Mn^{2+}; $(Sr,Ca)_{10}(PO_4)_6{*}nB_2O_3:Eu^{2+}$; $2SrO{*}0.84P_2O_5{*}0.16B_2O_3:Eu^{2+}$; $Sr_2Si_3O_8{*}2SrCl_2:Eu^{2+}$; $(Ba,Sr,Ca)Mg_xP_2O_7:Eu^{2+}$, Mn^{2+}; $Sr_4Al_{14}O_{25}:Eu^{2+}$ (SAE); $BaAl_8O_{13}:Eu^{2+}$; and mixtures thereof. As an example, the green phosphor is selected from the group consisting of $(Ba,Sr,Ca)MgAl_{10}O_{17}:Eu^{2+}$, Mn^{2+} (BAMn); $(Ba,Sr,Ca)Al_2O_4:Eu^{2+}$; $(Y,Gd,Lu,Sc,La)BO_3:Ce^{3+},Tb^{3+}$; $Ca_8Mg(SiO_4)_4Cl_2:Eu^{2+}$, Mn^{2+}; $(Ba,Sr,Ca)_2SiO_4:Eu^{2+}$; $(Ba,Sr,Ca)_2(Mg,Zn)Si_2O_7:Eu^{2+}$; $(Sr,Ca,Ba)(Al,Ga,In)_2S_4:Eu^{2+}$; $(Y,Gd,Tb,La,Sm,Pr,Lu)_3(Al,Ga)_5O_{12}:Ce^{3+}$; $(Ca,Sr)_8(Mg,Zn)(SiO_4)_4Cl_2:Eu^{2+}$, Mn^{2+} (CASI); $Na_2Gd_2B_2O_7:Ce^{3+}$, Tb^{3+}; $(Ba,Sr)_2(Ca,Mg,Zn)B_2O_6:K,Ce,Tb$; and mixtures thereof. As an example, the red phosphor is selected from the group consisting of $(Gd,Y,Lu,La)_2O_3:Eu^{3+}$, Bi^{3+}; $(Gd,Y,Lu,La)_2O_2S:Eu^{3+}$, Bi^{3+}; $(Gd,Y,Lu,La)VO_4:Eu^{3+}$, Bi^{3+}; $Y_2(O,S)_3:Eu^{3+}$; $Ca_{1-x}Mo_{1-y}Si_yO_4$: where $0.05\leq x\leq0.5$, $0\leq y\leq0.1$; $(Li,Na,K)_5Eu(W,Mo)O_4$; $(Ca,Sr)S:Eu^{2+}$; $SrY_2S_4:Eu^{2+}$; $CaLa_2S_4:Ce^{3+}$; $(Ca,Sr)S:Eu^{2+}$; $3.5MgO{*}0.5MgF_2{*}GeO_2:Mn^{4+}$ (MFG); $(Ba,Sr,Ca)Mg_xP_2O_7:Eu^{2+}$, Mn^{2+}; $(Y,Lu)_2WO_6:Eu^{3+}$, Mo^{6+}; $(Ba,Sr,Ca)_3Mg_xSi_2O_8:Eu^{2+}$, Mn^{2+}, wherein $1<x\leq2$; $(RE_{1-y}Ce_y)Mg_{2-x}Li_xSi_{3-x}P_xO_{12}$, where RE is at least one of Sc, Lu, Gd, Y, and Tb, $0.0001<x<0.1$ and $0.001<y<0.1$; $(Y, Gd, Lu, La)_{2-x}Eu_xW_{1-y}Mo_yO_6$, where $0.5\leq x\leq1.0$, $0.01\leq y\leq1.0$; $(SrCa)_{1-x}Eu_xSi_5N_8$, where $0.01\leq x\leq0.3$; $SrZnO_2:Sm^{+3}$; M_mO_nX, wherein M is selected from the group of Sc, Y, a lanthanide, an alkali earth metal and mixtures thereof; X is a halogen; $1\leq m\leq3$; and $1\leq n\leq4$, and wherein the lanthanide doping level can range from 0.1 to 40% spectral weight; and Eu^{3+} activated phosphate or borate phosphors; and mixtures thereof.

The above has been generally described in terms of entities that are phosphor materials or phosphor like materials, but it would be recognized that other "energy-converting luminescent materials", which may include phosphors, semiconductors, semiconductor nanoparticles ("quantum dots"), organic luminescent materials, and the like, and combinations of them, can also be used. More generally the energy converting luminescent materials can be wavelength converting material and/or materials.

In a specific embodiment, the present packaged device includes an enclosure **117**. The enclosure can be made of a suitable material such as an optically transparent plastic, glass, or other material*, and thus be an optically transparent member*. As also shown, the enclosure has a suitable shape **119**. The shape can be annular, circular, egg-shaped, trapezoidal, or a combination of these shapes. Depending upon the embodiment, the enclosure with suitable shape and material is configured to facilitate and even optimize transmission of electromagnetic radiation from the LED device with coating through the surface region of the enclosure. FIGS. **2** through **5** illustrate a method of assembling the light emitting device of FIG. **1** according to an embodiment of the present invention. The method includes providing a substrate member **101** comprising a surface region. In a specific embodiment, the substrate is made of a suitable material such a metal including, but not limited to, Alloy 42, copper, dielectrics, plastics, or others. In a specific embodiment, the substrate is generally from a lead frame member such as a metal alloy, but can be others.

In a specific embodiment, the present substrate, which holds the LED, can come in various shapes, sizes, and configurations. In a specific embodiment, the surface region of substrate **101** is cupped. Alternatively, the surface region **101** is recessed according to a specific embodiment. Additionally, the surface region is generally a smooth surface, plating, or coating. Such plating or coating can be gold, silver, platinum, aluminum, or any pure or alloy material, which is suitable for bonding to an overlying semiconductor material, but can be others.

In a specific embodiment, the method includes providing one or more light emitting diode devices overlying the surface region. At least one of the light emitting diode devices **103** is fabricated on a semipolar or nonpolar GaN containing substrate. In a specific embodiment, the device emits polarized electromagnetic radiation **105**. As shown, the light emitting device is coupled to a first potential, which is attached to the substrate, and a second potential **109**, which is coupled to wire or lead **111** bonded to a light emitting diode. The light emitting diode device comprises at least a blue LED device which emits substantially polarized emission blue light at a range from about 430 nanometers to about 490 nanometers.

In a specific embodiment, the LED device is attached onto the surface region of the substrate by silver paste, eutectic, gold eutectic, or other suitable techniques. In a preferred embodiment, the LED device is attached using die attach methods such as eutectic bonding of metals such as gold, silver, or platinum, among others.

Referring now to FIG. **3**, the present method includes bonding wiring **[115]** *111* from **[**lead**]** *second potential* **109** to a bonding pad on the LED device. In a specific embodiment, the wire is a suitable material such as gold, aluminum, or others and is bonded using ultrasonic, megasonic, or techniques.

Referring now to FIG. **4**, the method includes providing a thickness **115** of one or more entities formed overlying the light emitting diode devices. In a specific embodiment, the entities are excited by the substantially polarized emission and emit electromagnetic radiation of second wavelengths. In a preferred embodiment, the plurality of entities emit substantially yellow light from an interaction with the substantially polarized emission of blue light. In a specific embodiment, the thickness of the plurality of entities, which are phosphor entities, is about five microns or less.

In a specific embodiment, the entities comprises a phosphor or phosphor blend selected from one or more of $(Y, Gd, Tb, Sc, Lu, La)_3(Al, Ga, In)_5O_{12}:Ce^{3+}$, $SrGa_2S_4:Eu^{2+}$, $SrS:Eu^{2+}$, and colloidal quantum dot thin films comprising CdTe, ZnS, ZnSe, ZnTe, CdSe, or CdTe. In other embodiments, the device may include a phosphor capable of emitting substantially red light. Such phosphor is be selected from $(Gd,Y,Lu,La)_2O_3:Eu^{3+}, Bi^{3+}$; $(Gd,Y,Lu,La)_2O_2S:Eu^{3+}, Bi^{3+}$; $(Gd,Y,Lu,La)VO_4:Eu^{3+}, Bi^{3+}$; $Y_2(O,S)_3:Eu^{3+}$; $Ca_{1-x}Mo_{1-y}Si_yO_4$: where $0.05 \leq x \leq 0.5$, $0 \leq y \leq 0.1$; $(Li,Na,K)_5Eu(W,Mo)O_4$; $(Ca,Sr)S:Eu^{2+}$; $SrY_2S_4:Eu^{2+}$; $CaLa_2S_4:Ce^{3+}$; $(Ca,Sr)S:Eu^{2+}$; $3.5MgO*0.5MgF_2*GeO_2:Mn^{4+}$ (MFG); $(Ba,Sr,Ca)Mg_xP_2O_7:Eu^{2+}, Mn^{2+}$; $(Y,Lu)_2WO_6:Eu^{3+}, Mo^{6+}$; $(Ba,Sr,Ca)_3Mg_xSi_2O_8:Eu^{2+}, Mn^{2+}$, wherein $1<x \leq 2$; $(RE_{1-y}Ce_y)Mg_{2-x}Li_xSi_{3-x}P_xO_{12}$, where RE is at least one of Sc, Lu, Gd, Y, and Tb, $0.0001<x<0.1$ and $0.001<y<0.1$; $(Y, Gd, Lu, La)_{2-x}Eu_xW_{1-y}Mo_yO_6$, where $0.5 \leq x \leq 1.0$, $0.01 \leq y \leq 1.0$; $(Sr Ca)_{1-x}Eu_xSi_5N_8$, where $0.01 \leq x \leq 0.3$; $SrZnO_2:Sm^{+3}$; M_mO_nX wherein M is selected from the group of Sc, Y, a lanthanide, an alkali earth metal and mixtures thereof; X is a halogen; $1 \leq m \leq 3$; and $1 \leq n \leq 4$, and wherein the lanthanide doping level can range from 0.1 to 40% spectral weight; and Eu^{3+} activated phosphate or borate phosphors; and mixtures thereof.

In a specific embodiment, the one or more entities comprise a blend of phosphors capable of emitting substantially blue light, substantially green light, and substantially red light. As an example, the blue emitting phosphor is selected from the group consisting of $(Ba,Sr,Ca)_5(PO_4)_3(Cl,F,Br,OH):Eu^{2+}, Mn^{2+}$; Sb^{3+},$(Ba,Sr,Ca)MgAl_{10}O_{17}:Eu^{2+}, Mn^{2+}$; $(Ba,Sr,Ca)BPO_5:Eu^{2+}, Mn^{2+}$; $(Sr,Ca)_{10}(PO_4)_6*nB_2O_3:Eu^{2+}$; $2SrO*0.84P_2O_5*0.16B_2O_3:Eu^{2+}$; $Sr_2Si_3O_8*2SrCl_2:Eu^{2+}$; $(Ba,Sr,Ca)Mg_xP_2O_7:Eu^{2+}, Mn^{2+}$; $Sr_4Al_{14}O_{25}:Eu^{2+}$ (SAE); $BaAl_8O_{13}:Eu^{2+}$; and mixtures thereof. As an example, the green phosphor is selected from the group consisting of $(Ba,Sr,Ca)MgAl_{10}O_{17}:Eu^{2+}, Mn^{2+}$ (BAMn); $(Ba,Sr,Ca)Al_2O_4:Eu^{2+}$; $(Y,Gd,Lu,Sc,La)BO_3:Ce^{3+},Tb^{3+}$; $Ca_8Mg(SiO_4)_4Cl_2:Eu^{2+}, Mn^{2+}$; $(Ba,Sr,Ca)_2SiO_4:Eu^{2+}$; $(Ba,Sr,Ca)_2(Mg,Zn)Si_2O_7:Eu^{2+}$; $(Sr,Ca,Ba)(Al,Ga,In)_2S_4:Eu^{2+}$; $(Y,Gd,Tb,La,Sm,Pr,Lu)_3(Al,Ga)_5O_{12}:Ce^{3+}$; $(Ca,Sr)_8(Mg,Zn)(SiO_4)_4Cl_2:Eu^{2+}, Mn^{2+}$ (CASI); $Na_2Gd_2B_2O_7:Ce^{3+}, Tb^{3+}$; $(Ba,Sr)_2(Ca,Mg,Zn)B_2O_6:K,Ce,Tb$; and mixtures thereof. As an example, the red phosphor is selected from the group consisting of $(Gd,Y,Lu,La)_2O_3:Eu^{3+}, Bi^{3+}$; $(Gd,Y,Lu,La)_2O_2S:Eu^{3+}, Bi^{3+}$; $(Gd,Y,Lu,La)VO_4:Eu^{3+}, Bi^{3+}$; $Y_2(O,S)_3:Eu^{3+}$; $Ca_{1-x}Mo_{1-y}Si_yO_4$: where $0.05 \leq x \leq 0.5$, $0 \leq y \leq 0.1$; $(Li,Na,K)_5Eu(W,Mo)O_4$; $(Ca,Sr)S:Eu^{2+}$; $SrY_2S_4:Eu^{2+}$; $CaLa_2S_4:Ce^{3+}$; $(Ca,Sr)S:Eu^{2+}$; $3.5MgO*0.5MgF_2*GeO_2:Mn^{4+}$ (MFG); $(Ba,Sr,Ca)Mg_xP_2O_7:Eu^{2+}, Mn^{2+}$; $(Y,Lu)_2WO_6:Eu^{3+}, Mo^{6+}$; $(Ba,Sr,Ca)_3Mg_xSi_2O_8:Eu^{2+}, Mn^{2+}$, wherein $1<x \leq 2$; $(RE_{1-y}Ce_y)Mg_{2-x}Li_xSi_{3-x}P_xO_{12}$, where RE is at least one of Sc, Lu, Gd, Y, and Tb, $0.0001<x<0.1$ and $0.001<y<0.1$; $(Y, Gd, Lu, La)_{2-x}Eu_xW_{1-y}Mo_yO_6$, where $0.5 \leq x \leq 1.0$, $0.01 \leq y \leq 1.0$; $(SrCa)_{1-x}Eu_xSi_5N_8$, where $0.01 \leq x \leq 0.3$; $SrZnO_2:Sm^{+3}$; M_mO_nX, wherein M is selected from the group of Sc, Y, a lanthanide, an alkali earth metal and mixtures thereof; X is a halogen; $1 \leq m \leq 3$; and $1 \leq n \leq 4$, and wherein the lanthanide doping level can range from 0.1 to 40% spectral weight; and Eu^{3+} activated phosphate or borate phosphors; and mixtures thereof.

In a specific embodiment, the entities are coated onto the surface region of the LED device using a suitable technique. Such technique can include deposition, spraying, plating, coating, spin coating, electrophoretic deposition, sputtering, dipping, dispensing, sedimentation, ink jet printing, and screen printing. The deposition can use an electrostatic technique to provide for uniformity and a high quality coating. In a specific embodiment, the entities have a uniformity between about 10 percent and about 0.1 percent. In some embodiments, the entities are coated onto the surface region of the LED device prior to its separation from a wafer into discrete dies.

In a specific embodiment, the present method includes providing an enclosure **117** overlying the LED device, which has been mounted, bonded, and coated. The enclosure can be made of a suitable material such as an optically transparent plastic, glass, or other material. As also shown, the enclosure has a suitable shape **119**. The shape can be annular, circular, egg-shaped, trapezoidal, or a combination of these shapes. Depending upon the embodiment, the enclosure is configured to facilitate and even optimize transmission of electromagnetic radiation from the LED device with coating through the surface region of the enclosure. FIG. **6** is a simplified diagram of an alternative packaged light emitting device **600** using multiple devices according to an embodiment of the present invention. In a specific embodiment, the present invention provides a packaged light emitting device **600** which has a substrate member with a surface region. In a specific embodiment, the substrate is made of a suitable material such a metal including, but not limited to, Alloy 42, copper, or others, including dielectrics and even plastics. In a specific embodiment, the substrate is generally from a lead frame member such as metal alloy.

The substrate, which holds the LED, can come in various shapes, sizes, and configurations. In a specific embodiment, the surface region of substrate **601** is cupped. Alternatively, the surface region **601** is recessed. The surface region generally has a smooth surface, plating, or coating. Such plating or coating can be gold, silver, platinum, aluminum, or any pure or alloy material, which is suitable for bonding to an overlying semiconductor material, but can be others.

Referring again to FIG. **6**, the device has light emitting diode devices overlying the surface region. At least one of the light emitting diode devices **103** is fabricated on a semipolar or nonpolar GaN containing substrate. The device emits polarized electromagnetic radiation. As shown, the light emitting device is coupled to a first potential, which is attached to the substrate, and a second potential **610**, which is coupled to wire or lead **611** bonded to a light emitting diode.

In a specific embodiment, at least one of the light emitting diode devices provides a quantum well region. The quantum well region is characterized by an electron wave function and a hole wave function which are substantially overlapped within a predetermined spatial region of the quantum well region according to a specific embodiment.

In a preferred embodiment, the light emitting diode device comprises at least a blue LED and the substantially polarized emission is blue light at a range from about 430 nanometers to about 490 nanometers.

The device has a thickness **115** of one or more which are excited by the substantially polarized emission and emit electromagnetic radiation at second wavelengths. In a preferred embodiment, the plurality of entities is emit substantially yellow light from an interaction with the substantially polarized emission of blue light. In a specific embodiment, the thickness of the plurality of entities, which are phosphor entities, is about five microns or less.

In a specific embodiment, the one or more entities comprises a phosphor or phosphor blend selected from one or more of $(Y, Gd, Tb, Sc, Lu, La)_3(Al, Ga, In)_5O_{12}:Ce^{3+}$, $SrGa_2S_4:Eu^{2+}$, $SrS:Eu^{2+}$, and colloidal quantum dot thin films comprising CdTe, ZnS, ZnSe, ZnTe, CdSe, or CdTe. In other embodiments, the device may include a phosphor capable of emitting substantially red light. Such phosphor is be selected from $(Gd,Y,Lu,La)_2O_3:Eu^{3+}$, Bi^{3+}; $(Gd,Y,Lu,La)_2O_2S:Eu^{3+}$, Bi^{3+}; $(Gd,Y,Lu,La)VO_4:Eu^{3+}$, Bi^{3+}; $Y_2(O,S)_3:Eu^{3+}$; $Ca_{1-x}Mo_{1-y}Si_yO_4$: where $0.05 \leq x \leq 0.5$, $0 \leq y \leq 0.1$; $(Li,Na,K)_5Eu(W,Mo)O_4$; $(Ca,Sr)S:Eu^{2+}$; $SrY_2S_4:Eu^{2+}$; $CaLa_2S_4:Ce^{3+}$; $(Ca,Sr)S:Eu^{2+}$; $3.5MgO*0.5MgF_2*GeO_2:Mn_4+$ (MFG); $(Ba,Sr,Ca)Mg_xP_2O_7:Eu^{2+}$, Mn^{2+}; $(Y,Lu)_2WO_6:Eu^{3+}$, Mo^{6+}; $(Ba,Sr,Ca)_3Mg_xSi_2O_8:Eu^{2+}$, Mn^{2+}, wherein $1<x \leq 2$; $(RE_{1-y}Ce_y)Mg_{2-x}Li_xSi_{3-x}P_xO_{12}$, where RE is at least one of Sc, Lu, Gd, Y, and Tb, $0.0001<x<0.1$ and $0.001<y<0.1$; $(Y, Gd, Lu, La)_{2-x}Eu_xW_{1-y}Mo_yO_6$, where $0.5 \leq x \leq 1.0$, $0.01 \leq y \leq 1.0$; $(SrCa)_{1-x}Eu_xSi_5N_8$, where $0.01 \leq x \leq 0.3$; $SrZnO_2:Sm^{+3}$; M_mO_nX wherein M is selected from the group of Sc, Y, a lanthanide, an alkali earth metal and mixtures thereof; X is a halogen; $1 \leq m \leq 3$; and $1 \leq n \leq 4$, and wherein the lanthanide doping level can range from 0.1 to 40% spectral weight; and Eu^{3+} activated phosphate or borate phosphors; and mixtures thereof.

In a specific embodiment, the light emitting diode device comprises at least a violet LED device capable of emitting electromagnetic radiation at a range from about 380 nanometers to about 440 nanometers, and the one or more entities are capable of emitting substantially white light. Other colored LEDs may also be used or combined according to a specific embodiment.

In a specific embodiment, the one or more entities comprise a blend of phosphors capable of emitting substantially blue light, substantially green light, and substantially red light. As an example, the blue emitting phosphor is selected from the group consisting of $(Ba,Sr,Ca)_5(PO_4)_3(Cl,F,Br,OH):Eu^{2+}$, Mn^{2+}; Sb^{3+},$(Ba,Sr,Ca)MgAl_{10}O_{17}:Eu^{2+}$, Mn^{2+}; $(Ba,Sr,Ca)BPO_5:Eu^{2+}$, Mn^{2+}; $(Sr,Ca)_{10}(PO_4)_6*nB_2O_3:Eu^{2+}$; $2SrO*0.84P_2O_5*0.16B_2O_3:Eu^{2+}$; $Sr_2Si_3O_8*2SrCl_2:Eu^{2+}$; $(Ba,Sr,Ca)Mg_xP_2O_7:Eu^{2+}$, Mn^{2+}; $Sr_4Al_{14}O_{25}:Eu^{2+}$ (SAE); $BaAl_8O_{13}:Eu^{2+}$; and mixtures thereof. As an example, the green phosphor is selected from the group consisting of $(Ba,Sr,Ca)MgAl_{10}O_{17}:Eu^{2+}$, Mn^{2+} (BAMn); $(Ba,Sr,Ca)Al_2O_4:Eu^{2+}$; $(Y,Gd,Lu,Sc,La)BO_3:Ce^{3+},Tb^{3+}$; $Ca_8Mg(SiO_4)_4Cl_2:Eu^{2+}$, Mn^{2+}; $(Ba,Sr,Ca)_2SiO_4:Eu^{2+}$; $(Ba,Sr,Ca)_2(Mg,Zn)Si_2O_7:Eu^{2+}$; $(Sr,Ca,Ba)(Al,Ga,In)_2S_4:Eu^{2+}$; $(Y,Gd,Tb,La,Sm,Pr,Lu)_3(Al,Ga)_5O_{12}:Ce^{3+}$; $(Ca,Sr)_8(Mg,Zn)(SiO_4)_4Cl_2:Eu^{2+}$, Mn^{2+} (CASI); $Na_2Gd_2B_2O_7:Ce^{3+}$, Tb^{3+}; $(Ba,Sr)_2(Ca,Mg,Zn)B_2O_6:K,Ce,Tb$; and mixtures thereof. As an example, the red phosphor is selected from the group consisting of $(Gd,Y,Lu,La)_2O_3:Eu^{3+}$, Bi^{3+}; $(Gd,Y,Lu,La)_2O_2S:Eu^{3+}$, Bi^{3+}; $(Gd,Y,Lu,La)VO_4:Eu^{3+}$, Bi^{3+}; $Y_2(O,S)_3:Eu^{3+}$; $Ca_{1-x}Mo_{1-y}Si_yO_4$: where $0.05 \leq x \leq 0.5$, $0 \leq y \leq 0.1$; $(Li,Na,K)_5Eu(W,Mo)O_4$; $(Ca,Sr)S:Eu^{2+}$; $SrY_2S_4:Eu^{2+}$; $CaLa_2S_4:Ce^{3+}$; $(Ca,Sr)S:Eu^{2+}$; $3.5MgO*0.5MgF_2*GeO_2:Mn^{4+}$ (MFG); $(Ba,Sr,Ca)Mg_xP_2O_7:Eu^{2+}$, Mn^{2+}; $(Y,Lu)_2WO_6:Eu^{3+}$, Mo^{6+}; $(Ba,Sr,Ca)_3Mg_xSi_2O_8:Eu^{2+}$, Mn^{2+}, wherein $1<x \leq 2$; $(RE_{1-y}Ce_y)Mg_{2-x}Li_xSi_{3-x}P_xO_{12}$, where RE is at least one of Sc, Lu, Gd, Y, and Tb, $0.0001<x<0.1$ and $0.001<y<0.1$; $(Y, Gd, Lu, La)_{2-x}Eu_xW_{1-y}Mo_yO_6$, where $0.5 \leq x \leq 1.0$, $0.01 \leq y \leq 1.0$; $(SrCa)_{1-x}Eu_xSi_5N_8$, where $0.01 \leq x \leq 0.3$; $SrZnO_2:Sm^{+3}$; M_mO_nX, wherein M is selected from the group of Sc, Y, a lanthanide, an alkali earth metal and mixtures thereof; X is a halogen; $1 \leq m \leq 3$; and $1 \leq n \leq 4$, and wherein the lanthanide doping level can range from 0.1 to 40% spectral weight; and Eu^{3+} activated phosphate or borate phosphors; and mixtures thereof.

In a specific embodiment, the present packaged device includes a second LED device **603** or possibly multiple devices. As shown, the second LED device is coupled to a first potential, which is attached to the substrate, and a second potential **609**, which is coupled to wire or lead **111** bonded to the second LED device. The second LED device can be coated with a phosphor or remain uncoated **615**. The LED device can be one of a plurality of colors including, but not limited to red, blue, green, yellow, violet, amber, cyan, and others emitting electromagnetic radiation, including ultraviolet. In a specific embodiment, the LED device can be made on a polar, non-polar, or semi-polar gallium nitride containing material. Alternatively, the LED can be made on an AlInGaP or like material.

In other embodiments, the packaged device can include other types of optical and/or electronic devices. As an example, the optical devices can be an organic light emitting diode (OLED), a laser diode, a nanoparticle optical device, or others. The electronic device can include an integrated circuit, a transistor, a rectifier, a sensor, a micro-machined electronic mechanical system, or any combination of these, and the like.

In a specific embodiment, the present packaged device includes an enclosure **617**. The enclosure can be made of a suitable material such as an optically transparent plastic, glass, or other material. As also shown, the enclosure has a suitable shape **619** which can be annular, circular, egg-shaped, trapezoidal, or a combination of these. Depending upon the embodiment, the enclosure is configured to facilitate, and even optimize transmission of electromagnetic radiation from the LED device with coating through the surface region of the enclosure.

FIGS. **7** through **10** illustrate a simplified method of assembling the light emitting device of FIG. **6** according to an embodiment of the present invention.

FIG. **11** is a simplified diagram of another alternative packaged light emitting device using an optical path to a plane region according to an embodiment of the present invention. As shown, the device has a substrate made of a suitable material such a metal including, but not limited to, Alloy 42, copper, dielectrics or plastics, among others. In a specific embodiment, the substrate is generally from a lead frame member such as a metal alloy, but can be others.

The substrate, which holds the LED, can come in various shapes, sizes, and configurations. In a specific embodiment, the surface region of substrate **1101** is cupped. Alternatively, the surface region **1101** is recessed. The surface region is generally a smooth surface, plating, or coating. Such plating or coating can be gold, silver, platinum, aluminum, or any pure or alloy material, which is suitable for bonding to an overlying semiconductor material, but can be others.

Referring again to FIG. **11**, the device has light emitting diode devices overlying the surface region. At least one of the light emitting diode devices **1103** is fabricated on a semipolar or nonpolar GaN containing substrate and emits polarized electromagnetic radiation **1105**. As shown, the light emitting device is coupled to a first potential, which is attached to the substrate, and a second potential **1109**, which is coupled to wire or lead **1111**. One of the light emitting diode devices includes a quantum well region characterized by an electron wave function and a hole wave function which are substantially overlapped within a predetermined spatial region of the quantum well region.

In a preferred embodiment, the light emitting diode device include at least a blue LED device which emits polarized blue light at a range from about 430 nanometers to about 490 nanometers.

The packaged device includes an enclosure **1117** made of a suitable material such as an optically transparent plastic, glass, or other material. The enclosure has a suitable shape **1119** which can be annular, circular, egg-shaped, trapezoidal, or a combination of these. Depending upon the embodiment, the enclosure with suitable shape and material is configured to facilitate and even optimize transmission of electromagnetic radiation from the LED device through the surface region of the enclosure. The enclosure includes an interior region and an exterior region with a volume defined within the interior region. The volume is open and filled with an inert gas or air to provide an optical path between the LED device or devices and the surface region of the enclosure.

In a specific embodiment, the present packaged device also has a thickness **[1115]** *1155* of entities formed overlying the enclosure to interact with light from the light emitting diode devices. In a specific embodiment, the entities are excited by the substantially polarized emission and emit electromagnetic radiation of second wavelengths. In a preferred embodiment, the plurality of entities is capable of emitting substantially yellow light from an interaction with the substantially polarized emission of blue light. In a specific embodiment, the thickness of phosphor entities is about five microns or less.

In a specific embodiment, entities comprises a phosphor or phosphor blend selected from one or more of $(Y, Gd, Tb, Sc, Lu, La)_3(Al, Ga, In)_5O_{12}:Ce^{3+}$, $SrGa_2S_4:Eu^{2+}$, $SrS:Eu^{2+}$, and colloidal quantum dot thin films comprising CdTe, ZnS, ZnSe, ZnTe, CdSe, or CdTe. In other embodiments, the device may include a phosphor capable of emitting substantially red light. Such phosphor is be selected from $(Gd,Y,Lu,La)_2O_3:Eu^{3+}, Bi^{3+}$; $(Gd,Y,Lu,La)_2O_2S:Eu^{3+}, Bi^{3+}$; $(Gd,Y,Lu,La)VO_4:Eu^{3+}, Bi^{3+}$; $Y_2(O,S)_3:Eu^{3+}$; $Ca_{1-x}Mo_{1-y}Si_yO_4$: where $0.05 \le x \le 0.5$, $0 \le y \le 0.1$; $(Li,Na,K)_5Eu(W,Mo)O_4$; $(Ca,Sr)S:Eu^{2+}$; $SrY_2S_4:Eu^{2+}$; $CaLa_2S_4:Ce^{3+}$; $(Ca,Sr)S:Eu^{2+}$; $3.5MgO*0.5MgF_2*GeO_2:Mn^{4+}$ (MFG); $(Ba,Sr,Ca)Mg_xP_2O_7:Eu^{2+}, Mn^{2+}$; $(Y,Lu)_2WO_6:Eu^{3+}, Mo^{6+}$; $(Ba,Sr,Ca)_3Mg_xSi_2O_8:Eu^{2+}, Mn^{2+}$, wherein $1 < x \le 2$; $(RE_{1-y}Ce_y)Mg_{2-x}Li_xSi_{3-x}P_xO_{12}$, where RE is at least one of Sc, Lu, Gd, Y, and Tb, $0.0001 < x < 0.1$ and $0.001 < y < 0.1$; $(Y, Gd, Lu, La)_{2-x}Eu_xW_{1-y}Mo_yO_6$, where $0.5 \le x \le 1.0$, $0.01 \le y \le 1.0$; $(Sr Ca)_{1-x}Eu_xSi_5N_8$, where $0.01 \le x \le 0.3$; $SrZnO_2:Sm^{+3}$; M_mO_nX wherein M is selected from the group of Sc, Y, a lanthanide, an alkali earth metal and mixtures thereof; X is a halogen; $1 \le m \le 3$; and $1 \le n \le 4$, and wherein the lanthanide doping level can range from 0.1 to 40% spectral weight; and Eu^{3+} activated phosphate or borate phosphors; and mixtures thereof.

In a specific embodiment, the one or more entities comprise a blend of phosphors capable of emitting substantially blue light, substantially green light, and substantially red light. As an example, the blue emitting phosphor is selected from the group consisting of $(Ba,Sr,Ca)_5(PO_4)_3(Cl,F,Br,OH):Eu^{2+}, Mn^{2+}$; $Sb^{3+},(Ba,Sr,Ca)MgAl_{10}O_{17}:Eu^{2+}, Mn^{2+}$; $(Ba,Sr,Ca)BPO_5:Eu^{2+}, Mn^{2+}$; $(Sr,Ca)_{10}(PO_4)_6*nB_2O_3:Eu^{2+}$; $2SrO*0.84P_2O_5*0.16B_2O_3:Eu^{2+}$; $Sr_2Si_3O_8*2SrCl_2:Eu^{2+}$; $(Ba,Sr,Ca)Mg_xP_2O_7:Eu^{2+}, Mn^{2+}$; $Sr_4Al_{14}O_{25}:Eu^{2+}$ (SAE); $BaAl_8O_{13}:Eu^{2+}$; and mixtures thereof. As an example, the green phosphor is selected from the group consisting of $(Ba,Sr,Ca)MgAl_{10}O_{17}:Eu^{2+}, Mn^{2+}$ (BAMn); $(Ba,Sr,Ca)Al_2O_4:Eu^{2+}$; $(Y,Gd,Lu,Sc,La)BO_3:Ce^{3+},Tb^{3+}$; $Ca_8Mg(SiO_4)_4Cl_2:Eu^{2+}, Mn^{2+}$; $(Ba,Sr,Ca)_2SiO_4:Eu^{2+}$; $(Ba,Sr,Ca)_2(Mg,Zn)Si_2O_7:Eu^{2+}$; $(Sr,Ca,Ba)(Al,Ga,In)_2S_4:Eu^{2+}$; $(Y,Gd,Tb,La,Sm,Pr,Lu)_3(Al,Ga)_5O_{12}:Ce^{3+}$; $(Ca,Sr)_8(Mg,Zn)(SiO_4)_4Cl_2:Eu^{2+}, Mn^{2+}$ (CASI); $Na_2Gd_2B_2O_7:Ce^{3+}, Tb^{3+}$; $(Ba,Sr)_2(Ca,Mg,Zn)B_2O_6:K,Ce,Tb$; and mixtures thereof. As an example, the red phosphor is selected from the group consisting of $(Gd,Y,Lu,La)_2O_3:Eu^{3+}, Bi^{3+}$; $(Gd,Y,Lu,La)_2O_2S:Eu^{3+}, Bi^{3+}$; $(Gd,Y,Lu,La)VO_4:Eu^{3+}, Bi^{3+}$; $Y_2(O,S)_3:Eu^{3+}$; $Ca_{1-x}Mo_{1-y}Si_yO_4$: where $0.05 \le x \le 0.5$, $0 \le y \le 0.1$; $(Li,Na,K)_5Eu(W,Mo)O_4$; $(Ca,Sr)S:Eu^{2+}$; $SrY_2S_4:Eu^{2+}$; $CaLa_2S_4:Ce^{3+}$; $(Ca,Sr)S:Eu^{2+}$; $3.5MgO*0.5MgF_2*GeO_2:Mn^{4+}$ (MFG); $(Ba,Sr,Ca)Mg_xP_2O_7:Eu^{2+}, Mn^{2+}$; $(Y,Lu)_2WO_6:Eu^{3+}, Mo^{6+}$; $(Ba,Sr,Ca)_3Mg_xSi_2O_8:Eu^{2+}, Mn^{2+}$, wherein $1 < x \le 2$; $(RE_{1-y}Ce_y)Mg_{2-x}Li_xSi_{3-x}P_xO_{12}$, where RE is at least one of Sc, Lu, Gd, Y, and Tb, $0.0001 < x < 0.1$ and $0.001 < y < 0.1$; $(Y, Gd, Lu, La)_{2-x}Eu_xW_{1-y}Mo_yO_6$, where $0.5 \le x \le 1.0$, $0.01 \le y \le 1.0$; $(SrCa)_{1-x}Eu_xSi_5N_8$, where $0.01 \le x \le 0.3$; $SrZnO_2:Sm^{+3}$; M_mO_nX, wherein M is selected from the group of Sc, Y, a lanthanide, an alkali earth metal and mixtures thereof; X is a halogen; $1 \le m \le 3$; and $1 \le n \le 4$, and wherein the lanthanide doping level can range from 0.1 to 40% spectral weight; and Eu^{3+} activated phosphate or borate phosphors; and mixtures thereof.

FIGS. **12** through **15** illustrate a simplified method of assembling the light emitting device of FIG. **11** according to an embodiment of the present invention.

FIG. **16** is a simplified diagram of a yet an alternative packaged light emitting device **1600** using an optical path to a plane region and filler material according to an embodiment of the present invention. The invention provides a packaged light emitting device **1600** with a substrate member having a surface region. In a specific embodiment, the substrate is made of a suitable material such a metal including, but not limited to, Alloy 42, copper, dielectric, or even plastic, among others, and preferably is a lead frame member such as a metal alloy.

The substrate, which holds the LED, can come in various shapes, sizes, and configurations and can be cupped or recessed. Additionally, the surface region is generally a smooth surface, with plating or coating. Such plating or coating can be gold, silver, platinum, or any pure or alloy material, which is suitable for bonding to an overlying semiconductor material, but can be others.

Referring again to FIG. **[1]** *16*, the device has one or more light emitting diode devices overlying the surface region. Each light emitting diode device **1603** is fabricated on a semipolar or nonpolar GaN containing substrate and emits polarized electromagnetic radiation. As shown, the light emitting device is coupled to a first potential, which is attached to the substrate, and a second potential **1609**, which is coupled to wire or lead **1611** bonded to a light emitting diode. At least one of the light emitting diode devices includes a quantum well region characterized by an electron wave function and a hole wave function. The electron wave function and the hole wave function are substantially overlapped within a predetermined spatial region of the quantum well. In a preferred embodiment, the one or more light emitting diode device comprises at least a blue LED device emitting substantially polarized blue light at a range from about 480 nanometers to about 570 nanometers.

In a specific embodiment, the present device also has a thickness **1615** of one or more entities formed overlying the light emitting diode devices and within an interior region of enclosure **1617**, which will be described in more detail below. The entities are excited by the substantially polarized emission and emit electromagnetic radiation of second wavelengths. In a preferred embodiment, the plurality of entities emits substantially yellow light from an interaction with the blue light. The phosphor is about five microns or less thick.

In a specific embodiment, entities comprises a phosphor or phosphor blend selected from $(Y, Gd, Tb, Sc, Lu, La)_3(Al, Ga, In)_5O_{12}:Ce^{3+}$, $SrGa_2S_4:Eu^{2+}$, $SrS:Eu^{2+}$, and colloidal quantum dot thin films comprising CdTe, ZnS, ZnSe, ZnTe, CdSe, or CdTe. In other embodiments, the device may include a phosphor capable of emitting substantially red light. Such phosphor is be selected from $(Gd,Y,Lu,La)_2O_3:Eu^{3+}$, Bi^{3+}; $(Gd,Y,Lu,La)_2O_2S:Eu^{3+}$, Bi^{3+}; $(Gd,Y,Lu,La)VO_4:Eu^{3+}$, Bi^{3+}; $Y_2(O,S)_3:Eu^{3+}$; $Ca_{1-x}Mo_{1-y}Si_yO_4$: where $0.05 \le x \le 0.5$, $0 \le y \le 0.1$; $(Li,Na,K)_5Eu(W,Mo)O_4$; $(Ca,Sr)S:Eu^{2+}$; $SrY_2S_4:Eu^{2+}$; $CaLa_2S_4:Ce^{3+}$; $(Ca,Sr)S:Eu^{2+}$; $3.5MgO*0.5MgF_2*GeO_2:Mn^{4+}$ (MFG); $(Ba,Sr,Ca)Mg_xP_2O_7:Eu^{2+}$, Mn^{2+}; $(Y,Lu)_2WO_6:Eu^{3+}$, Mo^{6+}; $(Ba,Sr,Ca)_3Mg_xSi_2O_8:Eu^{2+}$, Mn^{2+}, wherein $1<x \le 2$; $(RE_{1-y}Ce_y)Mg_{2-x}Li_xSi_{3-x}P_xO_{12}$, where RE is at least one of Sc, Lu, Gd, Y, and Tb, $0.0001<x<0.1$ and $0.001<y<0.1$; $(Y, Gd, Lu, La)_{2-x}Eu_xW_{1-y}Mo_yO_6$, where $0.5 \le x \le 1.0$, $0.01 \le y \le 1.0$; $(SrCa)_{1-x}Eu_xSi_5N_8$, where $0.01 \le x \le 0.3$; $SrZnO_2:Sm^{+3}$; M_mO_nX wherein M is selected from the group of Sc, Y, a lanthanide, an alkali earth metal and mixtures thereof; X is a halogen; $1 \le m \le 3$; and $1 \le n \le 4$, and wherein the lanthanide doping level can range from 0.1 to 40% spectral weight; and Eu^{3+} activated phosphate or borate phosphors; and mixtures thereof.

In a specific embodiment, the light emitting diode device comprises at least a violet LED device capable of emitting electromagnetic radiation at a range from about 380 nanometers to about 440 nanometers and the entities are capable of emitting substantially white light, the substantially polarized emission being violet light. Other colored LEDs may also be used or combined according to a specific embodiment.

In a specific embodiment, the entities comprise a blend of phosphors capable of emitting substantially blue light, substantially green light, and substantially red light. As an example, the blue emitting phosphor is selected from the group consisting of $(Ba,Sr,Ca)_5(PO_4)_3(Cl,F,Br,OH):Eu^{2+}$, Mn^{2+}; Sb^{3+},$(Ba,Sr,Ca)MgAl_{10}O_{17}:Eu^{2+}$, Mn^{2+}; $(Ba,Sr,Ca)BPO_5:Eu^{2+}$, Mn^{2+}; $(Sr, Ca)_{10}(PO_4)_6*nB_2O_3:Eu^{2+}$; $2SrO*0.84P_2O_5*0.16B_2O_3:Eu^{2+}$; $Sr_2Si_3O_8*2SrCl_2:Eu^{2+}$; $(Ba,Sr,Ca)Mg_xP_2O_7:Eu^{2+}$, Mn^{2+}; $Sr4Al_{14}O_{25}:Eu^{2+}$ (SAE); $BaAl_8O_{13}:Eu^{2+}$; and mixtures thereof. As an example, the green phosphor is selected from the group consisting of $(Ba,Sr,Ca)MgAl_{10}O_{17}:Eu^{2+}$, Mn^{2+} (BAMn); $(Ba,Sr,Ca)Al_2O_4:Eu^{2+}$; $(Y,Gd,Lu,Sc,La)BO_3:Ce^{3+},Tb^{3+}$; $Ca_8Mg(SiO_4)_4Cl_2:Eu^{2+}$, Mn^{2+}; $(Ba,Sr,Ca)_2SiO_4:Eu^{2+}$; $(Ba,Sr,Ca)_2(Mg,Zn)Si_2O_7:Eu^{2+}$; $(Sr,Ca,Ba)(Al,Ga,In)_2S_4:Eu^{2+}$; $(Y,Gd,Tb,La,Sm,Pr,Lu)_3(Al,Ga)_5O_{12}:Ce^{3+}$; $(Ca,Sr)_8(Mg,Zn)(SiO_4)_4Cl_2:Eu^{2+}$, Mn^{2+} (CASI); $Na_2Gd_2B_2O_7:Ce^{3+}$, Tb^{3+}; $(Ba,Sr)_2(Ca,Mg,Zn)B_2O_6:K,Ce,Tb$; and mixtures thereof. As an example, the red phosphor is selected from the group consisting of $(Gd,Y,Lu,La)_2O_3:Eu^{3+}$, Bi^{3+}; $(Gd,Y,Lu,La)_2O_2S:Eu^{3+}$, Bi^{3+}; $(Gd,Y,Lu,La)VO_4:Eu^{3+}$, Bi^{3+}; $Y_2(O,S)_3:Eu^{3+}$; $Ca_{1-x}Mo_{1-y}Si_yO_4$: where $0.05 \le x \le 0.5$, $0 \le y \le 0.1$; $(Li,Na,K)_5Eu(W,Mo)O_4$; $(Ca,Sr)S:Eu^{2+}$; $SrY_2S_4:Eu^{2+}$; $CaLa_2S_4:Ce^{3+}$; $(Ca,Sr)S:Eu^{2+}$; $3.5MgO*0.5MgF_2*GeO_2:Mn^{4+}$ (MFG); $(Ba,Sr,Ca)Mg_xP_2O_7:Eu^{2+}$, Mn^{2+}; $(Y,Lu)_2WO_6:Eu^{3+}$, Mo^{6+}; $(Ba,Sr,Ca)_3Mg_xSi_2O_8:Eu^{2+}$, Mn^{2+}, wherein $1<x \le 2$; $(RE_{1-y}Ce_y)Mg_{2-x}Li_xSi_{3-x}P_xO_{12}$, where RE is at least one of Sc, Lu, Gd, Y, and Tb, $0.0001<x<0.1$ and $0.001<y<0.1$; $(Y, Gd, Lu, La)_{2-x}Eu_xW_{1-y}Mo_yO_6$, where $0.5 \le x \le 1.0$, $0.01 \le y \le 1.0$; $(SrCa)_{1-x}Eu_xSi_5N_8$, where $0.01 \le x \le 0.3$; $SrZnO_2:Sm^{+3}$; M_mO_nX, wherein M is selected from the group of Sc, Y, a lanthanide, an alkali earth metal and mixtures thereof; X is a halogen; $1 \le m \le 3$; and $1 \le n \le 4$, and wherein the lanthanide doping level can range from 0.1 to 40% spectral weight; and Eu^{3+} activated phosphate or borate phosphors; and mixtures thereof.

In a specific embodiment, the present packaged device includes an enclosure **1617**. The enclosure can be made of a suitable material such as an optically transparent plastic, glass, or other material. As also shown, the enclosure has a suitable shape **1619** which can be annular, circular, egg-shaped, trapezoidal, or a combination of these shapes. Depending upon the embodiment, the enclosure with suitable shape and material is configured to facilitate and even optimize transmission of electromagnetic radiation from the LED device through the surface region of the enclosure. In a specific embodiment, the enclosure comprises an interior region and an exterior region with a volume defined within the interior region. The volume is open and filled with an inert gas or air to provide an optical path between the LED device or devices and the surface region of the enclosure. In a specific embodiment, the enclosure also has a thickness and fits around a base region of the substrate.

In a specific embodiment, the plurality of entities is suspended in a suitable medium. An example of such a medium can be a silicone, glass, spin on glass, plastic, polymer, which is doped, metal, or semiconductor material, including layered materials, and/or composites, among others. Depending upon the embodiment, the medium including polymers begins as a fluidic state, which fills an interior region of the enclosure. The medium fills and can seal the LED device or devices. The medium is then cured and fills in a substantially stable state. The medium is preferably optically transparent, but can also be selectively transparent and/or translucent. In addition, the medium, once cured, is substantially inert. In a preferred embodiment, the medium has a low absorption capability to allow a substantial portion of the electromagnetic radiation generated by the LED device to traverse through the medium and be outputted through the enclosure. In other embodiments, the medium can be doped or treated to selectively filter, disperse, or influence selected wavelengths of light. As an example, the medium can be treated with metals, metal oxides, dielectrics, or semiconductor materials, and/or combinations of these materials, and the like.

FIGS. **17** through **20** illustrate a simplified method of assembling the light emitting device of FIG. **16** according to an embodiment of the present invention.

FIG. **21** is a simplified diagram of a yet an alternative packaged light emitting device using an optical path to a plane region according to an embodiment of the present invention. As shown, the packaged light emitting device includes one or more entities formed within an interior region of enclosure **2117**.

FIG. **22** is a simplified diagram of a yet an alternative packaged light emitting device using an optical path to a plane region according to an embodiment of the present invention. The packaged light emitting device includes entities formed within a thickness of enclosure **2217**.

Although the above has been described in terms of an embodiment of a specific package, there can be many variations, alternatives, and modifications. As an example, the LED device can be configured in a variety of packages such as cylindrical, surface mount, power, lamp, flip-chip, star, array, strip, or geometries that rely on lenses (silicone, glass) or sub-mounts (ceramic, silicon, metal, composite). Alternatively, the package can be any variations of these packages.

In other embodiments, the packaged device can include other types of optical and/or electronic devices. As an example, the optical devices can be OLED, a laser, a nanoparticle optical device, and others. In other embodiments, the electronic device can include an integrated circuit, a sensor, a micro-machined electronic mechanical system, or any combination of these, and the like.

In a specific embodiment, the packaged device can be coupled to a rectifier to convert alternating current power to direct current, which is suitable for the packaged device. The rectifier can be coupled to a suitable base, such as an Edison screw such as E27 or E14, bipin base such as MR16 or GU5.3, or a bayonet mount such as GU10, or others. In other embodiments, the rectifier can be spatially separated from the packaged device.

Additionally, the present packaged device can be provided in a variety of applications. In a preferred embodiment, the application is general lighting, which includes buildings for offices, housing, outdoor lighting, stadium lighting, and others. Alternatively, the applications can be for display, such as those used for computing applications, televisions, flat panels, micro-displays, and others. Still further, the applications can include automotive, gaming, and others.

In a specific embodiment, the present devices are configured to achieve spatial uniformity. That is, diffusers can be added to the encapsulant to achieve spatial uniformity. Depending upon the embodiment, the diffusers can include TiO_2, CaF_2, SiO_2, $CaCO_3$, $BaSO_4$, and others, which are optically transparent and have a different index than the encapsulant causing the light to reflect, refract, and scatter to make the far field pattern more uniform. Of course, there can be other variations, modifications, and alternatives.

As used herein, the term GaN substrate is associated with Group III-nitride based materials including GaN, InGaN, AlGaN, or other Group III containing alloys or compositions that are used as starting materials. Such starting materials include polar GaN substrates (i.e., substrate where the largest area surface is nominally an (h k l) plane wherein h=k=0, and l is non-zero), non-polar GaN substrates (i.e., substrate material where the largest area surface is oriented at an angle ranging from about 80-100 degrees from the polar orientation described above towards an (h k l) plane wherein l=0, and at least one of h and k is non-zero) or semi-polar GaN substrates (i.e., substrate material where the largest area surface is oriented at an angle ranging from about +0.1 to 80 degrees or 110-179.9 degrees from the polar orientation described above towards an (h k l) plane wherein l=0, and at least one of h and k is non-zero).

While the above is a full description of the specific embodiments, various modifications, alternative constructions and equivalents may be used. Additionally, the above has been generally described in terms of entities that may be phosphor materials or phosphor like materials, but it would be recognized that other "energy-converting luminescent materials," which may include one or more phosphors, semiconductors, semiconductor nanoparticles ("quantum dots"), organic luminescent materials, and the like, and combinations of them, can also be used. The energy converting luminescent materials can generally be wavelength converting material and/or materials or thicknesses of them. Furthermore, the above has been generally described in electromagnetic radiation that directly emits and interacts with the wavelength conversion materials, but it would be recognized that the electromagnetic radiation can be reflected and then interact with the wavelength conversion materials or a combination of reflection and direct incident radiation. The specification describes specific gallium and nitrogen containing surface orientations, but it would be recognized that other plane orientations can be used. Therefore, the above description and illustrations should not be taken as limiting the scope of the present invention which is defined by the appended claims.

What is claimed is:

1. A light emitting device comprising:

a substrate member comprising a first surface region;

one or more light emitting diode devices overlying the first surface region, at least one of the light emitting diode devices **[**being fabricated on**]** *comprising* a semipolar or nonpolar *bulk* GaN containing **[**device**]** substrate *and light emitting layers*, **[**the device substrate comprising a bulk gallium nitride substrate, the at least one or more light emitting diode devices fabricated on the semipolar or nonpolar GaN containing device substrate emitting**]** *said light emitting diode device being configured to emit* substantially polarized emission of one or more first wavelengths;

an optically transparent member coupled to the one or more light emitting diode devices;

[an optical path provided between the one or more light emitting diode devices and the optically transparent member; and**]**

and a thickness of one or more entities formed within a vicinity of the optically transparent member, one or more of the entities being excited by the substantially polarized emission to emit electromagnetic radiation at one or more second wavelengths *such that said light emitting device emits polarized and non-polarized light*;

wherein the bulk gallium nitride substrate has a dislocation density in the plane of the large-area surface that is less than $5\times10^{6}\ cm^{-2}$.

2. The light emitting device of claim **1**, wherein at least one of the light emitting diode devices comprises a quantum well region, the quantum well region being characterized by an electron wave function and a hole wave function, the electron wave function and the hole wave function being substantially overlapped within a predetermined spatial region of the quantum well region.

3. The light emitting device of claim **1**, wherein the thickness of the one or more entities is formed overlying a first side of the optically transparent member, the first side facing the one or more of the light emitting diode devices.

4. The light emitting device of claim **1**, wherein the one or more light emitting diode devices comprise at least a blue LED device, the substantially polarized emission being blue light.

5. The light emitting device of claim **1**, wherein the one or more light emitting diode devices comprise at least a blue LED device capable of emitting electromagnetic radiation at a wavelength range from about 430 nanometers to about 490 nanometers, the substantially polarized emission being blue light.

6. The light emitting device of claim **1**, wherein the one or more light emitting diode devices comprise at least a blue LED device capable of emitting electromagnetic radiation at a range from about 430 nanometers to about 490 nanometers and the one or more entities is capable of emitting substantially yellow light, the substantially polarized emission being blue light.

7. The light emitting device of claim **6** wherein the one or more entities comprises a phosphor or phosphor blend selected from one or more of $(Y, Gd, Tb, Sc, Lu, La)_3(Al, Ga, In)_5O_{12}{:}Ce^{3+}$, $SrGa_2S_4{:}Eu^{2+}$, $SrS{:}Eu^{2+}$, and colloidal quantum dot thin films comprising CdTe, ZnS, ZnSe, ZnTe, CdSe, or CdTe.

8. The light emitting device of claim **6** further comprising a phosphor capable of emitting substantially red light, wherein the phosphor is selected from one or more of the group consisting of $(Gd,Y,Lu,La)_2O_3{:}Eu^{3+}$, $Bi^{3+}(Gd,Y,Lu,La)_2O_2S{:}EU^{3+}$, Bi^{3+}; $(Gd,Y,Lu,La)VO_4{:}Eu^{3+}$, Bi^{3+}; $Y_2(O,S)_3{:}\ Eu^{3+}$; $Ca_{1-x}Mo_{1-y}Si_yO_4$: where $0.05\leq x\leq 0.5$, $0\leq y\leq 0.1$; $(Li,Na,K)_5Eu(W,Mo)O_4$; **[**$(Ca,Sr)S{:}Eu^{2+}$;**]** $SrY_2S_4{:}Eu^{2+}$; $CaLa_2S_4{:}Ce^{3+}$; $(Ca,Sr)S{:}Eu^{2+}$; $3.5MgO{*}0.5MgF_2{*}GeO_2{:}Mn^{4+}$ (MFG); $(Ba,Sr,Ca)Mg_xP_2O_7{:}Eu^{2+}$, Mn^{2+}; $(Y,Lu)_2WO_6{:}Eu^{3+}$, Mo^{6+}; $(Ba,Sr,Ca)_3Mg_xSi_2O_8{:}Eu^{2+}$, Mn^{2+}, wherein $1\leq x\leq 2$; $(RE_{1-y}Ce_y)Mg_{2-x}Li_xSi_3,PxO_{12}$, where RE is at least one of Sc, Lu, Gd, Y, and Tb, $0.0001\leq x\leq 0.1$ and $0.001\leq y\leq 0.1$; $(Y, Gd, Lu, La)_{2-x}Eu_xW_{1-y}Mo_yO_6$, where $0.5\leq x.\leq 1.0$, $0.01\leq y\leq 1.0$; $(SrCa)_{1-x}Eu_xSi_5N_8$, where $0.01\leq x\leq 0.3$; $SrZnO_2{:}Sm^{+}$; M_mO_nX, wherein M is selected from the group of Sc, Y, a lanthanide, an alkali earth metal and mixtures thereof; X is a halogen; $1\leq m\leq 3$; and $1\leq n\leq 4$, and wherein the lanthanide doping level can range from 0.1 to 40% spectral weight; and Eu^{3+} activated phosphate or borate phosphors; and mixtures thereof.

9. The light emitting device of claim **1**, wherein the one or more light emitting diode devices comprise at least a violet LED device capable of emitting electromagnetic radiation at a range from about 380 nanometers to about 440 nanometers and the one or more entities are capable of emitting substantially white light, the substantially polarized emission being violet light.

10. The light emitting device of claim **1**, wherein the one or more entities comprise a blend of wavelength converting materials capable of emitting substantially blue light, substantially green light, and substantially red light.

11. The light emitting device of claim **10** wherein the blue emitting phosphor is selected from the group consisting of $(Ba,Sr,Ca)_5(PO_4)_3(Cl,F,Br,OH){:}Eu^{2+}$, Mn^{2+}; Sb^{3+},$(Ba,Sr,Ca)MgAl_{10}O_{17}{:}Eu^{2+}$, Mn^{2+}; $(Ba,Sr,Ca)BPO_5{:}Eu^{2+}$, Mn^{2+}; $(Sr, Ca)_{10}(PO_4)_6{*}nB_2O_3{:}Eu^{2+}$; $2SrO{*}0.84P_2O5{*}0.16B_2O_3{:}Eu^{2+}$; $Sr_2Si_3O_8{*}2SrCl_2{:}Eu^{2+}$; $(Ba,Sr,Ca)Mg_xP_2O_7{:}Eu^{2+}$, Mn^{2+}; $Sr_4Al_{14}O_{25}{:}Eu^{2+}$ (SAE); $BaAl_8O_{13}{:}Eu^{2+}$; and mixtures thereof.

12. The light emitting device of claim **10** wherein the green phosphor is selected from the group consisting of $(Ba,Sr,Ca)MgAl_{10}O_{17}{:}Eu^{2+}$, Mn^{2+} (BAMn); $(Ba,Sr,Ca)Al_2O_4{:}Eu^{2+}$; $(Y,Gd,Lu,Sc,La)BO_3{:}Ce^{3+},Tb^{3+}$; $Ca_8Mg(SiO_4)_4Cl_2{:}Eu^{2+}$, Mn^{2+}; $(Ba,Sr,Ca)_2SiO_4{:}Eu^{2+}$; $(Ba,Sr,Ca)_2(Mg,Zn)Si_2O_7{:}Eu^{2+}$; $(Sr,Ca,Ba)(Al,Ga,ln)_2S_4{:}Eu^{2+}$; $(Y,Gd,Tb,La,Sm,Pr,Lu)_3(Al,Ga)_5O_{12}{:}Ce^{3+}$; $(Ca,Sr)_8(Mg,Zn)(SiO_4)_4Cl_2{:}Eu^{2+}$, Mn^{2+} (CASI); $Na_2Gd_2B_2O_7{:}Ce^{3+}$, Tb^{3+}; $(Ba,Sr)_2(Ca,Mg,Zn)B_2O_6{:}K,Ce,Tb$; and mixtures thereof.

13. The light emitting device of claim **10** wherein the red phosphor is selected from the group consisting of $(Gd,Y,Lu,La)_2O_3{:}Eu^{3+}$, Bi^{3+}; $(Gd,Y,Lu,La)_2O_2S{:}Eu^{3+}$, Bi^{3+}; $(Gd,Y,Lu,La)VO_4{:}Eu^{3+}$, Bi^{3+}; $Y_2(O,S)_3{:}\ Eu^{3+}$; $Ca_{1-x}Mo_{1-y}Si_yO_4$: where $0.05\leq x\leq 0.5$, $0\leq y\leq 0.1$; $(Li,Na,K)_5Eu(W,Mo)O_4$; $(Ca,Sr)S{:}Eu^{2+}$; $SrY_2S_4{:}Eu^{2+}$; $CaLa_2S_4{:}Ce^{3+}$; **[**$(Ca,Sr)S{:}Eu^{2+}$;**]** $3.5MgO{*}0.5MgF_2{*}GeO_2{:}Mn^{4+}$ (MFG); $(Ba,Sr,Ca)Mg_xP_2O_7{:}Eu^{2+}$, Mn^{2+}; $(Y,Lu)_2WO_6{:}Eu^{3+}$, Mo^{6+}; $(Ba,Sr,Ca)_3Mg_xSi_2O_8{:}Eu^{2+}$, Mn^{2+}, wherein $1\leq x\leq 2$; $(RE_{1-y}Ce_y)Mg_{2-x}Li_xSi_{3-x}P_xO_{12}$, where RE is at least one of Sc, Lu, Gd, Y, and Tb, $0.0001\leq x\leq 0.1$ and $0.001<y<0.1$; $(Y, Gd, Lu, La)_{2-x}Eu_xW_{1-y}Mo_yO_6$, where $0.5\leq x.\leq 1.0$, $0.01\leq y\leq 1.0$; $(SrCa)_{1-x}Eu_xSi_5N_8$, where $0.01\leq x\leq 0.3$; $SrZnO_2{:}Sm^{+}$; M_mO_nX, wherein M is selected from the group of Sc, Y, a lanthanide, an alkali earth metal and mixtures thereof; X is a halogen; $1\leq m\leq 3$; and $1\leq n\leq 4$, and wherein the lanthanide doping level can range from 0.1 to 40% spectral weight; and Eu^{3+} activated phosphate or borate phosphors; and mixtures thereof.

14. The light emitting device of claim **1**, wherein the one or more entities being a plurality of wavelength converting entities are selected from a red emitting wavelength converting material, a green emitting wavelength converting material, a blue emitting wavelength converting material, and a yellow emitting wavelength converting material.

15. The light emitting device of claim **1**, wherein the thickness of the one or more entities is arc provided by at least one of electrophoretic deposition, plating, sputtering, spraying, dipping, and dispensing.

16. The light emitting device of claim **1**, wherein the one or more light emitting diode devices comprise two light emitting devices.

17. The light emitting device of claim **1**, wherein the bulk gallium nitride substrate was formed by slicing from a boule that was grown by hydride vapor epitaxy or ammonothermally.

18. The light emitting device of claim **1**, wherein the thickness of the one or more entities is formed overlying the one or more light emitting diode devices.

19. The light emitting device of claim **1**, **[**further comprising**]** *wherein the optical clear member comprises* an enclosure, wherein the enclosure has a shape chosen from among annular, circular, egg-shaped, trapezoidal, or a combination thereof.

20. The light emitting device of claim **1**, wherein the device is packaged and is coupled to a rectifier.

21. The light emitting device of claim **1**, further comprising a diffuser, the diffuser comprising at least one of TiO_2, CaF_2, SiO_2, $CaCO_3$, and $BaSO_4$.

22. A light emitting device comprising:

a substrate member comprising a first surface region;

one or more light emitting diode devices overlying the first surface region, at least one of the light emitting diode devices **[**being fabricated on**]** *comprising* a semipolar or nonpolar GaN containing **[**device**]** substrate *and light emitting layers*, **[**the device substrate comprising a bulk gallium nitride substrate, the at least one or more light emitting diode devices fabricated on the semipolar or nonpolar GaN containing device substrate emitting**]** *said light emitting diode device being configured to emit* substantially polarized emission of one or more first wavelengths;

an optically transparent member coupled to the one or more light emitting diode devices;

[an optical path provided between the one or more light emitting diode devices and the optically transparent member;**]** and

a thickness of one or more entities formed within a vicinity of the optically transparent member, one or more of the entities being excited by the substantially polarized emission to emit electromagnetic radiation at one or more second wavelengths *such that said light emitting device emits polarized and non-polarized light*;

wherein a crystallographic orientation of the device substrate is within ±5 degrees of the $\{1\ -1\ 0\ 0\}$ m plane, the $\{1\ 1\ -2\ 0\}$ a plane, the $\{1\ 1\ -2\ 2\}$ plane, the $\{2\ 0\ -2\pm1\}$ plane, the $\{1\ -1\ 0\pm1\}$ plane, the $\{1\ -1\ 0\ -\pm2\}$ plane, or the $\{1\ -1\ 0\pm3\}$ plane.

23. The light emitting device of claim **22**, wherein at least one of the light emitting diode devices comprises a quantum well region, the quantum well region being characterized by an electron wave function and a hole wave function, the electron wave function and the hole wave function being substantially overlapped within a predetermined spatial region of the quantum well region.

24. The light emitting device of claim **22**, wherein the thickness of the one or more entities is formed overlying a first side of the optically transparent member, the first side facing the one or more of the light emitting diode devices.

25. The light emitting device of claim **22**, wherein the one or more light emitting diode devices comprise at least a blue LED device, the substantially polarized emission being blue light.

26. The light emitting device of claim **22**, wherein the one or more light emitting diode devices comprise at least a blue LED device capable of emitting electromagnetic radiation at a wavelength range from about 430 nanometers to about 490 nanometers, the substantially polarized emission being blue light.

27. The light emitting device of claim **22**, wherein the one or more light emitting diode devices comprise at least a blue LED device capable of emitting electromagnetic radiation at a range from about 430 nanometers to about 490 nanometers and the one or more entities is capable of emitting substantially yellow light, the substantially polarized emission being blue light.

28. The light emitting device of claim **27**, wherein the one or more entities comprises a phosphor or phosphor blend selected from one or more of $(Y, Gd, Tb, Sc, Lu, La)_3(Al, Ga, In)_5O_{12}:Ce^{3+}$, $SrGa_2S_4:Eu^{2+}$, $SrS:Eu^{2+}$, and colloidal quantum dot thin films comprising CdTe, ZnS, ZnSe, ZnTe, CdSe, or CdTe.

29. The light emitting device of claim **27**, further comprising a phosphor capable of emitting substantially red light, wherein the phosphor is selected from one or more of the group consisting of $(Gd,Y,Lu,La)_2O_3:Eu^{3+}, Bi^{3+}$; $(Gd,Y,Lu,La)_2O_2S:Eu^{3+}, Bi^{3+}$; $(Gd,Y,Lu,La)VO_4:Eu^{3+}, Bi^{3+}$; $Y_2(O,S)_3: Eu^{3+}$; $Ca_{1-x}Mo_{1-y}Si_yO_4$: where $0.05\leq x\leq 0.5$, $0\leq y\leq 0.1$; $(Li,Na,K)_5Eu(W,Mo)O_4$; **[**$(Ca,Sr)S:Eu^{2+}$;**]** $SrY_2S_4:Eu^{2+}$; $CaLa_2S_4:Ce^{3+}$; $(Ca,Sr)S:Eu^{2+}$; $3.5MgO*0.5MgF_2*GeO_2:Mn^{4+}$ (MFG); $(Ba,Sr,Ca)Mg_xP_2O_7:Eu^{2+}, Mn^{2+}$; $(Y,Lu)_2WO_6:Eu^{3+}, Mo^{6+}$; $(Ba,Sr,Ca)_3Mg_xSi_2O_8:Eu^{2+}, Mn^{2+}$, wherein $1\leq x\leq 2$; $(RE_{1-y}Ce_y)Mg_{2-x}Li_xSi_3,PxO_{12}$, where RE is at least one of Sc, Lu, Gd, Y, and Tb, $0.0001\leq x\leq 0.1$ and $0.001\leq y\leq 0.1$; $(Y, Gd, Lu, La)_{2-x}Eu_xW_{1-y}Mo_yO_6$, where $0.5\leq x.\leq 1.0$, $0.01\leq y\leq 1.0$; $(SrCa)_{1-x}Eu_xSi_5N_8$, where $0.01\leq x\leq 0.3$; $SrZnO_2:Sm^{+3}$; M_mO_nX, wherein M is selected from the group of Sc, Y, a lanthanide, an alkali earth metal and mixtures thereof; X is a halogen; $1\leq m\leq 3$; and $1\leq n\leq 4$, and wherein the lanthanide doping level can range from 0.1 to 40% spectral weight; and Eu^{3+} activated phosphate or borate phosphors; and mixtures thereof.

30. The light emitting device of claim **22**, wherein the one or more light emitting diode devices comprise at least a violet LED device capable of emitting electromagnetic radiation at a range from about 380 nanometers to about 440 nanometers and the one or more entities are capable of emitting substantially white light, the substantially polarized emission being violet light.

31. The light emitting device of claim **22**, wherein the one or more entities comprise a blend of wavelength converting materials capable of emitting substantially blue light, substantially green light, and substantially red light.

32. The light emitting device of claim **31**, wherein the blue emitting phosphor is selected from the group consisting of $(Ba,Sr,Ca)_5(PO_4)_3(Cl,F,Br,OH):Eu^{2+}, Mn^{2+}$; Sb^{3+},$(Ba,Sr,Ca)MgAl_{10}O_{17}:Eu^{2+}, Mn^{2+}$; $(Ba,Sr,Ca)BPO_5:Eu^{2+}, Mn^{2+}$; $(Sr, Ca)_{10}(PO_4)_6*nB_2O_3:Eu^{2+}$; $2SrO*0.84P_2O5*0.16B_2O_3:Eu^{2+}$; $Sr_2Si_3O_8*2SrCl_2:Eu^{2+}$; $(Ba,Sr,Ca)Mg_xP_2O_7:Eu^{2+}, Mn^{2+}$; $Sr_4Al_{14}O_{25}:Eu^{2+}$ (SAE); $BaAl_8O_{13}:Eu^{2+}$; and mixtures thereof.

33. The light emitting device of claim **31**, wherein the green phosphor is selected from the group consisting of $(Ba,Sr,Ca)MgAl_{10}O_{17}:Eu^{2+}, Mn^{2+}$ (BAMn); $(Ba,Sr,Ca)Al_2O_4:Eu^{2+}$; $(Y,Gd,Lu,Sc,La)BO_3:Ce^{3+},Tb^{3+}$; $Ca_8Mg(SiO_4)_4Cl_2:Eu^{2+}, Mn^{2+}$; $(Ba,Sr,Ca)_2SiO_4:Eu^{2+}$; $(Ba,Sr,Ca)_2(Mg,Zn)Si_2O_7:Eu^{2+}$; $(Sr, Ca,Ba)(Al,Ga,ln)_2S_4:Eu^{2+}$; $(Y,Gd,Tb,La,Sm,Pr,Lu)_3(Al,Ga)_5O_{12}:Ce^{3+}$; $(Ca,Sr)_8(Mg,Zn)(SiO_4)_4Cl_2:Eu^{2+}, Mn^{2+}$ (CASI); $Na_2Gd_2B_2O_7:Ce^{3+}, Tb^{3+}$; $(Ba,Sr)_2(Ca,Mg,Zn)B_2O_6:K,Ce,Tb$; and mixtures thereof.

34. The light emitting device of claim **31**, wherein the red phosphor is selected from the group consisting of $(Gd,Y,Lu,La)_2O_3:Eu^{3+}, Bi^{3+}$; $(Gd,Y,Lu,La)_2O_2S:Eu^{3+}, Bi^{3+}$; $(Gd,Y,Lu,La)VO_4:Eu^{3+}, Bi^{3+}$; $Y_2(O,S)_3: Eu^{3+}$; $Ca_{1-x}Mo_{1-y}Si_yO_4$: where $0.05\leq x\leq 0.5$, $0\leq y\leq 0.1$; $(Li,Na,K)_5Eu(W,Mo)O_4$; $(Ca,Sr)S:Eu^{2+}$; $SrY_2S_4:Eu^{2+}$; $CaLa_2S_4:Ce^{3+}$; **[**$(Ca,Sr)S:Eu^{2+}$;**]** $3.5MgO*0.5MgF_2*GeO_2:Mn^{4+}$ (MFG); $(Ba,Sr,Ca)Mg_xP_2O_7:Eu^{2+}, Mn^{2+}$; $(Y,Lu)_2WO_6:Eu^{3+}, Mo^{6+}$; $(Ba,Sr,Ca)_3Mg_xSi_2O_8:Eu^{2+}, Mn^{2+}$, wherein $1\leq x\leq 2$; $(RE_{1-y}Ce_y)$

$Mg_{2-x}Li_xSi_{3-x}P_xO_{12}$, where RE is at least one of Sc, Lu, Gd, Y, and Tb, $0.0001 \leq x \leq 0.1$ and $0.001 \leq y \leq 0.1$; $(Y, Gd, Lu, La)_{2-x}Eu_xW_{1-y}Mo_yO_6$, where $0.5 \leq x. \leq 1.0$, $0.01 \leq y \leq 1.0$; $(SrCa)_{1-x}Eu_xSi_5N_8$, where $0.01 \leq x \leq 0.3$; $SrZnO_2:Sm^+$; M_mO_nX, wherein M is selected from the group of Sc, Y, a lanthanide, an alkali earth metal and mixtures thereof; X is a halogen; $1 \leq m \leq 3$; and $1 \leq n \leq 4$, and wherein the lanthanide doping level can range from 0.1 to 40% spectral weight; and Eu^{3+} activated phosphate or borate phosphors; and mixtures thereof.

35. The light emitting device of claim **22**, wherein the one or more entities being a plurality of wavelength converting entities are selected from a red emitting wavelength converting material, a green emitting wavelength converting material, a blue emitting wavelength converting material, and a yellow emitting wavelength converting material.

36. The light emitting device of claim **22**, wherein the thickness of the one or more entities is provided by at least one of electrophoretic deposition, plating, sputtering, spraying, dipping, and dispensing.

37. The light emitting device of claim **22**, wherein the one or more light emitting diode devices comprise two light emitting devices.

38. The light emitting device of claim **22**, wherein the bulk gallium nitride substrate was formed by slicing from a boule that was grown by hydride vapor epitaxy or ammonothermally.

39. The light emitting device of claim **22**, wherein the thickness of the one or more entities is formed overlying the one or more light emitting diode devices.

40. The light emitting device of claim **22**, further comprising an enclosure, wherein the enclosure has a shape chosen from among annular, circular, egg-shaped, trapezoidal, or a combination thereof.

41. The light emitting device of claim **22**, wherein the device is packaged and is coupled to a rectifier.

42. The light emitting device of claim **22**, further comprising a diffuser, the diffuser comprising at least one of TiO_2, CaF_2, SiO_2, $CaCO_3$, and $BaSO_4$.

43. A light emitting device comprising:

a substrate member having a first surface;

at least one light emitting diode overlying the first surface emitting a substantially polarized emission of first wavelengths, the light emitting diode comprising a [device] *semipolar or nonpolar bulk GaN containing* substrate [comprising a semipolar or nonpolar bulk gallium nitride substrate] *and light emitting layers, said light emitting diode device being configured to emit substantially polarized emission of one or more first wavelengths*;

an optically transparent member coupled to the at least one light emitting diode;

[an optical path between the at least one light emitting diode and the optically transparent;] and

a blend of phosphors, the phosphors being excited by the substantially polarized emission of first wavelengths to thereby emit electromagnetic radiation at second wavelengths *such that said light emitting device emits polarized and non-polarized light*;

wherein the substantially polarized emission of first wavelengths comprises blue light and the phosphor blend emits electromagnetic radiation at second wavelengths comprising yellow and red.

44. A light emitting device comprising:

a substrate member having a first surface;

at least one light emitting diode overlying the first surface emitting a substantially polarized emission of first wavelengths, the light emitting diode comprising [a device substrate comprising] a semipolar or nonpolar bulk [gallium nitride] *GaN containing* substrate *and light emitting layers, said light emitting diode device being configured to emit substantially polarized emission of one or more first wavelengths*;

an optically transparent member coupled to the at least one light emitting diode;

[an optical path between the at least one light emitting diode and the optically transparent;] and

a blend of phosphors, the phosphors being excited by the substantially polarized emission of first wavelengths to thereby emit electromagnetic radiation at second wavelengths *such that said light emitting device emits polarized and non-polarized light*;

wherein the substantially polarized emission of first wavelengths comprises violet light and the phosphor blend emits electromagnetic radiation at second wavelengths comprising blue, green, and red.

45. A light emitting device comprising:

a substrate member having a first surface;

at least one light emitting diode overlying the first surface emitting a substantially polarized emission of first wavelengths, the light emitting diode comprising [a device substrate comprising] a semipolar or nonpolar bulk gallium nitride *containing* substrate *and light emitting layers, said light emitting diode device being configured to emit substantially polarized emission of one or more first wavelengths*;

an optically transparent member coupled to the at least one light emitting diode;

[an optical path between the at least one light emitting diode and the optically transparent;] and

a blend of phosphors, the phosphors being excited by the substantially polarized emission of first wavelengths to thereby emit electromagnetic radiation at second wavelengths *such that said light emitting device emits polarized and non-polarized light*;

wherein the substantially polarized emission of first wavelengths comprises blue light and the phosphor blend emits electromagnetic radiation at second wavelengths comprising green and red.

46. A light emitting device for an automotive application comprising:

a substrate member comprising a first surface region;

one or more laser devices overlying the first surface region, at least one of the laser devices comprising a semipolar or nonpolar GaN containing substrate, the at least one or more laser devices configured to emit substantially polarized emission of one or more first wavelengths;

an optically transparent member coupled to the one or more laser devices;

and a thickness of one or more entities formed within a vicinity of the optically transparent member, one or more of the entities being excited by the substantially polarized emission to emit electromagnetic radiation at one or more second wavelengths such that said light emitting device emits polarized and non-polarized light;

wherein the bulk gallium nitride substrate has a dislocation density in the plane of the large-area surface that is less than $5 \times 10^6\ cm^{-2}$*;*

wherein the light emitting device is configured for connection to an automotive device.

47. The light emitting device of claim 46, wherein at least one of the laser devices comprises a quantum well region, *the quantum well region being characterized by an electron wave function and a hole wave function, the electron wave function and the hole wave function being substantially overlapped within a predetermined spatial region of the quantum well region;*

wherein the one or more laser device having an epitaxial material formed on the semipolar or nonpolar GaN containing device substrate.

48. The light emitting device of claim 46, wherein the thickness of the one or more entities is formed overlying a first side of the optically transparent member, the first side facing the one or more of the laser devices.

49. The light emitting device of claim 46, wherein the one or more laser devices comprise at least a blue laser device, the substantially polarized emission being blue light.

50. The light emitting device of claim 46, wherein the one or more laser devices comprise at least a blue laser device capable of emitting electromagnetic radiation at a wavelength range from about 430 nanometers to about 490 nanometers, the substantially polarized emission being blue light.

51. The light emitting device of claim 46, wherein the one or more laser devices comprise at least a blue laser device capable of emitting electromagnetic radiation at a range from about 430 nanometers to about 490 nanometers and the one or more entities is capable of emitting substantially yellow light, the substantially polarized emission being blue light.

52. The light emitting device of claim 51, wherein the one or more entities comprises a phosphor or phosphor blend selected from one or more of $(Y, Gd, Tb, Sc, Lu, La)_3(Al, Ga, In)_5O_{12}:Ce^{3+}$, $SrGa_2S_4:Eu^{2+}$, $SrS:Eu^{2+}$, and colloidal quantum dot thin films comprising CdTe, ZnS, ZnSe, ZnTe, CdSe, or CdTe.

53. The light emitting device of claim 51 further comprising a phosphor capable of emitting substantially red light, wherein the phosphor is selected from one or more of the group consisting of $(Gd,Y,Lu,La)_2O_3:Eu^{3+}$, $Bi^{3+}(Gd,Y,Lu,La)_2O_2S:Eu^{3+}$, Bi^{3+}; $(Gd,Y,Lu,La)VO_4:Eu^{3+}$, Bi^{3+}; $Y_2(O,S)_3:Eu^{3+}$; $Ca_{1-x}Mo_{1-y}Si_yO_4$: where $0.05 \le x \le 0.5$, $0 \le y \le 0.1$; $(Li,Na,K)_5Eu(W,Mo)O_4$; $SrY_2S_4:Eu^{2+}$; $CaLa_2S_4:Ce^{3+}$; $(Ca,Sr)S:Eu^{2+}$; $3.5MgO*0.5MgF_2*GeO_2:Mn^{4+}$ (MFG); $(Ba,Sr,Ca)Mg_xP_2O_7:Eu^{2+}$, Mn^2+; $(Y,Lu)_2WO_6:Eu^{3+}$, Mo^{6+}; $(Ba,Sr,Ca)_3Mg_xSi_2O_8:Eu^{2+}$, Mn^{2+}, wherein $1 \le x \le 2$; $(RE_{1-y}Ce_y)Mg_{2-x}Li_xSi_{3-x}PxO_{12}$, where RE is at least one of Sc, Lu, Gd, Y, and Tb, $0.0001 \le x \le 0.1$ and $0.001 \le y \le 0.1$; $(Y, Gd, Lu, La)_{2-x}Eu_xW_{1-y}Mo_yO_6$, where $0.5 \le x \le 1.0$, $0.01 \le y \le 1.0$; $(Sr Ca)_{1-x}Eu_xSi_5N_8$, where $0.01 \le x \le 0.3$; $SrZnO_2:Sm^+$; M_mO_nX, wherein M is selected from the group of Sc, Y, a lanthanide, an alkali earth metal and mixtures thereof; X is a halogen; $1 \le m \le 3$; and $1 \le n \le 4$, and wherein the lanthanide doping level can range from 0.1 to 40% spectral weight and Eu^{3+} activated phosphate or borate phosphors; and mixtures thereof.

54. The light emitting device of claim 46, wherein the one or more laser devices comprise at least a violet laser device capable of emitting electromagnetic radiation at a range from about 380 nanometers to about 440 nanometers and the one or more entities are capable of emitting substantially white light, the substantially polarized emission being violet light.

55. The light emitting device of claim 46, wherein the one or more entities comprise a blend of wavelength converting materials capable of emitting substantially blue light, substantially green light, and substantially red light.

56. The light emitting device of claim 55, wherein the blue emitting phosphor is selected from the group consisting of $(Ba,Sr,Ca)_5(PO_4)_3(Cl,F,Br,OH):Eu^{2+}$, Mn^{2+}; Sb^{3+},$(Ba,Sr,Ca)MgAl_{10}O_{17}:Eu^{2+}$, Mn^{2+}; $(Ba,Sr,Ca)BPO_5:Eu^{2+}$, Mn^{2+}; $(Sr,Ca)_{10}(PO_4)_6*nB_2O_3:Eu^{2+}$; $2SrO*0.84P_2O5*0.16B_2O_3:Eu^{2+}$; $Sr_2Si_3O_8*2SrCl_2:Eu^{2+}$; $(Ba,Sr,Ca)Mg_xP_2O_7:Eu^{2+}$, Mn^{2+}; $Sr_4Al_{14}O_{25}:Eu^{2+}$ (SAE); $BaAl_8O_{13}:Eu^{2+}$; and mixtures thereof.

57. The light emitting device of claim 55, wherein the green phosphor is selected from the group consisting of $(Ba,Sr,Ca)MgAl_{10}O_{17}:Eu^{2+}$, Mn^{2+} (BAMn); $(Ba,Sr,Ca)Al_2O_4:Eu^{2+}$; $(Y,Gd,Lu,Sc,La)BO_3:Ce^{3+}$, Tb^{3+}; $Ca_8Mg(SiO_4)_4Cl_2:Eu^{2+}$, Mn^{2+}; $(Ba,Sr,Ca)_2SiO_4:Eu^{2+}$; $(Ba,Sr,Ca)_2(Mg,Zn)Si_2O_7:Eu^{2+}$; $(Sr,Ca,Ba)(Al,Ga,ln)_2S_4:Eu^{2+}$; $(Y,Gd,Tb,La,Sm,Pr,Lu)_3(A1,Ga)_5O_{12}:Ce^{3+}$; $(Ca,Sr)_8(Mg,Zn)(SiO_4)_4Cl_2:Eu^{2+}$, Mn^{2+} (CASI); $Na_2Gd_2B_2O_7:Ce^{3+}$, Tb^{3+}; $(Ba,Sr)_2(Ca,Mg,Zn)B_2O_6:K,Ce,Tb$; and mixtures thereof.

58. The light emitting device of claim 55, wherein the red phosphor is selected from the group consisting of $(Gd,Y,Lu,La)_2O_3:Eu^{3+}$, Bi^{3+}; $(Gd,Y,Lu,La)_2O_2S:Eu^{3+}$, Bi^{3+}; $(Gd,Y,Lu,La)VO_4:Eu^{3+}$, Bi^{3+}; $Y_2(O,S)_3: Eu^{3+}$; $Ca_{1-x}Mo_{1-y}Si_yO_4$: where $0.05 \le x \le 0.5$, $0 \le y \le 0.1$; $(Li,Na,K)_5Eu(W,Mo)O_4$; $SrY_2S_4:Eu^{2+}$; $CaLa_2S_4:Ce^{3+}$; $(Ca,Sr)S:Eu^{2+}$ $3.5MgO*0.5MgF_2*GeO_2:Mn^{4+}$ (MFG); $(Ba,Sr,Ca)Mg_xP_2O_7:Eu^{2+}$, Mn^{2+}; $(Y,Lu)_2WO_6:Eu^{3+}$, Mo^{6+}; $(Ba,Sr,Ca)_3Mg_xSi_2O_8:Eu^{2+}$, Mn^{2+}, wherein $1 \le x \le 2$; $(RE_{1-y}Ce_y)Mg_{2-x}Li_xSi_{3-x}P_xO_{12}$, where RE is at least one of Sc, Lu, Gd, Y, and Tb, $0.0001 \le x \le 0.1$ and $0.001 < y < 0.1$; $(Y, Gd, Lu, La)_{2-x}Eu_xW_{1-y}Mo_yO_6$, where $0.5 \le x \le 1.0$, $0.01 \le y \le 1.0$; $(Sr Ca)_{1-x}Eu_xSi_5N_8$, where $0.01 \le x \le 0.3$; $SrZnO_2:Sm^{3+}$; M_mO_nX, wherein M is selected from the group of Sc, Y, a lanthanide, an alkali earth metal and mixtures thereof; X is a halogen; $1 \le m \le 3$; and $1 \le n \le 4$, and wherein the lanthanide doping level can range from 0.1 to 40% spectral weight; and Eu^{3+} activated phosphate or borate phosphors; and mixtures thereof.

59. The light emitting device of claim 46, wherein the one or more entities being a plurality of wavelength converting entities are selected from a red emitting wavelength converting material, a green emitting wavelength converting material, a blue emitting wavelength converting material, and a yellow emitting wavelength converting material.

60. The light emitting device of claim 46, wherein the thickness of the one or more entities is provided by at least one of electrophoretic deposition, plating, sputtering, spraying, dipping, and dispensing.

61. The light emitting device of claim 46, wherein the one or more laser devices comprise two light emitting devices.

62. The light emitting device of claim 46, wherein the bulk gallium nitride substrate was formed by slicing from a boule that was grown by hydride vapor epitaxy or ammonothermally.

63. The light emitting device of claim 46, wherein the thickness of the one or more entities is formed overlying the one or more laser devices.

64. The light emitting device of claim 46, further comprising an enclosure, wherein the enclosure has a shape chosen from among annular, circular, egg-shaped, trapezoidal, or a combination thereof.

65. The light emitting device of claim 46, wherein the device is packaged and is coupled to a rectifier.

66. The light emitting device of claim 46, further comprising a diffuser, the diffuser comprising at least one of TiO_2, CaF_2, SiO_2, $CaCO_3$, and $BaSO_4$.

67. A light emitting device for an automotive application comprising:

one or more laser devices comprising a semipolar or nonpolar GaN containing substrate and light emitting *layers, the one or more laser devices emitting substantially polarized emission of one or more first wavelengths;*

an optically transparent member coupled to the one or more laser devices; and

a thickness of one or more entities formed within a vicinity of the optically transparent member, one or more of the entities being excited by the substantially polarized emission to emit electromagnetic radiation at one or more second wavelengths such that said light emitting device emits polarized and non-polarized light;

wherein a crystallographic orientation of the device substrate is within ±5 degrees of the {1 −1 0 0} m plane, the {1 1 −2 0} a plane, the {1 1 −2 2} plane, the {2 0 −2±1} plane, the {1 −1 0±1} plane, the {1 −1 0 ±2} plane, or the {1 −1 0±3} plane.

68. The light emitting device of claim 67, wherein at least one of the laser devices comprises a quantum well region, the quantum well region being characterized by an electron wave function and a hole wave function, the electron wave function and the hole wave function being substantially overlapped within a predetermined spatial region of the quantum well region.

69. The light emitting device of claim 67, wherein the thickness of the one or more entities is formed overlying a first side of the optically transparent member, the first side facing the one or more of the laser devices.

70. The light emitting device of claim 67, wherein the one or more laser devices comprise at least a blue laser device, the substantially polarized emission being blue light.

71. The light emitting device of claim 67, wherein the one or more laser devices comprise at least a blue laser device capable of emitting electromagnetic radiation at a wavelength range from about 430 nanometers to about 490 nanometers, the substantially polarized emission being blue light.

72. The light emitting device of claim 67, wherein the one or more laser devices comprise at least a blue laser device capable of emitting electromagnetic radiation at a range from about 430 nanometers to about 490 nanometers and the one or more entities is capable of emitting substantially yellow light, the substantially polarized emission being blue light.

73. The light emitting device of claim 72, wherein the one or more entities comprises a phosphor or phosphor blend selected from one or more of $(Y, Gd, Tb, Sc, Lu, La)_3(Al, Ga, In)_5O_{12}:Ce^{3+}$, $SrGa_2S_4:Eu^{2+}$, $SrS:Eu^{2+}$, and colloidal quantum dot thin films comprising CdTe, ZnS, ZnSe, ZnTe, CdSe, or CdTe.

74. The light emitting device of claim 72, further comprising a phosphor capable of emitting substantially red light, wherein the phosphor is selected from one or more of the group consisting of $(Gd,Y,Lu,La)_2O_3:Eu^{3+}, Bi^{3+}$; $(Gd,Y,Lu,La)_2O_2S:Eu^{3+}, Bi^{3+}$; $(Gd,Y,Lu,La)VO_4:Eu^{3+}, Bi^{3+}$; $Y_2(O,S)_3: Eu^{3+}$; $Ca_{1-x}Mo_{1-y}Si_yO_4$: where $0.05\leq x\leq 0.5$, $0\leq y\leq 0.1$; $(Li,Na,K)_5Eu(W,Mo)O_4$; $SrY_2S_4:Eu^{2+}$; $CaLa_2S_4:Ce^{3+}$; $(Ca,Sr)S:Eu^{2+}$; $3.5MgO*0.5MgF_2*GeO_2:Mn^{4+}$ (MFG); $(Ba,Sr,Ca)Mg_xP_2O_7:Eu^{2+}, Mn^{2+}$; $(Y,Lu)_2WO_6:Eu^{3+}, Mo^{6+}$; $(Ba,Sr,Ca)_3Mg_xSi_2O_8:Eu^{2+}, Mn^{2+}$, wherein $1\leq x\leq 2$; $(RE_{1-y}Ce_y)Mg_{2-x}Li_xSi_3,PxO_{12}$, where RE is at least one of Sc, Lu, Gd, Y, and Tb, $0.0001\leq x\leq 0.1$ and $0.001\leq y\leq 0.1$; $(Y, Gd, Lu, La)_{2-x}Eu_xW_{1-y}Mo_yO_6$, where $0.5\leq x\leq 1.0$, $0.01\leq y\leq 1.0$; $(Sr Ca)_{1-x}Eu_xSi_5N_8$, where $0.01\leq x\leq 0.3$; $SrZnO_2:Sm^{+3}$; M_mO_nX, wherein M is selected from the group of Sc, Y, a lanthanide, an alkali earth metal and mixtures thereof; X is a halogen; $1\leq m\leq 3$; and $1\leq n\leq 4$, and wherein the lanthanide doping level can range from 0.1 to 40% spectral weight; and Eu^{3+} activated phosphate or borate phosphors; and mixtures thereof.

75. The light emitting device of claim 67, wherein the one or more laser devices comprise at least a violet laser device capable of emitting electromagnetic radiation at a range from about 380 nanometers to about 440 nanometers and the one or more entities are capable of emitting substantially white light, the substantially polarized emission being violet light.

76. The light emitting device of claim 67, wherein the one or more entities comprise a blend of wavelength converting materials capable of emitting substantially blue light, substantially green light, and substantially red light.

77. The light emitting device of claim 76, wherein the blue emitting phosphor is selected from the group consisting of $(Ba,Sr,Ca)_5(PO_4)_3(Cl,F,Br,OH):Eu^{2+}, Mn^{2+}$; Sb^{3+},$(Ba,Sr,Ca)MgAl_{10}O_{17}:Eu^{2+}, Mn^{2+}$; $(Ba,Sr,Ca)BPO_5:Eu^{2+}, Mn^{2+}$; $(Sr,Ca)_{10}(PO_4)_6*nB_2O_3:Eu^{2+}$; $2SrO*0.84P_2O5*0.16B_2O_3:Eu^{2+}$; $Sr_2Si_3O_8*2SrCl_2:Eu^{2+}$; $(Ba,Sr,Ca)Mg_xP_2O_7:Eu^{2+}, Mn^{2+}$; $Sr_4Al_{14}O_{25}:Eu^{2+}$ (SAE); $BaAl_8O_{13}:Eu^{2+}$; and mixtures thereof.

78. The light emitting device of claim 76, wherein the green phosphor is selected from the group consisting of $(Ba,Sr,Ca)MgAl_{10}O_{17}:Eu^{2+}, Mn^{2+}$ (BAMn); $(Ba,Sr,Ca)Al_2O_4:Eu^{2+}$; $(Y,Gd,Lu,Sc,La)BO_3:Ce^{3+},Tb^{3+}$; $Ca_8Mg(SiO_4)_4Cl_2:Eu^{2+}, Mn^{2+}$; $(Ba,Sr,Ca)_2SiO_4:Eu^{2+}$; $(Ba,Sr,Ca)_2(Mg,Zn)Si_2O_7:Eu^{2+}$; $(Sr, Ca,Ba)(Al,Ga,ln)_2S_4:Eu^{2+}$; $(Y,Gd,Tb,La,Sm,Pr,Lu)_3(Al,Ga)_5O_{12}:Ce^{3+}$; $(Ca,Sr)_8(Mg,Zn)(SiO_4)_4Cl_2:Eu^{2+}, Mn^{2+}$ (CASI); $Na_2Gd_2B_2O_7:Ce^{3+}, Tb^{3+}$; $(Ba,Sr)_2(Ca,Mg,Zn)B_2O_6:K,Ce,Tb$; and mixtures thereof.

79. The light emitting device of claim 76, wherein the red phosphor is selected from the group consisting of $(Gd,Y,Lu,La)_2O_3:Eu^{3+}, Bi^{3+}$; $(Gd,Y,Lu,La)_2O_2S:Eu^{3+}, Bi^{3+}$; $(Gd,Y,Lu,La)VO_4:Eu^{3+}, Bi^{3+}$; $Y_2(O,S)_3: Eu^{3+}$; $Ca_{1-x}Mo_{1-y}Si_yO_4$: where $0.05\leq x\leq 0.5$, $0\leq y\leq 0.1$; $(Li,Na,K)_5Eu(W,Mo)O_4$; $(Ca,Sr)S:Eu^{2+}$; $SrY_2S_4:Eu^{2+}$; $CaLa_2S_4:Ce^{3+}$; $3.5MgO*0.5MgF_2*GeO_2:Mn^{4+}$ (MFG); $(Ba,Sr,Ca)Mg_xP_2O_7:Eu^{2+}, Mn^{2+}$; $(Y,Lu)_2WO_6:Eu^{3+}, Mo^{6+}$; $(Ba,Sr,Ca)_3Mg_xSi_2O_8:Eu^{2+}, Mn^{2+}$, wherein $1\leq x\leq 2$; $(RE_{1-y}Ce_y)Mg_{2-x}Li_xSi_{3-x}P_xO_{12}$, where RE is at least one of Sc, Lu, Gd, Y, and Tb, $0.0001\leq x\leq 0.1$ and $0.001\leq y\leq 0.1$; $(Y, Gd, Lu, La)_{2-x}Eu_xW_{1-y}Mo_yO_6$, where $0.5\leq x\leq 1.0$, $0.01\leq y\leq 1.0$; $(Sr Ca)_{1-x}Eu_xSi_5N_8$, where $0.01\leq x\leq 0.3$; $SrZnO_2:Sm^+$; M_mO_nX, wherein M is selected from the group of Sc, Y, a lanthanide, an alkali earth metal and mixtures thereof; X is a halogen; $1\leq m\leq 3$; and $1\leq n\leq 4$, and wherein the lanthanide doping level can range from 0.1 to 40% spectral.

80. The light emitting device of claim 67, wherein the one or more entities being a plurality of wavelength converting entities are selected from a red emitting wavelength converting material, a green emitting wavelength converting material, a blue emitting wavelength converting material, and a yellow emitting wavelength converting material.

81. The light emitting device of claim 67, wherein the thickness of the one or more entities is provided by at least one of electrophoretic deposition, plating, sputtering, spraying, dipping, and dispensing.

82. The light emitting device of claim 67, wherein the one or more laser devices comprise two light emitting devices.

83. The light emitting device of claim 67, wherein the bulk gallium nitride substrate was formed by slicing from a boule that was grown by hydride vapor epitaxy or ammonothermally.

84. The light emitting device of claim 67, wherein the thickness of the one or more entities is formed overlying the one or more laser devices.

85. The light emitting device of claim 67, further comprising an enclosure, wherein the enclosure has a shape chosen from among annular, circular, egg-shaped, trapezoidal, or a combination thereof.

86. The light emitting device of claim 67, wherein the device is packaged and is coupled to a rectifier.

87. The light emitting device of claim 67, further comprising a diffuser, the diffuser comprising at least one of TiO_2, CaF_2, SiO_2, $CaCO_3$, *and* $BaSO_4$.

88. A light emitting device for an automotive application comprising:

a substrate member having a first surface;

at least one laser device overlying the first surface emitting a substantially polarized emission of first wavelengths, the laser device comprising a semipolar or nonpolar bulk gallium nitride substrate and light emitting layers;

an optically transparent member coupled to the at least one laser device; and

a blend of phosphors, the phosphors being excited by the substantially polarized emission of first wavelengths to thereby emit electromagnetic radiation at second wavelengths such that said light emitting device emits polarized and non-polarized light;

wherein the substantially polarized emission of first wavelengths comprises blue light and the phosphor blend emits electromagnetic radiation at second wavelengths comprising yellow and red.

89. A light emitting device for an automotive application comprising:

a substrate member having a first surface;

at least one laser device having a layer fabricated overlying the first surface emitting a substantially polarized emission of first wavelengths, the at least one laser device comprising a semipolar or nonpolar bulk gallium nitride substrate;

an optically transparent member coupled to the at least one laser device; and

a blend of phosphors, the phosphors being excited by the substantially polarized emission of first wavelengths to thereby emit electromagnetic radiation at second wavelengths such that said light emitting device emits polarized and non-polarized light;

wherein the substantially polarized emission of first wavelengths comprises violet light and the phosphor blend emits electromagnetic radiation at second wavelengths comprising blue, green, and red; and

wherein the light emitting device is configured for connection to an automotive device.

90. A light emitting device for an automotive application comprising:

a substrate member having a first surface;

at least one laser device overlying the first surface emitting a substantially polarized emission of first wavelengths, the at least one laser device comprising a semipolar or nonpolar bulk gallium nitride substrate;

an optically transparent member coupled to the at least one laser device; and

a blend of phosphors, the phosphors being excited by the substantially polarized emission of first wavelengths to thereby emit electromagnetic radiation at second wavelengths such that said light emitting device emits polarized and non-polarized light;

wherein the substantially polarized emission of first wavelengths comprises blue light and the phosphor blend emits electromagnetic radiation at second wavelengths comprising green and red; and

wherein the light emitting device is configured for an automotive application.

91. A light source comprising:

a substrate member comprising a first surface region;

one or more laser diode devices overlying the first surface region, the one or more laser diode devices comprising a semipolar or nonpolar GaN containing substrate and light emitting layers, the one or more laser diode devices emitting substantially polarized emission of one or more first wavelengths;

an optically transparent member coupled to the one or more laser diode devices;

and a thickness of one or more entities formed within a vicinity of the optically transparent member, one or more of the entities being excited by the substantially polarized emission to emit electromagnetic radiation at one or more second wavelengths such that said light emitting device emits polarized and non-polarized light;

wherein the bulk gallium nitride substrate has a dislocation density in the plane of the large-area surface that is less than $5\times10^6\ cm^{-2}$.

92. The light emitting device of claim 1, further comprising an optical path provided between the one or more light emitting diode devices and the optically transparent member.

93. The light emitting device of claim 1, wherein said substrate and said layers are configured to emit polarized light.

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