viewing area for viewing the blind spot area at the side and rearward of the vehicle, while the primary or central region of the reflective element provides a generally planar reflective surface for viewing rearward and sideward of the vehicle mirror.

[00132] The reflective element 310' includes a perimeter band 326' around the perimeter of the reflective element and a perimeter band portion 326a' inboard of a wide angle area or region 352 at the reflective element and around an inboard perimeter region of the wide angle reflector 350. The perimeter band thus separates and/or demarcates the wide angle reflective portion from the generally planar reflective portion of the reflective element, and may conceal or hide the edges of the wide angle reflector. As can be seen with reference to FIG. 13, the perimeter band 326' is disposed on the second surface 312a of the front substrate 312 and generally at or along the perimeter seal 322 of the reflective element 310', while the perimeter band portion 326a' is disposed on the second surface 312a and inboard of the seal 322 to generally outline/demarcate an inner perimeter of the wide angle reflector 350. The perimeter band portion 326a' may have generally the same width as the perimeter band 326', or may have a reduced width or narrow width to reduce the effect on the viewing area of the reflective element.

[00133] Wide angle reflector 350 is positioned at the rear (or fourth) surface 314b of rear substrate 314 and may be adhered to rear surface 314b and generally behind the wide angle area 352 defined by the perimeter band 326' and perimeter band portion 326a'. In the illustrated embodiment, wide angle reflector 350 comprises a substantially clear, transparent optical plastic member 354 (such as, for example, an acrylic or polycarbonate or COC or CR39 or the like) and a reflective coating or layer or adhesive or film 356. Optical plastic member 354 has a substantially flat mating surface 354a and a curved face 354b opposite to the mating face 354a. Reflective film 356 may be adhered or otherwise attached to curved face 354b so as to establish a curved reflective surface 356a. Wide angle reflector 350 may be adhered to or otherwise attached to rear surface 314b of rear substrate 314, such as via an optical adhesive 358, such as an optical epoxy or acrylic material. The optical adhesive may be substantially optically matched to the reflective element substrates, so that the refractive index of the optical adhesive is substantially similar to the refractive index of the glass substrate (such as at about 1.52 refractive index), such as by utilizing aspects of the reflective element described in U.S. pat. application, Ser. No. 10/993,302, filed Nov. 19, 2004 (Attorney Docket DON01 P-1186), which is hereby incorporated herein by reference in its entirety.

[00134] Thus, the wide angle reflector may be positioned at the rear surface of the reflective element and may reflect light from a wide angle view to the driver of the vehicle to assist the driver in viewing the blind spot area at the side of the vehicle. The reflective element may comprise an electro-optic reflective element with a transparent conductive coating or layer 318 at the rear surface 312a of the front substrate 312 and a third surface reflective coating or layer (or layers) 320b at the front surface 314a of the rear substrate 314, and with an electro-optic or electrochromic medium 316 disposed therebetween. As can be seen in FIG. 13, the third surface reflective coating or layer 320b (such as a layer of chromium or ruthenium or rhodium or ruthenium/chromium or rhodium/chromium or other suitable layer or coating) may be removed or not established at the wide angle reflector area, and a transparent conductive coating or layer 320a may be disposed over the third surface, including the wide angle reflector area, so that the electro-optic feature may function in that area. A window or port or non-reflective region 321 thus may be formed in the third surface reflector (so as to provide a window or area that is substantially devoid of the reflective coating or coatings) to enhance the light transmissivity therethrough (such as by ablating or masking the area to remove or not establish the reflective coating or coatings at the wide angle reflector area). The front surface of the rear substrate thus may have the transparent conductive coating 320a over its entire surface, with the wide angle reflector area being masked during the deposition or coating of the third surface reflective coating or coatings so that the reflective coatings are not deposited or established at the wide angle viewing area (or the reflective coatings may be removed or ablated after the coating process). The wide angle reflector thus may be disposed behind the electro-optic medium so as to provide the wide angle reflective field of view through the electro-optic medium.

[00135] Optionally, the perimeter seal may be disposed around the perimeter of the reflective element and along the wide angle perimeter band portion 326a' so that the wide angle area 352 is devoid of the electro-optic medium (and may be devoid of the third surface reflector layers or coatings in that area as well) to enhance light transmissivity through the reflective element in the wide angle viewing area. In such an application, the transparent conductive coating may also be removed from the wide angle reflector area, such that the coatings or layers in that area may be readily removed or not established, such as by laser ablating or masking or the like.

[00136] Optionally, the perimeter band (and/or any indicia or display elements or the like as described above) may be established at a rear surface of a curved or bent substrate, such as for a passenger-side exterior mirror of a vehicle. For example, and with reference to FIG. 14,

a curved reflective element 410 includes a bent or curved substrate 412 (such as a convex or aspheric substrate) and a reflective coating or layer 418 disposed or established at the rear surface 412a of substrate 412. A perimeter border or band 426 (such as chromium or other suitable material) may be disposed around the perimeter region of the reflective element, such as directly on the rear surface of the substrate 412 (as shown in FIG. 14) or over the reflective coating at the perimeter region (so that the reflective coating is between the perimeter band and the rear surface of the substrate), such as described above.

[00137] The reflective coating or layer may comprise a metallic reflective material or may comprise transflective materials, such as a silicon or indium/silver material or an interference stack, such as an $SiO_2/TiO_2/SiO_2$ stack of layers or the like (such as by utilizing aspects of the reflective elements described in PCT Application No. PCT/US03/29776, filed Sep. 9, 2003 by Donnelly Corp. et al. for MIRROR REFLECTIVE ELEMENT ASSEMBLY (Attorney Docket DON01 FP-1109(PCT)); and/or PCT Application No. PCT/US03/35381, filed Nov. 5, 2003 by Donnelly Corp. et al. for ELECTRO-OPTIC REFLECTIVE ELEMENT ASSEMBLY (Attorney Docket DON01 FP-1116(PCT)); and/or U.S. pat. applications, Ser. No. 11/021,065, filed Dec. 23, 2004 by McCabe et al. for ELECTRO-OPTIC MIRROR CELL (Attorney Docket DON01 P-1193); Ser. No. 10/528,269, filed Mar. 17, 2005 (Attorney Docket DON01 P-1109); Ser. No. 10/533,762, filed May 4, 2005 (Attorney Docket DON01 P-1116); Ser. No. 10/993,302, filed Nov. 19, 2004 (Attorney Docket DON01 P-1186), which are hereby incorporated herein by reference in their entireties). As shown in FIG. 13, a protective coating 438 (such as a lacquer or paint, which may be substantially transparent if the reflective element is a transflective reflective element) may be disposed over the reflective coating 418 to protect the reflective coating.

[00138] Typically, it is desired that the appearance of the mirror reflective elements of the exterior rearview mirrors of a vehicle match or substantially match between the driver-side and passenger-side rearview mirrors of a vehicle, so that, for example, for a vehicle with a driver-side electro-optic reflective element and a passenger-side non-electro-optic reflective element, the bleached (or non-colored or non-darkened) appearance of the driver-side mirror reflector matches or substantially matches the appearance of the non-electro-optic passenger-side mirror reflector. A person viewing the vehicle, such as in a vehicle showroom or at a parking lot or the like, or while the vehicle is being driven along a road, thus may view and discern that that the mirror reflector at the driver-side mirror matches or substantially matches the mirror reflector at the passenger-side mirror.

[00139] When both the driver and passenger-side rearview mirrors are selected to have the same type of reflective element (such as a frameless electro-optic reflective element using a border, non-dimming metallic reflective band, such as, for example, a frameless electrochromic reflective element as described above), such symmetry of appearance is readily achieved. However, it is not unusual, for economy purposes, to provide an electro-optic reflective element at the driver-side exterior rearview mirror and a non-electro-optic reflective mirror at the passenger-side exterior rearview mirror. When an electro-optic driver-side exterior rearview mirror is implemented on a vehicle with a non-electro-optic passenger-side exterior rearview mirror (as is often selected to reduce costs associated with the mirror assemblies of the vehicle), it is still typically desired that the reflective elements of the side rearview mirrors substantially or fully match in appearance to provide a similar appearance or style at the mirror at both sides of the vehicle, such as for aesthetic purposes. Thus, it is desired that the appearance of the non-electro-optic reflective element of the passenger-side rearview mirror substantially or fully match the appearance of the electro-optic reflective element of the driver-side rearview mirror, such as when the electro-optic reflective element is in its bleached or non-powered or non-darkened state (such as during high ambient lighting or daytime lighting conditions).

[00140] The perimeter band material thus may be selected to substantially match the appearances between the driver-side exterior mirror (which may comprise an electrochromic mirror with a perimeter band around the perimeter to conceal the perimeter seal of the reflective element) and the passenger-side exterior mirror (which may comprise a non-electrochromic mirror), so that both mirrors provide a similar appearance to the perimeter band and reflective element. For applications where the perimeter band material of the electrochromic or driver-side mirror is selected to be the same as the third surface reflector material, the optical match (as viewed by a person viewing the reflective element) between the perimeter band and the third surface reflector is sufficient so that the perimeter band is not readily discernible at the mirror reflector. Thus, in such applications, it may not be necessary to provide a perimeter band on the corresponding conventional (such as chrome or titanium or "Blue" coated), non-EC passenger-side exterior mirror reflective element.

[00141] However, even in such applications, the perimeter band at the driver-side mirror may be discernible to a person viewing the exterior mirror, even when the perimeter band is substantially optically matched with the central reflector region of the reflective element. Thus, in order to at least substantially match the passenger-side non-electro-optic reflective element with the electro-optic reflective element at the driver-side mirror, a perimeter band or

coating (for example, a layer of chromium or of rhodium or of rhodium/chromium) may be disposed around the perimeter edge or region of the non-electro-optic reflective element, such as a curved single substrate reflective element or the like. Thus, when one exterior side rearview mirror has an electro-optic reflective element (as is typically located at the driver-side of the vehicle) and the other exterior side rearview mirror has a curved reflective element or non-electro-optic reflective element (as may be provided at the passenger-side of the vehicle), a matching perimeter band may be disposed around the non-electro-optic reflective element so that the perimeter band of the passenger-side mirror matches or substantially matches the perimeter band of the driver-side mirror (such as by utilizing aspects described in U.S. patent application Ser. No. 11/226,628, filed Sep. 14, 2005 (Attorney Docket DON01 P-1236), which is hereby incorporated herein by reference in its entirety).

[00142] Such a matching appearance of the non-electro-optic reflective element with the frameless electro-optic reflective element (with perimeter band as described above) may be achieved via various processes. For example (and such as described above and shown in FIG. 14), a perimeter reflective border may comprise a first metallic reflective layer (such as a metallic border or band, such as a ruthenium metal or the like) and may be disposed around the perimeter region of the second surface of the curved glass substrate (such as by sputter deposition or the like of the border material over the second surface of the substrate while the central region or primary viewing area of the second surface of the substrate is masked). A reflective layer or coating of a second metal reflector material (such as chromium or the like) may be disposed over the second surface and over the perimeter border or band to provide the central reflective region with a reflective perimeter border or band for a frameless non-electro-optic reflective element (such as by utilizing aspects described in U.S. patent applications, Ser. No. 11/226,628, filed Sep. 14, 2005 (Attorney Docket DON01 P-1236); Ser. No. 10/533,762, filed May 4, 2005 (Attorney Docket DON01 P-1116); and/or Ser. No. 11/021,065, filed Dec. 23, 2004 (Attorney Docket DON01 P-1193), and/or U.S. provisional applications, Ser. No. 60/681,250, filed May 16, 2005 (Attorney Docket DON01 P-1221); Ser. No. 60/690,400, filed Jun. 14, 2005 (Attorney Docket DON01 P-1225); Ser. No. 60/695,149, filed Jun. 29, 2005 (Attorney Docket DON01 P-1227); Ser. No. 60/730,334, filed Oct. 26, 2005 (Attorney Docket DON01 P-1250); and Ser. No. 60/750,199, filed Dec. 14, 2005 (Attorney Docket DON01 P-1260), which are hereby incorporated herein by reference in their entireties. Optionally, and desirably, the percent reflectivity of the second metallic reflective layer is less than the percent reflectivity of the first metallic reflective layer. Optionally, the reflective material and thickness of the material layer at the perimeter or

border region of the reflective element may be selected to provide a desired spectral reflectivity so as to match or substantially match the spectral reflectivity and appearance of the central region or main reflective region or dimming region of the electro-optic reflective element when the electro-optic reflective element is in its bleached or non-powered or non-darkened/non-colored state.

[00143] Optionally, the appearance of a matching perimeter band (that matches a perimeter band of an electro-optic reflective element, such as a perimeter band that substantially matches the color or tint of the central reflective region of the electro-optic reflective element when bleached) may be achieved by establishing a demarcation line along and through the reflective coating of a single substrate, so that the demarcation line appears to be an inward perimeter edge of a reflective perimeter band or border. For example, and as shown in FIGS. 15A and 15B, a reflective element 510, such as a generally planar reflective element or a curved reflective element for an exterior rearview mirror, includes a substrate 512 (such as a glass substrate, such as a generally flat substrate or a bent or curved substrate, such as a convex or aspheric substrate) and a reflective coating or layer 518 (such as a mirror reflector coating or coatings comprising, for example, chromium or titanium or silver or aluminum or silver alloy or aluminum alloy or a stack of layers, such as an ITO/silver/ITO stack of layers, or like) disposed or established at the second or rear surface 512b of substrate 512 (opposite the first or front or viewable surface 512a of the substrate 512), such as by sputter deposition in a vacuum deposition chamber, such as is known in the coating arts. As shown in FIG. 15B, a perimeter or border reflector region 526 may be outlined or demarcated or defined by a demarcation line 526a established (such as by laser etching or the like) through the reflective coating or layer 518 at the perimeter region. The reflective element 510 thus has a central main reflector region 524 and the perimeter or border reflector region 526 separated or defined or circumscribed by demarcation line 526a.

[00144] Thus, a mirror substrate or shape (such as a glass substrate or shape) may be cut from a sheet of glass to the desired mirror shape. The mirror substrate may be uniformly coated (with no masking) over at least substantially or entirely the second or rear surface of the substrate to provide a substantially uniform reflective coating or layer at the second surface of the substrate. Optionally, a sheet of glass or the like may be substantially uniformly coated over a surface of the sheet, and one or more coated mirror substrates or shapes may be cut from the coated glass sheet to provide the mirror substrate with the reflective coating or layer at the second surface of the substrate. The demarcation line then may be established (such as via laser etching or the like) around the perimeter of the cut and coated substrate so as to

circumscribe and run around substantially or wholly the perimeter region of the cut substrate or shape. The demarcation line and perimeter or border reflector region and central main reflector region of the reflective element thus may be established via a single, unmasked coating process. The demarcation line may be established at a range of about 2 mm to about 5 mm (or more or less) inward from the perimeter cut edge of the substrate, whereby the width of the demarcation line may be selected to match or substantially match the border or perimeter band on the electro-optic reflective element at the driver-side mirror.

[00145] As shown in FIG. 15B, a coating or layer or overcoating 538 (such as a lacquer or paint or frit or tape or appliqué or coating) may be disposed over the reflective coating 518 to cover or coat the rear surface of the reflective element. The coating or layer may be painted or pad printed or screened or inked or otherwise applied or disposed or established at the rear surface of the reflective element. Optionally, the coating or layer 538 may be disposed over the entire rear surface (whereby the coating may provide environmental protection if needed or desired at and over the metallic layer materials (such as aluminum or gold or the like) of the reflective layer or coating, or may be disposed along the demarcation line 526a to substantially fill in the demarcation line 526a.

[00146] The paint or coating or layer may be selected to be any desired color or tint so as to provide the desired edge demarcation of the perimeter or border reflector region 526. For example, the coating or layer 538 may comprise a dark color, such as black or the like, or may comprise a light grey or other color or tint, depending on the particular application and, more particularly, on the color or visibility or viewability of the perimeter band on the electro-optic reflective element at the driver-side rearview mirror. For example, the darker the color of the coating or layer or paint, the more readily viewable or discernible the demarcation line 526a may be to a person viewing the exterior rearview mirror. Thus, it may be desirable to provide a light grey (or similar or selected pale color or the like) demarcation line so that the demarcation line is readily viewable/discernible, but not overly apparent or dominant at the reflective element.

[00147] The viewable width of the demarcation line (the dimension across the demarcation line when viewed at the reflective element by a person viewing the exterior rearview mirror) may be selected to provide the desired degree of viewability or discernibility of the demarcation line, so as to give the appearance of an edge of a perimeter band or border coating. Optionally, for example, the demarcation line may have a width of preferably less than approximately 350 microns (one micron being equal to one millionth of a meter), more preferably less than approximately 250 microns and more preferably less than approximately

175 microns. Also, for example, the demarcation line may have a width of preferably greater than approximately 50 microns, more preferably greater than approximately 75 microns and more preferably greater than approximately 100 microns. The demarcation line through the reflective coating at the rear surface of the reflective element thus functions to demarcate a perimeter border or band so as to provide the appearance of a perimeter band at the border region of the reflective element that substantially optically matches the central main reflector region of the reflective element.

[00148] Although shown and described as a substantially continuous or uninterrupted demarcation line that circumscribes the perimeter region of the reflective element substrate, the demarcation line may be formed to only partially circumscribe the perimeter region of the reflective element substrate, without affecting the scope of the present invention. For example, the demarcation line may be a line segment around a portion of the perimeter region of the substrate or the demarcation line may comprise a non-continuous or interrupted demarcation line (such as a plurality of line segments or dashes or the like) that extends partially or entirely around the perimeter region of the mirror substrate.

[00149] Optionally, and as shown in FIG. 16, a mirror reflective element 510' may have a mirror reflective coating or reflector 518 and a perimeter or border reflector region 526' and central main reflector region 524', and a demarcation line 526a', such as described above. Mirror reflective element 510' includes a second demarcation line 526b' established or formed (such as by laser etching or the like) in and through the reflective coating 518, such as in a similar manner as described above with respect to demarcation line 526a of reflective element 510. In the illustrated embodiment, the second demarcation line 526b' extends along the lower perimeter region of the mirror substrate and curves downward to the perimeter edge of the reflective element 510'. Such a second demarcation line may be desirable for a passenger-side non-electro-optic mirror reflective element so that the non-electro-optic passenger-side mirror reflective element matches or substantially matches an electro-optic driver-side mirror reflective element, such as, for example, the driver-side mirror reflective element supplied by Gentex Corp. of Zeeland, MI for a model year 2006 Audi vehicle. The mirror reflective element 510' may be otherwise substantially similar to the mirror reflective element 510 described above, such that a detailed discussion of the mirror reflective elements will not be repeated herein.

[00150] Although shown and described as having the central main reflector region and the border reflector region (as either defined by a demarcation line through the reflector coating or by a separate layer or coating around a perimeter region of the reflective element) at the

same surface of the electro-optic or non-electro-optic reflective element, it is envisioned that the border reflector band may be formed or established on the second or rear surface of the substrate while the central or main reflector coating may be established on the first or front surface of the substrate (in such an application, masking may be required to form the coatings at one or both sides of the substrate). Alternately, and optionally, the border reflector band may be established on the first surface of the substrate while the central or main reflector coating may be established on the second surface of the substrate (in such an application, masking may be required to form the coatings at one or both sides of the substrate). Optionally, the border and central reflector coatings may both be on the first or front surface of the reflective element, depending on the particular application of the reflective element and mirror assembly.

[00151] The substrate or substrates of the reflective element may comprise any type of suitable substrate, such as a single glass substrate or the like. For example, the substrate may comprise a glass substrate having a thickness of at least about 1.6 mm, more preferably a thickness of at least about 1.8 mm and more preferably a thickness of at least about 2 mm, but could have a greater thickness or a reduced thickness without affecting the scope of the present invention. The substrate may comprise a substantially flat or planar substrate or may comprise a curved substrate depending on the particular application of the reflective element.

[00152] Optionally, and with reference to FIGS. 17-21, a reflective element assembly 610 for an exterior rearview mirror assembly includes a front substrate 612 (FIG. 21) and a rear substrate 614 spaced from front reflective element substrate 612, with an electro-optic medium 616 (preferably an electrochromic medium) sandwiched therebetween. The front substrate 612 has a transparent conductive coating or layer 618 (such as an ITO layer, such as a ½ wave ITO layer or a doped tin oxide layer or a doped zinc oxide layer or the like) disposed on its rear surface 612a (typically referred to as the second surface of the laminate reflective element assembly) and the rear substrate 614 has a third surface mirror reflector 620 (FIGS. 20 and 21) coated thereon (the mirror reflector may comprise a layer or stack of layers of metals or a metal or stack of metals with at least one conductive oxide layer, such as ITO, or the like as discussed below). The third surface mirror reflector covers the central region or EC-active or viewing region of the front surface 614a (typically referred to as the third surface of the reflective element assembly) of the rear substrate 614 (but does not extend or cover fully to the perimeter edge of the substrate), and the mirror reflector coating 620 overlaps a tab-out or edge wraparound coating or coatings 636 (that extends substantially or fully to a perimeter edge of the substrate, and preferably, if in a "flush" electrochromic

mirror element construction, wraps around the cut edge of the substrate) as discussed below. An epoxy seal material 622 (FIG. 21) or the like, is applied between the substrates to define the cavity for the electrochromic medium and to adhere the substrates together. The epoxy seal 622 overlaps and seals an overlap region 621 where the third surface mirror reflector 620 overlaps the wraparound coating 636 to environmentally protect the third surface mirror reflector 620, as also discussed below.

[00153] Because an exterior rearview mirror is located at the exterior of a vehicle, the mirror reflective element is typically exposed to a hostile environment and may be exposed to humidity, rain, snow, ice, dirt, salt, debris and the like. In typical laminate electrochromic reflective element assemblies, any portion of the mirror reflector layer or layers that extend beyond the perimeter seal toward the outer edge of the rear substrate (for purposes of electrical contact) are particularly vulnerable. Thus, it is desirable to provide a robust reflective element, such as a mirror reflective element having environmentally stable coatings or layers on the surfaces of the reflective element substrates that can be exposed to the hostile environment. Although such environmentally stable or robust coatings, as discussed below, are desirable and suited for exterior mirror applications, aspects of such coatings and the constructions herein are equally suited for interior mirror applications as well.

[00154] As shown in FIG. 18, the rear substrate 614 of reflective element 610 includes a third surface conductor or coating 636 that is disposed over the uncoated glass substrate and along a portion (such as an uncoated perimeter region or perimeter glass surface) of the third surface 614a of rear substrate 614. The third surface coating 636 includes a third surface conductor portion or tab-out portion 636a (disposed at the perimeter region of the third surface 614a) and a wrap-around portion or coating 636b that wraps around and over a perimeter edge or cut edge 614c of rear substrate 614. Third surface coating 636 may comprise an environmentally stable metallic layer or material, such as chromium or rhodium or ruthenium or platinum or the like, or a stack of, for example, of chromium/ruthenium or chromium/rhodium or chromium/platinum or the like, and thus provides an environmentally stable or robust wraparound coating at the perimeter region of the front surface 614a of the rear substrate 614.

[00155] As shown in FIGS. 17 and 19, rear substrate 614 also includes a fourth surface conductor or coating 638 disposed over the glass substrate and along a portion (such as an uncoated perimeter region or perimeter glass surface) of the fourth surface 614b of rear substrate 614. Fourth surface coating 638 includes a fourth surface conductor portion or electrical contact portion 638a and a wrap-around portion or coating 638b that wraps around

and over perimeter edge or cut edge 614c of rear substrate 614 onto the cut edge of the substrate and contacting third surface conductor coating 636 (and may be disposed at or over or under wrap-around portion 636b at perimeter edge 614c, as shown in FIG. 19), in order to provide electrical conductivity between the fourth surface conductor 638a and the third surface conductor 636 and the third surface mirror reflector coating 620, as discussed below. The fourth surface conductor 638a and wrap-around coating 638b may comprise the same material as the third surface conductor 636a and wrap-around coating 636b (such as chromium or molybdenum or tungsten or Hastelloy or ruthenium or rhodium or platinum, or a stack of, for example, of chromium/ruthenium or chromium/rhodium or chromium/platinum or the like, or other suitable environmentally stable conductive material). Alternately, the fourth surface coating 638 may comprise a different material than the third surface coating 636, with both coatings or layers being selected to be substantially environmentally stable or robust.

[00156] The third and fourth surface conductors 636, 638 may be disposed onto the respective perimeter regions and edge of the rear substrate during the same or separate coating processes. For example, the rear substrate preferably has at least the third and fourth perimeter edge wraparound environmentally robust conductor coatings formed in a dual-side sputtering coating chamber (such as a sputter-up/sputter-down or a sputter-left/sputter-right coating chamber where the substrate carrier passes through opposing sputter targets so that the substrate can be coated at both sides), such as by utilizing aspects of the coating chambers and processes described in U.S. patent application Ser. No. 11/021,065, filed Dec. 23, 2004 by McCabe et al. for ELECTRO-OPTIC MIRROR CELL (Attorney Docket DON01 P-1193), which is hereby incorporated herein by reference in its entirety. In such a chamber, for example, one of the conductors (such as, for example, fourth surface conductor 638) may be sputter coated from the bottom of the substrate, while the other conductor (such as, for example, third surface conductor 636) may be sputter coated from the top of the substrate (with the central region of the respective third and fourth surface (and other perimeter portions or regions where the conductor coating is not desired) masked so that the respective conducting coatings are deposited only at an edge). The conductor coatings 636, 638 thus are disposed over the perimeter edge 614c and over a perimeter region of the respective glass surfaces 614a, 614b of the rear substrate 614. Optionally, one or both of the conductor coatings 636, 638 may be disposed around more than one perimeter region or around substantially the entire perimeter of the substrate. Optionally, one of the coatings may be disposed over the other coating at the perimeter edge 614c (if the coatings are disposed

during separate coating processes) or the coatings may be disposed together onto the perimeter edge (such as for applications where the coatings are disposed during a single coating process) so as to contact one another and establish electrical conductivity between the conductor coatings 636, 638 and, thus, between the fourth surface and the third surface of the rear substrate of the reflective element assembly.

[00157] After the conductor coatings 636, 638 are disposed at the respective perimeter regions and at the edge of the substrate, the perimeter regions 614d of the front surface 614a of rear substrate 614 may be masked, whereby the third surface mirror reflector coating or layer 620 is disposed (such as via a sputter deposition process or the like) over the unmasked or central portion or EC-active portion or viewing portion or region (which is within the perimeter seal of the reflective element assembly when the reflective element assembly or cell is assembled) of the third surface 614a, and within or encompassed or surrounded by the perimeter band or region 614d of the third surface 614a of rear substrate 614. The third surface perimeter band 614d may be established by masking the perimeter region of the third surface 614a prior to deposition of the mirror reflector coating or layer 620 onto the central region of the third surface 614a. The third surface mirror reflector coating or layer 620 may comprise a transflective coating or layer or other suitable third surface mirror reflector coating comprising reflective and conductive coatings. For example, the third surface mirror reflector coating 620 may comprise a reflective metallic coating or layer or multiple coatings or layers, such as a bi-layer or the like, such as a reflective metallic coating or layer (or multiple coatings or layers), such as a layer of chromium/rhodium or chromium/ruthenium or molybdenum/chromium, or an ITO/silver/ITO or AZO/silver/AZO stack of layers or the like, over the central region or viewing region or EC-active region of the front surface 614a of the rear substrate 614.

[00158] Optionally, the third surface mirror reflector coating may not be transflective (such as for a fourth surface reflective element), and/or may comprise a substantially non-transmissive metallic reflector coating, such as a coating or layer of silver or aluminum or their alloys or the like, or may comprise a substantially non-transmissive ITO/Ag/ITO or AZO/Ag/AZO coating or layers or the like. Optionally, the rear substrate may initially be coated with a transparent conductive coating, such as ITO or the like, disposed over its entire third or front surface (for example, a substrate having such a coating already established thereon may be purchased by the mirror manufacturer), whereby the third surface conductor 636 is disposed over the perimeter region of the ITO coated third surface and the mirror reflector coating or

coatings is/are disposed over the ITO coated central region or EC-active region of the rear substrate, without affecting the scope of the present invention.

[00159] As shown in FIGS. 20 and 21, the mirror reflector coating or layer 620 is disposed over the central region or portion of the third surface 614a that is substantially surrounded by the perimeter seal 622 and so is environmentally protected thereby. The mirror reflector coating 620 overlaps and makes conductive contact at a portion of the third surface conductor 636a of third surface coating 636, such as at overlap region 621, so as to contact the conductor 636a and establish conductivity between the mirror reflector coating 620 and the third surface conductor coating 636 and, thus, between the mirror reflector coating 620 and the fourth surface conductor 638a at the fourth surface 614b of rear substrate 614. As can be seen in FIG. 21, the overlap region 621 is positioned inward of the perimeter edge of the rear substrate and at a region that is encompassed by the perimeter seal 622 when the seal 622 is established at the rear substrate 614. Perimeter seal 622 thus overlaps a portion of the mirror reflector coating 620 and a portion of the third surface conductor 636a and limits or substantially precludes exposure of the mirror reflector coating 620 to the exterior elements. The perimeter seal overlaps and seals against a perimeter portion of the mirror reflector coating and the uncoated glass surface of the third surface of the rear substrate in other perimeter regions where the third surface conductor 636a is not established.

[00160] The fragile or less environmentally stable mirror reflector coating 620 thus terminates or stops within the area encompassed by the perimeter seal 622 and the robust or more environmentally stable third surface conductor coating 636a contacts/overlaps the fragile mirror reflector coating 620 in the area encompassed by the perimeter seal. Thus, the more environmentally stable third surface conductor coating 636a extends outward from the perimeter seal and over the third surface at the perimeter region and to the edge of the substrate. The perimeter seal 622 thus provides environmental protection for the mirror reflector coating 620, so that the mirror reflector coating 620 may comprise a less environmentally stable or robust material, such as silver or silver alloy or ISI stack (such as metal oxide/metal/metal oxide stack, such as an ITO-silver-ITO stack or a ZnAlO/Ag/ZnAlO stack or a ZnAlO/Al/ZnAlO stack or a ITO/Ag/ZnAlO stack or the like), while the third surface conductor coating 636 and the fourth surface conductor coating 638 may comprise a more environmentally stable or robust material (such as chromium or rhodium or ruthenium or the like). Thus, the exposed conductor coatings 636, 638 (i.e., the coatings that are not encompassed and sealed by the perimeter seal and thus not within the sealed EC region of the

reflective element) may be exposed to the elements and may withstand exposure to the elements at the exterior perimeter of the rear substrate and/or reflective element.

[00161] In the illustrated embodiment, and as also shown in FIG. 21, electrical connectors 640a, 640b, such as terminals or clips or pins or conductive epoxy or paste or the like, may be conductively connected to the second surface transparent conductive coating 618 and the fourth surface conductor 638a, respectively. The connectors 640a, 640b may be connected to an electrical wire or wire harness or lead or terminal or the like (not shown) to electrically connect the electrochromic reflective element to a vehicle or mirror control or power source or the like. Thus, the environmentally stable conductive wrap-around coatings 636, 638 provide electrical conductivity between the fourth surface of the reflective element to the third surface mirror reflector coating 620 at the EC-active region of the third surface of the reflective element, while the third surface mirror reflector coating 620 is substantially sealed and protected and substantially or entirely not exposed to the elements.

[00162] In a preferred embodiment, the rear substrate 614 may comprise a glass substrate having a thickness of between about 1.1 mm and about 1.6 mm or thereabouts. The third surface conduct coating 636 may comprise a layer of chromium, such as a layer of chromium that is sputtered deposited onto the glass substrate to a thickness of about 800 to about 1000 angstroms or more. The fourth surface conductor coating 638 may comprise a layer of chromium, such as a layer of chromium that is sputtered deposited onto the substrate to a thickness of about 800 to about 1000 angstroms, and the coating may be overcoated with a layer of ruthenium (such as a layer that is about 300 angstroms thick) or a layer of rhodium (such as a layer that is about 200 angstroms thick), whereby the electrical connector (typically a silver paste or epoxy or the like) contacts the overcoated layer of ruthenium or rhodium to establish the electrical connection to the conductor coating/coatings.

[00163] Optionally, and as shown in FIG. 21, reflective element 610 may include a display device 630 at the fourth surface 614b of rear substrate 614. Display device 630 may be operable to emit or project illumination through the reflective element 610, such as through a window established at the third surface mirror reflector coating 620, or through the third surface mirror reflector coating 620 for a transflective reflective element. Display device 630 may be operable to provide a turn signal indicator or a blindspot alert indicator or the like, and may be directed to be substantially viewable to a driver of a rearwardly approaching vehicle or to be substantially viewable to the driver of the subject vehicle, depending on the particular application of the display device. The display device and reflective element may utilize aspects of the display devices described in U.S. patent application Serial No.

11/226,628, filed Sep. 14, 2005 (Attorney Docket DON01 P-1236); and/or U.S. provisional applications, Ser. No. 60/717,093, filed Sep. 14, 2005 by Lynam (Attorney Docket DON01 P-1240); Ser. No. 60/732,245, filed Nov. 1, 2005 (Attorney Docket DON01 P-1251); and/or Ser. No. 60/759,992, filed Jan. 18, 2006 by Weller et al. for INTERIOR REARVIEW MIRROR ASSEMBLY WITH DISPLAY (Attorney Docket DON01 P-1264), which are hereby incorporated herein by reference in their entireties.

[00164] The construction shown in FIG. 21 particularly suits "flush" type reflective elements having overhang regions (defined by the front substrate being larger than the rear substrate so as to provide an overhang region or regions along the upper and/or lower perimeter regions of the reflective element assembly) as shown in FIG. 21 (and such as described in U.S. patent application Ser. No. 11/226,628, filed Sep. 14, 2005 (Attorney Docket DON01 P-1236), which is hereby incorporated herein by reference in its entirety). However, for offset reflective elements, where the front and rear substrates may be similarly sized, but one is vertically offset relative to the other (such as described in U.S. patent application Ser. No. 11/021,065, filed Dec. 23, 2004 by McCabe et al. for ELECTRO-OPTIC MIRROR CELL (Attorney Docket DON01 P-1193); and/or U.S. Pat. Nos. 5,724,187 and 5,668,663, which are hereby incorporated herein by reference in their entireties), the reflective element may not include a fourth surface conductive wraparound coating or bus bar. For example, an offset reflective element may not include a fourth surface conductor coating, whereby the environmentally stable third surface conductor coating may be disposed at the perimeter region of the front or third surface of the rear substrate and may or may not wrap-around onto the cut edge of the rear substrate, whereby the electrical connection to the third surface coatings may be made by a known clip or the like at the perimeter region so as to contact the conductor coating at the perimeter region of the third surface of the rear substrate.

[00165] The third surface mirror reflector coating (established over the central or EC-active region of the glass third surface of the rear substrate) may comprise a metallic coating or layer or a metal oxide/metal/metal oxide coating, such as a stack of materials or layers, such as, for example, a layer of ITO (such as about 500 angstroms thick), a layer of metal (such as a layer of silver or aluminum that is about 300 angstroms thick), and a layer of ITO (such as about 120 angstroms thick). Optionally, the third surface mirror reflector stack may comprise an aluminum zinc oxide (AZO) stack, such as a stack comprising an AZO layer, a metallic layer, and another AZO layer (for example, an AZO/Ag/AZO stack of layers). The layer or layers of AZO may be sputtered from a sputtering target comprising zinc oxide doped with aluminum oxide. For example, a doped zinc oxide target having ZnO: 2% Al_2O_3 has

achieved desired results. Such an AZO layer may be formed via sputter deposition with such a doped zinc oxide sputtering target, such as can be made by a co-precipitation process; formed of ZnO: 2% Al_2O_3. Note that while good results have been obtained with aluminum-doped zinc oxide, other dopants such as silver or gold can be used.

[00166] Preferably, the sputtering is done by direct current (DC) sputtering, more preferably by pulsed DC sputtering, and more preferably by medium frequency (such as within a range of about 40 kHz to about 1 MHz or thereabouts) dual magnetron DC sputtering. Alternatively, radio frequency (RF) sputtering could be used or other sputtering techniques or systems may be used, depending on what is better suited for the particular chamber and chamber conditions.

[00167] Advantages found by utilizing an AZO layer or layers include that it is a lower cost material than ITO. We find that effective AZO coatings for purposes of the present invention (i.e. highly transmissive and sufficiently conductive to allow electron flow therethrough for electrical contact to the electrochromic medium when a thin layer of AZO is overcoated over the underlying metal layer (the layer of AZO that contacts the electrochromic medium when the reflective element is assembled)) can be formed or established using non-reactive DC magnetron sputtering (and hence obviating the cost/complexity of introducing and controlling an oxygen partial vapor pressure during the sputter deposition process). Although the AZO layer may not be as conductive as an ITO layer, the conductivity of the AZO layer is sufficient to allow the electron flow from the highly conductive metallic layer (that underlies the AZO layer and acts as a conductive raceway over the third surface of the rear substrate) and through the thin AZO layer to energize the electrochromic medium when electrical power is applied to the connectors or contacts of the reflective element assembly. For instance, and for the AZO layer that the electrochromic medium contacts, we find that AZO layers having a sheet resistance of greater than about 100 ohms per square, or in certain constructions greater than about 250 ohms per square, are effective.

[00168] The glass surface of the rear substrate thus may be coated with a third surface mirror reflector comprising a conductive coating or a stack of coatings or layers. For example, the glass surface may be regionally coated (such as at a perimeter region) with a conductive tab-out layer of sputtered chromium (such as a layer having a thickness of about 500 angstroms or thereabouts), and the central or EC-active or viewing portion of the front surface of the substrate, and a portion of the conductive tab-out layer, is overcoated with a third surface mirror reflector/mirror transflector layer. For example, a mirror reflector coating may be disposed that comprises a stack of layers, such as, for example, an AZO layer (such as about

500 angstroms thick), a metallic layer (such as a highly conducting layer of silver or aluminum doped silver or doped aluminum or the like and having a thickness of about 800 angstroms to about 1000 angstroms or thereabouts), and a layer of aluminum zinc oxide or AZO (such as a layer of AZO having a thickness of about 100 angstroms to about 200 angstroms or thereabouts). Such an AZO:metal:AZO stack of layers thus provides the desired transmissivity and reflectivity at the EC-active region of the reflective element, while being sufficiently conductive for its intended purpose of selectively energizing the electrochromic medium. Other thicknesses of layers and other materials may be utilized depending on the particular application and desired characteristics of the reflective element and mirror assembly.

[00169] Optionally, and desirably, a rear substrate for a reflective element may have a mirror reflector coating that utilizes chromium (or titanium or other stable metal) for an adhesion layer at the glass surface of the front of the substrate. For example, a preferred embodiment of such a rear substrate may have a mirror reflector coating comprising a layer of chromium (such as a layer that is about 400 angstroms thick), with a layer of metal, such as silver or aluminum or alloys thereof the like, such as a layer of silver that is about 800 angstroms thick, disposed thereon. A layer of AZO (such as a layer of AZO that is about 150 angstroms thick) is then non-reactively deposited or disposed onto the metal layer. Thus, the AZO layer or overcoat (that contacts the electrochromic medium when the reflective element is assembled and protects or isolates the metal layer from the electrochromic medium) may be non-reactively deposited, and thus obviating the cost/complexity of introducing and controlling an oxygen partial vapor pressure during the sputter deposition process. Such a mirror reflector coating may be disposed at the glass third surface of the rear substrate via a multiple target sputtering process. The adhesion layer of chromium at the glass surface of such a rear substrate may also provide reduced costs of the mirror reflector coating and of the reflective element as compared to rear substrates with an ITO adhesion layer at the glass surface.

[00170] Note that a benefit of a third surface reflector that comprises a glass substrate coated first with an environmentally stable electrically conducting layer (such as chromium), which in turn is overcoated with a highly reflecting metallic mirror layer (such as a layer of silver or of a predominantly silver silver-alloy or such as a layer of aluminum or of a predominantly aluminum aluminum-alloy), which in turn is overcoated with a transparent electrically conductive layer (that is disposed between the highly reflecting mirror metallic layer and the electrochromic medium within the electrochromic mirror element cell), is that electrical

conductivity and contact to the electrochromic medium can be sustained by the underlying environmentally stable electrically conducting layer even if its overlaying environmentally fragile layers (such as silver or the like) degrade or deteriorate due to environmental exposure. An example of such a third surface reflector comprises a glass/chromium/metal (such as silver or aluminum or an alloy of silver or of aluminum)/aluminum doped zinc oxide [herein referred to as "CAZ"]. In such an exemplary construction, the third surface reflector coating (TSR) can be taken out to the edge (or wrap-around the edge) of the substrate beyond the seal, and the end product can be environmentally resilient without the need to use encapsulants or the like to environmentally protect tab out regions, cut-edge wraparound coatings, offset regions, overhang regions and/or the like. This is because the electrical continuity of CAZ or similar constructions is environmentally stable due to the underlying bedrock of the environmentally stable metallic electrical conductor, such as chromium. In such constructions, any environmentally fragile layers, such as AZO and silver coating portion, that extends beyond the perimeter seal of the mirror cell may be exposed to environmental conditions and so may deteriorate in severe environmental testing, such as 85C / 85%RH, salt spray, steam autoclave, etc. (or in field usage on a vehicle), while the underlying adhesion layer/base electrically conducting coating of chromium remains intact. Thus, the EC mirror element cell can still be powered even if the overlying layers of the CAZ were partially or substantially deteriorated at the likes of a tabout or edge wraparound or offset or overhang region. Thus, for example, in an offset interior mirror (or exterior mirror) electrochromic cell construction, the clips or contacts can maintain electrical contact to the chromium (and hence thereby to the third surface mirror reflector coating that is protected by the EC perimeter seal itself), even if the overlying silver or AZO layer may locally corrode.

[00171] In a flush construction, where the likes of an edge overcoat or fourth surface electrical connection, such as via a conductive epoxy or the like, may be made, the conductive epoxy itself may locally encapsulate and environmentally protect the CAZ layer or stack, but having the bedrock of environmentally stable chromium (or a similar environmentally stable metal electrically conducting thin film layer such as of a chromium-based alloy or such as of as a nickel-based alloy, such as an Inconel or a Hastelloy, or such as of an iron-based alloy, such as a stainless steel or such as of titanium or a titanium-based alloy) has the advantage that the underlying chromium or similarly environmentally stable metal thin film layer remains electrically conducting and integral even should the overlying silver or AZO (or other transparent electrical conductor, such as other doped zinc oxides or a doped indium tin oxide, such as ITO or indium oxide or tin oxide or doped tin oxide) degrade or deteriorate in harsh

environmental conditions. For example, for third surface mirror reflectors, such as ITO/Ag/ITO (ISI) or the like, where the silver metal layer is environmentally vulnerable, an encapsulating or potting material (such as described in U.S. patent application Serial No. 11/021,065, filed Dec. 23, 2004 by McCabe et al. for ELECTRO-OPTIC MIRROR CELL (Attorney Docket DON01 P-1193), which is hereby incorporated herein by reference in its entirety) may be used at the tabout or edge wraparound or offset or overhang regions, and this has proven to be successful. But, with the likes of CAZ, where the underlying bedrock adhesion-enhancing and electrically-conducting metal layer comprises an environmentally stable metal material, such as chromium or titanium or nickel or metal alloys or the like, the use of any extra potting or encapsulating material, such as at a tab-out region or at a clip region or wherever electrical connection is being made to the third surface reflector coating or layer outside of its sealed portion, becomes optional.

[00172] An example of a preferred stack design for an interior rearview mirror reflective element 710 is shown in FIG. 22 and includes a rear glass substrate 714 (such as float glass) and a CAZ layer 720 disposed at the front or third surface of the rear substrate 714. The CAZ layer 720 comprises a layer of chromium 720a (having a thickness of about 800 angstroms) disposed on the front surface of the rear substrate (i.e. the third surface of the electrochromic cell), a layer of silver 720b (having a thickness of about 800 angstroms) over the chromium layer 720a, and a layer 720c of ZnO:Al (such as a layer deposited by sputtering from a sputter target of $ZnO:Al_2O_3$ so as to have a layer thickness of about 80 angstroms) disposed over the silver layer 720b. An electrochromic medium 716, such as an electrochromic solid polymer matrix (SPM) or other suitable electrochromic medium (such as a liquid or solid electrochromic medium), is disposed between the coated rear substrate 714 and a coated front substrate 712 (such as in a 110 μm interpane gap between the substrates and coatings/layers) and sealed within the interpane cavity via a perimeter seal 722 (such as an epoxy seal). The front glass substrate 712 (preferably float glass) has a layer of a transparent electrical conductor 718 (such as ITO, and preferably having a resistivity of about 12 ohms per square) disposed on its rear or second surface. Optionally, and as shown in FIG. 22, the reflective element 710 may include an indicia coating or layer or element 724, which preferably is disposed at the second surface of the front substrate (as shown in FIG. 22), but may be optionally disposed at the third or fourth surface of the rear substrate, such as in the manners described herein. Of course, the FIG. 22 is purely exemplary, and other constructions and materials and thicknesses may be selected and implemented depending on the particular

application and desired performance of the interior or exterior vehicular mirror reflective cell, while remaining within the spirit and scope of the present invention.

[00173] The CAZ layers may be coated on either the tin side of the float glass substrate or the air side of the float glass substrate. Other environmentally stable electrically conductive materials, such as a layer of titanium or the like, may be disposed at the substrate in place of the layer of chromium. For example, a grade 2 titanium may be used. Although AZO is typically about 1/3 the cost of ITO and thus may be desired, ITO or other transparent conductors can be used. Alternately, however, AZO or other suitable or similar transparent conductors can be used instead of the ITO. Alternately, aluminum, such as Al(6061), or an aluminum alloy or a silver alloy, which has a high reflectivity of light incident thereon, such as a reflectivity of at least about 80 percent of light incident thereon, more preferably at least about 85 percent reflective of light incident thereon, and more preferably at least about 90 percent reflective of light incident thereon, may be used instead of silver.

[00174] Preferably, the surface or surfaces of the glass substrates are cleaned and/or treated prior to deposition of the coatings. For example, the surface may be prepared or treated to prepare the surface and/or to dissolve any moisture or water vapor from the surface. For example, the substrate may be heated prior to deposition or the surface may be treated with a plasma or ion beam, such as described in U.S. patent application Serial No. 11/021,065, filed Dec. 23, 2004 by McCabe et al. for ELECTRO-OPTIC MIRROR CELL (Attorney Docket DON01 P-1193), which is hereby incorporated herein by reference in its entirety.

[00175] Preferably, the coatings or layers are deposited at the substrate in a multi-cathode (either vertical or horizontal) conveyorized sputter chamber. The chamber may contain an argon atmosphere at the AZO and/or other sputtering target, such as of silver or chromium, at about 3-5 mtorr, and the AZO material may be sputtered at about 300 sccm or more of argon flow. However, other chambers and/or processes may be implemented, depending on the particular coater being used and depending on the particular application. The power density applied to the AZO target (and to other targets) is preferably at least about 3 W/cm^2, more preferably at least about 5 W/cm^2, and more preferably at least about 8 W/cm^2. Due to the relatively inferior electrical specific conductivity of AZO, a dual magnetron sputtering system is desired for long term stable, arc-free operation within the sputter chamber. An example of a suitable AZO sputtering target is a ceramic of $ZnO:Al_2O_3$ (e.g., 98% / 2% weight), formed from a co-precipitation process, "hip'd" and sintered. The preferred density is greater than about 5.3 g/cc. The AZO tiles may be attached, such as soldered, such as indium soldered, to an OFHC copper backing plate.

[00176] One desirable property of AZO is that it can be deposited in a metallizer sputter chamber without the cost/complexity of introducing oxygen gas handling to the vacuum chamber at the sputter station for the AZO. Thus, advantageously, a chromium target and a silver target and an AZO target (in that sequence relative to the direction of travel of the substrates thereunder) may be disposed in the same vacuum chamber and may be commonly exposed to the same sputtering atmosphere, such as the argon atmosphere described above. Thus, the sputtering station and the sputtering of the thin films may be achieved non-reactively and without recourse to introducing additional oxygen. By contrast, but optionally, another transparent conductor, such as ITO, could be used instead of AZO. However, reactive sputtering in a oxygen rich atmosphere is desirable for ITO transparent electrical conductor thin film deposition, and in such a vacuum chamber, steps must be taken to isolate the non-reactive sputtering of the preceding silver and chromium metallic layers from the reactive sputtering of the ITO layer. We find surprisingly good results when AZO is used in the CAZ layer and when the AZO is deposited in an argon sputtering atmosphere.

[00177] Optical properties of both the coated rear substrate and of the completed CAZ interior EC mirror element are shown in FIGS. 23 and 24, respectively. FIG. 23 shows the reflectance of the stack 720 of FIG. 22 of light incident on the coated rear substrate 714. As shown, the reflectance of visible light incident on the coated rear substrate 714 is about 90 percent or more. When the coated substrate 714 is formed into a cell 710, such as a cell using an electrochromic solid polymer matrix (SPM) (such as described in U.S. Pat. Nos. 5,725,809; 5,910,854; 6,002,511; 6,154,306; 6,245,262; 6,420,036; 6,855,431; and 6,954,300, which are hereby incorporated herein by reference in their entireties), the reflectance of light incident on the cell is as shown in FIG. 24. FIG. 24 shows the reflectance of light incident on the cell when the cell is in its bleached and when the cell is in its darkened or colored state (such as with about 1.2 volts applied across the cell). As can be seen in FIG. 24, visible light reflectance is greater than about 80 percent or thereabouts in the bleached state and around 10 percent or thereabouts in the colored state.

[00178] The optical constants of the ZnO:Al layer are shown in FIG. 25. More specifically, FIG. 25 shows the optical constants, particularly the index of refraction "n" and the extinction coefficient "k", for the coated substrate. The sheet resistance of the coated rear substrate and of its individual layers was measured to be about 4-5 ohms per square for the 800 angstroms thick chromium layer and less than about 1 ohm per square for the 800 angstroms thick silver layer.

[00179] The electrochromic performance (high end/low end reflectivity and color and bleach speeds, etc.) of the CAZ interior EC mirror element is shown in the tables of FIGS. 26 and 27. The tables show the rate to color/bleach of the cells and the maximum and minimum percent reflectance of light incident thereon, and the maximum current draw and steady state current draws of the cells. FIG. 26 shows the initial performance characteristics of various samples at about 23 degrees Celsius and at 1.2 volts when powered, while FIG. 27 shows the final performance characteristics of various samples at the same temperature and voltage, but after the samples have endured about 50,000 cycles at 65 degrees Celsius and 95 percent relative humidity.

[00180] The AZO is desirably deposited in an argon sputter atmosphere and without added oxygen in the sputtering gas mix or composition. This may simplify in-line sputter coater designs, since there may be no need for "process isolation" between the chromium sputtering station/cathode, the silver sputtering station/cathode and the AZO sputtering station/cathode.

[00181] We find that the optical extinction coefficient "k" of ITO deposited under nearly identical oxygen-free sputtering in argon conditions is over ten times greater than that for AZO that is similarly non-reactively sputtered. Also, ITO exhibits an index grading, whereas AZO does not. We also find reduced formation of surface nodules using the AZO ceramic target when it is non-reactively sputtered as compared to reactive sputtering with ITO targets. Further, AZO sputtered in pure argon has a faster deposition rate than ITO in Ar/O_2; such as at least about 30 percent faster rate.

[00182] If a display on demand transflective display application is desired, the stack or layers used for the third surface reflector are correspondingly reduced and/or adjusted in thickness. For enhanced transmissivity, a transparent conductor may be used as the adhesion layer in place of the chromium. For example, a transflective TSR rear substrate may comprise: glass/AZO/Ag/AZO or glass/ITO/AZO/Ag/AZO. Due to the K value of AZO, its use in transflective third surface reflector (TSR) constructions can be desirable, given that such a DOD stack has a good T%, R% and neutral appearance.

[00183] A chromium layer has excellent adhesion to an ITO base coat and may improve the environmental robustness of the cell and may eliminate any need for surface preparation, such as ion beam cleaning.

[00184] AZO exhibits less compressive stress compared to ITO, which may enable more environmentally stable DOD stacks with thicker AZO layers.

[00185] AZO also may be used as the second surface transparent conductive coating or oxide (TCO) in the electrochromic cell if sufficiently thick so as to have a sheet resistance of at or

about 20 ohms per square or lower. AZO is less inherently conductive than ITO, which has a specific resistivity of about 2 x 10-4 ohm.cm. With appropriate deposition conditions, including use of an oxygen sputtering atmosphere and heated substrate, a specific resistivity of about 6 x 10-4 ohm.cm or better of AZO can be achieved. The AZO layer, when deposited on the glass substrate, may provide a transparent conductor having a sheet resistance of about 20 ohms per square or lower if appropriately deposited. An electrochromic cell thus may be constructed using AZO as its second surface transparent electrically conductive layer.

[00186] Therefore, the present invention provides an electrochromic mirror element with the rear glass substrate third surface reflector (TSR) coated with an environmentally stable or resilient electrically conductive metal layer, such as chromium or titanium, and with a highly specularly reflective metal layer [such as comprising silver or silver alloy (such as preferably at least 80 percent and more preferably at least 90 percent silver content) or aluminum or aluminum alloy (such as preferably at least 80 percent and more preferably at least 90 percent aluminum content) or the like] disposed over the environmentally stable underlying layer. The highly reflecting mirror reflective layer itself thus has a reflectivity of preferably at least about 80 percent reflectivity (more preferably at least about 85 percent reflectivity, and more preferably at least about 90 percent reflectivity) of light incident thereon, as measured per SAE J964a. The AZO layer or other transparent electrically conductive layer is then disposed over the highly reflecting mirror reflective metal layer and need only have a modest but finite electrical conductivity, since the underlying highly reflecting mirror reflective layer and/or the adhesion promoting environmentally stable metal layer can provide the desired high electrical conductivity across the third surface of the EC cell. The CAZ or similarly coated rear substrate thus provides substantial reflectivity at the third surface of the mirror element, while providing an environmentally stable layer for providing conductive continuity to the third surface of the mirror element and any portions of the third surface reflector such as tabouts or edge wraparounds or offset regions or overhang regions or the like.

[00187] Optionally, and as shown in FIG. 28, an electro-optic mirror assembly 710' (such as for an interior or exterior mirror assembly) includes a rear glass substrate 714' and a larger front substrate 712' so that no cross dimension of the smaller rear substrate 714' extends beyond a corresponding cross dimension of the larger front substrate 712'. An electrochromic medium 716', such as an electrochromic solid polymer matrix (SPM) or other suitable electrochromic medium (such as a liquid or solid electrochromic medium), is disposed between the coated rear substrate 714' and a coated front substrate 712' (such as in a 110 μm

interpane gap between the substrates and coatings/layers) and sealed within the interpane cavity via a perimeter seal 722' (such as an epoxy seal). Of course other thicknesses or interpane gaps can be used without affecting the scope of the present invention.

[00188] Rear substrate 714' includes a third surface mirror reflector 720' (optionally, the third surface mirror reflector may be a third surface transflective mirror reflector) disposed at the front or third surface 714a' of the rear substrate 714'. The third surface mirror reflector 720' may be any type of suitable third surface mirror reflector, such as a third surface mirror reflector similar to the CAZ reflector described above, or a third surface reflective element consisting of glass/chromium/ruthenium or glass/ITO/silver or silver alloy/ITO or the like. For example, the third surface mirror reflector 710' may include a layer 720a' of environmentally stable metallic material, such as chromium or the like, disposed on the front surface of the rear substrate (i.e. the third surface of the electrochromic cell), and a layer or layers 720b' of metal/transparent conductive material/materials over the chromium layer 720a', such as described above. The third surface mirror reflector 720' includes a wraparound portion or tabout portion 721' that wraps around and overcoats a perimeter edge 714c' of the rear substrate 714' in order to facilitate electrical connection at the fourth surface as discussed below.

[00189] As can be seen in FIG. 28, a portion of the third surface mirror reflector 720' terminates at the third surface 714a' of the rear substrate 714' before the perimeter edge 714d' and within the seal region so that there is a gap 714e' at the third surface between the perimeter edge region 714d' and the edge of the third surface mirror reflector 720'. For example, the third surface of the rear substrate may be masked at a portion or region along the perimeter edge 714d' of the substrate during the coating or deposition of the third surface mirror reflector 720' so that a portion 714e' of the third surface 714a' is devoid of the third surface mirror reflector. The masked portion or gap portion 714e' may be only a portion or section or length along the perimeter edge 714d', and provides electrical isolation between the third surface mirror reflector and a conductive material or element 719' that provides electrical conductivity between a rear or fourth surface contact 740b' and the second surface transparent conductor 718', as discussed below. The third surface mirror reflector may be disposed over the rest of the third surface 714a' except at the gap portion, leaving an area (such as about 1 to 2 cm long along the edge 714d') along the edge region 714d' that is devoid of the third surface mirror reflector.

[00190] The gap portion 714e' electrically isolates or insulates the third surface mirror reflector 720' from the outer perimeter region or edge 714d' of rear substrate 714' at the

region or portion along the perimeter edge at which the gap portion is established. The perimeter seal 722' is disposed at and substantially fills in the gap portion 714e' to further electrically isolate or insulate the third surface mirror reflector 720' from the outer perimeter region or edge 714d' of rear substrate 714' and to obviate any electrical contact or shorting with the second surface conductive electrode. The gap 714e' may be formed or established by masking of the perimeter edge region 714d' during the coating/deposition process of the third surface mirror reflector 720', or the third surface mirror reflector may be disposed over substantially the entire third surface and the third surface mirror reflector may be removed at the gap region via deletion or ablation (or sand blasting or other suitable deletion/ablation means, such as laser ablation) of the third surface mirror reflector 720' at or near the perimeter edge region 714d', without affecting the scope of the present invention.

[00191] The front glass substrate 712' has a transparent electrical conductor 718' disposed on its rear or second surface 712a'. As shown in FIG. 28, a perimeter band 726' (which may comprise any suitable material, and preferably is a reflective perimeter band comprising a chromium reflective layer or the like) is disposed around the perimeter region of the rear surface of the front substrate 712', with the transparent electrical conductor 718' overlapping the perimeter band 726'. However, the transparent electrical conductor may be disposed over the rear surface of the front substrate and the perimeter band 726' may be disposed over the transparent electrical conductor, without affecting the scope of the present invention.

[00192] Reflective element 710' provides fourth surface electrical contacts or connectors 740a', 740b' (such as conductive epoxy or the like) at the rear surface 714b' of the rear substrate 714' for electrical connection to the third surface mirror reflector 720' and second surface transparent conductor 718', respectively. Reflective element 710' includes a fourth surface wraparound coating or coatings or layers 738' that is/are disposed over a portion of the rear surface 714b' of rear substrate 714' and that overlaps the wraparound portion 721' of the third surface mirror reflector 720'. In the illustrated embodiment, the fourth surface wraparound layer 738' comprises an environmentally stable stack of metallic conductive layers, such as a chromium layer 738a' and a ruthenium layer 738b' disposed over chromium layer 738a'. The wraparound portion 721' may extend over substantially the entire edge portion 714c' of the rear substrate 714' or may extend only partially over the edge portion 714c' (such as shown in FIG. 28), with the fourth surface wraparound portion 738' extending partially or entirely over the wraparound portion 721' so as to establish electrical conductivity between the wraparound portions 721' and 738'. The fourth surface wraparound coating 738' thus provides electrical conductivity between the fourth surface busbar or contact 740a' (such

as conductive epoxy or the like disposed at the fourth surface of the reflective element and at a portion of the wraparound coating 738' at the fourth surface of the reflective element) and the third surface mirror reflector 720' via the substantial overlap at the perimeter edge region of the rear substrate 714'.

[00193] The electrical conductivity between the electrical contact 740b' at the fourth surface of the reflective element 710' and the second surface transparent conductor 718' may be established via a conductive element or material 719' (such as a conductive epoxy) disposed over a portion of the fourth surface 714b' and over the perimeter edge 714d' of the rear substrate and between the front and rear substrates so as to contact and establish electrical conductivity to the second surface transparent conductor 718' at the rear of the front substrate 712'. The conductive element or material 719' is disposed at the reflective element at the area or region that corresponds to the gap portion 714e' at which the third surface 714a' is devoid of the third surface mirror reflector material. Because the third surface mirror reflector 720' is not present at the gap portion 714e' at the third surface 714a' of the rear substrate (and the third surface mirror reflector terminates inboard or perimetally inward of the perimeter edge 714d' at the gap region 714e' and is within the seal region of the reflective element or cell at the gap region 714e'), the third surface mirror reflector 720' is substantially electrically insulated or isolated from the conductive epoxy 719' at the perimeter edge 714d'. The conductive element or material 719' is thus disposed at the portion or region of the reflective element that corresponds to the gap portion 714e' to provide electrical conductivity between the fourth surface contact 740b' and the second surface transparent conductor 718' at that portion, which may be about 1 to 2 cm (or thereabouts or more or less) along the perimeter edge regions of the substrates of the reflective element.

[00194] Optionally, and as shown in FIGS. 29 and 30, a reflective element assembly 810 (such as for an interior or exterior mirror assembly) includes a smaller front substrate 812 and a larger rear substrate 814, so that an overhang region 815 is defined or established by the perimeter region or regions of the rear substrate overhanging or extending beyond the perimeter region or regions of the front substrate 812. Similar to rear substrate 714', discussed above, rear substrate 814 include a third surface mirror reflector 820 (which may comprise any suitable third surface mirror reflector, such as a third surface transflective mirror reflector or the like). For example, the third surface mirror reflector 820 may be similar to the CAZ reflector described above, may include a layer 820a of environmentally stable metallic material, such as chromium or the like, disposed on the front surface of the rear substrate (i.e. the third surface of the electrochromic cell), and a layer or layers 820b of

metal/transparent conductive material/materials over the chromium layer 820a. The third surface mirror reflector 820 includes a wraparound portion or tabout portion 821 that wraps around and overcoats a perimeter edge 814c of the rear substrate 814 to establish electrical conductivity between the third surface mirror reflector 820 and a fourth surface electrical contact 840a via a fourth surface wraparound portion or coating or layer 838, such as in a similar manner as discussed above (and which may comprise an environmentally stable stack of metallic conductive layers, such as a chromium layer 838a and a ruthenium layer 838b disposed over chromium layer 838a). The wraparound portion 821 may extend over substantially the entire edge portion 814c of the rear substrate 814 or may extend only partially over the edge portion 814c (such as shown in FIG. 29), with the fourth surface wraparound portion 838 extending partially or entirely over the wraparound portion 821 so as to establish electrical conductivity between the wraparound portions 821 and 838.

[00195] An electrochromic medium 816, such as an electrochromic solid polymer matrix (SPM) or other suitable electrochromic medium (such as a liquid or solid electrochromic medium), is disposed between the coated rear substrate 814 and a coated front substrate 812 (such as in a 110 μm interpane gap between the substrates and coatings/layers) and sealed within the interpane cavity via a perimeter seal 822 (such as an epoxy seal). The third surface mirror reflector 820 is disposed substantially over the entire third surface 814a except at a gap portion or isolating portion 814e at a portion of the third surface along and inboard or perimetally inward of the perimeter edge 814d (or in other words is disposed over the third surface with the perimeter portion masked during the deposition process) so as to define a gap or isolating portion 814e at the third surface 814a where the third surface mirror reflector is not disposed. The gap or isolating portion 814e may extend along the perimeter edge region about 1 to 2 cm (or thereabouts or more or less) and functions to electrically insulate or isolate the third surface mirror reflector from the perimeter edge region and overhang region 815 of the reflective element at that portion of the edge region. The perimeter seal 822 is disposed at the gap portion and may overlap an edge portion of the third surface mirror reflector to further electrically insulate or isolate the third surface mirror reflector 820 from the perimeter edge region 814d of rear substrate 814. The third surface mirror reflector 820 may extend over substantially the entire third surface 814a except at the gap portion (and thus may extend to the perimeter edge 714d at other areas at either side of the gap portion), such that the gap portion may be established by masking a relatively small portion of the third surface during the deposition of the third surface mirror reflector materials on the third surface or front surface of the rear substrate.

[00196] The front glass substrate 812 has a transparent electrical conductor 818 (such as a coating or layer of ITO or the like) disposed on its rear or second surface 812a. As shown in FIG. 29, a perimeter band 826 (which may comprise any suitable material, such as chromium or the like) may be disposed around the perimeter region of the rear surface of the front substrate 812, with the transparent electrical conductor 818 overlapping the perimeter band 826. Optionally, however, the transparent electrical conductor may be disposed over the rear surface of the front substrate and the perimeter band may be disposed over the transparent electrical conductor, without affecting the scope of the present invention. The perimeter band 826 includes a wraparound portion or tabout portion 826a disposed over a perimeter edge 812b of front substrate 812 (such as about a 1 to 2 cm length or portion along the perimeter edge 812b), while the transparent electrical conductor 818 likewise includes a wraparound portion or tabout portion 818a that is disposed over (or could be under depending on the particular application) the wraparound portion or tabout portion 826a of perimeter band 826 at the perimeter edge 812b of front substrate 812. The tabout portions 818a, 826a are formed along a portion of the perimeter edge 812b of front substrate 812 that corresponds to the location of the gap portion 814e at the third surface 814a of rear substrate 814 when the substrates 812, 814 are juxtaposed, such that the third surface reflector 820 is not coincident with or opposing the tabout portion 818a, 826a of the second surface transparent conductor of the front substrate.

[00197] Thus, the perimeter metallic band 826 may be disposed around the entire perimeter region of the rear surface of the front substrate and the second surface transparent conductor 818 may be disposed over the entire second surface and over the metallic band. The second surface transparent conductor may also be disposed at a wrap around or tab out portion of one edge, such as only about 1 to 2 cm or thereabouts (or more or less) along one of the edges of the front substrate. The third surface mirror reflector may be disposed over the third surface (the front surface of the rear substrate) except at a corresponding portion or region of the front surface of the rear substrate that corresponds with or opposes the second surface transparent conductor tabout / wraparound portion when the substrates are juxtaposed. The third surface mirror reflector thus may be disposed over the front surface of the rear substrate with a mask portion or element only at the portion of the front surface that corresponds to and opposes the second surface transparent conductor tabout / wraparound portion of the front substrate.

[00198] A wraparound element or tabout element or portion 842 is disposed at the perimeter edge 814d of rear substrate 814 and at the gap portion 814e (such as about a 1 to 2 cm length

or portion along the perimeter edge) of rear substrate 814 (and thus at a location along the perimeter edge that corresponds to the location of the tabout portion 826a, 818a at the front substrate 812 when the reflective element assembly is assembled together and the front and rear substrates are juxtaposed as shown in FIG. 29). As can be seen in FIG. 29, the tabout portion 842 may be disposed partially at the rear surface 814b of the rear substrate 814 to establish a fourth surface contact or busbar 840b, and the tabout portion 842 may be disposed partially at the front or third surface 814a of the rear substrate and at the region 814e that is devoid of the third surface reflector 820. Thus, electrical conductivity may be established between the fourth surface contact 840b at the fourth surface 814b of rear substrate 814 via a conductive element or material 819 (such as a conductive epoxy or the like) established or disposed at the overhang region 815 of the reflective element 810 (such as at the perimeter region 814d of the rear substrate 814 and the perimeter region 812b of the front substrate 812), and generally at a location along the perimeter edge region 814d that corresponds with the gap portion 814e and that corresponds with the location of the tabout portions 818a, 826a at the front substrate when the front and rear substrates are juxtapositioned next to one another. In the illustrated embodiment, the electrically conductive tab or wraparound coating or layer or element 842 is disposed over a portion of the rear surface 814b and perimeter region 814d and also partially over the perimeter gap region 814e of the front or third surface 814a of the rear substrate 814. The wraparound layer or element 842 is electrically isolated or insulated from the third surface mirror reflector 820 via the gap (or area at the third surface that is devoid of the third surface reflector 820) and the perimeter seal.

[00199] Thus, the conductive epoxy 819 disposed at the overhang region 815 contacts and establishes electrical conductivity to the second surface electrical conductor 818 via the wraparound portions 826a, 818a at perimeter edge 812b of front substrate 812, and may provide electrical conductivity to the fourth surface contact 840b via the wraparound element or tab or portion 842 at the corresponding location along the perimeter region of the third surface 814a of rear substrate 814. The wraparound portion 818a (comprising ITO or the like) is desirably disposed between the wraparound chromium portion 826a and the conductive epoxy 819 so that the conductive epoxy 819 does not directly contact the chromium perimeter band 826 and wraparound portion 826a. Optionally, the electrical conductivity between the wraparound portions 818a, 826a and the fourth surface contact 840b may be established by disposing a conductive material, such as conductive epoxy or the like, at the overhang region and further over the perimeter edge region 814d of the rear surface. Optionally, the electrical conductivity between the wraparound portions 818a, 826a

and the fourth surface contact or bus bar 840b may be established by disposing a conductive material, such as a conductive epoxy or the like, at the overhang region and providing a metallic clip or element at the corresponding portion of the perimeter region of the rear substrate. For example, the conductive material or epoxy may be disposed at the overhang region 815 and over the perimeter region 814d and a metallic clip may be slid over the perimeter region while the conductive epoxy is wet to establish electrical conductivity between the fourth surface portion of the clip and the conductive epoxy at the overhang region. Other means of establishing such electrical conductivity between the fourth surface of the larger rear substrate and the second surface wraparound portions at the smaller front substrate may be implemented without affecting the scope of the present invention.

[00200] As shown in FIGS. 30 and 30A, reflective element assembly 810 may be disposed at a mirror support or casing or housing or bezel 850 of an interior rearview mirror assembly 852. The bezel portion 850 may include a thin, substantially non-structural overlap 850a at the front surface of the front substrate 812, while the oversized rear substrate 814 is supported by a supporting portion 850b of the bezel portion 850, and thus takes substantially all of the load at the bezel portion 850. Such construction substantially reduces the stresses, such as hoop stresses, applied to the seal 822 and reflective element assembly 810 during assembly and construction of the mirror assembly, because the bezel primarily contacts the larger dimensioned rear substrate and preferably makes little or no contact to the smaller dimensioned front substrate. Further, such construction facilitates the use of a reduced reflective perimeter band 826, since the perimeter seal 822 is partially hidden or concealed by the thin overlap portion 850a of bezel portion 850. The size of the reflective band and the visibility or viewability or discernibility of the reflective band thus may be reduced. The overlap 850a may extend or overlap the front surface of the front substrate enough so as to at least partially and preferably substantially cover or conceal the perimeter seal 822. The electrical connection to the second surface transparent conductor thus may be made via an electrical connection at the fourth or rear surface of the rear substrate and outboard of the perimeter seal and thus hidden from view via the bezel portion 850.

[00201] As can be seen with reference to FIGS. 30, 30A and 30B, the smaller front substrate reflective element construction of FIGS. 30 and 30A allows the bezel to substantially or primarily or entirely engage and support the reflective element at the rear substrate, while primarily not contacting the front substrate. The smaller front substrate reflective element construction thus allows for a smaller bezel overlap portion at the front of the reflective element, as compared to an offset reflective element construction as shown at 870 in FIG.

30B. In the mirror construction of FIG. 30B, a larger bezel 872 is used to contain the cell 874 and to cover up or conceal the perimeter seal of the cell. As shown in FIG. 30B, the reflective element may include a backing plate or structural support and the bezel portion may attach to or snap to a rear casing portion or cap portion or the like to assemble the mirror assembly, such as utilizing aspects described in PCT Application No. PCT/US2004/015424, filed May 18, 2004, and published Dec. 2, 2004 as PCT Publication No. WO 2004/103772 A3 (our file DON01 FP-1150 (PCT)), which is hereby incorporated herein by reference in its entirety.

[00202] For example, and as shown in FIG. 30A, the bezel overlap portion 850a may extend only about 1 mm over the front surface of the reflective element. As shown in FIG. 30A, the bezel 850 may include the overlap portion 850a that extends about 2 mm (such as about 2.33 mm as shown in FIG. 30A) from the rear substrate contact or support portion 850b so as to extend over the front surface of the reflective element about 1 mm or thereabouts (i.e., the 2.33 mm overlap portion extends over or across the overhang region 815 of the reflective element (which is illustrated as being about 1.33 mm) and further over the front surface of the reflective element about 1 mm). Although the dimensions described above are shown in FIG. 30A as being relative to the lower chin portion of the bezel portion, similar dimensioned bezel portions may be provided at the upper portion of the bezel. A backing plate or attachment plate 854 may be provided at the rear of the rear substrate 814 and may extend to the bezel portion 850, such as for securing the reflective element to or within the mirror assembly and/or for providing user inputs, such as buttons or switches or the like, or display elements or illumination sources or the like, at the bezel portion for viewing and/or access by a user or occupant of the vehicle.

[00203] The smaller front substrate reflective element construction of the present invention thus allows for a smaller or reduced bezel portion around the perimeter of the front surface of the front substrate, while providing substantial support and retention of the reflective element at the bezel. The electrical conductive connection to the transparent conductor at the rear of the front or first substrate may be made via wraparound elements and/or conductive elements or materials (such as conductive epoxy or the like), such as described above. Thus, the reflective element may be supported at the bezel with a reduced overlap bezel portion around the front perimeter of the reflective element, and while providing for electrical connection to the reflective element or cell at the fourth surface of the reflective element or cell. Electrical connection or conductive continuity may be made to the second surface transparent conductor

on the smaller front substrate via the wraparound or tab out portion at the portion of the perimeter edge of the front substrate.

[00204] Optionally, and as shown in FIG. 31, an opaque paint or coating or layer 860 may be established or disposed at the rear surface 814b of the rear substrate 814 of the reflective element 810. In applications where the reflective element 810 is a transflective reflective element, the electrical contacts or tabs 841 at the rear of the reflective element may be viewable through the reflective element if they are positioned inboard of the perimeter seal and bezel portion. Thus, it is desirable to establish an opaque coating/layer 860, such as via printing or painting an opaque material or paint or ink or the like, onto the rear or fourth surface to substantially conceal the electrical contact or tab. The opaque coating/layer 860 may be screen printed or laser jet printed or ink jet printed or transfer printed, such as via booby printing or the like, or otherwise established across the fourth surface (or may be an opaque tape applied to the fourth surface) and partially over the fourth surface conductor or bus bar 840a (optionally, the opaque coating/layer 860 may be disposed onto the rear surface of the substrate and the fourth surface conductor 840a may be disposed partially over the opaque coating/layer). The electrical contact or tab 841 thus may be disposed at the fourth surface and partially over the opaque coating 860 and over or to or in conductive continuity with the fourth surface bus bar 840a, so that the tab 841 can extend into the viewing area for electrical connection without becoming visible through the reflective element. Optionally, the opaque layer may comprise a conductive material, whereby the tab may not be necessary.

[00205] Optionally, the mirror assembly may include a logo or message or iconistic display that is formed or established in and through (or at least partially through) the opaque layer. Optionally, the layer may be partially transmissive (so its mostly opaque (maybe 3-5%T)) at least at a portion of the opaque or substantially opaque layer, and the mirror reflective element assembly could have an icon behind the layer, such as an opaque icon or the like. Thus, an illumination source may be located at the rear of the reflective element and may be activatable or energizable to backlight the logo or message or icon so it is viewable through the reflective element. The backlit logo or message or icon thus may be readily viewable or discernible by a person viewing the mirror reflective element.

[00206] For the third surface metallic reflectors, second surface metallic reflectors, second surface metallic reflective bands, second surface indicia reflective bands/indicia and/or fourth surface wrap-around metallic conductor layers (such as are described herein and/or disclosed in U.S. pat. applications, Ser. No. 11/226,628, filed Sep. 14, 2005 (Attorney Docket DON01 P-1236); Ser. No. 11/021,065, filed Dec. 23, 2004 by McCabe et al. for ELECTRO-OPTIC

MIRROR CELL (Attorney Docket DON01 P-1193); and/or Ser. No. 11/334,139, filed Jan. 18, 2006 by Byers et al. for MIRROR ASSEMBLY WITH HEATER ELEMENT (Attorney Docket DON01 P-1259); and/or U.S. provisional applications, Ser. No. 60/644,903, filed Jan. 19, 2005 by Byers et al. for MIRROR ASSEMBLY WITH HEATER ELEMENT (Attorney Docket DON01 P-1202); Ser. No. 60/667,049, filed Mar. 31, 2005 by Byers et al. for MIRROR ASSEMBLY WITH HEATER ELEMENT (Attorney Docket DON01 P-1213); and/or Ser. No. 60/692,113, filed Jun. 20, 2005 (Attorney Docket DON01 P-1224), which are hereby incorporated herein by reference in their entireties), thin film coatings formed preferably by sputtering of nickel-alloys or iron-alloys can be used.

[00207] For example, Inconel (a nickel-based superalloy such as Inconel alloy 600 which is 72 percent nickel, 16 percent chromium, and 8 percent iron) can be used. Other forms of Inconel can be used, depending on the property required for a particular mirror construction/coating. For example, Inconel alloy 750, which has a small percentage of titanium and aluminum added for hardenability, can be used. Another example of a suitable material is Inconel 625, which contains molybdenum and columbium.

[00208] Another suitable nickel-alloy choice is HASTELLOY, which is a registered trademark name of Haynes International, Inc. The predominant alloying ingredient is typically nickel. Other alloying metals may be added to the nickel, including varying percentages of the elements molybdenum, chromium, cobalt, iron, copper, manganese, titanium, zirconium, aluminum, carbon, and tungsten. For example, for the third surface metallic reflectors, second surface metallic reflective bands and/or fourth surface wrap-around metallic conductor layers of the electrochromic mirrors described herein, thin film coatings may be deposited on the substrates involved by sputtering in a vacuum chamber from a Hastelloy C 276 or a Hastelloy X alloy planar magnetron or rotary magnetron sputtering target.

[00209] Another suitable choice is Nichrome, which is an alloy of nickel and chromium. Typically, the alloy is 80 percent nickel and 20 percent chromium. Nichrome, when sputter deposited as a conductive, metallic, reflective thin film of at least about 300 angstroms thickness has a specular reflectivity greater than about 60 percent reflectivity; and depending on the vacuum deposition conditions greater than about 65 percent reflectivity (as measured using SAE J964a). For example, good results can be achieved using a thin film of Nichrome [typically about 400-600 angstroms thick sputter-deposited onto the inward-facing surface (third surface) of the rear substrate in a laminate-type electrochromic mirror cell construction], and then overcoating this thin layer of Nichrome with a thinner layer (typically

about 100-200 angstroms thick or thereabouts) of Rhodium to form a Nichrome/Rhodium third surface reflector. If Nichrome is also used as a wrap-around fourth surface conductor [or for the perimetal reflector band around the edge perimeter of the inward-facing surface (second surface) of the front substrate of the EC cell construction], contact resistance challenges sometimes experienced when a chromium thin film conductor layer is contacted to by some silver-loaded conductive epoxies are reduced/mitigated.

[00210] Another alloy choice for these third surface metal reflector, second surface indicia reflective bands/indicia and/or fourth surface conductor layers is a coating of Nickel Silver, which is an alloy of copper with nickel and often, but not always, zinc. Nickel-silver alloys are commonly named by listing their percentages of copper and nickel, thus "Nickel Silver 55-18" would contain 55 percent copper, 18 percent nickel, and 27 percent other elements, most probably entirely zinc. For example, a NS-12 Nickel-silver alloy, which is 88 percent copper and 12 percent nickel, may be used.

[00211] Another alloy choice for these third surface metal reflector, second surface indicia reflective bands/indicia and/or fourth surface conductor layers is a coating of Cupronickel which is an alloy of copper, nickel and strengthening impurities. A typical mix is 75 percent copper, 25 percent nickel, and a trace amount of manganese. A 55 percent copper/45 percent nickel alloy may also be used.

[00212] Another alloy choice for these third surface metal reflector, second surface indicia reflective bands/indicia and/or fourth surface conductor layers is a coating of Monel metal, which is a copper-nickel alloy. Monel is a metal alloy, primarily composed of nickel and copper, with some iron and other trace elements. Also, bronze (copper alloyed with tin), brass (copper alloyed with zinc), and nickel silver (another group of copper-nickel alloys) may be used.

[00213] Another alloy choice for these third surface metal reflector, second surface indicia reflective bands/indicia and/or fourth surface conductor layers is a coating of stainless steel which is a ferrous alloy with a minimum of 10.5 percent chromium, preferably with additions of more than 12 percent (by weight) chromium. For example, a thin film coating sputtered off a AL-6XN alloy target, which is a superaustenitic stainless steel which was developed by Allegheny Ludlum Corporation (*www.alleghenyludlum.com*), can be used. It exhibits far greater resistance to chloride pitting, crevice corrosion and stress-corrosion cracking than exhibited by the standard 300 series stainless steels, and is less costly than traditional nickel-base corrosion resistant alloys. The UNS Designation of the AL-6XN® alloy is N08367.

[00214] The high nickel (24 percent) and molybdenum (6.3 percent) contents of the AL-6XN® alloy give it good resistance to chloride stress-corrosion cracking. The molybdenum confers resistance to chloride pitting. The nitrogen content of AL-6XN® alloy serves to further increase pitting resistance and also gives it higher strength than typical 300 series austenitic stainless steels, and thereby often allows it to be used in thinner sections. The high levels of chromium, molybdenum and nitrogen in AL-6XN® alloy all serve to produce exceptional corrosion resistance for this formable and weldable stainless steel.

[00215] Another alloy choice for these third surface metal reflector, second surface indicia reflective bands/indicia and/or fourth surface conductor layers is a coating of Chinese silver, which is an alloy made of silver, nickel and bronze, such as used for jewelry or a coating of a Ferroalloy that constitutes various alloys of less than 50 percent iron and one or more other element, manganese or silicon for example. The main Ferroalloys are: ferromanganese, ferrochromium, ferromolybdenum, ferrotitanium, ferrovanadium, ferrosilicon, ferroboron, and ferrophosphorus.

[00216] Another alloy choice for these third surface metal reflector, second surface indicia reflective bands/indicia and/or fourth surface conductor layer is a coating of German silver that is an alloy of 45–70 percent copper, 5–30 percent nickel, and 8–45 percent zinc - sometimes small amounts of tin or lead are added. It has a color resembling silver. Other names are Nickel silver, Pakfong (also *Paktong*) and Alpacca (originally a trademark of Berndorf AG).

[00217] Another alloy choice for these third surface metal reflector, second surface indicia reflective bands/indicia and/or fourth surface conductor layer is a coating of a titanium alloy such as a Grade F-5 titanium alloy (6 percent aluminum, 4 percent vanadium); Grade F-6 titanium alloy (5 percent aluminum, 2.5 percent tin); a titanium/palladium alloy; Grade F-12 titanium alloy (0.3 percent molybdenum, 0.8 percent nickel).

[00218] Another alloy choice for these third surface metal reflector, second surface indicia reflective bands/indicia and/or fourth surface conductor layer is a coating of a manganese alloy, such as a manganese-copper or a manganese-iron or a manganese-gold alloy. Another alloy choice for these metal reflector and/or conductor layers is a coating of a molybdenum alloy, such as a 52 percent molybdenum/48 percent rhenium alloy or a 99 percent Mo, 0.5 percent Ti and 0.08 percent Zr alloy (commonly known as a TZM alloy).

[00219] Another alloy choice for these third surface metal reflector, second surface indicia reflective bands/indicia and/or fourth surface conductor layer is Sterling silver, which is an alloy of silver containing least 92.5 percent pure silver and 7.5 percent other metals, usually

copper. In Sterling silver, the silver is usually alloyed with copper to give strength. Other metals can replace the copper. For example, a thin film coating formed by sputter deposition from a Silver/Germanium alloy target can be used.

[00220] Another alloy choice for these third surface metal reflector, second surface indicia reflective bands/indicia and/or fourth surface conductor layer is an aluminum alloy, such as Duralumin which is an alloy of aluminum (about 95 percent), copper (about 4 percent), and small amounts of magnesium (0.5 percent to 1 percent) and manganese (less than 1 percent). When sputter deposited to form a thin film metallic conductor reflector/electrode layer, such aluminum alloy thin films may optionally be overcoated with a thin film of a transparent conductor (such as of indium tin oxide) that is thus disposed between the aluminum-based reflector layer and the electrochromic medium in the electrochromic cell construction (and thus protecting the aluminum-based reflector layer from direct contact with the electrochromic medium).

[00221] Another alloy choice for these third surface metal reflector, second surface indicia reflective bands/indicia and/or fourth surface conductor layer is Stellite, which is a range of cobalt-chromium alloys designed for wear resistance. It may also contain tungsten and a small but important amount of carbon.

[00222] Another alloy choice for these third surface metal reflector, second surface indicia reflective bands/indicia and/or fourth surface conductor layer is Billon, which is an alloy of silver (sometimes gold) with a high base metal content (such as copper) or a silver alloy such as a silver-palladium alloy.

[00223] Another alloy choice for these third surface metal reflector, second surface indicia reflective bands/indicia and/or fourth surface conductor layer are copper-zinc-aluminium alloys or nickel-titanium (NiTi) alloys, such as the nickel-titanium alloy available under the trade name Nitinol (an acronym for NIckel TItanium Naval Ordnance Laboratories).

[00224] Another alloy choice for these third surface metal reflector, second surface indicia reflective bands/indicia and/or fourth surface conductor layer are tungsten alloys with tungsten content ranging from 40 to 97 percent featuring varying degrees of physical and mechanical properties; examples include W-Fe, W-Cu and W-Co alloys.

[00225] Another alloy choice for these third surface metal reflector, second surface indicia reflective bands/indicia and/or fourth surface conductor layer are palladium alloys, such as palladium-rhodium alloys.

[00226] Another alloy choice for these third surface metal reflector, second surface indicia reflective bands/indicia and/or fourth surface conductor layer are indium alloys, such as indium-bismuth-tin alloys or lead-indium alloys or tin-indium alloys.

[00227] Another alloy choice for these third surface metal reflector, second surface indicia reflective bands/indicia and/or fourth surface conductor layer are zinc alloys, such as with copper or magnesium or nickel.

[00228] Another alloy choice for these third surface metal reflector, second surface indicia reflective bands/indicia and/or fourth surface conductor layer is Brass, which is an alloy of copper and zinc. Some types of brass are called bronzes, despite their high zinc content. Alpha brasses (with less than 40 percent zinc) or Beta brasses, with a higher zinc content, can be used, depending on the circumstance involved. White brass, with more than 45 percent zinc, can also be used when it delivers the desired property.

[00229] Another alloy choice for these third surface metal reflector, second surface indicia reflective bands/indicia and/or fourth surface conductor layer is a rhenium alloy, such as a molybdenum-rhenium or a tungsten-rhenium alloy.

[00230] Another alloy choice for these third surface metal reflector, second surface indicia reflective bands/indicia and/or fourth surface conductor layer is a gold alloy such as an ELKONIUM® 76 gold-copper alloy or an ELKONIUM® 70 gold-silver-nickel alloy or a gold-palladium-nickel alloy or a gold-copper alloy or a gold-copper-nickel alloy or a gold-indium alloy or gold-nickel alloy or a gold-tin alloy.

[00231] Another alloy choice for these third surface metal reflector, second surface indicia reflective bands/indicia and/or fourth surface conductor layer is a platinum alloy, such as with cobalt, or with copper or with iridium (for example, Pt70/Ir30) or with palladium or with rhodium or with gallium or with ruthenium or with tungsten or with indium.

[00232] Another alloy choice for these third surface metal reflector, second surface indicia reflective bands/indicia and/or fourth surface conductor layer is a rhodium alloy, such as with iron or platinum (for example, Pt90/Rh10 or Pt87/Rh13).

[00233] Another alloy choice for these third surface metal reflector, second surface indicia reflective bands/indicia and/or fourth surface conductor layer is a cobalt alloy, such as with iron or nickel.

[00234] Another alloy choice for these third surface metal reflector, second surface indicia reflective bands/indicia and/or fourth surface conductor layer is a copper alloy, such as with tin or nickel or lead. Examples include Phosphor Bronze, Gun Metal, Tin Bronze, Leaded Bronze and Nickel Bronze.

[00235] Another alloy choice for these third surface metal reflector, second surface indicia reflective bands/indicia and/or fourth surface conductor layer are superalloys, such as PM200 available from Plansee AG of Reutte, Austria, and having a composition in weight percentage: 20 Cr, 5.5 Al, 0.5 Ti, 0.3 Al, 0.5 Y_2O_3, remainder Fe. The Plansee PM 2000 is a highly oxidation resistant and extremely creep resistant ferritic iron-chromium based alloy, due to its high content of aluminum and chromium.

[00236] Another alloy choice for these third surface metal reflector layers, second surface indicia reflective bands/indicia layers and/or fourth surface conductor layers are tantalum alloys, such as tantalum-tungsten alloys and tantalum-niobium alloys. Another alloy choice for these metal reflector and/or conductor layers are niobium alloys or zirconium or iridium alloys or osmium alloys or ruthenium alloys or lead alloys or beryllium alloys or tin alloys.

[00237] Alloys formed of tin and lead with other metal elements and non-metal elements (such as phosphorous or silicon or carbon) may be used where the coating properties suit the particular electrochromic cell structure/performance desired.

[00238] Another alloy choice for these third surface metal reflector, second surface indicia reflective bands/indicia and/or fourth surface conductor layer is a magnesium alloy, such as Magnesium-manganese; Magnesium-aluminum-manganese; Magnesium-aluminum-zinc-manganese; Magnesium-zirconium; Magnesium-zinc-zirconium; Magnesium-rare earth metal-zirconium; Magnesium-silver-rare earth metal-zirconium; and/or Magnesium-yttrium-rare earth metal-zirconium.

[00239] Metal reflector layers and/or indicia layers and/or conductor layers may also be sputter (or otherwise) deposited from metal targets such as from a chromium metal target, or from a nickel metal target or from a tungsten metal target or from a ruthenium metal target or from a titanium metal target or from a molybdenum metal target or from a cobalt metal target or from a manganese metal target or from a silver metal target or from an aluminum metal target or from a platinum metal target or from a palladium metal target or from a gold metal target or from a rhenium metal target or from a rhodium metal target or from a tantalum metal target or from a niobium target or from a zirconium target or from an iridium target or from an osmium target or from a lead target or from a beryllium target or from a zinc target or from a tin target or from an indium target or from a target that is a mixture of one or more of these metals (optionally with other metallic and/or non-metallic elements included). In general, improved results in terms of making contact thereto, such as via a conductive epoxy (such as lower, stabler contact resistances), are obtained for metal reflector and/or conductor layers by using metals or alloys that have a low Gibbs Energy of formation of metal oxides as

the sputter target (or evaporation material) for vacuum deposition of thin metallic layers. For example, deposited thin films of palladium or nickel or tungsten or molybdenum or rhodium have a low Gibbs Energy of formation of metal oxides compared to, for example, thin films of aluminum or chromium.

[00240] The choice of alloy or metal reflector and/or conductor layer to use is dependent on the reflectivity level and spectral content desired (for example, whether a silvery reflectivity is desired or whether a more copper-toned reflectivity is desired) and by the electrical properties (such as specific conductivity of the deposited thin film) and/or optical properties (such as the optical constants such as refractive index and k-value) desired for the deposited thin metallic film and/or by the sputtering rate/evaporation rate desired in the production process and/or by the cost bearable by the construction involved.

[00241] Also, when sputtering or otherwise vacuum depositing the metal reflector and/or conductor layers of the present invention from an alloy or mixed-metal target or source, the elemental composition/structure of the target/source is preferably substantially replicated in the deposited metallic thin film coating or layer but need not be exactly replicated.

[00242] Also, and as described previously above and optionally, the third surface metal reflector on the third surface of the rear substrate of the cell, the perimeter reflective border band around the edge border of the second surface of the front substrate and any indicia on the second surface but inward of the border band (if present) may be substantially the same material so that all three have substantially the same optical properties such as reflectivity level and refractive index /k-value. By so choosing, the optical contrast between the third surface reflector coating and the second surface perimeter border is substantially reduced and essentially eliminated such that the viewer barely sees or notices the presence of the second surface border band when the electrochromic cell is not powered (i.e. is undimmed and is in its bleached state). For example, the third surface reflector coating and the second surface perimetal border reflector band may both comprise chromium thin films or both may comprise ruthenium thin films or both may comprise rhodium thin films or both may comprise Hastelloy C-276 thin films or both may comprise molybdenum thin films or both may comprise aluminum (or aluminum alloy) thin films or both may comprise aluminum/palladium alloy thin films or both may comprise silver (or silver alloy) thin films or both may comprise an ITO/thick Ag (preferably greater than about 200 angstroms physical thickness; more preferably greater than about 250 angstroms thickness and most preferably greater than about 300 angstrom thickness)/ITO stack or a ZnAlO/thick Al/ZnAlO stack or a ZnAlO/thick Ag/ZnAlO stack or an SnO2/Ag/SnO2 stack or the like.

[00243] Optionally, it may be desirable to select a bezel for a mirror assembly that has a material or color or appearance or construction or reflectance character that matches or accentuates or complements the reflective surface of the interior mirror (or exterior mirror) reflector, and particularly for an interior EC mirror element that uses a reflecting perimeter border band or coating (such as disclosed in U.S. pat. applications, Ser. No. 11/021,065, filed Dec. 23, 2004 by McCabe et al. for ELECTRO-OPTIC MIRROR CELL (Attorney Docket DON01 P-1193); Ser. No. 10/528,269, filed Mar. 17, 2005 (Attorney Docket DON01 P-1109); Ser. No. 10/533,762, filed May 4, 2005 (Attorney Docket DON01 P-1116); Ser. No. 11/226,628, filed Sep. 14, 2005 (Attorney Docket DON01 P-1236); and/or Ser. No. 11/021,065, filed Dec. 23, 2004 by McCabe et al. for ELECTRO-OPTIC MIRROR CELL (Attorney Docket DON01 P-1193), which are hereby incorporated herein by reference in their entireties) in a flush or frameless EC mirror cell construction. The bezel of the mirror casing and the perimeter metal band around the perimeter of the reflective element are preferably selected so as to mutually pick up on or complement each other so as to enhance the appearance and utility of the mirror assembly. The mirror assembly thus may include the use of a metal (or metal-like or metal-coated) bezel that can pick up on or complement the frameless character of the mirror element, and give the mirror assembly a metal-look functionality. For example, and as shown in FIG. 32, a mirror assembly 910 includes a mirror reflective element 912 having a perimeter metallic band 914 (with a metallic or silvery appearance or color). The mirror assembly 910 includes a bezel portion 916 that is selected to substantially match or contrast the color or appearance or reflectance of the perimeter metallic band 914. In the illustrated embodiment, the perimeter band has a silvery appearance or color, and the bezel portion 916 is selected to have a silver or chrome appearance or color or reflectance. Thus, for reflective elements with metallic perimeter bands (or other mirror reflector types), the bezel portion may comprise a metallic material (such as a silvery or brass-like metal stamping or forming or a chromed or metal-coated plastic molding) so as to have a metallic or metal-like appearance. The bezel portion thus picks up or complements the perimeter band of the mirror reflective element (or the mirror reflector itself) so as to provide an aesthetically pleasing mirror assembly. Although shown in FIG. 32 as an interior rearview mirror assembly, the mirror assembly may comprise an exterior rearview mirror assembly utilizing similar principles. Thus, a retro-look or high-tech look can be imparted to the mirror assembly and the look to the driver or occupants of the vehicle of the bezel can blend in with the look of the mirror reflective element itself.

[00244] Optionally, the mirror assembly may include one or more displays, such as for the accessories or circuitry described herein. The display or displays may be similar to those described above, or may be of the types described in U.S. Pat. Nos. 5,530,240 and/or 6,329,925, which are hereby incorporated herein by reference in their entireties, or may be display-on-demand or transflective type displays or other displays, such as the types disclosed in U.S. Pat. Nos. 6,690,268; 5,668,663 and/or 5,724,187, and/or in U.S. pat. applications, Ser. No. 10/054,633, filed Jan. 22, 2002 by Lynam et al. for VEHICULAR LIGHTING SYSTEM (Attorney Docket DON01 P-962); Ser. No. 11/021,065, filed Dec. 23, 2004 by McCabe et al. for ELECTRO-OPTIC MIRROR CELL (Attorney Docket DON01 P-1193); Ser. No. 10/528,269, filed Mar. 17, 2005 (Attorney Docket DON01 P-1109); Ser. No. 10/533,762, filed May 4, 2005 (Attorney Docket DON01 P-1116); Ser. No. 10/538,724, filed Jun. 13, 2005 by Hutzel et al. for ACCESSORY SYSTEM FOR VEHICLE (Attorney Docket DON01 P-1123); Ser. No. 11/226,628, filed Sep. 14, 2005 by Karner et al. (Attorney Docket DON01 P-1236); Ser. No. 10/993,302, filed Nov. 19, 2004 (Attorney Docket DON01 P-1186); and/or Ser. No. 11/284,543, filed Nov. 22, 2005 (Attorney Docket DON01 P-1245), and/or PCT Application No. PCT/US03/29776, filed Sep. 9, 2003 by Donnelly Corp. et al. for MIRROR REFLECTIVE ELEMENT ASSEMBLY (Attorney Docket DON01 FP-1109(PCT)); and/or PCT Application No. PCT/US03/35381, filed Nov. 5, 2003 by Donnelly Corp. et al. for ELECTRO-OPTIC REFLECTIVE ELEMENT ASSEMBLY (Attorney Docket DON01 FP-1116(PCT)); and/or U.S. provisional applications, Ser. No. 60/630,061, filed Nov. 22, 2004 by Lynam et al. for MIRROR ASSEMBLY WITH VIDEO DISPLAY (Attorney Docket DON01 P-1189); Ser. No. 60/667,048, filed Mar. 31, 2005 by Lynam et al. for MIRROR ASSEMBLY WITH VIDEO DISPLAY (Attorney Docket DON01 P-1212); Ser. No. 60/629,926, filed Nov. 22, 2004 by McCabe et al. for METHOD OF MANUFACTURING ELECTRO-OPTIC MIRROR CELL (Attorney Docket DON01 P-1190); Ser. No. 60/531,838, filed Dec. 23, 2003 (Attorney Docket DON01 P-1132); Ser. No. 60/553,842, filed Mar. 17, 2004 (Attorney Docket DON01 P-1143); Ser. No. 60/563,342, filed Apr. 19, 2004 (Attorney Docket DON01 P-1153); Ser. No. 60/681,250, filed May 16, 2005 (Attorney Docket DON01 P-1221); Ser. No. 60/690,400, filed Jun. 14, 2005 (Attorney Docket DON01 P-1225); Ser. No. 60/695,149, filed Jun. 29, 2005 (Attorney Docket DON01 P-1227); Ser. No. 60/717,093, filed Sep. 14, 2005 by Lynam (Attorney Docket DON01 P-1240); Ser. No. 60/730,334, filed Oct. 26, 2005 by Baur for VEHICLE MIRROR ASSEMBLY WITH INDICIA AT REFLECTIVE ELEMENT (Attorney Docket DON01 P-1250); Ser. No. 60/732,245, filed Nov. 1, 2005 (Attorney Docket DON01 P-1251); and/or

Ser. No. 60/759,992, filed Jan. 18, 2006 by Weller et al. for INTERIOR REARVIEW MIRROR ASSEMBLY WITH DISPLAY (Attorney Docket DON01 P-1264), and/or PCT Application No. PCT/US03/40611, filed Dec. 19, 2003 by Donnelly Corp. et al. for ACCESSORY SYSTEM FOR VEHICLE (Attorney Docket DON01 FP-1123(PCT)), which are all hereby incorporated herein by reference in their entireties, or may include or incorporate video displays or the like, such as the types described in PCT Application No. PCT/US03/40611, filed Dec. 19, 2003 by Donnelly Corp. et al. for ACCESSORY SYSTEM FOR VEHICLE (Attorney Docket DON01 FP-1123(PCT)), U.S. patent applications, Ser. No. 10/538,724, filed Jun. 13, 2005 (Attorney Docket DON01 P-1123); and/or Ser. No. 11/284,543, filed Nov. 22, 2005 (Attorney Docket DON01 P-1245), and/or U.S. provisional applications, Ser. No. 60/630,061, filed Nov. 22, 2004 by Lynam et al. for MIRROR ASSEMBLY WITH VIDEO DISPLAY (Attorney Docket DON01 P-1189); and Ser. No. 60/667,048, filed Mar. 31, 2005 by Lynam et al. for MIRROR ASSEMBLY WITH VIDEO DISPLAY (Attorney Docket DON01 P-1212), which are hereby incorporated herein by reference in their entireties.

[00245] Optionally, the mirror assembly and/or reflective element assembly (such as a transflective electro-optic or non-electro-optic mirror reflective element) may include or may be associated with a rearwardly facing video display screen, such as a video display screen positioned at and behind the fourth surface of the reflective element and operable to emit light through the reflective element so as to be viewable to a driver of the vehicle when actuated. Typically, the intensity of the display is maximized during daytime operation (such as bright ambient light conditions) to reduce or limit washout of the display. However, at night, the intensity may be reduced, such as via photo-sensor control or by applying a reduced voltage when vehicle logic adapts an instrument panel dimmed illumination state. Accordingly, visibility of the display at night (i.e., during low or reduced ambient light conditions) is readily accomplished for such displays as the intensity of the display emission can be readily reduced by applying a reduced voltage compared to that applied when the display intensity is maximized during daytime driving. However, when an electro-optic (such as electrochromic) reflective element is dimmed or darkened at night in response to a detected glaring headlight condition, it may be desirable to re-brighten the intensity of the display (such as a navigation display or the like) to compensate for the reduced transmission through the electro-optic medium and thus enhance visibility and discernibility of the display through the darkened or dimmed reflective element, such as by utilizing aspects of the system described in U.S. Pat. Nos. 5,285,060 and 5,416,313, which are hereby incorporated herein

by reference in their entireties. Also, when the electro-optic medium is dimmed, such dimming may introduce a spectral characteristic or tint at the display and/or may impact the color rendition and/or color balance of a displayed color video image. Thus, and as described below, it may be desirable to avoid actuation and hence darkening/dimming of the electro-optic medium local to and in front of where the video display is disposed behind the reflective element.

[00246] For backup applications, such as a display that displays a rearward view at the rear of the vehicle, such as in conjunction with reverse aid or backup systems, such as a display that emits a video image of the rearward scene in response to a rearward facing video camera, the electro-optic mirror element may function in association with a reverse inhibit function (where the dimming of the electro-optic reflective element is inhibited when the reverse gear of the vehicle is engaged, such as described in U.S. Pat. Nos. 6,992,573; 6,590,193; 6,547,404; 6,305,807; 6,089,721; and 5,812,321, which are hereby incorporated herein by reference in their entireties), whereby the mirror reflective element is forced to and maintained in its day state when the vehicle is shifted into its reverse gear. In such backup or rear vision system applications, it may be desirable to locally dim the electro-optic medium in front of where the display is located behind the reflective element. Alternatively, and in particular applications, preferably, an electro-optically dimmed or darkened frame may be electro-optically created adjacent to and around where the video display is disposed (behind the reflective element) so as to frame the display for enhance viewability and discernibility of the display at and behind the reflective element. For example, and with reference to FIG. 33, a reflective element assembly 920 may be segmented into a primary reflective element viewing area or region D and a video display viewing area or region B, with the video display viewing area B at least partially surrounded or framed by a framing area or portion or region A.

[00247] Optionally, a lower frame portion or area or region C may be provided along the lower portion of the video display viewing area B, with a pair of leg portions of the video display viewing area B extending to the perimeter of the reflective element 920 at opposite sides of lower frame portion C and between lower frame portion C and frame portion A. The size or length of frame portion or region C may be selected depending on the desired or appropriate size or width of the legs of display area B, since the legs provide the conductive path to display area B and the electric flow to display area B may be reduced as the legs are made more narrow. Optionally, the reflective element may have a perimeter border band (such as described above), and the lower frame portion may not be readily viewable at the

lower perimeter band, such that the reflective element may not include such a lower frame portion.

[00248] The different portions or areas or regions A, B, C, D are defined by demarcation lines or deletion lines through at least one or some of the conductive coating or coatings of the reflective element 920 so as to electrically isolate one region from another and so as to enable electrical powering, and hence local actuation and dimming, of the electro-optic medium at each particular segment or region separate from the others. The demarcation lines are formed to electrically isolate the adjacent regions, while being sufficiently thin so as to be largely unnoticeable to the viewer of the mirror element. Preferably, the deletion lines are formed through the transparent conductive layer (such as ITO or the like) disposed on the second surface or rear surface of the front substrate of an electro-optic reflective element, such as by laser ablating or deleting thin lines along the second surface to define the desired viewing portions. Optionally, the deletion lines may be formed in and through the third surface reflector coatings or layers, but such deletion lines in the third surface reflector may be more readily visible or discernible than deletion lines formed through the second surface transparent conductive coating or layer.

[00249] Thus, during normal dimming or anti-glare operation of the reflective element 920, all of the regions A, B, C, D are powered to dim the viewable area of the reflective element. Optionally, the reflective element may be selectively dimmed, such as by dimming or darkening regions A and C (such as by powering contacts or electrodes at E and grounding or shorting contacts or electrodes at F) so as to provide a darkened frame around the video display and display area B. Such selective dimming may occur in response to the vehicle being shifted into its reverse gear. Such a frame enhances the viewability of the display by drawing the driver's eyes to the display area B when the frame is dimmed and the other viewing regions are not. Optionally, either the main or principle viewing / reflecting area D or the display area B may be dimmed while the other is un-dimmed or unpowered, in order to provide the desired reflectivity and viewability of the reflective element and display, depending on the particular application and desired appearance and function of the reflective element assembly.

[00250] In this manner, the presence and viewability of a video image displayed on such a video display/screen disposed behind a transflective electrochromic mirror element may be enhanced even during usage by day under higher ambient lighting (sunny) conditions where display wash-out can be a problem. The localized darkening of the EC medium local to and at least partially framing (preferably, substantially or wholly framing) the portion of the EC

mirror element where the video screen is disposed during daylight operation as described above helps draw the driver's attention and focus to the potentially faint/washed-out video image (such as a reversing back-up scene) and helps the driver distinguish this from the much brighter reflected image from the mirror reflector at other than where the video display is disposed.

[00251] This discrimination can be further augmented by increasing the intensity of display backlighting and or provision of additional lighting at but just beyond the border peripheral edges of the display element so that a ring or at least a partial frame of intense light can be seen by the driver that at least partially frames where the video screen is located (and so draws his/her attention and eye-focus to that location). Such an intense-light created frame or the like can be also used with a conventional fixed reflectance transflective mirror element (such as a transflective day/night prismatic mirror element)/video display as described above [with or without demarcation lines being ablated, such as by laser ablation, into the mirror reflector's coating(s)]. Such a ring or frame of intense light may be created, for example, by disposing behind the mirror element a number of intense light sources (such as LEDs or diode lasers or cold cathode tubes) that at least partially circumscribe the video display element at the rear of the mirror reflector, but that are located close to but just outside the display element itself so that the light emitted by such, for example, LEDs does not pass through (and so be attenuated by) the display element itself (typically, an LCD video display element). For example, a linear row of a plurality of LEDs, such as 3 – 6 LEDs or more, can be positioned along (but just outside) the top edge, along the bottom edge, along the right edge and/or along the left edge, so as to frame the location of the video display via emitting intense light through the transflective reflector of such a DOD transflective electrochromic or non-electrochromic (conventional) through-the-reflector video mirror.

[00252] Optionally, the likes of light pipes/light conduits and light distributors/diffusers (such as are common in the art) can be used in conjunction with an LED or a couple of LEDs or a plurality of LEDs in creating such a frame of intense light that at least partially frames the video display image so that its visibility and viewability to the driver is enhanced during daylight operation and so that the driver can better discern and focus on the video image being displayed, even under wash-out conditions. Optionally, the likes of photosensors can be used to adjust the intensity of such framing light sources (that preferably are LEDs but that alternatively can be a cold-cathode tubular light source, such as light sources of the types described in U.S. provisional applications, Ser. No. 60/732,245, filed Nov. 1, 2005 (Attorney Docket DON01 P-1251); and Ser. No. 60/759,992, filed Jan. 18, 2006 (Attorney Docket

DON01 P-1264), which are hereby incorporated herein by reference in their entireties, or can be any other suitable intense light source, such as a diode laser light source or a high-intensity incandescent light source) in accordance with prevailing ambient light conditions (and so that at night, intensity is reduced but by day, intensity is increased in accordance with an increase in ambient lighting detected). Note that it may be preferable to use a red or any other selected spectral intensity/color for the ring or frame of intense light created around the video image so that the demarcation creates both spectral demarcation and light intensity demarcation relative to the light intensity and spectral character of the video image itself.

[00253] Typically, it is desirable to substantially render unnoticeable or camouflage the presence of the video display (such as a liquid crystal display (LCD) video display or the like) that is disposed behind a transflective mirror element, such as a transflective mirror element that is at least about 10 percent transmissive of light therethrough and preferably about 20 percent transmissive. It is known to use a dark or black tape (or other suitable darkening or opacifying materials or layers, such as dark paint or ink or the like) to black out or opacify the areas where the display is not present, so that the presence of the display is not readily discernible to a person viewing the reflective element. However, this may lead to the joint lines between the tape and the display being visible or discernible, and even with such opacifying means, the outline of the display or display area may be noticeable to the driver, particularly during high ambient lighting conditions, such as during daytime driving conditions.

[00254] Optionally, a video display framing element or pocket may be provided as follows that is surprisingly effective in rendering the presence behind a transflective mirror element (and an interior prismatic transflective mirror element in particular) of the un-illuminated video screen non-noticeable. A piece of metal shim stock, such as stainless steel (such as a sheet or shim of stainless steel having a thickness of about 0.01 inches to about 0.02 inches or thereabouts) or the like, may be laser cut to match the shape of the prism or reflective element. The shim stock stainless steel substrate may have a window formed or laser cut therefrom that matches or substantially matches the size and shape of the active area of the display screen. Desirably, the color, reflectance and gloss of the shim stock substrate is selected to substantially match the OFF condition of the video display screen. The video display screen may be located at and behind the window of the shim stock substrate, and may be secured or adhered or glued or fastened in place at the window. The display element and shim stock substrate assembly may be located at or attached to the reflective element and behind the display on demand (DOD) reflective element.

[00255] The presence and location of the video display is thus substantially camouflaged or hidden or non-discernible so that it may be difficult to identify or discern the location of the video display when viewing the reflective element. The display assembly (including the shim stock plate or substrate and display element attached thereto) may be attached or adhered to the rear of the reflective element, such as to the rear of a backing plate of the reflective element or to the rear surface of a prismatic reflective element substrate or prism. Optionally, the display assembly may be attached or adhered to the rear surface of a prismatic reflective element substrate, such as an aluminum and silicon layered transflective prism, such as a prismatic substrate or element utilizing aspects of the mirrors described in U.S. Pat. Nos. 6,286,965; 6,196,688; 5,535,056; 5,751,489; and 6,065,840, and/or in U.S. pat. application, Ser. No. 10/993,302, filed Nov. 19, 2004 by Lynam for MIRROR REFLECTIVE ELEMENT FOR A VEHICLE (Attorney Docket DON01 P-1186), which are all hereby incorporated herein by reference in their entireties.

[00256] Optionally, a non-electro-optic transflective or display-on-demand (DOD) mirror element, such as a transflective prismatic mirror element, may be formed using a transflective DOD coating or coating stack on its second surface. Preferably, the coating or coating stack may comprise a coating comprising silicon or doped-silicon, such as silicon-aluminum mirror stack (with high silicon content) deposited onto the substrate surface. Such a silicon or doped-silicon coating may provide about 70 percent or more reflectivity of light incident thereon, while providing at least about 10 percent or more transmission of light therethrough, typically at least 20 percent or more transmission. The reflectivity from such a silicon-based coating may provide a silvery appearance and may provide enhanced durability to the substrate surface. Such a silicon-based mirror stack may be suitable for a transflective display on demand (DOD) prismatic substrate, such as for an interior or exterior rearview mirror assembly. Such a transflective silicon-based mirror element is suitable for use with a video display located behind the mirror so as to display video images at the mirror element for viewing by the driver of the vehicle. Alternately, similar silicon-based transflective mirror elements can be formed for exterior or outside mirror elements, such as flat, convex or aspheric elements (optionally, with the transflective layers on the front or first surface or on the rear or second surfaces, such as is known in the exterior mirror arts).

[00257] Optionally, a mirror reflective element may comprise a transflective display-on-demand (DOD) reflective element having suitable transflective coatings or layers on the third surface or fourth surface of an electro-optic reflective element, or on the first surface or second surface of a single substrate conventional fixed reflectance reflective element.

Desirably, a mirror substrate may have a silicon or doped-silicon coating or other suitable coating on its transflective surface. For example, mirror reflective elements for use in automobiles may utilize, in forming their substrates, transflective reflector-coated glass sheets having silicon-based transflective coatings or other suitable material, such as transflective reflector-coated glass sheets of the type that is commercially available from Pilkington of Toledo, Ohio and marketed under the trade name Mirropane T.M.™ Transparent Mirror Glass. Such silicon-based transflective coated glass sheets may have a reflectivity of at least about 70 percent of light incident thereon and a transmissivity, even in grey, of at least about 11 percent, and if clear glass, its transmissivity may be higher, such as up to about 20 percent or more. To manufacture an interior mirror prismatic element from such commercially available transflective reflector-coated glass sheets or substrates or panels, large, thick (such as about 6 mm to 6.6 mm thick or thereabouts) silicon-based transflective mirror glass sheets (preferably with the transflective reflector coating(s) coated onto non-tinted, highly light transmitting clear glass) may be purchased from Pilkington or another manufacturer. The transflective reflector-coated glass sheets may then be cut to interior mirror sized shapes or dimensions, which in turn may be ground to a prism wedge and edge finished to form the desired silicon-based transflective interior prismatic mirror elements suitable for use in interior automotive rearview mirror assemblies as a flip or manually-operated day/night mirror, as is known in the art. Such a process benefits from advantages such as its superior durability and chemical inertness of the silicon-based reflector during the prism manufacturing operations(s). Optionally however, a transparent tape or coating may be disposed over the reflector of the transflective reflector-coated glass as a protectorant prior to and during the prism fabrication process. Note that the silicon-based transflective mirror reflector coating is on the second surface opposite to the ground prism's slanted front surface of the mirror shape.

[00258] For a transflective interior mirror element behind which a video screen will be disposed as part of a display-through-the-mirror element video mirror/reversing camera system or the like, a clear, light transmitting layer or film may be used to environmentally and/or physically protect or encapsulate the mirror reflector coating or coatings at the second surface of the prismatic glass element. Suitable materials to use include encapsulants and conformal coatings commonly used in the electronics industry, and such as are available for CDs and DVDs, such as SK3200 and similar materials from Sony Chemicals or Shinetsu moisture cure silicone or Dymax 3095 or Loctite 3493 or Emerson & Cuming UV 7993. Such coatings can be applied by screen printing, dipping, spraying, roller coating, pad

printing, ink-jet printing and the like, and may be cured chemically or by heating or by UV exposure or the like. It is desirable to avoid any voids or bubbles or inclusions in the applied optically clear coating/film and that the applied coating/film be clear and highly light transmitting and be uniform in thickness. Optionally, a flexible sheet of plasticized PVB or of silicone or similar optically clear and transparent flexible film sheet may be laid over the second surface coating, and then vacuum-assisted/heating means (such as are described in U.S. provisional applications, Ser. No. 60/732,245, filed Nov. 1, 2005 (Attorney Docket DON01 P-1251); and Ser. No. 60/759,992, filed Jan. 18, 2006 (Attorney Docket DON01 P-1264), which are hereby incorporated herein by reference in their entireties) can be used to conform and attach to the coated second surface of the prism shape and so encapsulate/protect.

[00259] Even for the likes of a silicon-based second surface reflector, but particularly if a more environmentally fragile transflective reflector, such as of ITO/Ag/ITO, is used, it is desirable and preferred to protect well the exposed edges at the border edges around second surface of the prism part or substrate. In this regard, it is desirable either to mask close to the edges so that the reflector coating is not formed right out to the very edge and so that any encapsulant or conformal coating or sheet or means used can extend out to the very edge and/or to ensure that any encapsulant or conformal coating or sheet or means used actually wraps around the cut edge to form a wrap-around encapsulant/protectorant that mitigates or prevents edge corrosion.

[00260] If a metal oxide/metal/metal oxide transflective stack, such as ITO/Ag/ITO (ISI), is used as the mirror transflector, clear optical conformal coatings, such as acrylics or silicones or epoxies (that may be chemically cured or thermally cured or UV cured or microwave cured) or the like, can beneficially have the effect of flattening any spectral character of the thin film stack by acting as a massive layer (the physical thickness of the conformal coating or similar polymeric encapsulating layer may be many microns in thickness whereas the thin film ISI coatings are only several nanometers in thickness). For example, and for a typical ISI transflective mirror reflector coated onto the second surface of a cut glass prism shape, photopic reflection rose by about 6%R when a typical clear conformal polymeric coating was sprayed and cured thereon, and the percent transmission correspondingly decreased. Thus, if an ISI stack is to be used as a second surface reflector on a prism shape and then in turn is to be conformal coated for protection as described above, then the layer thicknesses of the ISI stack should be adjusted, as known in the optical modeling arts, to compensate for the

addition of the clear optical protecting massive film (massive relative to the thickness of the ISI stack layers).

[00261] As an alternative to directly coating the likes of a silicon-based transflector or an ISI transflector directly onto the second surface of a ground, clear-glass prismatic shape, the transflector coating or coatings can be deposited onto a flat thin glass shape that is then adhered to/laminated to the glass second surface of the prism shape, such as is disclosed in U.S. pat. application, Ser. No. 10/993,302, filed Nov. 19, 2004 by Lynam for MIRROR REFLECTIVE ELEMENT FOR A VEHICLE (Attorney Docket DON01 P-1186), which is hereby incorporated herein by reference in its entirety (and with the transflector coating(s) sandwiched between the two glass substrates). This has the advantage that the transflector coating(s) are protected against physical damage and/or environmental degradation (including edge attack) by the extra glass substrate, and that large stock sheets of thin glass can be coated from which interior mirror shapes can be cut later to match the particular prism part to be laminated to.

[00262] The likes of an autoclave or a vacuum/heat-assisted technique may be used to adhere the flat transflector-coated shape to the second surface of the clear prism part [such as by placing the uncoated prism shape onto a hotplate with its second surface up, placing a flexible sheet of PVB or silicone onto the second surface, juxtaposing the cut flat transflector-coated glass shape onto the flexible polymeric sheet with the coated surface downward, pulling a rubber flexible cover over this sandwich (or placing the sandwich in a vacuum bag), drawing down a vacuum so as to remove air and compress the parts together, and heating to laminate and secure permanently]. Alternatively, the rear flat second transflector-coated shape may be adhered to the second-surface of the front prism-shaped element via a seal as is used in EC cell constructions, and the interpane gap may be left unfilled or filled with the likes of a solvent, such as propylene carbonate or a solid film such as a plasticized urethane or the like.

[00263] Also, large sheets of, for example, about 2 mm thick or thereabouts, coated flat transflective reflector-coated mirror panes can be purchased. Such sheets or shapes can be bent or cut to the desired shape or form to suit the exterior mirror shape desired, and may be heated and bent to the desired curvature or form so that the shapes may be suitable for use in exterior mirror assemblies. The glass sheets may be purchased as coated sheets such as those described above. The mirror elements may comprise prismatic DOD substrates, and may utilize aspects described in U.S. Patent application, Ser. No. 10/993,302, filed Nov. 19, 2004 by Lynam for MIRROR REFLECTIVE ELEMENT FOR A VEHICLE (Attorney Docket DON01 P-1186), which is hereby incorporated herein by reference in its entirety. Optionally,

a transflective CAZ coating stack or a transflective ISI coating stack or the like may be used as a fourth surface transflective reflector in an electrochromic mirror element or as a first or second surface of a single substrate exterior mirror assembly.

[00264] Optionally, the transflective mirror reflector, such as for a silicon-based transflective prismatic interior mirror element or a flat or bent silicon-based exterior transflective mirror element, may be sputter coated in a vacuum deposition process using an aluminum-doped silicon target or the like (such as utilizing aspects described in U.S. Patent Application, Ser. No. 11/021,065, filed Dec. 23, 2004 (Attorney Docket DON01 P-1193, which is hereby incorporated herein by reference in its entirety). Alternatively, the mirror reflector may be formed by chemical deposition or chemical vapor deposition or pyrolitic deposition on the glass surface. Optionally, the silicon-based transflective mirror reflector may be formed by deposition onto the glass surface at the glass float-line itself when the glass ribbon is first being formed from the molten glass raw materials (where the red-hot molten glass exiting the glass furnace is floated onto a tin bath and where the coating materials or gasses or precursors are blown onto the red hot glass ribbon as it first forms while it exits the tin bath and while it is still in a very hot condition to form the transflective coatings on the glass surface).

[00265] Optionally, for example, a driver-side mirror may comprise an electro-optic mirror element (such as a driver-side flat electrochromic electrically variable reflectance mirror element, preferably a transflective, display-on-demand flat electrochromic electrically variable reflectance mirror element, and most preferably of flush or frameless construction and utilizing a reflective border band), and the passenger-side mirror may comprise a non-electro-optic mirror element (such as a passenger-side convex conventional fixed reflectance mirror element, preferably a transflective, display-on-demand fixed reflectance mirror element, and most preferably utilizing a reflective border band to match that used on the corresponding driver-side mirror element, as described herein). The driver-side electro-optic mirror element (that preferably comprises an electro-optic medium disposed between and sandwiched by a front transparent glass or plastic substrate and a rear, mirror reflector-coated transparent glass or plastic substrate) may have the second surface of its front transparent substrate coated with a transparent electrically conductive coating (such as ITO or the like) and may have its third surface (the inward surface of its rear transparent substrate) also coated with a transparent conductive coating (such as ITO or the like) so that light passes therethrough, and may have a significantly visible light reflecting (preferably at least about 60%R specularly reflecting there off; more preferably at least about 65%R there off and most preferably at least about 70%R there off) and substantially visible light transmitting

(preferably at least about 10%T there through; more preferably at least about 15%T there through and most preferably at least about 20%T there through) transflective mirror reflector on its fourth surface (the rearmost substrate of the EC cell) that, preferably, comprises a high optical refractive index elemental semiconductor mirror coating, such as of silicon or doped-silicon (or germanium or doped germanium), and most preferably comprises sputter coated silicon or doped-silicon such as silicon-aluminum or the like, such as described above. Suitable high optical refractive index elemental semiconductor mirror coatings such as of silicon or doped-silicon (or germanium or doped germanium) and preferably having an index of refraction of at least 3 and an optical thickness of at least about 275 angstroms are disclosed in U.S. Pat. Nos. 6,286,965; 5,751,489; and 5,535,056, the entire disclosures of which are hereby incorporated by reference herein. The passenger-side non-electro-optic mirror element may comprise a bent glass shape or substrate with a transflective mirror reflector on its first or second surface that, preferably, comprises a high index semiconductor coating such as of silicon or doped-silicon (or germanium or doped germanium), and more preferably comprises sputter coated silicon or doped-silicon such as silicon-aluminum or the like, and most preferably is selected to match the reflectance characteristic and visual appearance of the driver-side mirror element's reflector. Optionally, both the driver-side electro-optic mirror element and the passenger-side non-electro-optic mirror element may include a metallic specularly reflecting perimeter border band, such as a neutral reflecting perimeter band as described above, such as described above. Preferably, the driver-side mirror element has the perimeter band disposed on its second surface with the ITO coating disposed over the second surface and over the perimeter band, and the passenger-side mirror element has the perimeter band disposed on its second surface with the silicon or doped-silicon or silicon-aluminum disposed over the second surface and over the perimeter band. Thus, the reflective perimeter bands of the driver and passenger-side mirror elements may provide a generally cosmetic or visual appearance match between the two mirrors as both might be viewed, for example, at a car dealership or in use on the road or in a parking lot or the like.

[00266] Optionally, the interior mirror of the vehicle may comprise a transflective prismatic mirror element (such as with a transflective mirror reflector comprising silicon coating or doped-silicon coating, such as a silicon-aluminum coating, disposed thereon) and a display operable to emit illumination or video images through the transflective interior mirror element. The driver-side and/or passenger-side mirror element/assembly may include an independent EC controller or control circuit system (such as is disclosed in U.S. Pat. No.

5,659,423, the entire disclosure of which is hereby incorporated by reference herein) for independently controlling the driver-side (and/or passenger-side) electro-optic mirror element or, for example, the driver-side independent EC controller outboard at the exterior mirror element/assembly may also control an interior electro-optic mirror element if applicable. Optionally, the vehicle may have an interior electro-optic mirror that includes EC driver/circuitry/controllers for controlling the interior electro-optic mirror element and the driver-side electro-optic mirror element (and even a passenger-side electro-optic mirror element if applicable). Also, compass-on-a-chip circuitry as disclosed herein may be included in either or both of the exterior mirror assemblies, and the microprocessor or allied circuitry of such an exterior mirror-located compass-on-a-chip may also function to control the reflectivity of an electro-optic mirror element, such as an independent exterior electrochromic side view mirror element or an interior electrochromic rear view mirror element.

00267] Where a video display screen is disposed behind a transflective interior prismatic mirror element (for use as, for example, the video screen in a video mirror/reversing or back-up camera application), the video screen or monitor (typically an LCD or OLED flat panel of about 2.5 inches to about 3.5 inches diagonal dimension) may attach directly to the flat second surface of the interior prism mirror element, or preferably, may be mounted at an angle thereto so as to compensate for the prism wedge angle (typically about 4 degrees to about 4.75 degrees or thereabout – about 4.5 degrees being common) so as to mitigate any potential double imaging/ghosting due to the angling of the first surface of the prism wedge from its second surface. For example, a clear optical plastic block can be attached to the second surface of the prism and with its rear surface at an about 4.5 degree angle to its front (that contacts the second surface of the prism) and slanted so that the rear surface of the optical plastic block runs generally parallel to the front, first surface of the prism shape. Then, when the flat video screen element attaches to the rear surface of the block, it is orientated generally parallel with the front, first surface of the prism element, and video images emitted by the video screen are generally incident perpendicular to the prism's first surface and so video image double-imaging and ghosting is reduced. As an alternative to a clear optical block, a slanted mount can be used to hold the video screen at an angle to the second surface of the prism in order to achieve similar benefit. Also, and optionally, a light control film such as 3M's Vikuiti™ Light Control Film can be placed in front of the video screen between it and the rear of the mirror element so as to mitigate washout in high ambient viewing conditions such as a sunny day. Such light control films or louver films comprise a continuous matrix of parallel black louvers embedded in the likes of a polycarbonate film/thin (typically less than 0.04 inches thick) plastic sheet that limits viewing off axis of the direction of the louvers. For example, and taking an example where the louvers are at a 0.00 degrees angle to a vertical axis to the horizontal plane of the sheet (i.e., the louvers are vertical to the horizontal plane of the sheet), light transmission of light that impinges generally vertically to the horizontal plane of the sheet has an about 75%T transmission through the light control sheet, whereas light that impinges at about 15 degrees to vertical has only about a 35%T transmission due to the vertical orientation of the louvers, and light impinging or incident at an angle of about 30 degrees and above is largely cut-off by the louvers. 3M Vikuiti™ ALCF-P light control film can be used, having a louver angle of about 0 degrees (plus or minus 2 degrees), a viewing angle of about 60 degrees (plus or minus 4 degrees) and a sheet thickness of about 0.021 inches (plus or minus 0.003 inches). Alternately, 3M Vikuiti™ LCF-P light control film can be used, having a louver angle of about 0 degrees (plus or minus 8 degrees), a viewing angle of about 60 degrees (plus or minus 8 degrees) and a sheet thickness of about 0.021 inches (plus or minus 0.003 inches). Alternately, 3M Vikuiti™ LCF-P light control film can be used, having a louver angle of about 0 degrees (plus or minus 8 degrees), a viewing angle of about 60 degrees (plus or minus 8 degrees) and a sheet thickness of about 0.032 inches (plus or minus 0.005 inches). Should an angled block or mechanical angling of the video screen to the plane of the rear of the mirror element be used, then the light control film may be similarly angled if the louver angle is at about 0 degrees (such as by placing it between the video screen and the angled rear surface of the optical block attached to the rear, second surface of the prismatic mirror element). If no angling is used for the video screen with respect to the back of the transflective mirror element (such as a prismatic transflective mirror element or an electrochromic transflective mirror element), then the Vikuiti™ Light Control Film can be placed between the video screen and the second surface of the prism to which it is mounted. Note that if moiré patterns are seen with such light control films, the film may be slightly angled to mitigate this.

[00268] Optionally, an exterior mirror reflective element of the present invention may be used in a vehicle equipped with a transflective interior prismatic mirror element such as is disclosed in co-pending U.S. Patent Application Serial No. 10/993,302, filed Nov. 19, 2004 by Lynam for MIRROR REFLECTIVE ELEMENT FOR A VEHICLE, and published Jun. 23, 2005 as U.S. Publication No. US 2005/0134983 (Attorney Docket DON01 P-1186), the entire disclosure of which is hereby incorporated by reference herein. A transflective

prismatic mirror element may be made by first grinding clear glass prisms from about 6 mm to about 6.5 mm or so thick flat glass shapes, and then coating the non-ground surface of these clear glass shapes with a transflective mirror reflector, such as for example, with a sputter-coater deposited ITO/silver or silver-alloy/ITO transflective mirror reflector coating stack. Similarly, conventional transflective non-electro-optic transflective exterior mirror elements can be made by first cutting clear glass shapes from about 2 mm or so thick glass sheets, bending if desired, edge finishing and then sputter coating the second surface (or less preferably the first surface) with a transflective doped-silicon mirror reflector or with a transflective metal oxide/metal/metal oxide transflective mirror reflector (such as ITO/silver/ITO or AZO/Ag-alloy/AZO) or with a transflective silver or silver alloy coating or with a transflective aluminum or aluminum alloy coating [and optionally environmentally protecting the second surface coating with a clear, light transmitting protectorant such as a lacquer or coating (although in regions behind the second surface of the transflective prism element where display may not be likely located, a non-light transmitting protecting means may be used)].

[00269] Optionally, the mirror assembly and/or reflective element assembly (such as a transflective mirror reflective element) may include a photodiode or phototransistor or a silicon-based photosensor or the like for sensing ambient light and/or glare at the reflective element. Optionally, the photosensor may comprise a silicon-based photosensor, such as the types available from Microsemi of Irvine, CA, such as a Microsemi 1973B photosensor, such as a LX 1973A or 1973B photosensor that has a maximum dark current (at 50 degrees Centigrade) of less than about 7500 microLux, preferably less than about 5000 microLux, and more preferably less than about 4000 microLux. Preferably, such a photosensor (which is arranged so as to be looking through the transflective mirror reflector of the reflective element) operates in a closed loop control, such as is known in the art and such as is described in U.S. Pat. No. 4,917,477, which is hereby incorporated herein by reference in its entirety.

[00270] Optionally, the mirror assembly may accommodate other accessories or circuitry or the like as well, such as a rain sensor or imaging device or the like. For example, the mirror assembly may include a mounting portion (such as the types described in U.S. patent application Ser. No. 11/226,628, filed Sep. 14, 2005 (Attorney Docket DON01 P-1236); and/or U.S. provisional applications, Ser. No. 60/692,113, filed Jun. 20, 2005 (Attorney Docket DON01 P-1224); Ser. No. 60/677,990, filed May 5, 2005 (Attorney Docket DON01 P-1219); Ser. No. 60/653,787, filed Feb. 17, 2005 (Attorney Docket DON01 P-1207); Ser.

No. 60/642,227, filed Jan. 7, 2005 (Attorney Docket DON01 P-1199); Ser. No. 60/638,250, filed Dec. 21, 2004 (Attorney Docket DON01 P-1198); Ser. No. 60/624,091, filed Nov. 1, 2004 (Attorney Docket DON01 P-1184), and Ser. No. 60/609,642, filed Sep. 14, 2004 (Attorney Docket DON01 P-1171), which are all hereby incorporated herein by reference in their entireties), and may include a rain sensor or the like and may position the rain sensor against the windshield, such as described in U.S. Pat. Nos. 6,250,148; 6,341,523; 6,516,664; 6,968,736; and 6,824,281, and in U.S. pat. application Ser. No. 10/958,087, filed Oct. 4, 2004 by Schofield et al. for VEHICLE ACCESSORY MODULE (Attorney Docket DON01 P-1175), which are all hereby incorporated herein by reference in their entireties. Optionally, the mirror assembly may include an imaging device, such as an imaging array sensor for imaging systems of the types described in U.S. Pat. Nos. 6,757,109; 6,717,610; 6,396,397; 6,201,642; 6,353,392; 6,313,454; 6,396,397; 5,550,677; 5,670,935; 5,796,094; 5,877,897; 6,097,023; and 6,498,620, and U.S. pat. applications, Ser. No. 09/441,341, filed Nov. 16, 1999 by Schofield et al. for VEHICLE HEADLIGHT CONTROL USING IMAGING SENSOR (Attorney Docket DON01 P-770); Ser. No. 10/427,051, filed Apr. 30, 2003 by Pawlicki et al. for OBJECT DETECTION SYSTEM FOR VEHICLE, now U.S. Pat. No. 7,038,577 (Attorney Docket DON01 P-1075); and/or Ser. No. 11/315,675, filed Dec. 22, 2005 (Attorney Docket DON01 P-1253), and/or U.S. provisional application, Ser. No. 60/638,687, filed Dec. 23, 2004 (Attorney Docket DON01 P-1195), which are all hereby incorporated herein by reference in their entireties.

[00271] Optionally, the mirror assembly may be associated with various accessories or systems, such as, for example, a tire pressure monitoring system or a passenger air bag status or a garage door opening system or a telematics system or any other accessory or system of the mirror assembly or of the vehicle or of an accessory module or console of the vehicle, such as an accessory module or console of the types described in U.S. Pat. Nos. 6,690,268; 6,672,744; 6,386,742; and 6,124,886, and/or U.S. pat. applications, Ser. No. 10/739,766, filed Dec. 18, 2003 by DeLine et al. for MODULAR REARVIEW MIRROR ASSEMBLY, now U.S. Pat. No. 6,877,888 (Attorney Docket DON01 P-1119); and/or Ser. No. 10/355,454, filed Jan. 31, 2003 by Schofield et al. for VEHICLE ACCESSORY MODULE, now U.S. Pat. No. 6,824,281 (Attorney Docket DON01 P-1050), and/or PCT Application No. PCT/US03/03012, filed Jan. 31, 2003 by Donnelly Corporation for VEHICLE ACCESSORY MODULE (Attorney Docket DON01 FP-1050(PCT)), and/or PCT Application No. PCT/US03/40611, filed Dec. 19, 2003 by Donnelly Corporation for ACCESSORY SYSTEM FOR VEHICLE (Attorney Docket DON01 FP-1123(PCT)), and/or PCT Application No.

PCT/US04/15424, filed May 18, 2004 by Donnelly Corporation et al. for MIRROR ASSEMBLY FOR VEHICLE (Attorney Docket DON01 FP-1150(PCT)), which are hereby incorporated herein by reference in their entireties.

[00272] Optionally, the mirror assembly may support one or more other accessories or features, such as one or more electrical or electronic devices or accessories. For example, illumination sources or lights, such as map reading lights or one or more other lights or illumination sources, such as illumination sources of the types disclosed in U.S. Pat. Nos. 6,690,268; 5,938,321; 5,813,745; 5,820,245; 5,673,994; 5,649,756; 5,178,448; 5,671,996; 4,646,210; 4,733,336; 4,807,096; 6,042,253; 6,971,775; and/or 5,669,698, and/or U.S. pat. applications, Ser. No. 10/054,633, filed Jan. 22, 2002 (Attorney Docket DON01 P-962); and/or Ser. No. 10/933,842, filed Sep. 3, 2004 by Kulas et al. for INTERIOR REARVIEW MIRROR ASSEMBLY (Attorney Docket DON01 P-1166), which are hereby incorporated herein by reference in their entireties, may be included in the mirror assembly. The illumination sources and/or the circuit board may be connected to one or more buttons or inputs for activating and deactivating the illumination sources. Optionally, the mirror assembly may also or otherwise include other accessories, such as microphones, such as analog microphones or digital microphones or the like, such as microphones of the types disclosed in U.S. Pat. Nos. 6,243,003; 6,278,377; and/or 6,420,975, and/or in U.S. patent application Ser. No. 10/529,715, filed Mar. 30, 2005 (Attorney Docket DON01 P-1111), and in PCT Application No. PCT/US03/308877, filed Oct. 1, 2003 by Donnelly Corp. et al. for MICROPHONE SYSTEM FOR VEHICLE (Attorney Docket DON01 FP-1111(PCT)). Optionally, the mirror assembly may also or otherwise include other accessories, such as a telematics system, speakers, antennas, including global positioning system (GPS) or cellular phone antennas, such as disclosed in U.S. Pat. No. 5,971,552, a communication module, such as disclosed in U.S. Pat. No. 5,798,688, a voice recorder, a blind spot detection and/or indication system, such as disclosed in U.S. Pat. Nos. 5,929,786 and/or 5,786,772, and/or U.S. pat. applications, Ser. No. 10/427,051, filed Apr. 30, 2003, now U.S. Pat. No. 7,038,577 (Attorney Docket DON01 P-1075) ; and/or Ser. No. 11/315,675, filed Dec. 22, 2005 (Attorney Docket DON01 P-1253); and/or Ser. No. 10/209,173, filed Jul. 31, 2002, now U.S. Pat. No. 6,882,287 (Attorney Docket DON01 P-1016); and/or U.S. provisional applications, Ser. No. 60/638,687, filed Dec. 23, 2004 (Attorney Docket DON01 P-1195); Ser. No. 60/696,953, filed Jul. 6, 2006 (Attorney Docket DON01 P-1228); and/or Ser. No. 60/784,570, filed Mar. 22, 2006 (Attorney Docket DON01 P-1273), transmitters and/or receivers, such as for a garage door opener or a vehicle door unlocking system or the like (such as a remote

keyless entry system), a digital network, such as described in U.S. Pat. No. 5,798,575, a high/low headlamp controller, such as a camera-based headlamp control, such as disclosed in U.S. Pat. Nos. 5,796,094 and/or 5,715,093, a memory mirror system, such as disclosed in U.S. Pat. No. 5,796,176, a hands-free phone attachment, an imaging system or components or circuitry or display thereof, such as an imaging and/or display system of the types described in U.S. Pat. Nos. 6,690,268 and 6,847,487; and/or U.S. provisional applications, Ser. No. 60/614,644, filed Sep. 30, 2004 (Attorney Docket DON01 P-1177); Ser. No. 60/618,686, filed Oct. 14, 2004 (Attorney Docket DON01 P-1183); Ser. No. 60/628,709, filed Nov. 17, 2004 (Attorney Docket DON01 P-1188); Ser. No. 60/644,903, filed Jan. 11, 2005 (Attorney Docket DON01 P-1202); Ser. No. 60/667,049, filed Mar. 31, 2005 (Attorney Docket DON01 P-1213); and/or U.S. pat. applications, Ser. No. 11/105,757, filed Apr. 14, 2005 (Attorney Docket DON01 P-1208); and/or Ser. No. 11/239,980, filed Sep. 30, 2005 (Attorney Docket DON01 P-1238), a slide out or extendable/retractable video device or module, such as described in U.S. patent applications, Ser. No. 10/538,724, filed Jun. 13, 2005 (Attorney Docket DON01 P-1123); and/or Ser. No. 11/284,543, filed Nov. 22, 2005 (Attorney Docket DON01 P-1245), U.S. provisional applications, Ser. No. 60/630,061, filed Nov. 22, 2004 (Attorney Docket DON01 P-1189); and/or Ser. No. 60/667,048, filed Mar. 31, 2005 (Attorney Docket DON01 P-1212); and/or PCT Application No. PCT/US03/40611, filed Dec. 19, 2003 (Attorney Docket DON01 FP-1123(PCT)), a video device for internal cabin surveillance (such as for sleep detection or driver drowsiness detection or the like) and/or video telephone function, such as disclosed in U.S. Pat. Nos. 5,760,962 and/or 5,877,897, a remote keyless entry receiver, a seat occupancy detector, a remote starter control, a yaw sensor, a clock, a carbon monoxide detector, status displays, such as displays that display a status of a door of the vehicle, a transmission selection (4wd/2wd or traction control (TCS) or the like), an antilock braking system, a road condition (that may warn the driver of icy road conditions) and/or the like, a trip computer, a tire pressure monitoring system (TPMS) receiver (such as described in U.S. Pat. Nos. 6,124,647; 6,294,989; 6,445,287; 6,472,979; and/or 6,731,205; and/or U.S. patent application Ser. No. 11/232,324, filed Sep. 21, 2005 by O'Brien et al. for TIRE PRESSURE ALERT SYSTEM (Attorney Docket DON01 P-1237); and/or U.S. provisional application, Ser. No. 60/611,796, filed Sep. 21, 2004 (Attorney Docket DON01 P-1179)), and/or an ONSTAR® system and/or any other accessory or circuitry or the like (with all of the above-referenced patents and PCT and U.S. patent applications being commonly assigned to Donnelly Corporation, and with the disclosures of the referenced patents and patent applications being hereby incorporated herein by reference in their entireties).

[00273] Optionally, the accessory module and/or mirror assembly may accommodate other accessories or circuitry or the like as well, such as a rain sensor or imaging device or the like. For example, the mirror assembly may include a mounting portion (such as the types described in U.S. patent application Ser. No. 11/226,628, filed Sep. 14, 2005 (Attorney Docket DON01 P-1236); and/or U.S. provisional applications, Ser. No. 60/692,113, filed Jun. 20, 2005 (Attorney Docket DON01 P-1224); Ser. No. 60/677,990, filed May 5, 2005 (Attorney Docket DON01 P-1219); Ser. No. 60/653,787, filed Feb. 17, 2005 (Attorney Docket DON01 P-1207); Ser. No. 60/642,227, filed Jan. 7, 2005 (Attorney Docket DON01 P-1199); Ser. No. 60/638,250, filed Dec. 21, 2004 (Attorney Docket DON01 P-1198); Ser. No. 60/624,091, filed Nov. 1, 2004 (Attorney Docket DON01 P-1184); Ser. No. 60/609,642, filed Sep. 14, 2004 (Attorney Docket DON01 P-1171); and/or Ser. No. 60/729,430, filed Oct. 21, 2005 (Attorney Docket DON01 P-1249), which are all hereby incorporated herein by reference in their entireties), and may include a rain sensor or the like and may position the rain sensor against the windshield, such as described in U.S. Pat. Nos. 6,250,148; 6,341,523; 6,516,664; 6,968,736; and 6,824,281, and in U.S. pat. application Ser. No. 10/958,087, filed Oct. 4, 2004 by Schofield et al. for VEHICLE ACCESSORY MODULE (Attorney Docket DON01 P-1175), which are all hereby incorporated herein by reference in their entireties. Optionally, the mirror assembly may include an imaging device, such as an imaging array sensor for imaging systems of the types described in U.S. Pat. Nos. 6,757,109; 6,717,610; 6,396,397; 6,201,642; 6,353,392; 6,313,454; 6,396,397; 5,550,677; 5,670,935; 5,796,094; 5,877,897; 6,097,023; and 6,498,620, and U.S. pat. applications, Ser. No. 09/441,341, filed Nov. 16, 1999 by Schofield et al. for VEHICLE HEADLIGHT CONTROL USING IMAGING SENSOR (Attorney Docket DON01 P-770); Ser. No. 10/427,051, filed Apr. 30, 2003 by Pawlicki et al. for OBJECT DETECTION SYSTEM FOR VEHICLE, now U.S. Pat. No. 7,038,577 (Attorney Docket DON01 P-1075); and/or Ser. No. 11/315,675, filed Dec. 22, 2005 (Attorney Docket DON01 P-1253), and/or U.S. provisional application, Ser. No. 60/638,687, filed Dec. 23, 2004 (Attorney Docket DON01 P-1195), which are all hereby incorporated herein by reference in their entireties.

[00274] Optionally, the mirror assembly may include one or more other accessories at or within the mirror casing, such as one or more electrical or electronic devices or accessories, such as antennas, including global positioning system (GPS) or cellular phone antennas, such as disclosed in U.S. Pat. No. 5,971,552, a communication module, such as disclosed in U.S.

Pat. No. 5,798,688, a blind spot detection system, such as disclosed in U.S. Pat. Nos. 5,929,786 and/or 5,786,772, transmitters and/or receivers, such as a garage door opener or the like, a digital network, such as described in U.S. Pat. No. 5,798,575, a high/low headlamp controller, such as disclosed in U.S. Pat. Nos. 5,796,094 and/or 5,715,093, a memory mirror system, such as disclosed in U.S. Pat. No. 5,796,176, a hands-free phone attachment, a video device for internal cabin surveillance and/or video telephone function, such as disclosed in U.S. Pat. Nos. 5,760,962 and/or 5,877,897, a remote keyless entry receiver, lights, such as map reading lights or one or more other lights or illumination sources, such as disclosed in U.S. Pat. Nos. 6,690,268; 5,938,321; 5,813,745; 5,820,245; 5,673,994; 5,649,756; 5,178,448; 5,671,996; 4,646,210; 4,733,336; 4,807,096; 6,042,253; and/or 5,669,698, and/or U.S. pat. applications, Ser. No. 10/054,633, filed Jan. 22, 2002 by Lynam et al. for VEHICULAR LIGHTING SYSTEM (Attorney Docket DON01 P-962); Ser. No. 10/745,056, filed Dec. 22, 2003 by Lynam et al. for LIGHT MODULE FOR INTERIOR REARVIEW MIRROR ASSEMBLY (Attorney Docket DON01 P-1122); and/or Ser. No. 10/933,842, filed Sep. 3, 2004 by Kulas et al. for INTERIOR REARVIEW MIRROR ASSEMBLY (Attorney Docket DON01 P-1166), microphones, such as disclosed in U.S. Pat. Nos. 6,243,003; 6,278,377; and/or 6,420,975; and/or U.S. patent application Ser. No. 10/529,715, filed Mar. 30, 2005 (Attorney Docket DON01 P-1111); and/or PCT Application No. PCT/US03/30877, filed Oct. 1, 2003 (Attorney Docket DON01 FP-1111(PCT)), speakers, antennas, including global positioning system (GPS) or cellular phone antennas, such as disclosed in U.S. Pat. No. 5,971,552, a communication module, such as disclosed in U.S. Pat. No. 5,798,688, a voice recorder, a blind spot detection system, such as disclosed in U.S. Pat. Nos. 5,929,786 and/or 5,786,772, and/or U.S. pat. applications, Ser. No. 10/427,051, filed Apr. 30, 2003, now U.S. Pat. No. 7,038,577 (Attorney Docket DON01 P-1075); Ser. No. 11/315,675, filed Dec. 22, 2005 (Attorney Docket DON01 P-1253); and Ser. No. 10/209,173, filed Jul. 31, 2002, now U.S. Pat. No. 6,882,287 (Attorney Docket DON01 P-1016); and/or U.S. provisional application, Ser. No. 60/638,687, filed Dec. 23, 2004 (Attorney Docket DON01 P-1195), transmitters and/or receivers, such as for a garage door opener or a vehicle door unlocking system or the like (such as a remote keyless entry system), a digital network, such as described in U.S. Pat. No. 5,798,575, a high/low headlamp controller, such as a camera-based headlamp control, such as disclosed in U.S. Pat. Nos. 5,796,094 and/or 5,715,093, a memory mirror system, such as disclosed in U.S. Pat. No. 5,796,176, a hands-free phone attachment, an imaging system or components or circuitry or display thereof, such as an imaging and/or display system of the types described in U.S. Pat. Nos. 6,690,268 and 6,847,487; and/or U.S.

provisional applications, Ser. No. 60/614,644, filed Sep. 30, 2004 (Attorney Docket DON01 P-1177); Ser. No. 60/618,686, filed Oct. 14, 2004 (Attorney Docket DON01 P-1183); Ser. No. 60/628,709, filed Nov. 17, 2004 (Attorney Docket DON01 P-1188); Ser. No. 60/644,903, filed Jan. 11, 2005 (Attorney Docket DON01 P-1202); Ser. No. 60/667,049, filed Mar. 31, 2005 (Attorney Docket DON01 P-1213); and/or U.S. patent application Ser. No. 11/105,757, filed Apr. 14, 2005 (Attorney Docket DON01 P-1208), a video device for internal cabin surveillance (such as for sleep detection or driver drowsiness detection or the like) and/or video telephone function, such as disclosed in U.S. Pat. Nos. 5,760,962 and/or 5,877,897, a remote keyless entry receiver, a seat occupancy detector, a remote starter control, a yaw sensor, a clock, a carbon monoxide detector, status displays, such as displays that display a status of a door of the vehicle, a transmission selection (4wd/2wd or traction control (TCS) or the like), an antilock braking system, a road condition (that may warn the driver of icy road conditions) and/or the like, a trip computer, a tire pressure monitoring system (TPMS) receiver (such as described in U.S. Pat. Nos. 6,124,647; 6,294,989; 6,445,287; 6,472,979; and/or 6,731,205; and/or U.S. patent application Ser. No. 11/232,324, filed Sep. 21, 2005 by O'Brien et al. for TIRE PRESSURE ALERT SYSTEM (Attorney Docket DON01 P-1237); and/or U.S. provisional application, Ser. No. 60/611,796, filed Sep. 21, 2004 (Attorney Docket DON01 P-1179)), and/or an ONSTAR® system, a compass, such as disclosed in U.S. Pat. Nos. 5,924,212; 4,862,594; 4,937,945; 5,131,154; 5,255,442; and/or 5,632,092, and/or U.S. pat. applications, Ser. No. 10/456,599, filed Jun. 6, 2003 by Weller et al. for INTERIOR REARVIEW MIRROR SYSTEM WITH COMPASS (Attorney Docket DON01 P-1076); and/or Ser. No. 11/305,637, filed Dec. 16, 2005 (Attorney Docket DON01 P-1254), and/or any other accessory or circuitry or the like (with all of the above-referenced patents and PCT and U.S. patent applications being commonly assigned to Donnelly Corporation, and with the disclosures of the referenced patents and patent applications being hereby incorporated herein by reference in their entireties).

[00275] Optionally, a display of driver performance or aggressiveness or the like can be included at the interior mirror assembly or at a windshield electronics module that utilizes data from the likes of the SmartCenter developed by and available from Drive Diagnostics Ltd of Tel Aviv, Israel (see www.drivediagnostics.com). DriveDiagnostics' SafetyCenter comprises sensors that monitor moves and maneuvers the vehicle makes by measuring the forces on the car and software that identifies the maneuvers and produces a 'driver behavior' report. The system also can have a GPS location device that measures the speed at which the car is being driven, rather than hooking up to the car's own speedometer. As disclosed in

U.S. Pat. Publication No. 20050131597 (published Jun. 16, 2005 based on an U.S. Patent Application Serial No. 10/894345, filed Jul. 20, 2004, the entire disclosure of which is hereby incorporated by reference herein), the system and method analyzes and evaluates the performance and attitude of a motor vehicle driver. A raw data stream from a set of vehicle sensors is filtered to eliminate extraneous noise, and then parsed to convert the stream into a string of driving event primitives. The string of driving events is then processed by a pattern-recognition system to derive a sequence of higher-level driving maneuvers.

[00276] Driving maneuvers include such familiar procedures as lane changing, passing, and turning and braking. Driving events and maneuvers are quantified by parameters developed from the sensor data. The parameters and timing of the maneuvers can be analyzed to determine skill and attitude factors for evaluating the driver's abilities and safety ratings. The rendering of the data into common driving-related concepts allows more accurate and meaningful analysis and evaluation than is possible with ordinary statistical threshold-based analysis.

[00277] As soon as aggressive or dangerous driving is detected, real time alerts are presented to the driver in the car (such as by a transflective display at the interior mirror or by another mirror-located display) and optionally, a parent can be notified via SMS messaging, mail or voice mail or a report can be sent to the car owner via a regular report (for example, for General Motors vehicles equipped with an OnStar® telematics systems, the monthly OnStar® e-mail report sent to subscribers can include a report on driver safety/"aggressiveness" and on the impact such has on fuel economy. SafetyCenter builds driver specific profiles and points directly at attitude and skill deficiencies that have to be corrected. Using user-friendly web interface, and as an example, both a parent and a young driver can get a better understanding of a driver's behavior and what has to be done in order to turn a young driver into a skilled and responsible driver.

[00278] To achieve this, a compact unit can be installed, for example, in the interior mirror housing or on a pod attaching to the interior mirror mount (so it is fixedly mounted) that may link into an in-car data logging/analysis system and/or can link into the on-board OnStar® or similar system so that GPS data and driver behavior data may be regularly broadcast to the external OnStar® or similar telematics server for recording/compilation/analysis and reporting back to the driver/owner/subscriber/insurance agency. The unit mounted at or in the interior mirror assembly/windshield electronics module may comprise its own set of sensors, GPS modem and GPS unit. The sensors in such a unit can measure the forces impacting the vehicle and provide precise information about each maneuver the driver

performs. Each maneuver can be evaluated on both attitude and skill parameters. This high resolution detection enables full visibility of driver behavior. Once aggressive or dangerous driving is detected, the information is sent real-time to an external server (such as the OnStar® server) or can be processed in-car; the data is analyzed and driver specific reports describing the driver's behavior are generated and can be reported/displayed to the driver such as via a transflective video interior mirror display. The displayed data can provide information and prescriptive guidance to driver while he/she is driving and can alert if the driving pattern suggest risky/aggressive/unsafe driving and/or a driving pattern (fast starts/heavy stops) likely to reduce fuel efficiency.

[00279] Typically, such a system utilizes a PCB or similar circuit element equipped with a 3-axis accelerometer or the like. Such a PCB could by accommodated in the interior mirror assembly (or in an attachment thereto) or in a windshield electronics module. Thus, a display may be placed at or about the interior mirror of the vehicle mirror that feeds back to the driver his/her driver "aggressiveness" performance and ties this to fuel economy and/or safety, and preferably is a thru-the-mirror-reflector "display-on-demand" mirror display. Also, information from a forward facing video sensor (such as a lane departure warning video sensor or the likes of MobilEye's EyeQ video-based object detection sensing system) or of a video camera monitoring the driver's face/eyes to detect driver drowsiness can be combined/fused with DriveDiagnostic's "see how you drive" capability, thus making the assessment of aggressiveness tie into road type/conditions and weather conditions (what might not be aggressive driving on a clear day might be hazardous if it is snowing or foggy or at night or on a crowded road compared to a road with little traffic or on a wide road versus a narrow road) and make the diagnosis dynamic to road/weather conditions, and if a driver drowsiness is included, to how alert the driver appears to be. Packaging the electronics and/or the display (preferably a dynamic display and most preferably a display that ties in fuel economy to driver aggressiveness/behavior) in a windshield electronics module (WEM) or in (or at) an interior mirror assembly has several benefits, and particularly in a vehicle equipped with a telematics system (such as OnStar®) where the likes of GPS and 3-axis accelerometers may already be on board and where the interior mirror already serves as a human-machine interface or HMI (for example, microphone and button actuation) for the telematics system. Also, the mirror-mounted or WEM-mounted display may alert the driver if his or her driving habits are being reported unfavorably to the driver's insurance company and thus possibly degrading the ranking and reduction in premium awarded by the insurer in order to entice less-aggressive and hence safer driving. For example, a "green-yellow-red"

background or indicia may be utilized on the display to convey to the driver the ranking being reported.

[00280] Optionally, the mirror assembly of the present invention comprise an interior or exterior rearview mirror assembly and may include a compass-on-a-chip with electrochromic circuitry, such as described in U.S. pat. applications, Ser. No. 11/226,628, filed Sep. 14, 2005 (Attorney Docket DON01 P-1236); and/or Ser. No. 11/201,661, filed Aug. 11, 2005 (Attorney Docket DON01 P-1233), which are hereby incorporated herein by reference in their entireties. For example, an exterior mirror assembly may include a compass-on-a-chip, preferably with electrochromic circuitry, such as for an independent outside electrochromic mirror drive, such as by utilizing aspects described in U.S. Pat. No. 5,659,423, which is hereby incorporated herein by reference in its entirety. Optionally, the driver-side exterior mirror may comprise an electro-optic mirror element (such as an electrochromic mirror element) and the passenger-side exterior mirror may comprise a non-electro-optic mirror element, with the driver-side mirror having an independent electrochromic mirror drive and a compass-on-a-chip and electrochromic circuitry. Optionally, the interior rearview mirror assembly may comprise an electro-optic mirror element and may have an independent electrochromic mirror drive or may be driven by the electrochromic mirror drive of the driver-side electro-optic mirror.

[00281] Optionally, the mirror assembly may be utilized with a video slide-out mirror, such as the types described in PCT Application No. PCT/US03/40611, filed Dec. 19, 2003 by Donnelly Corp. et al. for ACCESSORY SYSTEM FOR VEHICLE (Attorney Docket DON01 FP-1123(PCT)), and/or U.S. pat. applications, Ser. No. 10/538,724, filed Jun. 13, 2005 (Attorney Docket DON01 P-1123); and/or Ser. No. 11/284,543, filed Nov. 22, 2005 (Attorney Docket DON01 P-1245), and/or U.S. provisional applications, Ser. No. 60/630,061, filed Nov. 22, 2004 by Lynam et al. for MIRROR ASSEMBLY WITH VIDEO DISPLAY (Attorney Docket DON01 P-1189); and Ser. No. 60/667,048, filed Mar. 31, 2005 by Lynam et al. for MIRROR ASSEMBLY WITH VIDEO DISPLAY (Attorney Docket DON01 P-1212), which are hereby incorporated herein by reference in their entireties. Further, when such a vehicle equipped with such a video mirror is also equipped with a side viewing or front viewing or rear viewing sensor vision system (such as by utilizing a radar sensor or an ultrasonic sensor or a camera sensor (such as described in U.S. patent applications, Ser. No. 10/534,632, filed May 11, 2005 (Attorney Docket DON01 P-1118); Ser. No. 11/239,980, filed Sep. 30, 2005 (Attorney Docket DON01 P-1238); and/or Ser. No. 11/315,675, filed Dec. 22, 2005 (Attorney Docket DON01 P-1253), and/or U.S. provisional

applications, Ser. No. 60/628,709, filed Nov. 17, 2004 by Camilleri et al. for IMAGING AND DISPLAY SYSTEM FOR VEHICLE (Attorney Docket DON01 P-1188); Ser. No. 60/614,644, filed Sep. 30, 2004 (Attorney Docket DON01 P-1177); Ser. No. 60/618,686, filed Oct. 14, 2004 by Laubinger for VEHICLE IMAGING SYSTEM (Attorney Docket DON01 P-1183); Ser. No. 60/731,183, filed Oct. 28, 2005 (Attorney Docket DON01 P-1248); Ser. No. 60/765,797, filed Feb. 7, 2006 (Attorney Docket DON01 P-1265); and/or Ser. No. 60/638,687, filed Dec. 23, 2004 by Higgins-Luthman for OBJECT DETECTION SYSTEM FOR VEHICLE (Attorney Docket DON01 P-1195), which are hereby incorporated herein by reference in their entireties) to monitor an area adjacent the vehicle), the video screen may automatically extend when such a sensor system detects the presence of an obstacle and/or a human adjacent to the vehicle. Also, the video display screen may extend in conjunction with a trailer-hitch monitoring system (such as the types described in U.S. pat. application, Ser. No. 10/418,486, filed Apr. 18, 2003 by McMahon et al. for VEHICLE IMAGING SYSTEM (Attorney Docket DON01 P-1070), which is hereby incorporated herein by reference in their entireties) and icons and/or indicia and/or instructions may be created on the video image displayed on the extended video screen of the video mirror to assist or guide the driver to hitch a trailer to the trailer hitch of the vehicle.

[00282] Optionally, the mirror assembly may include one or more user actuatable inputs or input devices or human machine interfaces. For example, the inputs or user interfaces may include buttons, such as are described in U.S. Pat. No. 6,501,387, which is hereby incorporated herein by reference in its entirety, or that include touch/proximity sensors such as are disclosed in U.S. Pat. Nos. 6,001,486; 6,310,611; 6,320,282; and 6,627,918, and U.S. pat. application, Ser. No. 09/817,874, filed Mar. 26, 2001 by Quist et al. for INTERACTIVE AUTOMOTIVE REARVISION SYSTEM (Attorney Docket DON01 P-889), and PCT Application No. PCT/US03/40611, filed Dec. 19, 2003 (Attorney Docket DON01 FP-1123(PCT)), which are hereby incorporated herein by reference in their entireties, or that include other types of buttons or switches, such as those described in U.S. pat. application, Ser. No. 11/029,695, filed Jan. 5, 2005 by Lindahl et al. for MIRROR ASSEMBLY (Attorney Docket DON01 P-1192); and/or U.S. provisional applications, Ser. No. 60/556,259, filed Mar. 25, 2004 (Attorney Docket DON01 P-1147); Ser. No. 60/553,517, filed Mar. 16, 2004 (Attorney Docket DON01 P-1145); and Ser. No. 60/535,559, filed Jan. 9, 2004 (Attorney Docket DON01 P-1134); and/or PCT Application No. PCT/US2004/015424, filed May 18, 2004 by Donnelly Corp. et al. for MIRROR ASSEMBLY FOR VEHICLE (Attorney Docket DON01 FP-1150(PCT)), which are hereby incorporated herein by

reference in their entireties, or that include fabric-made position detectors, such as are disclosed in U.S. Pat. Nos. 6,504,531; 6,501,465; 6,492,980; 6,452,479; 6,437,258; and 6,369,804, which are hereby incorporated herein by reference in their entireties. The mirror assembly may comprise any other type of switches or buttons, such as touch or proximity sensing switches, such as touch or proximity switches of the types described in U.S. patent application Ser. No. 11/021,065, filed Dec. 23, 2004 (Attorney Docket DON01 P-1193); Ser. No. 10/956,749, filed Oct. 1, 2004 by Schofield et al. for MIRROR REFLECTIVE ELEMENT ASSEMBLY INCLUDING ELECTRONIC COMPONENT (Attorney Docket DON01 P-1173); Ser. No. 10/933,842, filed Sep. 3, 2004 by Kulas et al. for INTERIOR REARVIEW MIRROR ASSEMBLY (Attorney Docket DON01 P-1166); Ser. No. 11/021,065, filed Dec. 23, 2004 (Attorney Docket DON01 P-1193); and/or Ser. No. 11/140,396, filed May 27, 2005 (Attorney Docket DON01 P-1215); and/or U.S. provisional application, Ser. No. 60/563,342, filed Apr. 19, 2004 by Bareman et al. for METHOD OF MANUFACTURING ELECTRO-OPTIC MIRROR CELL (Attorney Docket DON01 P-1153), which are hereby incorporated herein by reference in their entireties, or the inputs may comprise other types of buttons or switches, such as those described in U.S. pat. application, Ser. No. 11/029,695, filed Jan. 5, 2005 (Attorney Docket DON01 P-1192); and/or U.S. provisional applications, Ser. No. 60/553,517, filed Mar. 16, 2004 (Attorney Docket DON01 P-1145); Ser. No. 60/535,559, filed Jan. 9, 2004 (Attorney Docket DON01 P-1134); Ser. No. 60/690,401, filed Jun. 14, 2005 (Attorney Docket DON01 P-1226); Ser. No. 60/719,482, filed Sep. 22, 2005 (Attorney Docket DON01 P-1241); and Ser. No. 60/749,423, filed Dec. 12, 2005 (Attorney Docket DON01 P-1258), which are hereby incorporated herein by reference in their entireties, or such as fabric-made position detectors, such as those described in U.S. Pat. Nos. 6,504,531; 6,501,465; 6,492,980; 6,452,479; 6,437,258; and 6,369,804, which are hereby incorporated herein by reference in their entireties. Other types of switches or buttons or inputs or sensors may be incorporated to provide the desired function, without affecting the scope of the present invention. The manual inputs or user actuatable inputs or actuators may control or adjust or activate/deactivate one or more accessories or elements or features. For touch sensitive inputs or applications or switches, the mirror assembly or accessory module or input may, when activated, provide a positive feedback (such as activation of an illumination source or the like, or such as via an audible signal, such as a chime or the like, or a tactile or haptic signal, or a rumble device or signal or the like) to the user so that the user is made aware that the input was successfully activated.

[00283] Optionally, the user inputs or buttons may comprise user inputs for a garage door opening system, such as a vehicle based garage door opening system of the types described in U.S. Pat. Nos. 6,396,408; 6,362,771; and 5,798,688, and/or U.S. patent application Ser. No. 10/770,736, filed Feb. 3, 2004 (Attorney Docket DON01 P-1135); and/or U.S. provisional applications, Ser. No. 60/502,806, filed Sep. 12, 2003 by Taylor et al. for GARAGE DOOR OPENING SYSTEM FOR VEHICLE (Attorney Docket DON01 P-1114); and Ser. No. 60/444,726, filed Feb. 4, 2003 by Baumgardner et al. for GARAGE DOOR OPENING SYSTEM FOR VEHICLE (Attorney Docket DON01 P-1065), which are hereby incorporated herein by reference in their entireties. The user inputs may also or otherwise function to activate and deactivate a display or function or accessory, and/or may activate/deactivate and/or commence a calibration of a compass system of the mirror assembly and/or vehicle. The compass system may include compass sensors and circuitry within the mirror assembly or within a compass pod or module at or near or associated with the mirror assembly. Optionally, the user inputs may also or otherwise comprise user inputs for a telematics system of the vehicle, such as, for example, an ONSTAR® system as found in General Motors vehicles and/or such as described in U.S. Pat. Nos. 4,862,594; 4,937,945; 5,131,154; 5,255,442; 5,632,092; 5,798,688; 5,971,552; 5,924,212; 6,243,003; 6,278,377; 6,420,975; 6,946,978; and 6,477,464; and/or 6,678,614; and/or U.S. pat. applications, Ser. No. 10/456,599, filed Jun. 6, 2003 by Weller et al. for INTERIOR REARVIEW MIRROR SYSTEM WITH COMPASS (Attorney Docket DON01 P-1076); Ser. No. 10/645,762, filed Aug. 20, 2003 by Taylor et al. for VEHICLE NAVIGATION SYSTEM FOR USE WITH A TELEMATICS SYSTEM (Attorney Docket DON01 P-1103); and Ser. No. 10/964,512, filed Oct. 13, 2004 (Attorney Docket DON01 P-1174); and/or PCT Application No. PCT/US03/40611, filed Dec. 19, 2003 by Donnelly Corporation et al. for ACCESSORY SYSTEM FOR VEHICLE (Attorney Docket DON01 FP-1123(PCT)), and/or PCT Application No. PCT/US03/308877, filed Oct. 1, 2003 by Donnelly Corp. for MICROPHONE SYSTEM FOR VEHICLE (Attorney Docket DON01 FP-1116(PCT)), which are all hereby incorporated herein by reference in their entireties.

[00284] Optionally, the accessory module may utilize aspects of other accessory modules or windshield electronics modules or the like, such as the types described in U.S. pat. applications, Ser. No. 10/958,087, filed Oct. 4, 2004 by Schofield et al. for VEHICLE ACCESSORY MODULE (Attorney Docket DON01 P-1175); Ser. No. 10/456,599, filed Jun. 6, 2003 by Weller et al. for INTERIOR REARVIEW MIRROR SYSTEM WITH COMPASS (Attorney Docket DON01 P-1076); and/or Ser. No. 11/201,661, filed Aug. 11, 2005

(Attorney Docket DON01 P-1233), and/or U.S. Pat. Nos. 6,824,281; 6,690,268; 6,250,148; 6,341,523; 6,593,565; 6,428,172; 6,501,387; 6,329,925; and 6,326,613, and/or in PCT Application No. PCT/US03/40611, filed Dec. 19, 2003 by Donnelly Corp. et al. for ACCESSORY SYSTEM FOR VEHICLE (Attorney Docket DON01 FP-1123(PCT)), and/or Ireland pat. applications, Ser. No. S2004/0614, filed Sep. 15, 2004 (Attorney Docket P72723IE00); Ser. No. S2004/0838, filed Dec. 14, 2004 (Attorney Docket P73992IE00); and Ser. No. S2004/0840, filed Dec. 15, 2004 (Attorney Docket P73923IE00), which are all hereby incorporated herein by reference in their entireties.

[00285] Changes and modifications to the specifically described embodiments may be carried out without departing from the principles of the present invention, which is intended to be limited only by the scope of the appended claims as interpreted according to the principles of patent law.

[00286] The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A rearview mirror system for a vehicle comprising:

a rearview mirror assembly comprising an electro-optic mirror reflective element having electrically variable reflectivity between a high reflectance state and a dimmed reflectance state;

said electro-optic mirror reflective element comprising a front substrate having a first surface and a second surface;

said electro-optic mirror reflective element comprising a rear substrate having a third surface and a fourth surface;

said second surface of said front substrate and said third surface of said rear substrate opposing each other in said electro-optic mirror reflective element and with an electro-optic medium disposed therebetween;

a specularly reflecting mirror reflector established at a surface of said rear substrate;

a specularly reflecting indicia reflector locally established at said second surface of said front substrate to form indicia at said reflective element; and

the indicia providing a visible contrast between light incident at said mirror reflector and light incident at said indicia reflector so that when said electro-optic mirror reflective element is in its high reflectance state, indicia information is subtly viewable by a person viewing said reflective element of said mirror assembly.

2. The rearview mirror system of claim 1, wherein said rearview mirror assembly comprises an exterior rearview mirror assembly.

3. The rearview mirror system of claim 2 including at least one of a turn signal indicator and a blind spot system alert indicator at and to the rear of said reflective element for indicating, by display through said reflective element when actuated, at least one of (a) activation of a turn signal of the vehicle and (b) detection of another vehicle in a side lane.

4. The rearview mirror system of claim 3, wherein said at least one of a turn signal indicator and a blind spot system alert indicator comprises a transparent block to the rear of said reflective element, said block having light-transmitting pipeways formed at least

partially therethrough for passage of light therethrough, and wherein said pipeways are angled relative to the rear surface of said reflective element.

5. The rearview mirror system of claim 1, wherein said rearview mirror assembly comprises an interior rearview mirror assembly.

6. The rearview mirror system of claim 1, wherein said indicia reflector comprises a reflective metal coating.

7. The rearview mirror system of claim 1, wherein said indicia reflector is overcoated by a transparent electrically conductive coating at said second surface.

8. The rearview mirror system of claim 1, wherein the indicia is discernible due to at least one of (a) a contrast in color between said indicia reflector and said mirror reflector, (b) a contrast in reflectance between said indicia reflector and said mirror reflector, and (c) an interference effect of said indicia reflector with an undercoating transparent conductor layer.

9. The rearview mirror system of claim 1, wherein said reflective element comprises an electrochromic reflective element, said electro-optic medium comprising an electrochromic medium.

10. The rearview mirror system of claim 1, wherein said mirror reflector is established at said third surface of said reflective element.

11. The rearview mirror system of claim 10, wherein said mirror reflector comprises a transflective reflector disposed at said third surface of said reflective element.

12. The rearview mirror system of claim 10, wherein said mirror reflector comprises an environmentally stable metallic electrical conductor layer disposed at said third surface and an environmentally less stable layer disposed over said environmentally stable metallic electrical conductor layer.

13. The rearview mirror system of claim 12, wherein said environmentally stable metallic electrical conductor layer comprises chromium and said environmentally less stable layer comprises one of silver and a silver-alloy.

14. The rearview mirror system of claim 1 including a transparent electrically conductive coating disposed at said second surface of said front substrate.

15. The rearview mirror system of claim 14, wherein said indicia reflector is disposed one of in front of said transparent electrically conductive coating and behind said transparent electrically conductive coating as viewed by a person viewing said reflective element through said front substrate.

16. The rearview mirror system of claim 14, wherein said indicia reflector is established behind said transparent electrically conductive coating and between said mirror reflector and said transparent electrically conductive coating.

17. The rearview mirror system of claim 14, wherein said indicia reflector is established in front of said transparent electrically conductive coating and between said transparent electrically conductive coating and said second surface.

18. The rearview mirror system of claim 1, wherein said indicia reflector comprises a reflective coating or stack of coatings having a lower reflectivity than that of a reflective coating or stack of coatings of said mirror reflector.

19. The rearview mirror system of claim 1, wherein said indicia reflector is configured to provide one of (a) an icon, (b) a logo, and (c) an information message at said reflective element.

20. The rearview mirror system of claim 1, wherein the indicia conveys information informing that said rearview mirror assembly is an automatic dimming type.

21. The rearview mirror system of claim 1, wherein said rearview mirror assembly comprises an exterior rearview mirror assembly and wherein said rearview mirror system further comprises an interior rearview mirror assembly having a transflective mirror element.

22. The rearview mirror system of claim 21, wherein said interior rearview mirror assembly includes a video screen covertly disposed behind said transflective mirror element and operable so that when said video screen is actuated and is displaying an image, the image is viewable to a driver of the vehicle who views said transflective mirror element of said interior rearview mirror assembly when it is normally mounted in the vehicle.

23. The rearview mirror system of claim 22, wherein said transflective mirror element comprises a transflective day/night prismatic mirror element.

24. The rearview mirror system of claim 23, wherein said transflective day/night prismatic mirror element comprises a silicon-based second-surface transflector.

25. The rearview mirror system of claim 23, wherein said transflective day/night prismatic mirror element comprises a metal oxide layer/a metal layer/a metal oxide layer second-surface transflector.

26. The rearview mirror system of claim 25, wherein said metal layer comprises silver or a silver alloy.

27. The rearview mirror system of claim 23, wherein said transflective day/night prismatic mirror element comprises an indium tin oxide/metal/indium tin oxide second-surface transflector.

28. The rearview mirror system of claim 27, wherein said metal comprises silver or a silver alloy.

29. The rearview mirror system of claim 23, wherein said transflective day/night prismatic mirror element comprises a second-surface transflector that is protected by an overlying optically clear protectorant.

30. The rearview mirror system of claim 29, wherein said overlying optically clear protectorant comprises a clear polymeric coating layer.

31. The rearview mirror system of claim 30, wherein said polymeric coating layer comprises at least one of an acrylic, an acrylate, a urethane, a silicone, a poly vinyl butyral and an epoxy.

32. The rearview mirror system of claim 29, wherein said overlying optically clear protectorant comprises a flat transparent glass element adhered to the transflector by at least one of an optically clear adhesive and an optically clear laminating film.

33. The rearview mirror system of claim 1, wherein at least one light source is disposed at an angle to the rear of said fourth surface and is operable to emit light when powered through said mirror reflective element with a principal beam axis that is substantially non-perpendicular to the horizontal plane of said fourth surface of said rear substrate.

34 The rearview mirror system of claim 1, including a light control film disposed to the rear of said rear substrate, said light control film comprising embedded micro louvers and said light control film having a higher light transmission for light incident thereon along an axis generally parallel to the axis of alignment of said micro louvers than for light incident thereon along an axis generally different from the axis of alignment of said micro louvers.

35. A rearview mirror system for a vehicle comprising:

a rearview mirror assembly comprising an electrochromic mirror reflective element having electrically variable reflectivity between a high reflectance state and a dimmed reflectance state;

said electrochromic mirror reflective element comprising a front substrate having a first surface and a second surface;

said electrochromic mirror reflective element comprising a rear substrate having a third surface and a fourth surface;

said second surface of said front substrate and said third surface of said rear substrate opposing each other in said electrochromic mirror reflective element and with an electrochromic medium disposed therebetween;

a specularly reflecting mirror reflector established at said third surface of said rear substrate, said specularly reflecting mirror reflector having a reflectance value of at least about 70 percent of light incident thereon;

a specularly reflecting indicia reflector locally established at said second surface of said front substrate to form indicia at said reflective element, said specularly reflecting indicia reflector having a reflectance value of light that passes through said front substrate to be incident thereon that is at least about 5 percent less than that of said specularly reflecting mirror reflector; and

the indicia providing a visible contrast between light incident at said mirror reflector and light incident at said indicia reflector so that when said electrochromic mirror reflective element is in its high reflectance state, indicia information is subtly viewable by a person viewing said reflective element of said mirror assembly.

36. The rearview mirror system of claim 35, wherein said third surface reflector comprises a ruthenium coating.

37. The rearview mirror system of claim 36, wherein said specularly reflecting indicia reflector comprises a chromium coating.

38. A rearview mirror system for a vehicle comprising:

an interior rearview mirror assembly comprising an electro-optic mirror reflective element having electrically variable reflectivity between a high reflectance state and a dimmed reflectance state;

said electro-optic mirror reflective element comprising a front substrate having a first surface and a second surface;

said electro-optic mirror reflective element comprising a rear substrate having a third surface and a fourth surface;

said second surface of said front substrate and said third surface of said rear substrate opposing each other in said electro-optic mirror reflective element and with an electro-optic medium disposed therebetween;

a specularly reflecting mirror reflector established at said third surface of said rear substrate, said specularly reflecting mirror reflector having a reflectance value of at least about 70 percent of light incident thereon;

a specularly reflecting indicia reflector locally established at said second surface of said front substrate to form indicia at said reflective element, said specularly reflecting indicia reflector having a reflectance value of light that passes through said front substrate to be incident thereon that is one of (a) higher than, (b) the same as, and (c) lower than that of said specularly reflecting mirror reflector;

the indicia providing a visible contrast between light incident at said mirror reflector and light incident at said indicia reflector so that when said electro-optic mirror reflective element is in its high reflectance state, indicia information is subtly viewable by a person viewing said reflective element of said mirror assembly; and

wherein the indicia conveys information that least one of: (a) informs that the rearview mirror assembly is an automatic dimming type, (b) informs of a brand logo and (c) informs of a personalization logo.

36. The rearview mirror system of claim 35, wherein said third surface reflector comprises one of a silver coating and a silver alloy coating.

37. The rearview mirror system of claim 36, wherein said third surface reflector comprises a conducting metal oxide coating.

38. The rearview mirror system of claim 37, wherein said conducting metal oxide coating comprises indium tin oxide.

39. The rearview mirror system of claim 37, wherein said conducting metal oxide coating comprises doped zinc oxide.

40. The rearview mirror system of claim 39, wherein said doped zinc oxide comprises aluminum-doped zinc oxide.

41. The rearview mirror system of claim 36, wherein the indicia conveys information that informs that the rearview mirror assembly is an automatic dimming type.

42. The rearview mirror system of claim 36, wherein the indicia conveys information that informs of a brand logo.

43. The rearview mirror system of claim 36, wherein the indicia conveys information that informs of a personalization logo.

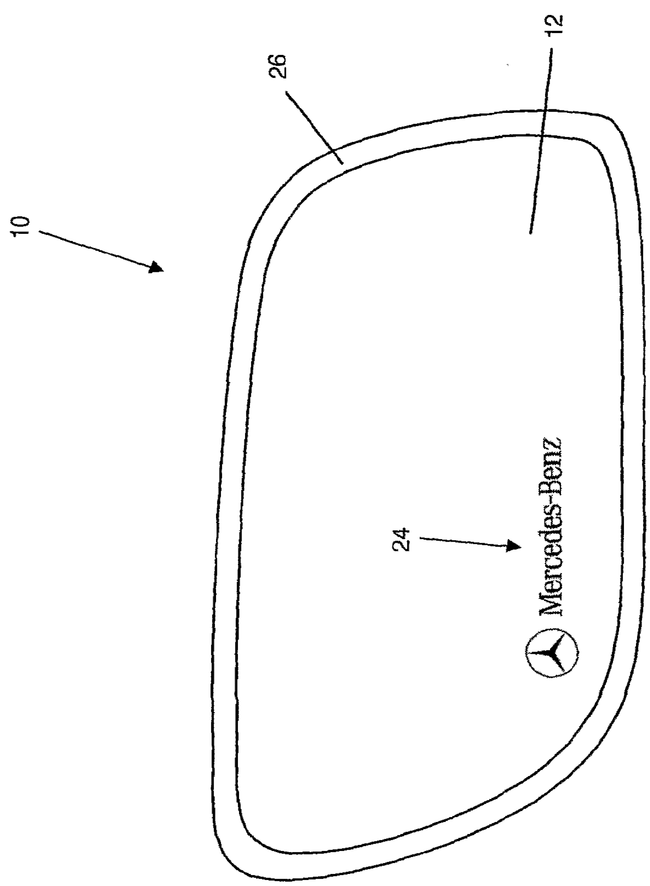


Fig. 1

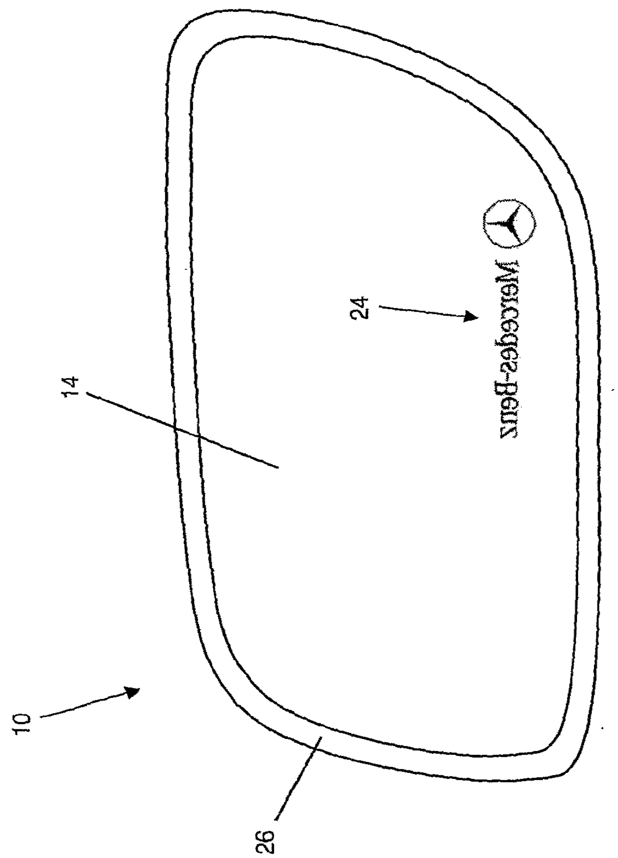


Fig. 2

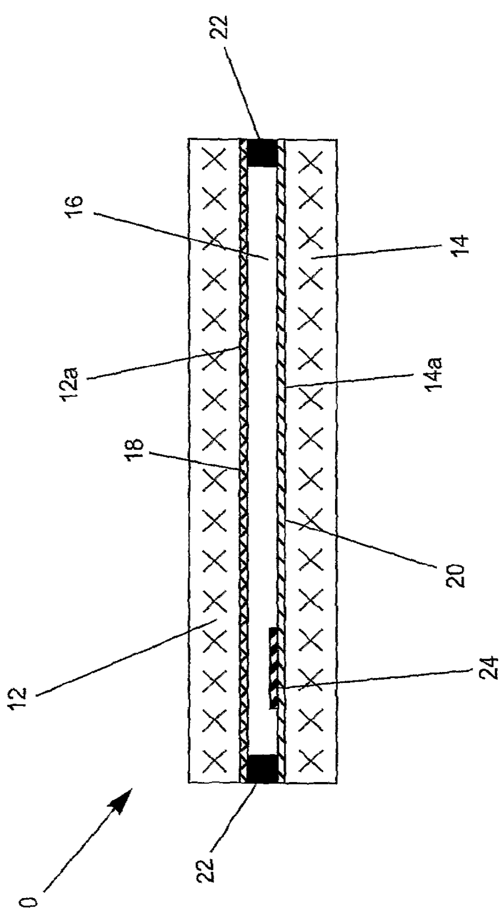


Fig. 3

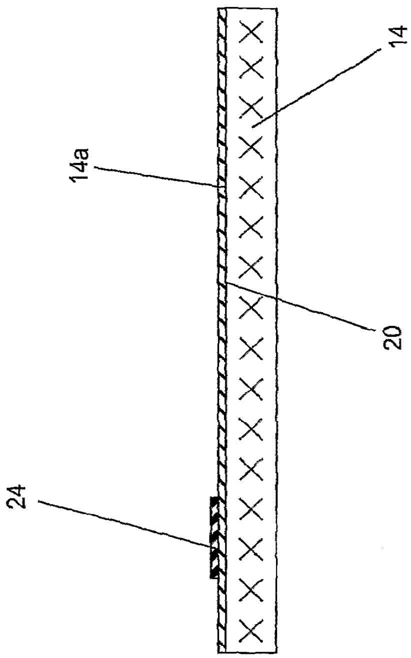


Fig. 4

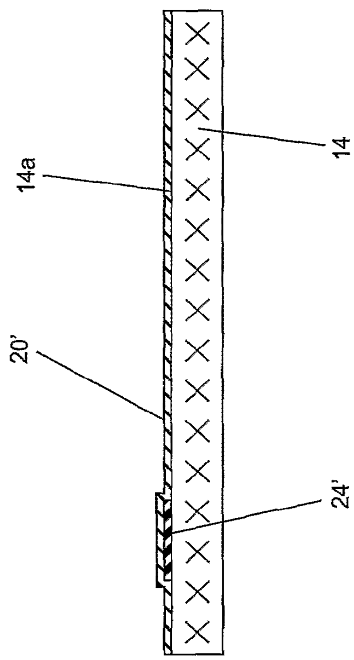


Fig. 5

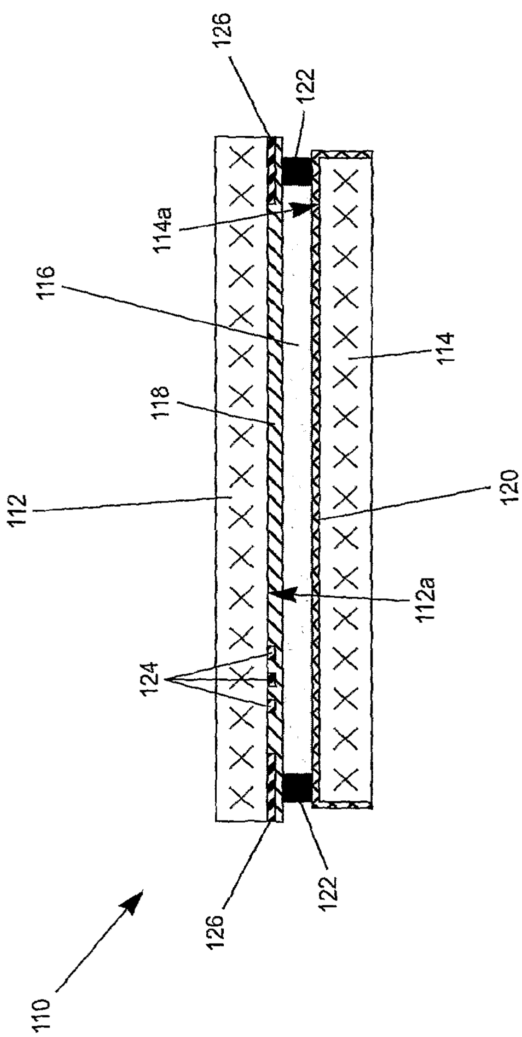


Fig. 6

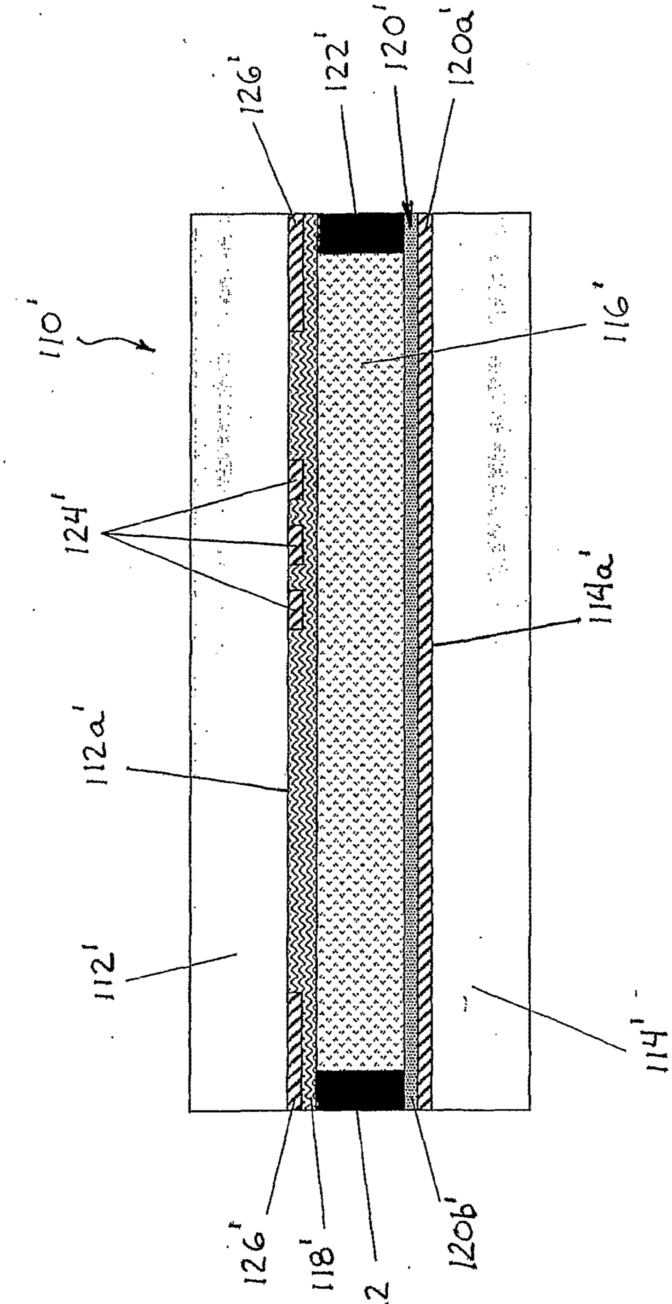


Fig. 6A

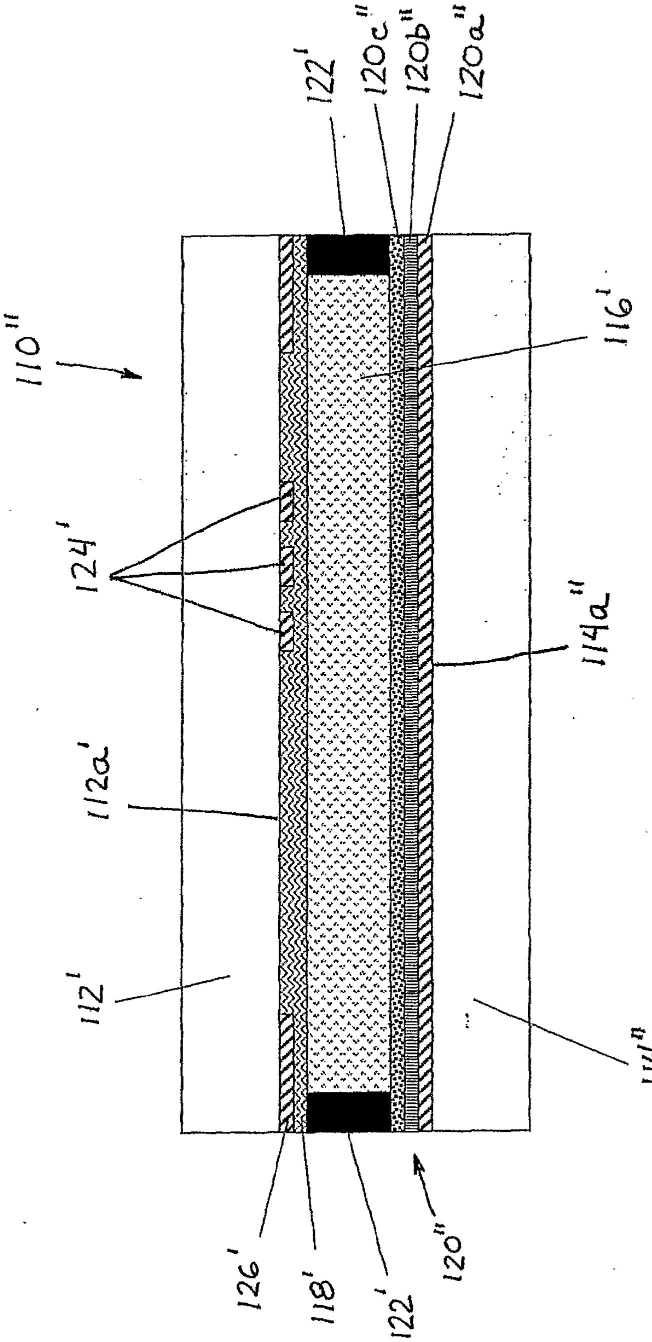
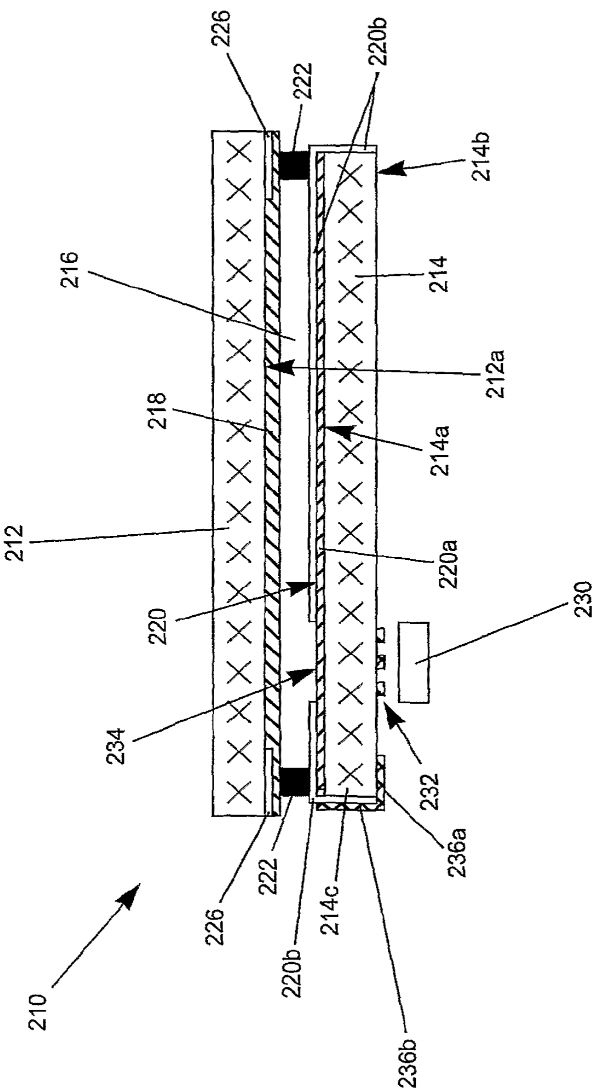

110"
122'
120c"
120b"
120a"
116'
124'
114a"
112a'
112'
114"
126'
118'
122'
120"

Fig. 6B


210
212
216
218
220
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220b
214b
214
212a
214a
220a
230
234
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236a
236b
214c

Fig. 7

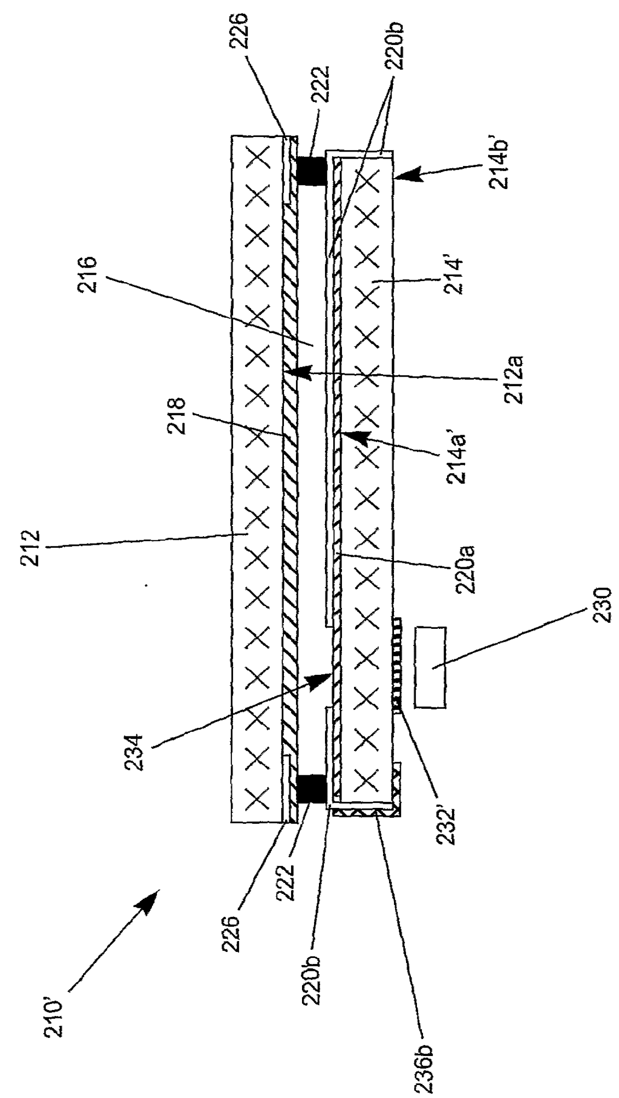

226
222
220b
214b'
216
214'
212a
218
214a'
212
220a
230
234
232'
226
222
220b
236b
210'

Fig. 8

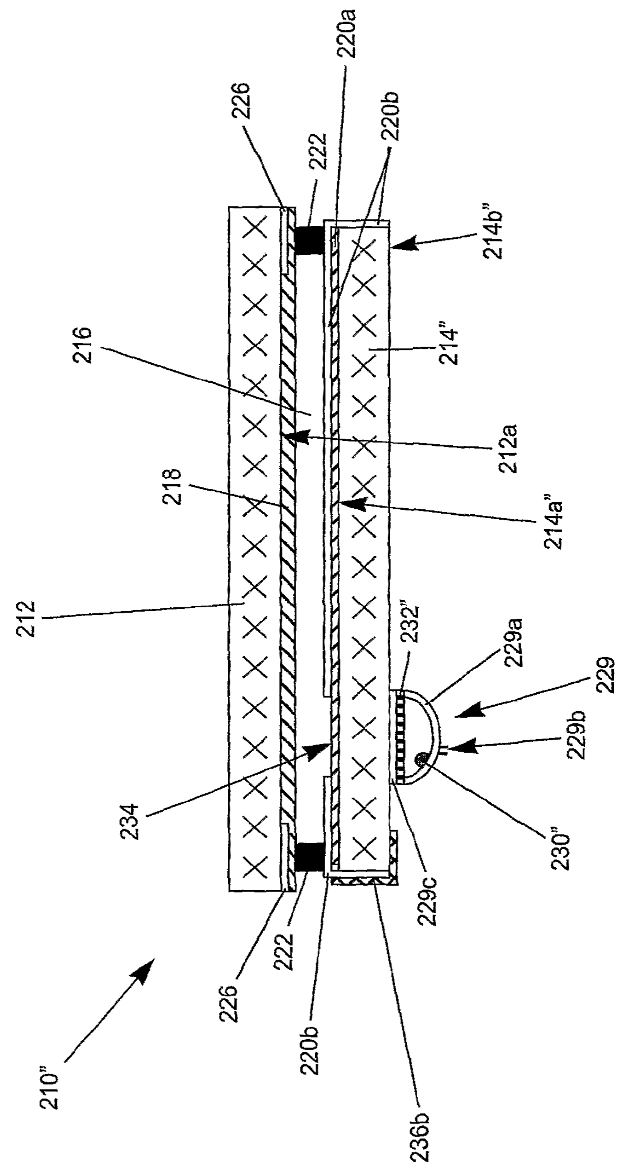

220a
226
222
220b
214b"
216
214"
212a
218
214a"
212
232"
229a
229
229b
234
230"
229c
226
222
220b
210"
236b

Fig. 9

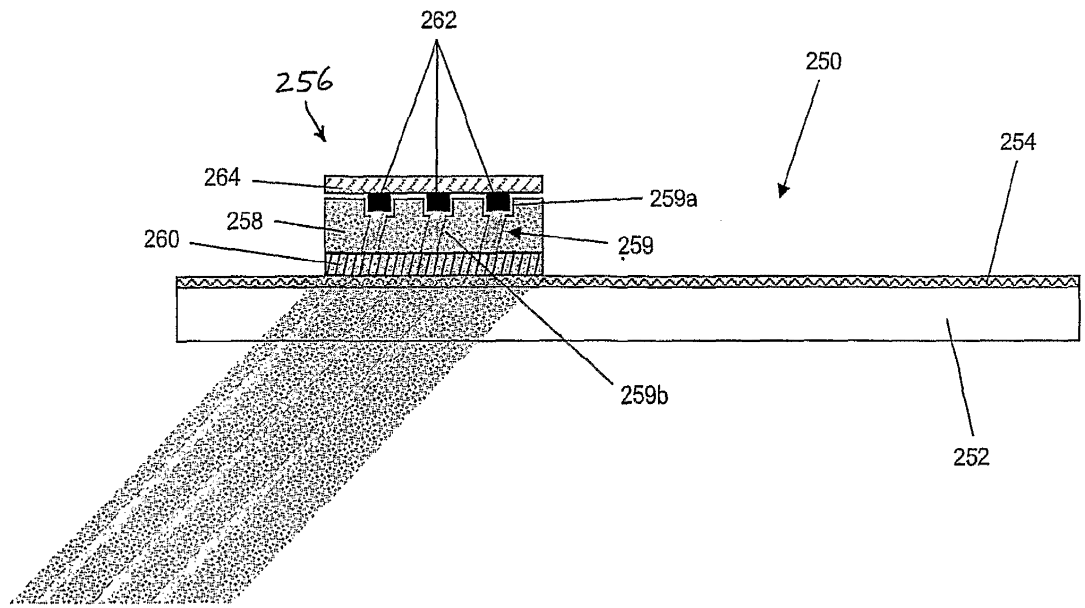


Fig. 10A

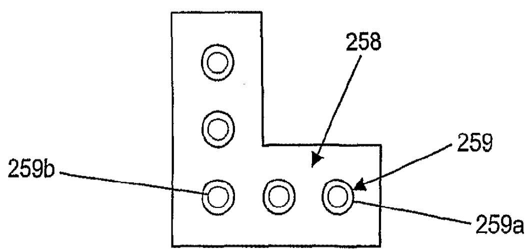


Fig. 10B

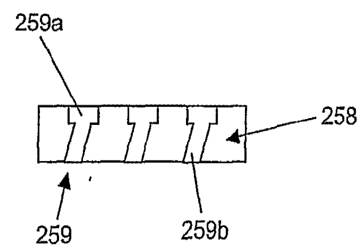


Fig. 10C

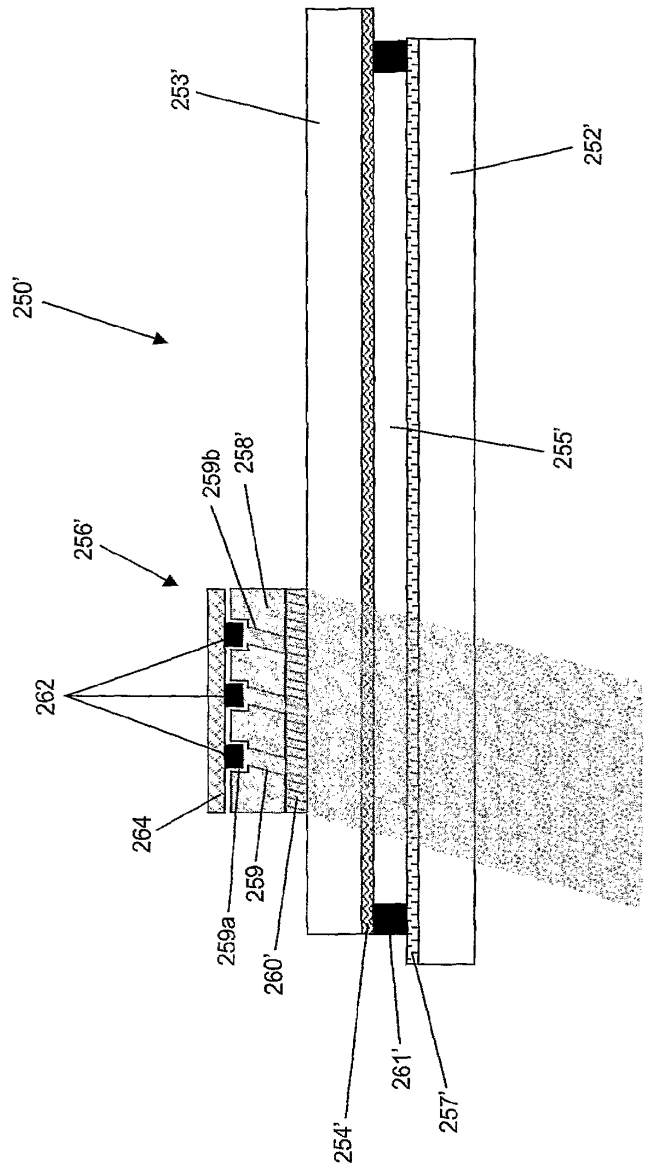


Fig. 10D

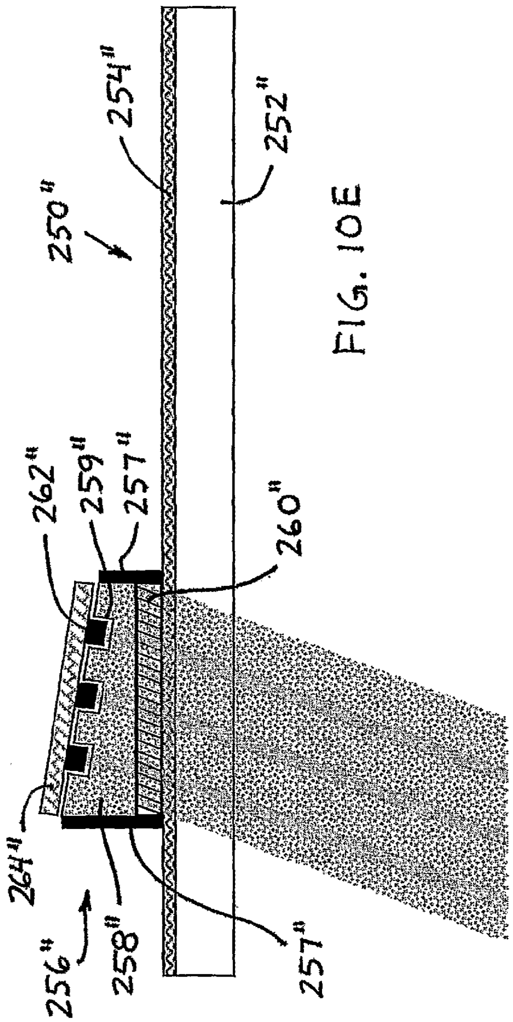


FIG. 10E

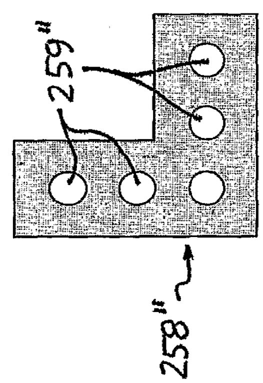


FIG. 10F

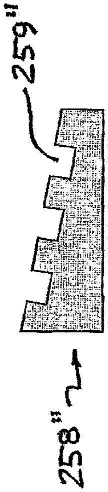


FIG. 10G

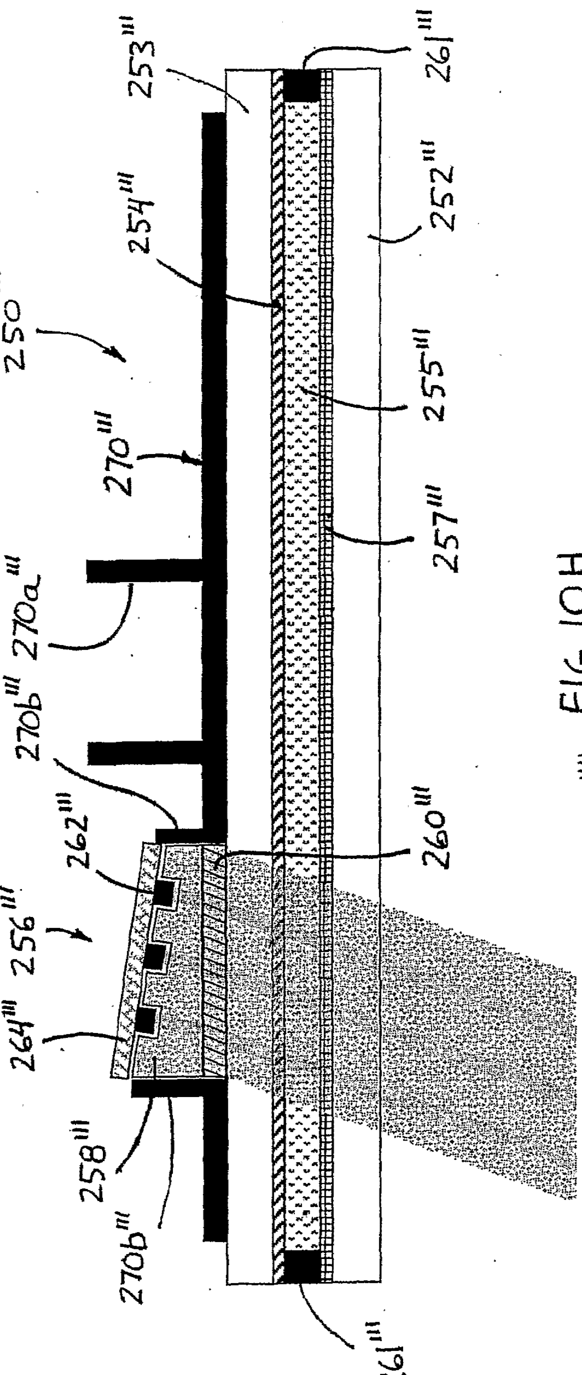


FIG. 10H

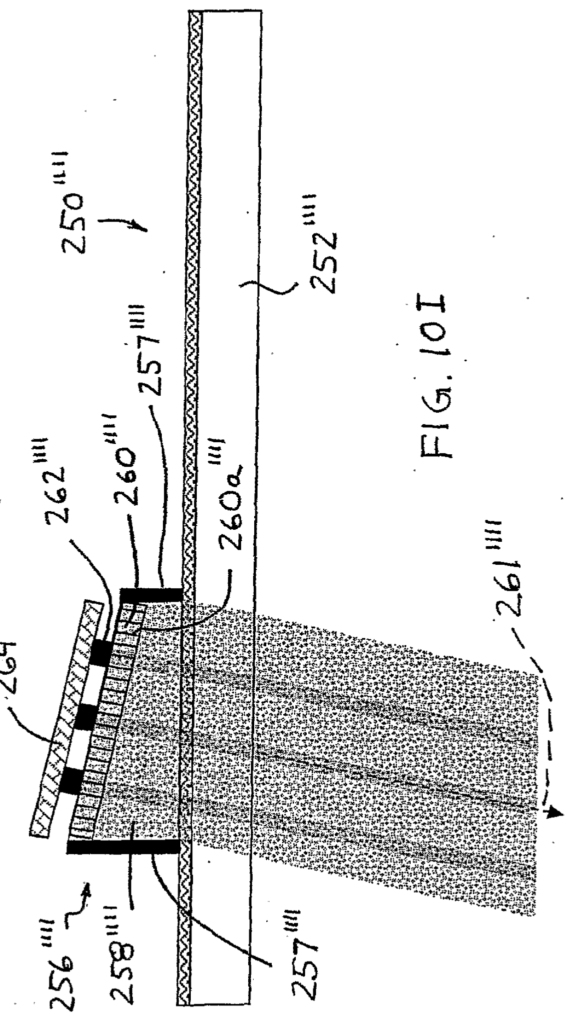


FIG. 10I

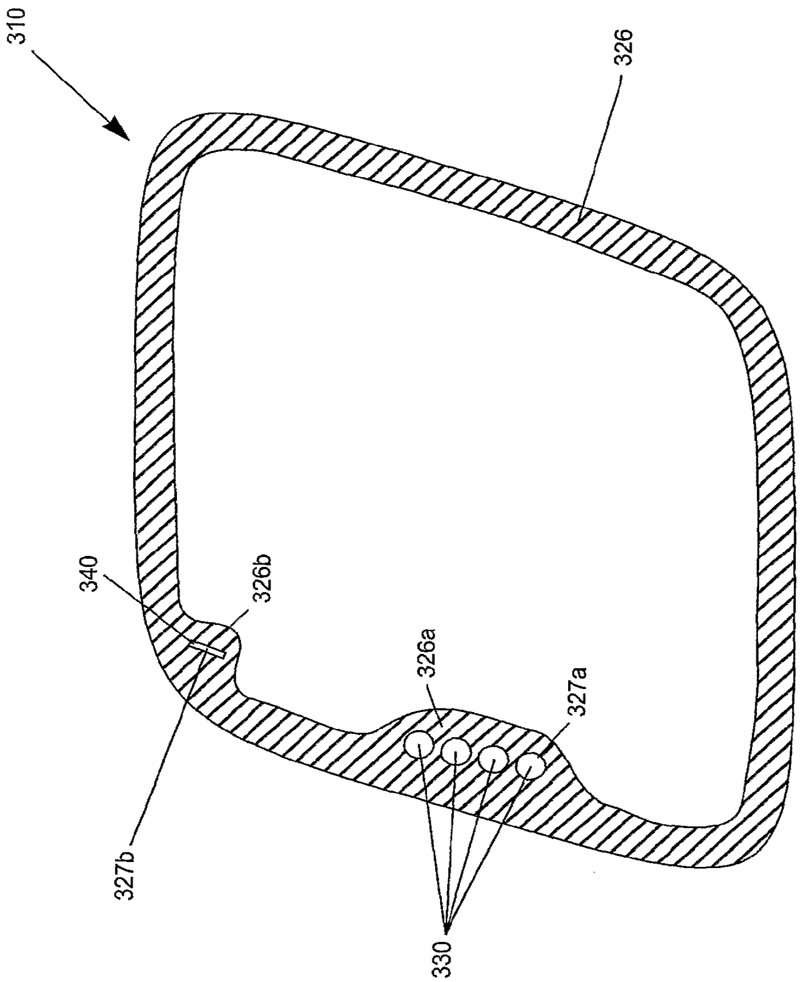


Fig. 11

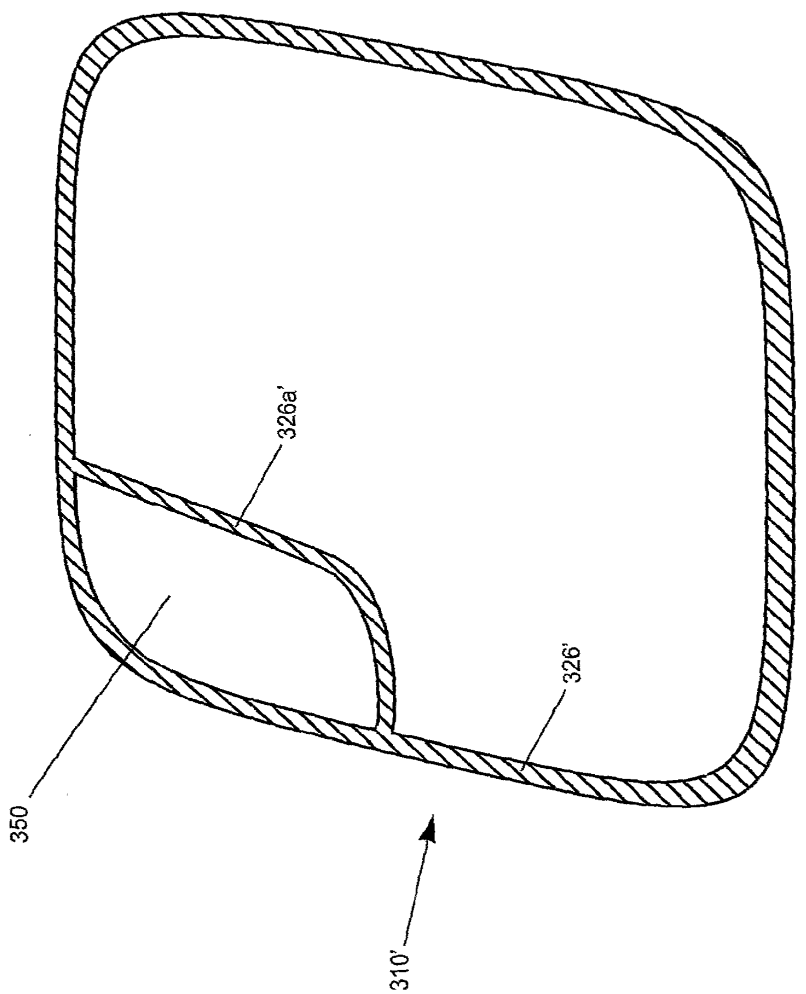
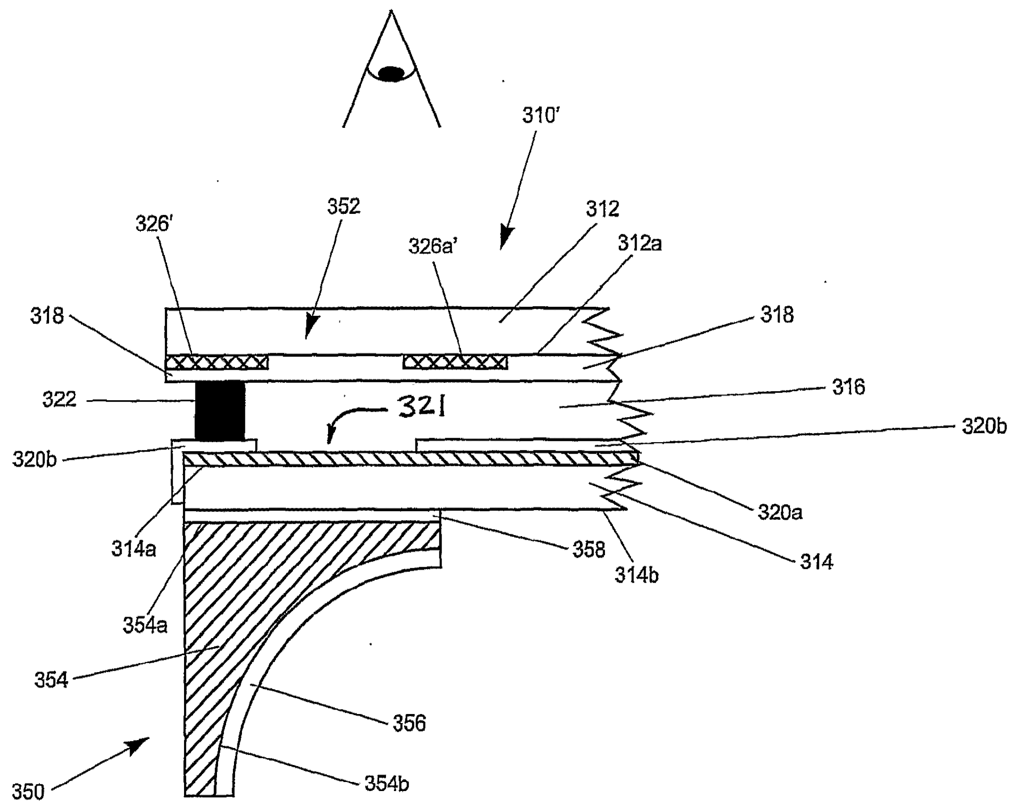


Fig. 12


310'
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326'
326a'
312
312a
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318
322
321
316
320b
320b
320a
314a
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314b
314
354a
354
356
350
354b

Fig. 13

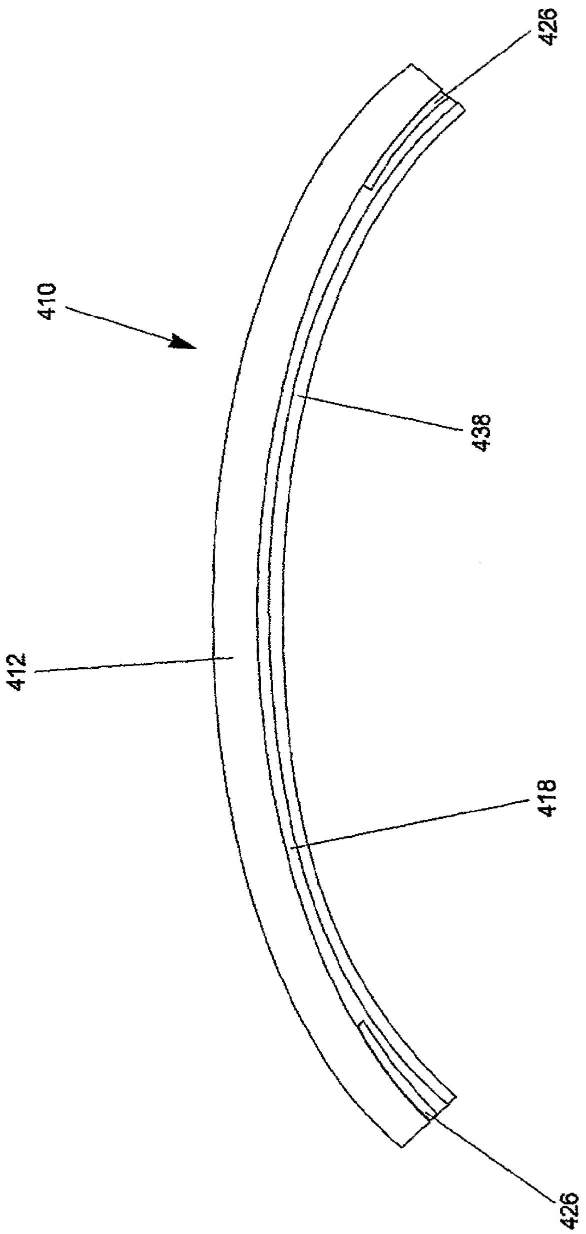


Fig. 14

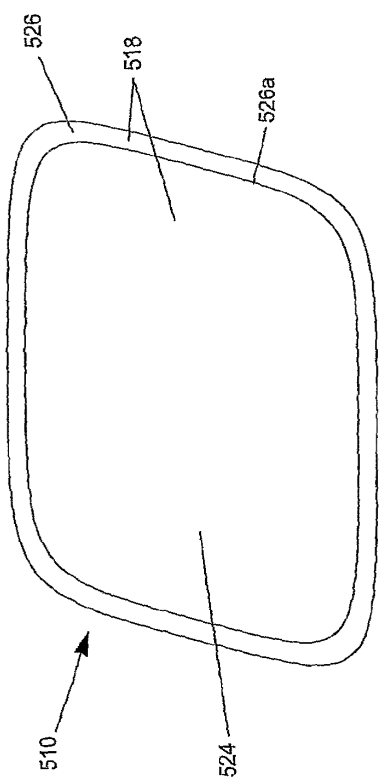


Fig. 15A

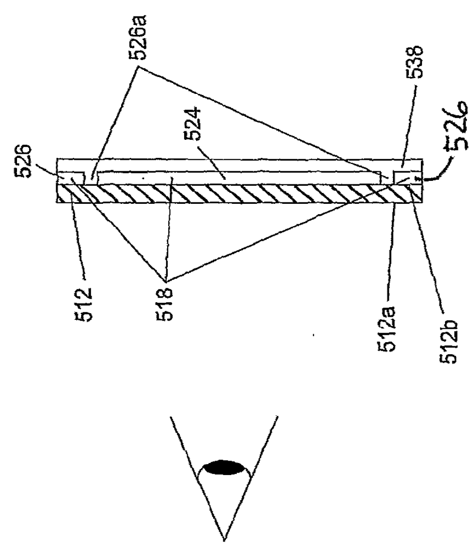


Fig. 15B

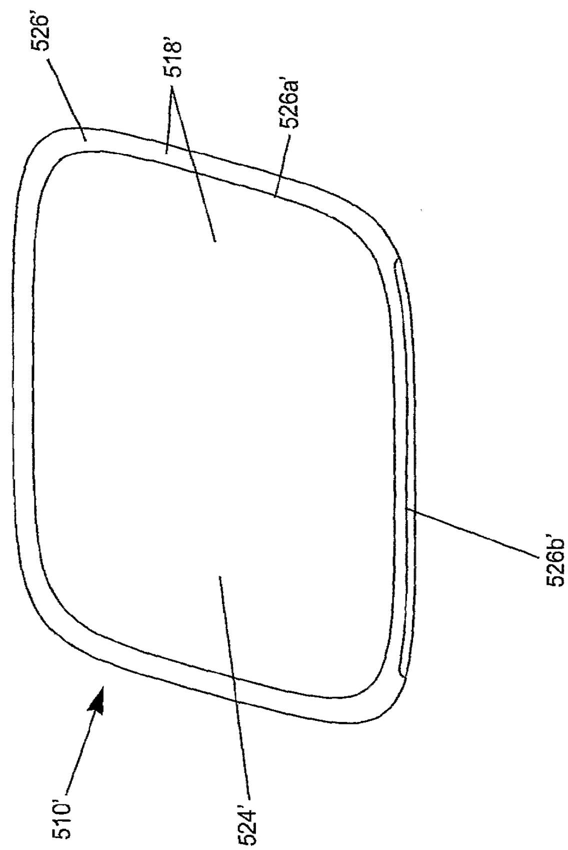


Fig. 16

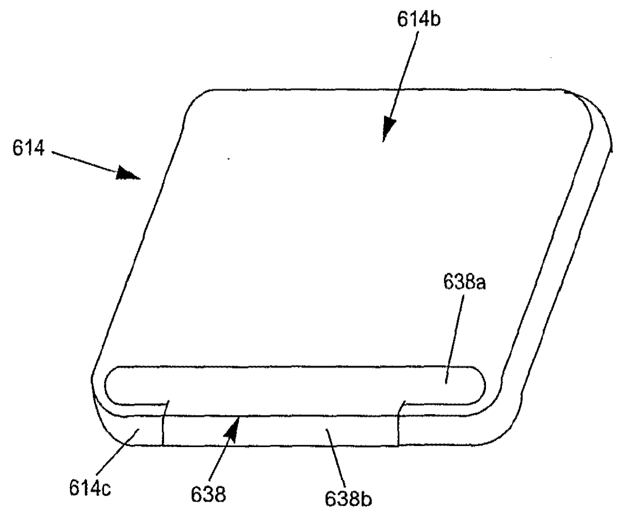


Fig. 17

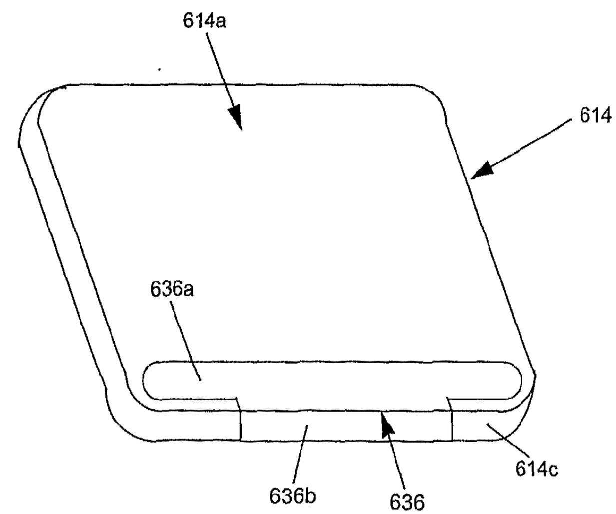


Fig. 18

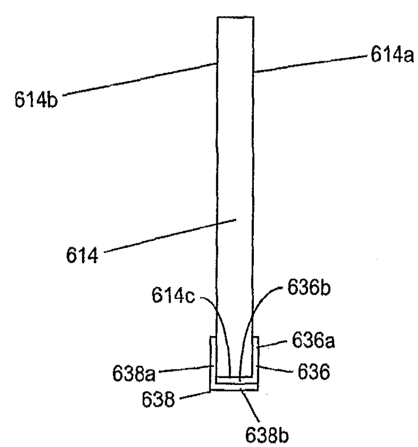
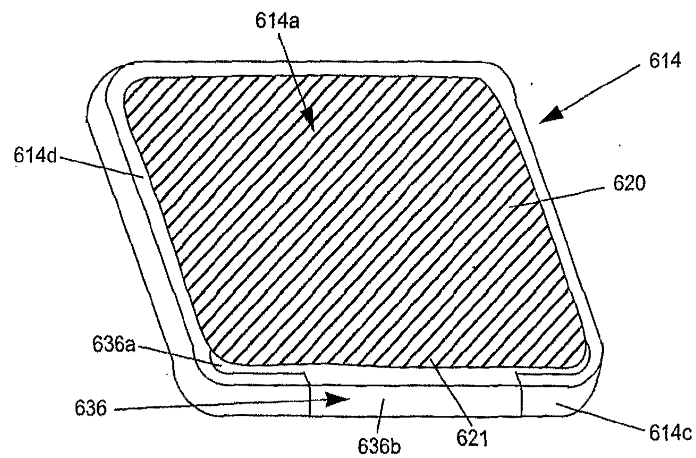


Fig. 19


614a
614
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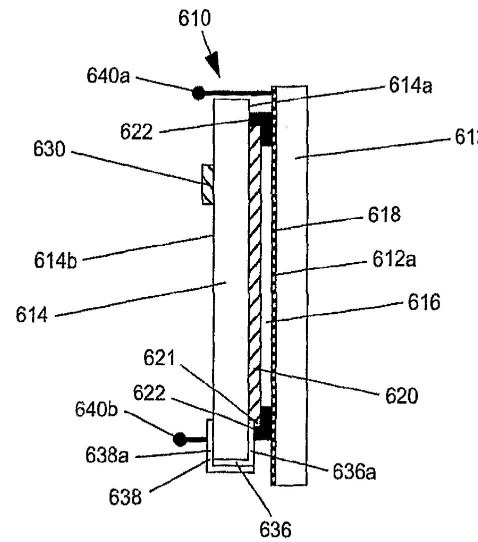
620
636a
636
636b
621
614c

Fig. 20


610
640a
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612
630
618
614b
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614
616
621
622
620
640b
638a
636a
638
636

Fig. 21

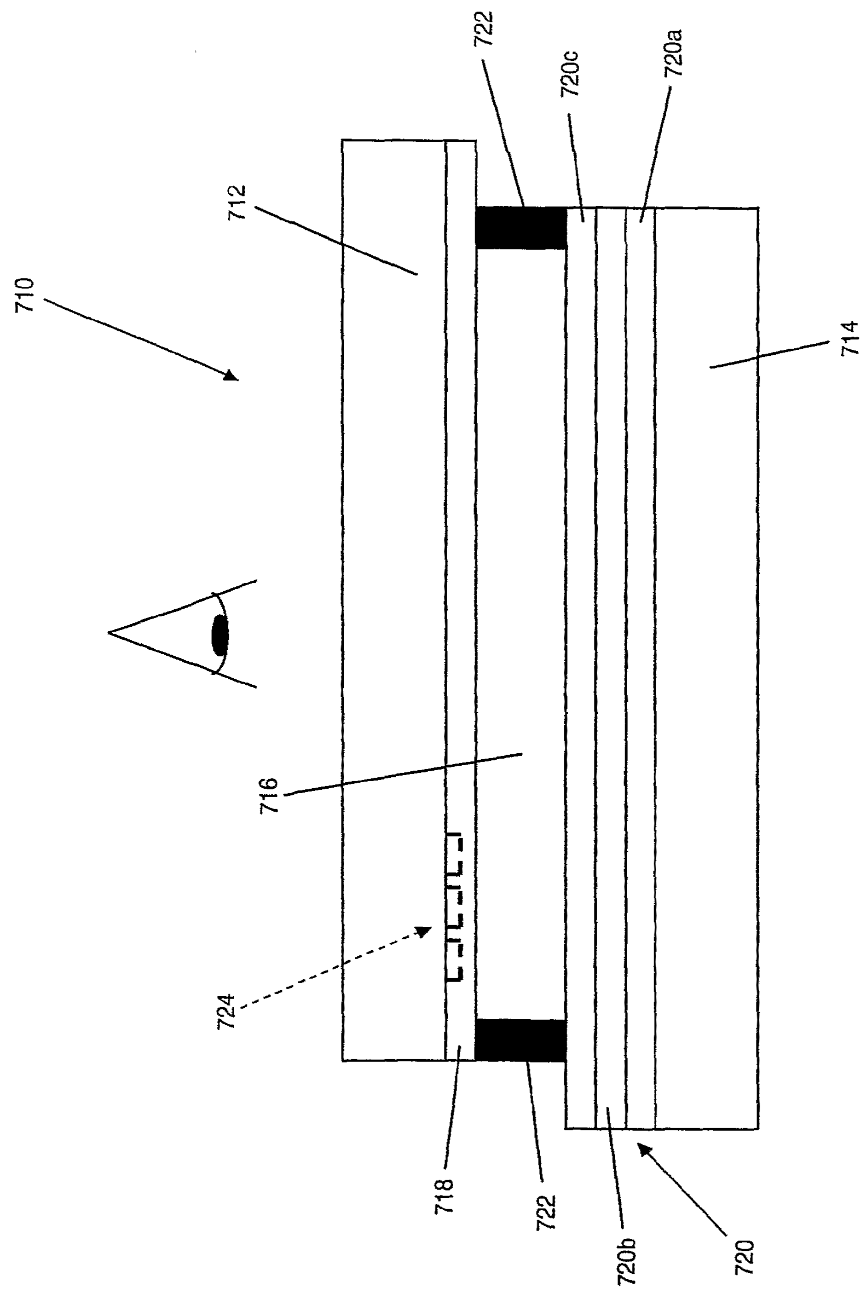


Fig. 22

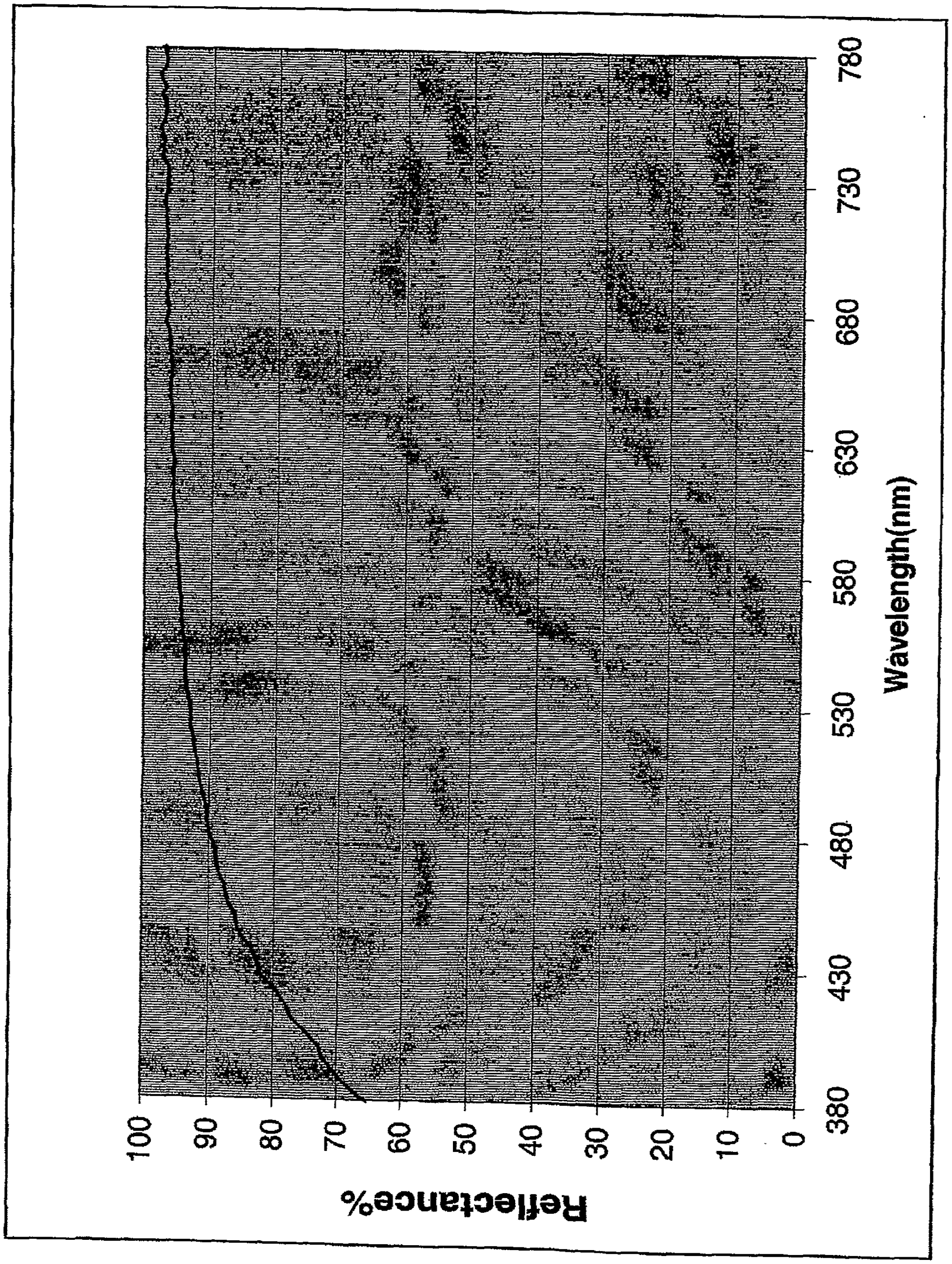

Reflectance%
100
90
80
70
60
50
40
30
20
10
0
380
430
480
530
580
630
680
730
780
Wavelength(nm)

FIG. 23

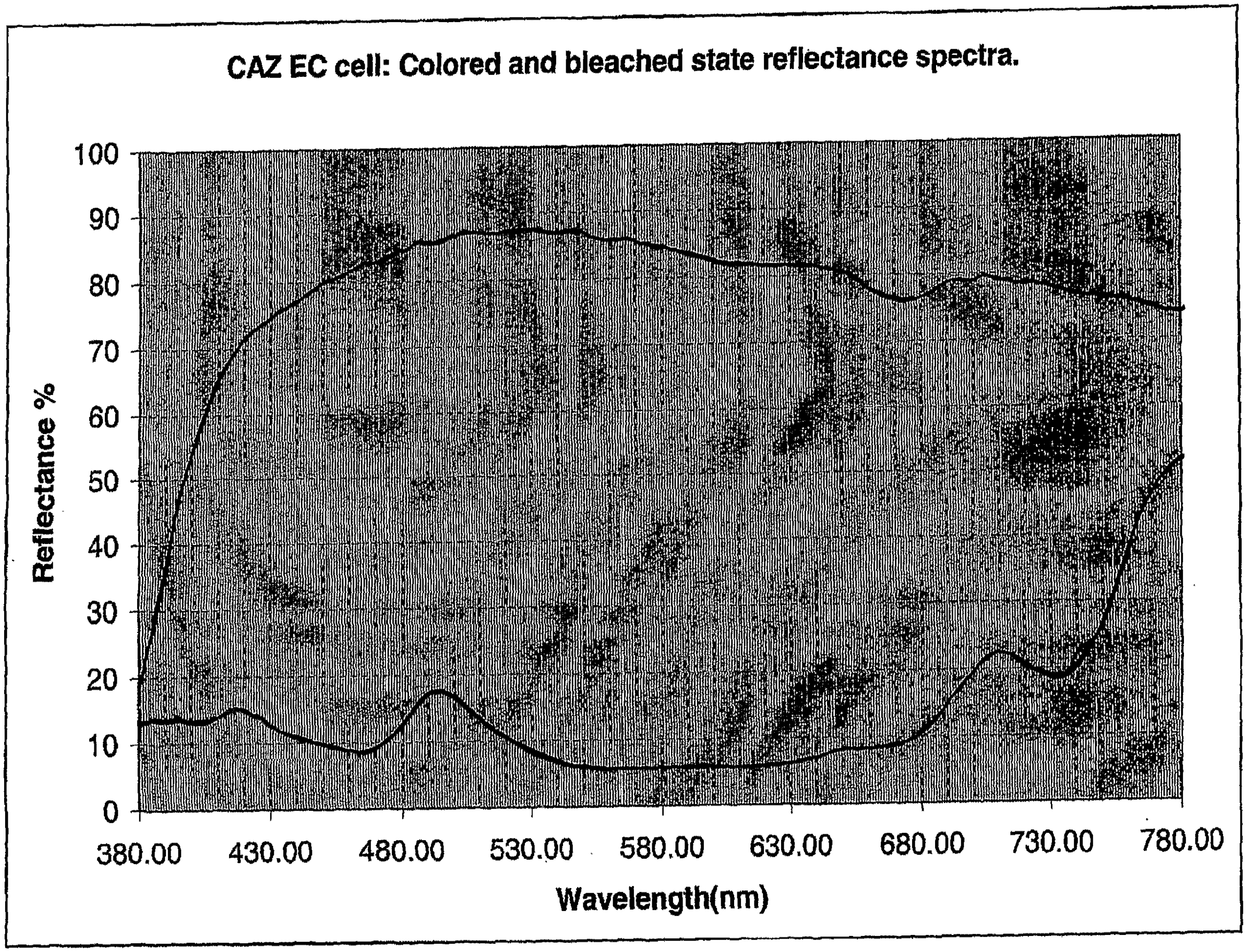
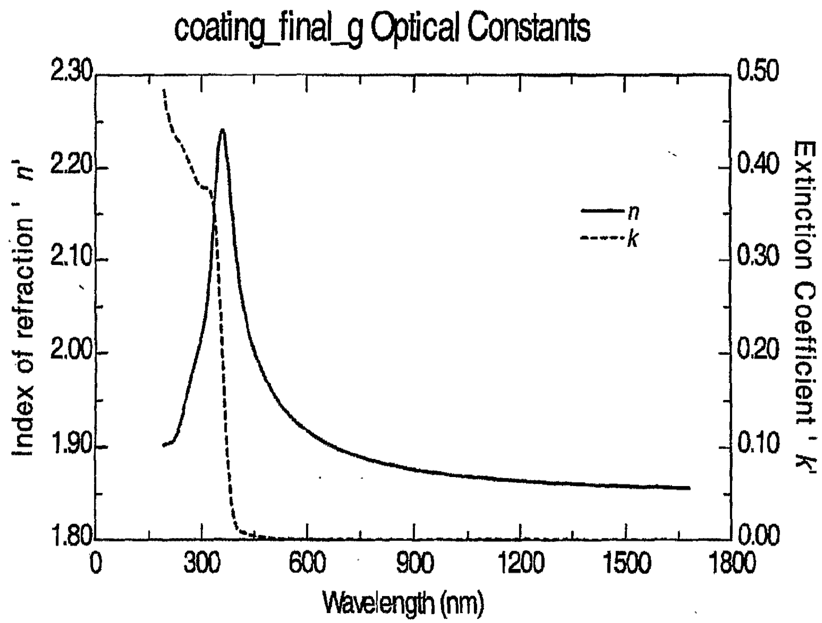

CAZ EC cell: Colored and bleached state reflectance spectra.
Reflectance %
100
90
80
70
60
50
40
30
20
10
0
380.00
430.00
480.00
530.00
580.00
630.00
680.00
730.00
780.00
Wavelength(nm)

FIG. 24



n,k of 300A of ZnO:Al2O3 on soda lime glass. Denton coater

FIG. 25

Initial Reflectance, Response Time and Current Draw @ 23°C, 1.2V

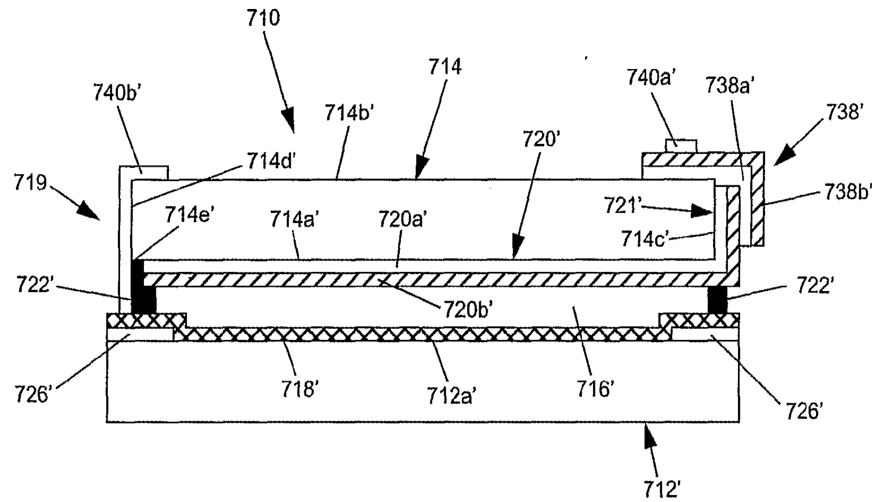
Sample #	50 to 10% Color (sec)	10 to 50% Bleach (sec)	Max Ref (%)	Min Ref (%)	Max Current Draw (mA)	SS Current Draw (mA)
1	3.2	4.9	86.1	6.8	287	110
2	3.2	5.1	86.6	6.6	286	106
3	3.1	5.5	87.3	6.5	282	103
4	3.5	4.9	87.9	6.9	275	106
5	2.8	5.5	85.6	6.4	319	104
6	3.4	5.2	87.4	6.8	282	108
7	3.1	5.0	85.1	6.6	291	109
8	3.1	5.0	85.7	6.8	307	108
9	3.0	5.1	84.8	6.6	310	107
10	3.1	5.1	85.1	6.7	311	107
11	2.9	5.0	84.8	6.8	315	108
12	3.0	5.5	86.4	6.3	300	103
13	3.0	4.9	86.9	6.7	311	108
14	3.1	5.2	84.4	6.5	286	106
15	3.1	5.0	85.6	6.6	300	107
16	2.9	5.1	85.2	6.6	318	107
17	3.2	5.0	86.2	6.8	276	106
18	3.1	5.3	86.5	6.6	287	107
19	3.0	5.2	84.7	6.6	300	108
20	3.1	5.2	85.2	6.7	300	107
21	3.0	5.0	85.9	6.8	300	109
22	3.0	5.1	85.4	6.6	301	108
23	3.0	5.3	86.8	6.5	312	105
24	2.9	5.2	85.9	6.6	312	107
25	3.2	5.2	86.3	6.6	284	107
26	2.9	5.1	86.3	6.6	314	108
27	3.0	4.7	87.6	6.9	309	110
28	3.1	4.8	87.1	6.9	311	108

Fig. 26

Initial Reflectance, Response Time and Current Draw @ 23°C, 1.2V
After 50,000 cycles (30 sec, 30 sec) @ 65°C / 95% RH

Sample #	50 to 10% Color (sec)	10 to 50% Bleach (sec)	Max Ref (%)	Min Ref (%)	Max Current Draw (mA)	SS Current Draw (mA)
1	4.0	5.6	84.8	6.7	241	97
2	3.6	5.5	85.2	6.6	251	95
3	3.5	6.0	85.8	6.6	250	94
4	3.8	5.4	86.7	6.8	249	96
5	3.4	6.1	84.1	6.4	277	96
6	3.6	5.5	86.0	6.8	256	98
7	3.6	5.8	84.0	6.5	252	96
8	3.6	5.5	84.1	6.7	257	97
9	3.6	5.9	83.0	6.5	269	96
10	3.5	5.8	83.6	6.6	266	97
11	3.4	5.5	83.4	6.7	272	97
12	3.2	6.2	84.8	6.2	259	93
13	3.5	5.4	85.2	6.8	264	97
14	3.4	5.7	83.4	6.3	251	96
15	3.6	5.7	84.1	6.7	255	97
16	3.2	5.5	83.5	6.5	277	98
17	3.8	5.6	84.9	6.7	249	96
18	3.5	5.8	84.8	6.6	258	96
19	3.4	5.4	83.5	6.7	266	97
20	3.4	5.7	83.6	6.7	267	97
21	3.4	5.4	84.2	6.8	266	98
22	3.4	5.5	83.9	6.6	263	97
23	3.5	5.9	85.2	6.5	269	96
24	3.7	5.9	84.3	6.5	271	96
25	3.8	5.8	84.9	6.6	242	95
26	3.2	5.7	84.9	6.6	279	97
27	3.5	5.2	85.9	6.8	277	99
28	3.5	5.3	85.7	6.7	265	98

Fig. 27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714
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714b'
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738a'
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714d'
719
738b'
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714a'
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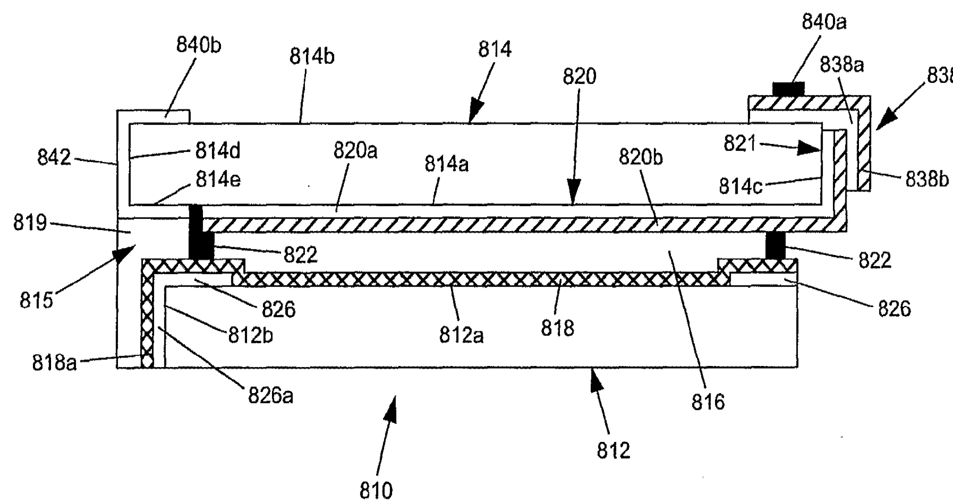
714c'
722'
722'
720b'
726'
718'
712a'
716'
726'
712'

Fig. 28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815
826
826
812b
812a
818
818a
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816
812
810

Fig. 29

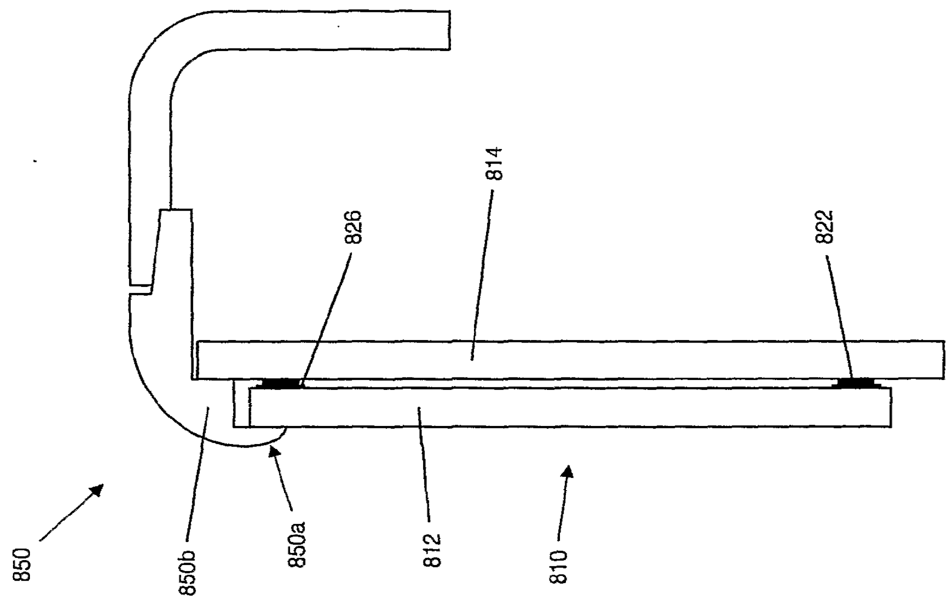

Fig. 30

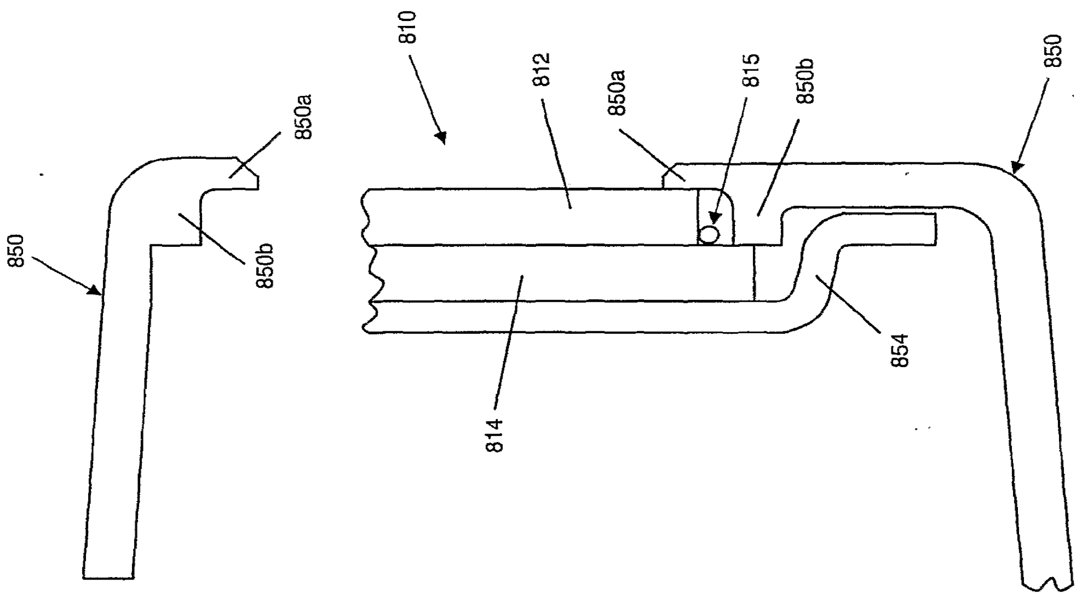

Fig. 30A

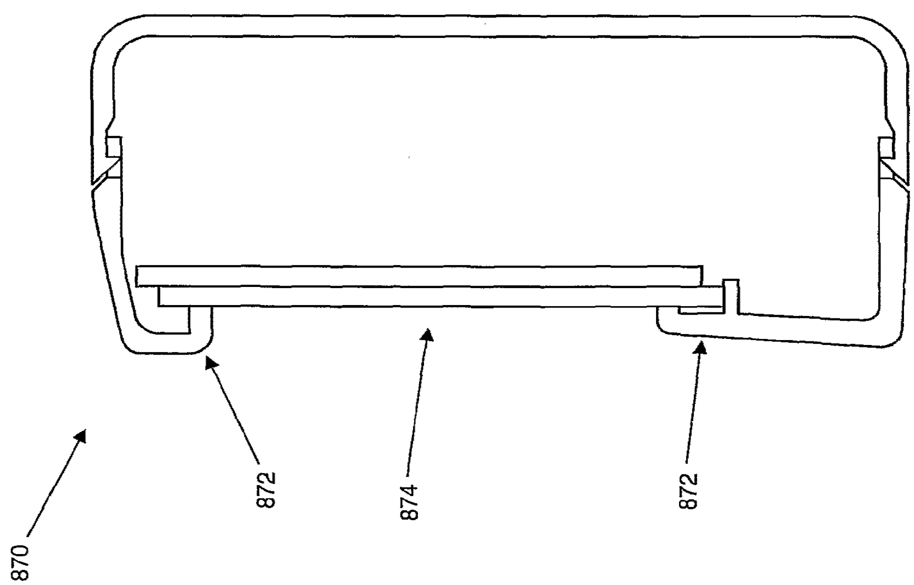

Fig. 30B

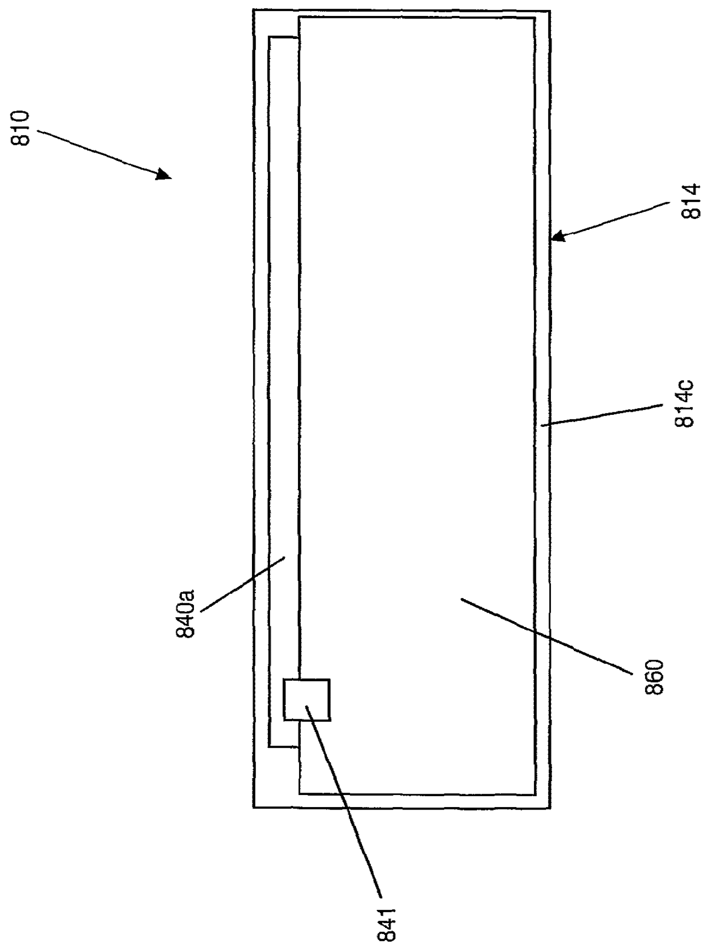

Fig. 31

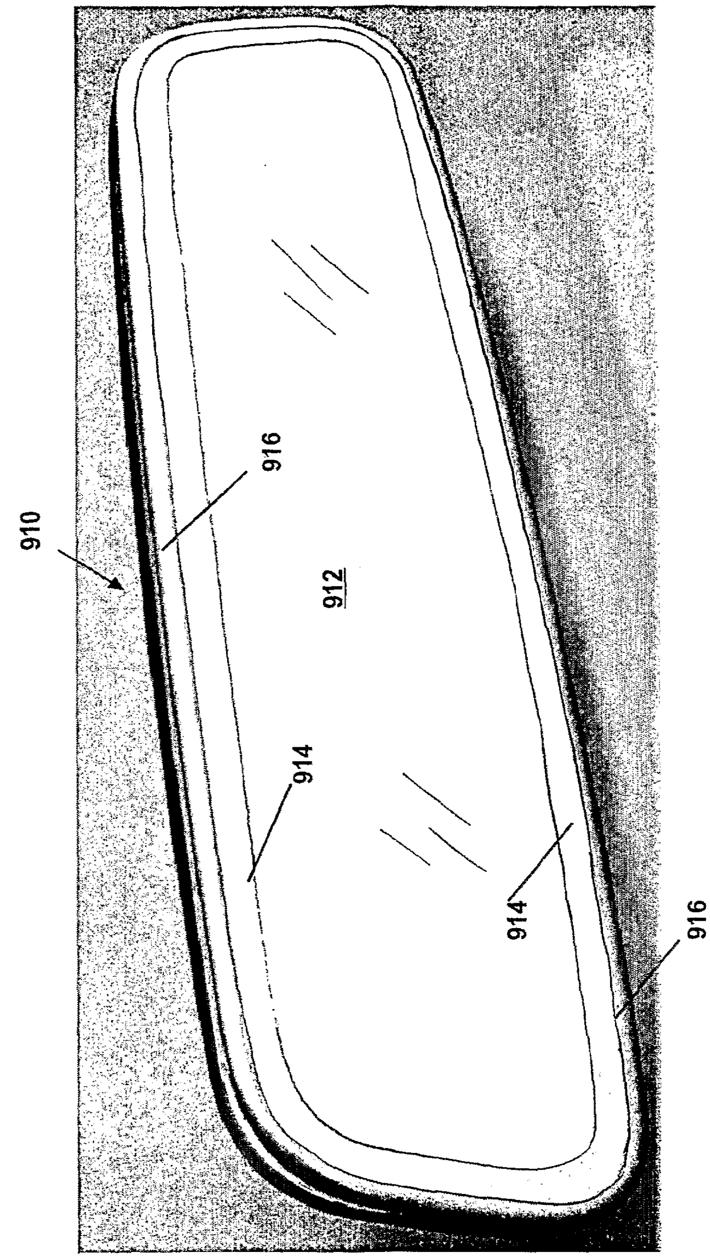

Fig. 32

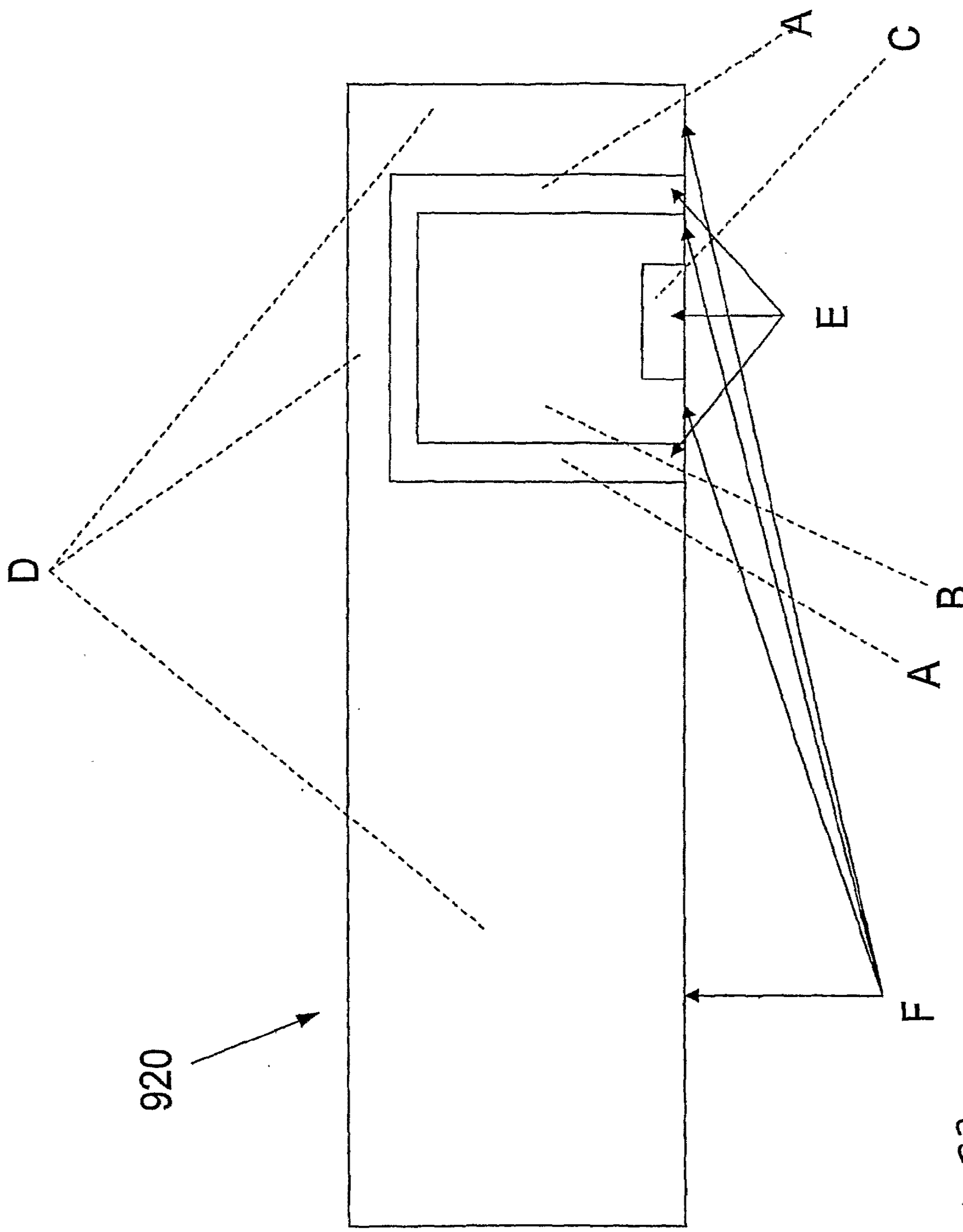

FIG. 33

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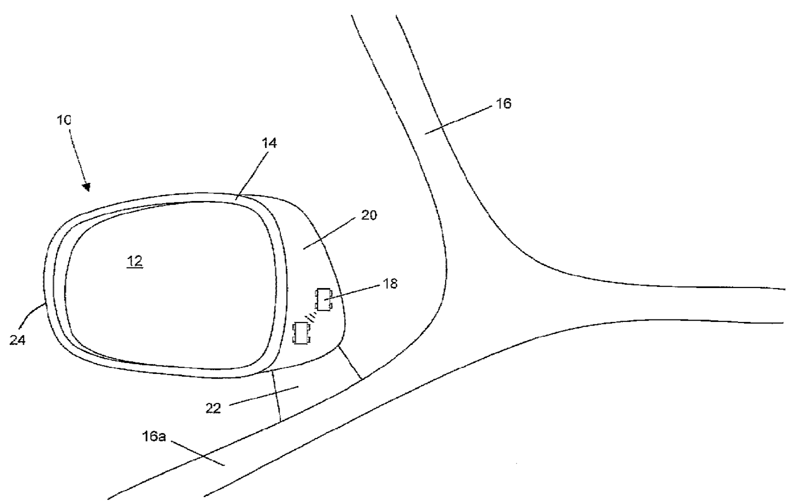
[Continued on next page]

(54) **Title:** VEHICLE EXTERIOR MIRROR ASSEMBLY WITH BLIND SPOT INDICATOR



(57) **Abstract:** An exterior rearview mirror system for a vehicle includes an exterior mirror assembly (10) that is mountable at an exterior side (16a) of a vehicle (16) and has an inboard portion (20) that is viewable by a driver of the vehicle when the mirror assembly is mounted at the exterior side of the vehicle. A blind spot indicator (18) is disposed at the inboard portion (20) of the mirror casing (14) of the mirror assembly. The blind spot indicator comprises at least one illumination source for indicating to the driver a detected presence of an object alongside of and/or rearward of the vehicle. The indicator may comprise a unitary indicator module (518) that is mountable at the inboard portion of the mirror assembly. The indicator module includes an illumination source (546c, 546d) and circuitry (546) and is connectable to an electrical connector (548).

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VEHICLE EXTERIOR MIRROR ASSEMBLY WITH BLIND SPOT INDICATOR

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims benefit of U.S. provisional applications, Ser. No. 60/696,953, filed July 6, 2005 (Attorney Docket DON01 P-1228); and Ser. No. 60/784,570, filed Mar. 22, 2006 (Attorney Docket DON01 P-1273), which are hereby incorporated herein by reference in their entireties.

FIELD OF THE INVENTION

[0002] The present invention relates to exterior rearview mirror assemblies and, more particularly, to an exterior rearview mirror assembly having a blind spot indicator and/or a lane change aid (LCA) indicator at the mirror assembly.

BACKGROUND OF THE INVENTION

[0003] It is known to provide a blind spot detection/LCA system for a vehicle that detects the presence of another vehicle or object in the lane next to the host vehicle, where it may be difficult for the driver of the host vehicle to determine whether or not there is another vehicle or object adjacent to the host vehicle. Such a blind spot detection/LCA system often includes a visual indicator that visually indicates to the driver that another vehicle or object has been detected. The visual indicator (commonly a light emitting diode or the like) is often located at the reflective mirror element of the exterior rearview mirror assembly and external of the vehicle cabin, or may be located interior to the vehicle, such as at the A-pillar of the vehicle within the interior of the vehicle cabin (such as on MY 2005 Volvo vehicle models equipped with camera-based BLIS systems). The visual blind spot/LCA indicators indicate or alert to the driver of the host vehicle the presence or impending presence of another vehicle in a blind spot in an adjacent side lane that typically cannot be readily seen within the field of view of the exterior mirror reflective element of the exterior mirror assembly mounted at that side of the vehicle and/or cannot be readily seen by the driver's peripheral vision or the like. The visual blind spot/LCA indicators typically must be viewable principally or solely by the driver of the host vehicle and not by drivers of other vehicles. If the indicator is located external to the vehicle cabin, and especially since it is now common to use turn signals on exterior mirrors, any visibility of the indicator to the driver of another vehicle (such as a trailing vehicle or an overtaking vehicle) may cause confusion to the driver of the other vehicle as to whether or not the indicator is a turn signal indicator or some other vehicle lighting or the like. This may be particularly problematic when the blind spot indicator is located behind (and often supported by) the reflective mirror element of the vehicle exterior mirror assembly, and may be especially confusing if other indicators are also disposed behind/supported by the mirror reflective element so as to function, for example, as turn signal indicators. For example, somewhat costly and complicated blind spot indicator constructions have been contemplated that, when placed behind and supported by the mirror reflective element, attempt to have their projected beam of emitted light shielded from view by other drivers and attempt to be directed principally to be viewed by the driver of the host vehicle. This can be further complicated by the fact that the mirror reflective element (and hence any blind spot indicator supported thereon/therebehind) is adjustable via a mirror actuator (such as described in U.S. Pat. Nos. 6,755,544; 6,616,314; 6,467,920; and 6,243,218, which are hereby incorporated herein by reference in their entireties), so that the axis of principal illumination of the blind spot indicator will move with movement of the mirror reflective element.

[0004] Thus, prior art blind spot/LCA indicators are often supported by and to the rear of the movable mirror reflective element, so as to be viewable by a driver of the host vehicle through the reflective element of the mirror assembly. For example, a transmissive window may be formed in the reflective coating or coatings of the reflective element and an illumination source or indicator may be positioned so as to direct or emit illumination through the window and toward the driver of the host vehicle so as to be viewable by the driver of the host vehicle. Alternately, transflective mirror coatings (such as, for example, those described in U.S. Pat. Nos. 6,855,431; 5,724,187; 5,340,503; 6,286,965; 6,196,688; 5,535,056; 5,751,489; and 6,065,840, which are hereby incorporated herein by reference in their entireties) may be used.

[0005] Because of vehicle regulations and mirror and vehicle configurations and geometries, and because of the need to provide an uninterrupted reflective surface to satisfy the likes of the FMVSS 111 field of view regulation, blind spot/LCA indicators in the prior art are typically located towards or at the outboard edge, and typically towards or at the upper corner/quadrant, of the reflective mirror element of the exterior mirror assembly. Thus, the prior art blind spot/LCA indicators are located at a distal or furthest outboard location of the mirror reflective element, such that the driver of the host vehicle typically has to look across to the outboard dimension of the reflective element to view and discern the blind spot indicator. Also, the blind spot/LCA indicators (when located at the reflective element so as to be viewable through the reflective element and when supported thereon such that the blind spot/LCA indicator moves in tandem with the mirror reflective element when its field of view is adjusted by the driver to his/her preferences) may be directed differently for different drivers. These prior art blind spot/LCA indicators thus are not provided at a universally controllable angle or fixed angle relative to the geometry of the vehicle and thus may not be optimally directed for viewing by some drivers, depending on the desired and set angle of the mirror reflective element for the particular driver of the host vehicle and/or may not be optimally directed for non-viewing by drivers of other vehicles, such as trailing or overtaking vehicles that are part of the traffic encountered by the host vehicle.

[0006] A variety of interior and exterior mirror assemblies with indicators are known in the art, such as U.S. Pat. Nos. 5,788,357; 6,257,746; 6,005,724; 5,481,409; 6,512,624; 6,356,376; 2,263,382; 2,580,014; 3,266,016; 4,499,451; 4,588,267; 4,630,904; 4,623,222; 4,721,364; 4,906,085; 5,313,335; 5,587,699; 5,575,552; 5,938,320; and 5,786,772, Canadian Pat. No. CA 1,063,695, Pat. Abstracts of Japan Publication No. 0917573, published Jul. 8, 1997, which are all hereby incorporated herein by reference in their entireties.

[0007] Therefore, there is a need in the art for an improved blind spot/LCA indicator that is readily viewable by a driver of the host vehicle and not visible or viewable by a driver of another vehicle.

SUMMARY OF THE INVENTION

[0008] The present invention provides a blind spot indicator or lane change assist (LCA) indicator that is fixedly located at the mirror shell or casing and/or at a support arm of an exterior rearview mirror assembly, so as not to move or adjust when the mirror reflective element is moved or adjusted to set its field of view. Preferably, the blind spot indicator is fixedly located at the inboard wall or portion of the mirror shell or casing, so as to be readily viewed by the driver of the host vehicle, while being substantially non-visible or non-viewable by a driver of another vehicle. The blind spot/LCA indicator is preferably located at an angled, outwardly extending rearward portion of the mirror assembly that is angled so as to slope or extend at an angle away from the body side of the vehicle, so that the blind spot/LCA indicator is generally facing the driver of the host vehicle and is readily viewable by the driver of the host vehicle and substantially non-visible or non-viewable by a driver of another vehicle at or approaching the host vehicle.

[0009] According to an aspect of the present invention, an exterior rearview mirror assembly for a vehicle includes a reflective element, a mirror shell or casing and a blind spot indicator. The shell or casing has an inboard portion that is inboard of the reflective element relative to the position of the reflective element with respect to the body side of the vehicle when the exterior mirror assembly is mounted thereto, and thus is between the reflective element and the body side of the vehicle to which the mirror assembly is attached. The blind spot indicator is located at and oriented at the inboard portion of the mirror shell or casing so as to be viewable by the driver of the vehicle and so as to be substantially to totally non-viewable by the drivers of other vehicular traffic, such as other vehicular traffic rearward of, sideward of, approaching, overtaking, forward of or otherwise at or near the host vehicle.

[0010] The inboard portion of the mirror shell or casing (which at least in part defines a cavity within which the mirror reflective element is disposed and within which the mirror reflective element is adjustable) may comprise an inboard wall of the mirror shell or casing. Typically, the exterior mirror assembly comprises a stalk or support arm or member of the mirror assembly that extends from the side of the vehicle to where the mirror shell is disposed.

[0011] The blind spot indicator may include a light source or illumination source (such as one or more light emitting diodes (LEDs) or the like), and may include a lens or other optic or light directing/guiding device or element or means or a light channel, conduit or means, or a light baffle or means, or a light louver or blind or means, or a light directing element or means, preferably at the mirror shell or casing (and substantially disposed therein so as not to overly protrude to create aerodynamic drag and so as to provide an aesthetically pleasing exterior appearance) for directing the light emitted by the light source toward the driver for viewing by the driver of the host vehicle and, if required, for limiting or restricting viewing by drivers of other vehicles.

[0012] Thus, the present invention provides an exterior rearview mirror assembly for a vehicle that includes a mirror shell portion and a blind spot or lane change assist (LCA) indicator. A cavity of the mirror shell portion is formed or defined at least partially by the walls of the shell portion. A variety of suitable mirror shells are known in the exterior mirror assembly art, such as skull-cap mirror shells (such as described in U.S. Pat. Nos. 6,612,708; 6,447,130; and 6,310,738, which are hereby incorporated herein by reference in their entireties), uni-body mirror shells, and the like. A reflective element is disposed within the cavity, along with any accessories or displays and associated adjustment device or actuator associated with the reflective element or mirror assembly. The mirror shell consists of an inner or inboard wall or side or portion that, when the mirror assembly is mounted at the side of the vehicle, preferably proximate to or at the driver or passenger side front door and proximate to or at the join of the door to the front portion of the vehicle body side (often referred to as the A-pillar region of the vehicle), the inner wall portion is at or near to the vehicle side body and readily viewable by the driver of the host vehicle. The mirror shell also includes an outer or outboard side or wall or portion that is further from the side of the vehicle and outward or outboard from the inner or inboard wall or portion. The mirror reflective element is disposed within the mirror shell and between the inner wall or portion or side and the outer wall or portion or side of the mirror shell. The blind spot or LCA indicator is located at the inboard or inner wall or side or portion of the mirror shell and, thus, is readily viewable by the driver of the host vehicle.

[0013] The mirror assembly is mounted to the body side of the vehicle (such as to a front door portion or to a vehicle body portion, depending on the particular application of the mirror assembly). The mounting portion of the mirror assembly often includes a stalk or mounting arm or member or support arm or member that extends from the mounting area of the vehicle body side to where the mirror shell is disposed. The mounting arm may extend from the vehicle body side by about an inch or more, and often about two to three inches or thereabouts, depending on the styling, type or size of the vehicle and associated exterior mirror assembly.

[0014] Note that, and as can be readily seen in FIGS. 6A and 6B, the inner portion of the driver side mirror assembly is most readily visible / viewable to the driver of the vehicle, as compared to the inner portion of the passenger side mirror assembly. The blind spot/LCA indicator of the present invention is thus highly suited for applications where the blind spot indicator is on the driver side only. However, it is envisioned that a blind spot/LCA indicator of the present invention may also or otherwise be located at the inner or inboard portion or wall or side of the passenger side exterior rearview mirror assembly, without affecting the scope of the present invention.

[0015] According to another aspect of the present invention, an exterior rearview mirror system for a vehicle includes an exterior mirror assembly having a mirror casing. The mirror casing comprises a mirror portion including a reflective element and an attachment portion configured for attaching the mirror assembly at an exterior side of a vehicle, such as via an attachment or attachment element for attaching the mirror assembly at the exterior side of the vehicle, such as via any suitable attachment element or means, such as are known in the automotive mirror art. The reflective element is adjustably supported by an actuator within the mirror portion of the mirror casing. The mirror casing has an inboard portion that faces generally toward the exterior side of the vehicle and is viewable by a driver of the vehicle when the exterior mirror assembly is attached at the exterior side of the vehicle. The mirror system includes a unitary indicator module at the inboard portion of the mirror casing. The unitary indicator module comprises an illumination source, and is responsive to a control signal to activate the illumination source to indicate to the driver a detected presence of an object at least one of alongside the vehicle and rearward of the vehicle. The unitary indicator module is substantially sealed so as to be substantially impervious to water. The unitary indicator module is configured at the inboard portion of the mirror casing so that illumination of the illumination source is readily viewable by the driver of the vehicle and wherein the illumination of the illumination source is generally not viewed by other road users when the exterior rearview mirror assembly is mounted to the side of the vehicle and when the vehicle is operated on a road.

[0016] According to another aspect of the present invention, a method of supplying an exterior rearview mirror system for a vehicle includes providing mirror casings, with each mirror casing at least comprising a mirror portion including a reflective element. The reflective element is adjustably supportable by an actuator within the mirror portion of the mirror casing. Each of the mirror casings has an inboard portion that faces generally toward the exterior side of the vehicle and that is viewable by a driver of the vehicle when the exterior mirror assembly is mounted at the exterior side of the vehicle. At least some of the mirror casings are provided with an aperture established at the inboard portion. Blind spot indicator units are provided, with each of the blind spot indicator units comprising at least one illumination source for indicating to the driver a detected presence of an object at at least one of alongside and rearward of the vehicle. First mirror assemblies are established by disposing the blind spot indicator units at the apertures of the inboard portions of the at least some of the mirror casings. The blind spot indicator units are at least partially received at the apertures. Second mirror assemblies are established by providing mirror casings lacking an aperture established at the inboard portion. The first mirror assemblies are supplied to a vehicle manufacturing facility when inclusion of a blind spot indicator is required and the second mirror assemblies are supplied to a vehicle manufacturing facility when inclusion of a blind spot indicator is not required.

[0017] Therefore, the present invention provides a blind spot indicator at an inboard wall or portion of an exterior rearview mirror assembly. The blind spot indicator is located at an inboard wall or portion of the mirror casing or shell or at an inboard support arm or the like of the mirror assembly and, thus, is readily viewable by the driver of the host vehicle, and without the driver having to look across to the outboard dimension of the mirror reflective element to see or notice actuation or illumination of the blind spot indicator. The blind spot indicator thus may be readily viewable by the driver and may be so viewable without the driver having to look at the reflective element of the exterior mirror to see the blind spot indicator. Also, because the blind spot indicator is located at the inboard portion of the mirror assembly, the blind spot indicator is viewable principally or solely by the driver of the host vehicle, and is not readily viewable or visible to a driver of another vehicle. Because the blind spot indicator is not located at a primary viewing area, the curb-side appeal or appearance of the vehicle is not adversely impacted by the choice and styling of the blind spot indicator. Also, because the blind spot indicator of the present invention is not located behind a window in the reflective element, or behind a transflective portion of the reflective element, the blind spot indicator may be fixedly placed and may provide a low cost indicator that may be readily incorporated into an exterior rearview mirror assembly of a vehicle.

[0018] These and other objects, advantages, purposes and features of the present invention will become apparent upon review of the following specification in conjunction with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] FIG. 1 is a perspective view of an exterior mirror assembly with a blind spot indicator in accordance with the present invention, shown with the indicator as an ISO icon;

[0020] FIG. 2 is a perspective view of an exterior mirror assembly similar to FIG. 1, shown with the indicator as a multi-stage indicator;

[0021] FIG. 2A is a perspective view of another exterior mirror assembly similar to FIG. 2, with the indicator located at an upper region of the inboard portion of the mirror assembly;

[0022] FIG. 3 is a perspective view of another exterior mirror assembly similar to FIG. 1, shown with the indicator as a hazard icon;

[0023] FIG. 4 is a perspective view of a vehicle with an exterior mirror assembly and blind spot indicator of the present invention, shown as the driver of a trailing vehicle may view the vehicle and exterior mirror assembly;

[0024] FIG. 5 is a perspective view of the vehicle of FIG. 4, shown as the driver of an overtaking vehicle may view the vehicle and exterior mirror assembly;

[0025] FIGS. 6A and 6B are perspective views of the driver and passenger side exterior mirror assemblies and of the interior rearview mirror assembly, with blind spot indicators in accordance with the present invention;

[0026] FIG. 7 is a perspective view of another exterior mirror assembly with a blind spot indicator in the support arm of the mirror assembly in accordance with the present invention, shown with the indicator as an ISO icon;

[0027] FIG. 8 is a perspective view of an exterior mirror assembly similar to FIG. 7, shown with the indicator as a multi-stage indicator;

[0028] FIG. 9 is a perspective view of another exterior mirror assembly similar to FIG. 7, shown with the indicator as a hazard icon;

[0029] FIG. 10 is a perspective view of another exterior mirror assembly similar to FIG. 7, shown with a multi-stage indicator at the side of the mirror shell;

[0030] FIG. 11 is a perspective view of another exterior mirror assembly similar to FIG. 10, with the indicator at the side of the mirror shell and above the support arm;

[0031] FIGS. 12A and 12B are perspective views of the driver and passenger side exterior mirror assemblies of a vehicle, with blind spot indicators in accordance with the present invention;

[0032] FIG. 13 is a perspective view of another exterior mirror assembly with a blind spot indicator in accordance with the present invention;

[0033] FIG. 14 is a perspective view of another exterior mirror assembly with a blind spot indicator module in accordance with the present invention;

[0034] FIGS. 15A and B are perspective views of the blind spot indicator module of FIG. 14;

[0035] FIGS. 16A-C are plan views of the blind spot indicator module of FIG. 14;

[0036] FIG. 17 is an exploded perspective view of the blind spot indicator module of FIGS. 14-16;

[0037] FIG. 18 is an exploded perspective view of the exterior mirror assembly of FIG. 14;

[0038] FIG. 19 is a perspective view of the blind spot indicator module as attached to the mirror housing;

[0039] FIG. 20 is another perspective view of the blind spot indicator and mirror housing of FIG. 19;

[0040] FIG. 21 is an enlarged perspective view of the blind spot indicator as mounted at the mirror assembly;

[0041] FIG. 22 is a perspective view of the mounting portion of the housing of the mirror assembly;

[0042] FIG. 23 is a perspective view of the back cap of the exterior mirror assembly of FIGS. 14 and 18;

[0043] FIG. 24 is an exploded perspective view of another blind spot indicator module in accordance with the present invention;

[0044] FIGS. 25A-C are plan views of the blind spot indicator module of FIG. 24;

[0045] FIG. 26 is an exploded perspective view of an exterior mirror assembly and the blind spot indicator module in accordance with the present invention;

[0046] FIGS. 27A and 27B are perspective views of the exterior mirror assembly and blind spot indicator module of FIG. 26;

[0047] FIG. 28 is an exploded perspective view of another blind spot indicator module in accordance with the present invention;

[0048] FIGS. 29A-C are plan views of the blind spot indicator module of FIG. 28;

[0049] FIG. 30 is an exploded perspective view of an exterior mirror assembly and the blind spot indicator module in accordance with the present invention; and

[0050] FIGS. 31A and 31B are perspective views of the exterior mirror assembly and blind spot indicator module of FIG. 30.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0051] Referring now to the drawings and the illustrative embodiments depicted therein, an exterior rearview mirror assembly 10 for a vehicle includes a reflective element 12 and a mirror shell or casing 14 (FIG. 1). Mirror assembly 10 is mounted at the side 16a of a host or subject vehicle 16, and includes a blind spot indicator 18 at an inboard portion 20 of mirror assembly 10. The blind spot indicator 18 is operable by illumination to indicate to the driver of the subject or host vehicle that an object or other vehicle is detected at the side or blind spot region of the host vehicle by a blind spot detection system, as discussed below. The indicator may be activated or energized in response to a detection of an object or other vehicle approaching or adjacent to the host vehicle in order to alert or warn the driver of the host vehicle not to attempt or initiate a lane change that moves the subject or host vehicle into the already occupied (or soon to be occupied) side lane or region adjacent either the driver side or the passenger side of the host vehicle.

[0052] Mirror assembly 10 is connected at the side 16a of vehicle 16 and includes a mounting arm or stem 22 or the like, which is mounted to or extends from the side 16a of vehicle 16. In the illustrated embodiment of FIG. 1, the inboard portion 20 of mirror assembly 10 comprises the inboard wall or side of the mirror shell or casing 14. The inboard portion or wall is at the inboard side of the casing 14 of the mirror assembly and generally faces the side 16a of the vehicle 16. As can be seen in FIG. 1, the inboard portion 20 is spaced from and opposite from an outboard portion or side 24 of the mirror assembly 10.

[0053] The exterior rearview mirror assembly may comprise a fixed exterior rearview mirror assembly, whereby the mirror portion of the mirror casing and the attachment portion of the mirror casing form a uni-body. Alternately, and preferably, the exterior rearview mirror assembly may comprise a breakaway exterior rearview mirror assembly and more preferably, the exterior rearview mirror assembly may comprise a powerfold exterior rearview mirror assembly. For example, the exterior rearview mirror assembly may comprise a fixed or foldable or breakaway or powerfold mirror assembly, whereby the mirror casing may encompass an attachment portion that attaches to the side of the vehicle, and a mirror or reflective element portion (that supports the reflective element) that is attached to and supported by the attachment portion. The reflective element is mounted at an actuator (such as a manual actuator or an electronic actuator) within the mirror portion of the mirror casing so that the rearward field of view of the driver is adjustable via adjustment of the reflective element.

[0054] Typically, side exterior rearview mirror assemblies for vehicles extend from the side of the vehicle and are angled to reduce aerodynamic drag and to provide an aesthetically pleasing appearance. Thus, the inboard portion of the exterior rearview mirror may be angled outwardly from the vehicle and thus slopes away from vehicle and provides a surface at which to mount/install the blind spot indicator, whereby the blind spot indicator is generally facing the driver of the host vehicle while being generally or substantially or entirely hidden from the view of drivers of other vehicles encountered by the host vehicle. Also, because the indicator is located at the inboard portion of the mirror shell or casing, the indicator may be selected to be substantially large, since the size of the indicator is not constrained by the field of view regulations of the mirror reflective element. The blind spot indicator of the present invention thus may be located at the mirror inboard wall or portion or side, which is contoured so that the wall or surface slopes away from the body side of the vehicle. By positioning the indicator at this location, the presence of the indicator at the inboard or inner wall or side of the exterior mirror is substantially or totally obscured from the view of drivers of trailing or side overtaking vehicles by the very body and structure of the exterior mirror. Also, because of the natural aerodynamic styling and structure of the inboard wall portion or section, operation of the blind spot indicator is substantially or totally non-viewable by the drivers of leading vehicles (traveling in front of the host vehicle) or vehicles approaching the host vehicle from in front of the host vehicle.

[0055] Blind spot/LCA indicator 18 may include an illumination or light source (such as one or more light emitting diodes (LEDs) or organic light emitting diodes (OLEDs) or the like that is/are energized to direct or emit illumination toward the driver of the host vehicle. The illumination source may be positioned within or behind the inboard wall or portion of the mirror assembly and the indicator may include an iconistic display area (such as transparent or substantially transparent or translucent windows or apertures formed or established at the inboard wall so that the illumination passes through the windows for viewing and discerning by the driver of the host vehicle). The iconistic display may be established or formed at a lens or element that attaches to the shell or casing or may be formed or established at the shell or casing wall itself. The indicator may include baffles or light piping or tubing or electroluminescent foil or other light direction means or occluding means, such as louvers or shutters or filters or light directing film or the like for directing or guiding the illumination from the illumination source at the desired angle and through the inboard wall or portion so as to be principally or solely viewable by the driver of the host vehicle. Because the blind spot indicator is located at an area or region that is not readily viewable by a person outside of the vehicle cabin, the indicator may be located at the surface of the inboard wall or portion (and may protrude partially therefrom), and need not be recessed within the casing surface, without adversely affecting the appearance of the exterior mirror assembly. The location and degree of recess or inset of the blind spot indicator may be selected depending on the particular application of the blind spot indicator and on the location of any internal mirror content (such as an actuator, security light or other indicators or accessories or the like) located within the mirror shell.

[0056] As shown in FIG. 1, blind spot indicator 18 may comprise an ISO icon (showing icons representing the host vehicle and another vehicle at the side and/or rearward of the host vehicle) to indicate to the driver of the host vehicle that another vehicle has been detected at the side and/or rearward of the host vehicle. The iconistic representation may be formed as a translucent window or portion of the inboard wall or portion or may be otherwise established at the inboard wall or portion of the mirror assembly. Optionally, however, the indicator may comprise other forms, without affecting the scope of the present invention. For example, and with reference to FIG. 2, a blind spot indicator or LCA indicator 18' of an exterior mirror assembly 10' may comprise a multi-stage indicator having multiple indicating portions or elements or devices for indicating a degree of hazard or the like of an object or vehicle detected alongside and/or rearward of the host vehicle. The indicating portions or elements or devices may comprise different color indicators, such as green, amber and red or the like, to indicate the degree of hazard detected. For example, the multi-stage indicator may provide a first indication when no object is detected at the side lane adjacent to the vehicle, a second indication when an object is detected that is approaching the side lane area, and a third indication when an object is detected that is occupying the side lane area.

[0057] The multi-stage indicator may comprise multiple illumination sources selectively operable to indicate the degree of hazard detected, or optionally the different or multiple indications may be provided with one illumination source or indicating element. The first, second and third indications provide at least one of (a) first, second and third color indications and (b) first, second and third indication modulations (such as where one or more indicating elements is/are flashed or modulated or intermittently activated/deactivated to provide different indications) that are readily discernible and recognizable by the driver of the vehicle.

[0058] Such a multi-stage indicator is suitable for use with a lane change assist (LCA) system, and may, for example, provide a green indication when the adjacent side lane is clear, an amber indication when a vehicle approaches the side lane area, and a red indication when another vehicle is occupying the side lane area adjacent to the host vehicle. As shown in FIG. 2, the blind spot indicator or LCA indicator 18' may be positioned at a lower region of the inboard portion 20' of the mirror assembly 10', or (and as shown in FIG. 2A), the blind spot indicator 18" may be positioned at an upper region of the inboard portion 20" of the mirror assembly 10" (where the indicator may be more readily visible/viewable to the driver of the host vehicle). Optionally, for example, and with reference to FIG. 3, a blind spot indicator 18"' of an exterior rearview mirror assembly 10"' may comprise a hazard indicator or the like at the inboard portion 20"' to provide a hazard indication or warning or alert signal to the driver of the host vehicle when an object or vehicle is detected at the side and/or rearward of the host vehicle, and when the driver of the host vehicle is attempting a lane change or the like (such as when the driver activates the turn signal of the host vehicle). Other iconistic images or indicia or the like may be used for the blind spot/LCA indicator, without affecting the scope of the present invention.

[0059] As can be seen in FIGS. 4 and 5, the blind spot indicator of the present invention is not readily viewable or discernible by other road users, such as a driver of a vehicle approaching the host vehicle from the rear of the host vehicle (as shown in FIG. 4) or a driver of a vehicle approaching and overtaking the host vehicle along a side of the host vehicle (as shown in FIG. 5). Although not shown, the blind spot indicator is also substantially not viewable by or visible to a driver of a vehicle ahead of or leading the host vehicle. The blind spot indicator of the present invention thus may be sufficiently large to enhance viewability and discernibility of the indicator by the driver of the host vehicle, without detracting from the appearance of the mirror assembly and without being readily viewable/discernible by the driver of another vehicle, thereby limiting or substantially precluding confusion (to the driver of the other vehicle) between a turn signal indicator (not shown) of the mirror assembly and the blind spot indicator.

[0060] Although shown in FIGS. 1-5 and described above as being located at a driver side exterior mirror, the blind spot/LCA indicator of the present invention may also or otherwise be located at the passenger side exterior mirror, if desired. Optionally, the blind spot indicator of the present invention may be located at both the driver side mirror assembly and the passenger side mirror assembly of the host vehicle. The indicator at either side may be selectively activated or illuminated to indicate to the driver of the host vehicle that an object or other vehicle has been detected at that particular side lane region of the host vehicle. Optionally, the blind spot indicator may be associated with a blind spot detection and indication system that includes one or more indicators at the interior rearview mirror assembly of the host vehicle. For example, and with reference to FIG. 6, a blind spot indicator 118a may be located at an inboard portion or wall 120a of a driver side exterior rearview mirror assembly 110a, while a blind spot indicator 118b may be located at an inboard portion or wall 120b of a passenger side exterior rearview mirror assembly 110b. Also, an interior rearview mirror assembly 130 may include one or more indicators 119a, 119b that provide further indication to the driver of the host vehicle of a detection of an object or other vehicle at either side and/or rearward of the host vehicle, so that the driver of the host vehicle has a cognitive association of the indicators. The blind spot indicators may provide a redundant indication at both the interior and exterior mirrors in order to assist the driver in recognizing the conditions surrounding the host vehicle, such as by utilizing aspects of the blind spot detection system described in U.S. Pat. Nos. 6,198,409; 5,929,786; and 5,786,772, which are hereby incorporated herein by reference in their entireties.

[0061] Optionally, and with reference to FIG. 7, an exterior rearview mirror assembly 210 may include a reflective element 212 and a mirror casing or shell that includes a mirror portion 214 that is supported on a mounting arm or attachment portion 232, which includes an attachment element that is configured to attach or mount to the side 216a of the host vehicle 216 and/or which extends from the side 216a of the host vehicle 216. The blind spot indicator 218 may be located at an inboard portion 220 of the casing 214, such as at the support arm or attachment portion or stem 232 of the casing which mounts to the mounting arm 222. In the illustrated embodiment, the attachment portion 232 of the casing is pivotally mounted to the mounting arm 222, such as for a powerfold exterior mirror or a breakaway exterior mirror or the like. The inboard portion 220 thus may be positioned along the mirror portion 214 or attachment portion 232 (and preferably along a surface that is angled outwardly with respect to the vehicle side), and could optionally and less desirably be located at the support or mounting arm 222, so as to be directed generally toward the driver of the host vehicle and not readily viewable by other road users or drivers of other vehicles at or near the host vehicle.

[0062] As shown in FIG. 7, the indicator 218 may comprise an ISO indicator with the iconistic representation of the host vehicle and adjacent or approaching vehicle, such as described above with respect to FIG. 1. Optionally, and such as described above with respect to FIGS. 2 and 3, the blind spot indicator may comprise a multi-stage indicator 218' (FIG. 8) or a hazard indicator 218" (FIG. 9) at the support arm or stem of the mirror assembly.

[0063] Optionally, and as shown in FIG. 10, the blind spot indicator 318 (such as a multi-stage indicator or other type of indicator) may be located at the inboard wall 320 of the mirror casing 314 of an exterior mirror assembly 310 and generally at or rearward of the support arm or stem 332 (which mounts to a mounting arm or portion 322 at the vehicle and which may be pivotable relative to the mounting arm or portion 322) of the casing 314 (where the indicator is rearward of the support arm and thus facing generally rearwardly with respect to the forward direction of travel of the vehicle, and preferably on an outwardly angled portion so as to be facing partially inward toward the driver of the vehicle). The indicator thus is readily viewable by the driver of the host vehicle at the mirror casing and rearward of the support arm or stem of the mirror assembly. As shown in FIG. 11, the blind spot indicator 318' may be located at the inboard portion 320' of the casing 314' of an exterior mirror assembly 310' and generally above the support arm or stem 332' (which mounts to the mounting arm or portion 322'), if desired. The particular location of the blind spot indicator may be selected depending on the geometries and content of the mirror assembly and support arm and mounting portion of the mirror assembly and on the vehicle door design and/or the vehicle A-pillar design, so as to provide enhanced viewability and discernibility of the blind spot indicator to the driver of the host vehicle. As shown in FIGS. 12A and 12B, a blind spot indicator 318a" may be located at the inboard portion 320a" of the casing 314a" of a driver side exterior mirror assembly 310a", while a blind spot indicator 318b" may be located at the inboard portion 320b" of the casing 314b" of a passenger side exterior rearview mirror assembly 310b", so that the indicators 318a", 318b" are readily viewable and discernible by the driver of the host vehicle while being substantially non-viewable to drivers of other vehicles at or near or trailing or approaching or overtaking or leading the host vehicle. The blind spot indicator or indicators may be located at other inboard portions or inward facing portions of the mirror casing, including a movable casing portion (such as a movable mirror portion or movable attachment portion or the like) and/or a fixed casing portion (such as a fixed mirror portion or fixed attachment portion or the like), so as to be viewable by the driver of the vehicle and not readily viewable by other road users or drivers of other vehicles, while remaining within the spirit and scope of the present invention.

[0064] Optionally, and with reference to FIG. 13, an exterior rearview mirror assembly 410 for a vehicle includes a reflective element 412 and a mirror shell or casing 414. Mirror assembly 410 is mounted at the side 416a of a host or subject vehicle 416, and includes a blind spot indicator 418 at an inboard portion or surface 420 of an outer wall 424 of the mirror casing 414 of mirror assembly 410. The blind spot indicator 418 thus may be located at a cusp or inboard surface of the outer wall 424 of mirror casing 414 so as to be readily viewable by the driver of the host vehicle, while being substantially hidden or not viewable by the driver of another vehicle at or near or approaching the host vehicle. The blind spot indicator 418 thus is located at a region that is remote from the reflective element of the mirror assembly so as to limit or substantially preclude confusion between the blind spot indicator and any display or indicator (such as a turn signal display or the like) that is located at the reflective element of the mirror assembly (and thus that may be intended for viewing by the driver of another vehicle).

[0065] Optionally, the blind spot indicator or LCA indicator of the present invention may be provided as an indicator module that is a unitary module including an illumination source, electrical connectors and cover and/or light directing or guiding elements or means. The unitary indicator module is preferably sealed so as to be substantially impervious to water so as to provide a robust module that can withstand the exposure to the elements at the exterior rearview mirror assembly. The sealing means for sealing the module may comprise any suitable sealing means, such as sealing means that are known or conventional in the art, such as gasketing, welding, such as ultrasonic welding or the like, or adhering or any other suitable sealing means for sealing the module. The mirror assembly may be formed with a cavity or opening (such as at the inboard wall of the mirror housing that faces or opposes the vehicle) for receiving or attaching the unitary indicator module therein or thereat, and may include the electrical connectors at the cavity or opening for making the appropriate electrical connections to the indicator module. Optionally, the electrical connections may be made while the indicator module is attached to the mirror assembly, such as via a plug and socket type arrangement or configuration, and such as by utilizing aspects of the mirror assembly described in U.S. Pat. No. 6,669,267, which is hereby incorporated herein by reference in its entirety. The unitary indicator module may include or utilize aspects of various light modules or systems or devices, such as the types described in U.S. Pat. Nos. 6,227,689;

6,582,109; 5,371,659; 5,497,306; 5,669,699; 5,823,654; 6,176,602; and/or 6,276,821, which are hereby incorporated herein by reference in their entireties.

[0066] The unitary indicator module thus may be provided as a unitary element or unit and may be readily installed at an exterior mirror assembly to provide the blind spot/LCA indicator at the inboard wall or portion of the exterior mirror. The blind spot detection system (and thus the blind spot indicator) thus may be selected by a customer as an option for their vehicle, whereby the blind spot indicator unit or module or unitary module may be provided for the appropriate mirror assembly. Optionally, the exterior mirror assembly may be shipped to a vehicle assembly plant with the blind spot indicator module already installed, or the exterior mirror assembly may be shipped to the vehicle assembly plant with a socket or structure or receiving portion (such as at the inboard portion of the mirror assembly) for receiving or mounting or attaching the indicator module. The indicator module, when selected, may be connected or plugged in or otherwise attached to the mirror assembly at the socket or structure or receiving portion at the vehicle assembly plant, so as to be substantially flush with the outer surface of the mirror housing when so inserted or connected or plugged in or attached. Optionally, the indicator module may be slightly to moderately proud of the outer surface of the inboard portion of the mirror casing or housing when attached thereto, so as to be slightly protruding outward (generally toward the vehicle) from the inboard portion of the mirror casing or housing, such as less than about 1 mm to about 3 mm or thereabouts. The indicator module may make both the mechanical and electrical connections to the mirror assembly when attached thereto, such as by utilizing aspects described in U.S. Pat. No. 6,669,267, which is hereby incorporated herein by reference in its entirety. The indicator module thus may be installed at the appropriate mirror assembly (such as for a vehicle that has the blind spot indicator selected as an option) at the vehicle assembly plant, while a blank out panel or element or the like may be attached to the mirror assembly (such as by snapping or connecting or attaching a blank out panel or element at the receiving portion of the inboard portion of the mirror assembly) for vehicles that do not have the blind spot indicator option selected. Because the blind spot indicator and associated circuitry/electronics may be costly, the unitary indicator module allows the indicator to be added to the exterior mirror only for those vehicles with the indicator option selected, and without affecting the mirror assembly structure and design, so that a common mirror shell may be utilized for a standard mirror and for a mirror with the indicator option selected, thereby deproliferating parts and providing economies of scale for the mirror assemblies. An operator need only attach the selected or appropriate one of the blind spot indicator module or the blank out element at the receiving portion of the inboard portion of the mirror assembly.

[0067] For example, a method of supplying an exterior rearview mirror system for a vehicle includes providing mirror casings, with each mirror casing at least comprising a mirror portion including a reflective element. The reflective element is adjustably supportable by an actuator within the mirror portion of the mirror casing. Each of the mirror casings has an inboard portion that faces generally toward the exterior side of the vehicle and that is viewable by a driver of the vehicle when the exterior mirror assembly is mounted at the exterior side of the vehicle. At least some of the mirror casings are provided with an aperture or receiving portion established at the inboard portion. Blind spot indicator units are provided, with each of the blind spot indicator units comprising at least one indicating element and/or illumination source for indicating to the driver a detected presence of an object at at least one of alongside and rearward of the vehicle. First mirror assemblies are established by disposing the blind spot indicator units at the apertures of the inboard portions of the at least some of the mirror casings and second mirror assemblies are established by providing mirror casings lacking an aperture established at the inboard portion. The blind spot indicator units are at least partially received at the apertures of the first mirror assemblies. The first mirror assemblies are supplied to a vehicle manufacturing facility when inclusion of a blind spot indicator is required and the second mirror assemblies are supplied to a vehicle manufacturing facility when inclusion of a blind spot indicator is not required.

[0068] Optionally, a method of manufacturing an exterior rearview mirror assembly includes providing an exterior mirror assembly having a reflective element and a mirror casing. The mirror casing is mountable at an exterior side of a vehicle and has an inboard portion that faces generally toward the exterior side of the vehicle and is viewable by a driver of the vehicle when the exterior mirror assembly is mounted at the exterior side of the vehicle. The inboard portions of at least some of the mirror casings have an aperture or receiving portion established thereat. The method includes providing a blind spot indicator having at least one illumination source for indicating to the driver a detected presence of an object alongside of and/or rearward of the vehicle. A blank element or blank out panel or element or cover portion or casing or cap portion that substantially corresponds with a surface of the inboard portion of the exterior rearview mirror assembly may also be provided (or some mirror casings may be provided without an aperture or receiving portion at the inboard portion). The method includes selecting a selected element, where the selected element is selected from a group consisting of (a) the blind spot indicator and (b) the blank element and (c) a mirror casing without an aperture or receiving portion at the inboard portion. The method may further include attaching the selected element at the inboard portion of the mirror assembly, whereby the selected element is at least partially received at the receiving portion, and an exterior surface of the selected element is substantially flush with a surface of the inboard portion. If the mirror assembly is targeted for installation on a vehicle without an optional side object detection system selected, then the operator may readily attach the blank out element at the receiving portion of the inboard portion of the mirror assembly instead of the indicator module. In applications where some of the mirror casings are not provided with an aperture or receiving portion, no cap or blank element is needed to provide the substantially flush inboard portion for applications where no side object detection system is selected. The mirror assembly thus is assembled and installed at the appropriate vehicle with the appropriate or selected features or content for that particular vehicle and selected option.

[0069] The method may include determining a desired optional content of each exterior rearview mirror assembly and selecting a selected element or mirror casing according to the determined desired optional content for each exterior rearview mirror assembly. The attaching of the selected element or use of the selected mirror casing preferably is made at the mirror manufacturer's facility, but could be made at a vehicle assembly plant (such as at a location or station of the vehicle assembly plant at or before the station where the mirror assembly is attached to the vehicle). The attaching of the selected element preferably also includes connecting the indicating element or illumination source of the blind spot indicator to an electrical connector. Preferably, the attaching of the selected element includes making both the mechanical and electrical connections for the indicator at the inboard portion of the mirror assembly.

[0070] For example, and with reference to FIGS. 14-23, an exterior rearview mirror assembly 510 for a vehicle includes a reflective element 512 and a mirror shell or casing or housing 514. The reflective element 512 is movably supported at housing 514 via a mirror actuator 513 (FIG. 18). Mirror assembly 510 includes a blind spot indicator module 518 at an inboard portion or surface 520 of an inner wall 524 of the mirror housing 514 of mirror assembly 510. Blind spot indicator module 518 is mounted in an aperture 514b formed at the housing 514, and the mirror assembly 510 includes a back cap 540 that may substantially cover a portion of the housing 514, and may cover or surround a portion of the indicator module 518, as discussed below. As shown in FIGS. 15-17, blind spot indicator module 518 includes a housing 542, a lens element or optic element 544 and a printed circuit board or PCB assembly 546. The housing 542 includes mounting tabs 542a protruding therefrom for flexing as the module 518 is attached to a mounting portion 514a (FIGS. 18-22) of housing 514 and retaining the module 518 to the housing 514.

[0071] PCB assembly 546 includes a board or substrate 546a with an electrical connector or terminals 546b and a plurality of illumination sources disposed thereon, such as four amber light emitting diodes 546c and one red light emitting diode 546d. Electrical connectors 546b comprise conductive terminals protruding from an inner surface of the substrate 546a and are configured for connection to an electrical wiring or connector 548 (FIGS. 18-20) of the vehicle. The indicator module may be relatively small and readily attachable to the mirror assembly. For example, an exemplary embodiment of the module may be about 15 mm thick, and about 45 mm long and about 37 mm wide or thereabouts. However, other sized and/or shaped modules may be implemented while remaining within the spirit and scope of the present invention. The illumination sources or light emitting diodes (LEDs) 546c, 546d are disposed at an outer surface of the substrate 546a and emit light through lens element 544 when activated/energized.

[0072] Lens element 544 comprises a transparent or translucent element or block with graphics or icons or indicia 544a formed or established at a primary or principle viewing area 544b of the lens element. For example, the lens element may include vehicle icons established thereon so that a person viewing the module readily recognizes that the purpose of the indicator module is for a blind spot detection system, particularly when the illumination sources are not activated. The primary viewing area 544b of the lens element 544 may be generally aligned with the amber LEDs 546c and may be aligned with or at least partially protrude through an opening or aperture 542b through housing 542 so that the icons or indicia at the primary viewing area 544b are illuminated by the amber LEDs to alert the driver of a detection of an object in an adjacent lane. In the illustrated embodiment, the lens element 544 includes an alert indicating projection or element 544c in the form of an "X". The projection 544c is generally aligned with the red LED 546d of the PCB assembly 546 and is at least partially received through or aligned with a correspondingly formed or shaped aperture 542c in housing 542, such that red light emitted by the red LED is viewable as a red "X" to indicate to the driver of the vehicle that an object is detected (so as to alert the driver of the object and to indicate that the driver should not change lanes to that side).

[0073] As shown in FIG. 18, housing 514 of mirror assembly 510 includes an aperture 514b formed at an inner wall or portion 520 of housing 514. The housing 514 includes a mounting portion 514a for indicator module 518. As shown in FIG. 22, mounting portion 514a includes a pair of tabs 514c that are formed to engage the arms 542a of housing 542 of indicator module 518 and a pocket or recess 514d for receiving a portion of housing 542 therein, in order to mount and retain indicator module 518 at housing 514 of mirror assembly. The pocket 514d receives an end portion of the indicator module housing to set and retain the indicator housing at a location such that the outer surface of the indicator module housing is substantially flush with the mirror housing. Indicator module 518 thus is attached to mounting portion 514a of mirror housing 514, and the wire harness and connector 548 may be readily connected to terminals 546b of indicator module 518, as shown in FIGS. 19 and 20, either before or after indicator module 518 is attached to the mounting portion 514a.

[0074] After the electrical connection is made and after the indicator module is attached to the mounting portion 514a, the back cap 540 may be readily attached to the mirror housing 514 to substantially close the aperture 514b in mirror housing 514 and to cover a portion of and partially surround indicator module 18. As can be seen in FIGS. 20, 21 and 23, the housing 542 of indicator module 518 includes a raised portion 542d that protrudes slightly outward from the outer surface of the housing, and the back cap 540 is formed with a slot 540a that receives or partially surrounds the raised portion 542d at the inner side of the mirror assembly. The back cap 540 may include a pocket 540b for receiving a tab 542e of housing 542 when back cap 540 is attached to the mirror housing so as to set the back cap to be substantially flush with the outer surface of the indicator module when the back cap is attached to the mirror housing and partially surrounds the indicator module. As shown in FIG. 23, the edges of the slot 540a may be tapered or otherwise formed to engage the edges of the raised portion 542d and the thickness of the back cap 540 and the height of the raised portion 542d are selected to be substantially similar so that the back cap 540 and outer surface of the raised portion 542d provide a substantially flush surface at the inner side of the mirror assembly. Optionally, other means for retaining or connecting the back cap to the indicator module in a flush manner may be implemented, such as a tongue and groove configuration or the like.

[0075] Optionally, if the indicator module is not selected for the mirror assembly, a blank out element or cover element may be provided at the receiving portion (and may snap into the receiving portion in a similar manner as the indicator module as described above) or the back cap or cover element may include a portion that extends over the receiving portion so as to substantially cover/conceal the receiving portion when an indicator module is not installed thereat, or the mirror casing may be provided without an aperture or receiving portion at the inboard portion. Thus, the inboard portion of a mirror casing that does not include a blind spot indicator module may have a substantially flush or continuous or un-interrupted surface due to the absence of or lacking of an aperture or receiving portion or module thereat.

[0076] Optionally, and with reference to FIGS. 24-27B, an exterior rearview mirror assembly 510' for a vehicle includes a reflective element 512' and a mirror shell or casing or housing 514'. Mirror assembly 510' includes a blind spot indicator module 518' at an inboard portion or surface 520' of an inner wall 524' of the mirror housing 514' of mirror assembly 510'. Blind spot indicator module 518' is mounted in an aperture 514b' formed at the housing 514', and the mirror assembly 510' includes a back cap 540' that may substantially cover a portion of the housing 514', and may cover or close or substantially seal an aperture 514c' of housing 514', such as described above. Blind spot indicator module 518' may be substantially similar to blind spot indicator module 518, discussed above, and includes a housing 542', a lens element or optic element 544' (such as a clear lens with graphics, such as an ISO icon and/or diffusion and/or the like, and a hardcoat or the like), a printed circuit board or PCB assembly 546' (which may include multiple LEDs or the like, and may comprise a slave design with minimal current control), a potting element 549' at the PCT assembly and housing (such as a black potting element or material or the like) and a gasket 547' (such as a die-cut foam or other suitable gasket material). Because blind spot indicator module 518' may be substantially similar to blind spot indicator module 518, discussed above, a detailed discussion of the blind spot indicator modules will not be repeated herein. The indicator module may be generally square-shaped and relatively small and readily attachable to the mirror assembly. For example, an exemplary embodiment of the module may be about 15 mm thick, and about 37 mm long and about 37 mm wide or thereabouts. However, other sized and/or shaped modules may be implemented while remaining within the spirit and scope of the present invention.

[0077] As can be seen in FIG. 24, lens element 544' blind spot indicator module 518' includes a raised portion 544b' that protrudes outward from the outer surface of the housing 542' when lens element is received therein (as can be seen in FIGS. 25A and 25B), and the aperture 514b' in mirror housing 514' is formed to at least partially receive the raised portion 544b' therethrough when the indicator module 518' is mounted at the inner side of the mirror housing 514'. As shown in FIG. 26, a cover element or close-out element 550' may be provided at the indicator module 518' to provide a custom, flush close-out (such as a close-out element having a clear or transparent or translucent center region and an opaque or dark colored outer region) at and around the raised portion 544b' and at the aperture 514b' of the mirror housing 514'.

[0078] The mirror housing 514' includes a second aperture 514c' to facilitate insertion of and mounting of the indicator module at the aperture 514b' from outside the mirror assembly 510'. The back cap 540' may be attached to the mirror housing 514' to substantially close and seal the aperture 514c' after the indicator module 518' is mounted at the inner side of the mirror housing 514' (and after the electrical connection of the indicator module terminals 546b' to the wire harness 548 is made). The raised portion 544b' is received into the close-out element 550' and the outer surfaces of the close-out element and of the raised portion 544b' of the indicator module are substantially flush with the inward facing surface of the inner side of the mirror housing 514' so as to provide a substantially flush surface at the inner side of the mirror assembly.

[0079] Optionally, and with reference to FIGS. 28-31B, an exterior rearview mirror assembly 510" for a vehicle includes a reflective element 512" and a mirror shell or casing or housing 514". Mirror assembly 510" includes a blind spot indicator module 518" at an inboard portion or surface 520" of an inner wall 524" of the mirror housing 514" of mirror assembly 510". Blind spot indicator module 518" is mounted in an aperture 514b" formed at the housing 514", and the mirror assembly 510" includes a back cap 540" that may substantially cover a portion of the housing 514", and may cover or close or substantially seal an aperture 514c" of housing 514", such as described above. Blind spot indicator module 518" may be substantially similar to blind spot indicator modules 518, 518', discussed above, and includes a housing or backplate 542" (which may include insert molded water proof connectors or the like), a lens element or close-out element 544", and a printed circuit board or PCB assembly 546". Because blind spot indicator module 518" may be substantially similar to blind spot indicator modules 518, 518", discussed above, a detailed discussion of the blind spot indicator modules will not be repeated herein. The indicator module may be relatively small and readily attachable to the mirror assembly. For example, an exemplary embodiment of the module may be about 15 mm thick, and about 33 mm long and about 23 mm wide or thereabouts. However, other sized and/or shaped modules may be implemented while remaining within the spirit and scope of the present invention.

[0080] The backplate 542" includes electrically conductive terminals 542a" that terminate at a connector 542b" for electrically connecting the indicator module 518" to an electrical wire or connector 548" of the vehicle. The terminals 542a" connect to the PCB assembly 546" to electrically power or energize the illumination sources (such as two amber LEDs 546c" and one red LED 546d") established thereon (other circuitry, such as resistors and diodes and the like may also be established on the PCB assembly without affecting the scope of the present invention). The close-out element 544" may comprise any suitable material to provide the desired appearance of the indicator module. For example, the close-out element 544" may comprise an insert molded film with a 3M light control film (such as the types described in U.S. provisional application Serial No. 60/783,496, filed Mar. 18, 2006 (Attorney Docket DON01 P-1272); and International PCT Application No. PCT/US2006/18567, filed May 15, 2006 by Donnelly Corp. for VEHICLE MIRROR ASSEMBLY WITH INDICIA AT REFLECTIVE ELEMENT (Attorney Docket DON01 FP-1274(PCT)), which are hereby incorporated herein by reference in their entireties), and may have a hard coat, graphics and/or diffusing element established thereon or thereat.

[0081] As can be seen in FIGS. 29A and 29B, the close-out element 544" includes an outer portion 544a" that has a larger perimeter than an inner portion 544b" of the element 544". The outer portion may be countersunk or received in a recess formed in the mirror housing 514" and at the aperture 514b", so that the outer surface of the outer portion 544a" is substantially flush with the outer surface of the inner side of the mirror housing 514" when the indicator module 518" is mounted to the mirror housing 514". The indicator module 518" thus may be inserted or plugged into the mirror housing from the outside and the electrical connection may be made before the module is plugged in or after (such as by reaching through another aperture 514c" in the housing 514"), whereby the outer surface of the indicator module is substantially flush with the outer surface of the mirror housing. The cover or back cap 540" may be attached to the mirror housing to cover and/or close/seal the aperture 514c" at the housing.

[0082] Therefore, the blind spot indicator module of the present invention may comprise a "plug-in" module that may be readily installed and connected to the mirror housing and electrical wiring from the outside of the mirror assembly. The indicator module is countersunk into an aperture in the mirror housing so that the outer surfaces of the indicator module and the mirror housing end up being substantially flush with one another so as to preserve the vehicle styling and aerodynamic streamlining of the vehicle, and thus limit or substantially preclude creating any wind noise. Also, because the outer surfaces are substantially flush, the indicator module limits or avoids providing a site where frost, debris or snow may gather.

[0083] The indicator module may thus be readily installed and connected at a mirror assembly and the back cap or cover may be attached to the mirror housing to substantially close or seal the aperture or apertures at which the indicator module is installed. The cap or cover thus closes the mirror housing and may also provide the desired exterior surface or styling for the particular vehicle at which the mirror assembly is attached. The mirror assembly thus may be shipped with or without the indicator module, whereby the indicator module may be readily installed to the mirror assembly by an operator at the mirror manufacturer or at the vehicle assembly plant or facility.

[0084] The indicator module may provide a standard or substantially universal module that establishes a seal at the aperture with the desired lighting and indicia for the blind spot detection system. The indicator module may provide a desired lighting and may direct or guide or control the light in a desired direction. The cover or close-out element or custom lens may be customized for the particular vehicle application, and may provide a desired or selected appearance for the indicator depending on the particular vehicle application. For example, the custom lens or close-out element may have an optical element (such as to transmit light in a desired manner or direction) or other indicial or characteristics depending on the desired appearance and/or affect of the element that is desired by the vehicle or mirror manufacturer.

[0085] The blind spot indicator module may include indicia or icons at the lens element so that a person viewing the indicator module may readily discern the function of the module. During operation, the driver need not recognize the icons, but only needs to recognize or discern that the amber or red illumination sources are activated. However, when the module is not activated and a person is viewing the mirror assembly, the icons or indicia indicate the function of the indicator module so a person viewing the mirror assembly recognizes that the module is associated with a blind spot detection system. The icons thus are preferably established at the surface of the lens element of the indicator module, such as by stenciling, printing, or the like (or by providing optical facets or the like) so as to convey to the consumer / viewer what the indicator module is for when it is not in use. The indicator module or unit (or cover or lens thereof) thus may include or provide an icon or iconistic display that is indicative of the function of the indicator module, and that is discernible by the driver of the vehicle even when the icon or icons are not illuminated by the illumination source or illumination sources.

[0086] Desirably, the principal light radiating axis of the indicator module or unit coincides generally with a line drawn between the indicator module and the center of an eye ellipse of a driver sitting with the driver seat of the vehicle set at a standard position for that vehicle model and such as is known in the automotive arts. Such a line angle may be established by the structure (such as by molding or the like of the structure) of the indicator module housing and/or lens element or by the mirror housing itself, or the line angle may established by how the indicator module is received in the mounting area of the mirror housing, or by any other suitable means. The angling or direction of the indicator module thus may be set via the mirror housing or the indicator module itself, and may be set according to the vehicle line or application and according to which side of the vehicle the indicator module is mounted.

[0087] The blind spot indicator or indicator module of the present invention thus is positioned at the inboard portion of the exterior mirror and thus is positioned at an area that is readily viewable by the driver of the host vehicle. Because an exterior rearview mirror for a vehicle is formed to be angled for aerodynamic and aesthetic purposes, the exterior rearview mirror typically has an inboard portion or wall of the casing that is contoured or formed to be sloping outwardly and away from the vehicle, so as to provide a wall that is generally facing toward the driver of the vehicle so that the portion is readily viewable by the driver of the vehicle. This outwardly sloping portion or wall provides a location for the blind spot/LCA indicator of the present invention, where the indicator is readily viewable by the driver of the host vehicle, but is substantially hidden from the view of drivers of other vehicles at or near the host vehicle. Since the inboard wall or side or portion is not a primary viewing area, the blind spot indicator may be located at this portion without adversely affecting the styling lines and appearance of the mirror assembly. Optionally, a cowling or cover element or dome element or baffle or louver or the like may be provided at the mirror shell or support arm to further restrict the view of the indicator by drivers of other vehicles.

[0088] Typically, the mirror reflective element is recessed slightly within the cavity of the mirror shell, and it is not uncommon to have water beads, dirt, ice and the like build up in that area, since that area is sheltered from and is not directly exposed to the wind or slip stream as the vehicle travels along the road. By placing the indicator at the inboard wall or portion of the exterior mirror, the indicator is located in the slip stream and thus is exposed to the wind as the vehicle travels along the road. The blind spot indicator thus may be more visible to the driver of the host vehicle, since ice build up and/or debris build up is less likely in this area and since any water or ice or dirt or other debris or contaminants are often blown away from where the indicator is located, thus enhancing its visibility to the driver. Also, because the blind spot indicator is closer to the window (through which the driver views the indicator), the indicator is more readily viewable in fog or hazy conditions or other extreme weather conditions, such as during a snow storm or rain storm or the like, even if the driver cannot readily view the mirror reflective element of the exterior mirror.

[0089] The blind spot indicator thus is positioned at a location that is closer than conventional or known external indicators (which are typically located at the outboard upper corner of the reflective element) may be seen and discerned by the driver of the host vehicle even when the driver is not viewing the reflective element of the exterior rearview mirror. Because the blind spot indicator is located at the side or inboard portion of the mirror assembly or casing, the blind spot indicator may be relatively large (such as compared to indicators at the reflective element) to enhance viewing of the indicator, since the size of the indicator is not limited by the viewing requirements at the reflective element. For example, the blind spot indicator of the present invention may provide a viewing area dimension of preferably at least about one square centimeter, and more preferably at least about two square centimeters, and more preferably at least about four square centimeters. The size of the blind spot indicator thus may be selected to provide a desired viewing area, and is less fettered by the design constraints and regulations of the exterior mirror.

[0090] The blind spot indicator thus may be sized to provide the desired appearance and viewability/discernibility and may be positioned at the inboard portion in a manner that does not interfere with the movable parts of the exterior mirror assembly. Also, by locating the blind spot indicator at the inboard portion of the exterior rearview mirror assembly, the indicator is naturally occluded by the exterior mirror from the view of the driver of another vehicle or any other person outside of the host vehicle. The blind spot indicator of the present invention thus may be provided at the desired size, shape and location, and thus provides the potential for enhanced flexibility in the design and implementation of the blind spot indicator, since the size, shape and design of the indicator is not constrained by the regulations and limitations otherwise applicable at the reflective element of the exterior mirror.

[0091] The blind spot indicator preferably is fixedly positioned at the inboard portion of the mirror assembly (such as substantially within the mirror shell or casing and visible at the inner or inboard shell wall at or near or adjacent to the driver side or passenger side front window, depending on whether it is a driver side or pass side mirror). However, it is envisioned that the blind spot indicator may be adjustable (such as via a user input within the vehicle cabin) to direct the indicator toward the particular driver's head area. The indicator may be adjusted by the driver of the host vehicle to enhance viewing of the indicator by the driver. The indicator may be adjusted separately from any adjustment of the reflective element so that the indicator may be adjusted toward the driver's head area and irrespective of the desired adjustment of the reflective element of the exterior rearview mirror. The indicator and any adjustment or alignment thereof may utilize aspects of the alignment device described in U.S. Pat. No. 6,598,982, which is hereby incorporated herein by reference in its entirety.

[0092] The blind spot indicator thus is operable to provide an indication to the driver of the host vehicle that an object or other vehicle has been detected in the lane or area adjacent to the side of the host vehicle. The blind spot indicator may be operable in association with a blind spot detection system, which may include an imaging sensor or sensors, or ultrasonic sensor or sensors, or sonar sensor or sensors or the like. For example, the blind spot detection system may utilize aspects of the blind spot detection and/or imaging systems described in U.S. Pat. Nos. 6,882,287; 6,198,409; 5,929,786; and/or 5,786,772, and/or U.S. pat. applications, Ser. No. 10/427,051, filed Apr. 30, 2003 by Pawlicki et al. for OBJECT DETECTION SYSTEM FOR VEHICLE, now U.S. Pat. No. 7,038,577 (Attorney Docket DON01 P-1075); Ser. No. 11/315,675, filed Dec. 22, 2005 (Attorney Docket DON01 P-1253); and/or Ser. No. 11/239,980, filed Sep. 30, 2005 (Attorney Docket DON01 P-1238), and/or U.S. provisional applications, Ser. No. 60/717,093, filed Sep. 14, 2005 by Lynam for DISPLAY DEVICE FOR EXTERIOR REARVIEW MIRROR (Attorney Docket DON01 P-1240); Ser. No. 60/638,687, filed Dec. 23, 2004 by Higgins-Luthman for OBJECT DETECTION SYSTEM FOR VEHICLE (Attorney Docket DON01 P-1195); Ser. No. 60/628,709, filed Nov. 17, 2004 by Camilleri et al. for IMAGING AND DISPLAY SYSTEM FOR VEHICLE (Attorney Docket DON01 P-1188); Ser. No. 60/614,644, filed Sep. 30, 2004 (Attorney Docket DON01 P-1177); and/or Ser. No. 60/618,686, filed Oct. 14, 2004 by Laubinger for VEHICLE IMAGING SYSTEM (Attorney Docket DON01 P-1183), and/or of the reverse or backup aid systems, such as the rearwardly directed vehicle vision systems described in U.S. Pat. Nos. 5,550,677; 5,760,962; 5,670,935; 6,201,642; 6,396,397; 6,498,620; 6,717,610 and/or 6,757,109, and/or U.S. pat. application, Ser. No. 10/418,486, filed Apr. 18, 2003 by McMahon et al. for VEHICLE IMAGING SYSTEM, now U.S. Pat. No. 7,005,974 (Attorney Docket DON01 P-1070), and/or of the automatic headlamp controls described in U.S. Pat. Nos. 5,796,094 and/or 5,715,093; and/or U.S. pat. applications, Ser. No. 11/105,757, filed Apr. 14, 2005 by Schofield et al. for IMAGING SYSTEM FOR VEHICLE (Attorney Docket DON01 P-1208); and/or Ser. No. 11/105,757, filed Apr. 14, 2005 (Attorney Docket DON01 P-1208); and/or U.S. provisional application, Ser. No. 60/607,963, filed Sep. 8, 2004 by Schofield for IMAGING SYSTEM FOR VEHICLE (Attorney Docket DON01 P-1170), and/or of the rain sensors described in U.S. Pat. Nos. 6,250,148 and 6,341,523, and/or of other imaging systems, such as the types described in U.S. Pat. Nos. 6,353,392 and 6,313,454, which may utilize various imaging sensors or imaging array sensors or cameras or the like, such as a CMOS imaging array sensor, a CCD sensor or other sensors or the like, such as the types disclosed in commonly assigned, U.S. Pat. Nos. 5,550,677; 5,760,962; 6,097,023 and 5,796,094, and U.S. pat. applications, Ser. No. 09/441,341, filed Nov. 16, 1999 by Schofield et al. for VEHICLE HEADLIGHT CONTROL USING IMAGING SENSOR (Attorney Docket DON01 P-770); and/or Ser. No. 10/534,632, filed May 11, 2005 (Attorney Docket DON01 P-1118), and/or PCT Application No. PCT/US2003/036177 filed Nov. 14, 2003, published Jun. 3, 2004 as PCT Publication No. WO 2004/047421 A3 (Attorney Docket DON01 FP-1118(PCT)), with all of the above referenced U.S. patents, patent applications and provisional applications and PCT applications being commonly assigned and being hereby incorporated herein by reference in their entireties.

[0093] Optionally, the indicator of the present invention may alert the driver of the host vehicle of other situations or status or the like. For example, the indicator could function to alert the driver of the host vehicle that the brake lights of the host vehicle are functioning properly. Other applications or uses of the indicator may be implemented, without affecting the scope of the present invention.

[0094] The reflective element of the rearview mirror assembly may comprise an electro-optic or electrochromic reflective element or cell, such as an electrochromic mirror assembly and electrochromic reflective element utilizing principles disclosed in commonly assigned U.S. Pat. Nos. 6,690,268; 5,140,455; 5,151,816; 6,178,034; 6,154,306; 6,002,544; 5,567,360; 5,525,264; 5,610,756; 5,406,414; 5,253,109; 5,076,673; 5,073,012; 5,117,346; 5,724,187; 5,668,663; 5,910,854; 5,142,407; and/or 4,712,879, and/or U.S. pat. applications, Ser. No. 10/054,633, filed Jan. 22, 2002 by Lynam et al. for VEHICULAR LIGHTING SYSTEM (Attorney Docket DON01 P-962); Ser. No. 11/021,065, filed Dec. 23, 2004 (Attorney Docket DON01 P-1193); and/or Ser. No. 11/226,628, filed Sep. 14, 2005 (Attorney Docket DON01 P-1236), and/or U.S. provisional applications, Ser. No. 60/681,250, filed May 16, 2005 (Attorney Docket DON01 P-1221); Ser. No. 60/690,400, filed Jun. 14, 2005 (Attorney Docket DON01 P-1225); Ser. No. 60/695,149, filed Jun. 29, 2005 (Attorney Docket DON01 P-1227); Ser. No. 60/730,334, filed Oct. 26, 2005 (Attorney Docket DON01 P-1250); Ser. No. 60/750,199, filed Dec. 14, 2005 (Attorney Docket DON01 P-1260); and Ser. No. 60/774,449, filed Feb. 17, 2006 (Attorney Docket DON01 P-1269); Ser. No. 60/783,496, filed Mar. 18, 2006 (Attorney Docket DON01 P-1272); and/or Ser. No. 60/692,113, filed Jun. 20, 2005 (Attorney Docket DON01 P-1224); and/or International PCT Application No. PCT/US2006/18567, filed May 15, 2006 by Donnelly Corp. for VEHICLE MIRROR

ASSEMBLY WITH INDICIA AT REFLECTIVE ELEMENT (Attorney Docket DON01 FP-1274(PCT)), which are all hereby incorporated herein by reference in their entireties, and/or as disclosed in the following publications: N. R. Lynam, "Electrochromic Automotive Day/Night Mirrors", *SAE Technical Paper Series* 870636 (1987); N. R. Lynam, "Smart Windows for Automobiles", *SAE Technical Paper Series* 900419 (1990); N. R. Lynam and A. Agrawal, "Automotive Applications of Chromogenic Materials", *Large Area Chromogenics: Materials and Devices for Transmittance Control*, C.M. Lampert and C.G. Granquist, EDS., Optical Engineering Press, Wash. (1990), which are hereby incorporated herein by reference in their entireties. The thicknesses and materials of the coatings on the substrates of the electrochromic reflective element, such as on the third surface of the reflective element assembly, may be selected to provide a desired color or tint to the mirror reflective element, such as a blue colored reflector, such as is known in the art and/or such as described in U.S. Pat. Nos. 5,910,854 and 6,420,036, and in PCT Application No. PCT/US03/29776, filed Sep. 9, 2003 by Donnelly Corp. et al. for MIRROR REFLECTIVE ELEMENT ASSEMBLY (Attorney Docket DON01 FP-1109(PCT)), and U.S. Patent Application Serial No. 10/528,269, filed Mar. 17, 2005, and published Mar. 9, 2006 as U.S. Patent Publication No. US-2006-0050356-A1 (Attorney Docket DON01 P-1109), which are all hereby incorporated herein by reference in their entireties.

[0095] Optionally, use of an elemental semiconductor mirror, such as a silicon metal mirror, such as disclosed in U.S. Pat. Nos. 6,286,965; 6,196,688; 5,535,056; 5,751,489; and 6,065,840, and/or in U.S. pat. application, Ser. No. 10/993,302, filed Nov. 19, 2004 by Lynam for MIRROR REFLECTIVE ELEMENT FOR A VEHICLE (Attorney Docket DON01 P-1186), which are all hereby incorporated herein by reference in their entireties, can be advantageous because such elemental semiconductor mirrors (such as can be formed by depositing a thin film of silicon) can be greater than 50 percent reflecting in the photopic (SAE J964a measured), while being also substantially transmitting of light (up to 20 percent or even more). Such silicon mirrors also have the advantage of being able to be deposited onto a flat glass substrate and to be bent into a curved (such as a convex or aspheric) curvature, which is also advantageous since many passenger-side exterior rearview mirrors are bent or curved.

[0096] Optionally, the reflective element may include a perimeter metallic band, such as the types described in PCT Application No. PCT/US03/29776, filed Sep. 19, 2003 by Donnelly Corp. et al. for ELECTROCHROMIC MIRROR ASSEMBLY (Attorney Docket DON01 FP-1109(PCT)); and/or PCT Application No. PCT/US03/35381, filed Nov. 5, 2003 by Donnelly

Corp. et al. for ELECTRO-OPTIC REFLECTIVE ELEMENT ASSEMBLY (Attorney Docket DON01 FP-1116(PCT)); and/or U.S. pat. applications, Ser. No. 11/021,065, filed Dec. 23, 2004 by McCabe et al. for ELECTRO-OPTIC MIRROR CELL (Attorney Docket DON01 P-1193); Ser. No. 10/528,269, filed Mar. 17, 2005, and published Mar. 9, 2006 as U.S. Patent Publication No. US-2006-0050356-A1 (Attorney Docket DON01 P-1109); Ser. No. 10/533,762, filed May 4, 2005 (Attorney Docket DON01 P-1116); and/or Ser. No. 11/226,628, filed Sep. 14, 2005 (Attorney Docket DON01 P-1236); and/or U.S. provisional applications, Ser. No. 60/692,113, filed Jun. 20, 2005 (Attorney Docket DON01 P-1224); Ser. No. 60/677,990, filed May 5, 2005 (Attorney Docket DON01 P-1219); Ser. No. 60/653,787, filed Feb. 17, 2005 (Attorney Docket DON01 P-1207); Ser. No. 60/642,227, filed Jan. 7, 2005 (Attorney Docket DON01 P-1199); Ser. No. 60/638,250, filed Dec. 21, 2004 (Attorney Docket DON01 P-1198); Ser. No. 60/624,091, filed Nov. 1, 2004 (Attorney Docket DON01 P-1184), and Ser. No. 60/609,642, filed Sep. 14, 2004 (Attorney Docket DON01 P-1171), which are hereby incorporated herein by reference in their entireties. Optionally, the reflective element may include indicia formed at and viewable at the reflective element, such as by utilizing aspects of the reflective elements described in U.S. provisional applications, Ser. No. 60/681,250, filed May 16, 2005 (Attorney Docket DON01 P-1221); Ser. No. 60/690,400, filed Jun. 14, 2005 (Attorney Docket DON01 P-1225); Ser. No. 60/695,149, filed Jun. 29, 2005 (Attorney Docket DON01 P-1227); Ser. No. 60/730,334, filed Oct. 26, 2005 (Attorney Docket DON01 P-1250); Ser. No. 60/750,199, filed Dec. 14, 2005 (Attorney Docket DON01 P-1260); and Ser. No. 60/774,449, filed Feb. 17, 2006 (Attorney Docket DON01 P-1269); Ser. No. 60/783,496, filed Mar. 18, 2006 (Attorney Docket DON01 P-1272), and International PCT Application No. PCT/US2006/18567, filed May 15, 2006 by Donnelly Corp. for VEHICLE MIRROR ASSEMBLY WITH INDICIA AT REFLECTIVE ELEMENT (Attorney Docket DON01 FP-1274(PCT)), which are all hereby incorporated herein by reference in their entireties.

[0097] Although shown and described as an electro-optic or electrochromic reflective element assembly or cell, the reflective element may comprise a single substrate with a reflective coating at its rear surface, without affecting the scope of the present invention. The mirror assembly thus may comprise a prismatic mirror assembly or other mirror having a single substrate reflective element, such as a mirror assembly utilizing aspects described in U.S. Pat. Nos. 6,318,870; 6,598,980; 5,327,288; 4,948,242; 4,826,289; 4,436,371; and 4,435,042; and PCT Application No. PCT/US04/015424, filed May 18, 2004 by Donnelly Corporation et al. for MIRROR ASSEMBLY FOR VEHICLE (Attorney Docket DON01 FP-

1150(PCT)); and U.S. pat. applications, Ser. No. 10/933,842, filed Sep. 3, 2004 (Attorney Docket DON01 P-1166); and/or Ser. No. 10/556,754, filed Nov. 15, 2005 (Attorney Docket DON01 P-1150), which are hereby incorporated herein by reference in their entireties. Optionally, the reflective element may comprise a conventional prismatic or flat reflective element or prism, or may comprise a prismatic or flat reflective element of the types described in PCT Application No. PCT/US03/29776, filed Sep. 19, 2003 by Donnelly Corp. et al. for MIRROR REFLECTIVE ELEMENT ASSEMBLY (Attorney Docket DON01 FP-1109(PCT)); U.S. pat. applications, Ser. No. 10/709,434, filed May 5, 2004 by Lynam for MIRROR REFLECTIVE ELEMENT (Attorney Docket DON01 P-1152); Ser. No. 10/933,842, filed Sep. 3, 2004 by Kulas et al. for INTERIOR REARVIEW MIRROR ASSEMBLY (Attorney Docket DON01 P-1166); Ser. No. 11/021,065, filed Dec. 23, 2004 by McCabe et al. for ELECTRO-OPTIC MIRROR CELL (Attorney Docket DON01 P-1193); Ser. No. 10/556,754, filed Nov. 15, 2005 (Attorney Docket DON01 P-1150); and/or Ser. No. 10/993,302, filed Nov. 19, 2004 by Lynam for MIRROR REFLECTIVE ELEMENT FOR A VEHICLE (Attorney Docket DON01 P-1186), and/or PCT Application No. PCT/US2004/015424, filed May 18, 2004 by Donnelly Corp. et al. for MIRROR ASSEMBLY FOR VEHICLE (Attorney Docket DON01 FP-1150(PCT)), which are all hereby incorporated herein by reference in their entireties, without affecting the scope of the present invention.

[0098] Optionally, the mirror assembly may include one or more displays, such as the types disclosed in U.S. Pat. Nos. 5,530,240 and/or 6,329,925, which are hereby incorporated herein by reference in their entireties, and/or display-on-demand or transflective type displays, such as the types disclosed in U.S. Pat. Nos. 6,690,268; 5,668,663 and/or 5,724,187, and/or in U.S. pat. applications, Ser. No. 10/054,633, filed Jan. 22, 2002 by Lynam et al. for VEHICULAR LIGHTING SYSTEM (Attorney Docket DON01 P-962); Ser. No. 11/021,065, filed Dec. 23, 2004 by McCabe et al. for ELECTRO-OPTIC MIRROR CELL (Attorney Docket DON01 P-1193); Ser. No. 10/528,269, filed Mar. 17, 2005 (Attorney Docket DON01 P-1109); Ser. No. 10/533,762, filed May 4, 2005 (Attorney Docket DON01 P-1116); Ser. No. 10/538,724, filed Jun. 13, 2005 by Hutzel et al. for ACCESSORY SYSTEM FOR VEHICLE (Attorney Docket DON01 P-1123); Ser. No. 11/226,628, filed Sep. 14, 2005 by Karner et al. (Attorney Docket DON01 P-1236); Ser. No. 10/993,302, filed Nov. 19, 2004 (Attorney Docket DON01 P-1186); and/or Ser. No. 11/284,543, filed Nov. 22, 2005 (Attorney Docket DON01 P-1245), and/or PCT Application No. PCT/US03/29776, filed Sep. 9, 2003 by Donnelly Corp. et al. for MIRROR REFLECTIVE ELEMENT ASSEMBLY (Attorney Docket DON01 FP-

1109(PCT)); and/or PCT Application No. PCT/US03/35381, filed Nov. 5, 2003 by Donnelly Corp. et al. for ELECTRO-OPTIC REFLECTIVE ELEMENT ASSEMBLY (Attorney Docket DON01 FP-1116(PCT)); and/or U.S. provisional applications, Ser. No. 60/630,061, filed Nov. 22, 2004 by Lynam et al. for MIRROR ASSEMBLY WITH VIDEO DISPLAY (Attorney Docket DON01 P-1189); Ser. No. 60/667,048, filed Mar. 31, 2005 by Lynam et al. for MIRROR ASSEMBLY WITH VIDEO DISPLAY (Attorney Docket DON01 P-1212); Ser. No. 60/629,926, filed Nov. 22, 2004 by McCabe et al. for METHOD OF MANUFACTURING ELECTRO-OPTIC MIRROR CELL (Attorney Docket DON01 P-1190); Ser. No. 60/531,838, filed Dec. 23, 2003 (Attorney Docket DON01 P-1132); Ser. No. 60/553,842, filed Mar. 17, 2004 (Attorney Docket DON01 P-1143); and Ser. No. 60/563,342, filed Apr. 19, 2004 (Attorney Docket DON01 P-1153), and/or PCT Application No. PCT/US03/40611, filed Dec. 19, 2003 by Donnelly Corp. et al. for ACCESSORY SYSTEM FOR VEHICLE (Attorney Docket DON01 FP-1123(PCT)), which are all hereby incorporated herein by reference in their entireties, or may include or incorporate video displays or the like, such as the types described in PCT Application No. PCT/US03/40611, filed Dec. 19, 2003 by Donnelly Corp. et al. for ACCESSORY SYSTEM FOR VEHICLE (Attorney Docket DON01 FP-1123(PCT)), and/or U.S. pat. applications, Ser. No. 10/538,724, filed Jun. 13, 2005 by Hutzel et al. for ACCESSORY SYSTEM FOR VEHICLE (Attorney Docket DON01 P-1123); and/or Ser. No. 11/284,543, filed Nov. 22, 2005 (Attorney Docket DON01 P-1245), and/or U.S. provisional applications, Ser. No. 60/630,061, filed Nov. 22, 2004 by Lynam et al. for MIRROR ASSEMBLY WITH VIDEO DISPLAY (Attorney Docket DON01 P-1189); and Ser. No. 60/667,048, filed Mar. 31, 2005 by Lynam et al. for MIRROR ASSEMBLY WITH VIDEO DISPLAY (Attorney Docket DON01 P-1212), which are hereby incorporated herein by reference in their entireties.

[0099] Optionally, the mirror assembly may include an imaging device, such as an imaging array sensor for imaging systems of the types described in U.S. Pat. Nos. 6,757,109; 6,717,610; 6,396,397; 6,201,642; 6,353,392; 6,313,454; 6,396,397; 5,550,677; 5,670,935; 5,796,094; 5,877,897; 6,097,023; and 6,498,620, and U.S. pat. applications, Ser. No. 09/441,341, filed Nov. 16, 1999 by Schofield et al. for VEHICLE HEADLIGHT CONTROL USING IMAGING SENSOR (Attorney Docket DON01 P-770), and Ser. No. 10/427,051, filed Apr. 30, 2003 by Pawlicki et al. for OBJECT DETECTION SYSTEM FOR VEHICLE, now U.S. Pat. No. 7,038,577 (Attorney Docket DON01 P-1075), which are all hereby incorporated herein by reference in their entireties.

[00100] Changes and modifications to the specifically described embodiments may be carried out without departing from the principles of the present invention, which is intended to be limited only by the scope of the appended claims as interpreted according to the principles of patent law.

Claims:

1. An exterior rearview mirror system for a vehicle, said exterior rearview mirror system comprising:

an exterior mirror assembly having a mirror casing, said mirror casing comprising a mirror portion including a reflective element and an attachment portion including an attachment for attaching said mirror assembly at an exterior side of a vehicle, said reflective element being adjustably supported by an actuator within said mirror portion of said mirror casing, said mirror casing having an inboard portion that faces generally toward the exterior side of the vehicle and is viewable by a driver of the vehicle when said exterior mirror assembly is attached at the exterior side of the vehicle;

a unitary indicator module at said inboard portion of said mirror casing, said unitary indicator module comprising an illumination source, said indicator module being responsive to a control signal to activate said illumination source to indicate to the driver a detected presence of an object at least one of alongside the vehicle and rearward of the vehicle, said unitary indicator module being substantially sealed so as to be substantially impervious to water; and

wherein said unitary indicator module is configured at said inboard portion of said mirror casing so that illumination of said illumination source is readily viewable by the driver of the vehicle and wherein said illumination of said illumination source is generally not viewed by other road users when said exterior rearview mirror assembly is mounted to the side of the vehicle and when the vehicle is operated on a road.

2. The exterior rearview mirror system of claim 1, wherein said unitary indicator module comprises an at least partially light transmitting cover that is viewable by the driver of the vehicle at said inboard portion.

3. The exterior rearview mirror system of claim 2, wherein said cover includes an icon that is indicative of the function of said unitary indicator module irrespective of actuation of said illumination source.

4. The exterior rearview mirror system of claim 1, wherein said unitary indicator module comprises a light directing element for directing illumination from said illumination source toward the side of the vehicle at which the exterior rearview mirror is mounted to enhance

viewing of said unitary indicator module by the driver of the vehicle when said illumination source is illuminated.

5. The exterior rearview mirror system of claim 1, wherein said unitary indicator module includes a housing and an optic element, said housing including at least one attaching element for attaching said unitary indicator module at said inboard portion.

6. The exterior rearview mirror system of claim 5, wherein said housing comprises a generally cylindrical-shaped structure.

7. The exterior rearview mirror system of claim 1, wherein said unitary indicator module is at least partially received within an aperture at said inboard portion of said mirror assembly.

8. The exterior rearview mirror system of claim 7, wherein said unitary indicator module includes an attaching element for attaching to said mirror assembly when said unitary indicator module is at least partially received within said aperture at said inboard portion.

9. The exterior rearview mirror system of claim 7, wherein said unitary indicator module includes an at least partially light transmitting cover that is one of (a) substantially flush with and (b) slightly to moderately proud of an outer surface of said inboard portion when said unitary indicator module is at least partially received within said aperture at said inboard portion.

10. The exterior rearview mirror system of claim 9, wherein said cover comprises an optical lens.

11. The exterior rearview mirror system of claim 1, wherein said unitary indicator module comprises a multi-stage indicator for indicating a degree of hazard of the detected object.

12. The exterior rearview mirror system of claim 11, wherein said multi-stage indicator comprises multiple illumination sources selectively operable to indicate the degree of hazard detected.

13. The exterior rearview mirror system of claim 11, wherein said multi-stage indicator provides a first indication when no object is detected at the side lane adjacent to the vehicle, a second indication when an object is detected that is approaching the side lane area, and a third indication when an object is detected that is occupying the side lane area.

14. The exterior rearview mirror system of claim 13, wherein said first, second and third indications provide at least one of (a) first, second and third color indications and (b) first, second and third indication modulations.

15. An exterior rearview mirror system for a vehicle, said exterior rearview mirror system comprising:

an exterior rearview mirror assembly having a mirror casing, said mirror casing comprising a mirror portion including a reflective element and an attachment portion including an attachment for attaching said mirror assembly at an exterior side of a vehicle, said reflective element being adjustably supported by an actuator within said mirror portion of said mirror casing, said mirror casing having an inboard portion that is viewable by a driver of a vehicle when said attachment portion attaches said mirror assembly at an exterior side of a vehicle;

a blind spot indicator fixedly disposed at said inboard portion of said mirror casing of said exterior mirror assembly, said blind spot indicator comprising at least one illumination source for indicating to the driver a detected presence of an object at at least one of alongside and rearward of the vehicle, said blind spot indicator indicating a degree of hazard of the detected object; and

wherein said blind spot indicator is configured at said inboard portion of said mirror casing so that illumination of said at least one illumination source is readily viewable by the driver of the vehicle and wherein said illumination of said at least one illumination source is generally non-viewable by other road users.

16. The exterior rearview mirror system of claim 15, wherein said blind spot indicator provides an icon that is indicative of the function of said blind spot indicator irrespective of actuation of said at least one illumination source.

17. The exterior rearview mirror system of claim 15, wherein said blind spot indicator comprises a multi-stage indicator for indicating the degree of hazard of the detected object.

18. The exterior rearview mirror system of claim 17, wherein said multi-stage indicator comprises multiple illumination sources selectively operable to indicate the degree of hazard detected.

19. The exterior rearview mirror system of claim 17, wherein said multi-stage indicator provides a first indication when no object is detected at the side lane adjacent to the vehicle, a second indication when an object is detected that is approaching the side lane area, and a third indication when an object is detected that is occupying the side lane area.

20. The exterior rearview mirror system of claim 19, wherein said first, second and third indications provide at least one of (a) a plurality of color indications and (b) a plurality of indication modulations.

21. A method of supplying an exterior rearview mirror system for a vehicle, said method comprising:

providing mirror casings, each of said mirror casings at least comprising a mirror portion including a reflective element, said reflective element being adjustably supportable by an actuator within said mirror portion of said mirror casing, each of said mirror casings having an inboard portion that faces generally toward the exterior side of the vehicle and that is viewable by a driver of the vehicle when said exterior mirror assembly is mounted at the exterior side of the vehicle;

providing at least some of said mirror casings with an aperture established at said inboard portion;

providing blind spot indicator units, each of said blind spot indicator units comprising at least one illumination source for indicating to the driver a detected presence of an object at at least one of alongside and rearward of the vehicle;

establishing first mirror assemblies by disposing said blind spot indicator units at said apertures of said inboard portions of said at least some of said mirror casings, said blind spot indicator units being at least partially received at said apertures;

establishing second mirror assemblies by providing mirror casings lacking an aperture established at said inboard portion; and supplying said first mirror assemblies to a vehicle manufacturing facility when inclusion of a blind spot indicator is required and supplying said second mirror assemblies to a vehicle manufacturing facility when inclusion of a blind spot indicator is not required.

22. The method of claim 21, wherein an exterior surface of said blind spot indicator unit is one of (a) substantially flush with and (b) at least slightly proud of a surface of said inboard portion when attached at said aperture of said inboard portion of said at least some of said mirror casings.

23. The method of claim 21, wherein one of said first and second mirror assemblies is selected for a particular vehicle by determining a desired optional content of each exterior rearview mirror assembly and selecting the first or second mirror assembly according to the determined desired optional content for the particular vehicle application.

24. The method of claim 21, wherein attaching said blind spot indicator unit comprises connecting said illumination source of said blind spot indicator unit to an electrical connector.

25. The method of claim 24, wherein said blind spot indicator unit is responsive to a control signal to activate said illumination source to indicate to the driver a detected presence of an object at least one of alongside the vehicle and rearward of the vehicle.

26. The method of claim 21, wherein said blind spot indicator unit comprises a unitary indicator module.

27. The method of claim 26, wherein said unitary indicator module includes a housing, an optic element and an electrical connector, said housing including at least one attaching element for attaching said unitary indicator module at said aperture of said inboard portion.

28. The method of claim 27, wherein attaching said blind spot indicator unit comprises making both the mechanical and electrical connections for said indicator module at said inboard portion of said mirror assembly.

29. The method of claim 22, wherein said blind spot indicator unit comprises a multi-stage indicator unit for indicating a degree of hazard of the detected object.

30. The method of claim 29, wherein said multi-stage indicator unit comprises multiple illumination sources selectively operable to indicate the degree of hazard detected.

31. The method of claim 29, wherein said multi-stage indicator unit provides a first indication when no object is detected at the side lane adjacent to the vehicle, a second indication when an object is detected that is approaching the side lane area, and a third indication when an object is detected that is occupying the side lane area.

32. The method of claim 21, wherein establishing second mirror assemblies comprises establishing second mirror assemblies by providing mirror casings with a cover element attached at said inboard portion of said mirror casings to cover an aperture at said inboard portion.

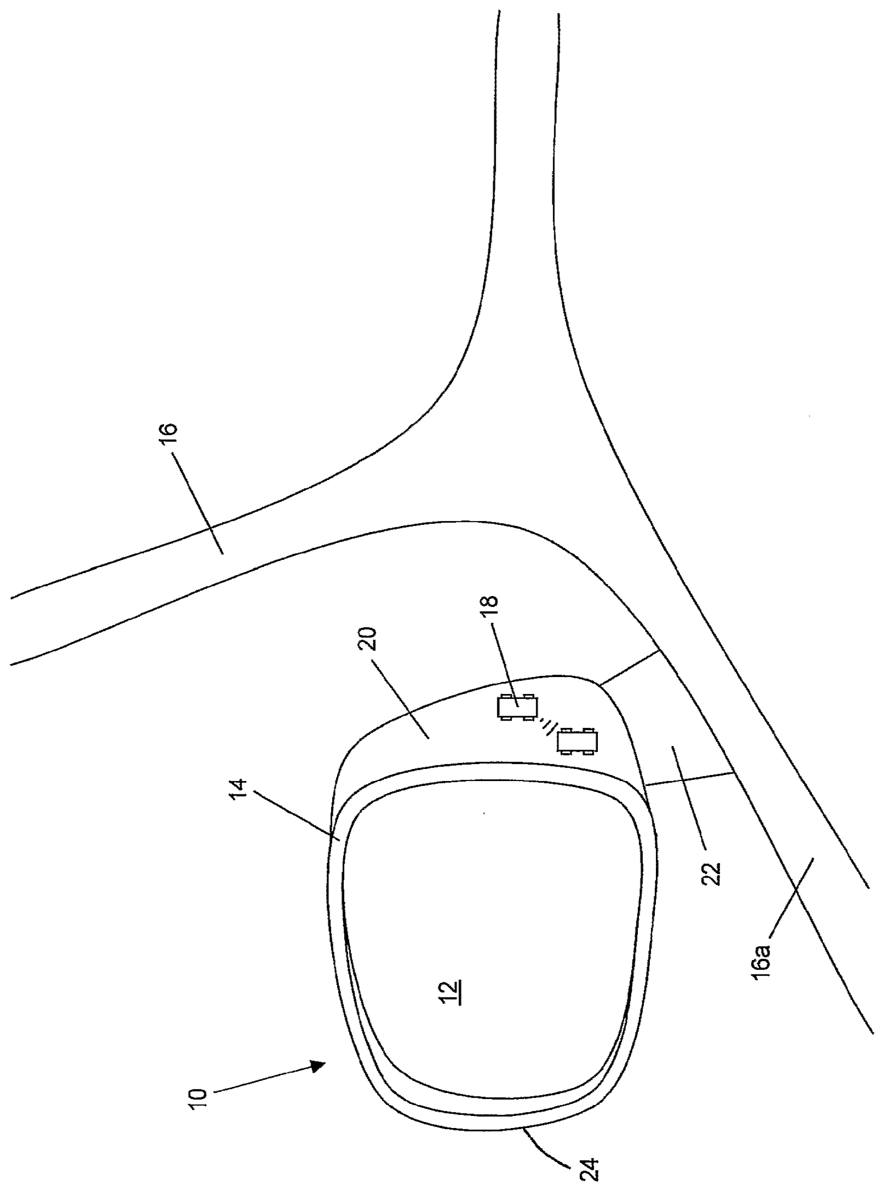

Fig. 1

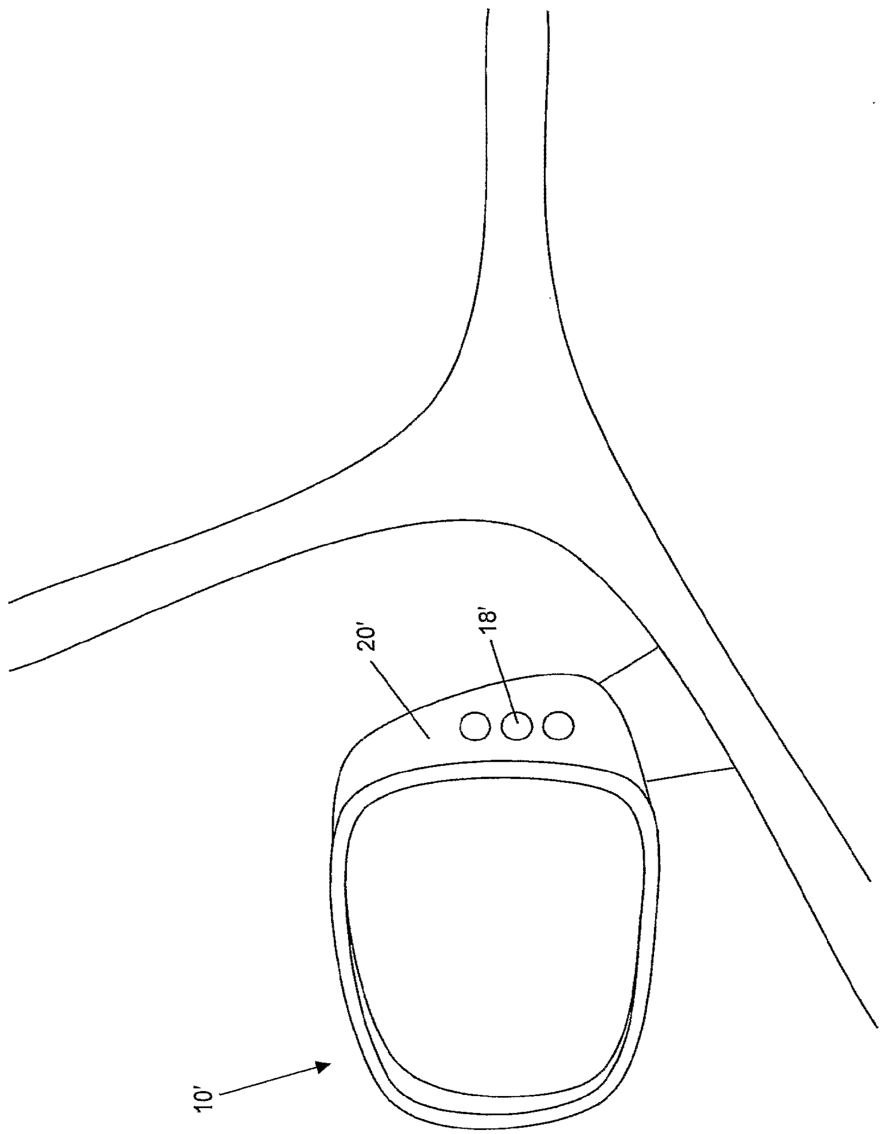

Fig. 2

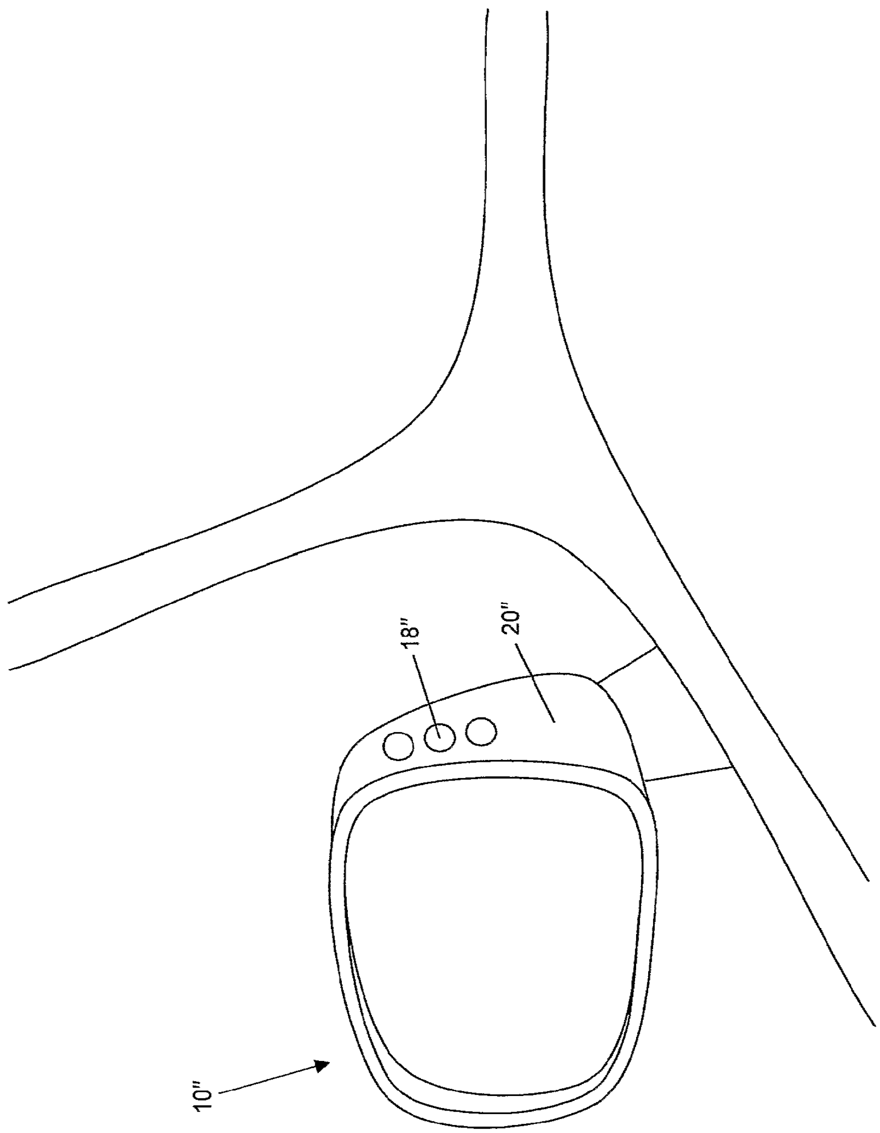

Fig. 2A

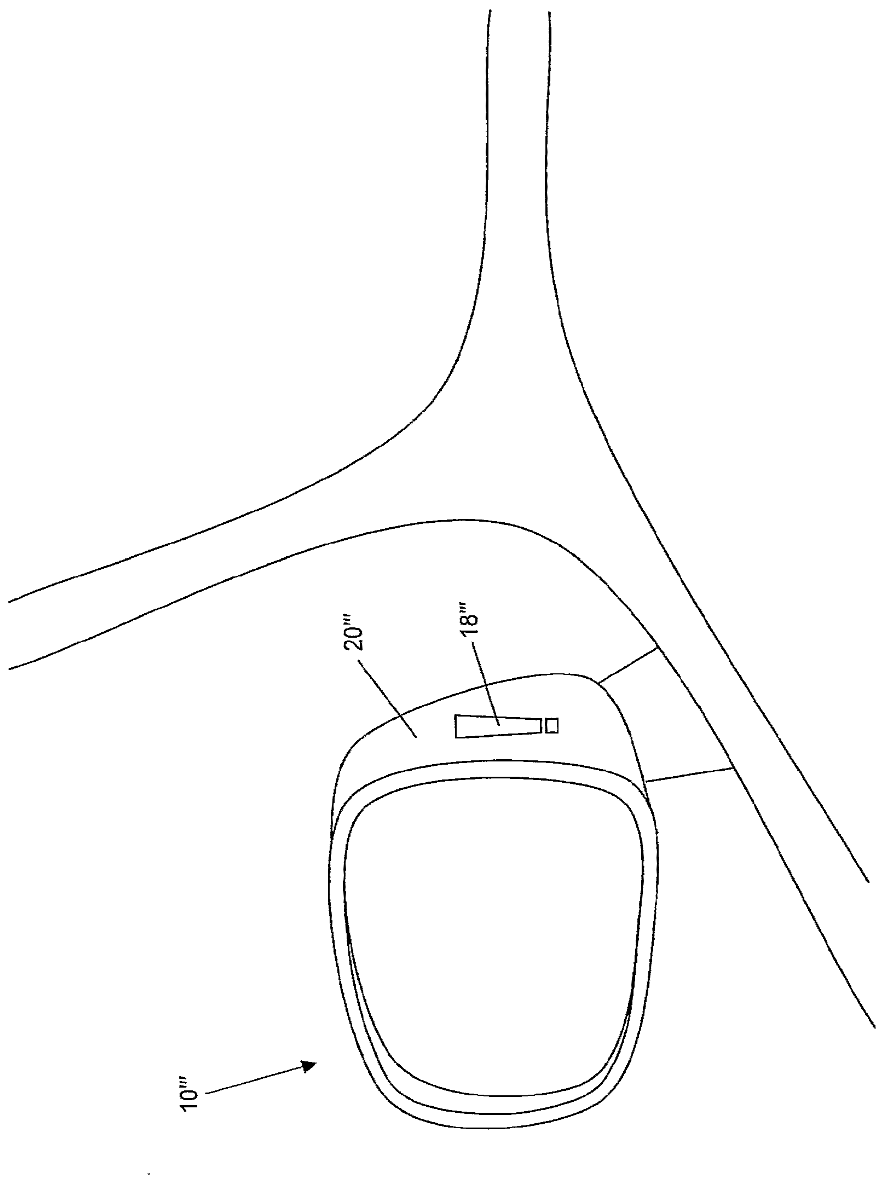

Fig. 3

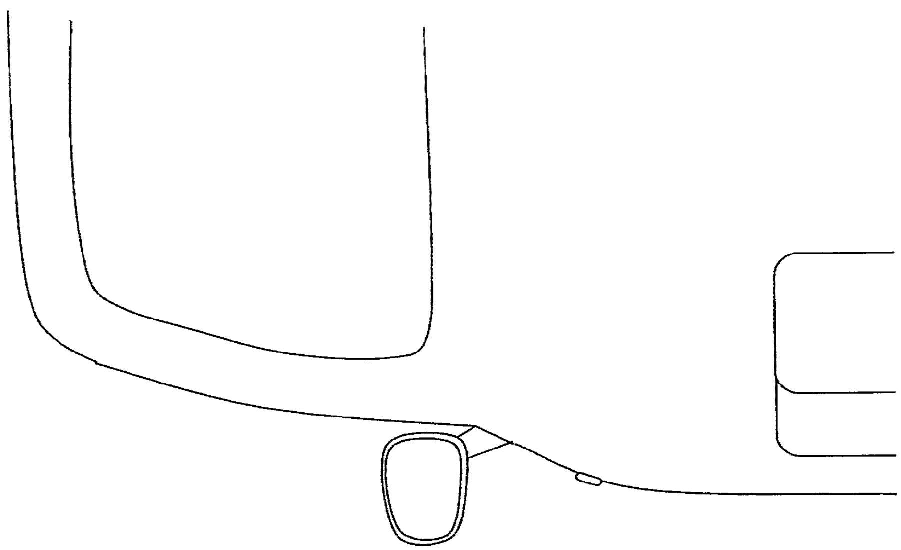

Fig. 4

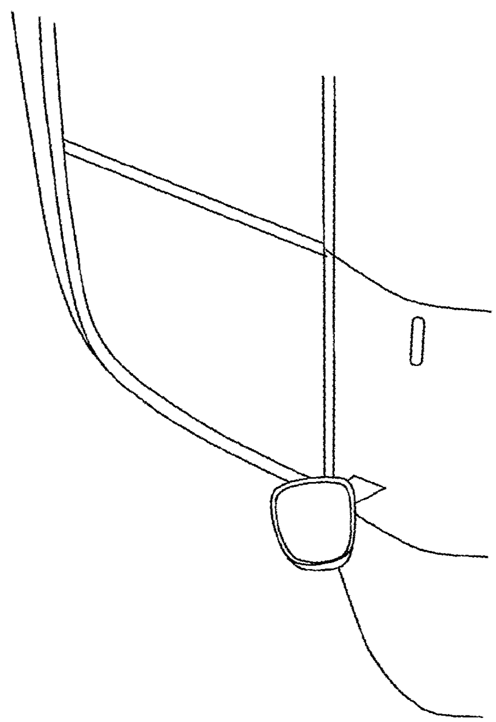

Fig. 5

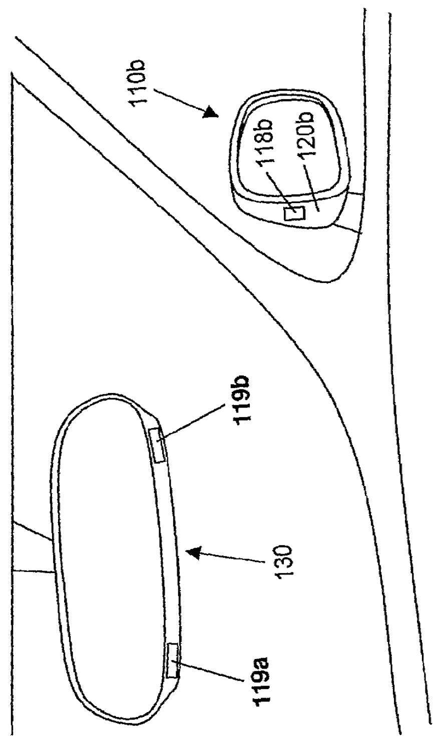

Fig. 6B

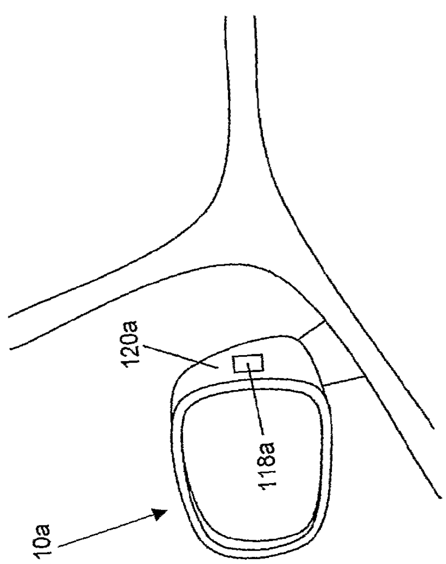

Fig. 6A

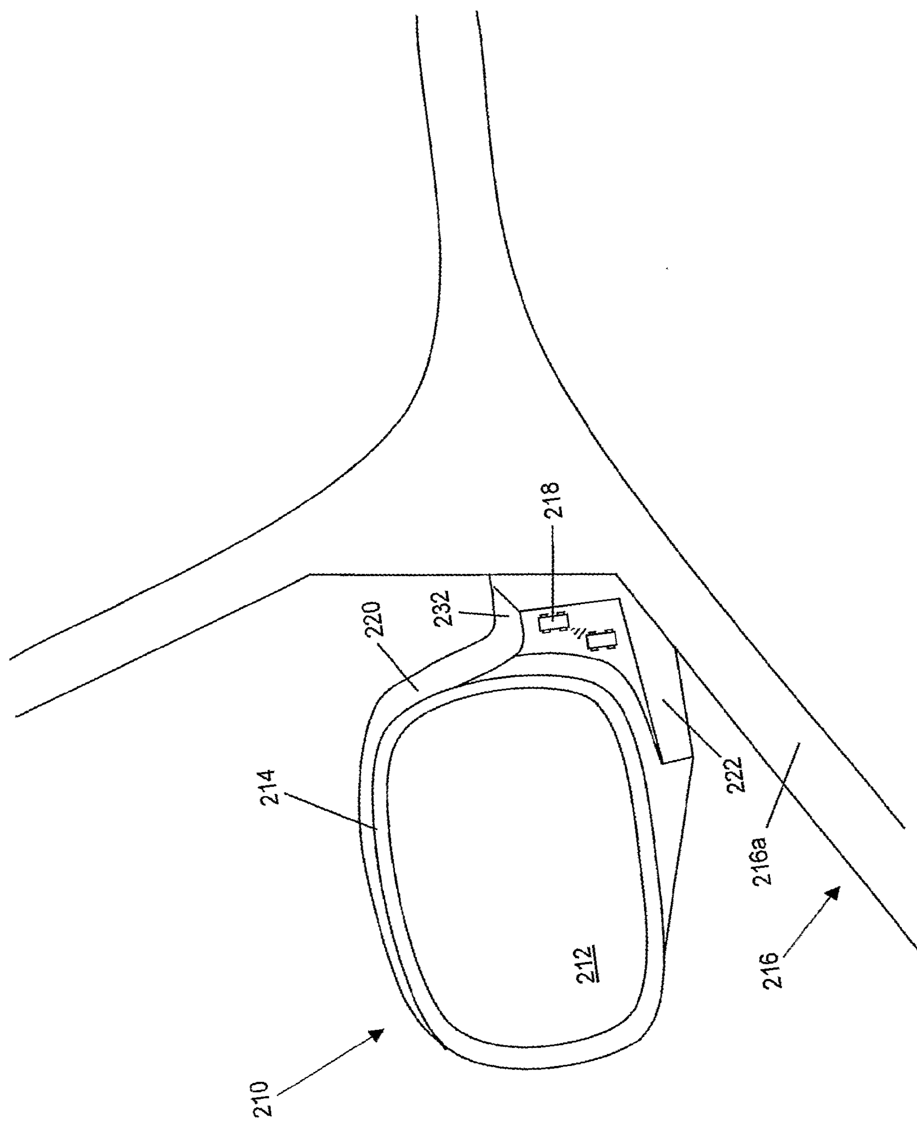

Fig. 7

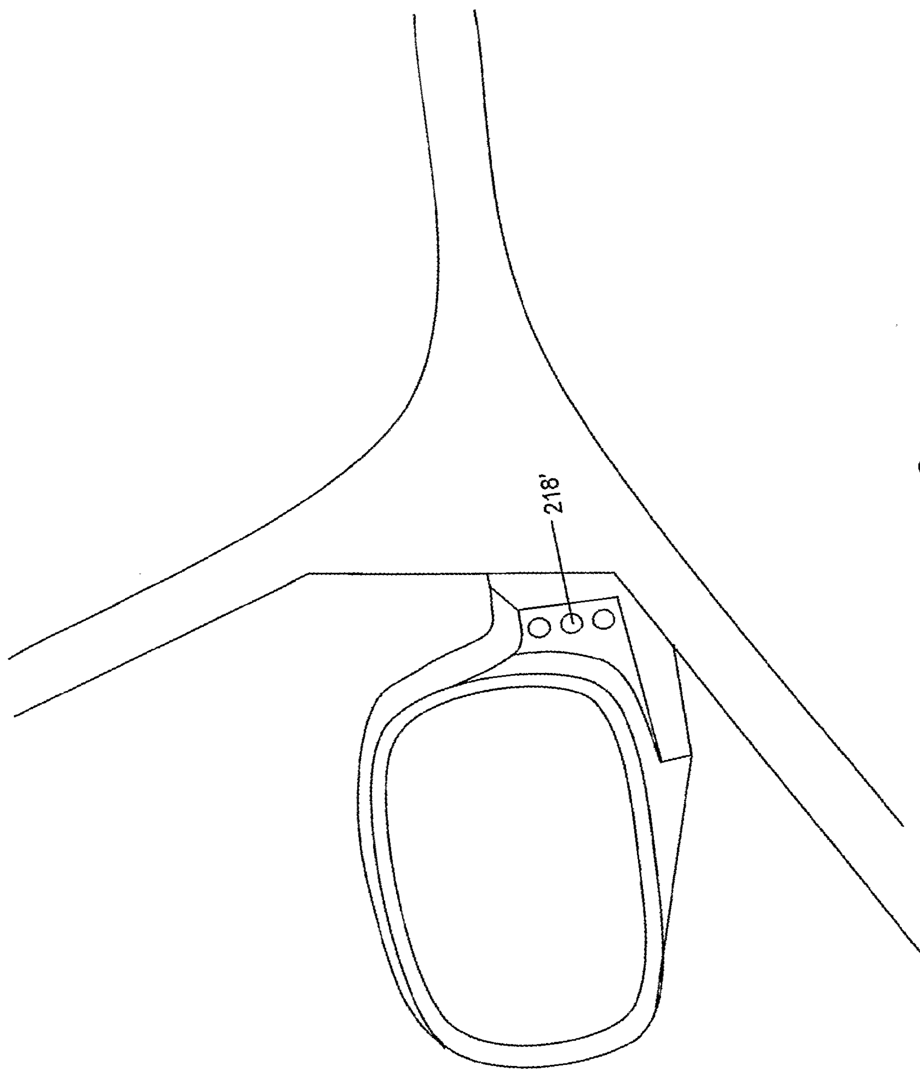

Fig. 8

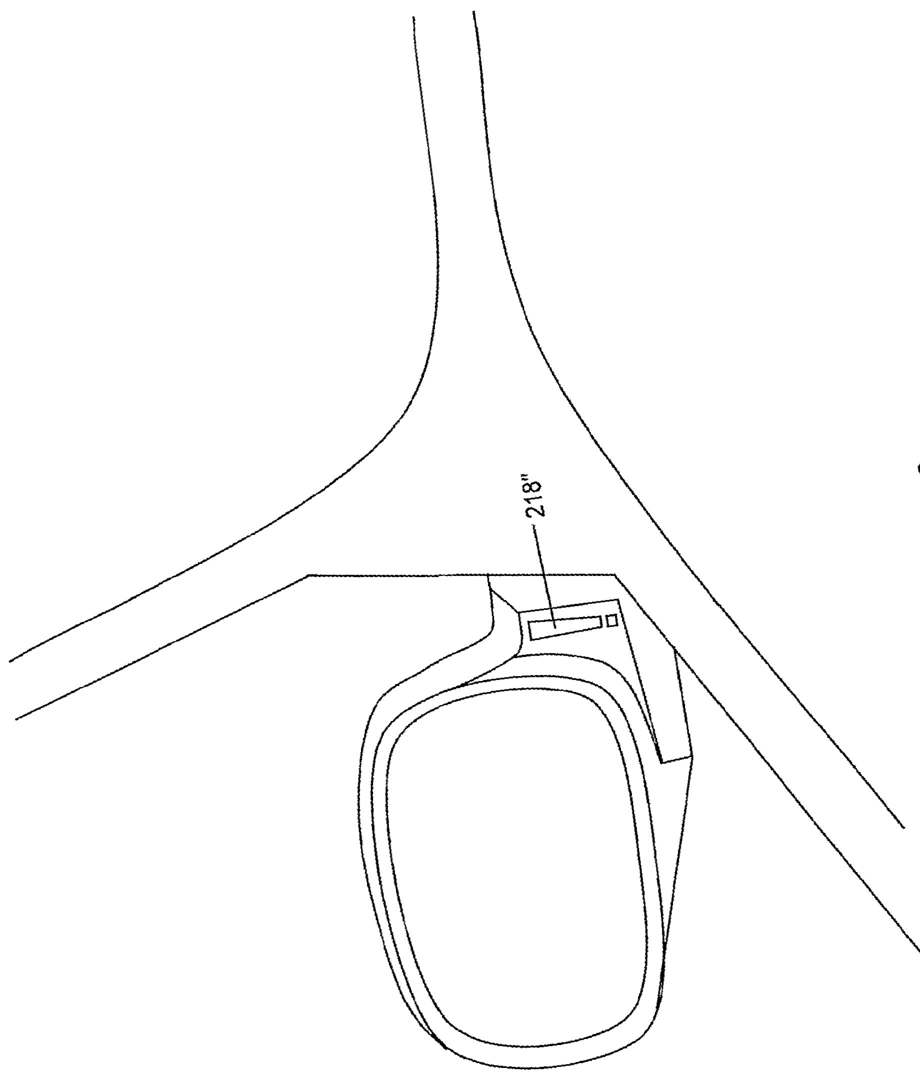

Fig. 9

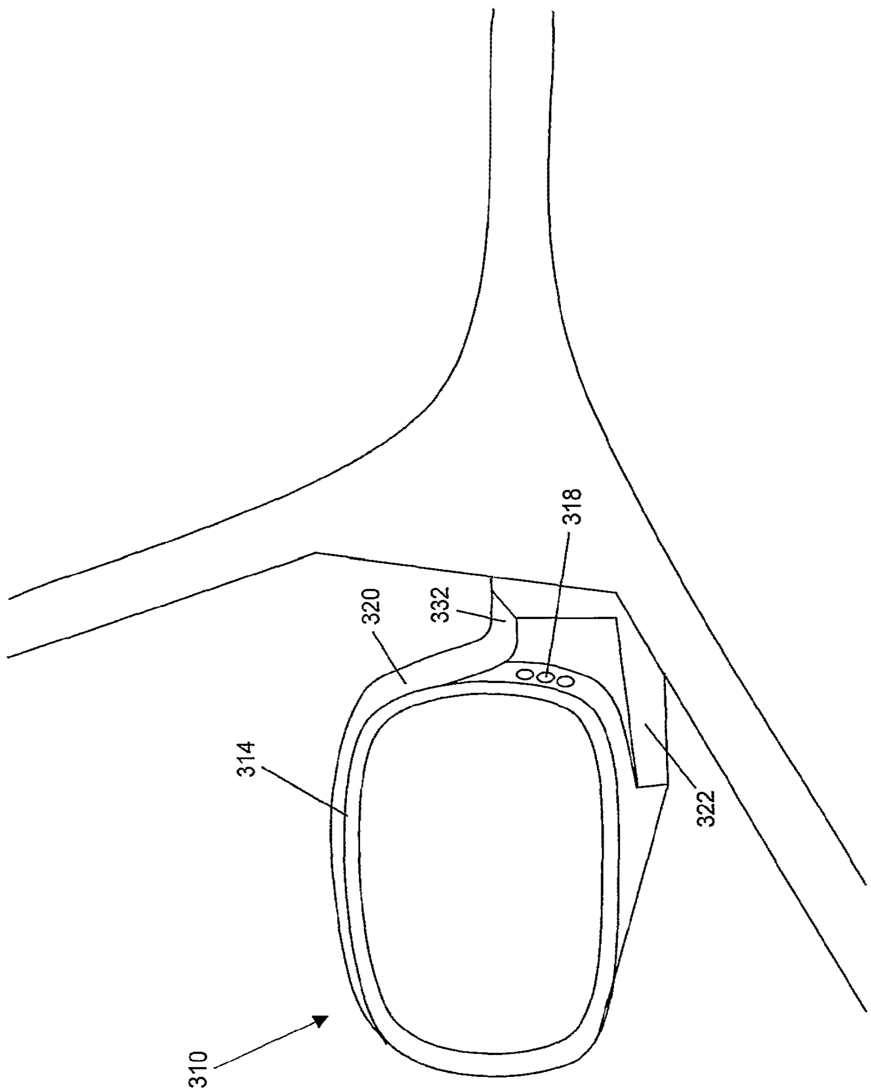

Fig. 10

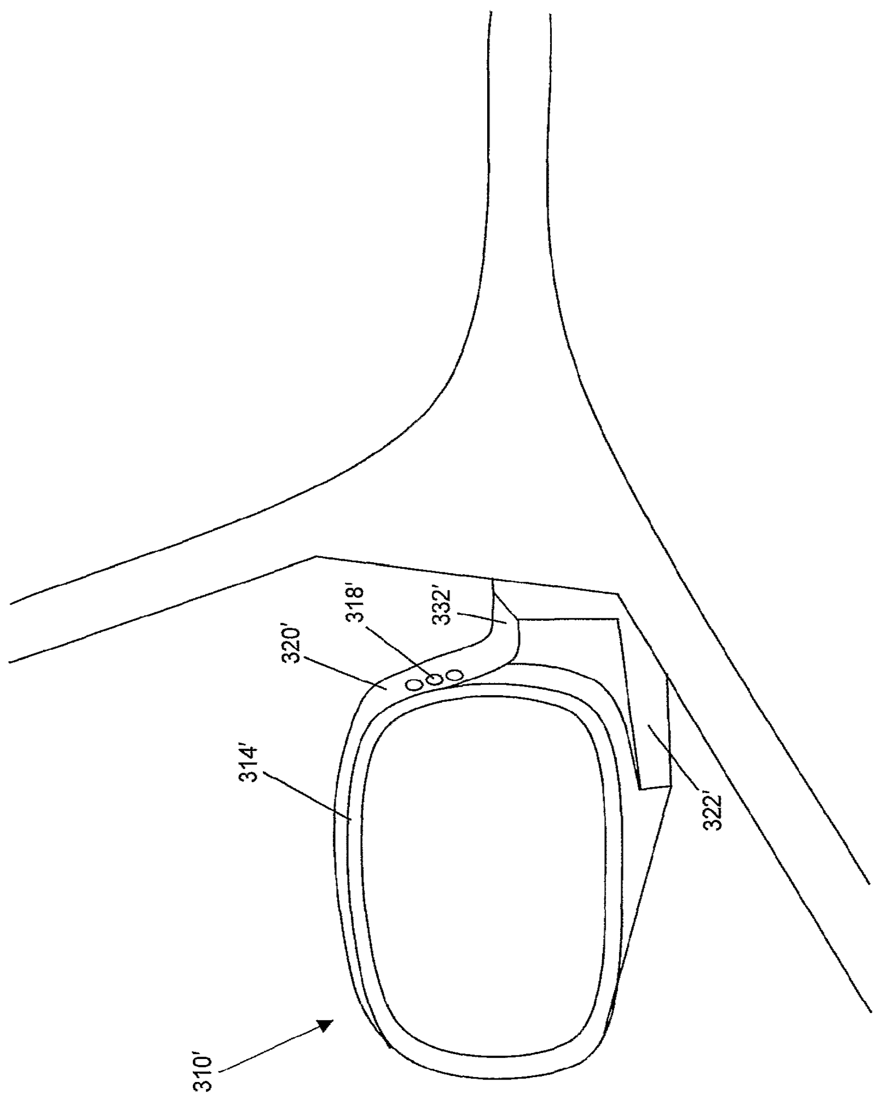

Fig. 11

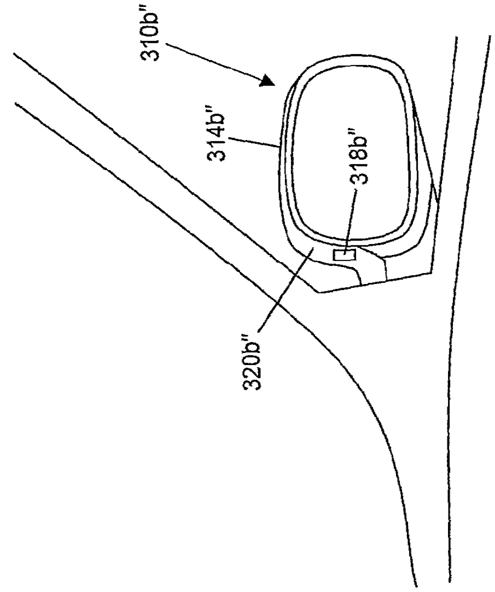

Fig. 12B

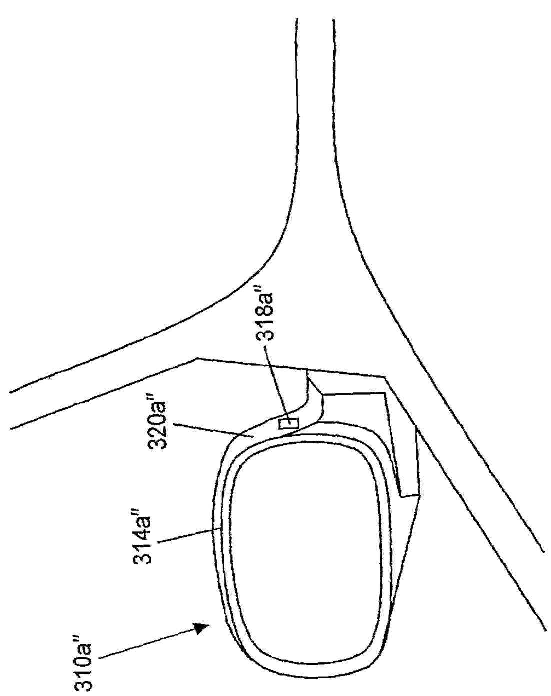

Fig. 12A

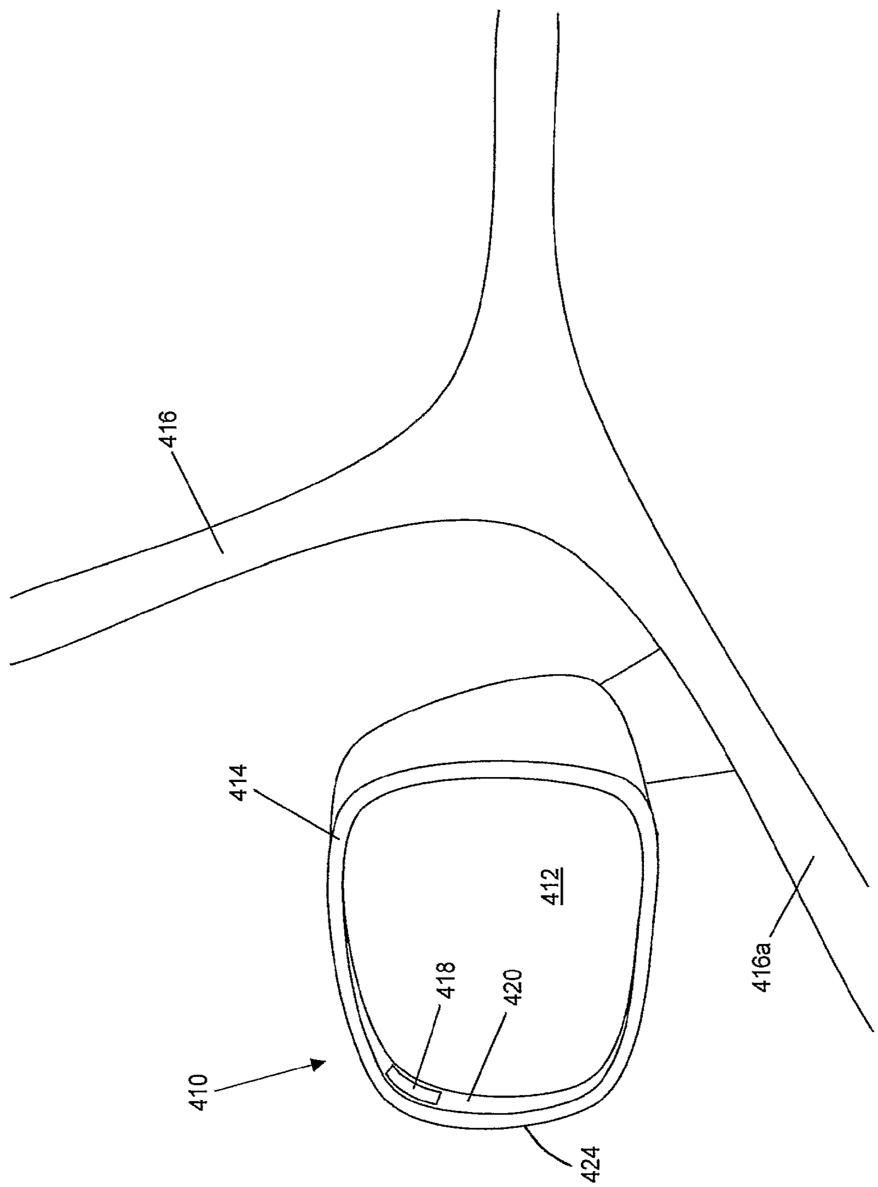

Fig. 13

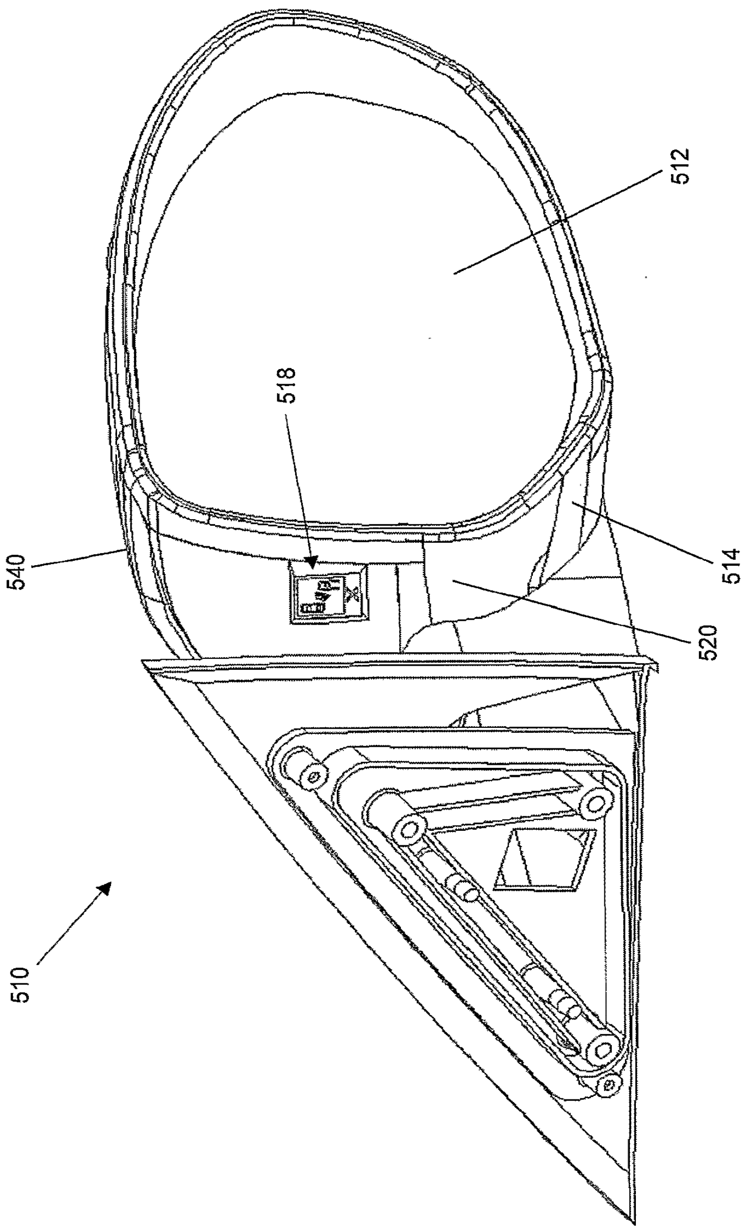

Fig. 14

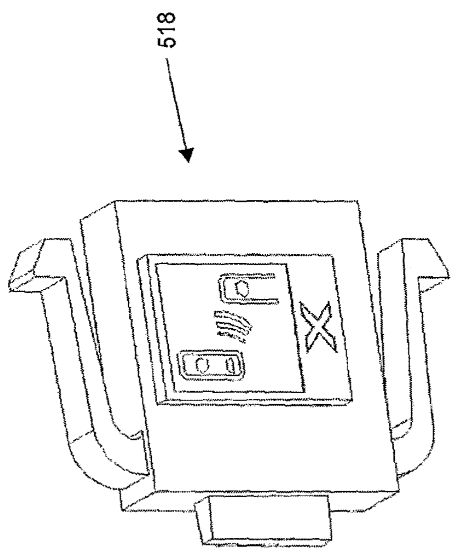

Fig. 15B

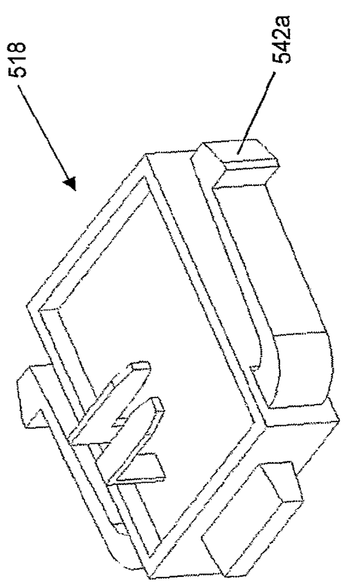

Fig. 15A

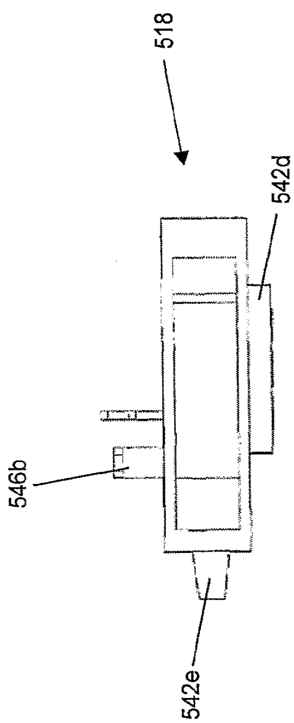

Fig. 16A

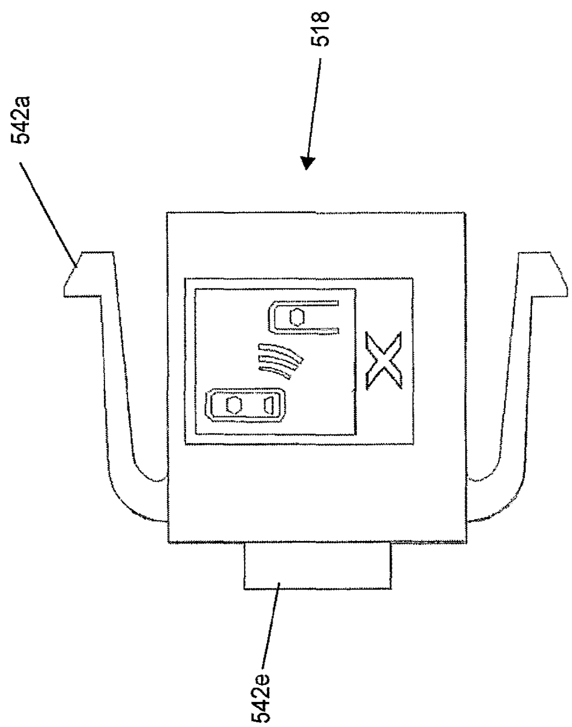

Fig. 16C

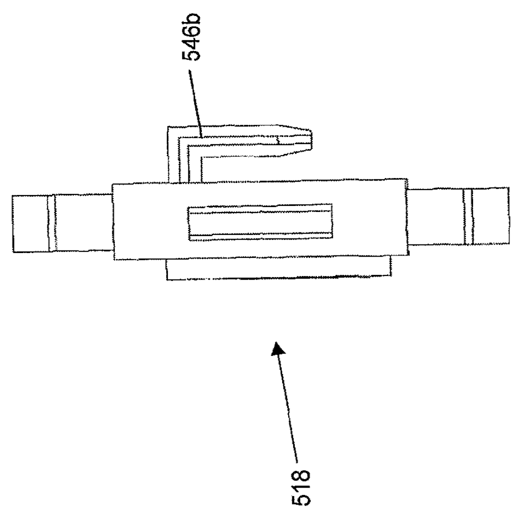

Fig. 16B

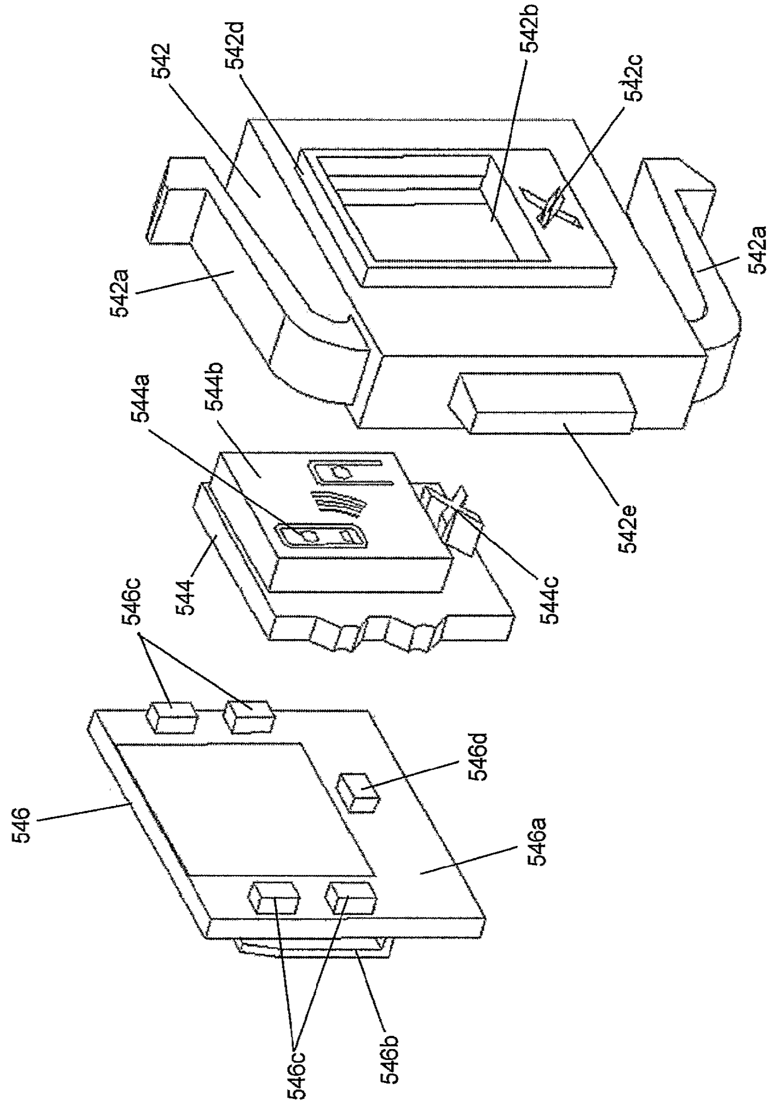
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Fig. 17

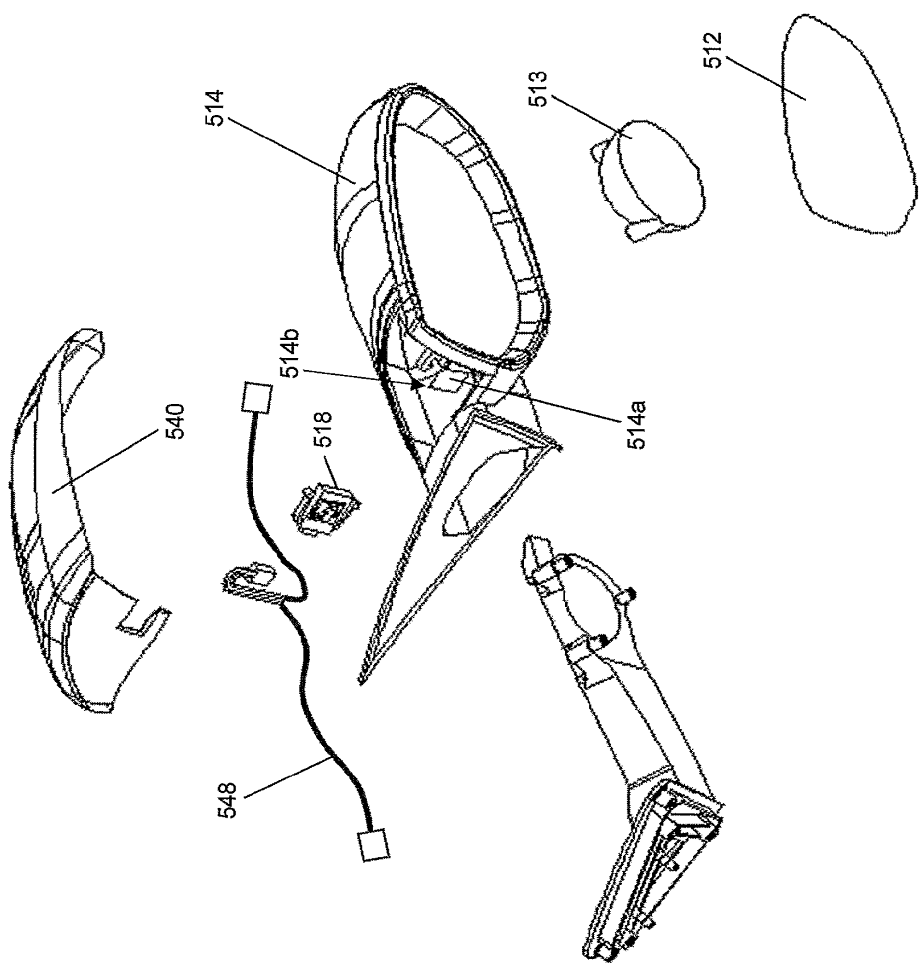

Fig. 18

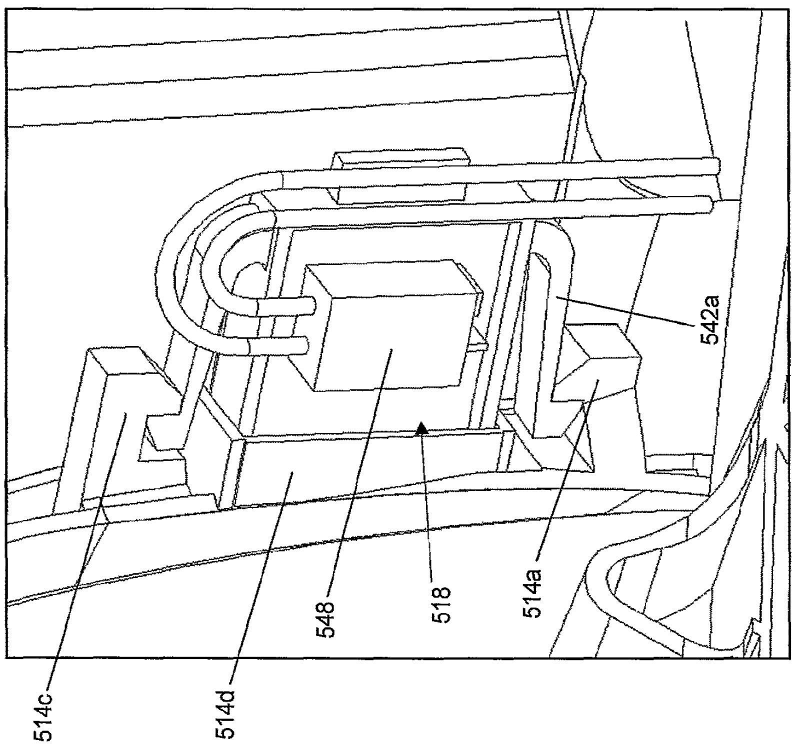

Fig. 19

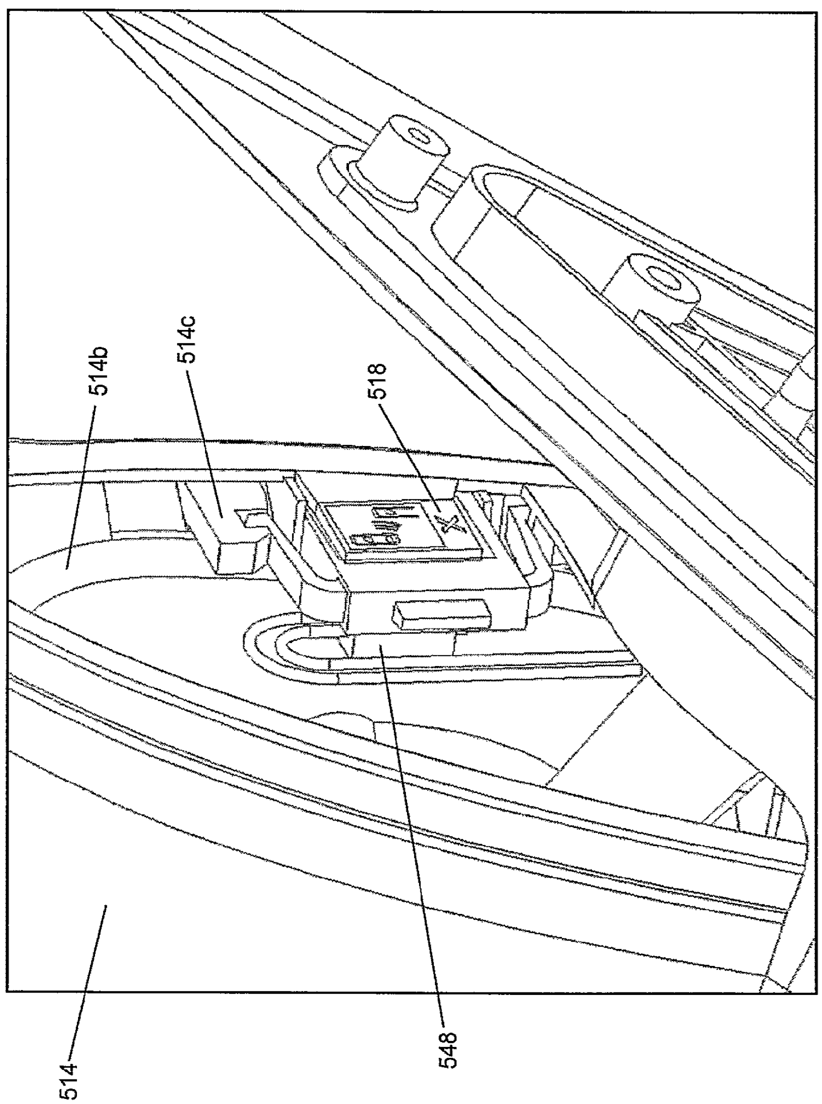

Fig. 20

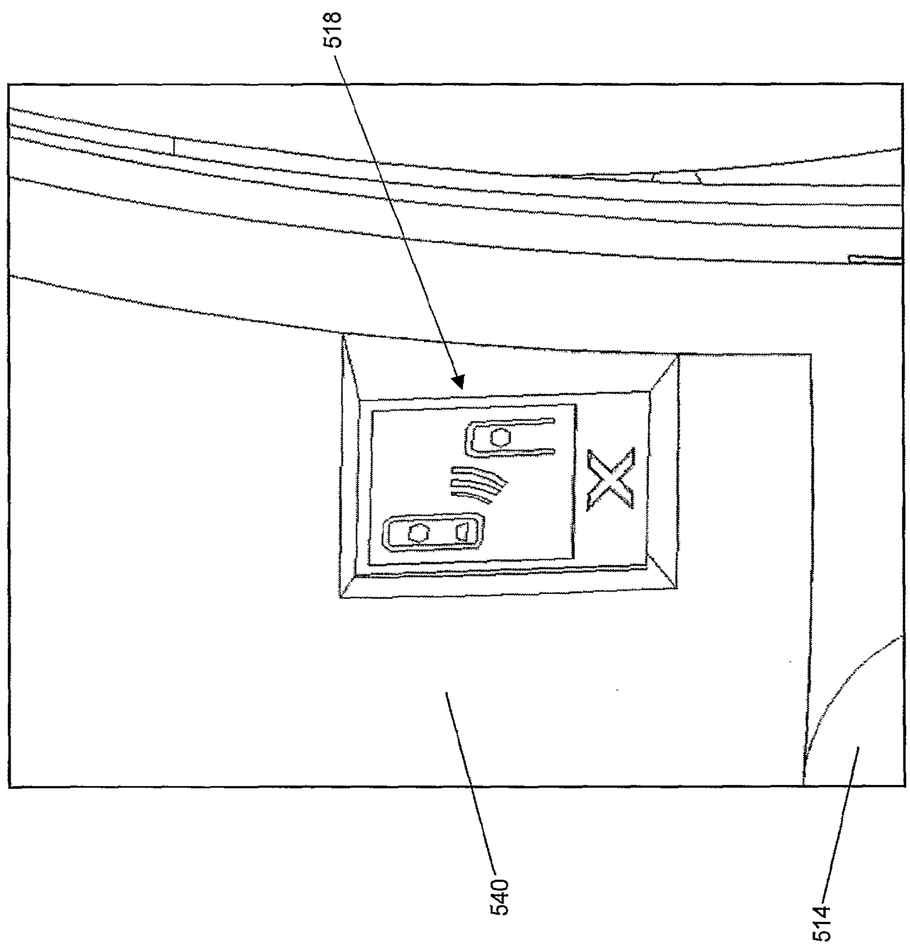

Fig. 21

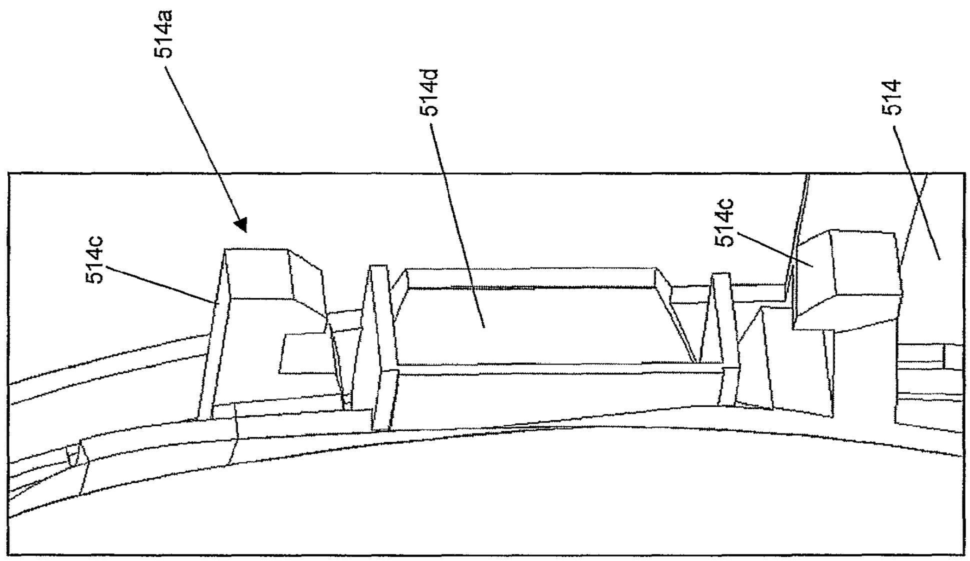

Fig. 22

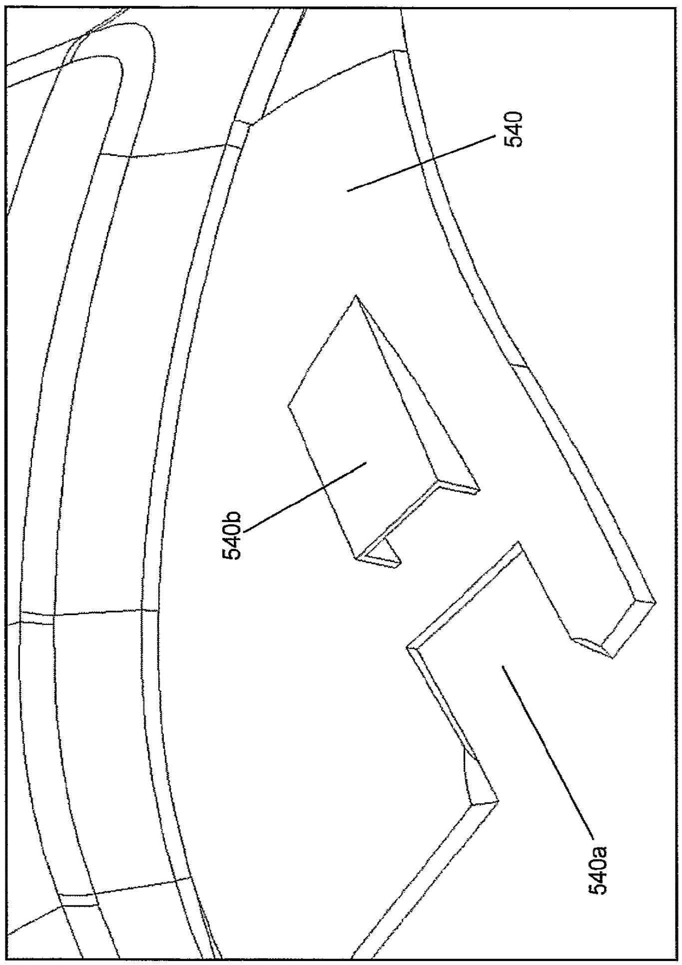

Fig. 23

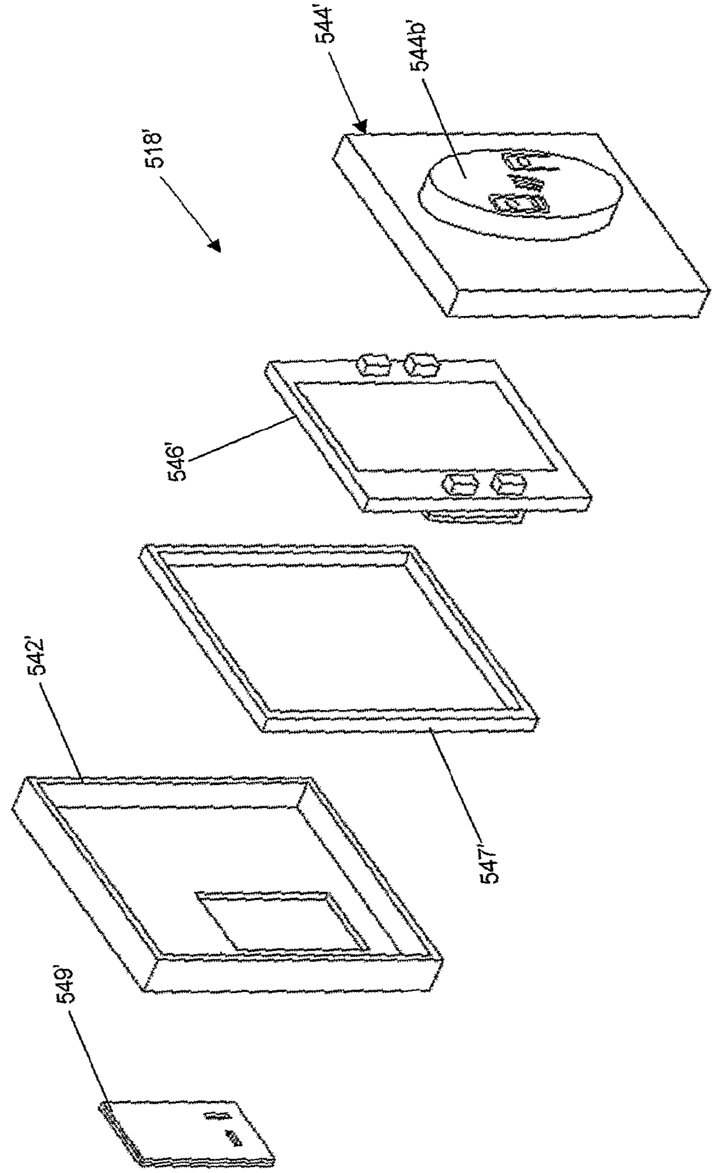

Fig. 24

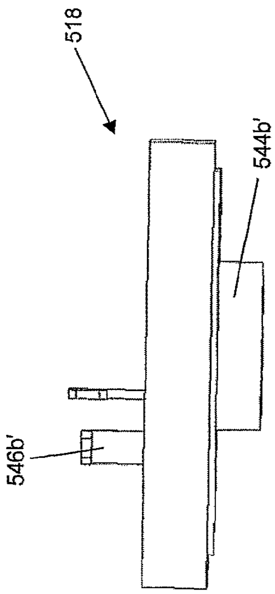

Fig. 25A

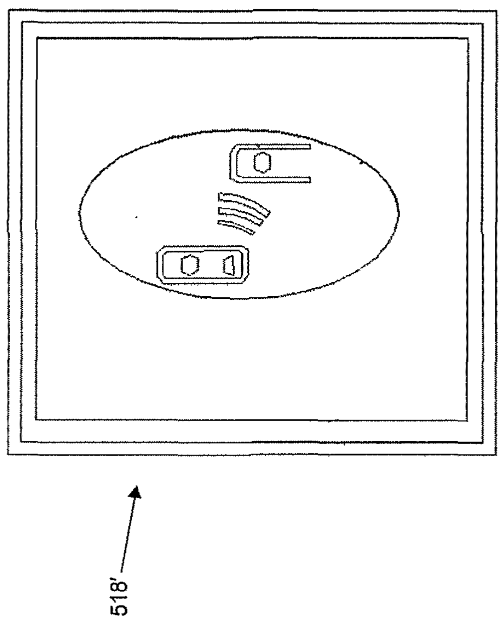

Fig. 25C

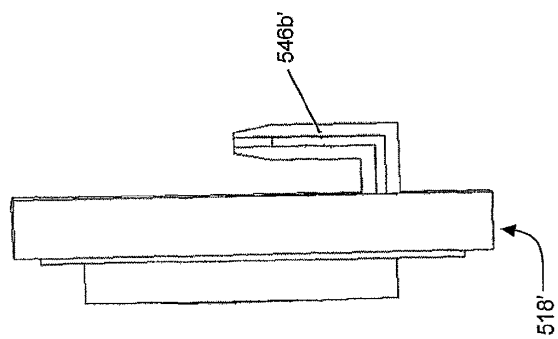

Fig. 25B

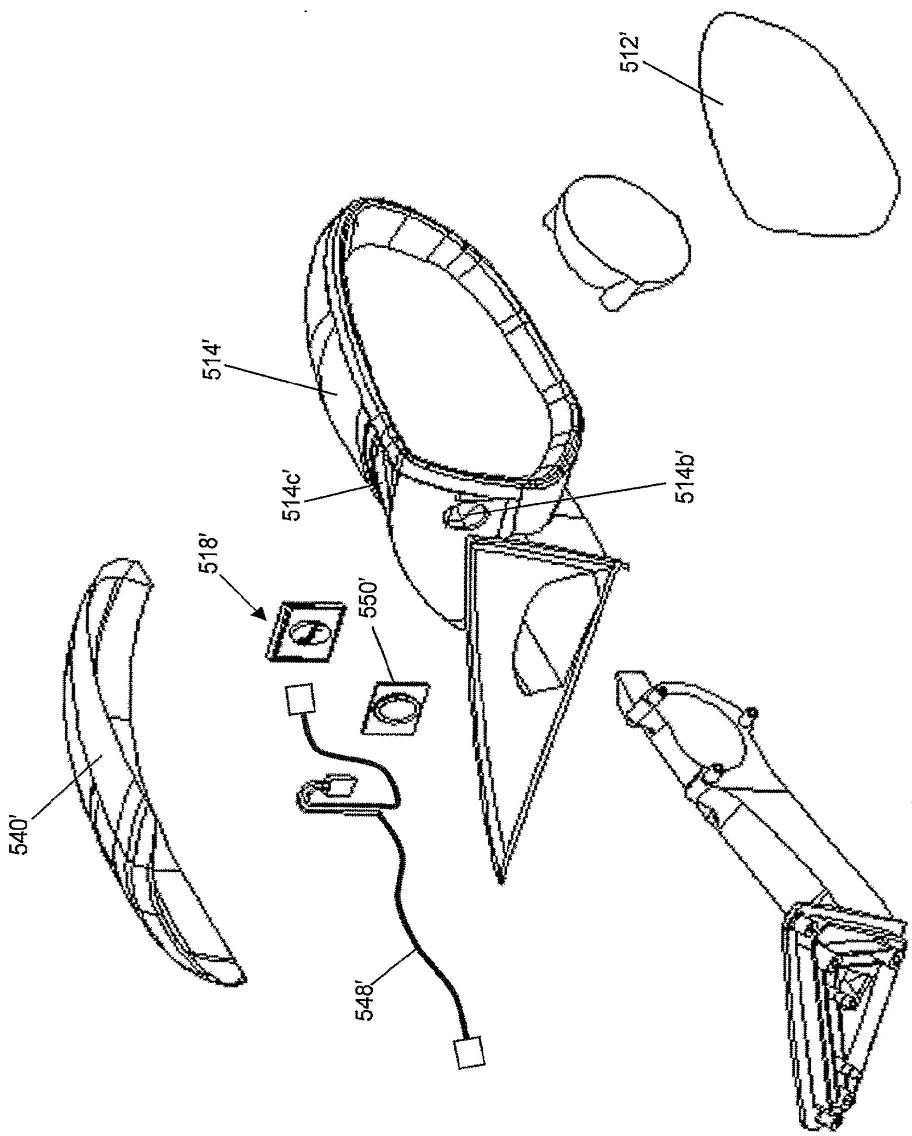

Fig. 26

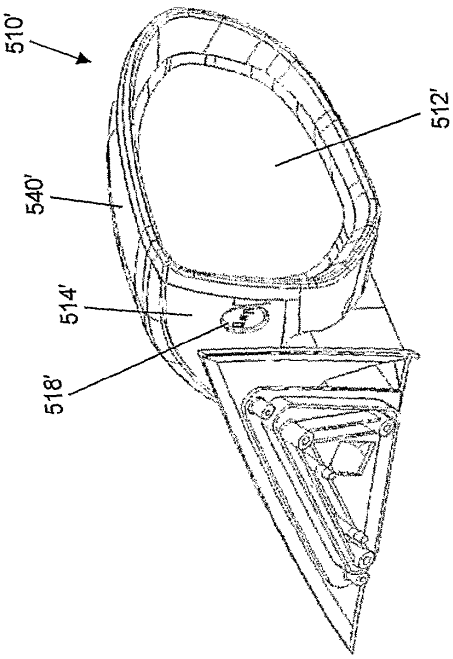

Fig. 27B

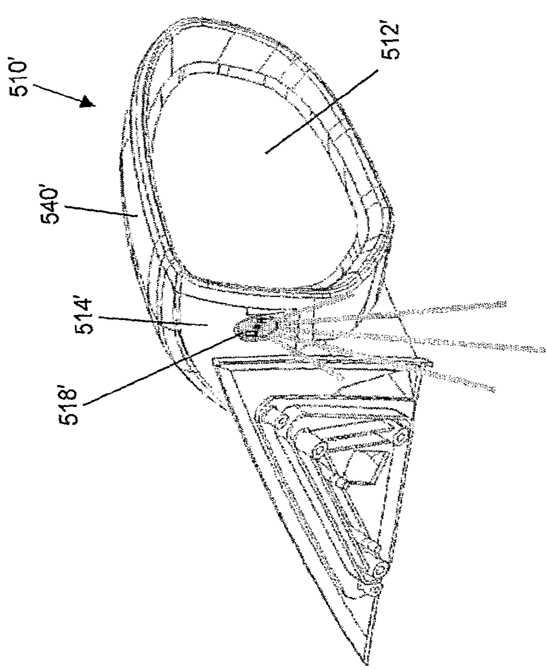

Fig. 27A

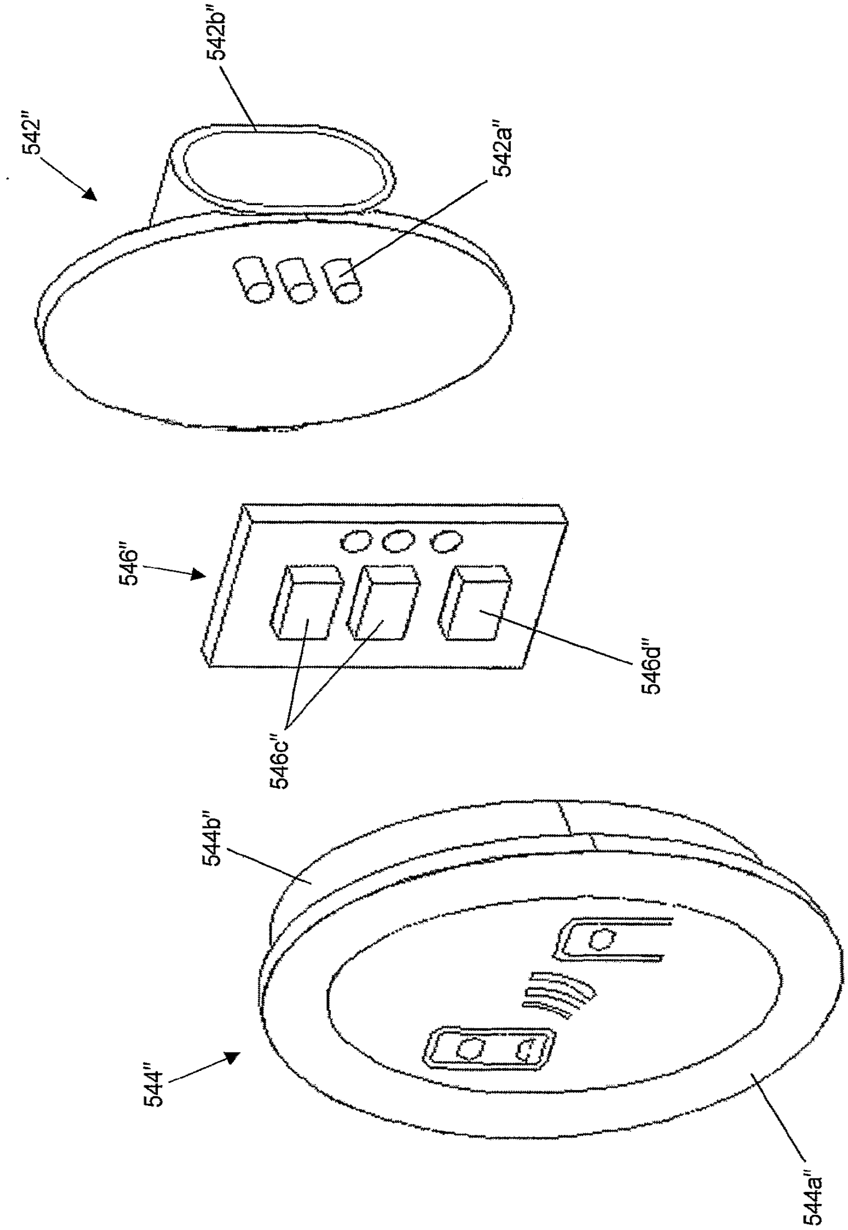

Fig. 28

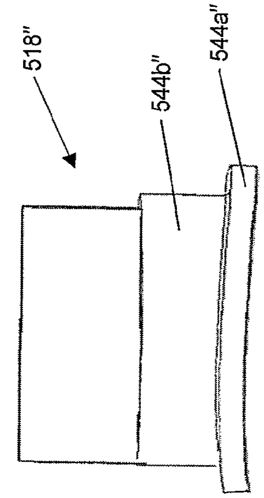

Fig. 29A

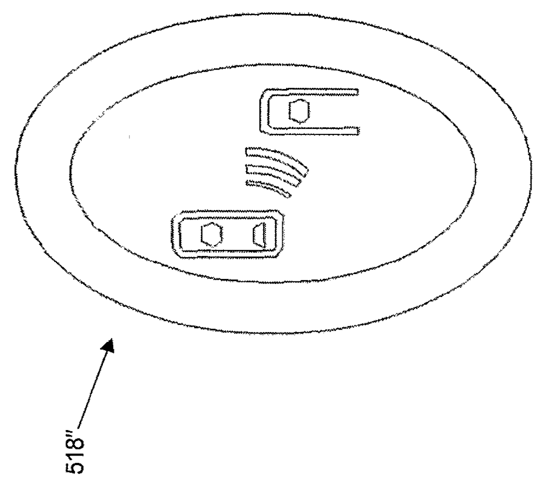

Fig. 29C

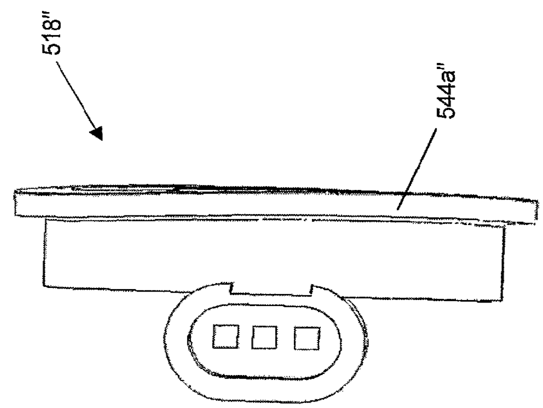

Fig. 29B

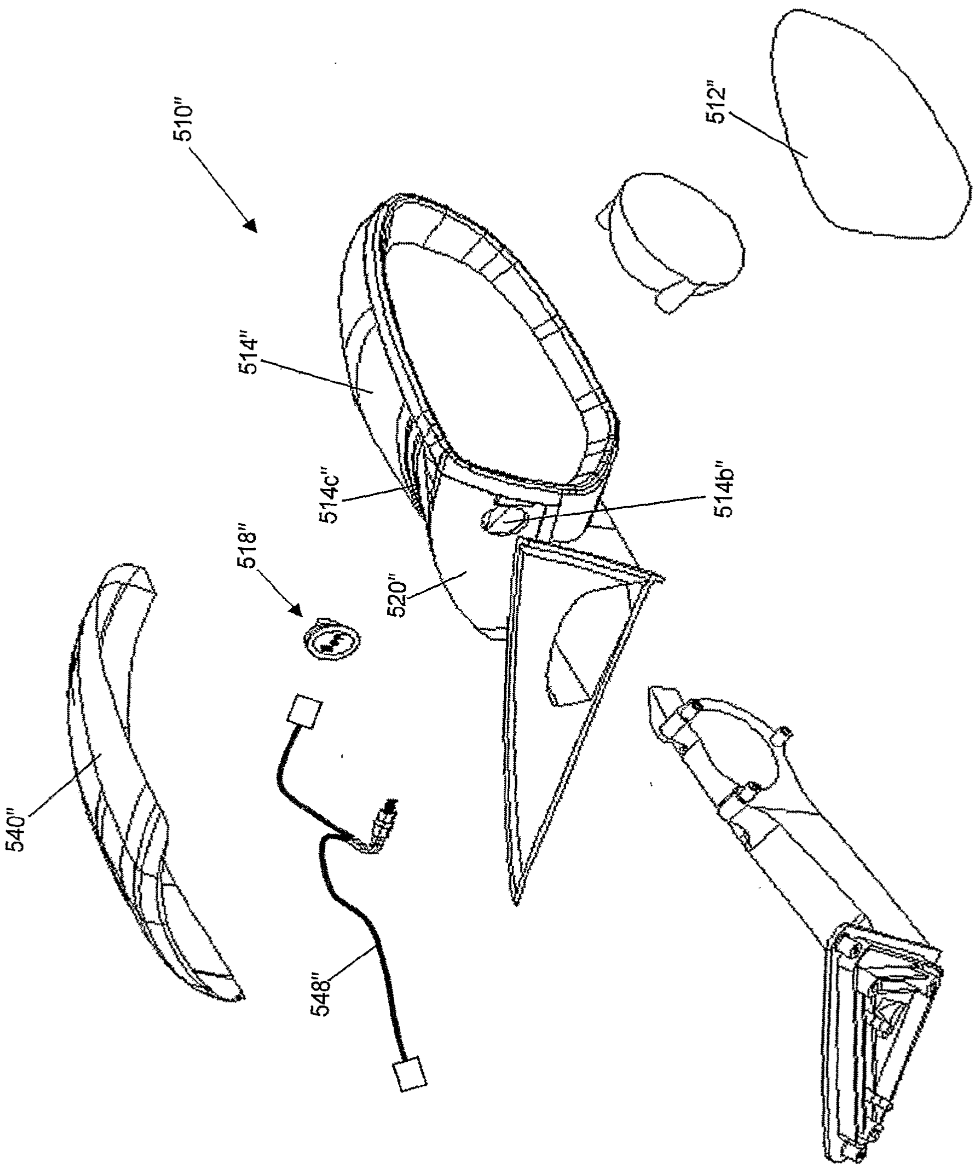

Fig. 30

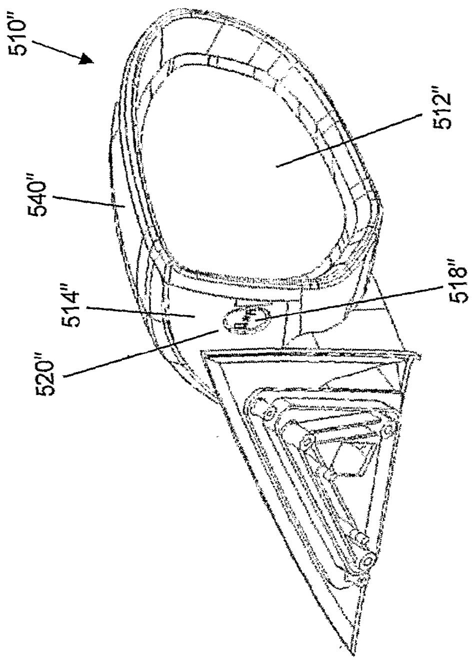

Fig. 31B

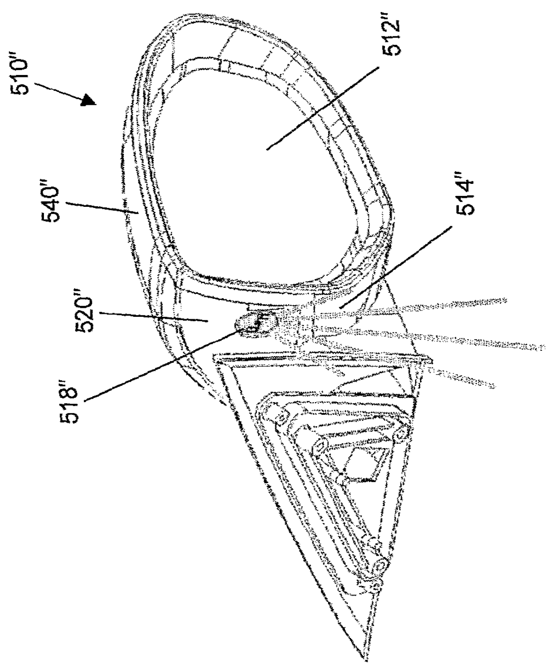

Fig. 31A

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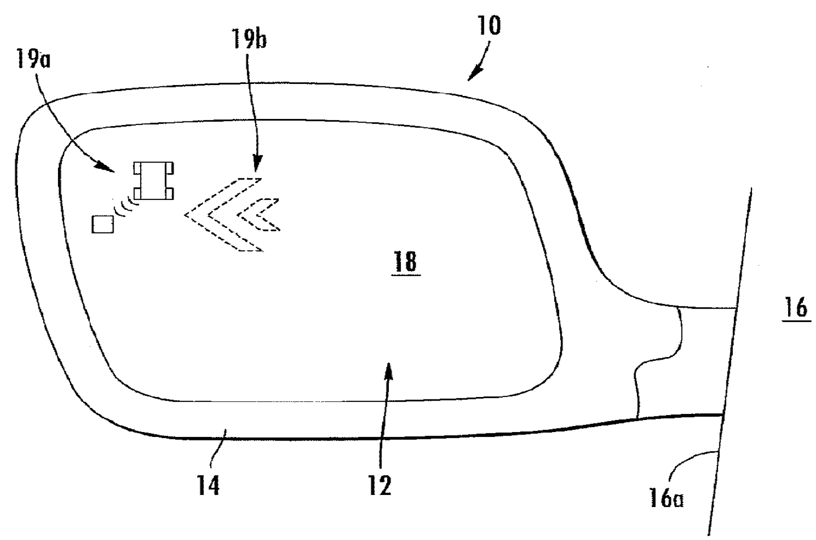
Declarations under Rule 4.17:
— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

[Continued on next page]

(54) Title: DISPLAY DEVICE FOR EXTERIOR MIRROR



(57) Abstract: A mirror reflective element sub-assembly includes a mirror back plate having a display receiving portion established thereat and being molded to have an integral light baffle at the display receiving portion. A display element attached to the display receiving portion of the mirror back plate and a light source is activatable to emit light through the display receiving portion and through the light baffle. The light baffle is configured to allow light emanating from the display element to pass through the light baffle at a predetermined angle so that light exiting the mirror reflective element when the light source is activated is viewable from one direction, while the light baffle substantially shields the light emanating from the display element so that the light is substantially non-viewable from another direction.

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DISPLAY DEVICE FOR EXTERIOR MIRROR

CROSS REFERENCE TO RELATED APPLICATIONS

The present application claims benefit of U.S. provisional applications, Ser. No. 60/853,850, filed Oct. 24, 2006; Ser. No. 60/918,089, filed Mar. 15, 2007; and Ser. No. 60/970,687, filed Sep. 7, 2007, which are hereby incorporated herein by reference in their entireties.

FIELD OF THE INVENTION

The present invention relates to exterior rearview mirror assemblies and, more particularly, to an exterior rearview mirror assembly having a blind spot/object detection indicator and/or a lane change aid (LCA) indicator and/or a turn signal or other indicator at the exterior rearview mirror assembly.

BACKGROUND OF THE INVENTION

It is known to provide an object in a blind spot detection/LCA system for a vehicle that detects the presence of another vehicle or object in the lane next to the host vehicle, where it may be difficult for the driver of the host vehicle to determine whether or not there is another vehicle or object adjacent to the host vehicle. Such an object in a blind spot detection/LCA system often includes a visual indicator that visually indicates the detection of another vehicle or object to the driver of the host vehicle. It is also know to provide a turn signal indicator that is activated when a turn signal is activated by the driver of the host vehicle so as to provide an indication of the vehicle turning or changing lanes to the driver of a vehicle in an adjacent lane to the host or subject vehicle or to another person external to the host or subject vehicle. The visual indicator or indicators (commonly a light emitting diode or the like) of such systems is/are often located at the mirror reflective element of the exterior rearview mirror assembly.

The object/LCA visual indicator or indicators indicate or alert the driver of the host vehicle of the presence or impending presence of another vehicle or object in a blind spot in an adjacent side lane that typically cannot be readily seen within the field of view of the exterior mirror reflective element of the exterior mirror assembly mounted at that side of the vehicle and/or cannot be readily seen by the driver's peripheral vision or the like. The object/LCA visual indicators typically are arranged to be viewable principally or solely by the driver of the host vehicle and not by drivers of other vehicles. Similarly, the turn signal visual indicator or indicators indicate or alert a person external of the host vehicle (such as the driver of another vehicle alongside or approaching the host vehicle) that the turn signal of the host vehicle is activated to indicate that the driver of the host vehicle is contemplating or commencing a turn or lane change or the like. It is desirable that such turn signal visual indicators are not readily viewable by the driver of the host vehicle when they are activated. Because of vehicle regulations and mirror and vehicle configurations and geometries, and because of the need to provide an uninterrupted reflective surface to satisfy the likes of the FMVSS 111 field of view regulation, blind spot/LCA indicators in the prior art are typically located towards or at the outboard edge, and typically towards or at the upper corner/quadrant, of the reflective mirror element of the exterior mirror assembly.

Somewhat costly and complicated indicator constructions have been contemplated that, when placed behind and supported by the mirror reflective element, attempt to have their projected beam of emitted light directed principally to be viewed by the driver of the host vehicle (or other persons external to the host vehicle for turn signal applications) through the mirror reflective element and shielded from view by other drivers in blind spot alert detection systems (or from the driver of the host vehicle for turn signal applications). In some applications, the mirror reflective element may have a transflective reflector coating or may have a window or port formed in a non-transflective reflector coating. For example, transflective mirror coatings (such as, for example, those described in U.S. Pat. Nos. 3,280,701; 6,855,431; 5,724,187; 5,340,503; 6,286,965; 6,196,688; 6,045,023; 5,788,357; 5,535,056; 5,751,489; and 6,065,840, which are hereby incorporated herein by reference in their entireties) may be used, or alternately, a transmissive window or port may be formed in the reflective coating or coatings of the mirror reflective element (such as, for example, those described in U.S. Pat. Nos. 6,005,724; 6,257,746; 6,111,683, 5,786,772, 5,313,335 and 5,285,060, which are hereby incorporated herein by reference in their entireties). An illumination source or indicator may be positioned so as to direct or emit illumination through the window or display area and toward the driver of the host vehicle so as to be viewable by the driver of the host vehicle (or outwardly away from the vehicle so as to be generally not viewable by the driver of the host vehicle for turn signal applications).

Such a mirror assembly and indicator often include a baffle or other light directing element and an illumination source positioned at the rear of the mirror reflective element (and generally at the transmissive window or port if applicable). The baffle shields from view by an observer or the light directing element directs the light or illumination from the illumination source toward the desired or appropriate viewer (such as the driver of the host vehicle for blind spot/LCA applications or the driver of another vehicle for turn signal applications) and away from others (such as away from other drivers for blind spot/LCA applications or away from the driver of the host vehicle for turn signal applications).

Typically, such baffles or other light directing elements are adhered to the rear surface of the mirror reflective element. In some applications, the illumination source may be provided as a module to the mirror assembly facility and adhered to the rear of the mirror reflective element as a unit or module (for instance, light from LEDs facing and emitting light in the direction away from the mirror element may be reflected back towards the mirror reflector, and hence through the mirror element, using suitably angled or disposed mirrored surfaces). After the baffle or module is attached to the reflective element, the back plate of the mirror assembly may be adhered to the mirror reflective element to complete the mirror reflector sub assembly that is then assembled with the actuator and casing and other components to form the complete mirror assembly for mounting to the side of the vehicle.

A variety of interior and exterior mirror assemblies with indicators are known in the art, such as U.S. Pat. Nos. 5,355,284; 5,788,357; 6,257,746; 6,005,724; 5,481,409; 6,111,683; 6,045,243; 6,512,624; 6,356,376; 2,263,382; 2,580,014; 3,266,016; 4,499,451; 4,588,267; 4,630,904; 4,623,222; 4,721,364; 4,906,085; 5,313,335; 5,587,699; 5,575,552; 5,436,741; 5,587,699; 5,938,320; 6,700,692; and 5,786,772, and Canadian Pat. No. CA 1,063,695, and Great Britain Patent Specification 1,172,382 and Pat. Abstracts of Japan Publication No. 0917573, published Jul. 8, 1997, and PCT Publication WO 95/30495, published Nov. 16 1995, which are all hereby incorporated herein by reference in their entireties.

Therefore, there is a need in the art for an improved object in a blind spot/LCA indicator that is readily viewable by a driver of the host vehicle and not visible or viewable by a driver of another vehicle and/or an improved turn signal indicator that is readily viewable by the driver of another vehicle and not visible or viewable by the driver of the host vehicle.

SUMMARY OF THE INVENTION

The present invention provides an object in a blind spot indicator or lane change assist (LCA) indicator or turn signal indicator or other indicator that is integral with the mirror reflector carrier or back plate of the mirror reflector sub-assembly so as to be positioned at and attached to the mirror reflective element as the back plate is adhered or otherwise attached at the back of the mirror reflective element. Preferably, the signal indicator is provided as a sealed or substantially sealed unit or module that can be snapped into or otherwise attached or secured (preferably mechanically but optionally adhesively) at the mirror back plate (and does so substantially or wholly sealingly to limit or substantially preclude water ingress to the module so that the module and back plate are substantially water impervious), preferably at the mirror sub-assembly manufacturing operation when the mirror reflective element (and any associated heater or other item or element) is joined to the mirror back plate, such as by utilizing aspects of the indicators described in U.S. patent application Ser. No. 11/520,193, filed Sep. 13, 2006 (Attorney Docket DON01 P-1286), and/or PCT Application No. PCT/US2006/018567, filed May 16, 2006 and published Nov. 23, 2006 as International Publication No. WO 2006/124682, which are hereby incorporated herein by reference in their entireties. The present invention thus provides a mirror reflector carrier or back plate with an integrated blind spot indicator/indicators and/or turn signal indicator/indicators and/or other indicator/indicators.

According to an aspect of the present invention, an exterior rearview mirror assembly for a vehicle includes a mirror reflective element, a back plate and an indicator or display device. The back plate is molded or formed with a baffle having a plurality of light baffle elements that define a plurality of slots through the back plate. The back plate is attached to the rear surface of the reflective element (the surface opposite the front surface, with the front surface facing generally rearward and toward the driver of the vehicle when the mirror assembly is mounted to the vehicle) and includes an indicator mount or mounting portion for mounting the indicator at the back plate and generally at the light baffle. The indicator mounting portion extends rearward away from the reflective element and may be integrally formed with the back plate, preferably by injection molding. The indicator mounting portion is formed to receive a transparent or translucent block or glow element, and one or more light sources are disposed at the block, such that light emitted by the light source or sources is transmitted through the block and through the slots at the light baffles and through the reflective element for viewing by a person viewing the reflective element at an angle that generally corresponds to the angle established by the light baffles and/or the indicator mounting portion, while shielding or shading the light from viewing by a person viewing the reflective angle at another angle that does not generally correspond to the angle established by the light baffles and/or indicator mounting portion.

The indicator thus is mounted at the indicator mounting portion and is activatable so that illumination from the indicator is directed through the slots at the light baffles and is thus viewable through the reflective element by a person viewing the mirror reflective element at a desired or generally corresponding angle. The angle of the light direction may be established by an angle of the light baffles of the back plate and/or an angle of the transparent or translucent block established by the block itself and/or the indicator mounting portion of the back plate.

The mirror back plate, including the light baffles and/or the indicator mounting portion or display receiving portion, may be configured to orient the block or display element at a predetermined angle so that light exiting the block when the light source is activated is directed one of (a) generally away from the vehicle when the mirror assembly is mounted to the vehicle so as to be principally viewed by drivers of other vehicles and so as to be substantially not viewed by the driver of the host vehicle, and (b) generally toward the driver of the vehicle when the mirror assembly is mounted to the vehicle so as to be principally viewed by the driver of the host vehicle and so as to be substantially not viewed by drivers of other vehicles.

Optionally, the display element is associated with a blind spot detection system of the vehicle. Optionally, the display element is associated with a turn signal of the vehicle. Optionally, the display element may comprise first and second display elements, with a first display element being associated with a turn signal of the vehicle and a second display element being associated with a blind spot detection system of the vehicle.

For applications of a turn signal indicator, the baffle protects or shields the driver from seeing the light or illumination from the illumination source by shading or direct line of sight occlusion (like a Venetian blind). The baffle thus allows illumination to be viewed by a targeted viewer (such as the driver of the host vehicle for blind spot/LCA applications or the driver of another vehicle for turn signal applications) and limits viewability (or provides direct line of sight occlusion) by others (such as away from other drivers for blind spot/LCA applications or away from the driver of the host vehicle for turn signal applications).

The back plate may comprise a plastic molding, such as a plastic molding formed by injection molding or co-injection molding or the like. The back plate may be formed with an attaching portion, such as a raised annular ring or annular prongs or annular snaps or the like at its rear surface (opposite from the mounting face or surface that attaches to the mirror reflective element) for attaching the back plate to a mirror actuator (for manually or electrically adjusting an angle of the mirror reflective element relative to the mirror casing).

Therefore, the present invention provides a display device or indicator at the back plate of a mirror reflector sub-assembly. The mirror reflector sub-assembly thus may achieve enhanced assembly processes, and may be supplied or provided to a mirror manufacturer or assembler as a unit that includes the indicator mounting portion (and that may also include the indicator) and display. The integrally formed back plate and indicator mount or mounting portion and light baffles may be readily attached to the mirror reflective element, and the indicator may be readily plugged into or connected to or received in the indicator mount to assemble the mirror reflector sub-assembly. The back plate may include one or more indicator mounts or mounting portions and associated light baffles for providing one or more displays at the reflective element, such as a blind spot/LCA display and/or a turn signal display and/or the like.

These and other objects, advantages, purposes and features of the present invention will become apparent upon review of the following specification in conjunction with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a view of an exterior mirror assembly with a display device or indicator in accordance with the present invention, shown as viewed in the direction of travel of the vehicle;

FIG. 2 is a sectional view of a mirror reflector sub-assembly having a back plate and indicator element in accordance with the present invention;

FIG. 3 is a perspective view of a display element or block suitable for use with the indicator element of the present invention;

FIG. 3A is a plan view of a display element or block of the present invention;

FIG. 4 is a partial sectional view of the block and a circuit element at a rear surface of the block in accordance with the present invention;

FIG. 5 is a sectional view of the back plate of the mirror reflector sub-assembly of FIG. 2;

FIG. 6 is a plan view of the back plate of FIG. 5;

FIG. 7 is a sectional view of another mirror reflector sub-assembly having a back plate and indicator element in accordance with the present invention, shown with the indicator element detached from the back plate;

FIG. 8 is another sectional view of the mirror reflector sub-assembly of FIG. 7, shown with the indicator element attached to the back plate;

FIG. 9 is a sectional view of another mirror reflector sub-assembly having a back plate and indicator element in accordance with the present invention, shown with the indicator element detached from the back plate;

FIG. 10 is another sectional view of the mirror reflector sub-assembly of FIG. 9, shown with the indicator element attached to the back plate;

FIG. 11 is a sectional view of another back plate of the present invention, having an angled attachment element for receiving an indicator element thereat;

FIG. 12 is a plan view of the back plate of FIG. 11;

FIG. 13 is a sectional view of another mirror reflector sub-assembly in accordance with the present invention;

FIG. 14 is a sectional view of another mirror reflector sub-assembly similar to the mirror reflector sub-assembly of FIG. 13, with an anti-reflection coating at a front surface of the reflective element;

FIG. 15 is a sectional view of a back plate and indicator modules in accordance with the present invention;

FIG. 16 is a sectional view of a mirror reflector sub-assembly having the back plate and indicator modules of FIG. 15;

FIG. 17 is a sectional view of another back plate and indicator modules in accordance with the present invention;

FIG. 18 is a sectional view of another back plate and indicator modules in accordance with the present invention;

FIG. 19A is a sectional view of another back plate and indicator module in accordance with the present invention;

FIG. 19B is a plan view of an indicator stencil or mask for use with the back plate and indicator module of FIG. 19A;

FIG. 19C is a plan view of a mirror reflective element having the back plate and indicator module and indicator mask of FIGS. 19A and 19B;

FIG. 20A is a sectional view of another mirror reflector sub-assembly having a back plate and indicator modules in accordance with the present invention;

FIG. 20B is a plan view of the mirror reflector subassembly of FIG. 20A;

FIG. 21A is a perspective view of a rear substrate coated with a metallic reflector in accordance with the present invention;

FIG. 21B is a side elevation of the coated rear substrate of FIG. 21A;

FIG. 22 is a sectional view of a mirror reflective element assembly incorporating the coated rear substrate of FIGS. 21A and 21B;

FIG. 23 is a diagram showing the process of forming and coating the rear substrate of FIGS. 21A and 21B;

FIG. 24 is a sectional view of another mirror reflective element assembly in accordance with the present invention; and

FIG. 25 is a sectional view of another mirror reflective element assembly in accordance with the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings and the illustrative embodiments depicted therein, an exterior rearview mirror assembly 10 for a vehicle includes a mirror reflector sub-assembly 12 and a mirror shell or casing 14 (FIG. 1). Mirror assembly 10 is mounted at the side 16a of a host or subject vehicle 16. As shown in FIG. 2, mirror reflector sub-assembly 12 includes a mirror reflective element 18 and a mirror reflector carrier or back plate 20 attached to or mounted to or adhered to a rear surface 18a of mirror reflective element 18. Mirror assembly 10 includes an indicator or display element or device or signal indication module 22 that is disposed at back plate 20 and behind reflective element 18, and that is operable to provide a display or indication at the reflective element for viewing the display or indication through the mirror reflective element. Signal indication module 22 includes a transparent or translucent polymeric block or element or indicating light source or element 24 (that is received into or attached to an indicator receiving portion or mounting portion or structure 26 of back plate so as to be disposed generally at a rear surface 20a of back plate 20) and an illumination source or indicator 28, such as one or more light emitting diodes (LEDs) or other suitable illumination source. Signal indication module 22 is attached to or mounted to or received in or at the indicator mounting portion 26 of back plate 20 so as to be disposed generally at and behind a light baffle 30 (FIGS. 2, 5 and 6) integrally formed with back plate 20. In the illustrated embodiment of FIGS. 2-6, the mirror assembly includes a signal indication module 22 for an object detection in a blind spot detection system or LCA system, as discussed below, but could also or otherwise include a display device for a turn signal indicator or signal indication module or other indicator device (as also discussed below). The indicator element or signal indication module thus may be readily mounted to or attached to a unitary back plate (including an indicator mounting portion), such as by utilizing aspects of the indicators described in U.S. patent applications, Ser. No. 11/520,193, filed Sep. 13, 2006 (Attorney Docket DON01 P-1286); and/or Ser. No. 11/226,628, filed Sep. 14, 2005 (Attorney Docket DON01 P-1236), and/or PCT Application No. PCT/US2006/018567, filed May 16, 2006 and published Nov. 23, 2006 as International Publication No. WO 2006/124682, which are hereby incorporated herein by reference in their entireties.

Optionally, the mirror assembly may include multiple display elements or devices or signal indication modules (such as two or more display elements or devices or signal indication modules) for providing both an object in a blind spot/LCA indicator and display area 19a and a turn signal indicator and display area 19b, such as shown in FIG. 1. The two or more signal indication modules may be incorporated together into a single unitary display module or unit (and thus with a common connector incorporated in the single unitary module and servicing, for example, a commonly housed turn signal indicator element and blind spot indicator element), or the two or more signal indication modules may be separate display devices (for example, a LCA blind spot indicator unitary module may be disposed at a bottom/lower inward portion of the mirror sub-assembly and a separate turn signal indicator unitary module may be disposed at an upper outward portion of the mirror sub-assembly), while remaining within the spirit and scope of the present invention. Optionally, for example, a turn signal indicator or device or element or module of the present invention may be incorporated into a mirror sub-assembly, and the exterior rearview mirror assembly may include a blind spot or lane change assist indicating device or element at a portion of the mirror casing (such as at an inboard facing portion of the casing that faces generally inboard toward the side of the vehicle so as to be readily viewable by the driver of the vehicle), such as by utilizing aspects of the indicating elements described in PCT Application No. PCT/US2006/026148, filed Jul. 5, 2006 and published Jan. 11, 2007 as International Publication No. WO 2007/005942, which is hereby incorporated herein by reference in its entirety.

As shown in FIGS. 2 and 4, signal indication module 22 includes a circuit element 32, such as a printed circuit board or the like (such as a rigid or flexible circuit board or element), with illumination sources or LEDs 28 disposed thereat (such as surface mounted or otherwise disposed LEDs or other suitable or equivalent light sources). Circuit element 32 is attachable to a rear surface 24a of indicating light source or block 24, whereby the illumination sources 28 are located at the rear surface and preferably at or partially within light source receiving apertures or recesses 24b at the rear surface 24a of indicating light source or block 24. The signal indication module 22 may be purchased as a display element assembly (including the circuit element and circuitry, which are attached at the rear of the indicating light source or block 24) and assembled to the mirror reflective element sub-assembly 12, such as at a mirror assembly facility, such as described below. Circuit element 32 preferably includes an electrical connector 32a or lead or terminal for electrically connecting the circuitry and light source to electrical power or electrical control at the mirror assembly when the signal indication module is attached to the back plate and installed at the mirror casing.

Indicating light source or block 24 of signal indication module 22 comprises a transparent or translucent polymeric block, such as may be cast or injection molded from an optical light transmitting polymeric resin, such as a polycarbonate or an acrylic, or an acrylate, or a polystyrene, or a CR-39 or a COC olefin or other suitable material. The block may be molded as a translucent element, and may comprise a material that is at least partially crystalline, or the material may have a light scattering material mixed therein, or may be otherwise selected so as to provide a diffuse block, whereby the illumination emitted by the illumination source or LED will emanate from the forward surface of the block as a substantially uniform glow. The translucent diffuse block or element may be formed to a desired or suitable shape, such as an arrow or chevron shape (such as shown in FIG. 3), so as to provide the desired form for viewing by the driver of the vehicle. Preferably, the block comprises a translucent block, and thus transmits and diffuses light passing therethrough so that the light sources are not clearly or readily seen through the block by a person viewing the block. The block thus provides substantially uniform light distribution and provides a glowing indicating light source or block when the illumination source or LED/LEDs are activated or energized. Thus, the light emanating from the signal indicating module will not be seen as one or more point sources of light (i.e., the LED or LEDs will not be seen as individual point sources of light), but the light will be provided via a substantially uniformly glowing light source or indicating light source via the diffuse, translucent block or element.

Preferably, the indicating light source or block is partially or substantially coated or painted or covered or sleeved or formed so as to have a light reflecting rear surface 24a and side surfaces 24c (FIG. 3) so that light emitted by illumination sources 28 at the receiving apertures 24b is directed through the block and toward and through the light baffle 30 and through the reflective element 18, and is not transmitted through the side walls or surfaces 24c and rear wall or surface 24a of the indicating light source or block 24, such that light is not emitted into the cavity of the mirror casing. For example, the rear surface (excluding the light source receiving apertures) and side surfaces of the block may be formed or coated to have white diffuse or silvery specular surfaces, such as via application of a reflective tape or a reflective coating or paint or a white tape or coating or paint (such as a diffuse coating such as a white paint or argon paint or titanium paint or the like) at the side and rear surfaces of the block (in other words, the block may be covered or coated at all of its surfaces except its front surface that faces generally toward the reflective element). Optionally, and desirably, the color of the coating or paint (or other material or surface layer or characteristic) may be selected to provide enhanced reflectivity depending on the color and/or type of illumination source or LED of the signal indicating module. For example, if a red LED is used as the illumination source, the indicating light source or block may have a red coating or paint at its side surfaces and rear surface so as to enhance reflectivity of the red light emitted by the red LED at the sides and rear of the block so that the light is reflected and transmitted through the block and toward the reflective element for viewing as a substantially uniform glowing block or indicating light source (if other color LEDs are used, then other correspondingly colored coatings may be used to generally correspond to the wavelengths of light emitted by the colored LEDs). Thus, light emitted by the illumination sources 28 is emitted into the block where the light may pass through the block (and toward the reflective element) or may reflect off of the sides and rear of the block and toward the reflective element so as to provide a substantially uniform glow to the indicating light source or block when the illumination sources are activated.

Back plate 20 is molded or formed, such as by injection molding, so as to provide the display receiving portion 26 and a generally planar backing portion 20a that attaches to the rear surface of the reflective element 18 (such as via adhesive or other suitable attachment means). Preferably, back plate 20, including display receiving portion 26 and light baffle 30, is molded of a substantially dark or opaque or black material, such as from an ABS or polycarbonate polymeric resin material or from any other suitable material such as known in the exterior rearview mirror art, so as to be substantially opaque such that light does not pass through the opaque back plate and the indicator mounting portion.

As shown in FIGS. 2, 5 and 6, indicator mounting portion 26 is unitarily or integrally formed with back plate 20 and may be formed with a pocket 26a for receiving or partially receiving block 24 to locate indicating light source or block 24 at the generally planar backing portion 20a of back plate 20. For example, the pocket 26a may receive indicating light source or block 24 at least partially therein, and the indicator mounting portion 26 may secure (such as by snapping or the like) the block at or in the pocket 26a of indicator mounting portion 26 of back plate 20.

Back plate 20 is formed (such as via injection molding or the like, such as injection molding of ABS or polypropylene or the like) with light baffle 30 at the pocket defined by mounting portion 26. As can be seen with reference to FIGS. 2 and 5, light baffle 30 comprises a plurality of angled or slanted ribs or vanes or baffle elements 30a that are separated or defined by gaps or slots or slits 30b formed through the back plate 20, whereby light from the light sources 28 is transmitted through the block 24 and through the gaps or slots 30b at the back plate 20. The baffle elements thus may be integrally formed with the back plate, with the slots being formed as openings or apertures or passageways through the generally planar back plate and between the baffle elements 30a. As can be seen in FIGS. 2

and 5, baffle elements 30a are integrally formed or molded with back plate 20 and are angled to direct or angle the light or allow the light passing through the slots to be viewed from a desired or appropriate direction, while shielding or shading the light or providing line of sight occlusion of the light so that the light is substantially not viewed from another direction. Optionally, the surfaces of the baffle elements 30a (such as the surfaces facing partially toward the reflective element when the back plate is attached to the rear of the reflective element) may be textured or stippled to diffuse or absorb light so as to reduce visibility of the baffle elements to a person viewing the reflective element when the signal indicating module is deactivated.

Optionally, and desirably, and as can be seen in FIG. 6, the baffle elements 30a and slots or slits 30b are substantially vertically oriented so as to be substantially vertical when the mirror assembly is mounted at the side of a vehicle (so as to shade or shield or limit viewability of light emanating from the indicator module in a generally horizontal direction). However, it is envisioned that the baffle elements and slots may be angled or canted (or non-vertical) depending on the particular application and desired shielding by the light baffle. In the illustrated embodiment of FIGS. 5 and 6, the generally vertical baffle elements are angled or slanted so that light emanating from indicator module 22 is viewable from a location outboard of the vehicle (such as for viewing of a turn signal indicator by a driver of a vehicle at the side of or rearward of the host vehicle), and is substantially non-viewable by the driver of the host vehicle. The angle or slant of the baffle elements may be selected depending on the particular application of the indicator module and on the location of the indicator module at the mirror assembly. For example, the baffle elements may be slanted so as to allow light to pass through the slots or gaps at an angle of about 65 degrees (or more or less) relative to the generally vertical plane of the back plate and reflective element (i.e., about 25 degrees outboard from a line extending perpendicularly from the plane of the back plate and reflective element). The baffle thus allows a person to view the indicator from an angle around 25 degrees outboard, yet substantially shields or provides direct line of sight occlusion to a person viewing the reflective element from another angle such as from within the vehicle, such as from a typical location of a driver's head.

Optionally, and desirably, the baffle elements may be formed to provide a minimum or reduced thickness while the gaps or slots are formed to allow a substantial amount of light from the glow block to pass therethrough, in order to enhance the viewability of the indicator along the targeted direction when the indicator is activated. For example, the baffle elements may be formed with a wall thickness of about 0.75 mm to about 1.1 mm (or more or less depending on the particular application), while the slots or gaps may be sized to each provide a passageway that is wider than the thickness of the baffle elements, such as about 1 mm to about 1.3 mm (or more or less depending on the particular application). The particular width of the baffle elements and slots or gaps may be selected to provide the desired viewability of light emanating from the indicator module in one direction, while shading or shielding or limiting viewability of the light from another direction, and thus may vary depending on the particular application of the indicator module and light baffle while remaining within the spirit and scope of the present invention.

Although shown in FIG. 6 as being a generally rectangular-shaped display region, the light baffle 30 and mounting portion 26 may be formed to provide the desired icon or indicator or display, such as a chevron shape or arrow shape or the like. Optionally, the light baffle and mounting portion may be formed as shown in FIG. 6, while the glow block or indicating light source may be formed to the desired shape such that the glow emanating from the indicating light source is viewable as the desired shape and from the desired or targeted direction (such an application may include a dark or opaque layer or element at the rear of the light baffle and around the glow block to limit passage of light therethrough).

For example, and as shown in FIG. 3, the glow block or indicating light source may have an arrow or chevron shape (and may be mounted at the mounting portion with the arrow pointing generally outward and away from the vehicle as shown in FIG. 1). The size of the block may be selected so that the light emanating therefrom (when the illumination source is activated) is readily viewable by the targeted viewer. For example, and as shown in FIG. 3A, the block may have a length (from the left tip in FIG. 3A to the right end of the block in FIG. 3A) of about 35 mm and a height of about 60 mm, with each leg being about 35 mm long and about 8 mm wide. The thickness of the block may be selected to provide the desired diffusion of the light from the illumination source so as to provide the desired glow by the block when the illumination source is activated. For example, the block may have a thickness t of about 15 mm (as shown in FIG. 4) so as to emanate the desired or appropriate diffuse light or glow when the illumination source is activated. Other size dimensions may be selected and may depend on the particular application of the block, without affecting the scope of the present invention.

Thus, the unitary back plate provides the mounting structure for mounting the signal indication module at the rear of the back plate and provides the light baffles or ribs or elements for directing the light from the signal indication module at a desired or appropriate direction toward and through the reflective element when the back plate (with the signal indication module attached thereto) is attached to the reflective element. As shown in FIG. 6, the indicator mounting portion 26 of back plate 20 is formed around the light baffle 30 of back plate 20, so as to generally frame or surround the light baffle, whereby the signal indication module is generally at or aligned with the light baffle when received in or mounted at the indicator mounting portion.

As shown in FIGS. 2, 5 and 6, an attachment element or elements 20b (such as an annular ring or tab or annular prongs or annular snaps or the like) may be formed or established at the rear of the backing portion 20a for attaching the back plate 20 and reflective element 18 to a mirror actuator (such as a mirror actuator as known in the art and/or as described in U.S. Pat. Nos. 7,080,914; 7,073,914; 6,916,100; 6,755,544; 6,685,864; 6,467,920; 6,362,548; 6,243,218; 6,229,226; 6,213,612; 5,986,364 and 5,900,999, which are hereby incorporated herein by reference herein in their entireties), which is adjustable or operable to adjust a viewing angle of mirror reflective element 18. When the mirror reflective element is canted or angled partially toward the driver of the host vehicle (which is typically the orientation of the reflective element during use so as to provide a generally rearward field of view to the driver of the host vehicle), there is sufficient space within the mirror casing at or near the outboard portion of the mirror assembly for the indicator mounting portion and signal indication module. The back plate and signal indication module of the present invention thus utilizes the space within the mirror head or casing that is already available and typically not used or occupied by other components.

Illumination source or sources 28 is/are operable or activatable or energizable to provide illumination at and through indicating light source or block 24, whereby the illumination is transmitted through indicating light source or block 24 and through the slots 30b of light baffle 30 of back plate 20 and through the reflective element 18 so as to be viewable through mirror reflective element 18 by a person viewing the mirror assembly 10. Preferably, the width of the slots are made so as to enhance or optimize light transmission through the light baffle of the back plate, whereby the baffle elements may be formed to be substantially thin. The signal indication module 22 may comprise a blind spot or object detection indicating device or module that is operable to indicate to the driver of the subject or host vehicle that an object or other vehicle is detected at the side or blind spot region of the host vehicle by a blind spot detection system (or may comprise a turn signal indicating device or module that is operable to indicate to the driver or passenger of another vehicle that the vehicle is turning or changing lanes, or may comprise other forms or types of display or illumination or indicating devices or modules, as discussed below).

Illumination source 28 (such as one or more light emitting diodes (LEDs) or organic light emitting diodes (OLEDs) or the like) is/are energized to direct or emit illumination through indicating light source or block 24 so that the indicator/light is viewable through the reflective element. The indicating light source or block 24 and/or light baffle 30 may be formed to provide a desired shape for viewing of the light passing through the reflective element or the mirror reflective element may include one or more iconistic display areas so that the illumination is viewable and discernible at the reflective element by the desired or targeted viewer, depending on the angle of the ribs or baffle elements 30a of light baffle 30. The mirror assembly thus may provide an iconistic display for an object detection/LCA system and/or an iconistic display for a turn signal indication, and/or may provide other displays or illumination devices, without affecting the scope of the present invention. Optionally, the baffle elements may be painted or coated with a diffuse reflecting layer or paint or coating to enhance the intensity of the light emanating from the light baffle and through the reflective element. Optionally, and desirably, however, the baffle elements may be dark colored and may include textured surfaces to substantially absorb light so as to reduce visibility of the light baffle through the reflective element when the illumination source is deactivated.

Preferably, the mirror reflective element 18 comprises a transflective display on demand reflective element that is partially transmissive and partially reflective, so that the light emanating or glowing from the block may be transmitted through the reflective element when the illumination source is activated, but the indicator and light baffle is substantially non-visible or viewable when the illumination source is deactivated. Optionally, the mirror reflective element 18 may comprise a single substrate or non-electro-optic reflective element (such as shown in FIG. 2), which has a glass substrate 34 with a transflector coating or layer 36 at its forward surface 34a. For example, the transflector coating or layer 36 may comprise an elemental semiconductor coating, such as a silicon-based coating, or may comprise a multilayer stack of non-conducting or poorly conducting but highly transparent thin film coatings (such as metal oxides, such as silicon dioxide or titanium dioxide or zirconium oxide, or metal halides, such as magnesium fluoride), and where the outermost layer of such a stack that is in contact with any electro-optic medium, such an electrochromic medium, is electrically conducting, and preferably comprises a indium tin oxide layer of sheet resistance in the range of about 5 ohms.square to about 20 ohms.square range, or the transflector coating or layer 36 may comprise a metal oxide/metal/metal oxide stack (with at least one of the metal oxide layers comprising a conducting or semiconducting layer), such as an IMI (such as ITO/silver/ITO or ITO/silver alloy/ITO or other suitable alternating layers of materials or the like) stack of layers or coatings such as by utilizing aspects of the reflective elements described in U.S. Pat. Nos. 6,690,268; 5,668,663 and/or 5,724,187, and/or in U.S. pat. applications, Ser. No. 10/528,269, filed Mar. 17, 2005, now U.S. Pat. No. 7,274,501; Ser. No. 10/533,762, filed May 4, 2005, now U.S. Pat. No. 7,184,190; and/or Ser. No. 11/021,065, filed Dec. 23, 2004 by McCabe et al. for ELECTRO-OPTIC MIRROR CELL, now U.S. Pat. No. 7,255,451, which are all hereby incorporated herein by reference in their entireties. Optionally, the reflective element may comprise an electro-optic, such as electrochromic, reflective element, such as discussed below.

Optionally, a heater pad 38 may be provided at the rear surface 34b of the glass substrate 34 of reflective element 18 and between the backing portion 20a of back plate 420 and the reflective element 18 to provide an anti-fogging of de-fogging feature to the exterior mirror assembly (such as by utilizing aspects of the heater elements or pads described in U.S. patent application Ser. No. 11/334,139, filed Jan. 18, 2006 by Byers et al. for MIRROR ASSEMBLY WITH HEATER ELEMENT (Attorney Docket DON01 P-1259), which is hereby incorporated herein by reference in its entirety). The back plate and/or heater pad may include suitable electrical connectors and connections incorporated therein (such as by utilizing aspects of the mirror assembly described in U.S. patent application Ser. No. 11/334,139, filed Jan. 18, 2006 by Byers et al. for MIRROR ASSEMBLY WITH HEATER ELEMENT (Attorney Docket DON01 P-1259), which is hereby incorporated herein by reference in its entirety) for electrically connecting the heater pad and/or display element (or other suitable electrical connectors may be utilized, such as electrical leads or wire harnesses or pigtails or other separate connectors or cables or the like). The heater pad 38 includes a hole or opening or aperture 38a therethrough (or optionally a window or transparent or translucent or diffuse portion of the heater pad, such as a clear or diffusing transparent polyester flexible plastic film or element) that generally corresponds to the light baffle 30 of back plate 20 when the heater pad 38 is attached to the rear surface 34b of glass substrate 34 and when the back plate 20 is attached to the rear surface of the heater pad 38. Optionally, and desirably, the heater pad 38 may include an adhesive layer (such as a pressure sensitive adhesive layer) at its rear surface for adhering the back plate 20 to the heater pad 38 and thus to the rear surface 34b of the glass substrate 34 of the reflective element 18. As shown in FIG. 2, back plate 20 is adhered to heater pad 38 such that indicator mounting portion 26 and light baffle 30 are positioned or located generally at the aperture 38a of heater pad 38 so as to be generally at the display area of the reflective element.

Optionally, the back plate may include a perimeter framing portion or bezel portion that extends around the perimeter edges of the reflective element to support the reflective element and frame the reflective element at the mirror assembly (such as by utilizing aspects of the mirror assemblies described in U.S. patent application Ser. No. 11/520,193, filed Sep. 13, 2006 (Attorney Docket DON01 P-1286), which is hereby incorporated herein by reference in its entirety). The perimeter bezel portion may be narrow or small depending on the particular application of the reflective element and mirror reflector sub-assembly. Optionally, the mirror reflector sub-assembly may comprise a bezelless or frameless reflective element (such as the types described in U.S. patent applications, Ser. No. 11/226,628, filed Sep. 14, 2005 (Attorney Docket DON01 P-1236); Ser. No. 10/533,762, filed May 4, 2005, now U.S. Pat. No. 7,184,190; and/or Ser. No. 11/021,065, filed Dec. 23, 2004, now U.S. Pat. No. 7,255,451, and/or PCT Application No. PCT/US2006/018567, filed May 15, 2006 by Donnelly Corp. et al., and published Nov. 23, 2006 as International Publication No. WO 2006/124682, which are hereby incorporated herein by reference in their entireties), whereby the back plate may not include a perimeter framing portion or bezel portion around the perimeter of the reflective element.

Optionally, and preferably, indicator element or display element or signal indication module 22 may snap into or may be threaded into the end or pocket of the indicator mounting portion 26 or may otherwise be attached or stuck at the indicator mounting portion, and may have a gasket or seal at the signal indication module to provide a substantially water proof or water resistant or water tight seal at the signal indication module, whereby the signal indication module may be sealed at the indicator mounting portion, such as by gluing or pressing or screwing or gasketing or hermetically sealing or otherwise substantially sealing the signal indication module at the indicator mounting portion. The signal indication module may comprise a self-contained, unitary, sealed or substantially sealed, indicator module that includes the translucent block, an illumination source (such as one or more LEDs or the like), a DC converter with a voltage dropping resistor (such as described in U.S. Pat. Nos. 6,902,284 and 6,690,268 and/or U.S. patent application Ser. No. 10/054,633, filed Jan. 22, 2002 by Lynam et al. for VEHICULAR LIGHTING SYSTEM, now U.S. Pat. No. 7,195,381, which are hereby incorporated herein by reference in their entireties). The signal indication module thus may be connected to a power source and may be activated or energized to illuminate the display for viewing by the driver of the vehicle. Optionally, the electrical connections to the signal indication module may be made while the signal indication module is attached to the mirror assembly, such as via a plug and socket type arrangement or configuration, and such as by utilizing aspects of the mirror assembly described in U.S. Pat. No. 6,669,267, which is hereby incorporated herein by reference in its entirety. The unitary signal indication module may include or utilize aspects of various light modules or systems or devices, such as the types described in U.S. Pat. Nos. 6,227,689; 6,582,109; 5,371,659; 5,497,306; 5,669,699; 5,823,654; 6,176,602; and/or 6,276,821, and/or U.S. patent application Ser. No. 11/520,193, filed Sep. 13, 2006 (Attorney Docket DON01 P-1286), and/or PCT Application No. PCT/US2006/018567, filed May 16, 2006 and published Nov. 23, 2006 as International Publication No. WO 2006/124682, which are hereby incorporated herein by reference in their entireties.

Optionally, the signal indication module may be supplied or provided to an assembly facility (such as a mirror assembly facility or the like) from a module supplier while the back plate may be supplied or provided to the assembly facility from a back plate supplier. An operator at the assembly facility may attach the module to the back plate, preferably by snapping or pressing the module to the back plate to assemble the module to the back plate (whereby the module may have a snug fit within the receiving portion or pocket such that the module and back plate are preferably substantially water impervious). Optionally, and desirably, electrical connection (such as to a power supply or 12 volt power wire of the vehicle battery/ignition system or to a power feed from a LIN bus controller) to the module may be made when the module is snapped or otherwise attached (preferably mechanically but optionally adhesively) to the back plate (such as by making electrical contact between the module and mirror circuitry [including circuitry associated with the reflective element and/or mirror assembly, such as electrochromic mirror circuitry, mirror lights and display circuitry and the like, typically disposed at a printed circuit board of the mirror assembly] when the module is snapped to the back plate, such as by press attaching the display module into receiving fingers or clips or snaps or the like that are integrally formed with the back plate in the injection molding operation that manufactures or forms the back plate itself) or alternately, electrical connection to the module may be made via other means, such as wires or leads or the like before or after the module is snapped or attached to the back plate.

Optionally, and as shown in FIGS. 7 and 8, a reflective element assembly 12' includes a reflective element 18' and a back plate 20', which includes a plurality of angled baffle elements 30a' of a light baffle 30'. Back plate 20' includes an attachment element or snap element 26a' for attaching to or snapping to a corresponding attachment element or snap element 26b' of a signal indicating module 22' to attach or support signal indicating module 22' at the rear of back plate 20' and at and rearward of light baffle 30'. The attachment element 26a' may be integrally formed at the rear of the back plate 20' (such as during the integral molding formation of the back plate itself and such as via an injection molding tool or the like) and at or near baffle elements 30a' of light baffle 30' of back plate 20', while attachment elements 26b' may be integrally formed or otherwise established at a forward surface of signal indicating module 22'. Although described as snaps or snap elements, other mechanical or adhesive means may be utilized to attach the signal indicating module to the back plate, while remaining within the spirit and scope of the present invention. Thus, the signal indicating module 22' may be mounted to or supported at the rear surface of the light baffle 30' (and may be substantially parallel to the rear surface of the reflective element 18' or to the generally planar portion 20a' or rear surface of the back plate 20'). Back plate 20' may also include a mounting portion 20b' for mounting or attaching the back plate 20' to a mirror actuator (not shown), such as described above.

Signal indication module 22' includes a transparent or translucent polymeric block or element or indicating light source or element 24' and an illumination source or indicator 28', such as one or more light emitting diodes (LEDs) or other suitable illumination source, such as described above. In the illustrated embodiment, signal indicating module 22' comprises a rhombus-shaped or parallelogram shaped element having a transparent or translucent optical plastic block 24' at least partially surrounded by or encased by side walls 25'. The optical block 24' may be light reflecting or light absorbing or light diffusing depending on the particular application and desired lighting effect for the signal indicating module. Optionally, the optical block may be cast or injection molded from an optical light transmitting polymeric resin, such as a polycarbonate or an acrylic, or an acrylate, or a polystyrene, or a CR-39 or a COC olefin or other suitable material. The block may be molded as a translucent element, and may comprise a material that is at least partially crystalline, or the material may have a light scattering material mixed therein, or may be otherwise selected so as to provide a diffuse block, whereby the illumination emitted by the illumination source or LED will emanate from the forward surface of the block as a substantially uniform glow. The translucent diffuse block or element may be formed to a desired or suitable shape, such as described above, so as to provide the desired form for viewing by the driver of the vehicle.

Signal indication module 22' includes a circuit element 32', such as a printed circuit board or the like (such as a rigid or flexible circuit board or element), with illumination sources or LEDs 28' disposed thereat (such as surface mounted or otherwise disposed LEDs or other suitable or equivalent light sources). Circuit element 32' is attachable to a rear surface 24a' of indicating light source or block 24', whereby the illumination sources 28' are located at the rear surface and preferably at or partially within light source receiving apertures or recesses 24b' at the rear surface 24a' of indicating light source or block 24'. The signal indication module 22' may be purchased as a display element assembly or module (including the circuit element and circuitry, which are attached at the rear of the indicating light source or block 24') and assembled to the mirror reflective element sub-assembly 12', such as at a mirror assembly facility, and such as via snapping the attachment elements 26a' and 26b' together to attach the signal indicating module 22' at the rear of the back plate 20' and generally at light baffle 30' molded or formed as part of the back plate 20'. Circuit element 32' preferably includes an electrical connector or lead or terminal for electrically connecting the circuitry and light source to electrical power or electrical control at the mirror assembly when the signal indication module is attached to the back plate and installed at the mirror casing.

Thus, signal indicating module 22' provides an angled shape with the side walls 25' being angled generally along a similar angle as the angle of the baffle elements or vanes 30a' of light baffle 30'. For application as a turn signal indicator, the angle of the vanes 30a' is selected so that the vanes 30a' are generally canted toward or directed toward the portion of the roadway adjacent to the side of the vehicle to which the exterior rearview mirror assembly utilizing signal indicating module 22' is mounted, and where the driver of an overtaking vehicle generally adjacent to the equipped vehicle would readily observe the indication. Alternatively, should the indicator be a blind spot indicator, the angle of the vanes or baffle elements may be selected so that the vanes are generally canted toward or directed toward the side of the vehicle to which the exterior rearview mirror assembly utilizing the signal indicating module is mounted, and where the driver of the equipped vehicle would readily observe the indication or alert provided by the indicating module.

The parallelogram shape of signal indicating module 22' provides the angled side walls 25' while providing a rear surface 24a' of optical block 24' that is generally parallel to the generally planar back plate 20', such that the non-angled rear surface of the optical block 24' may have a reduced depth into the mirror casing so as to be more readily packaged within the mirror assembly. The optical block 24' may be formed to the desired shape and the outer side walls 25' may be formed or established or coated therearound, such as via overmolding techniques or painting or the like, or the outer side walls 25' may be formed and the optical block 24' may be molded or injected or established therein, such as via a separate molding process or co-injection molding process or the like. The inner surfaces of the outer side walls 25' may have a surface treatment or characteristic, such as by decoration or treatment, such as by coatings or paints or the like, or such as by physical establishment, such as grain, stipple, pits/light traps or the like established during the molding of the plastic elements themselves, to provide the desired reflectivity/diffusivity of the signal indicating module 22'. Optionally, a cover or seal or the like may be provided at least partially around the signal indicating module to cover and/or substantially seal the circuit element and optical block at and within the signal indicating module. The signal indicating module thus provides a self-contained module or device that may be readily attached to the mirror back plate and readily connected to electrical wiring or leads of the mirror assembly.

In the illustrated embodiment, reflective element 18' comprises an electrochromic reflective element (but could comprise a non-electrochromic reflective element without affecting the scope of the present invention) having a front substrate 40, a rear substrate 42 and an electrochromic medium 43 (such as a solid polymer matrix electrochromic medium or the like) sandwiched therebetween and sealed via a perimeter seal 44. Front substrate 40 has a transparent conductor coating 46 (such as an indium tin oxide (ITO) coating or layer) disposed at its rear surface 40a, while rear substrate 42 has a transflector coating 48 (such as a non-dichroic transflector, such as an ITO/Ag/ITO stack of layers or coatings or the like) disposed at its front surface 42a. Optionally, the reflective element may include a perimetal metallic reflector band 50 (such as chromium or other suitable material), such as by utilizing aspects of the reflective elements described in U.S. pat. applications, Ser. No. 10/528,269, filed Mar. 17, 2005, now U.S. Pat. No. 7,274,501; Ser. No. 10/533,762, filed May 4, 2005, now U.S. Pat. No. 7,184,190; Ser. No. 11/021,065, filed Dec. 23, 2004 by McCabe et al. for ELECTRO-OPTIC MIRROR CELL, now U.S. Pat. No. 7,255,451; and/or Ser. No. 11/226,628, filed Sep. 14, 2005 by Karner et al. for MOUNTING ASSEMBLY FOR VEHICLE INTERIOR MIRROR (Attorney Docket DON01 P-1236), which are all hereby incorporated herein by reference in their entireties. In the illustrated embodiment, the metallic reflector band 50 is disposed at the rear surface 40a of front substrate 40, with the transparent conductor coating 46 overlapping the band 50 at the perimeter regions of the reflective element, but the reflector band may otherwise be disposed over the transparent conductor, depending on the particular or selected or desired tint or appearance of the metallic perimeter band.

Mirror reflector sub-assembly 12' also includes a heater pad 38 disposed between back plate 20' and the rear surface 42b of rear substrate 42. As shown in FIGS. 7 and 8, heater pad 38 has an aperture 38a formed therethrough that generally corresponds with the light baffle 30' of back plate 20' when the heater element is attached or adhered to the back plate. Optionally, and desirably, an opacifying element or layer or coating or film 52 (such as black or dark color, such as dark blue or dark grey, paint or ink or film or coating or tape or lacquer or the like, and preferably a dark, light-absorbing layer that is printed or screened onto the fourth or rear surface of the electrochromic reflective element or cell) may be disposed between heater element 38 and rear surface 42b of rear substrate 42. The dark or opacifying layer may be established via any suitable establishing methods or means, such as painting, printing, ink jet printing, pad printing, screening or the like.

Optionally, and with reference to FIGS. 9 and 10, a reflective element assembly 12" includes a reflective element 18' (such as similar to the reflective element described above) and a back plate 20". Back plate 20" includes an attachment element or snap element 26a" for attaching to or snapping to a corresponding attachment element or snap element 26b" of a signal indicating module 22" to attach or support signal indicating module 22" at the rear of back plate 20" and at and rearward of an aperture 20d" formed through back plate 20". The attachment element 26a" may be integrally formed at the rear of the back plate 20" and at or near aperture 20d" of back plate 20", while attachment elements 26b" may be integrally formed or otherwise established at a forward surface of signal indicating module 22". Thus, the signal indicating module 22" may be mounted to or supported at the rear surface of the back plate 20" (and may be substantially parallel to the rear surface of the reflective element 18' or to the generally planar portion 20a" or rear surface of the back plate 20"). Back plate 20" may also include a mounting portion 20b" for mounting or attaching the back plate 20" to a mirror actuator (not shown), such as described above.

As shown in FIGS. 9 and 10, signal indicating module 22" includes a transparent or translucent polymeric block or element or indicating light source or element 24" disposed at least partially within an outer casing or shell 25", and an illumination source or indicator 28", such as one or more light emitting diodes (LEDs) or other suitable illumination source, disposed at the rear surface 24a" of the optical block 24". Similar to signal indicating module 22', discussed above, signal indicating module 22" comprises a rhombus-shaped or parallelogram shaped element having a transparent or translucent optical plastic block 24" at least partially surrounded by or encased by outer shell 25". Optionally, the signal indicating module or shell or element may be any suitable or desirable or appropriate shape (at least at its terminal portion closest to the rear of the reflective mirror element) to provide a desired indicator or icon as seen by a person viewing from the front of the reflective mirror element when the signal indictor is activated. For example, the signal indicating module or tube or shell or element may comprise a triangular-shaped tube or element for providing a triangular-shaped indicator or icon, such as for a signal indicative of a hazard signal of the vehicle being activated, or may be any other shape as desired.

In the illustrated embodiment, outer shell 25" includes side walls 25a" and a forward surface or portion 25b", which includes a light baffle 30" molded as part of the outer shell. As shown in FIGS. 9 and 10, forward portion 25b" of outer shell 25" has the light baffle 30" (which includes a plurality of baffle elements or vanes 30a" formed at an angle relative to the planar forward surface of the forward portion 25b" with slots formed between the vanes for light from the illumination source 28" to pass therethrough) integrally formed therewith. Although shown in FIGS. 9 and 10 as extending partially along the depth of the outer shell 25", the baffle elements 30a" may extend substantially the entire depth of the shell 25" so that a rearward end or region of the baffle elements is generally at or near the rear surface of the optical block 24" when the optical block 24" is established within shell 25", as discussed below. Optionally, the baffle elements or vanes 30a" may be formed with apertures or holes therethrough to allow light from within optical block 24" (such as at the sides of the baffle) to pass through the vanes 30a" to enhance the light emanating from the forward portion of the signal indicating module when the illumination source is activated. The vanes at either or both sides of the baffle portion may have more holes or apertures therethrough, while the inner vanes may not have holes therethrough, in order to provide the desired degree of light emanating from the signal indicating module. The forward portion 25b" of shell 25" further includes attachment elements 26b", such as receiving portions for receiving the attachment elements 26a" of back plate 20".

Optionally, the outer shell 25" may be molded of a plastic or polymeric material, such as a dark plastic resin or a light or white plastic resin or the like, and the inner surfaces of the side walls 25a" may have a surface treatment or characteristic, such as stippling or texturing or coating or the like (such as discussed above), established thereon. The optical block 24" may be formed via a separate injection molding process or a co-injection molding process, wherein the polymeric material of the optical block (such as a polycarbonate or acrylic material or the like) may be injected or established within the side walls 25a" of outer shell 25" and within the slots between the baffle elements 30a". Optionally, the tube or shell or element or side walls of the tube or shell or element may be lined with a visible light highly reflecting material (such as by being formed at least partially of a bright reflecting material and/or by being coated or painted or decorated with a bright reflecting material and/or by being sleeved with a highly reflecting metal thin film or foil or coating) so as to enhance passage of light down along the tube or shell or element and so as to enhance the luminance of the displayed hazard or other indication as viewed by a person viewing the mirror assembly when the illumination source is activated and when being viewed such as on a bright sunny day where display wash-out might be a concern, or the tube or shell or side walls of the tube or shell or element may only have the distal part or portion (the portion or end region of the shell that is further away from the rear surface of the reflective element and toward or at the illumination source) be reflective (which may be specularly reflective, such as from a metal coating or foil, and/or may be diffusely reflective, such as from a white paint or pigment or from an Argent paint or coating), while the rest of the tube or shell or element, or side walls of the shell or tube or element, closest to the terminal end at the rear of the mirror reflective element are substantially not reflecting or are light absorbing or black or the like, in order to enhance the directionality of the light emitted by the indicator module.

The illumination source 28" or circuit element 32" (such as a printed circuit board or the like) may be attached or snapped to the rear of the module, such as to the rear surface 24a" of the optical block 24" or to a rear attachment portion of the outer shell, whereby the illumination sources 28" are located at the rear surface of the optical block and preferably at or partially within light source receiving apertures or recesses 24b" at the rear surface 24a" of optical block 24". The circuit element 32" may include electrical connectors or terminals for connecting the signal indicating module 22" to electrical leads of the mirror assembly when the reflective element assembly 12" is installed at or in a mirror assembly.

Optionally, a cover or seal or the like may be provided at least partially around the signal indicating module to cover and/or substantially seal the circuit element and optical block at and within the signal indicating module (or the signal indicating module may be otherwise substantially sealed) so that the signal indicating module may be substantially water impervious. The signal indicating module thus provides a self-contained module or device that may be readily attached to the mirror back plate and readily connected to electrical wiring or leads of the mirror assembly. Advantageously, the substantially sealed signal indicating module may be brought in or installed as a single or unitary module with sealed elements and mechanical connections and electrical connectors pre-established as part of the sealed unitary signal indicating module. Thus, the mechanical connectors or elements or connections may mechanically connect to the mirror back plate, and the electrical connectors may be electrically connected to electrical wiring or leads of the mirror assembly when the sealed, self-contained signal indicating module is installed at or in or at least partially in the exterior rearview mirror assembly.

Thus, signal indicating module 22" provides an angled shape with the side walls 25a" of the outer shell 25" being angled generally along a similar angle as the angle of the baffles or vanes or elements 30a" of light baffle 30" of outer shell 25" of signal indicating module 22". The parallelogram shape of signal indicating module 22" provides the angled side walls 25" while providing a rear surface 24a" of optical block 24" that is generally parallel to the generally planar back plate 20", such that the non-angled rear surface of the optical block 24" may have a reduced depth into the mirror casing so as to be more readily packaged within the mirror assembly with a reduced packing density within the mirror assembly.

The signal indicating module of the present invention (such as, for example, as shown in FIGS. 9 and 10) provides an economical and effective signal indicator without requiring the expense or complexity of providing a lens or other optical device that receives the light from the light assembly and emits it in a given direction as parallel rays. Thus, no collimating optical element, or equivalent thereof, is utilized or needed in the construction of the signal indicating module of the present invention. The present invention provides a semi-transparent mirror reflective element (having a substrate with a coating on one surface that is substantially transparent and reflective at any given point, e.g., a half-silvered or one way mirror) without any discreet apertures or individual apertures in the substantially continuous and uninterrupted reflector utilized. Thus, there are no identifiable gaps in the mirror coating through which light from the light assembly transmits.

Accordingly, the signal indication module 22" may be purchased as a display element assembly or module (including the circuit element and circuitry, which is/are attached at the rear of the block 24") and assembled to the mirror reflective element sub-assembly 12", such as at a mirror assembly facility, and such as via snapping the attachment elements 26a" and 26b" together to attach the signal indicating module 22" at the rear of the back plate 20" and generally at aperture 20d" of back plate 20". Circuit element 32" preferably includes an electrical connector or lead or terminal for electrically connecting the circuitry and light source to electrical power or electrical control at the mirror assembly when the signal indication module is attached to the back plate and installed at the mirror casing.

Optionally, and as shown in FIGS. 11 and 12, a back plate 120 may include an attachment element or indicator receiving portion 126 that has an angled or canted or slanted surface for receiving or supporting a signal indicating module 122 thereat. The indicator receiving portion 126 is integrally formed at the rear of the angled baffle elements 130a of a light baffle 130 of back plate 120. Thus, the signal indicating module 122 may be mounted to or supported at the canted surface 120c of the light baffle 130, such that the indicating light source or block 124 is angled relative to the generally planar backing portion 120a of back plate 120. Back plate 120 may also include a mounting portion 120b for mounting or attaching the back plate 120 to a mirror actuator (not shown), such as described above.

In the illustrated embodiment of FIGS. 11 and 12, the signal indicating module 122 includes a transparent or translucent indicating light source or glow block 124 (such as similar to block 24 described above) and a light source 128 at the rear of indicating light source or block 124. The light source 128 is preferably a power LED, such as of the types described in U.S. patent application Ser. No. 10/054,633, filed Jan. 22, 2002 by Lynam et al. for VEHICULAR LIGHTING SYSTEM, now U.S. Pat. No. 7,195,381, which is hereby incorporated herein by reference in its entirety. Illumination emitted by the power LED is directed through indicating light source or block 124 (which may have reflecting rear and side surfaces as described above) and is transmitted through slots 130b of light baffle 130, and is shaded or shielded from view from another angle via baffle elements 130a, such as in a similar manner as described above. Because the signal indicating module 122 and back plate 120 may be otherwise substantially similar to the signal indicating module 22 and back plate 20 described above, a detailed discussion of the modules and back plates need not be repeated herein. Because the block comprises a translucent diffusing block, the illumination emitted by the power LED is transmitted through the block (and preferably reflected off of the sides and rear of the block as described above) such that the light emanating from the block is viewed as a substantially uniform glow and not as a point source of light.

In the illustrated embodiment, the slots 130b and baffle elements 130a are angled through indicator mounting portion 126 and are generally normal to block 124. As can be seen in FIG. 11, the slots and baffle elements are angled outward and away from the host vehicle and away from the driver of the host vehicle. The light source 128 is located at block 124 (such as at a circuit element or board or the like), which is at or near the end of the slots 130b so that light emitted by light source 128 is emitted through slots 130b and away from the view of the driver of the host vehicle sitting in the vehicle cabin. The angle of the rear surface and/or the slots and baffle elements may be selected to provide the desired angle of the light path as the light exits the indicator receiving portion, depending on the particular application of the signal indicating module and reflective element sub-assembly. The light baffle may be established to provide the desired indicator form or shape, such as a chevron shape or arrowhead shape or other suitable shape or form, and may be readily viewable and discernible and recognizable when the light source is activated. Because the back plate 120 and indicator receiving portion 126 of back plate 120 are substantially opaque, the slots and block and light source are not readily viewable and discernible when the light source is deactivated. Optionally, the surfaces of the baffle elements 130a (such as the surfaces facing partially toward the reflective element when the back plate is attached to the rear of the reflective element) may be textured or stippled to diffuse or absorb light so as to reduce visibility of the baffle elements to a person viewing the reflective element when the signal indicating module is deactivated.

Optionally, and with reference to FIG. 13, a mirror reflector sub-assembly 112 may comprise back plate 120, a signal indicating module 122' and an electro-optic (such as electrochromic) reflective element 118. Back plate 120 is substantially similar to the back plate of FIGS. 11 and 12, and receives or supports signal indicating module 122' at the angled or canted surface 120c of the back plate 120 at the rear of the light baffle 130. In the illustrated embodiment, signal indicating module 122' includes a indicating light source or block 124' and an illumination source 128', which may comprise a power LED or the like. As shown in FIG. 13, illumination source 128' may be located at or in (such as recessed in) a side portion or surface 124c' of indicating light source or block 124'. The rear surface 124a' and side surfaces 124c' of indicating light source or block 124' may be coated or painted so as to have reflective surfaces, such as described above. Thus, the light emitted by the light source 128' at the side of the indicating light source or block 124' is reflected off of the side and rear surfaces of the block and is transmitted through the block and through and along the slots 130b of light baffle 130 and through the reflective element 118.

In the illustrated embodiment, reflective element 118 comprises an electrochromic reflective element having a front substrate 140, a rear substrate 142 and an electrochromic medium 143 (such as a solid polymer matrix electrochromic medium or the like) sandwiched therebetween and sealed via a perimeter seal 144. Front substrate 140 has a transparent conductor coating 146 (such as an indium tin oxide (ITO) coating or layer) disposed at its rear surface 140a, while rear substrate 142 has a transflector coating 148 (such as a non-dichroic transflector, such as an ITO/Ag/ITO stack of layers or coatings or the like) disposed at its front surface 142a. Optionally, the reflective element may include a perimetal metallic reflector band 150 (such as chromium or other suitable material), such as by utilizing aspects of the reflective elements described in U.S. pat. applications, Ser. No. 10/528,269, filed Mar. 17, 2005, now U.S. Pat. No. 7,274,501; Ser. No. 10/533,762, filed May 4, 2005, now U.S. Pat. No. 7,184,190; Ser. No. 11/021,065, filed Dec. 23, 2004 by McCabe et al. for ELECTRO-OPTIC MIRROR CELL, now U.S. Pat. No. 7,255,451; and/or Ser. No. 11/226,628, filed Sep. 14, 2005 by Karner et al. for MOUNTING ASSEMBLY FOR

VEHICLE INTERIOR MIRROR (Attorney Docket DON01 P-1236), which are all hereby incorporated herein by reference in their entireties. In the illustrated embodiment, the metallic reflector band 150 is disposed at the rear surface 140a of front substrate 140, with the transparent conductor coating 146 overlapping the band 150 at the perimeter regions of the reflective element, but the reflector band may otherwise be disposed over the transparent conductor, depending on the particular or selected or desired tint or appearance of the metallic perimeter band.

Mirror reflector sub-assembly 112 also includes a heater pad 138 disposed between back plate 120 and the rear surface 142b of rear substrate 142. As shown in FIG. 13, heater pad 138 has an aperture 138a formed therethrough that generally corresponds with the light baffle 130 of back plate 120 when the heater element is attached or adhered to the back plate. Optionally, and desirably, an opacifying element or layer or coating or film 152 (such as black or dark color, such as dark blue or dark grey, paint or ink or film or coating or tape or lacquer or the like, and preferably a dark, light-absorbing layer that is printed or screened onto the fourth or rear surface of the electrochromic reflective element or cell) may be disposed between heater element 138 and rear surface 142b of rear substrate 142. The dark or opacifying layer may be established via any suitable establishing methods or means, such as painting, printing, ink jet printing, pad printing, screening or the like.

Optionally, and with reference to FIG. 14, the reflective element 118' may include an anti-reflection layer or layers 154 disposed at the front surface 140b of front substrate 140 to reduce reflection of light incident on the reflective element. The anti-reflection layer/layers 154 may be deposited at the front surface of the front substrate during a pyrolytic deposition process. For example, the anti-reflection layer (such as an OPTIVIEW™ layer such as commercially available from Pilkington) may be deposited pyrolytically in a glass manufacturing plant where the anti-reflection layer may be formed by deposition onto the glass surface at the glass float-line itself when the glass ribbon is first being formed from the molten glass raw materials (where the red-hot molten glass exiting the glass furnace is floated onto a tin bath and where the coating materials or gasses or precursors are blown onto the red hot glass ribbon prior to it cooling to form the glass sheet, i.e., while the glass exits the tin bath and while it is still in a very hot condition to form the anti-reflection coatings on the glass surface by pyrolytic chemical reaction of the gaseous precursors as they are incident on the red-hot glass surface). It is envisioned that the conductive coating may also or otherwise be disposed or deposited at the surface of the glass via a pyrolytic deposition process, such as by utilizing aspects described in PCT Application No. PCT/US2006/018567, filed May 15, 2006 and published Nov. 23, 2006 as International Publication No. WO 2006/124682, which is hereby incorporated herein by reference in its entirety. Because the other components or elements of mirror reflective element 118' and mirror reflector sub-assembly 112' may be substantially similar to those of reflective element 118 and sub-assembly 112, discussed above, a detailed discussion of the reflective elements and sub-assemblies need not be repeated herein. The similar or common elements of the reflective elements and sub-assemblies are shown in FIGS. 13 and 14 with like reference numbers.

Although it is known to dispose an anti-reflection coating or layer at a first surface of a reflective element (such as described in U.S. Pat. No. 5,076,674, which is hereby incorporated herein by reference in its entirety), such coatings have not to date achieved commercial success due to the costs associated with such coatings. The prior concerns can be overcome utilizing a glass substrate or sheet that is coated with a durable and preferably bendable and most desirably temperable anti-reflective means. Preferably, such material is deposited pyrolytically in a glass manufacturing plant and as the glass ribbon being formed (and while still a red hot glass ribbon) is exiting the float bath (typically floating on molten tin). The bendability and temperability of the coated glass so formed via an in-float pyrolytic deposition process when the flat glass sheet is itself being made at the glass sheet manufacturing plant also allows the glass to be purchased in flat glass sheets and formed or cut and bent at a later time, such as by the mirror manufacturer.

Such pyrolytically coated glass provides a durable, bendable and temperable substrate that provides reduced reflectance of light incident thereon when the so-coated surface is used as the first surface in an EC mirror cell construction. For example, such coated glass preferably transmits at least 90 percent of visible light and has a first surface reflectance of less than 2 percent, more preferably less than 1 percent and more preferably less than 0.75 percent (broadly across the visible light spectrum). Such pyrolytic deposited coatings and coated substrates provide durable, bendable and temperable anti-reflection means, and preferably also have a low ultraviolet (UV) light transmission. For example, such coated glass may typically pass less than about 1 percent of solar UV energy therethrough (by comparison, clear float glass typically passes about 62 percent of solar UV energy therethrough).

Because the coated glass is durable, bendable and temperable, the mirror reflector manufacturer may purchase the coated glass in flat sheets and may cut and/or form and/or bend and/or temper the glass to make the desired or appropriately shaped mirror substrates or shapes. Also, because the coated glass provides a reduced reflectance at the first surface of the reflective element, a reflectance of light incident on the mirror reflective element of only about 4 to 5 percent (as measured in accordance with SAE J964a, which is hereby incorporated herein by reference in its entirety) can be achieved when the electrochromic mirror is dimmed to its maximum level (according to the applied voltage for the particular unit, typically about 1.2 to 1.4 volts and typically about 1.25 volts, when applied to the conductive coatings of the substrates of the reflective element). By comparison, typical interior and exterior rearview mirrors may dim to a minimum reflectance of light incident thereon that is at about 5 to 8 percent when the electrochromic mirror is dimmed to its maximum level. Optionally, the anti-reflection coating or layer may be disposed at the first or front surface of the reflective element utilizing aspects of the reflective elements described in U.S. Pat. No. 5,076,674, which is hereby incorporated herein by reference in its entirety.

Thus, the mirror reflective element of the present invention may provide a reduced reflectivity at the reflective element when the electro-optic reflective element is at its maximum dimming state. The mirror reflective element may be configured to provide the desired reflectivity at the maximum dimmed state (such as a photopic reflectance of light incident thereon of at least about 4 percent and at most about 5 percent), and the optical characteristics or properties may be selected or configured to attain the desired range of reflectivity. For example, the first surface anti-reflectivity coating (such as properties thereof) may be selected or adjusted, and/or the thickness of the transparent conductor coating (such as ITO) may be selected or adjusted, and/or the reflectivity of the third surface transflector coating may be selected or adjusted, and/or the type or thickness of the electrochromic medium itself may be selected or adjusted to adjust or reduce the reflectivity of the mirror to the desired range when the mirror reflector is at its fully dimmed state. For example, if a mirror reflective element provides about 3 percent reflectance of light incident thereon, the mirror manufacturer may reduce the thickness of the electrochromic medium to increase the reflectance to about 4 percent or more, while keeping the reflectance at or below 5 percent of light incident thereon.

Optionally, the back plate may have two or more indicator display elements or modules mounted thereto, such as in a similar manner as described above. For example, a light baffle may be formed at an outboard portion of the back plate (away from the vehicle when the mirror assembly is mounted at the side of the vehicle) and may have the baffle elements angled so as to direct the light or glow from the block generally outwardly so as to not be readily viewable by the driver of the vehicle and, thus, to provide a turn signal indicator at the exterior mirror assembly, while another light baffle may be formed at an inboard portion of the back plate (toward the vehicle when the mirror assembly is mounted at the side of the vehicle) and may have the baffle elements angled so as to direct the light or glow from the block generally inwardly so as to be readily viewable by the driver of the vehicle and, thus, to provide a blind spot alert or indicator for a side object detection system or blind spot detection system or lane change assist system or the like. The indicators or display modules may be substantially similar to those described above, or may utilize aspects of the indicator modules described in U.S. patent application Ser. No. 11/520,193, filed Sep. 13, 2006 (Attorney Docket DON01 P-1286), and/or PCT Application No. PCT/US2006/018567, filed May 16, 2006 and published Nov. 23, 2006 as International Publication No. WO 2006/124682, and/or U.S. provisional application Ser. No. 60/857,025, filed Nov. 6, 2006 (Attorney Docket DON01 P-1306), which are hereby incorporated herein by reference in their entireties.

For example, and with reference to FIGS. 15 and 16, a back plate 220 may include a turn signal indicator mounting portion 226a (such as at an outboard portion or region of the back plate) and a blind spot indicator mounting portion 226b (such as at an inboard portion or region of the back plate). In the illustrated embodiment, the turn signal indicator mounting portion 226a and signal indicating module 222a may be similar to mounting portion 126 and module 122 described above with respect to FIG. 11, and may include a translucent block or indicating light source or element 224 and illumination source 228a at a rear portion of the mounting portion 226a and generally at a light baffle 230 of back plate 220. Optionally, the blind spot indicator or alert module or element 222b at mounting portion 226b may utilize aspects of the indicator modules and mounting portions described in U.S. patent application Ser. No. 11/520,193, filed Sep. 13, 2006 (Attorney Docket DON01 P-1286), which is hereby incorporated herein by reference in its entirety. Briefly, such a mounting portion 226b may comprise a hollow tube 227 integrally formed with and extending from the rear of the back plate 220, and with a passageway extending therethrough or therealong, whereby the indicator module 222b is mounted at the rearward portion of the hollow tube 227. The indicator module 222b includes an illumination source or LED 228b that is operable to emit light into and along and through the passageway of the hollow tube 227 and toward and through the reflective element 218 (FIG. 16) for viewing by the driver of the vehicle. Back plate 220 also includes an actuator mounting portion 220b for attaching the back plate and reflective element to a mirror actuator for providing adjustment of the reflective element by the driver of the vehicle.

The reflective element 218 may comprise any type of reflective element, preferably a transflective or display on demand type reflective element such as described above. In the illustrated embodiment, reflective element 218 comprises a transflective electrochromic reflective element having a first or front substrate 240 and a second or rear substrate 242 with an electrochromic medium 243 sandwiched therebetween and sealed with a perimeter seal 244. The front substrate 240 includes a transparent conductor coating 246 at its rear surface and may include a perimeter metallic band 250 at the perimeter of the rear surface, such as described above. The rear substrate 242 includes a transflective coating or a metal oxide/metal/metal oxide stack (with at least one of the metal oxide layers comprising a conducting or semiconducting layer), such as an IMI stack of coatings or layers 248, at its front surface. The back plate 220 is adhered or attached at the rear surface of the rear substrate, and the mirror reflective element sub-assembly 212 may include a heater element 238 and an opacifying element or layer or coating or film 252 disposed between the back plate and rear substrate. As can be seen in FIG. 16, the heater element 238 and opacifying layer 252 include apertures therethrough at the location of the light baffle 230 and the passageway of the indicator mounting portion 226b of the back plate 220, so that light emanating from the signal indicating modules 222a, 222b is transmitted through the apertures in the heater element and opacifying layer and through the reflective element for viewing by a person viewing the reflective element at the appropriate angle.

Thus, the blind spot indicator mounting portion 226b may be angled so as to direct the light toward the vehicle and toward a driver or occupant of the host vehicle. More particularly, the light beam emitted from the blind spot signal indicating module 222b and transmitted through the reflective element is angled so as to have its principle beam axis directed generally toward the eyes of a driver seated in the interior cabin of the host vehicle. The indicator mounting portion thus may extend from the rear of the back plate at an acute angle (such as approximately about 25 to about 30 degrees or thereabouts) relative to the plane defined by the back plate so as to direct or guide light through the passageway and in the desired direction toward the side of the equipped/host vehicle for viewing the object/LCA indication principally or solely by the driver of the host vehicle. Should, however, the signal module be a turn signal module, then the indicator mounting portion may extend from the rear of the back plate at an acute angle (such as approximately about 55 to about 60 degrees or thereabouts) relative to the plane defined by the back plate so as to direct or guide light through the passageway and in the desired direction away from the side of the equipped/host vehicle for viewing the turn indication principally or solely by the drivers of overtaking vehicles and principally other than by the driver of the host vehicle.

The indicator may be activated or energized in response to a detection of an object or other vehicle approaching or adjacent to the host vehicle in order to alert or warn the driver of the host vehicle not to attempt or initiate a lane change that moves the subject or host vehicle into the already occupied (or soon to be occupied) side lane or region adjacent either the driver side or the passenger side of the host vehicle. The inboard display area may be for displaying or indicating to the driver of the host vehicle that an object has been detected in the blind spot, while the outboard display area may be for displaying or indicating a turn signal activation to the driver of another vehicle. Optionally, the inboard display area may comprise an industry standard icon, such as an ISO icon (showing icons representing the host vehicle and another vehicle at the side and/or rearward of the host vehicle) or the like, to indicate to the driver of the host vehicle that another vehicle has been detected at the side and/or rearward of the host vehicle. The iconistic display may be established at the reflective element, such as by providing indicia at the reflective element such as by utilizing aspects of the reflective elements described in PCT Application No. PCT/US2006/018567, filed May 15, 2006 and published Nov. 23, 2006 as International Publication No. WO 2006/124682, which is hereby incorporated herein by reference in its entirety.

Optionally, however, the display area may comprise other forms, such as, for example, a multi-stage indicator having multiple indicating portions or elements or devices for indicating a degree of hazard or the like of an object or vehicle detected alongside and/or rearward of the host vehicle (such as an indicating display of the types described in PCT Application No. PCT/US2006/026148, filed Jul. 5, 2006 and published Jan. 11, 2007 as International Publication No. WO 2007/005942; and U.S. provisional applications, Ser. No. 60/696,953, filed Jul. 6, 2005 by Lynam for VEHICLE EXTERIOR MIRROR ASSEMBLY WITH BLIND SPOT INDICATOR, and Ser. No. 60/784,570, filed Mar. 22, 2006, which are hereby incorporated herein by reference in their entireties), or other types of indicating means, such as by utilizing aspects of the displays or indicators described in U.S. Pat. No. 6,598,982, issued to Witt; U.S. pat. application Ser. No. 11/226,628, filed Sep. 14, 2005 (Attorney Docket DON01 P-1236); and/or PCT Application No. PCT/US2006/018567, filed May 15, 2006 and published Nov. 23, 2006 as International Publication No. WO 2006/124682, which are hereby incorporated herein by reference in their entireties, without affecting the scope of the present invention.

For example, the icons or pattern that define the display may be established at the rear of the rear substrate and between the rear surface of the rear substrate and the back plate. The icons or pattern that define the display may be established through or defined by the dark layer or opacifying layer so that icons or iconistic portions of the dark layer form the icon or icons of the iconistic display area. Optionally, the iconistic portions of the display area may be established by etching the dark layer or by a mask or the like positioned at the rear surface of the substrate during the painting or screening or coating process that applies the dark layer. Optionally, the iconistic portions of the display area may be established by etching or masking at a fourth surface conductive busbar or coating (such as a fourth surface conductive busbar of the types described in U.S. pat. applications, Ser. No. 11/021,065, filed Dec. 23, 2004 by McCabe et al. for ELECTRO-OPTIC MIRROR CELL, now U.S. Pat. No. 7,255,451; and/or Ser. No. 11/334,139, filed Jan. 18, 2006 by Byers et al. for MIRROR ASSEMBLY WITH HEATER ELEMENT (Attorney Docket DON01 P-1259); and/or U.S. provisional applications, Ser. No. 60/644,903, filed Jan. 19, 2005 by Byers et al. for MIRROR ASSEMBLY WITH HEATER ELEMENT; and Ser. No. 60/667,049, filed Mar. 31, 2005 by Byers et al. for MIRROR ASSEMBLY WITH HEATER ELEMENT, which are hereby incorporated herein by reference in their entireties). Optionally, the icons or pattern may be established via cutouts or holes or patterns or indicia portions formed in and through or partially through a heater pad (that may be attached to or adhered to the dark or opacifying layer at the rear surface of the reflective element, as discussed below), with the dark layer having an opening or aperture formed therethrough and generally corresponding with the indicia portions of the heater pad when the heater pad is adhered to the dark layer at the rear surface of the reflective element.

Optionally, and with reference to FIG. 17, a back plate 320 may be formed (such as via injection molding) to include the mirror actuator attachment portion 320b, an indicator mounting or receiving portion 326a and a second indicator mounting or receiving portion 326b. As can be seen in FIG. 17, indicator receiving portion 326a is formed to receive a signal indicating module 322a such that light emanating from indicating module 322a is transmitted through a passageway 325 of indicator receiving portion 326a. Signal indicating module 322a may be similar to the signal indicating modules described above, and may include a translucent diffusing block or glow element 324 and an illumination source 328a (such as at a rear portion of the block or at a side portion of the block) that emits light into the block, whereby the light reflects off of the sides and rear of the block and is transmitted along the passageway 325 of indicator receiving portion 326a and toward the reflective element.

Likewise, signal indicating module 322b may be similar to signal indicating module 222b discussed above, and may include an illumination source or LED 328b at a passageway along a hollow tube 327 of indicator mounting portion 326b. Preferably, signal indicating module 322a includes a light control film 356a at a forward surface of the glow block or indicating light source 324 to direct the substantially uniform diffuse light emanating from block 324 in a direction generally along passageway 325 of indicator receiving portion 326a. Likewise, the signal indicating module 322b may include a light control film 356b for directing light emitted by illumination source 328b toward and along the passageway of the hollow tube 327 of indicator mounting portion 326b.

The depth or length (or rearward extending dimension) of the indicator receiving portion 326a may be selected to provide the desired degree of shielding or blocking the viewability of light emanating from the indicator module by the driver of the vehicle and to provide the desired viewability of light emanating from the indicator module by the driver of another vehicle when the illumination source of the indicator module is activated, while limiting viewability of the indicator module when the illumination source is deactivated(desirable for example for a turn signal indicator). For example, the indicator receiving portion may extend about 40 mm (or more or less) rearward from the rear surface of the planar back plate portion 320a. Likewise, the angle of the passageway 325 may be selected depending on the particular application of the indicator module. For example, the passageway may be slanted so as to allow light to pass therethrough at an angle A of about 65 degrees (or more or less, such as plus or minus about 5 degrees or thereabouts) relative to the generally vertical plane of the planar back plate portion and reflective element (i.e., about 25 degrees outboard from a line extending perpendicularly from the plane of the planar back plate portion and reflective element), so that the axis formed by the slats or baffles or vanes is generally pointed away from the side of the vehicle (such as for a turn signal indicator application). Optionally, if it is desired, for example, to provide a blind spot indicator or LCA indicator, the passageway of the indicator receiving portion may be slanted so as to allow light to pass therethrough at an angle of about 65 degrees (or more or less, such as plus or minus about 5 degrees or thereabouts) relative to the generally vertical plane of the planar back plate portion and reflective element (i.e., about 25 degrees inboard from a line extending perpendicularly from the plane of the planar back plate portion and reflective element), so that the axis formed by the slats or baffles or vanes is generally pointed toward the side of the vehicle so that the light emanating from the indicator module is viewable by the driver of the host vehicle.

Optionally, and as shown in FIG. 18, a back plate 320' may be molded to include a mirror actuator mounting portion 320b', an indicator receiving or mounting portion 326a' for receiving or mounting a signal indicating module 322a', and another indicator receiving or mounting portion 326b' for receiving or mounting a signal indicating module 322b'. In the illustrated embodiment, the indicator mounting portion 326a' and signal indicating module 322a' are substantially similar to the indicator mounting portion 326a and signal indicating module 322a, discussed above, such that a detailed discussion of the mounting portions and indicating modules need not be repeated herein. Suffice it to say that indicating module 322a may include an optical block or glow element 324a' and at least one illumination source 328a' (such as a power LED) at the block, such as described above.

Likewise, the indicator mounting portion 326b' and signal indicating module 322b' may be similar in construction to the mounting portion 326a' and indicating module 322a' (although signal indicating module 322b' is shown in FIG. 18 with two illumination sources or LEDs 328b at the rear of the translucent optical block or glow element 324b'), but may be angled at a generally opposite direction as the indicating module 322a' and mounting portion 326a'. For example, indicating module 322a' may be configured so as to direct light (such as via the light control film 356a' and passageway 325a') in an outboard direction (generally away from the vehicle when the mirror assembly is mounted at the vehicle), such as for a turn signal indicator (whereby the transparent/translucent optical plastic block or glow element may be formed in the shape of an arrow head or a chevron or other suitable icon or shape), while indicating module 322b' may be configured so as to direct light (such as via the light control film 356b' and passageway 325b') in an inboard direction (generally toward the vehicle when the mirror assembly is mounted at the vehicle), such as for a blind spot alert indicator. Because the signal indicating modules 322a', 322b' and indicator mounting portions 326a', 326b' may be similar to the modules and mounting portions described above, a detailed discussion of the modules and mounting portions need not be repeated herein.

The light control film disposed at the indicator module may be disposed or adhered otherwise attached to the translucent block or to the rear surface of the respective indicator receiving portion so that light emanating from the block or illumination source is directed through the light control film and directed along and through the passageway established through the respective indicator receiving portion. The light control film may comprise any suitable film and may function as microlouvers, so as to preferentially direct light that is received from one angle whereby the light is redirected or controlled to another direction (such as the films of the types described in PCT Application No. PCT/US2006/018567, filed

May 15, 2006 and published Nov. 23, 2006 as International Publication No. WO 2006/124682, which is hereby incorporated herein by reference in its entirety). An example of a suitable light control film or material is disclosed in U.S. Pat. No. 5,481,409 (which is hereby incorporated herein by reference in its entirety), and may comprise a light control film manufactured by the 3M Company of Minn., such as the light control film commercially available under the trade name LCF-P (light control film - polycarbonate).

Such a light control film comprises a thin plastic film enclosing a plurality of closely spaced, light black colored microlouvers. A preferred light control film is approximately 0.75 mm thick or thereabouts, and the angled microlouvers are spaced approximately 0.127 mm apart. The microlouvers may be in various angular positions to provide a particular viewing angle, such as from as narrow as about a 48 degree angle to as wide as about a 90 degree angle, depending on the desired angle of the microlouvers for the particular application for angling/directing the light in a desired or appropriate direction or angle. Thus, the light control film controls or directs the light emanating from the block along a desired or appropriate or predetermined angle with respect to the back plate and mirror substrate or reflective element, and helps assure that the driver of the host vehicle is largely unaware or not bothered by actuation of the turn signal indicating light sources.

The likes of a 3M Light Control Film comprises a thin plastic film containing closely spaced dark or black or light absorbing microlouvers. When used as described herein, the film simulates a tiny Venetian blind, wherein the microlouvers allow for controlled transmission of the light emitted by the indicator light sources (that are disposed behind the transflective mirror element) along the axis of the microlouvers so that the light is seen by drivers overtaking the host vehicle in a side-lane blind spot area but the line of sight from the driver of the host vehicle to the turn signal indicator's emitted light beam is substantially blocked by the microlouvers. Examples of light directing or regulating filters or baffle assemblies can be found in U.S. Pat. Nos. 4,906,085 and 5,313,335, the entire disclosures of which are hereby incorporated by reference herein.

Optionally, and typically, the light control film may have its microlouvers at an angle of about zero degrees (i.e., generally perpendicular to the plane of the light control film) so as to direct the principle beam axis of the light emitted by the illumination sources at the desired or appropriate angle established by the angling of the rear surface of the display receiving portion relative to its front surface and so as to have the light beam emitted by the light sources pass through the display receiving portion to exit at the desired or set or selected angle. Placement of the light control film on the angled rear surface of the display receiving portion is advantageous when the light control film (such as 3M's Vikuiti™ ALCF-P or LCF-P) is used where the louver angle is zero degrees and where on-axis vertically incident light from the light sources is highly transmitted but where off-axis light is cut-off by the embedded microlouvers. Such zero degree louvered light control film is used for privacy filters for laptop computer screens and ATM screens, and so is economically available. By being able to purchase and use zero angle louvered light control film, and by using the likes of an angled rear surface (pre-established via molding of the mirror back plate at its display receiving portion) to support the light control film at an angle in front of the light sources that are similarly angled and supported, economical assembly can be enhanced. Optionally, and alternatively, a mechanical support to mutually support and angle the light control film/light sources relative to the plane of the rear of the mirror reflective element may be used so that light emitted by the light sources is generally aligned with or on-axis with the light transmission axis between the louvers, and so that the light beam passed through the light control film has its principal beam axis directed in the desired or appropriate direction, such as in a direction generally away (for a turn signal indicator) from the vehicle body side and away from direct view by a driver of the host vehicle to which the exterior mirror reflective element is attached, or such as in a direction generally toward (for a blind spot indicator) the vehicle body side for direct viewing by the driver of the host vehicle and away from direct view by a driver of another vehicle.

Preferably, the indicator mounting portion or portions 326a, 326b of back plate 320 include light absorbing means to substantially absorb non-axially directed light rays passing through the respective passageway. For example, the inner wall or surface of the passageway of the indicator mounting portion may be black or dark (such as due to the molding of the dark or opaque back plate), and may be at least partially light absorbing, and preferably substantially light absorbing, and most preferably fully light absorbing of light incident thereon. Thus, principally only light rays that pass substantially or entirely through the full length of the inner passageway exit the end of the light emitting passageway, and, therefore, the light emitting source is mainly visible only by viewing axially along or substantially along the line of direction of the passageway. For example, the inner surface of the passageway may be stippled or textured or faceted to make the passageway substantially light absorbing, or the inner surface may include a honeycomb structure that may substantially absorb the light that is not directed along the axis of the passageway.

Optionally, the blind spot indicator of the present invention may include a blind spot alert indicator stencil or mask, at the front surface of the back plate and behind the reflective element, for providing a dark mask at the indicator module or passageway while having a cut out of the desired or appropriate icon or light pattern for viewing by the driver of the vehicle (or other person in the subject vehicle or in a vehicle approaching or at the side of the subject vehicle) when the indicator or illumination source is activated. For example, and as shown in FIGS. 19A-C, a back plate 420 may include a blind spot indicator mounting portion 426 (such as at an inboard portion or region of the back plate) and blind spot indicator or alert module or element 422. Optionally, the blind spot indicator or alert module or element 422 at mounting portion 426 may utilize aspects of the blind spot indicator or alert module or element 222b and/or the indicator modules and mounting portions described in U.S. patent application Ser. No. 11/520,193, filed Sep. 13, 2006 (Attorney Docket DON01 P-1286), which is hereby incorporated herein by reference in its entirety.

In the illustrated embodiment, mounting portion 426 comprises a hollow tube 427 integrally formed with and extending from the rear of the back plate 420, and with a passageway extending therethrough or therealong, whereby the indicator module 422 is mounted at the rearward portion of the hollow tube 427. An indicator stencil or mask or masking element 425 is disposed at the front surface of the planar portion 420a of back plate 420 (and preferably received within a recess 420c established at the front surface of the planar portion 420a of back plate 420) and generally at the forward end of the passageway extending through the hollow tube 427. The indicator module 422 includes an illumination source or LED 428 that is operable to emit light into and along and through the passageway of the hollow tube 427 and through the stenciled element or masking element 425 and toward and through the reflective element 418 (FIG. 19C) for viewing by the driver of the vehicle. Optionally, the indicator module 422 may include a light control film 429 (such as a light control film of the types described above with respect to indicator modules 322a, 322b, 322a', 322b') to direct the light emitted by illumination source 428 in a direction generally along the passageway of the hollow tube 427 of indicator mounting portion 426.

As can be seen in FIG. 19B, the masking element 425 may be a dark or opaque substrate or element 425a with one or more apertures or icons or characters or patterns 425b etched or cut or otherwise established therethrough so that light will pass through the apertures or icons yet not through the other portions of the masking element. The reflective element 418 comprises a transflective display-on-demand reflective element that is partially transmissive to allow the light from the indicator module 422 to transmit through the stenciled icons 425b of masking element 425 and through the transflective reflective element. The transflective reflective element 418 is substantially reflective of light incident thereon, such the dark masking element 425 is substantially hidden or substantially non-viewable or discernable by a person viewing the reflective element when the indicator module is deactivated. Thus, the blind spot indicator is viewable and discernible when the illumination source 428 of indicator module 422 is activated and is substantially not viewable or discernible when the illumination source 428 of indicator module 422 is deactivated.

Back plate 420 includes an actuator mounting portion 420b for attaching the back plate and reflective element to a mirror actuator for providing adjustment of the reflective element by the driver of the vehicle. The indicator module and mounting portion 426 are disposed toward the inboard side of the reflective element subassembly and at a space that is available to the rear of the reflective element and clear of the mirror actuator.

Optionally, the reflective element subassembly and/or indicator module of the present invention may include a non-illuminated icon etched or otherwise formed or established at the mirror reflector and at or near an illuminated blind spot indicator so as to be readily viewed by the driver of the vehicle when the blind spot alert indicator is activated (such as in response to a detection of a vehicle or object in a lane adjacent to the subject vehicle and/or in response to the driver of the subject vehicle activating a turn signal indicator in anticipation of making a lane change and/or the like). For example, and as shown in FIG. 20A, a reflective element subassembly 510 includes a reflective element 518 and a back plate 520, which includes a turn signal indicator mounting portion 526a (such as at an outboard portion or region of the back plate) and a blind spot indicator mounting portion 526b (such as at an inboard portion or region of the back plate), such as in a similar manner as described above with respect to the reflective element subassembly of FIG. 16. In the illustrated embodiment, the turn signal indicator mounting portion 526a and signal indicating module 522a include a translucent block or indicating light source or element 524 and illumination source 528a at a rear portion of the mounting portion 526a and generally at a light baffle 530 of back plate 520. Optionally, the blind spot indicator or alert module or element 522b at mounting portion 526b may utilize aspects of the indicator modules and mounting portions described in U.S. patent application Ser. No. 11/520,193, filed Sep. 13, 2006 (Attorney Docket DON01 P-1286), which is hereby incorporated herein by reference in its entirety, and may comprise a hollow tube 527 integrally formed with and extending from the rear of the back plate 520, and with a passageway extending therethrough or therealong, whereby the indicator module 522b is mounted at the rearward portion of the hollow tube 527. The indicator module 522b includes an illumination source or LED 528b that is operable to emit light into and along and through the passageway of the hollow tube 527 and toward and through the reflective element

518 for viewing by the driver of the vehicle. Back plate 520 also includes an actuator mounting portion 520b for attaching the back plate and reflective element to a mirror actuator for providing adjustment of the reflective element by the driver of the vehicle.

The reflective element 518 may comprise any type of reflective element, preferably a transflective or display on demand type reflective element such as described above. In the illustrated embodiment, reflective element 518 comprises a transflective electrochromic reflective element having a first or front substrate 540 and a second or rear substrate 542 with an electrochromic medium 543 sandwiched therebetween and sealed with a perimeter seal 544. The front substrate 540 includes a transparent conductor coating 546 at its rear surface and may include a perimeter metallic band 550 at the perimeter of the rear surface, such as described above. The reflective element may comprise a "third surface" reflective element with its rear substrate 542 having a transflective coating or a metal oxide/metal/metal oxide stack (with at least one of the metal oxide layers that contacts any electro-optic medium comprising a conducting or semiconducting layer), such as an IMI stack of coatings or layers 548, at its front surface. An icon or character or indicia 525 may be etched or otherwise created or established (such as via masking during deposition of the reflector coating or later etching or ablation or the like) at and at least partially through the third surface reflective coatings or layers 548.

The back plate 520 is adhered or attached at the rear surface of the rear substrate, and the mirror reflective element sub-assembly 512 may include a heater element 538 and an opacifying element or layer or coating or film 552 disposed between the back plate and rear substrate. As can be seen in FIG. 20A, the heater element 538 and opacifying layer 552 include apertures therethrough (or transparent or translucent or light transmitting or light diffusing portion or portions of the heater element and/or opacifying layer) at the location of the light baffle 530 and the passageway of the indicator mounting portion 526b of the back plate 520, so that light emanating from the signal indicating modules 522a, 522b is transmitted through the apertures in the heater element and opacifying layer and through the reflective element for viewing by a person viewing the reflective element at the appropriate angle.

The icon or indicia may be formed through the reflector coating or coatings or partially through the reflector coating or coatings and thus may provide a non-reflective icon (which may appear as a dark icon due to the darkened or opaque opacifying element or layer 552), or may provide a partially reflective icon or indicia and may be a different tint or color as compared to the spectral reflectivity of the reflector coatings or layers. Optionally, the indicia may be established utilizing aspects of the reflective element assemblies described in U.S. pat. application Ser. No. 11/226,628, filed Sep. 14, 2005 by Karner et al. for MOUNTING ASSEMBLY FOR VEHICLE INTERIOR MIRROR (Attorney Docket DON01 P-1236); and/or PCT Application No. PCT/US2006/018567, filed May 15, 2006 and published Nov. 23, 2006 as International Publication No. WO 2006/124682, which are hereby incorporated herein by reference in their entireties. Optionally, if the reflective element has a transflective reflector, the reflective element may have a white or light colored layer or element behind the reflective element at the icon or indicia to make the presence of icon or indicia less covert and thus to provide enhanced viewing of the icon or indicia (by giving an indication of the presence of the icon or indicia without establishing a window through the mirror reflector). Thus, the presence of the blind spot feature is subtlely rendered when the mirror reflective element is viewed such as on a sunny day. Since the transflector of the transflective mirror element can be made to have a visible light transmission of about 20%T to as high as about 35%T, or higher, the use of a white or lighter colored element or icon or mask close to and contacting the substrate surface to the rear of the reflective element's substrate, and adjacent to where the blind spot indicator will illuminate, can stand out during daylight and be perceived in contrast to the otherwise highly light absorbing, generally opaque backing at the rear of the transflective mirror element. Thus, the owner of the vehicle gets a subtle indication that the vehicle is equipped with such a "another-vehicle-is-in-a-side-lane" blind spot alert system.

The icon or icons 525 etched or otherwise established at the mirror reflector are located at or near or adjacent to where the illuminated blind spot indicator 523 is viewable to the driver of the subject vehicle. As can be seen in FIG. 20B, the illumination of the blind spot indicator (via activation of the illumination source 528b of blind spot indicator module 522b) functions to alert the driver or draw the driver's attention to that region of the reflective element where the indicator is disposed. The non-illuminated icon functions to indicate to the driver that the illuminated indicator pertains to the blind spot detection system so that the driver is alerted to a detection of a vehicle or object at or in the respective blind spot of the vehicle. As can also be seen in FIG. 20B, the turn signal module 522a is activatable to illuminate a turn signal indicator icon 529 for viewing by the drivers of other vehicles rearward of and/or to the side of the subject vehicle. Because the reflective element 518 is preferably a transflective display-on-demand reflective element, the illuminated icons or indicators are viewable by a person viewing the reflective element when they are activated, but are substantially not viewable or discernible by a person viewing the reflective element when they are deactivated.

Thus, the indicator module is covertly placed at the back plate and behind the reflective element so that it is not readily visible to a person viewing the reflective element when the illumination source is deactivated. The dark or black walled passageway of the back plate functions to camouflage the presence of the indicator module. The length of the passageway and indicator mounting portion is selected so that the indicator module is located far enough back from the reflective element so as to be substantially not visible to a person viewing the reflective element (when the illumination source or module is deactivated). Preferably, the indicator module is disposed or located at least about 0.5 cm back from the rear surface of the reflective element, and more preferably is disposed or located at least about 1 cm back from the rear surface of the reflective element, and more preferably is disposed or located at least about 1.5 cm back from the rear surface of the reflective element. However, the indicator module may be located closer to or further back from the reflective element while remaining within the spirit and scope of the present invention.

Therefore, the indicator mounting portion and back plate and the signal indicating module of the present invention provide enhanced displays or indications at the mirror reflective element, while reducing the costs and complexities associated with displays or indicators of the prior art. For example, an advantage of creating a light baffle via molding the back plate is that such a back plate and light baffle obviates the costs and complexities associated with utilizing a separate light control film, such as what is disclosed in U.S. Pat. Nos. 4,906,085; 5,355,284; 5,788,357; and 6,045,243, which are hereby incorporated herein by reference in their entireties. Further, utilizing the glow block and its simple construction obviates the complexities and costs associated with the prior art mirror assemblies, such as those described in U.S. Pat. Nos. 5,788,357; and 6,045,243, which are hereby incorporated herein by reference in their entireties.

Thus, the mirror assembly or assemblies of the present invention obviate the need to have the likes of a collimating optical element and/or a refractive optical element or optical elements having total internal reflective portions. As can be seen from the figures and the above discussions, the present invention has a very economical construction comprising a glowing light source or block and a light baffle (which may comprise a light directing film or the innovative establishment of a light baffle during the molding of the back plate itself). The present invention thus may provide a reduced cost indicator for a turn signal indicator or blind spot alert indicator at an exterior rearview mirror of the vehicle. Optionally, aspects of the present invention may be utilized for displays or indicators of an interior rearview mirror assembly, while remaining within the spirit and scope of the present invention.

The angle and direction of the indicator mounting portions may be selected depending on the particular associated display indicia or icons and on the particular mirror application. The reflector carrier or back plate of the mirror reflector sub-assemblies may have an aperture or opening therethrough for at least partially receiving the indicator mounting portion or portions or hollow tube or tubes or passageways therethrough when the back plate is attached to the rear surface of the reflective element, whereby the hollow tube or tubes (and associated indicator or indicators) may protrude at least partially through the back plate when the mirror reflector sub-assembly is assembled. Optionally, the icons or displays of the mirror reflector sub-assemblies described herein may be established utilizing aspects of the icons or symbols or indicia described in U.S. pat. application Ser. No. 11/226,628, filed Sep. 14, 2005 by Karner et al. for MOUNTING ASSEMBLY FOR VEHICLE INTERIOR MIRROR (Attorney Docket DON01 P-1236); and/or PCT Application No. PCT/US2006/018567, filed May 15, 2006 and published Nov. 23, 2006 as International Publication No. WO 2006/124682, which are hereby incorporated herein by reference in their entireties.

Optionally, the mirror reflector sub-assembly may include masks or baffles or additional light direction means or occluding means or directional filtering. For example, the mirror reflective element sub-assembly may comprise louvers or shutters for shading from view, or filters or light directing film or the like, at the rear of the reflective element (such as between the back plate and the iconistic portions) for further directing or guiding the illumination from the illumination source at the desired angle and through the reflective element so as to be principally or solely viewable by the driver of the host vehicle (for blind spot/LCA applications) or so as to be principally or solely viewable by others at the side or rear of the vehicle but not principally by the host driver (for turn signal applications).

Therefore, the present invention provides a back plate that includes one or more indicator mounting portions or display receiving portions integrally formed therewith, so that the display element or device may be readily assembled to the mirror reflector sub-assembly via attachment or adherence of the back plate to the mirror reflective element. The present invention thus provides a display element or device that is readily assembled to a mirror reflector sub-assembly, and thus facilitates assembly of the mirror reflector sub-assembly at a facility remote from the mirror assembly facility, such that the mirror reflector sub-assembly (including the back plate and indicator mounting portion) may be provided or supplied to the mirror manufacturer as a unit. The mirror manufacturer then may install or attach the indicator or indicator module to the indicator mounting or receiving portion (or may electrically connect an already installed indicator to a wire or lead of the mirror assembly), and may attach the mirror reflector sub-assembly to the mirror actuator. The present invention thus provides enhanced assembly processing of the mirror assembly, while taking advantage of the otherwise typically unused space within the casing and behind the back plate of the exterior rearview mirror assembly. For example, a mirror manufacturer may purchase a sealed, pre-assembled signal indicator module (including the necessary electrical connectors for establishing electrical connection and power and control to the module as it is attached or mounted to the reflective element or back plate), and may insert the module into the housing or shell or structure of the back plate (that is pre-configured to receive such) or may otherwise engage the module with the rear of the reflective element assembly, such as by inserting one end of the module into the side walls of the shell or structure of the back plate and against the rear of the reflective element, whereby the module makes an at least partially efficient optical connection/coupling to the rear surface or portion of the transflective reflective element or to a light transmitting portion of any heater pad disposed between the back plate and the rear of the reflective element, preferably while also making a mechanical connection and alignment to the back plate of the reflective element assembly. Note that the receiving portion of the back plate at the rear of the heater pad/reflective element and where the signal indicator/light unit emits light therethrough when its light source or light sources are activated may itself comprise a resilient light transmitting clear and/or light-diffusing material or element (such as a low durometer soft plastic material or element, such as an element having less than 120 Shore A durometer hardness for example, such as a silicone pad or film, or such as an optical adhesive or optical tape or film) that at least one of (a) light-couples the receiving part of the back plate to the signal indicator/light unit and (b) light couples the part of the back plate where the signal indicator/light unit is disposed at (and emits light through) to the corresponding aperture or light transmitting window of the heater pad and/or to the rear surface of the substrate of the reflective element.

Optionally, a spring-like resilient light transmitting and/or light diffusing interface or pad, such as a silicone or other soft or pliable plastic having light transmitting qualities, may be provided at the interface end of the module (or at or in any aperture in the back plate where a light indicator shines through) to provide an interface at the rear (typically a glass surface that may be coated or uncoated) of the reflective element with little or no air gap between the module and the rear of the reflective element. Also, the indicator module (having a shape or structure, such as a triangular or trapezoid shape or the like, with one or more light sources or light emitting diodes and an electrical connector) may have a light transmitting element or window or lens (that may or may not have an optical light directing property) at its interfacing end that is at least somewhat soft or pliable, so that the module creates intimate contact at the rear of the reflective element when pressed against the reflective element. The module may be purchased with the light transmitting interface or pad already incorporated therein, or the pad may be a separate element at the rear of the reflective element or may be separately disposed between the module and the rear of the reflective element.

The signal indicator or blind spot indicator or turn signal indicator of the present invention thus provides a visible signal that is viewable at the exterior mirror by a person viewing the reflective element of the exterior rearview mirror at or near an appropriate angle or location relative to the exterior mirror. If the mirror reflective element is not a transflective mirror reflective element (such as a construction using laser ablation to create a hole or holes in the mirror reflector such as is now used on the likes of 2008 Toyota Tundra and 2008 Cadillac Escalade vehicles), the size of the icon or indicia of the display or signal indicator module is typically limited if used for blind spot indication, such as to a size dimension that is circumscribed by a circle having a diameter of about 5 mm to about 7 mm or less, since a larger indicator or display may interfere with viewing of the reflective element during normal driving conditions and when the signal indicator module is not activated, and may be aesthetically unacceptable. However, if the reflective element is a transflective mirror reflective element, the display area or icon or indicia may be larger than that of a non-transflective mirror reflective element, and may have a size dimension that is circumscribed by a circle having a diameter of greater than about 7 mm or preferably greater than about 15 mm and up to about 30 mm or thereabouts. This is because, for transflective mirror reflector applications, the icon or indicia or display of the signal indicator module is only viewable and discernible by a person viewing the rearview mirror assembly when it is activated and, thus, when it is desired or appropriate that the person viewing the mirror assembly readily sees and discerns the signal, and is substantially not viewable or discernible during normal driving conditions and when the signal indicator module is deactivated.

Desirably, the signal indicator module (such as for a blind spot indicator) will be sufficiently bright or intense when activated so as to be viewable during high ambient or daytime driving conditions. For example, the blind spot indication signal indicator module preferably has a luminance of preferably in the range of about 5,000 nits (candelas/square meter) to about 30,000 nits or greater when activated during daytime and when viewed via the reflective element from the front along its axis of highest brightness/directionality, and with the blind spot signal indictor behind the reflective element and emitting light therethrough. The signal indicator module is operable (such as via a photo sensor control) to have a significantly reduced intensity during low ambient lighting, night time driving conditions (and may be automatically adjusted to the reduced intensity in response to an ambient light sensor detecting an ambient light level at or below a threshold light level).

Although shown and described as being located at a driver side exterior mirror, the blind spot/LCA/turn signal indicator of the present invention may also or otherwise be located at the passenger side exterior mirror, if desired. Optionally, a blind spot indicator in accordance with the present invention may be located at both the driver side mirror assembly and the passenger side mirror assembly of the host vehicle. The indicator at either side may be selectively activated or illuminated to indicate to the driver of the host vehicle that an object or other vehicle has been detected at that particular side lane region of the host vehicle. Optionally, the blind spot indicator may be associated with a blind spot detection and indication system that includes one or more indicators at the interior rearview mirror assembly of the host vehicle. The blind spot indicators may utilize aspects of the blind spot indicators and/or blind spot detection systems described in U.S. Pat. Nos. 6,198,409; 5,929,786; and 5,786,772, and/or PCT Application No. PCT/US2006/026148, filed Jul. 5, 2006 by Donnelly Corp. et al. for VEHICLE EXTERIOR MIRROR ASSEMBLY WITH BLIND SPOT INDICATOR, and published Jan. 11, 2007 as International Publication No. WO 2007/005942, which are hereby incorporated herein by reference in their entireties.

Such an indicator or indicators may function as a lane change assist (LCA) indicator or indicators and/or a blind spot indicator or indicators. Such blind spot indicators are typically activated when an object is detected (via a side object or blind spot detection system or the like such as described in U.S. Pat. Nos. 7,038,577; 6,882,287; 6,198,409; 5,929,786; and 5,786,772, and/or U.S. pat. application, Ser. No. 11/315,675, filed Dec. 22, 2005 by Higgins-Luthman for OBJECT DETECTION SYSTEM FOR VEHICLE (Attorney Docket DON01 P-1253); and/or PCT Application No. PCT/US2006/026148, filed Jul. 5, 2006 by Donnelly Corp. et al. for VEHICLE EXTERIOR MIRROR ASSEMBLY WITH BLIND SPOT INDICATOR, and published Jan. 11, 2007 as International Publication No. WO 2007/005942, which are hereby incorporated herein by reference in their entireties) at the side and/or rear of the vehicle (at the blind spot) and when the turn signal is also activated, so as to provide an alert to the driver of the host vehicle that there is an object or vehicle in the lane next to the host vehicle at a time when the driver of the host vehicle intends to move over into the adjacent lane. Optionally, and alternately, the indicator or indicators may function as a lane change assist indicator or indicators, where the host vehicle may be detected to be moving into an adjacent lane without the turn signal being activated, and an object or vehicle may be detected at the adjacent lane, whereby the LCA indicator or indicators may be activated to provide an alert to the driver of the lane change to assist the driver in avoiding unintentional lane changes and/or lane changes when a vehicle or object is detected in the adjacent lane.

A challenge to providing an indicator at the exterior rearview mirror reflective element is that the back plate and associated components of the exterior reflective element subassembly may be exposed to harsh environmental conditions, such as water spray, rain, dirt and debris and the like, when the reflective element is mounted at a vehicle. Thus, it is desirable to provide a sealed, water impervious indicator module or display element so as to limit or substantially preclude water ingress or the like into the module or element. Optionally, the back plate and indicator module may be integrally molded to limit water entry into the module, whereby the illumination source and/or light directing film or the like may be sealed at the module to protect the electronic components of the module. Optionally, a lens or cover element may be provided at the planar portion of the back plate and may be sealed thereat to limit water entry into the indicator module through the back plate.

Optionally, and desirably, the display element or signal indicating module (such as a module of the types having a hollow tube configuration or a translucent block configuration as described above) may comprise a stand-alone unitary module that is a substantially sealed, water impervious, indicator module or display module, so as to be substantially impervious to water ingress or to debris ingress, and preferably with electrical connectors (such as a plug or socket connector) established or incorporated therein or with a lead or wire harness (such as a flying lead or pigtail) established or incorporated therein. The indicator module may be provided as a sealed or substantially sealed unit or module that can be snapped into or otherwise attached or secured (preferably mechanically but optionally adhesively) at the mirror back plate (and does so substantially or wholly sealingly to limit or substantially preclude water ingress to the module so that the module and back plate are substantially water impervious), preferably at the mirror sub-assembly manufacturing operation when the mirror reflective element (and any associated heater or other item or element) is joined to the mirror back plate, such as by utilizing aspects of the indicators described in U.S. patent application Ser. No. 11/520,193, filed Sep. 13, 2006 (Attorney Docket DON01 P-1286), and/or PCT Application No. PCT/US2006/018567, filed May 16, 2006 and published Nov.

23, 2006 as International Publication No. WO 2006/124682, which are hereby incorporated herein by reference in their entireties. For example, the indicator module may be provided with the illumination source and associated elements sealed to the hollow tube or sidewalls of the module, and a lens or optic element (such as a transparent lens element or the like) may be sealed at the opposite end of the hollow tube or housing structure of the module, such that both ends of the hollow tube or housing structure of the module are closed and sealed so that the module is substantially water impervious as a stand alone module. The sealed signal indicating module, including the light source and circuitry, may be supplied or provided to an assembly facility (such as a mirror assembly facility or the like) from a display element supplier, while the back plate may be molded and supplied or provided to the assembly facility from a back plate supplier. An operator at the assembly facility may attach the display device or indicator module and/or circuitry to the back plate (such as to the rear surface of the display receiving portion of the back plate), preferably by snapping the display device or module to snaps or clips or clasps or fingers or the like molded into the back plate (at its display element receiving portion) to assemble the display or indicator module to the back plate. Optionally, and desirably, the display receiving portion of the back plate and/or the display element (such as at the circuit element or circuit board) or indicator module may have attaching elements or snaps or clips or prongs (such as cooperating structure molded into the module and back plate so that the module is readily attached to or snapped or clasped to the back plate) to ease the assembly and securement of the display element or indicator module to the back plate, such as at or to a display receiving portion of the back plate, so that an operator may attach the display element or indicator module to the back plate via a snap connection or attachment.

Optionally, and desirably, electrical connection (such as to a power supply or 12 volt power wire of the vehicle battery/ignition system or to a power feed from a LIN bus controller) to the display circuitry may be made when the display element is snapped or otherwise attached (preferably mechanically but optionally adhesively) to the back plate, such as by making electrical contact between the display element and mirror circuitry (including circuitry associated with the reflective element and/or mirror assembly, such as electrochromic mirror circuitry, mirror lights and/or display circuitry and the like, typically disposed at a printed circuit board of the mirror assembly) when the display element is snapped to the back plate, such as via pressed contact or connection between respective electrical terminals or contacts of the display element and mirror circuitry as the display element is pressed or snapped or received to the display receiving portion of the back plate, such as by press attaching the display element or module into receiving fingers or clips or snaps or the like that are integrally formed with the display receiving portion of the back plate in the injection molding operation that manufactures or forms the back plate itself. For example, electrical terminals or contacts may be insert molded in the display receiving portion so as to be exposed at (or otherwise located at) the rear surface of the display receiving portion for electrical connection to the display element when the display element is attached or snapped to the display receiving portion of the back plate. Alternately, electrical connection to the display device may be made via other means, such as wires or leads or flying leads or wire harnesses or the like such as pigtails or other suitable connectors or leads, and before or after the display device is snapped or otherwise attached to the back plate, while remaining within the spirit and scope of the present invention.

i] Thus, a method of assembling such a mirror reflective element sub-assembly may include molding the back plate having an indicator mounting or receiving portion and providing the back plate and reflective element to an assembly facility, while also providing a display element or signal indicating module at the assembly facility. Preferably, the display element and the back plate are supplied or provided to the assembly facility from different sources. An operator at the assembly facility takes a back plate and a display element and snaps the display element to the rear surface of the display receiving portion of the back plate to attach and secure the display element at the display receiving portion. The operator also makes the electrical connection between circuitry or wiring of the mirror assembly or sub-assembly and the display element, either as the display element is snapped to the display receiving portion of the back plate (such as via contacts at the display element and display receiving portion of the back plate) or at a separate time from the attachment of the display element to the back plate (such as via separate connectors at or extending from the display element). Optionally, electrical connection to the display element may be made during assembly of the reflective element sub-assembly to the mirror casing of the mirror assembly (such as via connectors or leads or pigtails extending from the display element).

7] Thus, the display elements or devices or modules of the present invention provide a desired or appropriate iconistic display or indication that, when electrically actuated, emits light that is viewable by a person viewing the mirror reflective element. The display element may be formed with the back plate or may attach to the back plate (such as by snapping to the back plate or the like), and provides the desired angle effect relative to the reflective element. For example, the reflective element may be attached to or snapped into the back plate (which includes the display element at a perimeter region thereof), whereby the display element or module is thus positioned at a desired or appropriate angle relative to the reflective element to provide the desired or appropriate angle effect for directing the light from the light sources (when electrically actuated) in a desired or predetermined angle relative to the mirror reflective element. Thus, the display element provides the desired or appropriate preset angle when the mirror reflective element is attached to the back plate.

The blind spot indicators of the present invention thus provide a display element or indicator that is disposed at or integrally provided with the back plate. A back plate thus may be provided to a mirror manufacturer with mounting or attachment structure or receiving structure for the display element or display circuitry integrally formed with the back plate. The attachment structure or receiving portion is configured to receive or attach to a display element or display circuitry or indicator element. A mirror assembler or manufacturer may attach the display element to the attachment structure or receiving portion of the back plate (such as by snapping display circuitry or a circuit board at the attachment structure), whereby the display element is oriented at a desired angle relative to the mirror reflective element when attached to the back plate. Thus, illumination emanating from the display element is directed at the desired or appropriate angle for viewing, either by the driver of the host vehicle (for a blind spot detection system) or a driver of another vehicle (for a turn signal indicator).

The blind spot indicators of the present invention thus are operable to provide an indication to the driver of the host vehicle that an object or other vehicle has been detected in the lane or area adjacent to the side of the host vehicle. The blind spot indicator may be operable in association with a blind spot detection system, which may include an imaging sensor or sensors, or an ultrasonic sensor or sensors, or a sonar sensor or sensors or the like. For example, the blind spot detection system may utilize aspects of the blind spot detection and/or imaging systems described in U.S. Pat. Nos. 7,038,577; 6,882,287; 6,198,409; 5,929,786; and/or 5,786,772, and/or U.S. pat. applications, Ser. No. 11/239,980, filed Sep. 30, 2005 by Camilleri et al. for VISION SYSTEM FOR VEHICLE (Attorney Docket DON01 P-1238); and/or Ser. No. 11/315,675, filed Dec. 22, 2005 by Higgins-Luthman for OBJECT DETECTION SYSTEM FOR VEHICLE (Attorney Docket DON01 P-1253), and/or U.S. provisional applications, Ser. No. 60/638,687, filed Dec. 23, 2004 by Higgins-Luthman for OBJECT DETECTION SYSTEM FOR VEHICLE; Ser. No. 60/628,709, filed Nov. 17, 2004 by Camilleri et al. for IMAGING AND DISPLAY SYSTEM FOR VEHICLE; Ser. No. 60/614,644, filed Sep. 30, 2004; and/or Ser. No. 60/618,686, filed Oct. 14, 2004 by Laubinger for VEHICLE IMAGING SYSTEM, and/or of the reverse or backup aid systems, such as the rearwardly directed vehicle vision systems described in U.S. Pat. Nos. 5,550,677; 5,760,962; 5,670,935; 5,877,897; 6,201,642; 6,396,397; 6,498,620; 6,717,610 and/or 6,757,109, and/or U.S. pat. application, Ser. No. 10/418,486, filed Apr. 18, 2003 by McMahon et al. for VEHICLE IMAGING SYSTEM, now U.S. Pat. No. 7,005,974, and/or of the automatic headlamp controls described in U.S. Pat. Nos. 5,796,094 and/or 5,715,093; and/or U.S. pat. application, Ser. No. 11/105,757, filed Apr. 14, 2005 by Schofield et al. for IMAGING SYSTEM FOR VEHICLE (Attorney Docket DON01 P-1208); and/or U.S. provisional application, Ser. No. 60/607,963, filed Sep. 8, 2004 by Schofield for IMAGING SYSTEM FOR VEHICLE, and/or of the rain sensors described in U.S. Pat. Nos. 6,250,148 and 6,341,523, and/or of other imaging systems, such as the types described in U.S. Pat. Nos. 6,353,392 and 6,313,454, which may utilize various imaging sensors or imaging array sensors or cameras or the like, such as a CMOS imaging array sensor, a CCD sensor or other sensors or the like, such as the types disclosed in commonly assigned, U.S. Pat. Nos. 5,550,677; 5,760,962; 6,097,023 and 5,796,094, and U.S. pat. application, Ser. No. 09/441,341, filed Nov. 16, 1999 by Schofield et al. for VEHICLE HEADLIGHT CONTROL USING IMAGING SENSOR (Attorney Docket DON01 P-770), and/or PCT Application No. PCT/US2003/036177 filed Nov. 14, 2003, published Jun. 3, 2004 as PCT Publication No. WO 2004/047421 A3, with all of the above referenced U.S. patents, patent applications and provisional applications and PCT applications being commonly assigned and being hereby incorporated herein by reference in their entireties.

Optionally, the indicator or indicators of the present invention may alert the driver of the host vehicle of other situations or status or the like. For example, the indicator could function to alert the driver of the host vehicle that the brake lights of the host vehicle are functioning properly. Other applications or uses of the indicator may be implemented, without affecting the scope of the present invention.

The reflective element of the rearview mirror assembly may comprise an electro-optic or electrochromic reflective element or cell, such as an electrochromic mirror assembly and electrochromic reflective element utilizing principles disclosed in commonly assigned U.S. Pat. Nos. 6,690,268; 5,140,455; 5,151,816; 6,178,034; 6,154,306; 6,002,544; 5,567,360; 5,525,264; 5,610,756; 5,406,414; 5,253,109; 5,076,673; 5,073,012; 5,117,346; 5,724,187; 5,668,663; 5,910,854; 5,142,407; and/or 4,712,879, and/or U.S. pat. applications, Ser. No. 10/054,633, filed Jan. 22, 2002 by Lynam et al. for VEHICULAR LIGHTING SYSTEM, now U.S. Pat. No. 7,195,381; Ser. No. 11/021,065, filed Dec. 23, 2004, now U.S. Pat. No. 7,255,451; and/or Ser. No. 11/226,628, filed Sep. 14, 2005 by Karner et al. for MOUNTING

ASSEMBLY FOR VEHICLE INTERIOR MIRROR (Attorney Docket DON01 P-1236), and/or PCT Application No. PCT/US2006/018567, filed May 16, 2006 and published Nov. 23, 2006 as International Publication No. WO 2006/124682, and/or U.S. provisional applications, Ser. No. 60/695,149, filed Jun. 29, 2005; Ser. No. 60/690,400, filed Jun. 14, 2005; Ser. No. 60/681,250, filed May 16, 2005; and/or Ser. No. 60/692,113, filed Jun. 20, 2005, which are all hereby incorporated herein by reference in their entireties, and/or as disclosed in the following publications: N. R. Lynam, "Electrochromic Automotive Day/Night Mirrors", SAE Technical Paper Series 870636 (1987); N. R. Lynam, "Smart Windows for Automobiles", SAE Technical Paper Series 900419 (1990); N. R. Lynam and A. Agrawal, "Automotive Applications of Chromogenic Materials", Large Area Chromogenics: Materials and Devices for Transmittance Control, C.M. Lampert and C.G. Granquist, EDS., Optical Engineering Press, Wash. (1990), which are hereby incorporated by reference herein in their entireties. The thicknesses and materials of the coatings on the substrates of the electrochromic reflective element, such as on the third surface of the reflective element assembly, may be selected to provide a desired color or tint to the mirror reflective element, such as a blue colored reflector, such as is known in the art and/or such as described in U.S. Pat. Nos. 5,910,854; 6,420,036; and 7,274,501, and in PCT Application No. PCT/US03/29776, filed Sep. 9, 2003 by Donnelly Corp. et al. for MIRROR REFLECTIVE ELEMENT ASSEMBLY, and published Apr. 1, 2004 as International Publication No. WO 2004/026633, which are all hereby incorporated herein by reference in their entireties.

Optionally, use of an elemental semiconductor mirror, such as a silicon metal mirror, such as disclosed in U.S. Pat. Nos. 6,286,965; 6,196,688; 5,535,056; 5,751,489; and 6,065,840, and/or in U.S. pat. application, Ser. No. 10/993,302, filed Nov. 19, 2004 by Lynam for MIRROR REFLECTIVE ELEMENT FOR A VEHICLE (Attorney Docket DON01 P-1186), which are all hereby incorporated herein by reference in their entireties, can be advantageous because such elemental semiconductor mirrors (such as can be formed by depositing a thin film of silicon) can be greater than 50 percent reflecting in the photopic (SAE J964a measured), while being also substantially transmitting of light (up to 20 percent or even more). Such silicon mirrors also have the advantage of being able to be deposited onto a flat glass substrate and to be bent into a curved (such as a convex or aspheric) curvature, which is also advantageous since many passenger-side exterior rearview mirrors are bent or curved.

Optionally, the reflective element may include a perimeter metallic band, such as the types described in U.S. Pat. Nos. 7,255,451 and 7,274,501, and PCT Application No.

PCT/US03/29776, filed Sep. 19, 2003 by Donnelly Corp. et al. for ELECTROCHROMIC MIRROR ASSEMBLY, and published Apr. 1, 2004 as International Publication No. WO 2004/026633; and/or PCT Application No. PCT/US03/35381, filed Nov. 5, 2003 by Donnelly Corp. et al. for ELECTRO-OPTIC REFLECTIVE ELEMENT ASSEMBLY, and published May 21, 2004 as International Publication No. WO 2004/042457; and/or U.S. pat. application Ser. No. 11/226,628, filed Sep. 14, 2005 by Karner et al. for MOUNTING ASSEMBLY FOR VEHICLE INTERIOR MIRROR (Attorney Docket DON01 P-1236); and/or U.S. provisional applications, Ser. No. 60/692,113, filed Jun. 20, 2005; Ser. No. 60/677,990, filed May 5, 2005; Ser. No. 60/653,787, filed Feb. 17, 2005; Ser. No. 60/642,227, filed Jan. 7, 2005; Ser. No. 60/638,250, filed Dec. 21, 2004; Ser. No. 60/624,091, filed Nov. 1, 2004, and Ser. No. 60/609,642, filed Sep. 14, 2004, which are all hereby incorporated herein by reference in their entireties. Optionally, the reflective element may include indicia formed at and viewable at the reflective element, such as by utilizing aspects of the reflective elements described in PCT Application No. PCT/US2006/018567, filed May 15, 2006 and published Nov. 23, 2006 as International Publication No. WO 2006/124682; and U.S. provisional applications, Ser. No. 60/681,250, filed May 16, 2005; Ser. No. 60/690,400, filed Jun. 14, 2005; Ser. No. 60/695,149, filed Jun. 29, 2005; Ser. No. 60/730,334, filed Oct. 26, 2005; Ser. No. 60/750,199, filed Dec. 14, 2005; Ser. No. 60/774,449, filed Feb. 17, 2006; and Ser. No. 60/783,496, filed Mar. 18, 2006, which are all hereby incorporated herein by reference in their entireties.

Optionally, the reflective element may comprise a single substrate with a reflective coating at its rear surface, without affecting the scope of the present invention. The mirror assembly thus may comprise a prismatic mirror assembly or planar or non-planar mirror or other mirror having a single substrate reflective element, such as a mirror assembly utilizing aspects described in U.S. Pat. Nos. 6,318,870; 6,598,980; 5,327,288; 4,948,242; 4,826,289; 4,436,371; and 4,435,042; and PCT Application No. PCT/US04/015424, filed May 18, 2004 by Donnelly Corporation et al. for MIRROR ASSEMBLY FOR VEHICLE, and published Dec. 2, 2004 as International Publication No. WO 2004/103772; and U.S. pat. application, Ser. No. 10/933,842, filed Sep. 3, 2004, now U.S. Pat. No. 7,249,860, which are hereby incorporated herein by reference in their entireties. Optionally, the reflective element may comprise a conventional prismatic or flat reflective element or prism, or may comprise a prismatic or flat reflective element of the types described in PCT Application No. PCT/US03/29776, filed Sep. 19, 2003 by Donnelly Corp. et al. for MIRROR REFLECTIVE ELEMENT ASSEMBLY, and published Apr. 1, 2004 as International Publication No. WO

2004/026633; U.S. pat. applications, Ser. No. 10/709,434, filed May 5, 2004 by Lynam for MIRROR REFLECTIVE ELEMENT (Attorney Docket DON01 P-1152); Ser. No. 10/933,842, filed Sep. 3, 2004 by Kulas et al. for INTERIOR REARVIEW MIRROR ASSEMBLY, now U.S. Pat. No. 7,249,860; Ser. No. 11/021,065, filed Dec. 23, 2004 by McCabe et al. for ELECTRO-OPTIC MIRROR CELL, now U.S. Pat. No. 7,255,451; and/or Ser. No. 10/993,302, filed Nov. 19, 2004 by Lynam for MIRROR REFLECTIVE ELEMENT FOR A VEHICLE (Attorney Docket DON01 P-1186), and/or PCT Application No. PCT/US2004/015424, filed May 18, 2004 by Donnelly Corp. et al. for MIRROR ASSEMBLY FOR VEHICLE, and published Dec. 2, 2004 as International Publication No. WO 2004/103772, which are all hereby incorporated herein by reference in their entireties, without affecting the scope of the present invention.

Optionally, and with reference to FIGS. 21A, 21B and 22, a reflective element 618 may comprise a vehicular electrochromic reflective element (but could comprise a non-electrochromic reflective element without affecting the scope of the present invention) having a front substrate 640 (such as a transparent glass substrate or the like), a rear substrate 642 (such as a transparent glass substrate or the like) and an electrochromic medium 643 (such as a solid polymer matrix electrochromic medium such as the types disclosed in U.S. Pat. Nos. 5,724,187 or 5,910,854, or a liquid electrochromic medium such as the types disclosed in U.S. Pat. No. 4,902,108, the entire disclosures of which are incorporated by reference herein, or the like) sandwiched therebetween and sealed via a perimeter seal 644. Front substrate 640 has a transparent conductor coating 646 (such as an indium tin oxide (ITO) coating or layer) disposed at its rear surface 640a, while rear substrate 642 has a transflective mirror reflector or transflector coating 648 (such as a non-dichroic transflector, such as an IMI stack such as an ITO/Ag/ITO stack of layers or coatings or the like) disposed at its front surface 642a. The reflective element 618 includes a third surface tab-in portion or coating 650 and a fourth surface wraparound coating 652 at an edge region of the rear substrate so as to provide electrical conductivity or continuity between the fourth or rear surface 642b of the rear substrate 642 and the front or third surface 642a of the rear substrate 642.

As can be seen in FIGS. 21A, 21B and 22, the tab-in coating 650 may be established (such as via sputter deposition or other suitable coating or establishing means) at a perimeter region 643 of the third or front surface 642a of the rear substrate 642 and at least partially around and over the perimeter edge dimension 656 of rear substrate 642, while the fourth or rear surface wraparound coating 652 may be disposed so as to overlap a portion of the third surface tab-in portion 650 (such as at the edge dimension 656 of the rear substrate) and may wrap around at least partially onto the rear or fourth surface 642b of the rear substrate (such as by utilizing aspects of the reflective elements described in U.S. Pat. Nos. 7,274,501; 7,255,451; 7,184,190 and 7,004,593, which are hereby incorporated herein by reference in their entireties). Optionally, the third surface tab-in portion 650 and fourth surface wraparound portion may be commonly established via a common or same deposition process or the like. The third surface tab-in portion 650 may comprise any suitable conductive materials, such as a metallic or conductive layer or coating, such as a silver or silver alloy (such as an alloy with greater than about three percent and less than about 25 percent minority content), such as a silver-palladium alloy, a silver-platinum alloy, a silver-gold alloy, a silver-rhodium alloy, a silver-ruthenium alloy or the like, or an electrically conducting metal oxide layer, such as an indium tin oxide (ITO) transparent electrically conductive layer or the like, or a thin conductive ink or frit layer or film or tape or the like.

As shown in FIGS. 21A, 21B and 22, the third surface transflective mirror reflector 648 may be established at the front surface 642a of the rear substrate 642 and with an uncoated or non-conducting pathway or raceway 654 established around the perimeter region 643 of the front surface 642a of the rear substrate 642, such as by masking during the deposition of the mirror reflector on the front surface or by laser ablating or otherwise deleting or removing the mirror reflector from the front surface of the rear substrate at and around the perimeter region of the front surface 642a of the rear substrate 642. The third surface mirror reflector 648 may comprise any suitable reflective and transmissive material or materials, such as a silicon coating or a metal oxide/metal/metal oxide stack (with at least one of the metal oxide layers comprising a conducting or semiconducting layer), such as an IMI (such as ITO/silver/ITO or other suitable alternating layers of materials or the like) stack of layers or coatings such as by utilizing aspects of the reflective elements described in U.S. Pat. Nos. 7,274,501; 7,255,451; 7,184,190; 6,690,268; 5,724,187 and/or 5,668,663, which are all hereby incorporated herein by reference in their entireties.

As can be seen in FIGS. 21B and 22, the third surface mirror reflector 648 is disposed on the substrate surface after the tab-in portion has already being coated or otherwise dispose on the substrate and so as to partially overlap the tab-in portion 650 (with a portion of the tab-in portion being tucked under and making electrical contact with an outboard perimeter portion of the third surface mirror reflector), and at a location that is spanned or encompassed by the perimeter seal 644. With reference to FIG. 23, the process 670 of forming and coating the rear substrate includes shape cutting or forming the rear substrate at 672. The third surface of the cut substrate is then masked and coated at 674 to establish the tab-in coating or coatings at the third surface (and optionally at the edge dimension and fourth surface of the substrate depending on the particular application). After the tab-in coating is established, the third surface of the cut substrate is remasked and coated at 676 with the third surface reflector or transflective mirror reflector or transflector coating or coatings. An outboard portion of the third surface transflector coating is thus established over the previously established tab-in portion, and at a region that is encompassed by the perimeter seal when the reflective element is assembled together and the front and rear substrates are joined and sealed together by the perimeter seal.

Optionally, and desirably, the tab-in portion comprises a thin coating or layer (such as a layer having a thickness of about 20 microns or less, such as less than 10 microns (while remaining sufficiently electrically conductive), but could be more depending on the particular application) so as to limit any step or change in thickness of the coatings under the seal (that typically has a thickness in the range of from about 80 microns to about 150 microns or thereabouts) so as to limit any effect the presence of the thickness of the tab-in coatings may have on the sealing function of the perimeter seal at that location and/or any impact it might have on the uniformity of the inter-pane spacing between the front and rear substrates (although other means for providing a substantially uniform thickness of the various layers at the perimeter seal may be implemented to reduce non-uniformity at the interface between the perimeter seal and the third surface coatings or layers, such as by having the tab-in coating or stack of coating circumscribe the perimeter of the cut shape that constitutes the rear substrate).

Thus, the overlap region of the reflector 648 and tab-in coating 650 is entirely within, is under and is encompassed/protected by the perimeter seal 644 at that location at the perimeter region of the rear substrate (with the outer edge/periphery of the potentially environmentally vulnerable third surface reflector being inboard of an outer region/wall of the perimeter seal 644 and with the inner edge/periphery of the more environmentally robust tab-in coating or coatings (such as chromium or ruthenium or the like) preferably being outboard of an inner region of the perimeter seal 644 so as not to be visible to a viewer viewing the electrochromic-active region bounded by the perimetal seal). Thus, environmental concerns or environmental vulnerability of the transflective mirror reflector coating 648 are reduced by sealing the environmentally vulnerable third surface reflector coatings entirely within and under the bounds of the perimeter seal and providing electrical continuity/connection to the mirror reflector coating via an environmentally robust, electrically conducting tab-in coating, and with the electrical joint/overlap made and terminating under the seal. Optionally, an additional encapsulant or protectant 658 (such as a silicone sealant or an epoxy sealant or another suitable sealant) may be established at the tab-in portion and fourth surface wraparound portion to environmentally seal and protect the metallic or conductive tab-in and wraparound portions outside of the perimeter seal of the reflective element. This may conveniently be applied after the electrochromic mirror cell has been fabricated. Such additional sealing can augment the inherent environmental robustness of the tab-in coating or layers used, and such additional or secondary encapsulation well suits exterior mirror construction of the flush and/or frameless types, such as the types that are disclosed in U.S. Pat. Nos. 7,274,501; 7,255,451; and 7,184,190, which are all hereby incorporated herein by reference in their entireties.

The third surface tab-in portion thus extends from the overlap region (where the third surface reflector overlaps or overlays an inboard portion of the tab-in portion) or perimeter seal region and out to the perimeter edge of the cut shape of the rear substrate. In the illustrated embodiment, the tab-in portion extends over or wraps around a portion of the edge of the substrate (between the front and rear surfaces of the rear substrate), and a fourth surface wraparound portion covers a portion of the fourth surface and overlays or underlays a portion of the wraparound tab-in portion at the substrate edge. Because the reflective element does not necessarily require a wraparound coating at the edge dimension of the substrate, the tab-in portion may optionally be coated only on the perimeter region of the third or front surface of the rear substrate without any significant wraparound or coating on the edge dimension of the rear substrate. Optionally, the tab-in portion may wraparound a portion of the edge of the substrate or may be coated substantially across the edge dimension of the substrate, yet the reflective element may not include a fourth surface wraparound portion, whereby the tab-in portion may extend to the edge of the rear substrate and may extend or encompass a portion of the edge dimension of the substrate, such that electrical connection to the tab-in portion may be made at the perimeter region of the third surface of the rear substrate or at the edge or edge dimension of the rear substrate, while remaining within the spirit and scope of the present invention. Optionally, if a fourth surface wraparound coating is desired, the fourth surface wraparound coating may be established before or after or at the same time as the tab-in portion, such as via simultaneously sputter coating the tab-in coating and the fourth surface wraparound coating at the opposite sides and perimeter edge of the substrate via a two-sided sputter coating process, such as a sputter coating process that sputter coats the top and bottom surfaces of a substrate shape held in a fixture of a sputter coating chamber (with the coatings comprising the same coating composition or different coating composition as desired).

The fourth surface wraparound electrically conductive coating (or stack of coatings) thus may be deposited or disposed or coated onto the cut-edge dimension of the substrate, which has already been first coated with a portion of the tab-in coating (or stack of coatings) that wraps around or partially wraps around the edge dimension of the substrate so that the fourth surface wraparound electrically conductive coating (or stack of coatings) overlays, and thus protects, the underlying tab-in portion. Optionally, the fourth surface wraparound coating may comprise an environmentally robust composition or material, such as metallic chromium or ruthenium or the like, and thus may provide at least some enhanced environmental protection to the undercoated tab-in portion at the edge dimension of the substrate shape. Optionally, the sputter chamber in which the substrate shape is placed for coating of the fourth surface wraparound portion may utilize baffles or scattering techniques or other means for sputter coating the more environmentally robust coating(s) of the fourth surface wraparound portion over the tab-in portion at the edge dimension of the substrate shape and/or over the tab-in portion at the third surface of the substrate. Thus, the sputter-coated environmentally-protective coating(s) may sufficiently cover the tab-in portion so as to envelop and further environmentally protect the tab-in portion of the rear substrate. Also, and for constructions such as are disclosed in U.S. Pat. Nos. 7,255,451 and 7,184,190, and/or PCT Application No. PCT/US2006/018567, filed May 15, 2006 and published Nov. 23, 2006 as International Publication No. WO 2006/124682, which are hereby incorporated herein by reference in their entireties, where a third surface metallic reflector is principally protected by the seal of the electrochromic laminate assembly but with a tab-out portion that extends out beyond the seal to a cut edge (and preferably wraps-around the cut edge dimension) so as to facilitate electrical connection to the metallic reflector, the fourth surface coating or stack of coatings may be extended (such as by appropriate use of baffles or scattering means during sputter deposition in a vacuum chamber) from the fourth surface, along the cut edge dimension, and along the perimeter edge portion of the third surface where the tab-out of the third surface reflector has already been established so that the fourth surface coating (or stack of coatings) can overlay and thus help environmentally-protect the tab-out portion of the third surface reflector, not just along the cut edge dimension but also along the part of the tab-out portion that extends beyond the seal at the edge perimeter of the seal on the third surface of the rear substrate of the electrochromic mirror element.

Optionally, the mirror assembly may include one or more displays, such as the types disclosed in U.S. Pat. Nos. 5,530,240 and/or 6,329,925, which are hereby incorporated herein by reference in their entireties, and/or display-on-demand or transflective type displays, such as the types disclosed in U.S. Pat. Nos. 6,690,268; 5,668,663 and/or 5,724,187, and/or in U.S. pat. applications, Ser. No. 10/054,633, filed Jan. 22, 2002 by Lynam et al. for VEHICULAR LIGHTING SYSTEM, now U.S. Pat. No. 7,195,381; Ser. No. 10/528,269, filed Mar. 17, 2005, now U.S. Pat. No. 7,274,501; Ser. No. 10/533,762, filed May 4, 2005, now U.S. Pat. No. 7,184,190; Ser. No. 10/538,724, filed Jun. 13, 2005 by Hutzel et al. for ACCESSORY SYSTEM FOR VEHICLE (Attorney Docket DON01 P-1123); Ser. No. 11/284,543, filed Nov. 22, 2005 (Attorney Docket DON01 P-1245); and/or Ser. No. 11/021,065, filed Dec. 23, 2004 by McCabe et al. for ELECTRO-OPTIC MIRROR CELL, now U.S. Pat. No. 7,255,451; and/or PCT Application No. PCT/US03/29776, filed Sep. 9, 2003 by Donnelly Corp. et al. for MIRROR REFLECTIVE ELEMENT ASSEMBLY, and published Apr. 1, 2004 as International Publication No. WO 2004/026633; and/or PCT Application No. PCT/US03/35381, filed Nov. 5, 2003 by Donnelly Corp. et al. for ELECTRO-OPTIC REFLECTIVE ELEMENT ASSEMBLY, and published May 21, 2004 as International Publication No. WO 2004/042457; and/or U.S. provisional applications, Ser. No. 60/630,061, filed Nov. 22, 2004 by Lynam et al. for MIRROR ASSEMBLY WITH VIDEO DISPLAY; Ser. No. 60/667,048, filed Mar. 31, 2005 by Lynam et al. for MIRROR ASSEMBLY WITH VIDEO DISPLAY; Ser. No. 60/629,926, filed Nov. 22, 2004 by McCabe et al. for METHOD OF MANUFACTURING ELECTRO-OPTIC MIRROR CELL; Ser. No. 60/531,838, filed Dec. 23, 2003; Ser. No. 60/553,842, filed Mar. 17, 2004; and Ser. No. 60/563,342, filed Apr. 19, 2004, and/or PCT Application No. PCT/US03/40611, filed Dec. 19, 2003 by Donnelly Corp. et al. for ACCESSORY SYSTEM FOR VEHICLE, and published Jul. 15, 2004 as International Publication No. WO 2004/058540, which are all hereby incorporated herein by reference in their entireties, or may include or incorporate video displays or the like, such as the types described in PCT Application No. PCT/US03/40611, filed Dec. 19, 2003 by Donnelly Corp. et al. for ACCESSORY SYSTEM FOR VEHICLE, and published Jul. 15, 2004 as International Publication No. WO 2004/058540, and/or U.S. patent applications, Ser. No. 10/538,724, filed Jun. 13, 2005 (Attorney Docket DON01 P-1123); and/or Ser. No. 11/284,543, filed Nov. 22, 2005 (Attorney Docket DON01 P-1245); and/or U.S. provisional applications, Ser. No. 60/630,061, filed Nov. 22, 2004 by Lynam et al. for MIRROR ASSEMBLY WITH VIDEO DISPLAY; and Ser. No. 60/667,048, filed Mar. 31, 2005 by

Lynam et al. for MIRROR ASSEMBLY WITH VIDEO DISPLAY, which are hereby incorporated herein by reference in their entireties.

Telecommunications and wireless communication/data transfer between, from and within a vehicle equipped with the present invention may be by means of airwaves designated for other technologies in the standard known as IMT-2000, and can be over networks based on WiMAX. WiMAX — Worldwide Interoperability for Microwave Access — is capable of delivering wireless broadband connections at speeds of 70 megabits per second or more across an area of up to 40 miles. It is properly referred to as 802.16e-2005. WiMAX provides wireless data over long distances in a variety of ways, from point-to-point links to full mobile cellular type access, and is based on the IEEE 802.16 standard (which is also called WirelessMAN). The 802.16 specification applies across a wide swath of the RF spectrum, and WiMAX can function on any frequency below 10GHz (although higher frequencies can decrease the range to a few hundred meters in an urban environment). Although there is no uniform global licensed spectrum for WiMAX, WiMAX has three licensed spectrum profiles: 2.3GHz, 2.5GHz and 3.5GHz.

Optionally, and with reference to FIG. 24, a reflective element assembly 712, such as for an interior rearview mirror assembly, may include a video display element 714 at a rear portion of the reflective element 718 for viewing video display information through the reflective element when the vide display element 714 is activated. In the illustrated embodiment, reflective element 718 comprises an electro-optic reflective element having a front substrate 740 (such as a transparent glass substrate or the like), a rear substrate 742 (such as a transparent glass substrate or the like) and an electro-optic medium 743 (such as a solid type, such as a solid polymer matrix electrochromic medium or the like, such as the types described in U.S. Pat. Nos. 7,004,592; 5,724,187; 5,668,663; and 5,910,854, and commonly owned and co-assigned and co-pending U.S. patent applications, Ser. No. 11/653,254, filed Jan. 16, 2007 by Varaprasad et. al.; Ser. No. 11/244,182, filed Oct. 6, 2005 by Varaprasad et. al.; and Ser. No. 11/655,096, filed Jan. 19, 2007 by Varaprasad et. al., which are all hereby incorporated herein by reference in their entireties, or such as a liquid type, such as the types described in U.S. Pat. Nos. 4,902,108; 5,128,799 and 5,818,625, which are hereby incorporated herein by reference in their entireties) sandwiched therebetween and sealed via a perimeter seal 744. Front substrate 740 has a transparent conductor coating 746 (such as a ½ wave indium tin oxide (ITO) layer or doped tin oxide layer or doped zinc oxide layer, such as an AZO layer, or the like) disposed at its rear surface 740a, while rear substrate 742 has a third surface transparent electrical conductor coating 748 (such as a ½ wave indium tin oxide (ITO) layer or doped tin oxide layer or doped zinc oxide layer, such as an AZO layer, or the like) disposed at its front surface 742a and a fourth surface dichroic transflector coating or layer or layers 749 disposed at its rear surface 742b. Optionally, the conductive coatings or layers may be disposed or deposited at the surface of the glass substrate or substrates via any suitable means, such as via a sputter deposition process or via a pyrolytic deposition process, such as by utilizing aspects described in PCT Application No. PCT/US2006/018567, filed May 15, 2006 and published Nov. 23, 2006 as International Publication No. WO 2006/124682, which is hereby incorporated herein by reference in its entirety.

The dichroic transflector coating 749 of reflective element 718 comprises a stack of dielectric thin film layers, such as by utilizing aspects of optical dichroic mirrors as known in the optical dichroic mirror art. The dichroic reflector provides a reduced absorption level as compared to a metallic transflective layer, such that the reflective element 718 may provide enhanced transmissivity of light therethrough for a given level of reflectance of light incident thereon. Preferably, the reflectivity of light off of the dichroic transflector stack is greater than about 60% R, more preferably greater than about 70% R and more preferably greater than about 80% R, while the transmission of light through the dichroic transflector stack may be preferably greater than about 20% T, more preferably greater than about 25% T, and more preferably greater than about 30% T, but preferably less than about 40% T or thereabouts. Preferably, the dichroic transflector stack provides a non-specularly selective (i.e., neutral and substantially untinted and "silvery") reflection of light incident thereon and is also substantially neutral in transmission across the visible range of the electromagnetic spectrum (so that the likes of color video images generated on the video screen disposed to the rear of and emitting through the reflective element can be seen substantially true-to-color), such that the dichroic transflector is highly suitable for transmitting color video images therethrough. Thus, the dichroic transflector provides a wide band pass transmission of light substantially across the visible band of the electromagnetic spectrum. Thus, these dichroic reflectors have a wide band pass substantially across the visible light spectrum for transmission, and similarly for reflection.

In the illustrated embodiment, the display element 714 is disposed to the rear of the dichroic transflector stack 749 for emitting illumination therethrough. A light absorbing element 760 (such as a dark colored ink or paint or frit or coating or tape or film or layer or adhesive or plastic part or the like) may be disposed at the rear of the dichroic transflector stack 749 (except where the display element 714 is at) to limit light transmission through the reflective element except at the display element 714. Optionally, and as shown in FIG. 23, a first surface anti-reflector 762 may be provided at or established on the front or first surface 740b of the front substrate 740 to limit reflectance of light incident on the front substrate. Optionally, the anti-reflection layer (such as an OPTIVIEW™ layer such as commercially available from Pilkington) may be deposited pyrolytically in a glass manufacturing plant, such as described above or such as is disclosed in U.S. Pat. No. 5,076,674, which is hereby incorporated herein by reference in its entirety. The anti-reflector 762 may limit or reduce the first surface reflectivity to be, for example, preferably less than about 2 percent reflective of light incident thereon, preferably less than about 1 percent reflective of light incident thereon, and more preferably less than about 0.5 percent reflective of light incident thereon.

The display element 714 may comprise any suitable display element, such as a color video screen, such as a back-lit liquid crystal display video screen, such as a back-lit thin film transistor (TFT) liquid crystal display (LCD) video screen, such as a back-lit TFT LCD video screen that is back lit by a plurality of white light emitting light emitting diodes (such as an array of at least four white light emitting light emitting diodes or the like), such as light emitting diodes that utilize aspects of the light emitting diodes described in U.S. Pat. Nos. 6,690,268; 7,167,796 and 7,195,381, which are hereby incorporated herein by reference in their entireties.

Preferably, display element 714 comprises a video screen construction of the type disclosed in PCT Application No. PCT/US2006/042718, filed Oct. 31, 2006 by Weller et al. of Donnelly Corporation for INTERIOR REARVIEW MIRROR WITH DISPLAY, and published May 10, 2007 as International Publication No. WO2007/053710, which is hereby incorporated herein by reference in its entirety, that utilizes visible light transmitting brightness enhancing films such as Vikuiti™ Dual Brightness Enhancement Films (DBEF) that are commercially available from 3M® Corporation of Minneapolis, MN and that are typically a light transmitting plastic optical film consisting of over 800 polymer layers. Vikuiti™ Dual Brightness Enhancement (DBEF) film is a reflective polarizer made using multi-layer optical polymer film technology that manages light by preferentially transmitting one polarization state (P1) while reflecting the opposite polarization state (P2) back into the display. When a DBEF film is placed to the rear of the LCD panel of the video screen used with a video mirror of the present invention, so as to be between the LCD panel and the back-lighting light sources, and with the axis of polarization of the DBEF aligned with the axis of polarization (P1) of the polarizer at the rear of the rear glass substrate of the LCD panel, then light in the P2 polarization state emitted by the back-lighting light sources that would normally be absorbed by/not passed by the rear polarizer of the liquid crystal panel is recycled by reflection off the DBEF film back towards the back-lighting array to be in turn reflected off the likes of a mirror-like reflector of the back-lighting array with a concomitant change/scramble in handedness of polarization state back at least partially to a P1 polarization state, thus increasing the overall amount of light ultimately exiting the LCD display panel to pass through the reflective element for viewing by the driver of the vehicle equipped with the video mirror. Use can also be made of a Vikuiti™ BEF 111-1 OT film that provides about a 37 percent increase in on-axis brightness for direct-light systems, or the like. Vikuiti™ Brightness Enhancement Film (BEF) uses a microreplication process to create a prism structure that manages the angle of light ultimately exiting a display. Using the likes of total internal reflection and reflection/refraction at the micro prisms forming a random prism pattern, off-axis light rays incident at the rear of the BEF prism film can be made to exit more perpendicular to the plane of the BEF film and so on-axis display brightness is enhanced. When combined with Vikuiti™ DBEF-D400 (or D550) film or similar film or element, on-axis brightness can be increased by up to 68 percent or thereabouts.

Additionally, combining Vikuiti™ BEF ITT-l OT film with Vikuiti™ DBEF film may beneficially improve contrast when viewing an image displayed at the video mirror. For example, a video mirror can be constructed utilizing a video screen that comprises a thin film transistor liquid crystal display (LCD) panel that is back lit by an array of a plurality of white light emitting light emitting diodes (preferably more than four white LEDs) and including a Vikuiti™ DBEF reflecting polarizer and a Vikuiti™ BEF prism film, preferably disposed between the rear of the LCD panel and the back-lighting array of LEDs (and with the DBEF film closer to the LCD panel and the BEF film closer to the back-lighting so that light emitted by the back-lighting LEDs impinges on the BEF film (typically having passed through a light diffuser film, although a diffusing property may be included in the DBEF film such as Vikuiti™ Diffuse Reflective Polarizer Film DRPF or Vikuiti™ DBEF-D280) before passing through the DBEF film and then, in turn, passes through the LCD panel and then through the reflective element itself. Also, two BEF sheets crossed at 90 degrees can optionally be used to increase display brightness. Also, Vikuiti™ Brightness Enhancement Film-Reflective Polarizer (BEF-RP) that combines light recycling and reflection/refraction in a single multi-layer polymeric film/sheet that includes micro-prism structures and polarized light management may be used in the video screen device construction of a video mirror of the present invention. Also, Vikuiti™ BEF-RP or Vikuiti™ BEFRP2-RC multi-functional film that combines polarizing recycling and light angle management may be used in the video screen device construction of a video mirror of the present invention. Also, Vikuiti™ DBEF MF1-650 (having a film /sheet thickness of 650 microns) or multi-functional film Vikuiti™ DBEF MF1-470 (having a film /sheet thickness of 470 microns) that combines polarizing recycling and light angle management may be used in the video screen device construction of a video mirror of the present invention.

When viewed via the front substrate and when operated during normal driving conditions and under high ambient lighting (such as daylight driving conditions), the luminance of the images seen at the video display screen as viewed through the front substrate and through the electro-optic medium and through the rear substrate is preferably at least about 900 candelas/square meter, more preferably at least about 1,200 candelas/square meter, and more preferably at least about 1,500 candelas/square meter, when the electro-optic medium is in its undimmed state and with the back lighting light sources of the video screen being powered to their maximum normally-allowed power level for use in the interior rearview mirror assembly in the vehicle.

Optionally, and with reference to FIG. 25, the dichroic transflector layers 749' of a reflective element 718' may be disposed at the front surface or third surface 742a' of the rear substrate 742' and between the third surface 742a' and the transparent electrical conductor 748'. Similar to reflective element 718, a video display element 714' is disposed at a rear portion of the reflective element 718' for viewing video display information through the reflective element when the vide display element 714' is activated. Reflective element 718' comprises an electro-optic reflective element having a front substrate 740', rear substrate 742' and an electro-optic medium 743' sandwiched therebetween and sealed via a perimeter seal 744'. Front substrate 740' has a transparent conductor coating 746' disposed at its rear surface 740a' and an anti-reflective coating or layer 762' disposed at its front surface 740b', while rear substrate 742' has a light absorbing element 760' disposed at its rear surface 742b'.

The transparent electrical conductor layer 748' is thus disposed over the third surface dichroic transflector layers 749' and is between the electro-optic medium 743' and the dichroic transflector layers 749'. The transparent electrical conductor is thus in contact with the electro-optic medium and preferably has a resistivity of about 5-15 ohms per square for powering the electro-optic medium when a current is applied to the transparent electrical conductor. The third surface dichroic transflector reflective element 718' may be substantially similar to the fourth surface dichroic transflector reflective element 718, discussed above (although the stack design may be adjusted so as to accommodate use of the likes of a half-wave ITO transparent thin film as the outermost layer in electrical contact with the electro-optically active inter-pane medium), such that a detailed discussion of the reflective elements need not be repeated herein. The difference in appearance (as viewed by a person viewing the reflective elements when the respective mirror assemblies are normally mounted in a vehicle) between a third surface dichroic transflector reflective element and a fourth surface dichroic transflector reflective element is not readily discernible to a person viewing the reflective elements of the interior rearview mirror assemblies due to the size of the mirrors and mirror substrates.

The third and fourth surface dichroic transflector reflective elements of the present invention thus provide dichroic transflectors that have reduced absorption as compared to non-dichroic metallic transflectors (such as metal oxide/metal/metal oxide stacks of layers), so that the dichroic transflector reflective element exhibits enhanced transmissivity of light therethrough for a given level of reflectivity of light incident thereon. This is because the dichroic transflector layers used in the dichroic transflectors, being all non-metallic (such as transparent metal oxides or transparent metal halides or transparent metal nitrides or other transparent non-metallic metal compounds), have a significantly lower extinction coefficient (smaller "k" value in the optical constants) than a metal layer (such as a thin silver thin film coating or a thin silver alloy thin film coating or a thin aluminum thin film coating or a thin aluminum alloy thin film coating) used in a non-dichroic metallic transflector. The extinction coefficient for the layers or coatings is a measure of how well the layers or coatings absorb electromagnetic radiation. If electromagnetic waves can pass through with reduced absorption, the material has a lower extinction coefficient.

The constructions of the present invention are economical and effective compared to the more complicated and potentially more costly constructions of other mirror assemblies. For example, no collimating optical element (or any equivalent thereof) need be positioned at the light assembly of the embodiments of the present invention, since the slanted baffle in tandem with the slanted orientation of the light assembly to the rear of the back plate obviates the need for a collimating optical element. The present invention also obviates the cost and complexity of use of an optics block with collimating and deviator portions to control direction of light rays, or any equivalent thereof, such as is disclosed in PCT Application No. PCT/US00/07437, filed Mar. 7, 2005 by Gentex Corporation for OPTICS FOR CONTROLLING THE DIRECTION OF LIGHT RAYS AND ASSEMBLIES INCORPORATING THE OPTICS, and published Sep. 22, 2005 as International Publication No. WO 2005/086777, which is hereby incorporated herein by reference in its entirety.

Changes and modifications to the specifically described embodiments may be carried out without departing from the principles of the present invention, which is intended to be limited only by the scope of the appended claims as interpreted according to the principles of patent law.

CLAIMS:

1. A mirror reflective element sub-assembly for an exterior rearview mirror assembly of a vehicle, said mirror reflective element sub-assembly comprising:

a mirror reflective element;

a mirror back plate attached at a rear surface of said mirror reflective element, said mirror back plate formed by injection molding and having a display receiving portion established thereat, said mirror back plate being molded to have an integral light baffle at said display receiving portion;

a display element having a light source that is activatable to emit light, said display element attaching to said display receiving portion of said mirror back plate and said light source being activatable to emit light through said display receiving portion and through said light baffle; and

wherein said light baffle is configured to allow light emanating from said display element to pass through said light baffle at a predetermined angle so that light exiting said mirror reflective element when said light source is activated is viewable from a direction that is one of (a) generally away from the vehicle when the mirror assembly is mounted to the vehicle so as to be principally viewed by drivers of other vehicles and so as to be substantially not viewed by the driver of the host vehicle, and (b) generally toward the driver of the vehicle when the mirror assembly is mounted to the vehicle so as to be principally viewed by the driver of the host vehicle and so as to be substantially not viewed by drivers of other vehicles, said light baffle substantially shielding the light emanating from said display element so that the light is substantially non-viewable from another direction.

2. The mirror reflective element sub-assembly of claim 1, wherein said display element makes mechanical connection with said display receiving portion when attached thereto.

3. The mirror reflective element sub-assembly of claim 2, wherein said display element makes electrical connection with said display receiving portion when attached thereto.

4. The mirror reflective element sub-assembly of claim 1, wherein said display element substantially seals with said display receiving portion when attached thereto such that said display element and said display receiving portion are substantially water impervious.

5. The mirror reflective element sub-assembly of claim 1, wherein said display receiving portion includes at least one passageway therethrough, said emitted light being directed through said at least one passageway.

6. The mirror reflective element sub-assembly of claim 1, wherein said display element comprises an illumination source and a translucent element, said illumination source being activatable to emit illumination, whereby said illumination is transmitted through said translucent element and diffused by said translucent element such that said translucent element emanates a substantially uniform glow when said illumination source is activated.

7. The mirror reflective element sub-assembly of claim 1, wherein said back plate is adhered at said rear surface of said reflective element.

8. The mirror reflective element sub-assembly of claim 1 further comprising a heater pad disposed between said back plate and said reflective element.

9. The mirror reflective element sub-assembly of claim 1, wherein said light baffle is configured such that said light emanating from said display element when said light source is activated and when the mirror assembly is mounted at the vehicle is principally viewable by the driver of the vehicle and is substantially not viewable by drivers of other vehicles.

10. The mirror reflective element sub-assembly of claim 9, wherein said display element is associated with a blind spot detection system of the vehicle.

11. The mirror reflective element sub-assembly of claim 1, wherein said light baffle is configured such that said light emanating from said display element when said light source is activated and when the mirror assembly is mounted at the vehicle is principally viewable by drivers of other vehicles and is substantially not viewable by the driver of the host vehicle.

12. The mirror reflective element sub-assembly of claim 11, wherein said display element is associated with a turn signal of the vehicle.

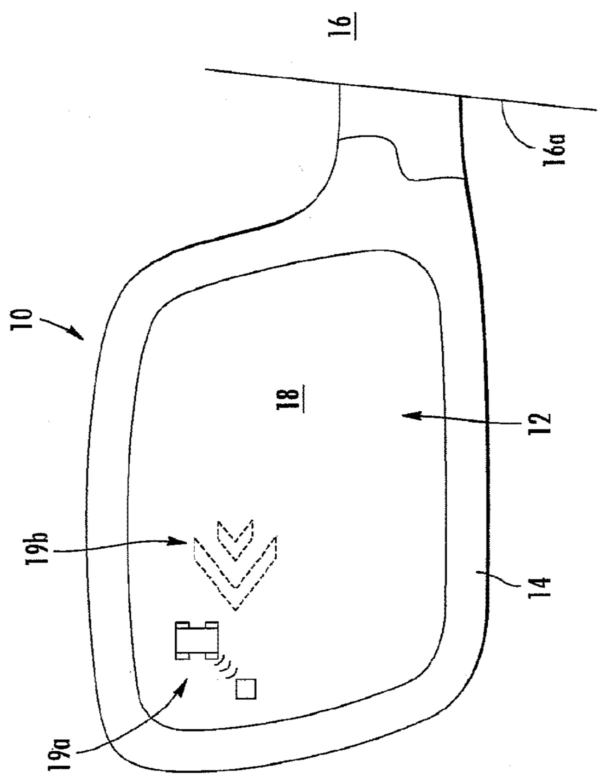
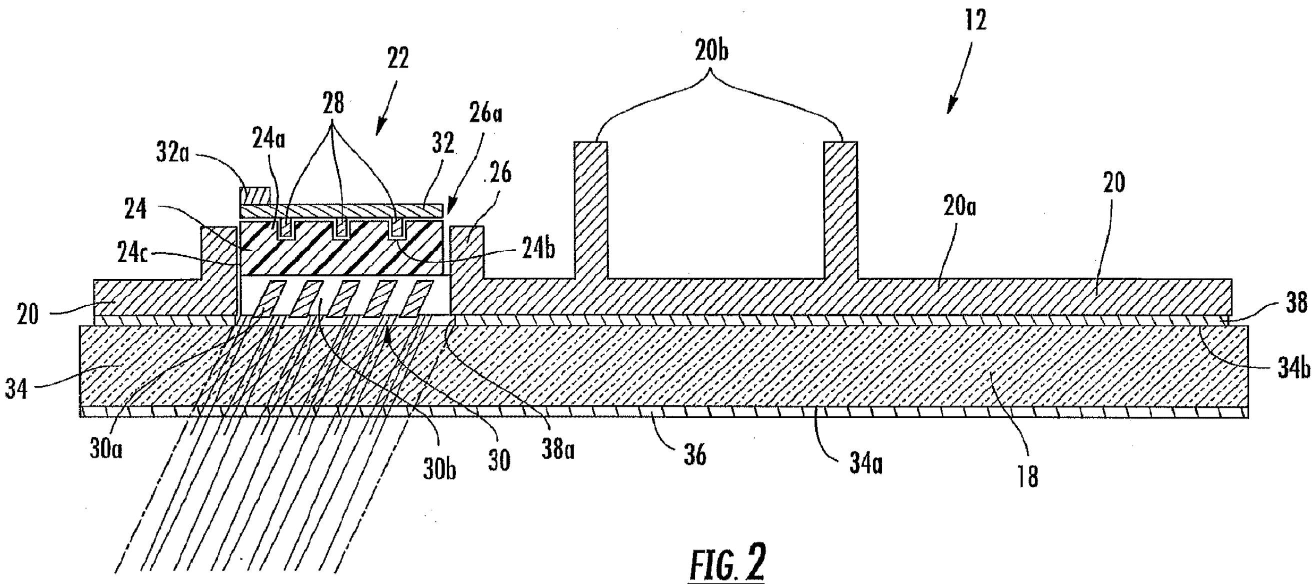


FIG. 1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34a
18

FIG. 2

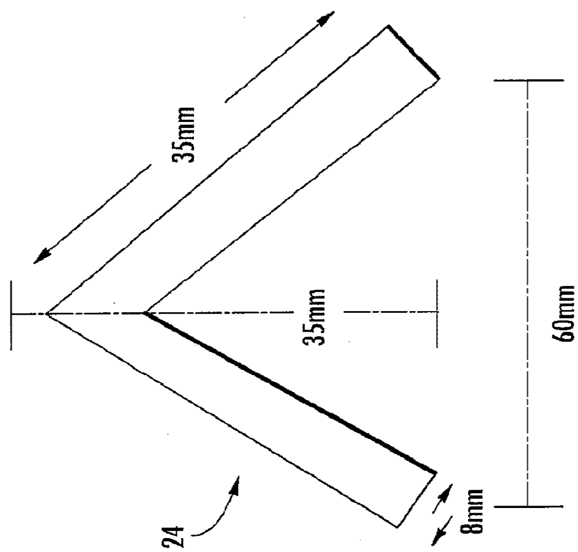

FIG. 3A

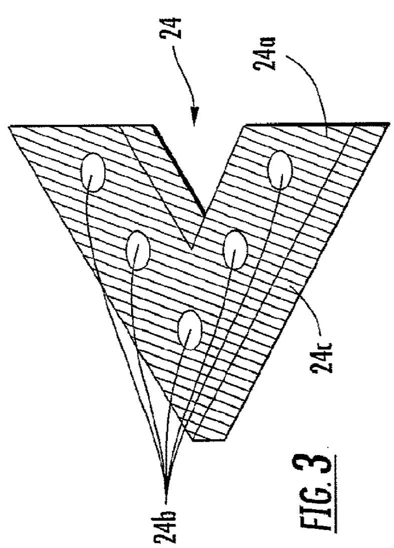

FIG. 3

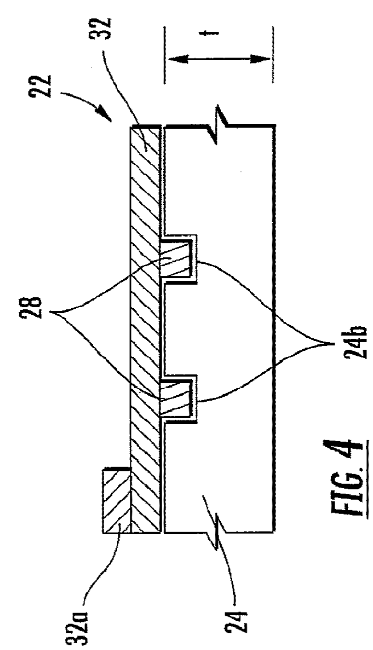

FIG. 4

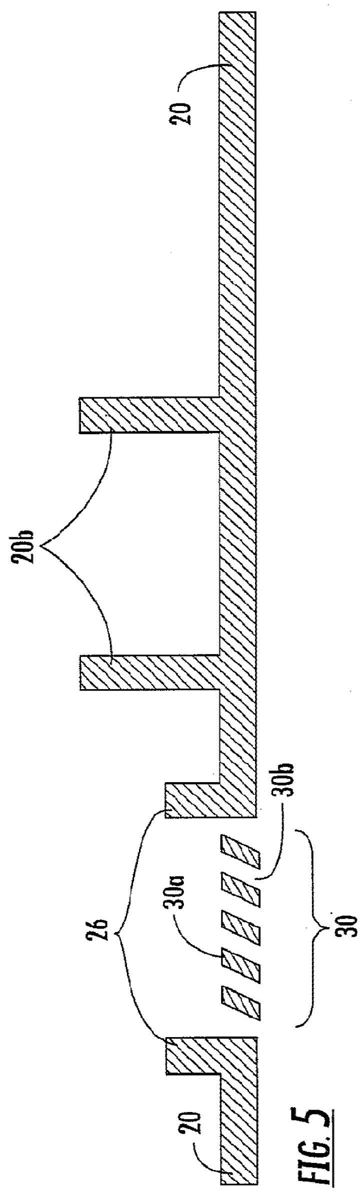

FIG. 5

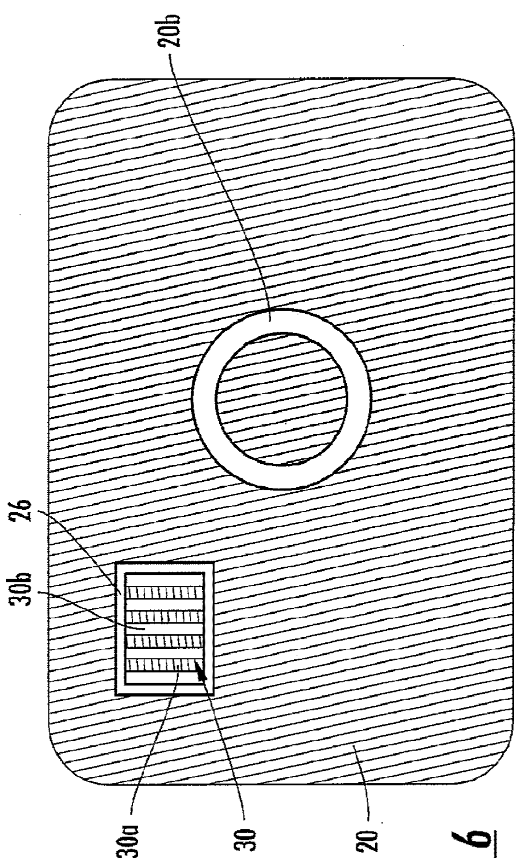

FIG. 6

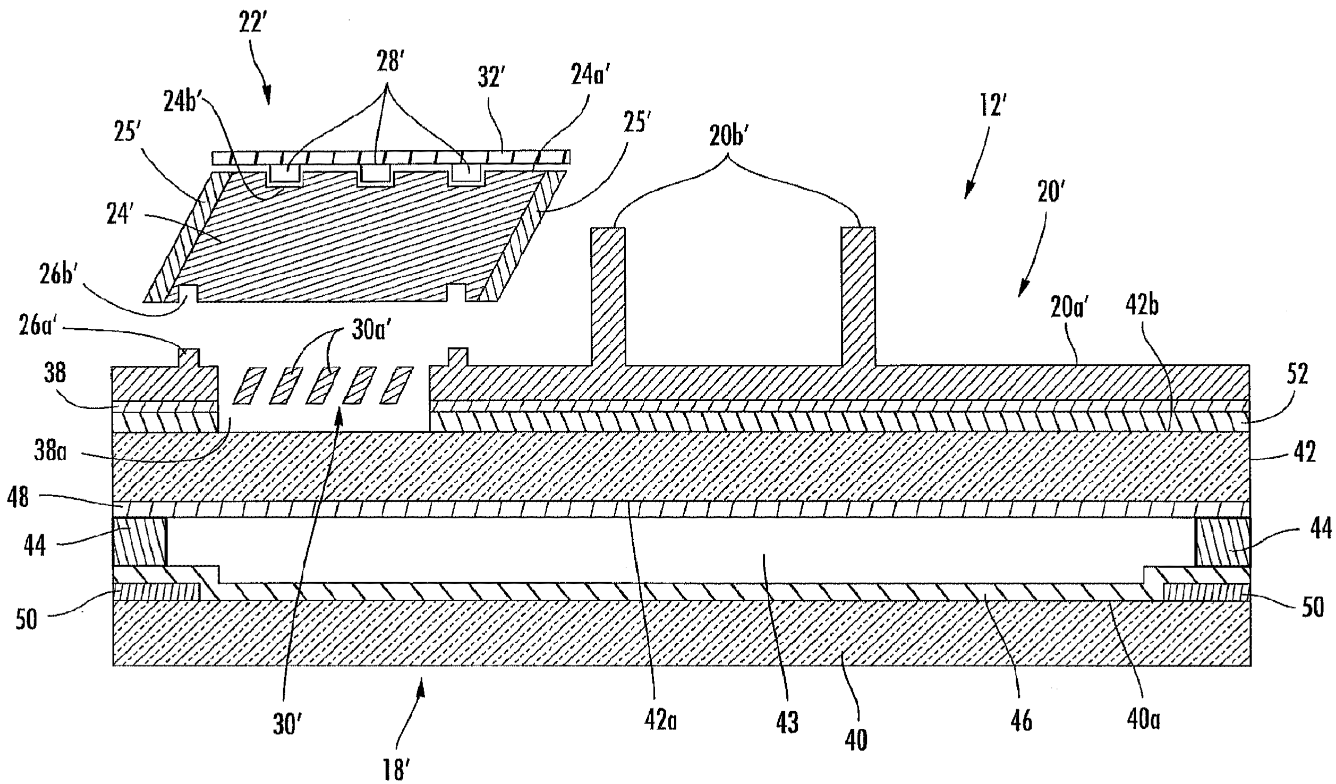
22′
28′
32′
24a′
24b′
25′
25′
20b′
12′
24′
20′
26b′
20a′
42b
26a′
30a′
38
52
38a
42
48
44
44
50
50
30′
42a
43
40
46
40a
18′

FIG. 7

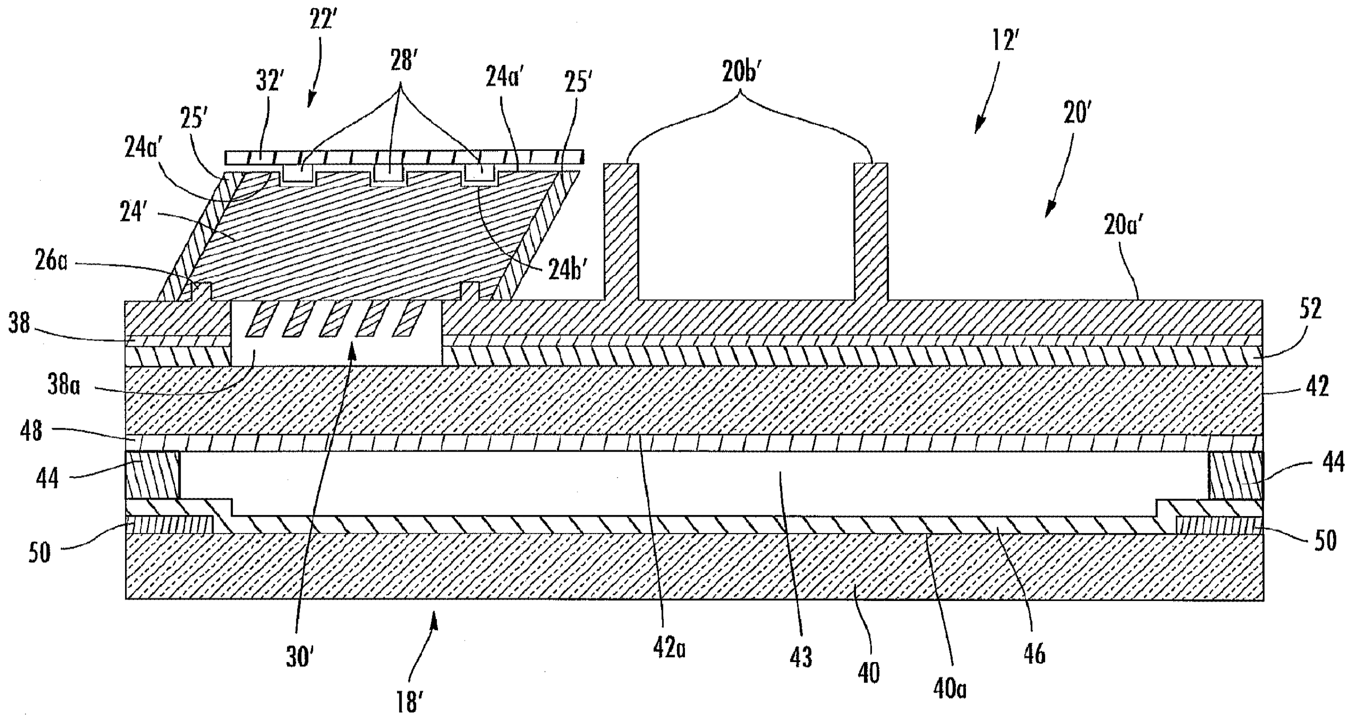
22′
28′
24a′
25′
32′
12′
20b′
20′
25′
24a′
24′
20a′
24b′
26a
38
52
38a
42
48
44
44
50
50
30′
42a
43
40
46
40a
18′

FIG. 8

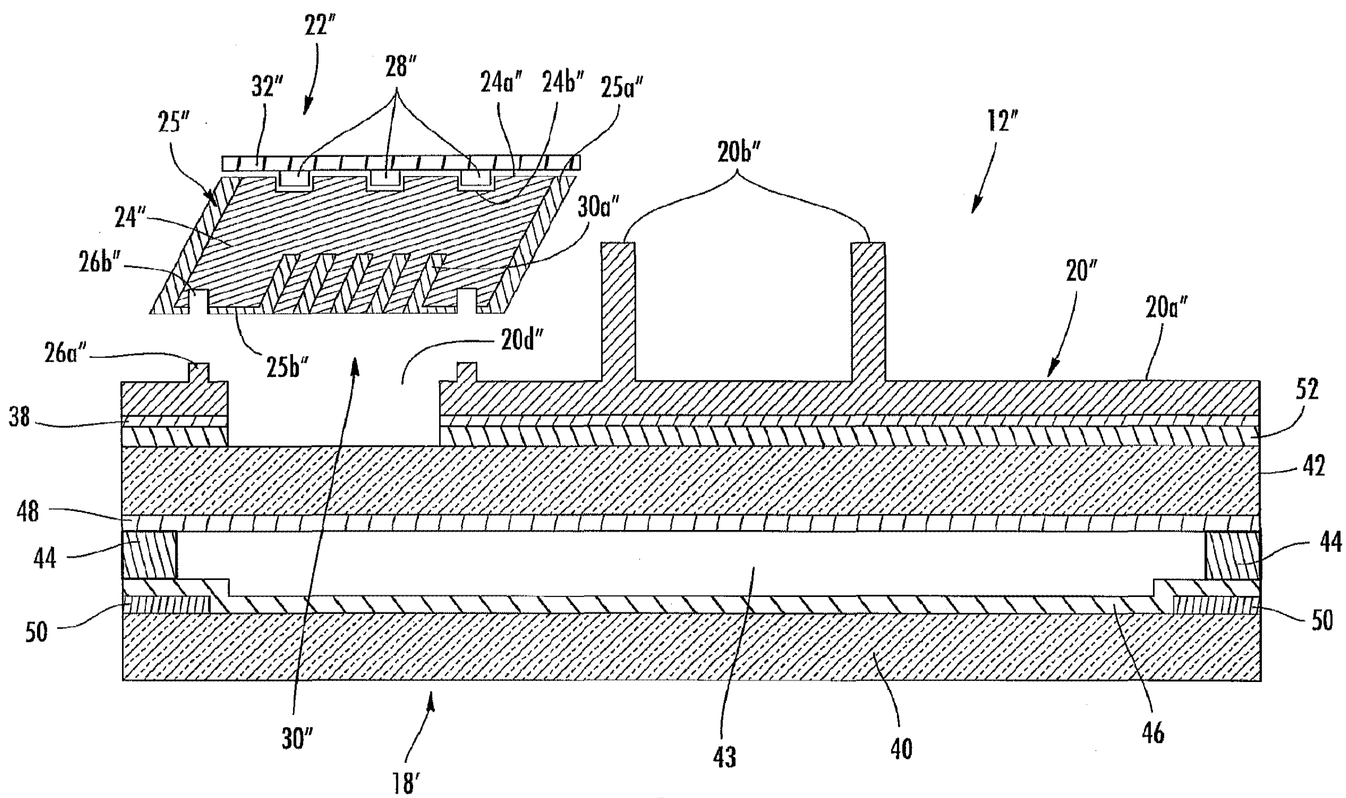
22"
28"
32"
24a"
24b"
25a"
25"
12"
20b"
24"
30a"
26b"
20"
20a"
20d"
26a"
25b"
38
52
42
48
44
44
50
50
30"
43
40
46
18'

FIG. 9

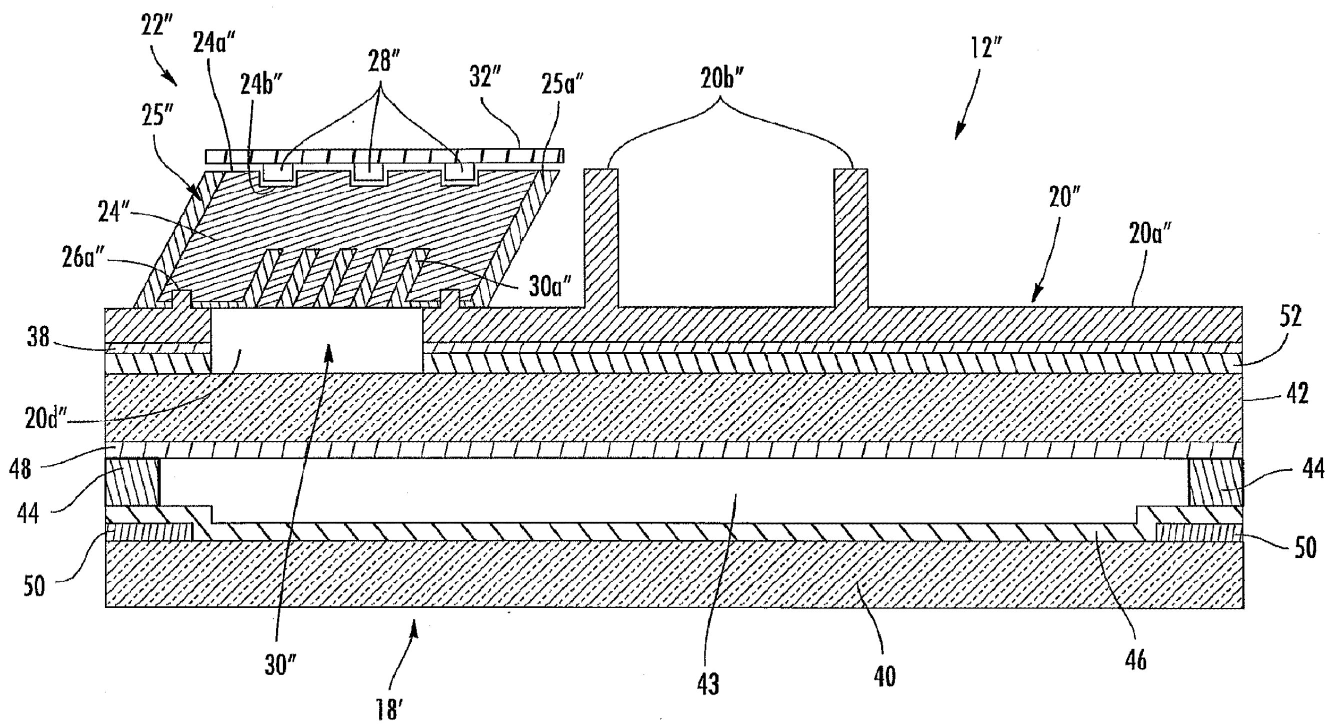
22″
24a″
24b″
28″
32″
25a″
20b″
12″
25″
24″
26a″
30a″
20″
20a″
38
52
42
20d″
48
44
44
50
50
30″
18′
43
40
46

FIG. 10

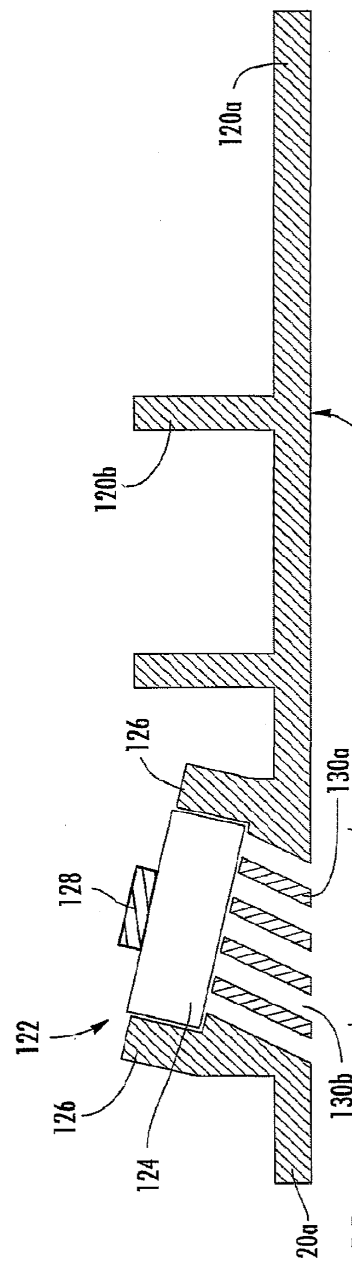

FIG. 11

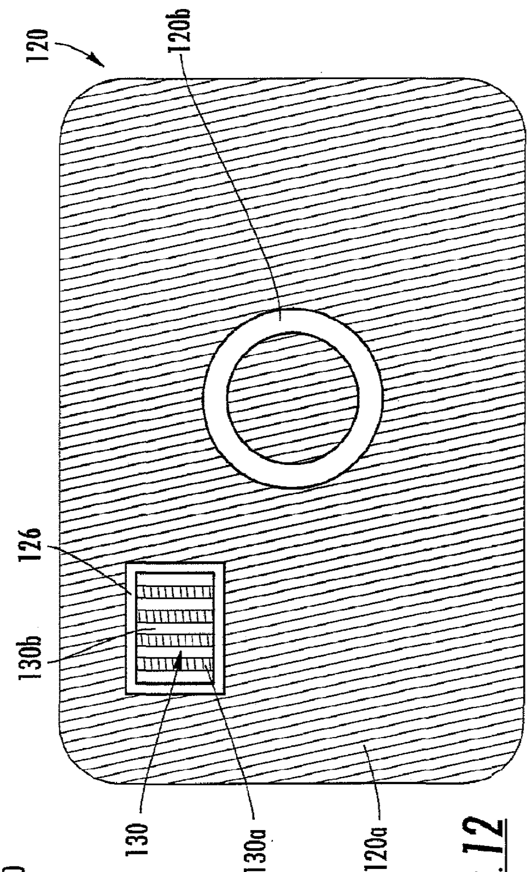

FIG. 12

SUBSTITUTE SHEET (RULE 26)

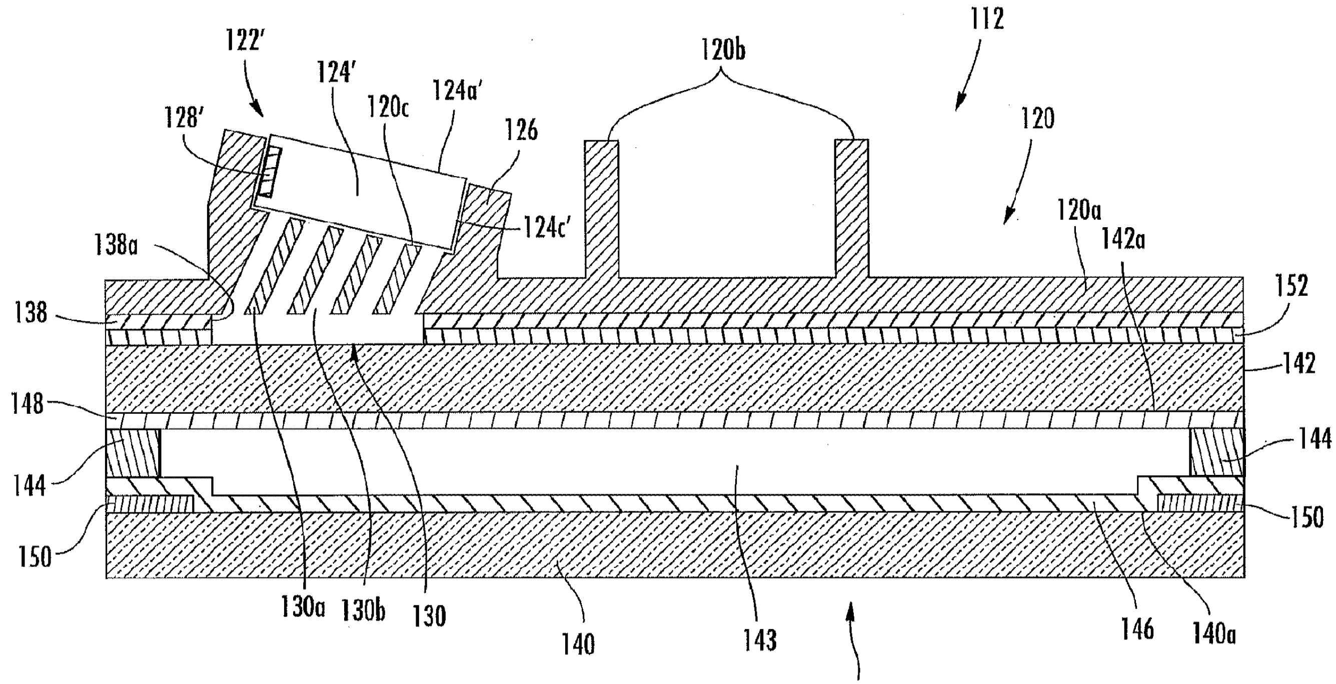
122'
124'
124a'
120c
128'
126
120b
112
120
120a
142a
124c'
138a
138
152
142
148
144
144
150
150
130a
130b
130
140
143
146
140a
118

FIG. 13

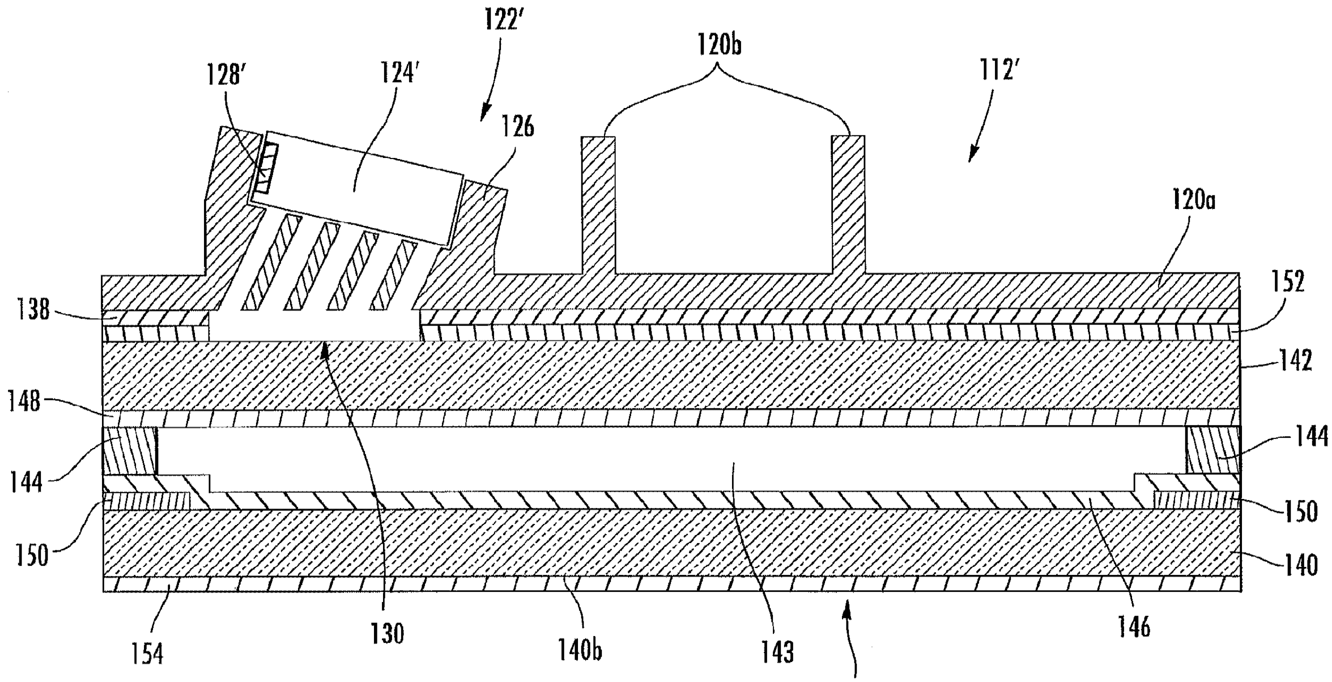
122′
128′
124′
126
120b
112′
120a
138
152
142
148
144
144
150
150
140
154
130
140b
143
118′
146

FIG. 14

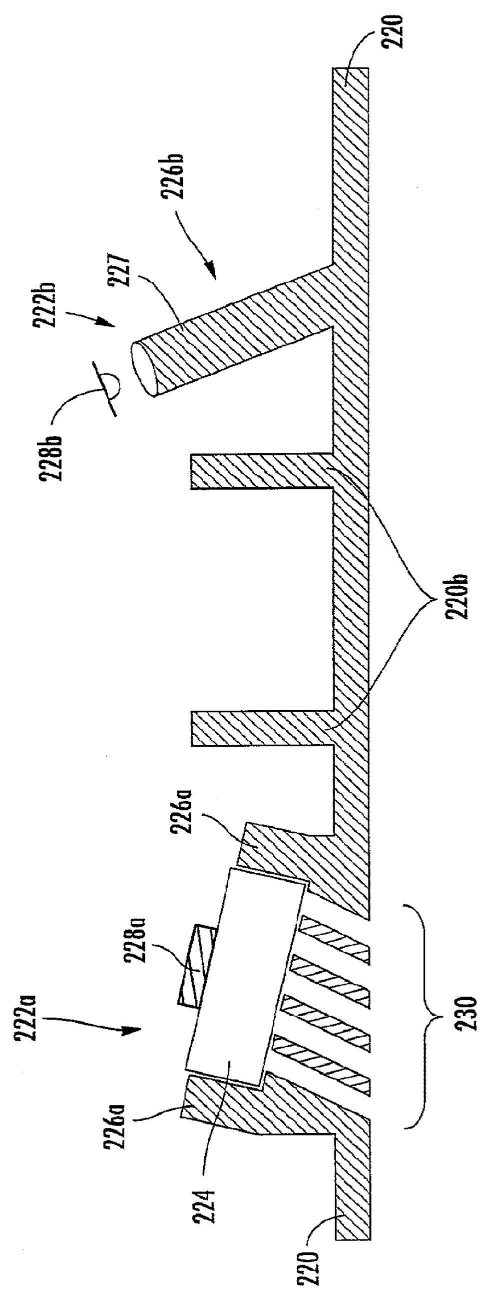

FIG. 15

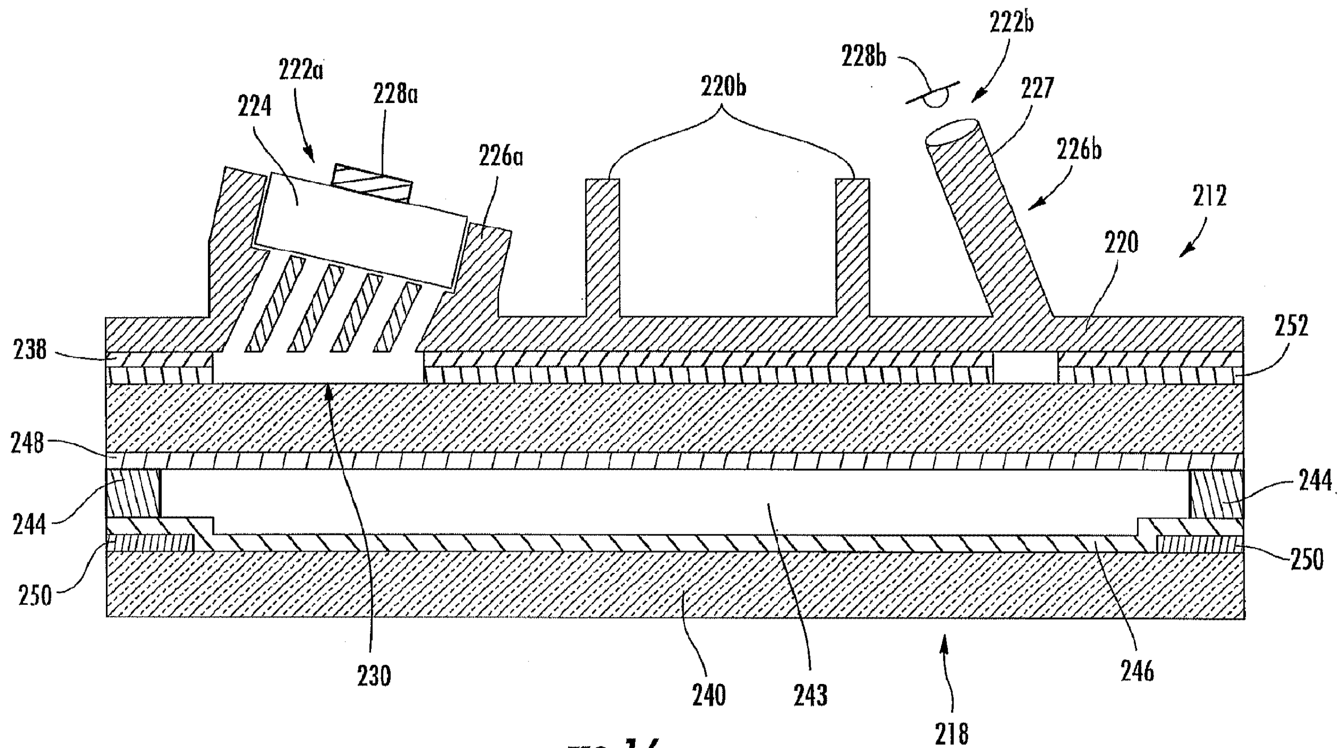
222a
224
228a
226a
220b
228b
222b
227
226b
212
220
238
252
248
244
244
250
250
230
240
243
218
246

FIG. 16

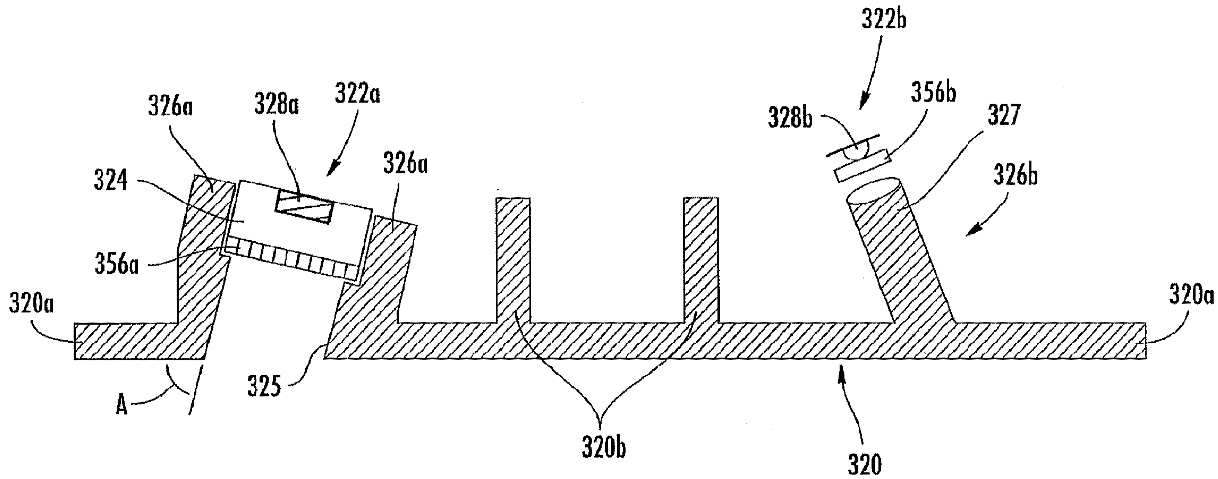
322b
328b
356b
327
326b
326a
328a
322a
324
326a
356a
320a
320a
325
A
320b
320

FIG. 17

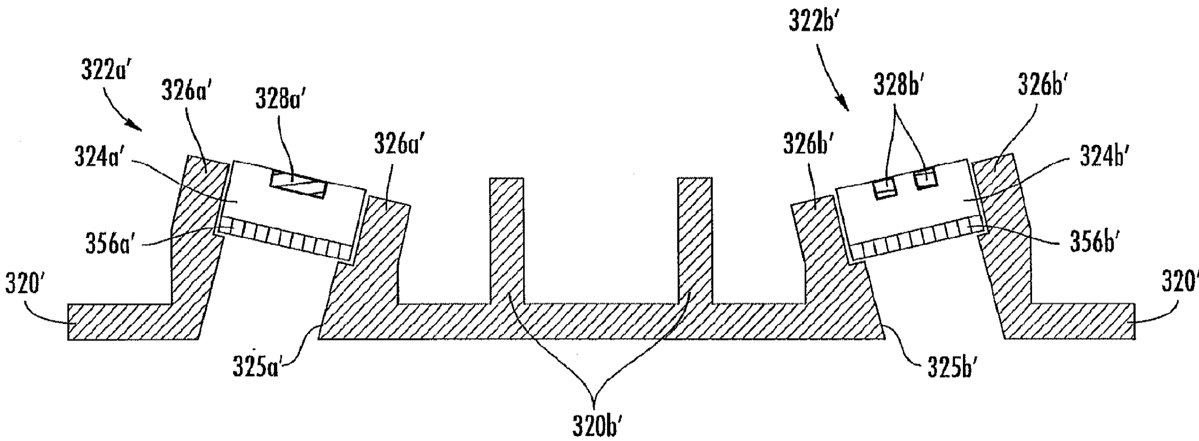
322a'
326a'
328a'
324a'
326a'
356a'
320'
325a'
320b'
322b'
328b'
326b'
326b'
324b'
356b'
320'
325b'

FIG. 18

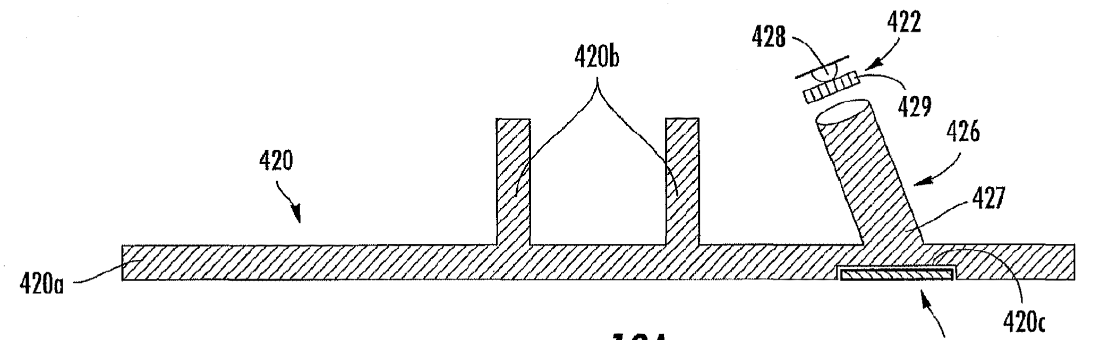

FIG. 19A

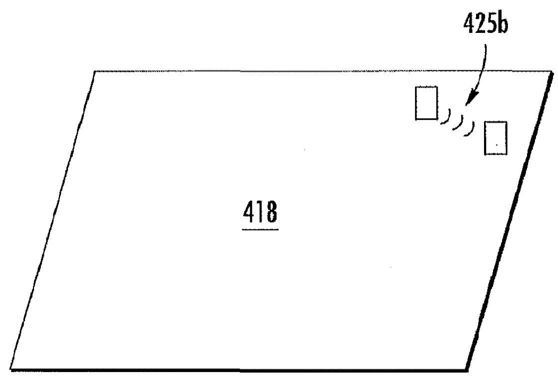

FIG. 19C

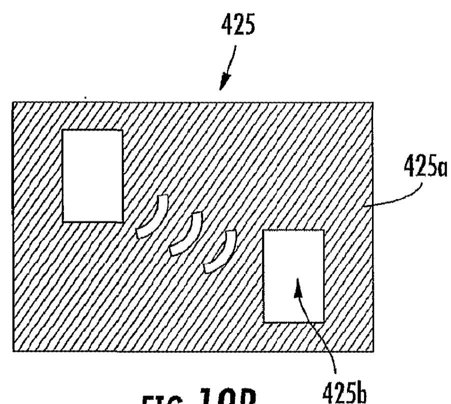

FIG. 19B

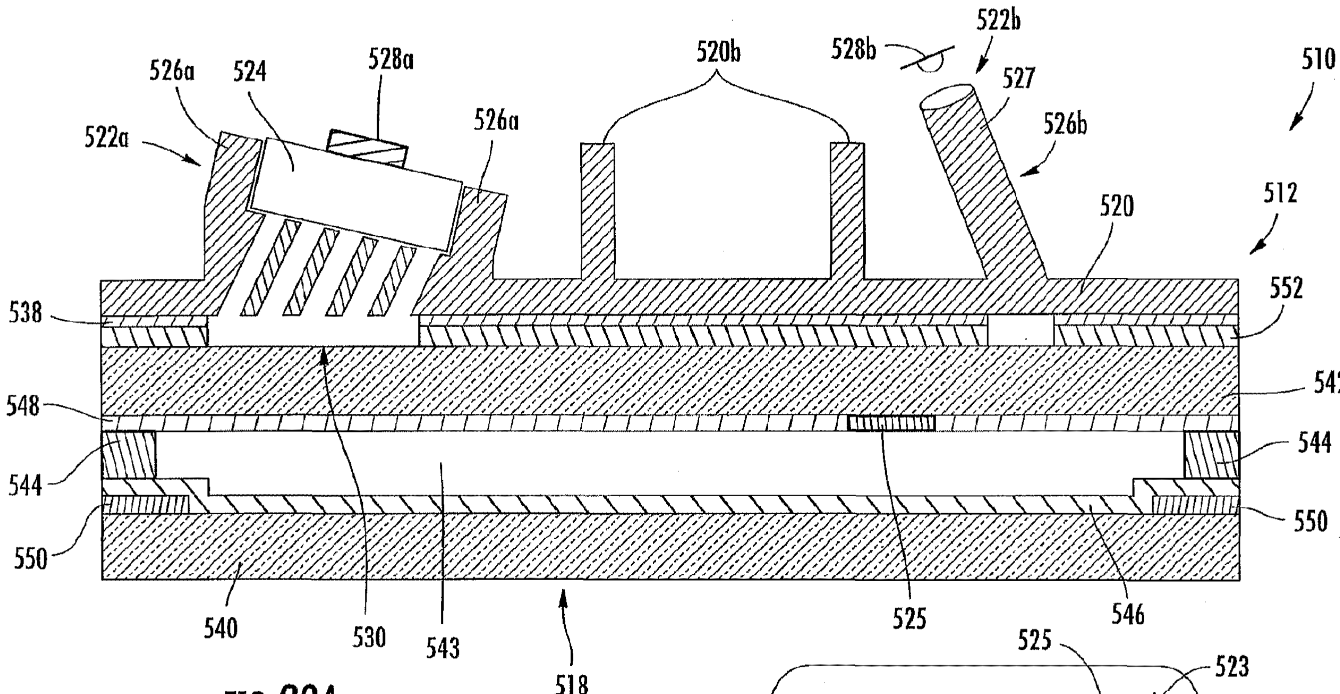

FIG. 20A

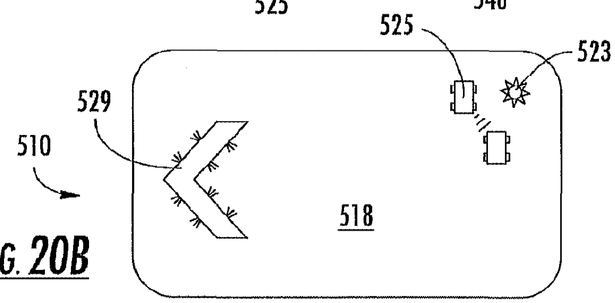

FIG. 20B

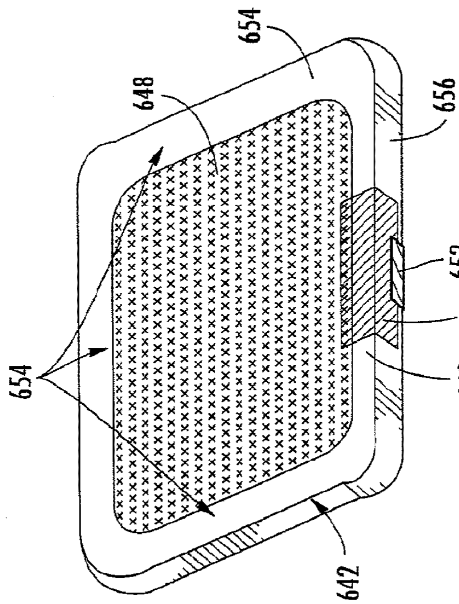

FIG. 21A

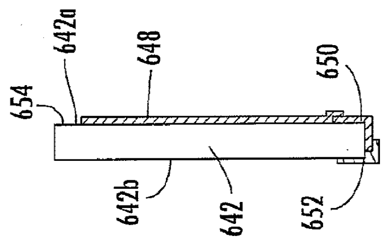

FIG. 21B

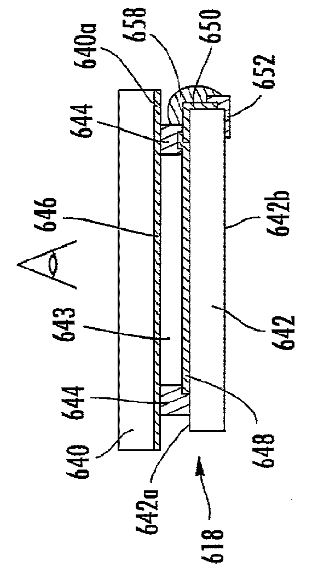

FIG. 22

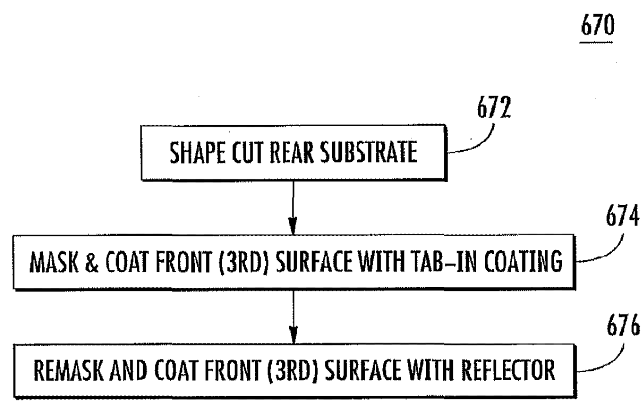
670
672
SHAPE CUT REAR SUBSTRATE
674
MASK & COAT FRONT (3RD) SURFACE WITH TAB-IN COATING
676
REMASK AND COAT FRONT (3RD) SURFACE WITH REFLECTOR

FIG. 23

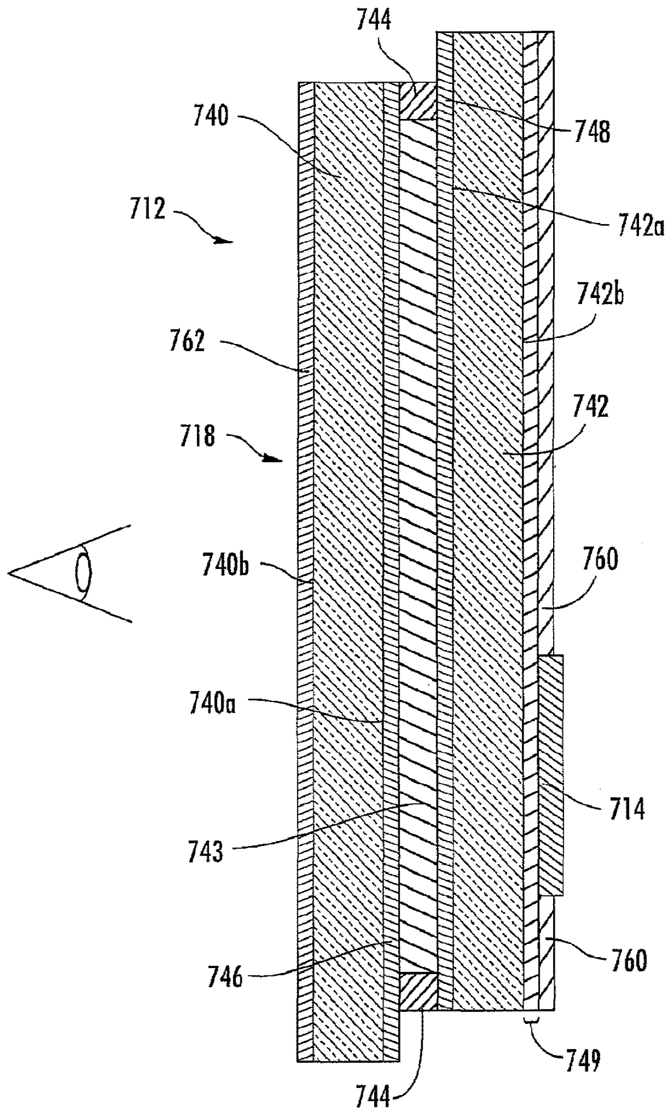
744
740
748
712
742a
742b
762
742
718
740b
760
740a
714
743
746
760
749
744

FIG. 24

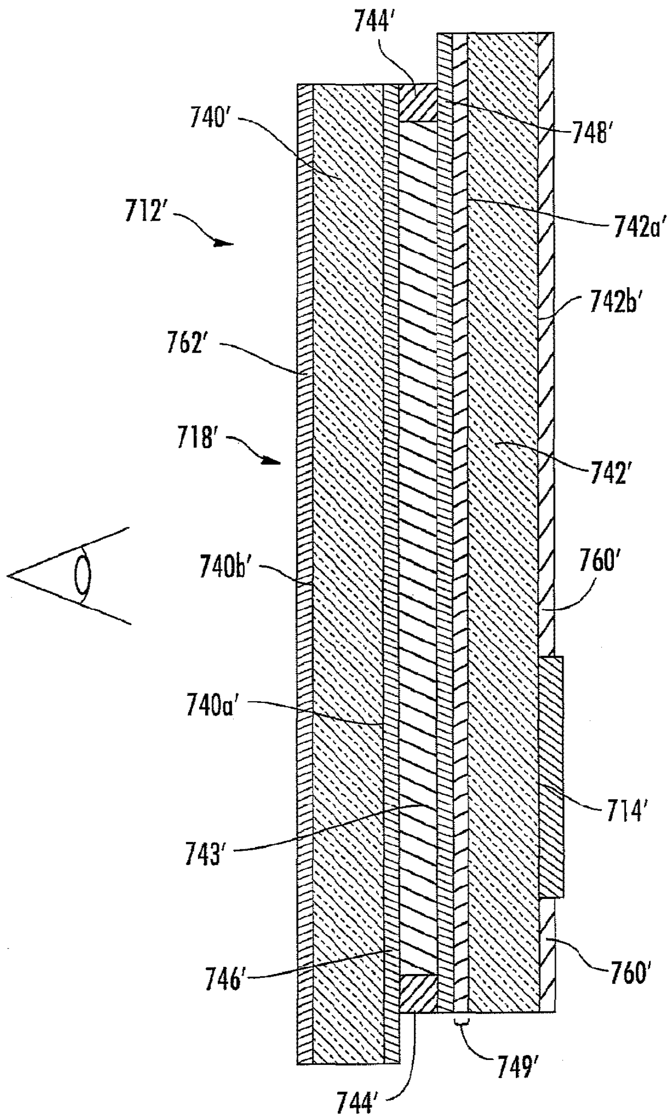
744'
740'
748'
712'
742a'
742b'
762'
718'
742'
740b'
760'
740a'
714'
743'
746'
760'
749'
744'

FIG. 25

Electronic Acknowledgement Receipt

EFS ID:	8189351
Application Number:	12851045
International Application Number:	
Confirmation Number:	1992
Title of Invention:	EXTERIOR SIDEVIEW MIRROR SYSTEM
First Named Inventor/Applicant Name:	Niall R. Lynam
Customer Number:	28101
Filer:	Timothy A. Flory/Amanda Sytsma
Filer Authorized By:	Timothy A. Flory
Attorney Docket Number:	DON09 P-1624
Receipt Date:	10-AUG-2010
Filing Date:	
Time Stamp:	15:29:48
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	TransmittalForm.pdf	79012 3be56612c0587a257f216fec28f310af5c401cb4	no	1

Warnings:

Information:

2	Transmittal Letter	IDSLetter.pdf	50325 6ee2095d466e969277128e4561eaca2730197c8c	no	1
Warnings:					
Information:					
3	Information Disclosure Statement (IDS) Filed (SB/08)	SIDS-DON09-P1624.pdf	1118094 d0d32e2158c2a2fab2df2136af29646a47f0c22d	no	12
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
4	Foreign Reference	DE2409748.pdf	94693 4ccc56c2867255fca959001c4846920b979d64c9	no	4
Warnings:					
Information:					
5	Foreign Reference	DE2550095.pdf	675357 74eab1361e1dee9b88c585a745ef85edc4df6f0a	no	16
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Information:					
		Total Files Size (in bytes):	49251886		

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New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Doc Code: TRAN.LET

Document Description: Transmittal Letter

PTO/SB/21 (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
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TRANSMITTAL FORM		Application Number	12/851,045
		Filing Date	August 5, 2010
		First Named Inventor	Niall R. Lynam
		Art Unit	2872
(to be used for all correspondence after initial filing)		Examiner Name	
Total Number of Pages in This Submission		Attorney Docket Number	DON09 P-1624

ENCLOSURES *(Check all that apply)*

- ☐ Fee Transmittal Form
  - ☐ Fee Attached
- ☐ Amendment/Reply
  - ☐ After Final
  - ☐ Affidavits/declaration(s)
- ☐ Extension of Time Request
- ☐ Express Abandonment Request
- ☑ Information Disclosure Statement
- ☐ Certified Copy of Priority Document(s)
- ☐ Reply to Missing Parts/ Incomplete Application
  - ☐ Reply to Missing Parts under 37 CFR 1.52 or 1.53
- ☐ Drawing(s)
- ☐ Licensing-related Papers
- ☐ Petition
- ☐ Petition to Convert to a Provisional Application
- ☐ Power of Attorney, Revocation Change of Correspondence Address
- ☐ Terminal Disclaimer
- ☐ Request for Refund
- ☐ CD, Number of CD(s) ____________
  - ☐ Landscape Table on CD
- ☐ After Allowance Communication to TC
- ☐ Appeal Communication to Board of Appeals and Interferences
- ☐ Appeal Communication to TC **(Appeal Notice, Brief, Reply Brief)**
- ☐ Proprietary Information
- ☐ Status Letter
- ☐ Other Enclosure(s) (please Identify below):

Remarks

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm Name	VAN DYKE, GARDNER, LINN & BURKHART, LLP		
Signature	Timothy A. Flory		
Printed name	Timothy A. Flory		
Date	August 10, 2010	Reg. No.	42540

CERTIFICATE OF TRANSMISSION/MAILING

I hereby certify that this correspondence is being facsimile transmitted to the USPTO or deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the date shown below:

Signature	Amanda R. Sytsma		
Typed or printed name	Amanda R. Sytsma	Date	August 10, 2010

PATENT
DON09 P-1624

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Group	:	2872
Applicant	:	Niall R. Lynam
Serial No.	:	12/851,045
Filing Date	:	August 5, 2010
For	:	EXTERIOR SIDEVIEW MIRROR SYSTEM

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

INFORMATION DISCLOSURE STATEMENT

In accordance with 37 CFR 1.51, 1.56, 1.97 and 1.98, Applicants submit herewith patents, publications or other information listed on the attached Forms PTO/SB/08A and PTO/SB/08B for consideration by the Examiner in connection with examination of the present application.

This Information Disclosure Statement is not intended to constitute an admission that any patent, publication or other information referred to herein is "prior art" for this invention unless specifically designated as such.

Under 37 CFR 1.97, the filing of this Information Disclosure Statement shall not be construed to mean that a search has been made or that no other material information as defined in 37 CFR 1.56(a) exists.

This Information Disclosure Statement is being filed before Applicants are aware of any mailing date of a first Office Action on the merits.

An early and favorable action on the merits is respectfully requested.

Respectfully submitted,

NIALL R. LYNAM

By: Van Dyke, Gardner, Linn & Burkhart, LLP

Date: August 10, 2010

Timothy A. Flory
Registration No. 42 540
2851 Charlevoix Drive, S.E., Suite 207
P.O. Box 888695
Grand Rapids, Michigan 49588-8695
(616) 975-5500

TAF/ars

UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No.	DON09 P-1624
First Inventor	Niall R. Lynam
Title	EXTERIOR SIDEVIEW MIRROR SYSTEM
Express Mail Label No.	

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

ADDRESS TO: **Commissioner for Patents**
P.O. Box 1450
Alexandria VA 22313-1450

1. ☐ **Fee Transmittal Form** (e.g., PTO/SB/17)
2. ☐ **Applicant claims small entity status.** See 37 CFR 1.27.
3. ☑ **Specification** [*Total Pages* 69]
   Both the claims and abstract must start on a new page
   (For information on the preferred arrangement, see MPEP 608.01(a))
4. ☑ **Drawing(s)** (*35 U.S.C. 113*) [*Total Sheets* 16]
5. **Oath or Declaration** [*Total Sheets* 1]
   a. ☐ Newly executed (original or copy)
   b. ☑ A copy from a prior application (37 CFR 1.63(d))
   (for continuation/divisional with Box 18 completed)
   i. ☐ DELETION OF INVENTOR(S)
   Signed statement attached deleting inventor(s) name in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b).
6. ☑ **Application Data Sheet.** See 37 CFR 1.76
7. ☐ **CD-ROM or CD-R** in duplicate, large table or Computer Program *(Appendix)*
   ☐ Landscape Table on CD
8. **Nucleotide and/or Amino Acid Sequence Submission**
   (if applicable, items a. – c. are required)
   a. ☐ Computer Readable Form (CRF)
   b. Specification Sequence Listing on:
   i. ☐ CD-ROM or CD-R (2 copies); or
   ii. ☐ Paper
   c. ☐ Statements verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

9. ☐ **Assignment Papers** (cover sheet & document(s))
   Name of Assignee____________________
10. ☐ **37 CFR 3.73(b) Statement** *(when there is an assignee)* ☐ **Power of Attorney**
11. ☐ **English Translation Document** *(if applicable)*
12. ☐ **Information Disclosure Statement** (PTO/SB/08 or PTO-1449)
    ☐ Copies of citations attached
13. ☐ **Preliminary Amendment**
14. ☐ **Return Receipt Postcard** (MPEP 503)
    (*Should be specifically itemized)*
15. ☐ **Certified Copy of Priority Document(s)**
    (if foreign priority is claimed)
16. ☐ **Nonpublication Request** under 35 U.S.C. 122(b)(2)(B)(i). Applicant must attach form PTO/SB/35 or equivalent.
17. ☐ Other:____________________

18. If a CONTINUING APPLICATION, *check appropriate box, and supply the requisite information below and in the first sentence of the specification following the title, or in an Application Data Sheet under 37 CFR 1.76:*

☑ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No.: 12/197,666................

Prior application information: *Examiner* Timothy J. Kennedy *Art Unit:* 1791

19. CORRESPONDENCE ADDRESS

☑ The address associated with Customer Number: 28101 **OR** ☐ Correspondence address below

Name					
Address					
City		State		Zip Code	
Country		Telephone		Email	

Signature	/taf/	Date	August 5, 2010
Name (Print/Type)	Timothy A. Flory	Registration No. (Attorney/Agent)	42 540

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Niall R. Lynam

For : EXTERIOR SIDEVIEW MIRROR SYSTEM

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

REQUEST FOR FILING CONTINUATION APPLICATION
UNDER 37 CFR 1.53(b)

This is a request for filing a continuation of U.S. patent application Serial No. 12/197,666, filed August 25, 2008, which is a division of U.S. patent application Serial No. 10/709,434, filed May 5, 2004, now U.S. Patent No. 7,420,756, which claims the benefit of U.S. provisional application, Serial No. 60/471,872, filed May 20, 2003.

1. Copy of Prior Application as Filed Which is Attached

I hereby verify that the attached papers are a copy of what is shown in my records to be the above-identified prior application, including the Declaration as originally filed (37 CFR 1.53). No amendments referred to in any Declaration filed to complete the prior application introduced new matter in that application.

The attached copy of the papers of the parent application includes 37 pages of specification, 31 pages of claims (92 claims), 1 page of Abstract, 16 sheets of drawings, and signed Declaration and Power of Attorney (1 page). The attached drawings are copies of the formal drawings filed in the parent application and correspond to the drawings originally filed with the parent application and as amended and/or approved during prosecution of the parent application.

2. Amendments

The copy of the application includes any amendments made during prosecution of the parent application and includes updates to any references to incorporated patent applications that have issued as patents and includes a revised/updated Cross Reference to Related Applications and new Abstract. The copy of the application includes Figures 9-22 and discussion thereof, which are from U.S. Patent No. 6,717,712, which is incorporated by reference in the present application and its priority applications.

The attached copy includes new claims 1-92, which replace the claims of the parent patent application.

3. Patent Application Bibliographic Data Form

A copy of the Patent Application Bibliographic Data Form is enclosed.

4. Filing Fee and Calculation

Filing Fee:

Basic Fee - $330	$330.00
Each independent claim in excess of three, -4- times $220.00	$880.00
Number of claims in excess of twenty, -72- times $52.00	$3744.00
Filing multiple dependent claims per application $390.00	$.00
Application size fee for each additional 50 sheets that exceeds 100 sheets (-0- times $270.00)	$0.00

Additional Fees:

Search Fee - $540	$540.00
Examination Fee - $220	$220.00
Total Filing Fee	**$5,714.00**

The above fees will be paid by credit card. The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment, to Deposit Account No. 22-0190.

The Commissioner is hereby authorized to charge the following fees during the pendency of this application, or credit any overpayment to Deposit Account 22-0190.

a) Any filing fees under 37 CFR 1.16 for presentation of extra claims for which full payment has not been tendered.

b) Any patent application processing fees under 37 CFR 1.17 for which full payment has not been tendered.

5. Drawings

Sixteen (16) sheets of formal drawings are enclosed and are copies of those filed in the parent application, with the addition of Figures 9-22, which correspond to Figures 1-14 of U.S. Patent No. 6,717,712, which is incorporated by reference in the present application and its priority applications. The formal drawings correspond to the drawings originally filed with the parent application and include any revisions made and approved during prosecution of the parent application.

6. Disclosure Statement

Applicants respectfully request that information cited in the prior parent application, Serial No. 12/197,666, be considered in the present application. An Information Disclosure Statement will be submitted that lists the cited references.

7. Inventorship Statement

With respect to the prior U.S. application from which this application claims benefit under 35 USC 120, the inventor in this application is the same, namely, Niall R. Lynam.

8. Assignment

The prior application was originally assigned to Donnelly Corporation, a corporation of the State of Michigan, located and doing business at 414 East Fortieth Street, Holland, Michigan 49423. That Assignment was recorded in the United States Patent and Trademark Office on August 23, 2004, at Reel 015715, Frame 0476.

9. Power of Attorney

The original Power of Attorney in application Serial No. 10/709,434 is to Van Dyke, Gardner, Linn & Burkhart, LLP and the individual patent attorneys and patent agents at such patent law firm.

Please address all future correspondence to:

Timothy A. Flory
Van Dyke, Gardner, Linn & Burkhart, LLP
2851 Charlevoix Drive, S.E.
P.O. Box 888695
Grand Rapids, MI 49588-8695
Ph: (616) 975-5500
Fax: (616) 975-5505

10. Verification

I hereby declare further that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Respectfully submitted,

NIALL R. LYNAM

By: Van Dyke, Gardner, Linn & Burkhart, LLP

Date: August 5, 2010

Timothy A. Flory
Registration No. 42 540
2851 Charlevoix Drive, S.E.
P.O. Box 888695
Grand Rapids, MI 49588-8695
(616) 975-5500

TAF/ars
DON09 P-1624

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	DON09 P-1624
	Application Number	

Title of Invention	EXTERIOR SIDEVIEW MIRROR SYSTEM

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Secrecy Order 37 CFR 5.2

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Applicant Information:

Applicant 1 [Remove]

Applicant Authority ◉ Inventor ◯ Legal Representative under 35 U.S.C. 117 ◯ Party of Interest under 35 U.S.C. 118

Prefix	**Given Name**	**Middle Name**	**Family Name**	**Suffix**
	Niall	R.	Lynam	

Residence Information (Select One) ◉ US Residency ◯ Non US Residency ◯ Active US Military Service

City	Holland	**State/Province**	MI	**Country of Residence** i	US

Citizenship under 37 CFR 1.41(b) i	US

Mailing Address of Applicant:

Address 1	281 Norwood Avenue		
Address 2			
City	Holland	**State/Province**	MI
Postal Code	49424	**Country**i	US

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. [Add]

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).

☐ **An Address is being provided for the correspondence Information of this application.**

Customer Number	28101	
Email Address	flory@vglb.com	[Add Email] [Remove Email]

Application Information:

Title of the Invention	EXTERIOR SIDEVIEW MIRROR SYSTEM		
Attorney Docket Number	DON09 P-1624	**Small Entity Status Claimed**	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Suggested Class (if any)		**Sub Class (if any)**	
Suggested Technology Center (if any)			
Total Number of Drawing Sheets (if any)	16	**Suggested Figure for Publication (if any)**	

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	DON09 P-1624
	Application Number	
Title of Invention	EXTERIOR SIDEVIEW MIRROR SYSTEM	

Publication Information:

☐	Request Early Publication (Fee required at time of Request 37 CFR 1.219)
☐	**Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S. C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32).
Enter either Customer Number or complete the Representative Name section below. If both sections are completed the Customer Number will be used for the Representative Information during processing.

Please Select One:	◉ Customer Number	○ US Patent Practitioner	○ Limited Recognition (37 CFR 11.9)
Customer Number	28101		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, or 365(c) or indicate National Stage entry from a PCT application. Providing this information in the application data sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78(a)(2) or CFR 1.78(a)(4), and need not otherwise be made part of the specification.

Prior Application Status	Pending		Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
	Continuation of	12197666	2008-08-25

Prior Application Status	Patented				Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
12197666	Division of	10709434	2004-05-05	7420756	2008-09-02

Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
10709434	non provisional of	60471872	2003-05-20

Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button. Add

Foreign Priority Information:

This section allows for the applicant to claim benefit of foreign priority and to identify any prior foreign application for which priority is not claimed. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55(a).

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	DON09 P-1624
	Application Number	
Title of Invention	EXTERIOR SIDEVIEW MIRROR SYSTEM	

Remove

Application Number	Country i	Parent Filing Date (YYYY-MM-DD)	Priority Claimed
			◯ Yes ⦿ No

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button. Add

Assignee Information:

Providing this information in the application data sheet does not substitute for compliance with any requirement of part 3 of Title 37 of the CFR to have an assignment recorded in the Office.

Assignee 1 Remove

If the Assignee is an Organization check here.	☒		
Organization Name	Donnelly Corporation		
Mailing Address Information:			
Address 1	414 E. Fortieth Street		
Address 2			
City	Holland	**State/Province**	MI
Country i	US	Postal Code	49424
Phone Number		Fax Number	
Email Address			

Additional Assignee Data may be generated within this form by selecting the **Add** button. Add

Signature:

A signature of the applicant or representative is required in accordance with 37 CFR 1.33 and 10.18. Please see 37 CFR 1.4(d) for the form of the signature.

Signature	/taf/			Date (YYYY-MM-DD)	2010-08-05
First Name	Timothy	Last Name	Flory	Registration Number	42540

This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

DON01 P-1152

DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor, if only one name is listed below, or an original, first and joint inventor, if plural names are listed below, of the subject matter which is claimed and for which a patent is sought on the invention entitled MIRROR REFLECTIVE ELEMENT, the specification of which was filed on May 5, 2004 as application Serial No. 10/709,434.

I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the United States Patent and Trademark Office (the Office), all information which is known by me to be material to patentability as defined in Title 37, Code of Federal Regulations (C.F.R.), Section 1.56.

CLAIM OF PRIORITY

I hereby claim the benefit under Title 35, United States Code, § 119(e) of any United States provisional application(s) listed below:

U.S. Serial No. 60/471,872, filed on May 20, 2003.

POWER OF ATTORNEY

I hereby appoint the patent law firm of Van Dyke, Gardner, Linn & Burkhart, LLP, 2851 Charlevoix Drive, S.E., Suite 207, Grand Rapids, Michigan 49546, telephone number 616/975-5500, facsimile number 616/975-5505, and the individual patent attorneys and patent agents at such patent law firm, namely, Daniel Van Dyke, Reg. No. 25 046; Donald S. Gardner, Reg. No. 25 975; Terence J. Linn, Reg. No. 30 283; Frederick S. Burkhart, Reg. No. 29 288; Catherine S. Collins, Reg. No. 37 599; Timothy A. Flory, Reg. No. 42 540; and Karl T. Ondersma, Reg. No. 55 894 my attorney(s) or agent(s) with full power of substitution and revocation, to prosecute this application and to transact all business in and to receive all correspondence from the Patent and Trademark Office connected therewith.

All statements made herein of my own knowledge are true and all statements made on information and belief are believed to be true, and further, these statements are made with the knowledge that willful false statements and the like are punishable by fine or imprisonment, or both, under 18 U.S.C. § 1001, and that such willful false statements may jeopardize the validity of this application or any patent issued thereon.

Sole inventor:

Niall Lynam 8/12/04

Niall R. Lynam Date

Citizenship: U.S.A.

Residence: 248 Foxdown
Holland, Michigan 49424
United States of America

Post Office Address: Same as above.

EXTERIOR SIDEVIEW MIRROR SYSTEM

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] The present application is a continuation of U.S. patent application Ser. No. 12/197,666, filed Aug. 25, 2008 (Attorney Docket DON09 P-1462), which is a division of U.S. patent application Ser. No. 10/709,434, filed May 5, 2004, now U.S. Pat. No. 7,420,756, which claims the benefit of U.S. provisional application, Ser. No. 60/471,872, filed May 20, 2003, which are hereby incorporated herein by reference in their entireties.

FIELD OF THE INVENTION

[0002] The present invention relates generally to rearview mirror elements for a rearview mirror assembly of a vehicle and, more particularly, to exterior rearview mirror elements comprising multi-radius reflective elements.

BACKGROUND OF THE INVENTION

[0003] Typically, mirror reflective elements are formed of glass and have a reflective coating deposited thereon, such as via vacuum deposition or wet chemical silvering or the like, such as on a silver line, such as described in U.S. Pat. No. 4,737,188, which is hereby incorporated herein by reference. Polymeric reflective elements are also known, such as are described in U.S. Pat. Nos. 6,601,960; 6,409,354; 4,944,581; 4,385,804; 4,193,668; 4,666,264; and 5,483,386, which are hereby incorporated herein by reference. For such polymeric mirror reflective elements, the need exists for a hard coat or surface on the first or outer or exterior surface of the element which is contacted by the exterior elements, such as rain, road debris, or the like, or contacted, for example, by a person scraping ice or wiping snow or condensation off the mirror element outer surface, such as during winter. A variety of hard coats have been proposed in the art, typically applied by dip coating or vacuum deposition techniques. However, a need exists for an automotive mirror reflective element which has the properties of plastic (i.e., a specific gravity roughly half that of glass), and which has a glass-like exterior surface.

[0004] Also, exterior rearview mirror reflective elements may be aspheric or multi-radius, and may typically have a less curved or substantially flat (around 2000 mm radius or thereabouts) inboard portion or surface at the inboard side of the reflective element (i.e., closer to the side body of the vehicle when the mirror assembly is mounted to the vehicle), and a more curved multi-radius portion or surface at the outboard side of the reflective element (i.e., further from the side body of the vehicle when the mirror assembly is mounted to the vehicle), in order to provide an extended field of view. It is typically desirable to have the reflective elements or substrates of such exterior mirror elements to be formed of a glass material because glass material typically provides an enhanced scratch resistance over conventional optical resins and the like.

[0005] Therefore, there is a need in the art for a mirror reflective element that overcomes the shortcomings of the prior art elements and substrates.

SUMMARY OF THE INVENTION

[0006] The present invention provides a molded wide angle or multi-radius substrate for a reflective element. The molded substrate comprises a polymeric optical resin transparent material and has a curved exterior surface, which may have a less curved/flatter or substantially flat inboard portion or surface and a more curved outboard portion or surface. The molded substrate may have an anti-abrasion film or layer, such as an ultrathin glass film, applied over the exterior surface or first surface to provide substantial protection against scratches occurring to the molded substrate. The inner surface or second surface of the reflective element substrate may have a reflective coating or layer, such as a polymeric reflective film, laminated or adhered or otherwise applied thereto.

[0007] According to an aspect of the present invention, a wide angle reflective element for a mirror assembly for a vehicle includes a wide angle substrate having an exterior surface and a glass film disposed at the exterior surface. The exterior surface of the substrate has a less curved inboard portion or surface and a more curved outboard portion or surface. The substrate comprises a polymeric resin material. The glass film is adapted to substantially conform to the exterior surface of the wide angle substrate. The glass film comprises a glass material and has a thickness of less than approximately 0.8 mm.

[0008] According to another aspect of the present invention, a reflective element for a mirror assembly for a vehicle comprises a substrate having an exterior surface, and an anti-abrasion film applied to the exterior surface. The substrate comprises a polymeric resin material, such as a transparent optical polymeric resin material. The anti-abrasion film preferably comprises a glass material (such as a soda lime glass or a borosilicate or the like) and has a thickness of less than approximately 0.8 mm, and is flexible to conform to the exterior surface.

[0009] The substrate may be cut from a strip or sheet of molded or extruded or cast substrate material (or less preferably, may be cut from an injected molded strip or sheet). The flexible glass film may be unrolled from a reel or roll and applied to the exterior surface of the elongated strip or sheet of substrate material. The substrate, including the glass film or layer, may then be cut or otherwise formed from the elongated strip or sheet.

[0010] The substrate may comprise a wide angle substrate and/or may comprise a multi-radius exterior surface having a less curved inboard portion or surface and a more curved outboard portion or surface.

[0011] A reflective film or layer may be applied to the inner surface or side of the substrate or strip opposite the exterior surface. The reflective film may comprise a polymeric reflective film laminated or otherwise adhered or applied to the inner side of the substrate or strip. The reflective film may comprise an all polymer-thin-film multilayer, high reflective mirror film comprising multiple coextrusion of many plastic layers to form a highly reflective mirror film.

[0012] Optionally, a reflective film or layer may be applied to the exterior surface of the substrate or sheet or strip, and the glass film or layer or sheet may be applied over the reflective film layer. In such an application, the substrate acts as a support or backing plate for the reflective film or layer and the glass film or layer, whereby optical clarity / transparency of the substrate material is not necessary.

[0013] According to another aspect of the present invention, a method for forming a reflective element substrate for a mirror assembly of a vehicle comprises generally continuously forming an elongated strip or sheet of substrate material and applying a substantially transparent functional film, such as an anti-abrasion film or a hydrophilic film or a hydrophobic film or the like, to a surface of the elongated strip sheet. The substrate material may comprise a transparent optical polymeric resin. The functional film is preferably unrolled from a reel or roll of film and applied to the surface of the elongated strip or sheet generally continuously as the strip or sheet is formed or extruded or cast or molded. Preferably, multiple mirror element shapes or mirror element substrates may be cut or otherwise formed from the elongated sheet after the functional film is applied to the surface of the strip or sheet.

[0014] The functional or anti-abrasion film may comprise an ultrathin glass material which is sufficiently flexible to be provided in a reel or roll (or in a sheet that is flexible and conformable to a bent substrate). The substrates may be formed with a wide angle exterior surface or a multi-radius exterior surface. The anti-abrasion film may be sufficiently flexible to conform to the wide angle or multi-radius or curved exterior surface.

[0015] A reflective film, such as a polymeric reflective film or the like, may be applied to the opposite surface of the substrate or sheet or strip. The reflective film may be sufficiently flexible to be provided in a reel or roll form (or in a sheet that is flexible and conformable to a bent substrate) for unrolling the reflective film as the film is generally continuously applied to the surface of the generally continuously formed sheet or strip.

[0016] Therefore, the present invention provides a molded wide angle or multi-radius single substrate for a rearview mirror assembly which has an anti-abrasion or anti-scratch film or layer applied to the curved, wide angle or multi-radius exterior surface of the substrate. The anti-abrasion film preferably comprises an ultrathin glass film or sheet to provide enhanced scratch resistance. The molded substrate may have a reflective film or layer laminated or applied to the inner surface opposite the exterior surface.

[0017] These and other objects, advantages, purposes and features of the present invention will become apparent upon review of the following specification in conjunction with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] FIG. 1 is a perspective view of an exterior rearview mirror assembly in accordance with the present invention;

[0019] FIG. 2 is a perspective view of a wide angle or multi-radius reflective element in accordance with the present invention;

[0020] FIG. 3 is a sectional view of the wide angle or multi-radius reflective element taken along the line III-III in FIG. 2;

[0021] FIG. 4 is a sectional view similar to FIG. 3, showing a wide angle or multi-radius reflective element in accordance with the present invention with a reflective film or layer applied to the exterior surface of the element and an anti-abrasion film or layer applied over the reflective film or layer;

[0022] FIG. 5 is a diagram showing the extruding, coating and cutting processes for manufacturing a prismatic mirror reflective element in accordance with the present invention;

[0023] FIG. 5A is an elevation of the extruder of FIG. 5, showing the wedge shape of the extruded strip and reflective element substrate;

[0024] FIG. 6 is a plan view of the extruded strip showing the cut out shapes of the reflective element cut from the extruded strip;

[0025] FIG. 7 is a sectional view of the reflective element formed by the process shown in FIG. 5;

[0026] FIG. 8 is a diagram showing an alternate process for manufacturing a prismatic mirror reflective element in accordance with the present invention, where a strip of substrate material is cast and formed via a caster and float section;

[0027] FIG. 9 is a perspective view of an automobile equipped with exterior sideview mirror assemblies according to this present invention;

[0028] FIG. 10 is a top plan partial fragmentary view of the driver's side exterior rearview mirror assembly of FIG. 9;

[0029] FIG. 11 is an enlarged sectional view of a plano-multiradius reflective element assembly of the mirror assembly in FIG. 10;

[0030] FIG. 12 is an enlarged sectional view of a demarcation element of the plano-multiradius reflective element assembly of FIG. 11;

[0031] FIGS. 13A-13H illustrate views of various locations for a plano reflective element and an auxiliary reflective element according to this present invention;

[0032] FIG. 14 is a sectional view of a second embodiment of a plano reflective element assembly according to the present invention including a demarcation element formed as a dividing wall in a backing plate element;

[0033] FIG. 14A is a cross-section taken along line XX of FIG. 14;

[0034] FIG. 14B is a cross-sectional view taken along line YY of FIG. 14;

[0035] FIG. 15 is a schematic of a third embodiment of a plano-auxiliary reflective element assembly according to this present invention;

[0036] FIG. 16 is a front elevation view of another embodiment of a plano reflective element assembly according to the present invention;

[0037] FIG. 17 is an exploded perspective view of the plano reflective element assembly of FIG. 16;

[0038] FIG. 18 is an end view of the plano reflective element assembly of FIG. 16 as viewed from line XVIII--XVIII of FIG. 16;

[0039] FIG. 19 is a top view of the plano reflective element assembly of FIG. 16 as viewed from line XIX--XIX of FIG. 16;

[0040] FIG. 20 is a schematic representation of the plano reflective element assembly of FIG. 16 illustrating the orientation of the reflective element;

[0041] FIG. 21 is another schematic representation of the orientation of the reflective elements of the plano reflective element in FIG. 16;

[0042] FIG. 22 is a diagram illustrating the range of viewing of the reflective elements of the plano reflective element assembly of FIG. 16; and

[0043] FIG. 23 is a perspective view of another embodiment of an exterior rearview mirror system of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0044] Referring now to the drawings and the illustrative embodiments depicted therein, an exterior rearview mirror assembly 10 includes a reflective element 12 mounted at a casing 14, which is mounted at an exterior portion of a vehicle 16 (FIG. 1). Reflective element 12 may provide an enhanced field of view or wide angle field of view to a driver or occupant of the vehicle and may comprise a single reflective element substrate 18 having an inner surface 18a and an opposite exterior surface 18b (FIGS. 2 and 3). The exterior surface 18b comprises a less curved or substantially flat inboard portion or surface 18c and a more curved outboard portion or surface 18d, as discussed below. The substrate 18 may have an anti-abrasion coating or layer or film 20, such as an ultrathin glass coating or layer or film, laminated or deposited or otherwise applied to the exterior surface 18b, and may have a reflective coating or layer 22 laminated or applied to the inner surface 18a, as also discussed below. Aspects of the reflective element of the present invention may be suitable for use in a reflective element for an exterior rearview mirror assembly (as shown in FIG. 1) and/or a reflective element for an interior rearview mirror assembly (not shown).

[0045] Reflective element 12 may comprise an aspheric or multi-radius or wide angle single element reflective element substrate. The reflective element 12 may provide a field of view similar to the plano-auxiliary reflective element assembly disclosed in U.S. Pat. Nos. 6,522,451 and 6,717,712, which are hereby incorporated herein by reference.

[0046] As illustrated in FIG. 9 from U.S. Pat. No. 6,717,712, incorporated above, passenger automobile 110 (which may be a sedan, a station-wagon, a sports car, a convertible, a minivan, a sports utility vehicle, a pick-up truck or a similar passenger carrying non-commercial, personal transportation automobile) includes an interior rearview mirror assembly 127 positioned within interior vehicle cabin 125. Interior vehicle cabin 125 further includes a steering wheel 116, a driver seat 129 positioned at steering wheel 116, a front passenger seat 121 adjacent to driver seat 129 in the front portion of cabin 125, and a rear passenger seat 123 in the rear portion of cabin 125. Automobile 110 further includes a driver-side exterior sideview mirror assembly 112 and a passenger-side exterior sideview mirror assembly 114, each adapted for attachment to opposing sides of automobile body 111, most preferably adjacent to the seating position of the driver seated in driver seat 129 for driver-side assembly 112 and adjacent to the front passenger seat 121 for passenger-side assembly 114. Exterior sideview mirrors, mounted as shown in FIG. 9 close to the driver seating location, are commonly referred to as door-mounted exterior sideview mirror assemblies. Driver-side exterior sideview mirror assembly 112 includes, as illustrated in FIG. 10, a plano-multiradius exterior sideview reflective element assembly 130. Plano-multiradius reflective element assembly 130 is mounted to a reflective element positioning actuator 136. The orientation of plano-multiradius reflective element assembly 130, and hence its rearward field of view, is adjustable by actuator 136 in response to control 137. Control 137 can comprise a handset control that allows the driver manually move the orientation of plano-multiradius reflective element assembly 130 within exterior mirror housing 140 (such as by a lever control or by a cable control) and hence reposition the rearward field of view of plano-multiradius reflective element assembly 130. Alternately, when actuator 136 comprises an electrically actuated actuator that is electrically operable incorporating at least one motor, control 137 can comprise a switch (which, preferably, is operable under control of the driver seated in cabin 125) or control 137 can comprise a memory controller, as known in the automotive mirror art, that controls actuator 136 to move the position of plano-multiradius reflective element assembly 130 to a pre-set orientation that suits the rearward field of view preference of an individual driver. Actuator 136 is mounted to bracket 138 which attaches to vehicle body side 111. Plano-multiradius reflective element assembly 130 is positionable by actuator 136 within exterior mirror housing 140.

[0047] Plano-multiradius reflective element assembly 130, as shown in FIG. 11, comprises a plano element 150 and a separate multiradius element 155. Preferably, plano element 150 is adjacent to multiradius element at a joint. At their joint, plano element 150 and separate multiradius element 155 can touch leaving substantially no gap or space therebetween, or plano element 150 and separate multiradius element 155 can be spaced apart at their joint by a space or gap, as in FIG. 11. Plano element 150 and multiradius element 155 are both mounted to surface 159 of, and are both supported by, a single backing plate element 160. Plano element 150 and multiradius element 155 are demarcated apart by demarcation element 165. Surface 161 of backing plate element 160 is preferably adapted to attach, such as by attachment member 164, to actuator 136 when plano-multiradius reflective element assembly 130 is mounted in driver-side exterior sideview mirror assembly 112 (and/or in passenger-side exterior side view mirror assembly 114) such that plano element 150 and multiradius element 155 are adjusted and positioned in tandem and simultaneously when the driver (or alternatively, when a mirror memory system, as is conventional in the rearview mirror arts) activates actuator 136 to reposition the rearward field of view of plano-multiradius reflective element assembly 130. Thus, since elements 150, 155 are part of plano-multiradius reflective element assembly 130, movement of plano-multiradius reflective element assembly 130 by actuator 136 simultaneously and similarly moves plano element 150 and multiradius element 155.

[0048] Plano element 150 preferably comprises a flat reflector-coated glass substrate having unit magnification, and comprises a reflective surface through which the angular height and width of the image of an object is equal to the angular height and width of the object when viewed at the same distance (except for flaws that do not exceed normal manufacturing tolerances). Plano element 150 may comprise a conventional fixed reflectance mirror reflector or it may comprise a variable reflectance mirror reflector whose reflectivity is electrically adjustable. For example, plano element 150 may comprise a flat glass substrate coated with a metallic reflector coating such as a chromium coating, a titanium coating, a rhodium coating, a metal alloy coating, a nickel-alloy coating, a silver coating, an aluminum coating (or any alloy or combination of these metal reflectors). The metal reflector coating of plano element 150 may be a first surface coating (such as on surface 166) or a second surface coating (such as on surface 167), as such terms are known in the mirror art. The reflector coating on plano element 150 may also comprise a dielectric coating, or a multilayer of dielectric coatings, or a combination of a metal layer and a dielectric layer to form automotive mirror reflectors as known in the automotive mirror art. If a variable reflectance reflector element, plano element 150 preferably comprises an electro-optic reflector element and, most preferably, an electrochromic reflector element.

[0049] When mounted into exterior side view mirror assembly 112 and/or 114, plano-multiradius reflective element assembly 130 is preferably orientated so that at least a portion of (more preferably a substantial portion of) the reflector surface of plano element 150 is positioned closer to the vehicle body (and hence to the driver) than any portion of the reflector surface of multiradius element 155. Thus, and referring to FIG. 11, side A of plano element 150 of plano-multiradius reflective element assembly 130 is positioned closer to the driver than side D of multiradius element 155 when plano-multiradius reflective element assembly 130 is mounted on an automobile. Also, when mounted into exterior side view mirror assembly 112 and/or 114, surfaces 166, 168 of plano-multiradius reflective element assembly 130 face rearwardly in terms of the direction of vehicle travel.

[0050] Multiradius element 155 of plano-multiradius reflective element assembly 130 preferably comprises a curved/bent mirrored glass substrate. The degree of curvature preferably increases (and hence the local radius of curvature decreases) across the surface of multiradius element 155 with the least curvature (largest radius of curvature) occurring at the side of multiradius element 155 (side C in FIG. 11) positioned adjacent its joint to plano element 150 when both are mounted on backing plate element 160. Thus, and referring to FIG. 11, the local radius of curvature at side C of multiradius element 155, when mounted on backing plate element 160, is larger than at side D. Also, the local radius of curvature preferably progressively decreases across multiradius element 155 from side C to side D. Preferably, the local radius of curvature at side C of multiradius element 155 is at least about 1000 mm; more preferably is at least about 2000 mm and most preferably is at least about 3000 mm whereas the local radius of curvature at side D of multiradius element 155 is, preferably, less than about 750 mm, more preferably less than about 350 mm; most preferably less than about 150 mm. Preferably, multiradius element 155 comprises a bent glass substrate with radii of curvature in the range of from about 4000 mm to about 50 mm. The multiradius prescription for the multiradius element to be used in a particular exterior mirror assembly can vary according to the specific field of view needs on a specific automobile model.

[0051] The total field of view rearwardly of the automobile of the plano-auxiliary reflective element assembly (which is a combination of the field of view of the plano reflective element and of the auxiliary reflective element) preferably generally subtends an angle of at least about 20 degrees (and more preferably, generally subtends an angle of at least about 25 degrees and most preferably, generally subtends an angle of at least about 30 degrees) with respect to the side of an automobile to which is attached an exterior sideview mirror assembly equipped with the plano-auxiliary reflective element assembly.

[0052] Multiradius element 155 may comprise a conventional fixed reflectance mirror reflector or it may comprise a variable reflectance mirror reflector whose reflectivity is electrically adjustable. For example, multiradius element 155 may comprise a flat glass substrate coated with a metallic reflector coating such as a chromium coating, a titanium coating, a rhodium coating, a metal alloy coating, a nickel-alloy coating, a silver coating, an aluminum coating (or any alloy or combination of these metal reflectors). The metal reflector coating of multiradius element 155 may be a first surface coating (such as on surface 168) or a second surface coating (such as on surface 169), as such terms are known in the mirror art. The reflector coating on multiradius element 155 may also comprise a dielectric coating, or a multilayer of dielectric coatings, or a combination of a metal layer and a dielectric layer to form automotive mirror reflectors as known in the automotive mirror art. If a variable reflectance reflector element, multiradius element 155 preferably comprises an electro-optic reflector element and, most preferably, an electrochromic reflector element.

[0053] Also, it is preferable that the thickness of plano element 150 and multiradius element 155 be substantially the same in dimension so that their respective outer surfaces, 166 and 168, are substantially coplanar so that a driver can readily view images in either or both elements. The thickness dimension of elements 150, 155 is determined by the thickness of the substrate (or in the case of laminate-type electrochromic reflective elements, the thickness of the two substrates between which the electrochromic medium is disposed). For example, plano element 150 and/or multiradius element 155 can comprise a reflector coated glass substrate or panel of thickness preferably equal to or less than about 2.3 mm, more preferably equal to or less than about 1.6 mm, most preferably equal to or less than about 1.1 mm. Use of a thinner substrate is beneficial in terms of improving the overall stability/vibration performance of the image seen in plano-multiradius reflective element assembly 130 when mounted to an automobile.

[0054] The reflector area of plano element 150 is preferably larger than that of multiradius element 155. Preferably, the width dimension of plano element 150 is larger than the width dimension of multiradius element 155 (both width dimensions measured at their respective widest dimension and with the width of the respective element being gauged with the respective element oriented as it would be orientated when mounted on the automobile). Thus, and referring to FIG. 11, the distance from side A to side B of plano element 150 is larger than the distance from side C to side D of multiradius element 155. Thus, the ratio of the width of plano element 150 to the width of multiradius element 155 is preferably greater than 1; more preferably greater than 1.5; most preferably greater than 2.5 in order to provide a large, unit magnification plano element 150 as the principal rear viewing portion of plano-multiradius reflective element assembly 130 and providing multiradius element 155 as a smaller, auxiliary, separate, wide-angle viewing portion of plano-multiradius reflective element assembly 130. For plano-multiradius reflective element assemblies to be mounted to the exterior sideview assemblies of passenger automobiles used non-commercially and for non-towing purpose, the width of plano element 150 (at its widest dimension) is preferably in the range of from about 50 mm to about 225 mm; more preferably in the range of from about 75 mm to about 175 mm; most preferably in the range of from about 100 mm to about 150 mm.

[0055] Backing plate element 160 is preferably a rigid polymeric substrate capable of supporting plano element 50 and multiradius element 155. Backing plate element 160 comprises a flat portion (generally between E and F as shown in FIG. 11) that corresponds to and is aligned with plano element 150. Backing plate element 60 also comprises a curved portion (generally between G and H as shown in FIG. 11) that corresponds to and is aligned with multiradius element 155. Preferably, curved portion G-H of multiradius element 155 is fabricated with a multiradius prescription that is substantially the same as the multiradius prescription of multiradius element 155. Backing plate element 160 is formed as a single element to which elements 150 and 155 are separately attached. Preferably, backing plate element 160 is formed by injection molding of a thermoplastic or a thermosetting polymer resin. Materials suitable to use for backing plate element 160 include unfilled or filled polymeric materials such as glass and/or mineral filled nylon or glass and/or mineral filled polypropylene, ABS, polyurethane and similar polymeric materials. For example, backing plate element 160 can be formed of ABS in an injection molding operation. Plano element 150 can be cut from a stock lite of flat chromium mirror-coated 1.6 mm thick glass. Multiradius element 155 can be cut from a stock lite of multiradiusly-bent chromium mirror-coated 1.6 mm thick glass. Plano element 150 and multiradius element 155 can then be attached (such as by an adhesive attachment such as an adhesive pad or by mechanical attachment such by clips, fasteners or the like) to the already molded backing plate element 160. Alternatively, plano element 150 and multiradius element 155 can each by individually loaded into an injection molding tool. Once loaded, a polymeric resin (or the monomers to form a polymeric resin) can be injected into the mold in order to integrally form backing plate element 160 with elements 150, 155 integrally molded thereto. Integral molding of the backing plate element to plano element 150 and multiradius element 155 (along with any other elements such as the demarcation element 165) in a single integral molding operation, is a preferred fabrication process for plano-multiradius reflective element assembly 130.

[0056] Plano-multiradius reflective element assembly 130 further preferably includes demarcation element 165 that functions to delineate and demarcate the plano region of the assembly from the wide-angle, multiradius region and also preferably functions to prevent ingress of debris, dirt, water and similar contaminants (such as road splash, car wash spray, rain, snow, ice, leaves, bugs and similar items that plano-multiradius reflective element assembly 130 would be subject to when mounted and used on an automobile) into any gap between plano element 150 and multiradius element 155 when both are attached to backing plate element 160. Optionally, at least a portion of demarcation element 165 can be disposed in any gap between plano element 150 and multiradius element 155 at their joint on backing plate element 160. Preferably, demarcation element 165 is formed of a polymeric material that is dark colored (such as black or dark blue or dark brown or dark grey or a similar dark color) such as a dark colored polypropylene resin or a dark colored nylon resin or a dark colored polyurethane resin or a dark colored polyvinyl chloride resin or a dark colored silicone material. Most preferably demarcation element 165 is formed of an at least partially elastomeric material (such as silicone, or EPDM, or plasticized PVC or the like) in order to provide a degree of vibration dampening for elements 150, 155. As shown in FIG. 12, demarcation element 165 optionally includes a crown portion 170 that includes wing portions 173, 173' and a stem portion 171. Stem portion 171 preferably has a cross-sectional width CCC of less than about 4 mm, more preferably less than about 3 mm and, most preferably less than about 2 mm. Crown portion 170 preferably is dimensioned to not protrude substantially beyond surfaces 166, 168 of elements 150, 155 when demarcation element 165 is installed between elements 150 and 155. Also, wings 173, 173' are preferably dimensioned to protrude (most preferably slightly) onto surfaces 166, 168 of elements 150, 155 when demarcation element 165 is installed between elements 150 and 155 in order to provide a weather barrier seal and/or to at least partially accommodate any dimensional tolerances of elements 150, 155 that could lead to variation in the inter-element gap between sides C and B. While the demarcation element shown in FIG. 12 is one embodiment, other constructions are possible including a demarcation element that has minimal or no crown portion. Likewise, a demarcation element can have little or no stem portion, especially when the joint between plano element 150 and multiradius element 155 includes no gap to receive a stem. Also, where a gap at the plano to multiradius joint exists, any stem of the demarcation element can at least partially be disposed in such gap so as to at least partially fill the gap (or it can optionally substantially fill the gap). Optionally, demarcation element 165 is fabricated by injection molding of a polymeric resin. After plano element 150 and multiradius element 155 have been attached to backing plate element 160, a separately formed demarcation element 165 can then be inserted (and secured such as by an adhesive or by a mechanical attachment such as by a fastener) into a space between elements 150 and 155. Note that, optionally, side B of plano element 150 and side C of multiradius element 155 can touch (leaving substantially no gap or space therebetween). In such a situation, demarcation element 165 can comprise a dark colored strip such as of a tape or of a plastic film that covers the joint between elements 150 and 155. Alternatively, demarcation element 165 can comprise a preferably dark-colored paint, lacquer, caulk or similar material that can be applied to, and that can preferably fill into, the joint between elements 150 and 155. The width of the portion of demarcation element 165 that is visible to the driver is preferably less than about 4 mm, more preferably less than about 3 mm and most preferably less than about 2 mm, but is equal to or greater than about 0.5 mm, more preferably is equal to or greater than about 0.75 mm, most preferably is equal to or greater than about 1 mm in order to provide adequate demarcation of the plano region from the multiradius radius region without unduly obscuring the rearward field of view of the respective elements. Optionally, demarcation element 165 can be formed as part of backing plate element 160 such as by forming demarcation element 165 as a wall structure of the backing plate element that partitions backing plate element 160 into two regions: A first region adapted to receive plano reflective element 150 and a separate and adjacent second region adapted to receive multiradius reflective element 155.

[0057] Thus, and referring to FIG. 14, a second embodiment of plano-multiradius reflective element assembly 130' may include a backing plate element 160' which comprises a plate molded from a polymer resin (such as a polyolefin such as polypropylene or such as ABS or nylon) with a demarcation element 165' that is molded as a wall structure that partitions backing plate element 165' into a first region (from CC to BB) adapted to receive and accommodate plano reflective element 150' and into a second region (from BB to AA) adapted to receive and accommodate wide-angle optic multiradius reflective element 155'. Note that section AA to BB of backing plate element 160' is angled to section BB to CC. Such angling of the auxiliary reflective element relative to the plano element can be advantageous in allowing the auxiliary reflective element view a portion of the road adjacent the automobile that is in a blind spot of the plano reflective element. In this regard, it is preferable that the multiradius element be angled away from the plane of the plano element, as shown in FIG. 14 by the angling of section AA to BB to section BB to CC.

[0058] Preferably, demarcation element 165 is formed in an integral molding operation, along with formation of backing plate element 160, and attachment of elements 150, 155 thereto. For example, plano element 150 and multiradius element 155 can each by individually loaded into an injection molding tool. Once loaded, a polymeric resin (or the monomers to form a polymeric resin) can be injected into the mold in order to integrally form backing plate element 160 with elements 150, 155 integrally molded thereto and, in the same molding operation and in the same tool, also form by molding the demarcation element. Integral molding of the backing plate element to plano element 150 and multiradius element 155 along with creation in the single molding operation of demarcation element 165 (along with any other elements such as attachment member 164) in a single integral molding operation, is a preferred fabrication process for plano-multiradius reflective element assembly 130. By loading all the sub components of plano-multiradius reflective element assembly 130 into a molding tool, and then injecting polymeric resin to form the backing plate, demarcation member and any attachment member, a substantially complete or fully complete plano-multiradius reflective element assembly can be unloaded from the tool at the completion of the integral molding operation (as known in the molding art), thus enabling economy in manufacturing and accommodation of any dimensional tolerances in the sub components. Where integral molding is so used, it is preferable to use a reactive molding operation such as reactive injection molding of a urethane as such reactive injection molding operations occur at relatively modest temperatures.

[0059] Plano element 150 and/or multiradius element 155 can comprise a heater element, as known in the automotive mirror art, that is operable to deice/demist surfaces 166, 168. Such heater elements are conventional and can comprise a positive temperature coefficient heater pad, a resistive heater element and/or a conductive coating. Plano element 150 and/or multiradius element 155 can also optionally comprise a scatterproofing member, as known in the automotive mirror art, such as an adhesive tape, to enhance safety in an accident.

[0060] Also, plano element 150 and/or multiradius element 155 can comprise a variable reflectance electro-optic element such as an electrochromic mirror reflector. Thus, both element 150 and element 155 can comprise an electrochromic mirror element or either of element 150 and element 155 can comprise an electrochromic mirror element and the other can comprise a fixed reflectance non-variable reflectance mirror element such as a metal reflector coated glass panel such as a chromium coated glass substrate. Also, if both plano element 150 and multiradius element 155 comprise an electro-optic element such as an electrochromic mirror element capable of electrically dimmable reflectivity, both elements 150, 155 can dim together and in tandem under control of a common dimming control signal (typically provided by an electro-optic automatic dimming interior mirror assembly mounted in the cabin of the automobile and equipped with photosensors to detect incident glare and ambient light). Alternately, if both plano element 150 and multiradius element 155 comprise an electrooptic element such as an electrochromic mirror element capable of electrically dimmable reflectivity, element 150 can dim independently of element 155 (such as is disclosed in U.S. Pat. No. 5,550,677, the entire disclosure of which is incorporated by reference in U.S. Pat. No. 6,717,712, incorporated herein above). If either or both of elements 150, 155 comprise an electrochromic element, preferably, the electrochromic reflective element comprises a front substrate and a rear substrate with an electrochromic medium disposed between, such as a solid polymer matrix electrochromic medium such as is disclosed in U.S. patent application Ser. No. 09/350,930, filed Jul. 12, 1999, entitled "ELECTROCHROMIC POLYMERIC SOLID FILMS, MANUFACTURING ELECTROCHROMIC DEVICES USING SUCH FILMS, AND PROCESSES FOR MAKING SUCH SOLID FILMS AND DEVICES" to Desaraju V. Varaprasad et al., now U.S. Pat. No. 6,154,306, or such as is disclosed in U.S. Pat. Nos. 5,668,663; 5,724,187; 5,910,854; and 5,239,405, the entire disclosures of which are incorporated by reference in U.S. Pat. No. 6,717,712, incorporated herein above. Most preferably, in such laminate-type electrochromic mirror reflective elements, the front substrate comprises a glass plate of thickness less than about 1.6 mm, most preferably about 1.1 mm thickness or lower, and the rear substrate comprises a glass plate of thickness equal to or greater than about 1.6 mm, more preferably greater than about 1.8 mm thickness, most preferably equal to or greater than about 2.0 mm thickness. The rearmost surface of the rear substrate (the fourth surface as known in the mirror art) is reflector coated with a high reflecting metal film such as of aluminum or silver, or an alloy of aluminum or silver. Most preferably, the front-most surface of the rear substrate (the third surface as known in the mirror art) is reflector coated with a high reflecting metal film such as of aluminum or silver, or an alloy of aluminum or silver.

[0061] Backing plate element 165 of plano-multiradius reflective element assembly 130 is optionally equipped on its rearmost surface with attachment member 164 to facilitate attachment to the reflector-positioning actuator of the exterior sideview mirror assembly that plano-multiradius reflective element assembly 130 is mounted to. Attachment of plano-multiradius reflective element assembly 130 to the actuator can be by mechanical attachment such as by a tab, clip or fastener, or may be by adhesive attachment such as by a silicone adhesive, a urethane adhesive or a similar adhesive material such as a tape coated on both surfaces with a pressure sensitive adhesive to form a "double-sticky" tape. The exterior sideview mirror assembly, on whose mirror reflector-positioning actuator the plano-multiradius reflective element assembly is mounted, can be a fixedly attached exterior sideview mirror assembly, a break-away exterior sideview mirror assembly and a powerfold exterior sideview mirror assembly, as known in the automotive mirror art.

[0062] FIGS. 13A-13H shows various arrangements of multiradius reflective element 155 relative to its adjacent plano reflective element 150 (with demarcation element 165 disposed at their joint). In FIGS. 13A, 13B, 13C, 13E and 13F, plano element 150 is mounted wholly inboard of multiradius element 155. Thus, in FIGS. 13A, 13B, 13C, 13E and 13F, plano element 150 would be disposed closer to the vehicle body (and hence to the driver) than multiradius element 155 when plano-multiradius reflective element assembly 130 was mounted in an exterior sideview mirror attached to a side of an automobile. Therefore, in FIGS. 13A, 13B, 13C, 13E and 13F, plano element 150 would be mounted inboard relative to the side of the automobile and multiradius element 155 would be mounted outboard relative to the side of the automobile. In general, the location of the multiradius reflective element in the outboard, upper portion of the plano-multiradius reflective element assembly, as in FIGS. 13B and 13E, is preferred as this allows the plano portion provide a desired rearward field of view along the side of the vehicle. The configuration as shown in FIG. 13G (where the multiradius reflective element is along the inboard side of the assembly) is also desirable as this allows the driver view the side of the vehicle (something many drivers desire in order to have a frame of reference for their rearward field of view) while facilitating having a wide field of view for the plano portion.

[0063] Unlike trucks, busses and commercial vehicles the size of an exterior sideview mirror assembly suitable for use on an automobile (and especially when the automobile is not towing a trailer or the like) is restricted. Automobiles generally are non-commercial vehicles intended for personal transportation. Automobiles typically carry 5 passengers or less, although minivans and large sports utility vehicles (which are classified herein as automobiles) can have seat accommodation for up to 10 passengers (although accommodation for 7 passengers or less is more common). The tandem mounting of a plano element of unit magnification and a separate auxiliary element onto a common, single backing plate element, and the mounting of this backing plate element onto an actuator of an exterior sideview mirror assembly so that a driver can simultaneously and similarly move the auxiliary element and the plano element so as to position their respective rearward fields of view, and to achieve this within the relatively restricted space available in a standard automobile-sized exterior sideview mirror assembly is an important element of this present invention. By utilizing a plano element of unit magnification in the plano-multiradius reflective element assembly, and by sizing the reflector area of the plano element larger than the reflector area of the multiradius element and, preferably, by sizing the reflector area of the plano element at a sufficiently large size that the rearward field of view provided by the plano element alone meets and satisfies the minimum field of view requirement mandated by an automaker specification and/or a government regulation, the need to provide a safety warning indicia such as "OBJECTS IN MIRROR ARE CLOSER THAN THEY APPEAR" in the plano element and/or in the multiradius element can be obviated. Preferably, the plano element comprises a reflector surface area of a size sufficient, when mounted as part of a plano-multiradius reflective element assembly in a driver-side exterior sideview mirror assembly on an automobile, to provide the driver of the automobile a view of a level road surface extending to the horizon from a line, perpendicular to a longitudinal plane tangent to the driver's side of the automobile at the widest point, extending 8 feet out from the tangent plane 35 feet behind the driver's eyes (at a nominal location appropriate for any 95th percentile male driver or at the driver's eye reference points established in Federal Motor Vehicle Standard No. 104), with the driver seated in the driver's seat and with the driver's seat in the rearmost position. Also, preferably, the aspect ratio of the plano-multiradius reflective element assembly (defined as the ratio of its largest vertical dimension to its largest horizontal dimension, measured with the plano-multiradius reflective element assembly oriented as it would be oriented when mounted in an exterior sideview mirror assembly on an automobile, and with "horizontal" being generally parallel with the road surface the automobile travels on and "vertical" being generally perpendicular to the road surface the automobile travels on) is preferably less than 1, more preferably less than 0.8, most preferably less than 0.6. Further, it is preferable that the multiradius element be disposed outboard (relative to the side of the vehicle and with the plano-multiradius reflective element assembly oriented as it would be when mounted in an exterior sideview mirror assembly on an automobile) on the plano-multiradius reflective element assembly so that the multiradius element is positioned to provide an auxiliary, wide-angle view of a "blind-spot" region in an adjacent sidelane while the more inboard-disposed plano element with unit magnification provides the principal sideview image to the driver.

[0064] Also, it is preferable that the principal axis of the rearward field of view of the multiradius element be different from and angled to the principal axis of the rearward field of view of the plano element when both are attached to the backing plate element of the plano-multiradius reflective element assembly and when the plano-multiradius reflective element assembly is mounted and operated in an exterior sideview mirror assembly on an automobile. Preferably, the principal axis of the rearward field of view of the plano element is directed generally parallel to the road that the automobile equipped with the plano-multiradius reflective element assembly is travelling on (i.e. generally parallel to the longitudinal axis of the automobile) so as to provide the driver with a long-distance view of approaching vehicles in the side lane that the plano element views). However, preferably the principal axis of the rearward field of view of the multiradius element of, for example, a door-mounted driver-side (or passenger-side) exterior sideview mirror assembly in which the plano-multiradius reflective element assembly is mounted is directed generally downwardly towards the road surface adjacent to the driver seating location and/or several feet (such as about 1 foot to about 24 feet; more preferably, about 1 foot to about 12 feet; most preferably about 1 foot to about 8 feet in distance) to its rear (in order to capture a field of view of a rear approaching vehicle that is approaching to overtake, or is about to overtake, or is overtaking the automobile equipped with the plano-multiradius reflective element assembly). Thus, preferably, the principal axis of the rearward field of view of the multiradius element is angled and directed generally downwardly with respect to the longitudinal axis of the automobile and thus is at an angle to the principal axis of the rearward field of view of the plano element. For example, multiradius element 155' when attached to surface 173" of backing plate 160' (see FIG. 14B) would have its principal axis of rearward view as indicated by 180' as in FIG. 14B, and as such would be canted towards the road surface when mounted in an exterior sideview mirror assembly attached to the side of an automobile. By contrast, plano element 150' when attached to surface 174' of backing plate 160' (see FIG. 14A) would have a principal axis as indicated by 185' as in FIG. 14A and, as such, would be generally parallel to the road surface when mounted in an exterior sideview mirror assembly attached to the side of an automobile. Having the multiradius element canted somewhat downwards towards the road surface assists visual detection by the driver of overtaking vehicles in the traditional "blind-spot" in the adjacent side lane. The angle that the multiradius element is angled on the backing plate element of the plano-multiradius reflective element assembly relative to the plane of the plano reflective element will vary from automobile model to model, but generally is preferred to be in the about 1 degree to about 10 degrees range; about 2 degrees to about 8 degrees range more preferred; and about 3 degrees to about 6 degrees range most preferred. In order to conveniently achieve an angling of the multiradius portion with respect to the plano portion (and preferably a downward angling), the portion of the backing plate element that the multiradius reflective element is attached to can be angled relative to the adjacent portion of the backing plate element that the plano reflective portion is attached to. Thus, and referring to FIG. 14, plano-multiradius reflective element assembly 130' includes a molded polymeric backing plate element 160' comprising a generally flat portion 162' (between BB and CC in FIG. 14) and an adjacent curved portion 161' (between AA and BB). As indicated by 190' and 195', portion AA to BB of backing plate element 160' is generally angled to portion BB to CC of backing plate 160'. Preferably, the portion of backing plate element 160' to which the auxiliary reflective element attaches is angled towards the front (compared to the angling of plano reflective element) of an automobile equipped with the plano-auxiliary reflective element assembly of the present invention. FIG. 14 is a view of plano-multiradius reflective element assembly 130' as it would appear from above the vehicle as it would be orientated in use (with portion 162' closer to the driver than portion 161'). The wall section, section XX in FIG. 14, taken through section 162' of backing plate element 160' is of substantially constant dimension (as illustrated in FIG. 14A) whereas the wall section, section YY in FIG. 14B, taken through section 161' of backing plate element 160' is of varying dimension and is angled. Plano reflective element 150' and multiradius reflective element 155' (for example, plano element 150' can comprise an electrochromic mirror element and multiradius element 155' can comprise a chrome coated glass reflector) are attached to portions 162' and 161', respectively. By being supported on the angled face 173" (see FIG. 14B) of portion 161', the principal viewing axis of multiradius reflector element 155' is angled downwards towards the road surface, as compared to the more horizontal-viewing principal viewing axis of plano element 150', when plano-multiradius reflective element 130' is mounted in an exterior sideview mirror assembly on an automobile. Demarcation element 165' is preferably molded in the same molding tool as is used to mold backing plate element 160', and so demarcation element 165' is formed as an integral part of backing plate element 160', forming a wall thereof that partitions the surface of backing plate element 160' into a region for receiving the plano reflective element 150' and a region for receiving the auxiliary reflective element 155'. Also, end-caps 170' and 171' are optionally provided. Plano reflective element 150' can attach into the cavity formed between demarcation element 165' and end-cap 171'; multiradius reflective element 155' can attach into the cavity formed between demarcation element 165' and end-cap 170'. Note that the portion of the backing plate element where the wide-angle optic multiradius element attaches can have a thicker wall thickness than that of the portion of the backing plate element where the unit magnification optic element attaches in order to allow for the angling of the multiradius element downwardly relative to the angle of the plano element, as illustrated in FIGS. 14A-B. As illustrated in FIGS. 14A-B, the angle downwards to the longitudinal axis of the vehicle of the multiradius element can generally be set by an angling of a surface of the backing plate element in order to ensure that the principal axis of the rearward field of view of the plano element is directed generally parallel to the longitudinal axis of an automobile equipped with the plano-multiradius reflective element assembly and that the principal axis of the rearward field of view of the multiradius element is directed generally at an angle downwards to the longitudinal axis of the automobile.

[0065] Note that the provision of the plano-multiradius reflective element assembly of this invention as a unitary module has manufacturing advantages, particularly for exterior sideview mirror assembly manufacturers who can procure a plano-multiradius reflective element assembly module from a mirror reflector supplier and then mount the plano-multiradius reflective element assembly module onto an actuator.

[0066] Referring to FIG. 15, a third embodiment 230 of a plano-multiradius reflective element assembly is illustrated. Plano-multiradius reflective element assembly 230 includes a plano reflective element 250 and a separate multiradius reflective element assembly 255, both individually attached to a backing plate element, and with demarcation element 265 disposed at their joint. Plano-multiradius reflective element assembly 230 is about 8.5 inches wide and about 4.25 inches tall (aspect ratio of 0.5), at their largest dimension. Shown as the shaded triangle 240 in plano reflective element 250 is the image of a triangular target object set about 35 feet rearward and of width about 8 feet and of height of about 4.1 feet as would be seen were plano-multiradius reflective element assembly 230 mounted in a driver-side exterior sideview mirror assembly in an automobile such as a sports utility vehicle. In general, it is desirable that the plano reflective element be dimensioned and configured so as to have its rearward field of view capture an image (that is visible, by reflection in the plano reflective element, to a driver seated in the driver's seat in an automobile to which is attached an exterior sideview mirror assembly equipped with the plano-auxiliary reflective element assembly according to this present invention) of a triangular shaped target located about 35 feet rearward of the driver seating location, extending about 8 feet out from the plane defined by the side of the automobile and reaching a height of between about 4 feet and about 5 feet from the road surface at that location

35 feet rearward of the automobile. The total field of view rearwardly of the vehicle of plano-multiradius reflective element assembly 230 (which is a combination of the field of view of plano reflective element 250 and of the auxiliary multiradius reflective element 255) preferably generally subtends an angle of at least about 30 degrees (and more preferably, generally subtends an angle of at least about 35 degrees and most preferably, generally subtends an angle of at least about 40 degrees) with respect to the side of an automobile to which is attached an exterior sideview mirror assembly equipped with plano-multiradius reflective element assembly 230.

[0067] Referring to FIG. 16, another embodiment 310 of the plano-auxiliary reflective element assembly of the present invention is illustrated. Plano-auxiliary reflective element assembly 310 includes a first reflective element 312 and a second or auxiliary, separate reflective element 314 which are together supported in a frame element assembly 316. As will be more fully described below, frame element assembly 316 is adapted such that when reflective elements 312 and 314 are placed, or otherwise positioned, in frame element assembly 316, the angular orientation of each reflective element is pre-established such that during assembly, the assembler need simply place the reflective elements in frame element assembly 316.

[0068] In the illustrated embodiment, frame element assembly 316 includes a frame 318 with a forward facing open portion 318a (FIG. 17) (and thus when frame element assembly 316 is mounted in a vehicle-mounted exterior sideview mirror assembly, the forward facing open portion (318a) is facing to the front of the vehicle) through which a reflective element subassembly 317a, which includes reflective element 312, is positioned in frame element assembly 316 and a rearward facing open portion 318b (FIG. 16) (which faces the rear of the vehicle when frame element assembly 316 is mounted in a vehicle mounted exterior sideview mirror assembly) in which a second reflective element subassembly 317b, which includes reflective element 314, is positioned in frame element assembly 316. Frame 318 preferably comprises a molded member formed from a plastic material, such as a reinforced nylon.

[0069] In preferred form, first reflective element 312 comprises a plano reflective element 350, such as a flat reflector coated glass substrate, with a reflective surface through which the angular height and width of an image of an object is equal to the angular height and width of the object when viewed to the same distance (except for flaws that do not exceed normal manufacturing tolerances) so as to have a unit magnification. Similar to the previous embodiment, plano reflective element 350 may comprise a conventional fixed reflectance reflective element or may comprise a variable reflectance reflective element who's reflectivity is electrically adjustable, as is known in the art. For example, plano reflective element 350 may comprise a flat glass substrate coated with metallic reflector coating, such as a chromium coating, titanium coating, rhodium coating, metal alloy coating, nickel alloy coating, silver coating, aluminum coating, or any alloy or composition of these metal reflectors. For further details of plano reflective element 350, reference is made to the previous embodiments.

[0070] In the illustrated embodiment, reflective element 312 comprises an electrochromic reflective element and includes a first substrate 312a and a second substrate 312b with an electrochromic medium 312c disposed between first and second substrates 312a, 312b. Such suitable electrochromic media include, for example, a solid polymer matrix electrochromic medium as noted in reference to the previous embodiments. Electrical connectors 320a and 320b are coupled to the electrochromic medium 312c to provide a potential across the electrochromic medium which induces the electrochromic medium to darken, as is known in the art. In the illustrated embodiment, reflective element subassembly 317a also includes an optional heater pad 322, which is disposed behind reflective element 312, and a vibration reducing element, such as a foam pad 326, positioned behind heater pad 322, which absorbs vibration of reflective element 312.

[0071] Referring again to FIG. 17, frame 318 is adapted to receive and support reflective element subassembly 317a, which is mounted to frame 318 by a backing plate 324, such as a plastic backing plate. In the illustrated embodiment, backing plate 324 mounts to the inner perimeter portion of frame 318 using conventional techniques, such as by adhesive bonding, heatstaking, snap-fit coupling, welding, or the like, to form part of frame element assembly 316. Alternatively, backing plate 324 may mount onto foam pad 326, for example, by an adhesive attachment, such as double sided sticky tape. In which case, reflective element 312 may be mounted to an inner surface of frame 318, such as by an adhesive attachment, including for example a silicone adhesive, with heater pad 322 mounted to reflective element 312, such as by an adhesive attachment, and foam pad 326 mounted to heater pad 322, such as by an adhesive attachment including, for example, double-sided sticky tape.

[0072] Frame element assembly 316 mounts reflective element assembly 310 in the mirror casing and preferably on an actuator, such as an electric actuator, which permits adjustment to the orientation of reflective element assembly 310 about one or more axis. Examples of suitable actuators are described in U.S. Pat. Nos. 5,900,999; 5,986,364; 6,132,052; 6,037,689; and 6,094,027 and applications Ser. No. 09/277,632, filed Mar. 26, 1999, now U.S. Pat. No.

6,229,226, and Ser. No. 09/408,867, filed Sep. 29, 1999, now U.S. Pat. No. 6,243,218, which are incorporated by reference in their entireties in U.S. Pat. No. 6,717,712 (incorporated herein above). Optionally and preferably, backing plate 324 is adapted to engage or be engaged by the actuator for repositioning of plano-auxiliary reflective element assembly 310 about one or more axes. In this manner, the orientation of both reflective element 312 and reflective element 314 are simultaneously adjusted by the actuator. As best seen in FIG. 17, forward facing side 324a of backing plate 324 includes mounting structures 324b which are engaged by the actuator to thereby mount reflective element assembly 310 in the mirror casing.

[0073] Referring again to FIG. 16, frame 318 is a unitary frame and includes a first bezel portion 330 which extends around reflective element 312 and a second bezel portion 332 which extends around reflective element 314 to provide styling utility as well as functional utility. In this manner, a portion of forward facing side of frame 318 forms a support surface for reflective element 312, while a portion of rearward facing side of frame 318 forms first bezel portion 330. Similarly, another portion of the rearward facing side of frame provides support for reflective element 314 and also provides bezel portion 332. In addition, a portion of frame 318 forms a demarcation element at the juncture of reflective elements 312 and 314. In the illustrated embodiment, the demarcation element is formed by a section or portion of bezel portion 330, which will be described in greater detail in reference to bezel portion 330. Thus, frame element assembly 316 provides a support function, a positioning function, including an angling function, while also serving to provide styling utility and a demarcation function.

[0074] Second reflective element 314 comprises a radiused reflective element and, more preferably, a multiradiused reflective element 355 having a multiradiused curvature. For example, the radii of curvature of reflective element 314 may range from about 4000 mm to about 100 mm and, preferably, range from about 3000 mm to about 150 mm, and, most preferably, range from about 2000 mm to about 200 mm. In addition, reflective element 314 may comprise a fixed reflectance reflective element or may comprise a variable reflectance reflective element who's reflectivity is electrically adjustable. Preferably, reflective elements 312 and 314 include glass substrates, with at least the outer surface of each reflective element comprising glass. However, metalized plastic reflectors may also be used which is especially suitable for reflective element 314. In which case, the reflective element (314) would be especially suitable for molding in or along with frame 318, with the preformed metalized substrate forming reflective element 314 being placed into the mold forming frame 318. For further details of other suitable reflective elements, reference is made to the previous embodiments. In addition to reflective element 314, reflective element subassembly 317b includes a vibration reducing element, such as a foam pad 314a, which is positioned behind reflective element 314. Similar to reflective element 312, foam pad 314a is attached to reflective element 314 by an adhesive attachment, such as a double-sided sticky tape and, similarly, is attached to frame 318 as will be more fully described below.

[0075] As noted above, frame 318 includes a first bezel portion 330 and a second bezel portion 332. In addition, frame 318 includes an auxiliary support element 320 that provides a mounting surface or support surface for reflective element subassembly 317b. As best seen in FIGS. 17 and 18, support element 320 includes a recessed support surface 328 which is angled to provide an angled support surface for reflective element subassembly 317b. Thus, when reflective subassembly 317b is positioned on and mounted on support surface 328, such as by an adhesive attachment between foam pad 314a and support surface 328, the orientation of reflective element 314 is established by the angle of the support surface. Optionally, support element 320 includes gussets 321a and 321b which project forwardly from the forward facing side of frame 318 to thereby reinforce support surface 328.

[0076] Referring to FIG. 16, first bezel portion 330 includes an upper portion 330a, two side portions 330b and 330c, and a lower portion 330d. Side portion 330b forms an acute angle with respect to the lower portion 330d and an obtuse angle with respect to upper portion 330a and together with upper portion 330a, side portion 330c, and lower portion 330d form a perimeter around reflective element 312 to thereby form a styling feature. Second bezel portion 332 extends outwardly from upper portion 330a and downwardly to lower portion 330d of first perimeter portion 330 and together with side portion 330b forms a perimeter around second reflective element 314. Support element 320 extends behind and between side portion 330b and second bezel portion 332 so that reflective element 314 is recessed behind side portion 330b and bezel portion 332.

[0077] As best seen in FIG. 18, upper portion 330a, side portions 330b and 330a, and lower portion 330d are substantially coplanar and together define an outer surface below which reflective element 312 is recessed when reflective element 312 is mounted in frame 318. In contrast, perimeter portion 332 is angled forwardly with respect to the plane in which upper portion 330a, side portions 330b and 330c, and lower portion 330d lie. It should be understood that the terms "forwardly", "rearwardly" and "downwardly", are used in reference to when the mirror system is mounted in an automobile. Therefore, "forwardly" is a direction heading toward the front of the automobile, "rearwardly" is a direction heading to the rear of the automobile, "outwardly" is a direction away from the side of the vehicle on which the mirror assembly is mounted, and "downwardly" is a direction heading toward the surface on which the vehicle is positioned (such as a ground or road surface). Similarly as noted above, reflective element 314 is recessed below an outer surface of perimeter portion 332 and also below the outer surface of side portion 330b when mounted in frame 318.

[0078] As would be understood from FIGS. 17-19, support surface 328 is also angled forwardly with respect to back plate 324 and/or reflective element 312 when frame element assembly 316 is mounted in an automobile mounted exterior sideview mirror system. In addition, support surface 328 is also angled or tilted downwardly with respect to reflective element 312 and/or backing plate 324 such that when reflective element 314 is supported on support surface 328, reflective element 314 provides an increased field of view extending laterally or outwardly from the longitudinal axis of the automobile and also downwardly of the longitudinal axis of the automobile.

[0079] Referring to FIGS. 21 and 22, support surface 328 is configured such that reflective element 314 is tilted forwardly at an angle α with respect to the X-axis of reflective element 312. In one form, angle α is in a range of about 0.75 degrees to about 5 degrees. In another form, angle α is in a range of about 1 degree to about 3 degrees. In yet another form, angle α is in a range of about 1.25 degrees to about 2.5 degrees. Reflective element 314 is also tilted downwardly with respect to the Y-axis of reflective element 312 at an angle β. In one form, angle β is in a range of about 0.75 degrees to about 5 degrees. In another form, angle β is in a range of about 1.5 degrees to about 3.5. In yet another form, angle β is in a range of about 2 degrees to about 3 degrees. With the tilted orientation of reflective element 314, reflective element 314 provides a field of view with a principal axis that sweeps outwardly and downwardly with respect to the principal axis of the field of view of reflective element 312.

[0080] In the illustrated embodiment, support surface 328 is provided by a plate member 321. Plate member 321 may comprise a solid plate member or a foraminous plate member. In the illustrated embodiment, plate member 321 is integrally formed with perimeter portions 330 and 332 during the molding process of frame 318. As previously noted, frame 318 includes a rearwardly facing opening 318b through which reflective element 314 is inserted for placement on support surface 328. For example, reflective element 314 may be positioned in frame 318 on support surface 328 during the molding process of frame 318, such as by insert molding, or may be inserted into frame 318 before the plastic material forming frame 318 is fully cured and is still pliable. In which case, reflective element subassembly 317b is mounted to auxiliary support 320 by an adhesive attachment or a mechanical attachment. Alternatively, support surface 328 may be formed by peripheral flange or a frame. In this manner, reflective element subassembly 317b may be placed in frame 318 from its forward facing side.

[0081] Referring to FIG. 22, when reflective element assembly 310 is mounted in a vehicle reflective element 312 has a field of view 360 which forms an angle A with respect to the longitudinal center line of the vehicle in a range of about 8 degrees to about 20 degrees. In another form, angle A is in a range of about 10 degrees to about 18 degrees. In yet another form, angle A is in a range of about 12 degrees to about 16 degrees. Similarly, reflective element 314 has a field of view 362 which forms an angle C in range of about 15 degrees to about 50 degrees. In another form, angle C is in a range of about 15 degrees to about 35 degrees. In yet another form, angle C is in a range of about 15 degrees to about 25 degrees. Consequently, the overall field of view of reflective elements 312 and 314 extends over an angle B, which ranges from about 8 degrees to about 50 degrees in one form, about 10 degrees to about 35 degrees in another form, and about 12 degrees to about 25 degrees in yet another form. Furthermore, field of views 360 and 362 overlap over a range having angle D in a range of about 20 degrees to about 2 degrees, or in a range of about 15 degrees to about 5 degrees. In another form, angle D is in a range of about 10 degrees to about 8 degrees.

[0082] From the foregoing, it can be appreciated that reflective elements 312 and 314 provide a wider field of view than a wholly planar rearview mirror element that fully accommodates an equivalent frame having similar dimensions. In addition, because reflective elements 312 and 314 have overlapping field of views, an image in the field of view of reflective element 314 will transition or move between the reflective elements and appear in both reflective elements during the transition to thereby enable the driver of the automobile to view or be conscious of the object continuously. In the illustrated embodiment, reflective element 314 is positioned in an outboard position relative to reflective element 312; therefore, when a vehicle or object that is approaching the automobile from the rear and to some extent from the side, the image of the approaching object will first appear in reflective element 312, then appear in both reflective elements 314 and 312, and then move to reflective element 314 so that the driver will be initially aware of the approaching object when its image first appears in reflective element 312 and continue to be aware of the object as it moves closer to the automobile, thus increasing the range of viewing of the driver. Since the image transitions smoothly from reflective element 312 to reflective element 314, the driver's awareness of the object is continuous and, further, the driver is not distracted from sudden transitions that often occur with conventional spotter mirrors. Typically, when an object "falls" or "drops" out, a driver's consciousness of the object reduces significantly, if not ceases, which is one of the causes of many automobile blind spot accidents. Hence, when combined with the field of view of an interior rearview mirror system, the present invention reduces, if not eliminates, an automobile's blind spot. For further discussion of blind spots in vehicle rearview mirror systems, reference is made to U.S. provisional application entitled VEHICULAR REARVIEW MIRROR SYSTEM, Ser. No. 60/252,149, filed Nov. 20, 2000 by Robert E. Schnell, David K. Willmore, and Richard J. Weber, which is incorporated by reference in its entirety in U.S. Pat. No. 6,717,712 (incorporated herein above). Thus, the plano-auxiliary reflective element assembly provides a seamless rearvision function whereby the image of a side approaching/side overtaking other vehicle is substantially seamlessly maintained as the image of the overtaking or approaching vehicle transitions from being principally and substantially viewed by the driver of the vehicle (the vehicle mounted with the mirror system of the present invention) in the plano reflective element to be seen in the auxiliary reflective element.

[0083] Referring to FIG. 23, the numeral 410 generally designates yet another embodiment of an automobile exterior sideview mirror system of the present invention. Exterior sideview mirror system 410 includes a housing 412, a first reflective element 414, and a second or auxiliary, separate reflective element 416, which together provide an increase field of view over conventional planar reflectors mounted in a frame of equivalent dimensions to the combined lateral dimensions of reflective element 414 and 416.

[0084] Housing 412 includes a mirror casing 417 and a sail 418, which mounts casing 412 to a side of an automobile. Though illustrated as a fixed mounting arrangement, it should be understood that mirror system 410, like the previous embodiments, may comprise a break-away mirror system or a powerfold mirror system.

[0085] In the illustrated embodiment, reflective element 414 comprises a plano reflective element having a unit magnification, similar to the plano reflective elements described in reference to the previous embodiments. Reflective element 416 preferably comprises a wide-angle reflector, such as a convex or aspheric reflector, and may include a multiradiused curvature. For further description of suitable reflectors, reference is made to the previous embodiment.

[0086] In the illustrated embodiment, reflective element 416 is mounted in an outboard position relative to reflective element 414 and is fixedly mounted to bezel 420 of mirror casing 417. In addition, reflective element 416 is preferably angled downwardly and forwardly relative to first reflective element 414 when mirror system 410 is mounted to an automobile to thereby increase the field of view of mirror system 410. Optionally and preferably, reflective element 416 is detachably mounted to bezel 420, such as by mechanical fasteners, including clips, so that reflective element 416 can be removed, such as for replacement.

[0087] Reflective element 414 preferably comprises an independently positionable reflective element and is mounted by a backing member, such as a backing plate, to an actuator, which provides multi-axis positioning of reflective element 414. In this manner, reflective element 414 and reflective element 416 are separately and independently mounted in housing 412. In addition, reflective element 414 optionally extends behind reflective element 416 in order to maintain the overlap of the field of views of reflective elements 414 and 416 even when reflective element 414 is moved by the actuator. Similar to the previous embodiment, when an object moves toward the automobile, in which mirror system 410 is mounted, from the rear of the automobile or laterally with respect to the automobile, the image of the object will appear initially in reflective element 414. As the object moves closer to the automobile, the image of the object will move from reflective element 414 to reflective element 416 such that when the image transitions between reflective element 414 and reflective element 416, the image will appear in both reflective elements.

[0088] Also, although it is preferable to utilize a multiradius or compound curvature reflective element, such as an aspherical element or a compound curvature element, for the second or auxiliary mirror element adjacent the plano or first reflective element (as this enables least discontinuity in image at the joint between the adjacent elements of the assembly), a spherical reflective element (that has substantially only one radius of curvature and, as such, is a section from a sphere) can optionally be used adjacent the plano reflective element instead of, or in addition to, the multiradius reflective element. Also, a plano auxiliary mirror such as a flat mirrored substrate can be used, less preferably, as a substitute for a multiradius reflective element in those embodiments where the auxiliary reflective element is angled relative to the plane of the principal, plano reflective element so as to view a blind spot region of the principal plano element. Also, the plano-multiradius reflective element assembly can optionally be fixedly attached to an exterior sideview mirror assembly housing that is not movable, or, alternately, the exterior sideview mirror assembly housing to which the plano-multiradius reflective element assembly is fixedly attached can itself be actuated to move, such as by motor action, so that by moving the exterior sideview mirror assembly housing, the field of rearward view of the plano-multiradius reflective element assembly fixedly attached thereto can correspondingly move and be repositioned to suit the field of view need of a particular driver seated in the automobile cabin.

[0089] The substrate 18 of the reflective element 12 of the present invention may be formed (such as by casting, extrusion or injection molding) of a polymeric optical resin material, such as an acrylic or polycarbonate resin, a polyolefin, a cyclic olefin copolymer, such as a COC resin known as "TOPAS" and available from Ticona of Summit, NJ (such as a resin of the type described in U.S. pat. application, Ser. No. 09/946,228, filed Sep. 5, 2001 for IMPROVED PLASTIC SUBSTRATE FOR INFORMATION DEVICE AND METHOD FOR MAKING SAME, which is hereby incorporated herein by reference) or the like. Because the substrate can be, for example, injection molded from an optical resin, the substrate may be molded or formed to a desired shape having a wide angle or multi-radius surface, which is typically challenging to accomplish with glass sheets. This is because any prescription or form for the substrate can be established in an injection mold by machining, such that when the injection mold is filled with molten injected optical resin material, the optical resin material takes the shape of the mold. Thus, for example, a substrate having a substantially or fully flat inboard region for a multi-radius (often referred to as an aspheric) exterior mirror element is fully practical.

[0090] As shown in FIGS. 1-3, inboard portion or surface 18c of exterior surface 18b is positioned at or toward the side of the reflective element that is toward the side body of the vehicle when the mirror assembly is mounted to or attached to the vehicle. The inboard portion 18c of surface 18b of substrate 18 may comprise a substantially flat or slightly curved or less curved surface, such as a surface having a radius of curvature of preferably greater than at least approximately 4000 mm, more preferably greater than at least approximately 9000 mm, and most preferably greater than at least approximately 12000 mm. The inboard surface 18c may provide a field of view of up to approximately 10 degrees, preferably up to approximately 15 degrees, and more preferably up to approximately 20 degrees.

[0091] Outboard portion or surface 18d of exterior surface 18b of substrate 18 is positioned outward from inboard portion and is thus further away from the side body of the vehicle when the mirror assembly is mounted to or attached to the vehicle. Outboard portion 18d of exterior surface 18b may be a more convex or curved surface, such that the substrate comprises a wide angle or multi-radius exterior surface substrate. The more curved outboard surface 18d of the substrate may have radii of curvature in the range of less than about 4000 mm to about 100 mm or lower. The more curved outboard portion or surface 18d may provide an extended field of view when combined with the less curved inboard portion or surface 18c. For example, the combined field of view of the mirror reflective element 12 may be preferably greater than at least approximately 25 degrees, more preferably greater than at least approximately 35 degrees, and most preferably greater than at least approximately 45 degrees. The substrate may be formed to have curves or shapes or to provide other field of views, without affecting the scope of the present invention.

[0092] The exterior surface 18b of substrate 18 may be coated or covered with a substantially transparent functional film or layer 20, such as an anti-abrasion film or layer, such as an ultrathin glass film or layer or sheet having a thickness of preferably less than or equal to approximately 0.8 mm, more preferably less than or equal to approximately 0.5 mm, and most preferably less than or equal to approximately 0.3 mm. The ultrathin glass film or layer or sheet 20 provides a flexible glass film which can be conformed to the exterior surface of the molded substrate (for example, such as described in U.S. Pat. No. 5,085,907, which is hereby incorporated herein by reference) after the substrate is molded. The ultrathin glass film or layer may provide substantial protection against scratches on the outboard surface, such as may occur due to impact by debris at the outside of the vehicle (for exterior mirror assembly applications) or by use of ice scrapers and the like on the glass surface and the like. The ultrathin glass film or layer may be applied to a molded or extruded strip (such as described below with respect to FIGS. 5-8) or may be applied to the surface or surfaces of a formed or cut substrate, without affecting the scope of the present invention. The flexible ultrathin glass film or layer of the present invention allows the wide angle or multi-radius substrate to be molded in the desired shape out of a transparent acrylic resin material, yet may conform to the curved or multi-radius or aspheric shape and provide enhanced protection or scratch resistance to the substrate.

[0093] It is envisioned that other functional films or hard coats or anti-abrasion films or the like may be applied to the exterior surface of the molded substrate, such as via adhering or applying a film to the exterior surface or via dip coating or vacuum deposition or the like. Optionally, a hydrophobic film or hydrophilic film or element or property may also or otherwise be applied to the exterior surface 18b of the substrate. Optionally, the functional film may comprise a non-glass or polymeric film, such as a polymeric material that is a harder and/or different property material than the substrate itself. Optionally, the anti-abrasion film may be formed of the same resin material as the substrate to match the coefficients of thermal expansion and thus reduce thermal expansion/contraction mismatches between the materials.

[0094] Optionally, the inner or rear surface 18a of the substrate 18 may have a reflective layer or coating or film or sheet 22 laminated or otherwise applied thereto. For example, the reflective layer or film 22 may comprise a polymeric reflective film 22 laminated or otherwise adhered or applied to the rear or inner surface 18a of a molded or extruded or cast strip (such as described below with respect to FIGS. 5-8) or of the molded or formed substrate 18. Reflective film 22 may comprise a polymeric reflective film, such as an all polymer-thin-film multilayer, high reflective mirror film, such as a multilayer, non-metallic reflective film which may comprise multiple coextrusion of many plastic layers to form a highly reflective mirror film, such as described in U.S. Pat. Nos. 3,773,882; 3,884,606; and 3,759,647, which are hereby incorporated herein by reference. Such a reflective film thus may comprise multilayers of polymer materials to form a highly reflective mirror film, such as a Radiant Light Film, a Radiant Mirror Film or a Radiant Color Film, such as commercially available from 3M of St. Paul, Minn., such as a Radiant Color Film CM590 or CM500. Also, a durable metallized polymeric mirror layer can be used, such as described in U.S. Pat. No. 5,361,172, which is hereby incorporated herein by reference.

[0095] As shown in FIG. 4, it is envisioned that a substrate or substrate shape or sheet or strip of substrate material 118 may have a reflective film or layer 122 adhered or laminated or otherwise applied to the exterior surface 118b of the substrate material. An anti-abrasion film or layer 120 (which may comprise an ultrathin glass film or layer as described above) may be adhered or laminated or otherwise applied to the reflective film or layer 122. In such an application, with the reflective layer on the front or exterior surface of the substrate, the substrate material may be molded or formed of a polymeric material that does not provide optical clarity and need not be transparent. The substrate material may act only as a support or backing plate for the reflective film or layer and the anti-abrasion film or layer and thus may be opaque or non-transparent. The exterior surface 118b of substrate material 118 may comprise a wide angle exterior surface or a multi-radius exterior surface having a less curved inboard portion or surface 118c and a more curved outboard portion or surface 118d, such as discussed above with respect to substrate 18.

[0096] Optionally, and such as shown in FIGS. 5, 6 and 8, the optical resin material may be molded or extruded or cast into a generally continuous strip 19 having the desired curved or multi-radius surfaces, and may be cut to form the substrates. The substrates may be cut from the strip via any known cutting process, such as via a laser cutting process or a water-jet cutting process or the like, without affecting the scope of the present invention.

[0097] As shown in FIGS. 5-8, the molding processes and film or layer application processes of the present invention may be used to form a prismatic or wedge-shaped strip for forming prismatic or wedge-shaped substrates 18' (FIG. 7) for use in an interior rearview mirror assembly of a vehicle.

[0098] As also shown in FIGS. 5-8, the substrate material or optical resin material may be extruded or cast to form the continuous strip or sheet 19. For example, and as shown in FIGS. 5 and 5A, the strip 19 may be extruded by an extruder 24, which, preferably continuously, extrudes the optical resin material through an extrusion nozzle 26. The extruded material may be moved through an annealing lehr 28 to reduce or substantially eliminate birefringence, striation, stress and/or distortion in the strip or substrates. The coatings or layers or films 20 and/or 22 may be applied to one or both surfaces of the strip or substrate after the annealing process. The strip 19 may then be cut, such as via laser cutting or water-jet cutting devices or processes 30, or via other forming processes, to form the substrates 18' after the films or coatings have been applied thereto.

[0099] Optionally, and as shown in FIG. 8, the strip 19 of optical polymeric resin material may be cast by a caster 32, which deposits the molten polymer or resin material onto a float section 34, such as a heated plate or heated melt. The float section 34 may be angled to form the wedge-shaped strip as the strip or ribbon of cast molten polymer solidifies as it passes across the hot float section (it is also envisioned that the float may provide a curved surface to form the curved outboard surface of the substrate). The coatings or layers or films 20, 22 may be applied to the solidified strip and the strip may be cut to form the substrates after the coatings or layers or films have been applied thereto.

[00100] Because the films or layers are flexible, it is envisioned that the anti-abrasion film or ultrathin glass film and/or the reflective polymeric film may be unwound or unrolled and applied along the generally continuously extruded or cast substrate material or strip 19. For example, and as shown in FIGS. 5-8, the ultrathin glass film (or other outer layer anti-abrasion coating or film) 20 may be provided in a reel or roll form or strip 20a and may be unwound or unrolled and

laminated or otherwise adhered or applied along the exterior surface 19b of the extruded or cast strip 19 of substrate material. Likewise, the reflective polymeric film 22 may be provided in a reel or roll form or strip 22a and may be attached or applied to the inner surface 19a of the substrate material strip 19, such as via laminating or adhering or otherwise applying the film to the substrate material, such as by using optical adhesive and/or via rolling or ironing the film or sheet (preferably at an elevated temperature and with vacuum assist) onto the substrate or strip surface, to secure the reflective film to the substrate or extruded or cast strip or sheet.

[00101] Optionally, the glass film or layer or sheet (or reel or roll of glass sheet or strip) may be coated with a highly reflective metallic layer, such as silver or aluminum or the like, deposited on or applied to its inner surface (i.e., the surface which is adhered to or otherwise applied to the substrate or substrate sheet or strip). The reflective layer or coating may be applied to the glass film or layer with or without transparent overcoats. The glass film thus may provide the reflective layer at the exterior surface of the substrate, such that the reflective layer provides the second layer or surface, with the substrate behind the reflective layer. The glass sheet or film may thus be provided with the reflective mirror coating already applied thereto. The glass layer with reflective layer or coating applied thereto may be provided in a reel or roll form for applying both the reflective layer and the anti-abrasion layer to the exterior surface of the substrate or substrate strip or sheet in one application process. In such an application, the substrate material need not comprise a transparent optical resin material, and a separate reflective layer or film or coating would not be necessary at the inner or rear surface of the substrate.

[00102] It is envisioned that other hard coats or films or the like may be applied to one or more surfaces of the molded substrate strip or to the molded and cut substrates, such as via dip coating or vacuum deposition or the like, without affecting the scope of the present invention. The other hard coats or films may be substantially flexible and may be applied via unrolling of a reel of an anti-abrasion film or sheet and applying the film or sheet to a surface of an extruded or cast strip of transparent acrylic resin or the like, as discussed above. Optionally, a hydrophobic film or hydrophilic film or element or property may also or otherwise be applied to (or sprayed on) one or both surfaces 18a, 18b of the substrate or strip or sheet. Optionally, one or both of the reflective polymeric film 22 and the anti-abrasion film 20 may be formed of the same resin material as the substrate 18, 18' or substrate strip 19 to match the coefficients of thermal expansion and thus reduce thermal expansion/contraction mismatches between the materials.

[00103] Optionally, it is envisioned that such ultrathin glass films, anti-abrasion films, reflective films or reflective systems may be used for electrochromic mirror reflective elements or cells as well. For example, the interior or exterior rearview mirror assembly of the present invention may comprise an electrochromic mirror, such as an electrochromic mirror assembly and electrochromic element utilizing principles disclosed in commonly assigned U.S. Pat. Nos. 5,140,455; 5,151,816; 6,690,268; 6,178,034; 6,154,306; 6,002,544; 5,567,360; 5,525,264; 5,610,756; 5,406,414; 5,253,109; 5,076,673; 5,073,012; 5,117,346; 5,724,187; 5,668,663; 5,910,854; 5,142,407 and/or 4,712,879, which are hereby incorporated herein by reference, and/or as disclosed in the following publications: N. R. Lynam, "Electrochromic Automotive Day/Night Mirrors", SAE Technical Paper Series 870636 (1987); N. R. Lynam, "Smart Windows for Automobiles", SAE Technical Paper Series 900419 (1990); N. R. Lynam and A. Agrawal, "Automotive Applications of Chromogenic Materials", Large Area Chromogenics: Materials and Devices for Transmittance Control, C.M. Lampert and C.G. Granquist, EDS., Optical Engineering Press, Wash. (1990), which are hereby incorporated by reference herein. The mirror assembly may comprise an interior rearview mirror assembly, and may include an accessory module or may be mounted to an accessory module, such as an accessory module of the types disclosed in U.S. pat. application, Ser. No. 10/355,454, filed Jan. 31, 2003 for VEHICLE ACCESSORY MODULE, now U.S. Pat. No. 6,824,281, which is hereby incorporated herein by reference.

[00104] Optionally, the mirror assembly may include one or more displays for displaying information to a driver of the vehicle at or through the reflective element of the mirror assembly. For example, the mirror assembly may include one or more displays of the types described in U.S. Pat. Nos. 6,329,925; 6,501,387; 6,690,268; 5,910,854; 6,420,036; 5,668,663; and 5,724,187, and/or in U.S. pat. applications, Ser. No. 10/054,633, filed Jan. 22, 2002 by Lynam et al. for VEHICULAR LIGHTING SYSTEM, now U.S. Pat. No. 7,195,381; and Ser. No. 10/456,599, filed Jun. 6, 2003 by Weller et al. for INTERIOR REARVIEW MIRROR SYSTEM WITH COMPASS, now U.S. Pat. No. 7,004,593, and/or in PCT Application No. PCT/US03/29776, filed Sep. 19, 2003 by Donnelly Corporation et al. for ELECTROCHROMIC MIRROR ASSEMBLY; PCT Application No. PCT/US03/35381, filed Nov. 5, 2003 by Donnelly Corporation et al. for ELECTRO-OPTIC REFLECTIVE ELEMENT ASSEMBLY; and/or PCT Application No. PCT/US03/40611, filed Dec. 19, 2003 by Donnelly Corporation et al. for ACCESSORY SYSTEM FOR VEHICLE, and/or in U.S. provisional applications, Ser.

No. 60/508,086, filed Oct. 2, 2003 by Schofield for MIRROR REFLECTIVE ELEMENT ASSEMBLY INCLUDING ELECTRONIC COMPONENT; Ser. No. 60/525,952, filed Nov. 26, 2003 by Lynam for MIRROR REFLECTIVE ELEMENT FOR A VEHICLE; Ser. No. 60/471,546, filed May 19, 2003; Ser. No. 60/525,537, filed Nov. 26, 2003; and Ser. No. 60/556,259, filed Mar. 25, 2004, which are all hereby incorporated herein by reference, without affecting the scope of the present invention.

[00105] Optionally, the mirror assembly may include or be associated with electronic accessories, such as, for example, antennas, including global positioning system (GPS) or cellular phone antennas, such as disclosed in U.S. Pat. No. 5,971,552, a communication module, such as disclosed in U.S. Pat. No. 5,798,688, a blind spot detection system, such as disclosed in U.S. Pat. Nos. 5,929,786 and/or 5,786,772, a high/low headlamp controller, such as disclosed in U.S. Pat. Nos. 5,796,094 and/or 5,715,093, transmitters and/or receivers, such as a garage door opener or the like, a digital network, such as described in U.S. Pat. No. 5,798,575, a memory mirror system, such as disclosed in U.S. Pat. No. 5,796,176, a hands-free phone attachment, a video device for internal cabin surveillance and/or video telephone function, such as disclosed in U.S. Pat. Nos. 5,760,962 and/or 5,877,897, a remote keyless entry receiver or system or circuitry and/or a universal garage door opening system or circuitry (such as the types disclosed in U.S. Pat. Nos. 6,396,408; 6,362,771; 5,798,688 and 5,479,155, and/or U.S. pat. application, Ser. No. 10/770,736, filed Feb. 3, 2004 by Baumgardner et al. for GARAGE DOOR OPENING SYSTEM FOR VEHICLE, now U.S. Pat. No. 7,023,322), lights, such as map reading lights or one or more other lights or illumination sources, such as disclosed in U.S. Pat. Nos. 6,690,268; 5,938,321; 5,813,745; 5,820,245; 5,673,994; 5,649,756; 5,178,448; 5,671,996; 4,646,210; 4,733,336; 4,807,096; 6,042,253; and/or 5,669,698, and/or U.S. pat. application, Ser. No. 10/054,633, filed Jan. 22, 2002 by Lynam et al. for VEHICULAR LIGHTING SYSTEM, now U.S. Pat. No. 7,195,381, microphones, such as disclosed in U.S. Pat. Nos. 6,243,003; 6,278,377; and/or 6,420,975, and/or PCT Application No. PCT/US03/30877, filed Oct. 1, 2003, speakers, a compass or compass system, such as disclosed in U.S. Pat. Nos. 5,924,212; 4,862,594; 4,937,945; 5,131,154; 5,255,442; and/or 5,632,092, and/or U.S. pat. application, Ser. No. 10/456,599, filed Jun. 6, 2003 by Weller et al. for INTERIOR REARVIEW MIRROR SYSTEM WITH COMPASS, now U.S. Pat. No. 7,004,593, a navigation system, such as described in U.S. Pat. No. 6,477,464, and U.S. pat. applications, Ser. No. 10/456,599, filed Jun. 6, 2003 by Weller et al. for INTERIOR REARVIEW MIRROR SYSTEM WITH COMPASS, now U.S. Pat. No.

7,004,593; Ser. No. 10/287,178, filed Nov. 4, 2002 by McCarthy et al. for NAVIGATION SYSTEM FOR A VEHICLE, now U.S. Pat. No. 6,678,614; Ser. No. 10/645,762, filed Aug. 20, 2003 by Taylor et al. for VEHICLE NAVIGATION SYSTEM FOR USE WITH A TELEMATICS SYSTEM, now U.S. Pat. No. 7,167,796; and Ser. No. 10/422,378, filed Apr. 24, 2003, now U.S. Pat. No. 6,946,978; and/or PCT Application No. PCT/US03/40611, filed Dec. 19, 2003 by Donnelly Corporation et al. for ACCESSORY SYSTEM FOR VEHICLE, a tire pressure monitoring system, such as the types disclosed in U.S. Pat. Nos. 6,294,989; 6,445,287; and/or 6,472,979, and/or in U.S. pat. application, Ser. No. 10/206,495, filed Jul. 26, 2002 by Schofield et al. for SELF TRAINING TIRE PRESSURE MONITORING SYSTEM, now U.S. Pat. No. 6,731,205, a seat occupancy detector, a trip computer, a telematics system, such as an ONSTAR® system or the like, and/or any other desired accessory or system or the like (with all of the above-referenced patents and patent applications and PCT applications being commonly assigned to Donnelly Corporation, and with the disclosures of all of the above referenced patents and patent applications and PCT applications being hereby incorporated herein by reference in their entireties).

[00106] Optionally, a vehicle compass or compass system may comprise a printed circuit board and may be positioned within a pod or the like that may be fixedly mounted in the vehicle. The compass may be initially calibrated (such as at the assembly plant or the like) via a small Helmholtz coil that may accommodate the small circuit board or pod. The coil induces a field to calibrate the compass, such as described in U.S. provisional application, Ser. No. 60/467,899, filed May 5, 2003, which is hereby incorporated herein by reference in its entirety. The induced field in the miniature Helmholtz coil may be controlled via the use of a highly permeable magnetic shielding material that may enclose the miniature Helmholtz coil with only a small slot for the circuit board or compass pod to enter through. Such a set up may allow the compass pod manufacturer to automate and magnetically shield the calibration and test stage of a microprocessor-based compass. The calibration process may utilize an indexing rotary table that may rotate to move a compass pod from a loading bay to a calibration bay. The shielded Helmholtz coil may be adjacent to the rotary table and may be shuttled back and forth to align with the rotary table to receive a compass pod therefrom. The rotary table may rotate to move a calibrated compass pod (after it leaves the miniature Helmholtz coil) from the calibration bay to a final functional test station to test the calibrated compass pod.

[00107] Therefore, the present invention provides a wide angle or multi-radius single substrate or reflective element which may provide an enhanced field of view for an interior or exterior rearview mirror assembly. The wide angle or multi-radius single element reflector may have an anti-abrasion coating or ultrathin glass film conformed to and applied to the exterior curved surface of the substrate. The substrate may be molded or extruded into the desired shape and may be formed into an elongated strip or sheet, whereby the anti-abrasion coating or film may be applied along the strip before the strip is cut into the desired substrates. The present invention thus provides a single element wide angle or multi-radius substrate which has enhanced scratch resistance. A polymeric reflective film may be laminated, adhered or otherwise applied to the opposite inner surface of the substrate or extruded strip while the anti-abrasion coating or film is applied to the exterior surface. Optionally, a reflective film or layer may be applied to the exterior surface of the substrate and an anti-abrasion film or layer may be applied to the reflective film or layer.

[00108] Changes and modifications in the specifically described embodiments can be carried out without departing from the principles of the present invention, which is intended to be limited only by the scope of the appended claims, as interpreted according to the principles of patent law.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. An exterior sideview mirror system suitable for use on an automobile, said exterior sideview mirror system comprising:

an exterior sideview mirror assembly adapted for attachment to a side of an automobile;

said exterior sideview mirror assembly including a reflective element having a rearward field of view when attached to the side of the automobile;

said reflective element attached to an electrically-operated actuator of said exterior sideview mirror assembly and movable by said actuator in order to position said rearward field of view to a driver-desired position when said exterior sideview mirror assembly is attached to the side of the automobile;

wherein said reflective element comprises a plano-auxiliary reflective element assembly, said plano-auxiliary reflective element assembly comprising a plano reflective element having unit magnification and a separate auxiliary reflective element having a curvature;

said plano reflective element and said auxiliary reflective element of said plano-auxiliary reflective element assembly mounted adjacently at said plano-auxiliary reflective element assembly in a side-by-side relationship and not superimposed with one reflective element on top of the other reflective element;

said plano reflective element and said auxiliary reflective element supported at a backing plate element, said backing plate element mounting to said actuator such that movement of said backing plate element of said plano-auxiliary reflective element assembly by said actuator simultaneously and similarly moves said plano reflective element and said auxiliary reflective element;

said auxiliary reflective element having a wide-angle field of view encompassing a blind spot in the side lane adjacent the side of the automobile to which said exterior sideview mirror assembly is attached;

said backing plate element having a first support portion supporting said plano reflective element and a second support portion supporting said auxiliary reflective element;

wherein said auxiliary reflective element is positioned at an outboard portion of said plano-auxiliary reflective element assembly when said exterior sideview mirror assembly is mounted to the side of the automobile;

wherein said backing plate element comprises a polymeric substrate that is formed as a single element by injection molding of a polymeric resin;

wherein said backing plate element is capable of supporting said plano reflective element and said auxiliary reflective element;

wherein said first support portion of said backing plate element comprises a flat portion and wherein said plano reflective element is disposed at said flat portion;

wherein said second support portion of said backing plate element comprises a curved portion and wherein said auxiliary reflective element is disposed at said curved portion;

wherein the rearward field of view of said auxiliary reflective element is different from and angled to the rearward field of view of said plano reflective element when both are attached to said backing plate element of said plano-auxiliary reflective element assembly when said plano-auxiliary reflective element assembly is included in said exterior sideview mirror assembly and when said exterior sideview mirror assembly is attached to the side of the automobile;

wherein angling of the rearward field of view of said auxiliary reflective element relative to the rearward field of view of said plano reflective element is achieved, at least in part, by an angling of said second support portion of said backing plate element supporting said auxiliary reflective element relative to said first support portion of said backing plate element supporting said plano reflective element;

wherein, when said exterior sideview mirror assembly is attached to the side of the automobile, the field of view of said plano reflective element generally views rearwardly of the equipped automobile and the field of view of said auxiliary reflective element generally views towards a blind spot in the side lane adjacent the side of the automobile to which said exterior sideview mirror assembly is attached, said blind spot being generally outside the rearward field of view of said plano reflective element when said plano reflective element is viewed by a driver of the equipped automobile when said exterior sideview mirror assembly is attached to the side of the automobile; and

wherein at least one of said plano reflective element and said auxiliary reflective element comprises one of (a) a glass substrate having a surface coated with a metallic reflector coating and (b) a polymeric substrate having a thin glass element applied to a surface thereof and with an opposing surface thereof having a reflecting layer applied thereto.

2. The exterior sideview mirror system of claim 1, wherein at least a portion of said auxiliary reflective element adjacent said plano reflective element has its front surface generally coplanar with the front surface of said plano reflective element.

3. The exterior sideview mirror system of claim 2, wherein an element of said backing plate element at least partially partitions said backing plate element into a first region where said plano reflective element is disposed and a separate and adjacent second region where said auxiliary reflective element is disposed, and wherein said first region is adapted to receive said plano reflective element and said second region is adapted to receive said auxiliary reflective element.

4. The exterior sideview mirror system of claim 1, wherein said plano reflective element and said auxiliary reflective element are adjacently supported at said backing plate element at a joint, and wherein said plano-auxiliary reflective element assembly includes a demarcation element, said demarcation element disposed at said joint to form a demarcation between said plano reflective element and said auxiliary reflective element, said demarcation element having a portion visible to a driver of the automobile when said exterior sideview mirror assembly is attached to the side of the automobile.

5. The exterior sideview mirror system of claim 4, wherein said demarcation element is dark colored.

6. The exterior sideview mirror system of claim 5, wherein said demarcation element is dark colored with a color selected from the group consisting of black, grey, blue and brown.

7. The exterior sideview mirror system of claim 5, wherein said demarcation element comprises at least one of a polymer material, a tape, a plastic film, a paint, a lacquer and a caulk.

8. The exterior sideview mirror system of claim 7, wherein said demarcation element comprises a polymer material.

9. The exterior sideview mirror system of claim 5, wherein the rearward field of view of said auxiliary reflective element is at an angle of at least about 3 degrees relative to the rearward field of view of said plano reflective element.

10. The exterior sideview mirror system of claim 4, wherein said joint comprises a space between said plano reflective element and said auxiliary reflective element.

11. The exterior sideview mirror system of claim 10, wherein said demarcation element is at least partially disposed at said space between said plano reflective element and said auxiliary reflective element.

12. The exterior sideview mirror system of claim 4, wherein said demarcation element comprises a wall on said backing plate element, said wall located on said backing plate element at said joint, said wall disposed between said plano reflective element and said auxiliary reflective element.

13. The exterior sideview mirror system of claim 1, wherein an element of said backing plate element at least partially partitions said backing plate element into a first region where said plano reflective element is disposed and a separate and adjacent second region where said auxiliary reflective element is disposed, and wherein said first region is adapted to receive said plano reflective element and said second region is adapted to receive said auxiliary reflective element.

14. The exterior sideview mirror system of claim 1, wherein the rearward field of view of said auxiliary reflective element is generally directed at least one of outwardly and downwardly with respect to the longitudinal axis of the equipped automobile when said exterior sideview mirror assembly is attached to the side of the automobile.

15. The exterior sideview mirror system of claim 1, wherein the rearward field of view of said auxiliary reflective element is generally directed outwardly and downwardly with respect to the longitudinal axis of the equipped automobile when said exterior sideview mirror assembly is attached to the side of the automobile.

16. The exterior sideview mirror system of claim 1, wherein said plano reflective element is supported at said backing plate element by at least one of an adhesive attachment and a mechanical attachment, and wherein said auxiliary reflective element is supported at said backing plate element by at least one of an adhesive attachment and a mechanical attachment.

17. The exterior sideview mirror system of claim 1, wherein said plano reflective element comprises a flat glass substrate having a surface coated with a metallic reflector coating and wherein said auxiliary reflective element comprises a bent glass substrate having a surface coated with a metallic reflector coating, and wherein said bent glass substrate has a spherical curvature.

18. The exterior sideview mirror system of claim 1, wherein said plano reflective element comprises a flat glass substrate having a surface coated with a metallic reflector coating and wherein said auxiliary reflective element comprises a bent glass substrate having a surface coated with a metallic reflector coating, and wherein said bent glass substrate has a multiradius curvature.

19. The exterior sideview mirror system of claim 1, wherein said plano reflective element comprises a flat glass substrate having a surface coated with a metallic reflector coating and wherein said auxiliary reflective element comprises a bent glass substrate having a surface coated with a metallic reflector coating, and wherein said bent glass substrate has an aspherical curvature.

20. The exterior sideview mirror system of claim 1, wherein said plano reflective element comprises a substrate having a surface coated with a metallic reflector coating and wherein said auxiliary reflective element comprises a substrate having a surface coated with a metallic reflector coating.

21. The exterior sideview mirror system of claim 20, wherein said curved portion of said backing plate element comprises a curvature corresponding to a curvature of said auxiliary reflective element.

22. The exterior sideview mirror system of claim 21, wherein said curved portion of said backing plate element has at least one of (a) a spherical curvature, (b) an aspherical curvature and (c) a multiradius curvature.

23. The exterior sideview mirror system of claim 22, wherein a demarcation element is disposed between said plano reflective element and said auxiliary reflective element and wherein said demarcation element comprises a part of said backing plate element, and wherein said demarcation element comprises a wall structure that at least partially partitions said backing plate element into a first region where said plano reflective element is disposed and a separate and adjacent second region where said auxiliary reflective element is disposed, and wherein at least one of (a) said first region is adapted to receive said plano reflective element and (b) said second region is adapted to receive said auxiliary reflective element.

24. The exterior sideview mirror system of claim 1, wherein said plano reflective element comprises a substrate formed from elongated sheet of substrate material comprising a polymeric resin material, and wherein said elongated sheet has a substantially transparent functional film applied at a surface thereof, and wherein said substantially transparent functional film provides at least one of (a) an anti-abrasion function, (b) a hydrophobic function and (c) a hydrophilic function, and wherein said functional film comprises an ultrathin glass material which is sufficiently flexible to be provided in a reel or roll, and wherein said functional film is sufficiently flexible to conform to said substrate of said plano reflective element, and wherein said plano reflective element comprises a reflective film disposed at a surface of said substrate opposite said substantially transparent functional film.

25. The exterior sideview mirror system of claim 1, wherein said plano reflective element comprises a thin flexible glass sheet and a polymeric substrate, said thin flexible glass sheet existing as a pre-formed glass sheet that is separate from said polymeric substrate, said thin glass sheet having an attaching surface, said attaching surface being opposed to and adhered to said surface of said polymeric substrate when said thin flexible sheet is adhered to said exterior surface of said polymeric substrate, said thin flexible sheet providing an anti-abrasion function at said surface of said polymeric substrate when adhered thereto, said thin flexible glass sheet substantially conforming to said exterior surface of said polymeric substrate when adhered

thereto, said thin glass sheet having a thickness of less than approximately 0.8 mm and greater than approximately 0.3 mm.

26. The exterior sideview mirror system of claim 25, wherein said substrate is cut from a molded or extruded or cast strip or sheet, said glass sheet being laminated to said strip or sheet and wherein said plano reflective element comprises a reflective film applied to an inner surface of said substrate opposite said exterior surface, and wherein said reflective film comprises a polymeric reflective film at least one of laminated, adhered and applied to said inner surface of said substrate.

27. The exterior sideview mirror system of claim 1, wherein said auxiliary reflective element comprises a heater element operable to demist/deice the outmost surface of said auxiliary reflective element when said auxiliary reflective element is disposed at said backing plate element and when said exterior sideview mirror assembly is attached and operated on the side of the automobile.

28. The exterior sideview mirror system of claim 1, wherein said exterior sideview mirror assembly including said plano-auxiliary reflective element having a rearward field of view when attached to the side of the automobile comprises a driver-side exterior sideview mirror assembly, and wherein, when attached to the side of the automobile, said driver-side exterior sideview mirror assembly provides to the driver of the equipped automobile a total field of view that generally subtends an angle of at least about 25 degrees with respect to the side of the equipped automobile.

29. The exterior sideview mirror system of claim 1, wherein said exterior sideview mirror assembly including said plano-auxiliary reflective element having a rearward field of view when attached to the side of the automobile comprises a driver-side exterior sideview mirror assembly, and wherein, when attached to the side of the automobile, said driver-side exterior sideview mirror assembly provides to the driver of the equipped automobile a total field of view that generally subtends an angle of at least about 30 degrees with respect to the side of the equipped automobile.

30. The exterior sideview mirror system of claim 1, wherein said auxiliary reflective element has an aspherical curvature.

31. The exterior sideview mirror system of claim 1, wherein said auxiliary reflective element has a spherical curvature.

32. The exterior sideview mirror system of claim 1, wherein the ratio of the width of said plano reflective element to the width of said auxiliary reflective element is greater than 1.5.

33. The exterior sideview mirror system of claim 1, wherein the ratio of the width of said plano reflective element to the width of said auxiliary reflective element is greater than 2.5.

34. The exterior sideview mirror system of claim 1, wherein said exterior sideview mirror assembly comprises a door-mounted exterior sideview mirror assembly adapted for attachment to a side of the automobile adjacent a driver seating location of a driver of the automobile and wherein the rearward field of view of said auxiliary reflective element generally views downwardly towards the road surface adjacent to the driver seating location at least at a distance in the range of about 1 foot to about 24 feet to the rear of the driver seating location.

35. The exterior sideview mirror system of claim 1, wherein at least one of said plano reflective element and said auxiliary reflective element comprises a glass substrate having a surface coated with a metallic reflector coating, and wherein said metallic reflector coating is selected from the group consisting of (i) a chromium coating, (ii) a titanium coating, (iii) a rhodium coating, (iv) a metal-alloy coating, (v) a nickel alloy coating, (vi) an aluminum coating and (vii) a silver coating.

36. The exterior sideview mirror system of claim 1, wherein at least one of said plano reflective element and said auxiliary reflective element comprises an electro-optic reflective element.

37. The exterior sideview mirror system of claim 1, wherein said plano reflective element comprises an electro-optical reflective element, and wherein said electro-optical reflective element comprises an electrochromic reflective element.

38. The exterior sideview mirror system of claim 37, wherein said auxiliary reflective element comprises a fixed reflectance mirror reflector.

39. The exterior sideview mirror system of claim 38, wherein said fixed reflectance mirror reflector comprises a spherically bent glass substrate coated with a metallic reflector coating.

40. An exterior sideview mirror system suitable for use on an automobile, said exterior sideview mirror system comprising:

an exterior sideview mirror assembly adapted for attachment to a side of an automobile;

said exterior sideview mirror assembly including a reflective element having a rearward field of view when attached to the side of the automobile;

said reflective element attached to an electrically-operated actuator of said exterior sideview mirror assembly and movable by said actuator in order to position said rearward field of view to a driver-desired position when said exterior sideview mirror assembly is attached to the side of the automobile;

wherein said reflective element comprises a plano-auxiliary reflective element assembly, said plano-auxiliary reflective element assembly comprising a plano reflective element having unit magnification and a separate auxiliary reflective element having a curvature;

said plano reflective element and said auxiliary reflective element of said plano-auxiliary reflective element assembly mounted adjacently at said plano-auxiliary reflective element assembly in a side-by-side relationship and not superimposed with one reflective element on top of the other reflective element;

said plano reflective element and said auxiliary reflective element supported at a backing plate element, said backing plate element mounting to said actuator such that movement of said backing plate element of said plano-auxiliary reflective element assembly by said actuator simultaneously and similarly moves said plano reflective element and said auxiliary reflective element;

said auxiliary reflective element having a wide-angle field of view encompassing a blind spot in the side lane adjacent the side of the automobile to which said exterior sideview mirror assembly is attached;

said backing plate element having a first support portion supporting said plano reflective element and a second support portion supporting said auxiliary reflective element;

wherein said auxiliary reflective element is positioned at an outboard portion of said plano-auxiliary reflective element assembly when said exterior sideview mirror assembly is mounted to the side of the automobile;

wherein said backing plate element comprises a polymeric substrate that is formed as a single element by injection molding of a polymeric resin;

wherein said backing plate element is capable of supporting said plano reflective element and said auxiliary reflective element;

wherein said first support portion of said backing plate element comprises a flat portion and wherein said plano reflective element is disposed at said flat portion;

wherein said second support portion of said backing plate element comprises a curved portion and wherein said auxiliary reflective element is disposed at said curved portion;

wherein the rearward field of view of said auxiliary reflective element is different from and angled to the rearward field of view of said plano reflective element when both are attached to said backing plate element of said plano-auxiliary reflective element assembly when said plano-auxiliary reflective element assembly is included in said exterior sideview mirror assembly and when said exterior sideview mirror assembly is attached to the side of the automobile;

wherein angling of the rearward field of view of said auxiliary reflective element relative to the rearward field of view of said plano reflective element is achieved, at least in part, by an angling of said second support portion of said backing plate element supporting said auxiliary reflective element relative to said first support portion of said backing plate element supporting said plano reflective element;

wherein, when said exterior sideview mirror assembly is attached to the side of the automobile, the field of view of said plano reflective element generally views rearwardly of the equipped automobile and the field of view of said auxiliary reflective element generally views towards a blind spot in the side lane adjacent the side of the automobile to which said exterior sideview mirror assembly is attached, said blind spot being generally outside the rearward field of view of said plano reflective element when said plano reflective element is viewed by a driver of the equipped automobile when said exterior sideview mirror assembly is attached to the side of the automobile;

wherein at least one of said plano reflective element and said auxiliary reflective element comprises one of (a) a glass substrate having a surface coated with a metallic reflector coating and (b) a polymeric substrate having a thin glass element applied to a surface thereof and with an opposing surface thereof having a reflecting layer applied thereto;

wherein said plano reflective element and said auxiliary reflective element are adjacently supported at said backing plate element at a joint, and wherein said plano-auxiliary reflective element assembly includes a demarcation element, said demarcation element disposed at said joint to form a demarcation between said plano reflective element and said auxiliary reflective element, said demarcation element having a portion visible to a driver of the automobile when said exterior sideview mirror assembly is attached to the side of the automobile;

wherein at least a portion of said auxiliary reflective element adjacent said plano reflective element has its front surface generally coplanar with the front surface of said plano reflective element;

wherein said demarcation element is dark colored;

wherein said demarcation element comprises a polymer material;

wherein said joint comprises a space between said plano reflective element and said auxiliary reflective element;

wherein said demarcation element is at least partially disposed at said space between said plano reflective element and said auxiliary reflective element; and

wherein said demarcation element comprises a wall on said backing plate element, said wall located on said backing plate element at said joint, said wall disposed between said plano reflective element and said auxiliary reflective element.

41. The exterior sideview mirror system of claim 40, wherein the rearward field of view of said auxiliary reflective element is at an angle of at least about 3 degrees relative to the rearward field of view of said plano reflective element.

42. The exterior sideview mirror system of claim 41, wherein the rearward field of view of said auxiliary reflective element is angled downward and outward relative to the rearward field of view of said plano reflective element.

43. The exterior sideview mirror system of claim 40, wherein the rearward field of view of said auxiliary reflective element is generally directed at least one of outwardly and downwardly with respect to the longitudinal axis of the equipped automobile when said exterior sideview mirror assembly is attached to the side of the automobile.

44. The exterior sideview mirror system of claim 40, wherein the rearward field of view of said auxiliary reflective element is generally directed outwardly and downwardly with respect to the longitudinal axis of the equipped automobile when said exterior sideview mirror assembly is attached to the side of the automobile.

45. The exterior sideview mirror system of claim 40, wherein said plano reflective element is supported at said backing plate element by at least one of an adhesive attachment and a mechanical attachment and wherein said auxiliary reflective element is supported at said backing plate element by at least one of an adhesive attachment and a mechanical attachment, and wherein said auxiliary reflective element comprises a glass substrate having a surface coated with a metallic reflector coating and wherein said auxiliary reflective element comprises a bent glass substrate with a spherical curvature.

46. The exterior sideview mirror system of claim 40, wherein said plano reflective element comprises a flat glass substrate having a surface coated with a metallic reflector coating and wherein said auxiliary reflective element comprises a bent glass substrate having a surface coated with a metallic reflector coating, and wherein said bent glass substrate has a spherical curvature.

47. The exterior sideview mirror system of claim 40, wherein said plano reflective element comprises a flat glass substrate having a surface coated with a metallic reflector coating and wherein said auxiliary reflective element comprises a bent glass substrate having a surface coated with a metallic reflector coating, and wherein said bent glass substrate has a multiradius curvature.

48. The exterior sideview mirror system of claim 40, wherein said plano reflective element comprises a flat glass substrate having a surface coated with a metallic reflector coating and wherein said auxiliary reflective element comprises a bent glass substrate having a surface coated with a metallic reflector coating, and wherein said bent glass substrate has an aspherical curvature.

49. The exterior sideview mirror system of claim 40, wherein said plano reflective element comprises a substrate having a surface coated with a metallic reflector coating and wherein said auxiliary reflective element comprises a substrate having a surface coated with a metallic reflector coating.

50. The exterior sideview mirror system of claim 49, wherein said curved portion of said backing plate element comprises a curvature corresponding to a curvature of said auxiliary reflective element, and wherein said curved portion of said backing plate element comprises at least one of (a) a spherical curvature, (b) an aspherical curvature and (c) a multiradius curvature.

51. The exterior sideview mirror system of claim 40, wherein said demarcation element comprises a wall structure that at least partially partitions said backing plate element into a first region where said plano reflective element is disposed and a separate and adjacent second region where said auxiliary reflective element is disposed, and wherein at least one of (a) said first region is adapted to receive said plano reflective element and (b) said second region is adapted to receive said auxiliary reflective element.

52. The exterior sideview mirror system of claim 51, wherein said auxiliary reflective element comprises a heater element operable to demist/deice the outmost surface of said auxiliary reflective element when said auxiliary reflective element is disposed at said backing plate element and when said exterior sideview mirror assembly is attached and operated on the side of the automobile.

53. The exterior sideview mirror system of claim 40, wherein said exterior sideview mirror assembly including said plano-auxiliary reflective element having a rearward field of view when attached to the side of the automobile comprises a driver-side exterior sideview mirror assembly,

and wherein, when attached to the side of the automobile, said driver-side exterior sideview mirror assembly provides to the driver of the equipped automobile a total field of view that generally subtends an angle of at least about 25 degrees with respect to the side of the equipped automobile.

54. The exterior sideview mirror system of claim 40, wherein said auxiliary reflective element has an aspherical curvature.

55. The exterior sideview mirror system of claim 40, wherein said auxiliary reflective element has a spherical curvature.

56. The exterior sideview mirror system of claim 40, wherein the ratio of the width of said plano reflective element to the width of said auxiliary reflective element is greater than 1.5.

57. The exterior sideview mirror system of claim 40, wherein said exterior sideview mirror assembly comprises a door-mounted exterior sideview mirror assembly adapted for attachment to a side of the automobile adjacent a driver seating location of a driver of the automobile and wherein the rearward field of view of said auxiliary reflective element generally views downwardly towards the road surface adjacent to the driver seating location at least at a distance in the range of about 1 foot to about 24 feet to the rear of the driver seating location.

58. The exterior sideview mirror system of claim 40, wherein at least one of said plano reflective element and said auxiliary reflective element comprises a glass substrate having a surface coated with a metallic reflector coating, and wherein said metallic reflector coating is selected from the group consisting of (i) a chromium coating, (ii) a titanium coating, (iii) a rhodium coating, (iv) a metal-alloy coating, (v) a nickel alloy coating, (vi) an aluminum coating and (vii) a silver coating.

59. The exterior sideview mirror system of claim 58, wherein said plano reflective element comprises an electro-optic reflective element.

60. The exterior sideview mirror system of claim 40, wherein said auxiliary reflective element comprises a fixed reflectance mirror reflector and said fixed reflectance mirror reflector comprises a curved substrate coated with a metallic reflector coating.

61. The exterior sideview mirror system of claim 60, wherein said curved substrate comprises a spherically bent glass substrate.

62. An exterior sideview mirror system suitable for use on an automobile, said exterior sideview mirror system comprising:

an exterior sideview mirror assembly adapted for attachment to a side of an automobile;

said exterior sideview mirror assembly including a reflective element having a rearward field of view when attached to the side of the automobile;

said reflective element attached to an electrically-operated actuator of said exterior sideview mirror assembly and movable by said actuator in order to position said rearward field of view to a driver-desired position when said exterior sideview mirror assembly is attached to the side of the automobile;

wherein said reflective element comprises a plano-auxiliary reflective element assembly, said plano-auxiliary reflective element assembly comprising a plano reflective element having unit magnification and a separate auxiliary reflective element having a curvature;

said plano reflective element and said auxiliary reflective element of said plano-auxiliary reflective element assembly mounted adjacently at said plano-auxiliary reflective element assembly in a side-by-side relationship and not superimposed with one reflective element on top of the other reflective element;

said plano reflective element and said auxiliary reflective element supported at a backing plate element, said backing plate element mounting to said actuator such that movement of said backing plate element of said plano-auxiliary reflective element assembly by said actuator simultaneously and similarly moves said plano reflective element and said auxiliary reflective element;

said auxiliary reflective element having a wide-angle field of view encompassing a blind spot in the side lane adjacent the side of the automobile to which said exterior sideview mirror assembly is attached;

said backing plate element having a first support portion supporting said plano reflective element and a second support portion supporting said auxiliary reflective element;

wherein said auxiliary reflective element is positioned at an outboard portion of said plano-auxiliary reflective element assembly when said exterior sideview mirror assembly is mounted to the side of the automobile;

wherein said backing plate element comprises a polymeric substrate that is formed as a single element by injection molding of a polymeric resin;

wherein said backing plate element is capable of supporting said plano reflective element and said auxiliary reflective element;

wherein said first support portion of said backing plate element comprises a flat portion and wherein said plano reflective element is disposed at said flat portion;

wherein said second support portion of said backing plate element comprises a curved portion and wherein said auxiliary reflective element is disposed at said curved portion;

wherein at least one of said plano reflective element and said auxiliary reflective element comprises one of (a) a glass substrate having a surface coated with a metallic reflector coating and (b) a polymeric substrate having a thin glass element applied to a surface thereof and with an opposing surface thereof having a reflecting layer applied thereto;

wherein said plano reflective element and said auxiliary reflective element are adjacently supported at said backing plate element at a joint, and wherein said plano-auxiliary reflective element assembly includes a demarcation element, said demarcation element disposed at said joint to form a demarcation between said plano reflective element and said auxiliary reflective element, said demarcation element having a portion visible to a driver of the automobile when said exterior sideview mirror assembly is attached to the side of the automobile;

wherein at least a portion of said auxiliary reflective element adjacent said plano reflective element has its front surface generally coplanar with the front surface of said plano reflective element;

wherein said demarcation element is dark colored;

wherein said demarcation element comprises a polymer material;

wherein said joint comprises a space between said plano reflective element and said auxiliary reflective element;

wherein said demarcation element is at least partially disposed at said space between said plano reflective element and said auxiliary reflective element;

wherein said demarcation element comprises a wall on said backing plate element, said wall located on said backing plate element at said joint, said wall disposed between said plano reflective element and said auxiliary reflective element; and

wherein, when said exterior sideview mirror assembly is attached to the side of the automobile, the entirety of said auxiliary reflective element is further distant from the side of the equipped automobile than the entirety of said plano reflective element.

63. The exterior sideview mirror system of claim 62, wherein the rearward field of view of said auxiliary reflective element is at an angle of at least about 3 degrees relative to the rearward field of view of said plano reflective element.

64. The exterior sideview mirror system of claim 62, wherein the rearward field of view of said auxiliary reflective element is generally directed at least one of outwardly and downwardly with respect to the longitudinal axis of the equipped automobile when said exterior sideview mirror assembly is attached to the side of the automobile.

65. The exterior sideview mirror system of claim 62, wherein said plano reflective element is supported at said backing plate element by at least one of an adhesive attachment and a mechanical attachment and wherein said auxiliary reflective element is supported at said backing plate element by at least one of an adhesive attachment and a mechanical attachment, and wherein said auxiliary reflective element comprises a glass substrate having a surface coated with a metallic reflector coating and wherein said auxiliary reflective element comprises a bent glass substrate.

66. The exterior sideview mirror system of claim 62, wherein said plano reflective element comprises a glass substrate having a surface coated with a metallic reflector coating and wherein said auxiliary reflective element comprises a glass substrate having a surface coated with a metallic reflector coating, and wherein said auxiliary reflective element comprises a bent glass substrate.

67. The exterior sideview mirror system of claim 62, wherein said plano reflective element comprises a flat glass substrate having a surface coated with a metallic reflector coating and

wherein said auxiliary reflective element comprises a bent glass substrate having a surface coated with a metallic reflector coating, and wherein said bent glass substrate has an aspherical curvature.

68. The exterior sideview mirror system of claim 62, wherein said plano reflective element comprises a substrate having a surface coated with a metallic reflector coating and wherein said auxiliary reflective element comprises a substrate having a surface coated with a metallic reflector coating, and wherein said curved portion of said backing plate element comprises a curvature corresponding to a curvature of said auxiliary reflective element, and wherein said curved portion of said backing plate element comprises at least one of (a) a spherical curvature, (b) an aspherical curvature and (c) a multiradius curvature.

69. The exterior sideview mirror system of claim 62, wherein said demarcation element comprises a wall structure that at least partially partitions said backing plate element into a first region where said plano reflective element is disposed and a separate and adjacent second region where said auxiliary reflective element is disposed, and wherein at least one of (a) said first region is adapted to receive said plano reflective element and (b) said second region is adapted to receive said auxiliary reflective element.

70. The exterior sideview mirror system of claim 69, wherein said auxiliary reflective element comprises a heater element operable to demist/deice the outmost surface of said auxiliary reflective element when said auxiliary reflective element is disposed at said backing plate element and when said exterior sideview mirror assembly is attached and operated on the side of the automobile.

71. The exterior sideview mirror system of claim 62, wherein said exterior sideview mirror assembly including said plano-auxiliary reflective element having a rearward field of view when attached to the side of the automobile comprises a driver-side exterior sideview mirror assembly, and wherein, when attached to the side of the automobile, said driver-side exterior sideview mirror assembly provides to the driver of the equipped automobile a total field of view that generally subtends an angle of at least about 25 degrees with respect to the side of the equipped automobile.

72. The exterior sideview mirror system of claim 62, wherein said auxiliary reflective element has an aspherical curvature.

73. The exterior sideview mirror system of claim 62, wherein the ratio of the width of said plano reflective element to the width of said auxiliary reflective element is greater than 1.5.

74. The exterior sideview mirror system of claim 62, wherein said exterior sideview mirror assembly comprises a door-mounted exterior sideview mirror assembly adapted for attachment to a side of the automobile adjacent a driver seating location of a driver of the automobile and wherein the rearward field of view of said auxiliary reflective element generally views downwardly towards the road surface adjacent to the driver seating location at least at a distance in the range of about 1 foot to about 24 feet to the rear of the driver seating location.

75. The exterior sideview mirror system of claim 62, wherein at least one of said plano reflective element and said auxiliary reflective element comprises a glass substrate having a surface coated with a metallic reflector coating, and wherein said metallic reflector coating is selected from the group consisting of (i) a chromium coating, (ii) a titanium coating, (iii) a rhodium coating, (iv) a metal-alloy coating, (v) a nickel alloy coating, (vi) an aluminum coating and (vii) a silver coating.

76. The exterior sideview mirror system of claim 62, wherein said plano reflective element comprises an electro-optic reflective element.

77. The exterior sideview mirror system of claim 76, wherein said auxiliary reflective element comprises a fixed reflectance mirror reflector and wherein said fixed reflectance mirror reflector comprises a curved substrate coated with a metallic reflector coating.

78. An exterior sideview mirror system suitable for use on an automobile, said exterior sideview mirror system comprising:

an exterior sideview mirror assembly adapted for attachment to a side of an automobile;

said exterior sideview mirror assembly including a reflective element having a rearward field of view when attached to the side of the automobile;

said reflective element attached to an electrically-operated actuator of said exterior sideview mirror assembly and movable by said actuator in order to position said rearward field of view to a driver-desired position when said exterior sideview mirror assembly is attached to the side of the automobile;

wherein said reflective element comprises a plano-auxiliary reflective element assembly, said plano-auxiliary reflective element assembly comprising a plano reflective element having unit magnification and a separate auxiliary reflective element having a curvature;

said plano reflective element and said auxiliary reflective element of said plano-auxiliary reflective element assembly mounted adjacently at said plano-auxiliary reflective element assembly in a side-by-side relationship and not superimposed with one reflective element on top of the other reflective element;

said plano reflective element and said auxiliary reflective element supported at a backing plate element, said backing plate element mounting to said actuator such that movement of said backing plate element of said plano-auxiliary reflective element assembly by said actuator simultaneously and similarly moves said plano reflective element and said auxiliary reflective element;

said auxiliary reflective element having a wide-angle field of view encompassing a blind spot in the side lane adjacent the side of the automobile to which said exterior sideview mirror assembly is attached;

said backing plate element having a first support portion supporting said plano reflective element and a second support portion supporting said auxiliary reflective element;

wherein said auxiliary reflective element is positioned at an outboard portion of said plano-auxiliary reflective element assembly when said exterior sideview mirror assembly is mounted to the side of the automobile;

wherein said backing plate element comprises a polymeric substrate that is formed as a single element by injection molding of a polymeric resin;

wherein said backing plate element is capable of supporting said plano reflective element and said auxiliary reflective element;

wherein said first support portion of said backing plate element comprises a flat portion and wherein said plano reflective element is disposed at said flat portion;

wherein said second support portion of said backing plate element comprises a curved portion and wherein said auxiliary reflective element is disposed at said curved portion;

wherein the rearward field of view of said auxiliary reflective element is different from and angled to the rearward field of view of said plano reflective element when both are attached to said backing plate element of said plano-auxiliary reflective element assembly when said plano-auxiliary reflective element assembly is included in said exterior sideview mirror assembly and when said exterior sideview mirror assembly is attached to the side of the automobile;

wherein angling of the rearward field of view of said auxiliary reflective element relative to the rearward field of view of said plano reflective element is achieved, at least in part, by an angling of said second support portion of said backing plate element supporting said auxiliary reflective element relative to said first support portion of said backing plate element supporting said plano reflective element;

wherein, when said exterior sideview mirror assembly is attached to the side of the automobile, the field of view of said plano reflective element generally views rearwardly of the equipped automobile and the field of view of said auxiliary reflective element generally views towards a blind spot in the side lane adjacent the side of the automobile to which said exterior sideview mirror assembly is attached, said blind spot being generally outside the rearward field of view of said plano reflective element when said plano reflective element is viewed by a driver of the equipped automobile when said exterior sideview mirror assembly is attached to the side of the automobile;

wherein at least one of said plano reflective element and said auxiliary reflective element comprises one of (a) a glass substrate having a surface coated with a metallic reflector coating and (b) a polymeric substrate having a thin glass element applied to a surface thereof and with an opposing surface thereof having a reflecting layer applied thereto;

wherein the rearward field of view of said auxiliary reflective element is generally directed at least one of outwardly and downwardly with respect to the longitudinal axis of the equipped automobile when said exterior sideview mirror assembly is attached to the side of the automobile;

wherein said exterior sideview mirror assembly including said plano-auxiliary reflective element having a rearward field of view when attached to the side of the automobile comprises a driver-side exterior sideview mirror assembly, and wherein, when attached to the side of the automobile, said driver-side exterior sideview mirror assembly provides to the driver of the equipped automobile a total field of view that generally subtends an angle of at least about 25 degrees with respect to the side of the equipped automobile; and

wherein said auxiliary reflective element comprises a fixed reflectance mirror reflector.

79. The exterior sideview mirror system of claim 78, wherein said auxiliary reflective element comprises a polymeric substrate having a thin glass element applied to a surface thereof and with an opposing surface thereof having a reflecting layer applied thereto.

80. The exterior sideview mirror system of claim 79, wherein said plano reflective element comprises a thin flexible glass sheet and a polymeric substrate, said thin flexible glass sheet existing as a pre-formed glass sheet that is separate from said polymeric substrate, said thin glass sheet having an attaching surface, said attaching surface being opposed to and adhered to said surface of said polymeric substrate when said thin flexible sheet is adhered to said exterior surface of said polymeric substrate, said thin flexible sheet providing an anti-abrasion function at said surface of said polymeric substrate when adhered thereto, said thin flexible glass sheet substantially conforming to said exterior surface of said polymeric substrate when adhered thereto, said thin glass sheet having a thickness of less than approximately 0.8 mm and greater than approximately 0.3 mm.

81. The exterior sideview mirror system of claim 78, wherein said auxiliary reflective element comprises a glass substrate having a surface coated with a metallic reflector coating.

82. The exterior sideview mirror system of claim 81, wherein said plano reflective element comprises a substrate having a surface coated with a metallic reflector coating and wherein said auxiliary reflective element comprises a substrate having a surface coated with a metallic reflector coating, and wherein said curved portion of said backing plate element comprises a curvature corresponding to a curvature of said auxiliary reflective element, and wherein said curved portion of said backing plate element comprises at least one of (a) a spherical curvature, (b) an aspherical curvature and (c) a multiradius curvature.

83. The exterior sideview mirror system of claim 78, wherein said auxiliary reflective element has a spherical curvature, and wherein said curved portion of said backing plate element has a spherical curvature.

84. The exterior sideview mirror system of claim 78, wherein said plano reflective element comprises a flat glass substrate having a surface coated with a metallic reflector coating and wherein said auxiliary reflective element comprises a bent glass substrate having a surface coated with a metallic reflector coating, and wherein said bent glass substrate has a spherical curvature.

85. An exterior sideview mirror system suitable for use on an automobile, said exterior sideview mirror system comprising:

an exterior sideview mirror assembly adapted for attachment to a side of an automobile;

said exterior sideview mirror assembly including a reflective element having a rearward field of view when attached to the side of the automobile;

said reflective element attached to an electrically-operated actuator of said exterior sideview mirror assembly and movable by said actuator in order to position said rearward field of view to a driver-desired position when said exterior sideview mirror assembly is attached to the side of the automobile;

wherein said reflective element comprises a plano-auxiliary reflective element assembly, said plano-auxiliary reflective element assembly comprising a plano reflective element having unit magnification and a separate auxiliary reflective element having a curvature;

said plano reflective element and said auxiliary reflective element of said plano-auxiliary reflective element assembly mounted adjacently at said plano-auxiliary reflective element assembly in a side-by-side relationship and not superimposed with one reflective element on top of the other reflective element;

said plano reflective element and said auxiliary reflective element supported at a backing plate element, said backing plate element mounting to said actuator such that movement of said backing plate element of said plano-auxiliary reflective element assembly by said actuator simultaneously and similarly moves said plano reflective element and said auxiliary reflective element;

said auxiliary reflective element having a wide-angle field of view encompassing a blind spot in the side lane adjacent the side of the automobile to which said exterior sideview mirror assembly is attached;

said backing plate element having a first support portion supporting said plano reflective element and a second support portion supporting said auxiliary reflective element;

wherein said auxiliary reflective element is positioned at an outboard portion of said plano-auxiliary reflective element assembly when said exterior sideview mirror assembly is mounted to the side of the automobile;

wherein said backing plate element comprises a polymeric substrate that is formed as a single element by injection molding of a polymeric resin;

wherein said backing plate element is capable of supporting said plano reflective element and said auxiliary reflective element;

wherein said first support portion of said backing plate element comprises a flat portion and wherein said plano reflective element is disposed at said flat portion;

wherein said second support portion of said backing plate element comprises a curved portion and wherein said auxiliary reflective element is disposed at said curved portion;

wherein the rearward field of view of said auxiliary reflective element is different from and angled to the rearward field of view of said plano reflective element when both are attached to said backing plate element of said plano-auxiliary reflective element assembly when said plano-auxiliary reflective element assembly is included in said exterior sideview mirror assembly and when said exterior sideview mirror assembly is attached to the side of the automobile;

wherein angling of the rearward field of view of said auxiliary reflective element relative to the rearward field of view of said plano reflective element is achieved, at least in part, by an angling of said second support portion of said backing plate element supporting said auxiliary reflective element relative to said first support portion of said backing plate element supporting said plano reflective element;

wherein, when said exterior sideview mirror assembly is attached to the side of the automobile, the field of view of said plano reflective element generally views rearwardly of the equipped automobile and the field of view of said auxiliary reflective element generally views towards a blind spot in the side lane adjacent the side of the automobile to which said exterior sideview mirror assembly is attached, said blind spot being generally outside the rearward field of view of said plano reflective element when said plano reflective element is viewed by a driver of the equipped automobile when said exterior sideview mirror assembly is attached to the side of the automobile;

wherein said plano reflective element comprises one of (a) a glass substrate having a surface coated with a metallic reflector coating and (b) a polymeric substrate having a thin glass element applied to a surface thereof and with an opposing surface thereof having a reflecting layer applied thereto; and

wherein said auxiliary reflective element comprises a fixed reflectance mirror reflector and wherein said fixed reflectance mirror reflector comprises a spherically bent glass substrate coated with a metallic reflector coating.

86. The exterior sideview mirror system of claim 85, wherein said plano reflective element comprises a glass substrate having a surface coated with a metallic reflector coating and wherein said curved portion of said backing plate element comprises a curvature corresponding to a curvature of said auxiliary reflective element.

87. The exterior sideview mirror system of claim 86, wherein a demarcation element is disposed between said plano reflective element and said auxiliary reflective element and wherein said demarcation element comprises a part of said backing plate element, and wherein said demarcation element at least partially partitions said backing plate element into a first region where said plano reflective element is disposed and a separate and adjacent second region where said auxiliary reflective element is disposed, and wherein said first region is adapted to receive said plano reflective element and said second region is adapted to receive said auxiliary reflective element.

88. The exterior sideview mirror system of claim 87, wherein said exterior sideview mirror assembly including said plano-auxiliary reflective element having a rearward field of view when attached to the side of the automobile comprises a driver-side exterior sideview mirror assembly, and wherein, when attached to the side of the automobile, said driver-side exterior sideview mirror assembly provides to the driver of the equipped automobile a total field of view that generally subtends an angle of at least about 25 degrees with respect to the side of the equipped automobile.

89. An exterior sideview mirror system suitable for use on an automobile, said exterior sideview mirror system comprising:

an exterior sideview mirror assembly adapted for attachment to a side of an automobile;

said exterior sideview mirror assembly including a reflective element having a rearward field of view when attached to the side of the automobile;

said reflective element attached to an electrically-operated actuator of said exterior sideview mirror assembly and movable by said actuator in order to position said rearward field of view to a driver-desired position when said exterior sideview mirror assembly is attached to the side of the automobile;

wherein said reflective element comprises a plano-auxiliary reflective element assembly, said plano-auxiliary reflective element assembly comprising a plano reflective element having unit magnification and a separate auxiliary reflective element having a curvature;

said plano reflective element and said auxiliary reflective element of said plano-auxiliary reflective element assembly mounted adjacently at said plano-auxiliary reflective element assembly in a side-by-side relationship and not superimposed with one reflective element on top of the other reflective element;

said plano reflective element and said auxiliary reflective element supported at a backing plate element, said backing plate element mounting to said actuator such that movement of said backing plate element of said plano-auxiliary reflective element assembly by said actuator simultaneously and similarly moves said plano reflective element and said auxiliary reflective element;

said auxiliary reflective element having a wide-angle field of view encompassing a blind spot in the side lane adjacent the side of the automobile to which said exterior sideview mirror assembly is attached;

said backing plate element having a first support portion supporting said plano reflective element and a second support portion supporting said auxiliary reflective element;

wherein said auxiliary reflective element is positioned at an outboard portion of said plano-auxiliary reflective element assembly when said exterior sideview mirror assembly is mounted to the side of the automobile;

wherein said backing plate element comprises a polymeric substrate that is formed as a single element by injection molding of a polymeric resin;

wherein said backing plate element is capable of supporting said plano reflective element and said auxiliary reflective element;

wherein said first support portion of said backing plate element comprises a flat portion and wherein said plano reflective element is disposed at said flat portion;

wherein said second support portion of said backing plate element comprises a curved portion and wherein said auxiliary reflective element is disposed at said curved portion;

wherein the rearward field of view of said auxiliary reflective element is different from and angled to the rearward field of view of said plano reflective element when both are attached to said backing plate element of said plano-auxiliary reflective element assembly when said plano-auxiliary reflective element assembly is included in said exterior sideview mirror assembly and when said exterior sideview mirror assembly is attached to the side of the automobile;

wherein angling of the rearward field of view of said auxiliary reflective element relative to the rearward field of view of said plano reflective element is achieved, at least in part, by an angling of said second support portion of said backing plate element supporting said auxiliary reflective element relative to said first support portion of said backing plate element supporting said plano reflective element;

wherein, when said exterior sideview mirror assembly is attached to the side of the automobile, the field of view of said plano reflective element generally views rearwardly of the equipped automobile and the field of view of said auxiliary reflective element generally views towards a blind spot in the side lane adjacent the side of the automobile to which said exterior sideview mirror assembly is attached, said blind spot being generally outside the rearward field of view of said plano reflective element when said plano reflective element is viewed by a driver of the equipped automobile when said exterior sideview mirror assembly is attached to the side of the automobile;

wherein said plano reflective element comprises one of (a) a glass substrate having a surface coated with a metallic reflector coating and (b) a polymeric substrate having a thin glass element applied to a surface thereof and with an opposing surface thereof having a reflecting layer applied thereto;

wherein said auxiliary reflective element comprises a fixed reflectance mirror reflector and wherein said fixed reflectance mirror reflector comprises a curved substrate coated with a metallic reflector coating; and wherein said plano reflective element and said auxiliary reflective element are adjacently supported at said backing plate element at a joint and wherein said joint comprises a space between said plano reflective element and said auxiliary reflective element and wherein a wall located on said backing plate element at said joint is disposed between said plano reflective element and said auxiliary reflective element.

90. The exterior sideview mirror system of claim 89, wherein said plano reflective element comprises a glass substrate having a surface coated with a metallic reflector coating, wherein said auxiliary reflective element comprises a fixed reflectance mirror reflector and wherein said fixed reflectance mirror reflector comprises a spherically bent glass substrate coated with a metallic reflector coating, wherein said curved portion of said backing plate element comprises a curvature corresponding to a curvature of said auxiliary reflective element, wherein said wall at least partially partitions said backing plate element into a first region where said plano reflective element is disposed and a separate and adjacent second region where said auxiliary reflective element is disposed, and wherein said first region is adapted to receive said plano reflective element and said second region is adapted to receive said auxiliary reflective element and wherein said exterior sideview mirror assembly including said plano-auxiliary reflective element having a rearward field of view when attached to the side of the automobile comprises a driver-side exterior sideview mirror assembly, and wherein, when attached to the side of the automobile, said driver-side exterior sideview mirror assembly provides to the driver of the equipped automobile a total field of view that generally subtends an angle of at least about 25 degrees with respect to the side of the equipped automobile.

91. An exterior sideview mirror system suitable for use on an automobile, said exterior sideview mirror system comprising:

an exterior sideview mirror assembly adapted for attachment to a side of an automobile;

said exterior sideview mirror assembly including a reflective element having a rearward field of view when attached to the side of the automobile;

said reflective element attached to an electrically-operated actuator of said exterior sideview mirror assembly and movable by said actuator in order to position said rearward field of view to a driver-desired position when said exterior sideview mirror assembly is attached to the side of the automobile;

wherein said reflective element comprises a plano-auxiliary reflective element assembly, said plano-auxiliary reflective element assembly comprising a plano reflective element having unit magnification and a separate auxiliary reflective element having a curvature;

said plano reflective element and said auxiliary reflective element of said plano-auxiliary reflective element assembly mounted adjacently at said plano-auxiliary reflective element assembly in a side-by-side relationship and not superimposed with one reflective element on top of the other reflective element;

said plano reflective element and said auxiliary reflective element supported at a backing plate element, said backing plate element mounting to said actuator such that movement of said backing plate element of said plano-auxiliary reflective element assembly by said actuator simultaneously and similarly moves said plano reflective element and said auxiliary reflective element;

said auxiliary reflective element having a wide-angle field of view encompassing a blind spot in the side lane adjacent the side of the automobile to which said exterior sideview mirror assembly is attached;

said backing plate element having a first support portion supporting said plano reflective element and a second support portion supporting said auxiliary reflective element;

wherein said auxiliary reflective element is positioned at an outboard portion of said plano-auxiliary reflective element assembly when said exterior sideview mirror assembly is mounted to the side of the automobile;

wherein said backing plate element comprises a polymeric substrate that is formed as a single element by injection molding of a polymeric resin;

wherein said backing plate element is capable of supporting said plano reflective element and said auxiliary reflective element;

wherein said first support portion of said backing plate element comprises a flat portion and wherein said plano reflective element is disposed at said flat portion;

wherein said second support portion of said backing plate element comprises a curved portion and wherein said auxiliary reflective element is disposed at said curved portion;

wherein the rearward field of view of said auxiliary reflective element is different from and angled to the rearward field of view of said plano reflective element when both are attached to said backing plate element of said plano-auxiliary reflective element assembly when said plano-auxiliary reflective element assembly is included in said exterior sideview mirror assembly and when said exterior sideview mirror assembly is attached to the side of the automobile;

wherein angling of the rearward field of view of said auxiliary reflective element relative to the rearward field of view of said plano reflective element is achieved, at least in part, by an angling of said second support portion of said backing plate element supporting said auxiliary reflective element relative to said first support portion of said backing plate element supporting said plano reflective element;

wherein, when said exterior sideview mirror assembly is attached to the side of the automobile, the field of view of said plano reflective element generally views rearwardly of the equipped automobile and the field of view of said auxiliary reflective element generally views towards a blind spot in the side lane adjacent the side of the automobile to which said exterior sideview mirror assembly is attached, said blind spot being generally outside the rearward field of view of said plano reflective element when said plano reflective element is viewed by a driver of the equipped automobile when said exterior sideview mirror assembly is attached to the side of the automobile;

wherein said plano reflective element comprises one of (a) a glass substrate having a surface coated with a metallic reflector coating and (b) a polymeric substrate having a thin glass element applied to a surface thereof and with an opposing surface thereof having a reflecting layer applied thereto;

wherein said auxiliary reflective element comprises a fixed reflectance mirror reflector and wherein said fixed reflectance mirror reflector comprises a spherically bent glass substrate coated with a metallic reflector coating;

wherein the rearward field of view of said auxiliary reflective element is generally directed at least one of outwardly and downwardly with respect to the longitudinal axis of the equipped automobile when said exterior sideview mirror assembly is attached to the side of the automobile; and

wherein said exterior sideview mirror assembly including said plano-auxiliary reflective element having a rearward field of view when attached to the side of the automobile comprises a driver-side exterior sideview mirror assembly, and wherein, when attached to the side of the automobile, said driver-side exterior sideview mirror assembly provides to the driver of the equipped automobile a total field of view that generally subtends an angle of at least about 25 degrees with respect to the side of the equipped automobile.

92. The exterior sideview mirror system of claim 91, wherein said plano reflective element comprises a glass substrate having a surface coated with a metallic reflector coating, wherein said curved portion of said backing plate element comprises a curvature corresponding to a curvature of said auxiliary reflective element, and wherein an element of said backing plate element at least partially partitions said backing plate element into a first region where said plano reflective element is disposed and a separate and adjacent second region where said auxiliary reflective element is disposed and wherein said first region is adapted to receive said plano reflective element and said second region is adapted to receive said auxiliary reflective element.

EXTERIOR SIDEVIEW MIRROR SYSTEM

ABSTRACT OF THE DISCLOSURE

An exterior sideview mirror system includes an exterior sideview mirror assembly including a plano-auxiliary reflective element having a rearward field of view when attached to a side of an automobile. The plano reflective element and the auxiliary reflective element are mounted adjacently at the reflective element assembly in a side-by-side relationship and not superimposed. The plano reflective element and the auxiliary reflective element are supported at a backing plate element. The rearward field of view of the auxiliary reflective element may be different from and angled to the rearward field of view of the plano reflective element. The plano reflective element and/or the auxiliary reflective element may have one of (a) a glass substrate having a surface coated with a metallic reflector coating and (b) a polymeric substrate having a thin glass element applied to a surface thereof and with an opposing surface thereof having a reflecting layer applied thereto.

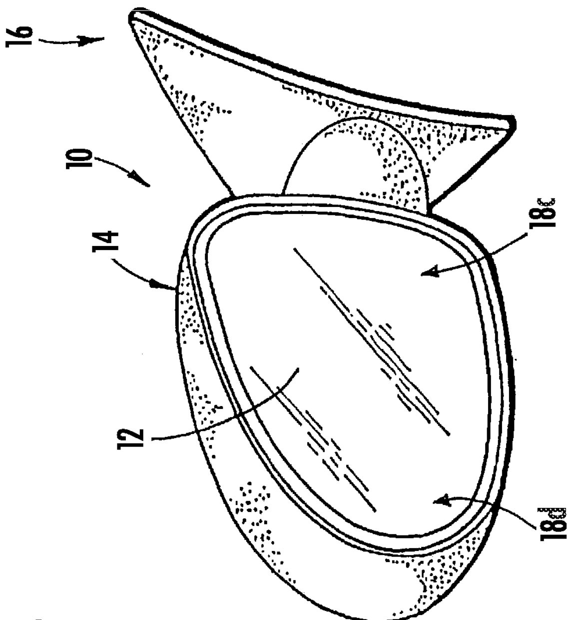


FIG. 1

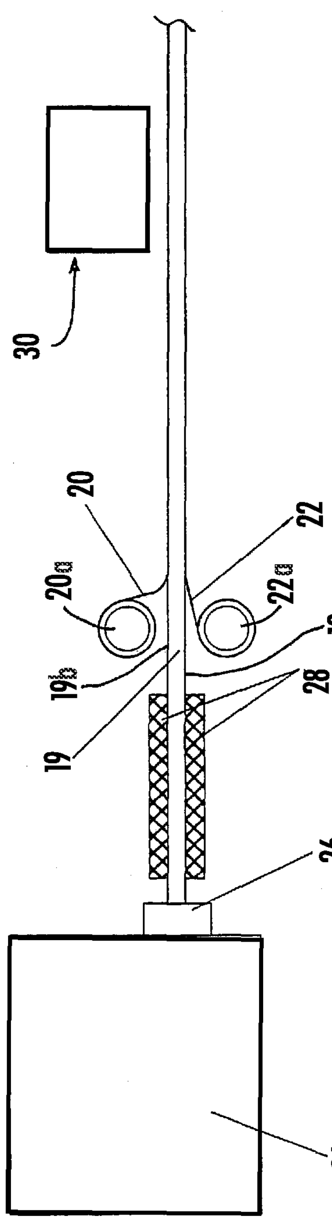


FIG. 5

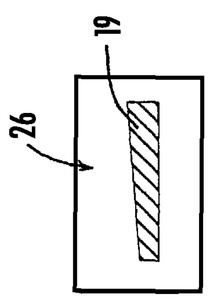
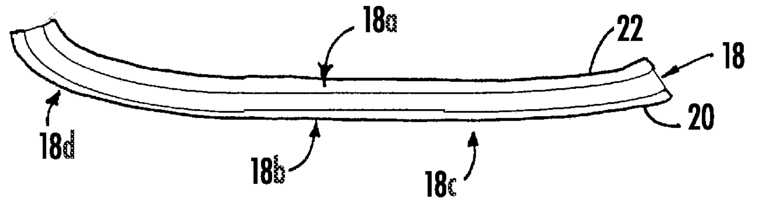


FIG. 5A

FIG. 3



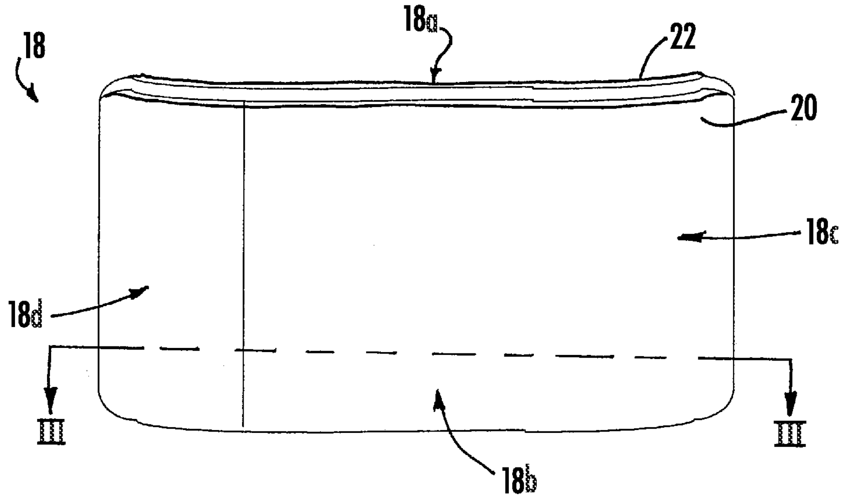
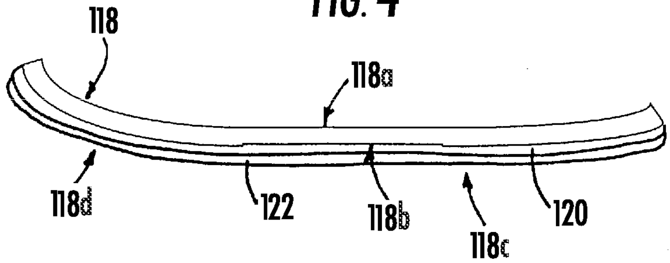


FIG. 2

FIG. 4



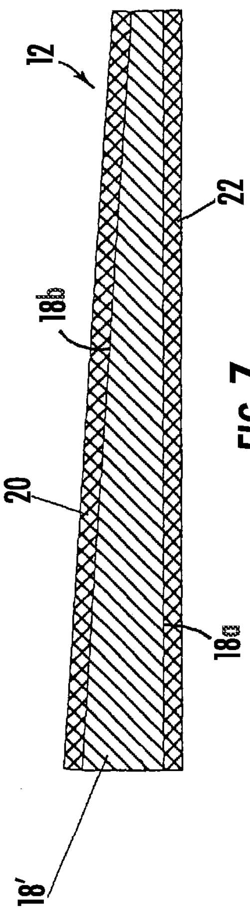


FIG. 7

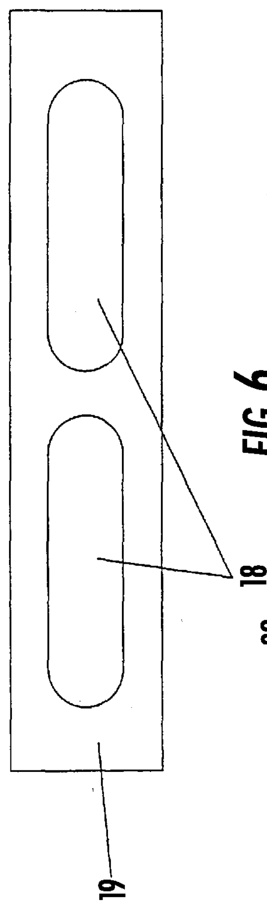


FIG. 6

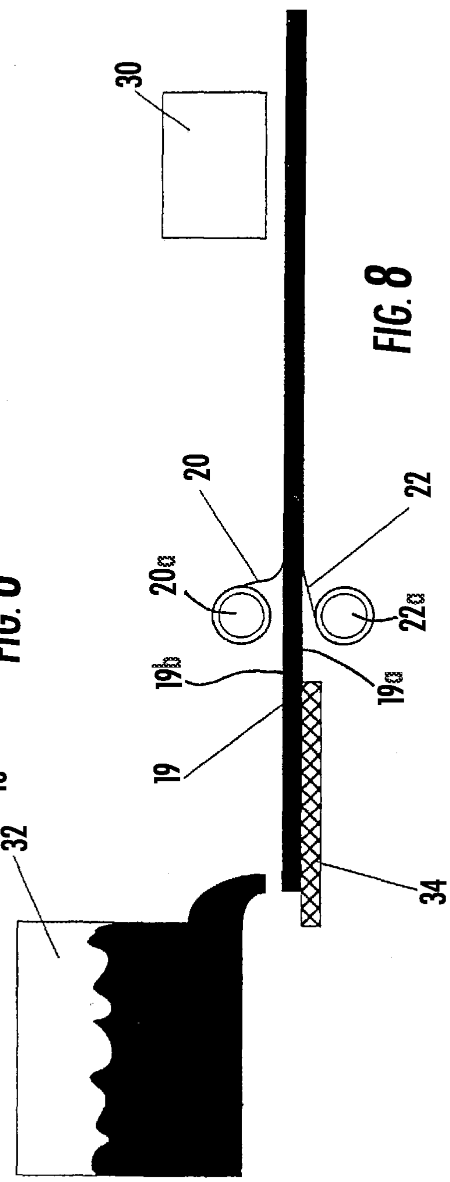


FIG. 8

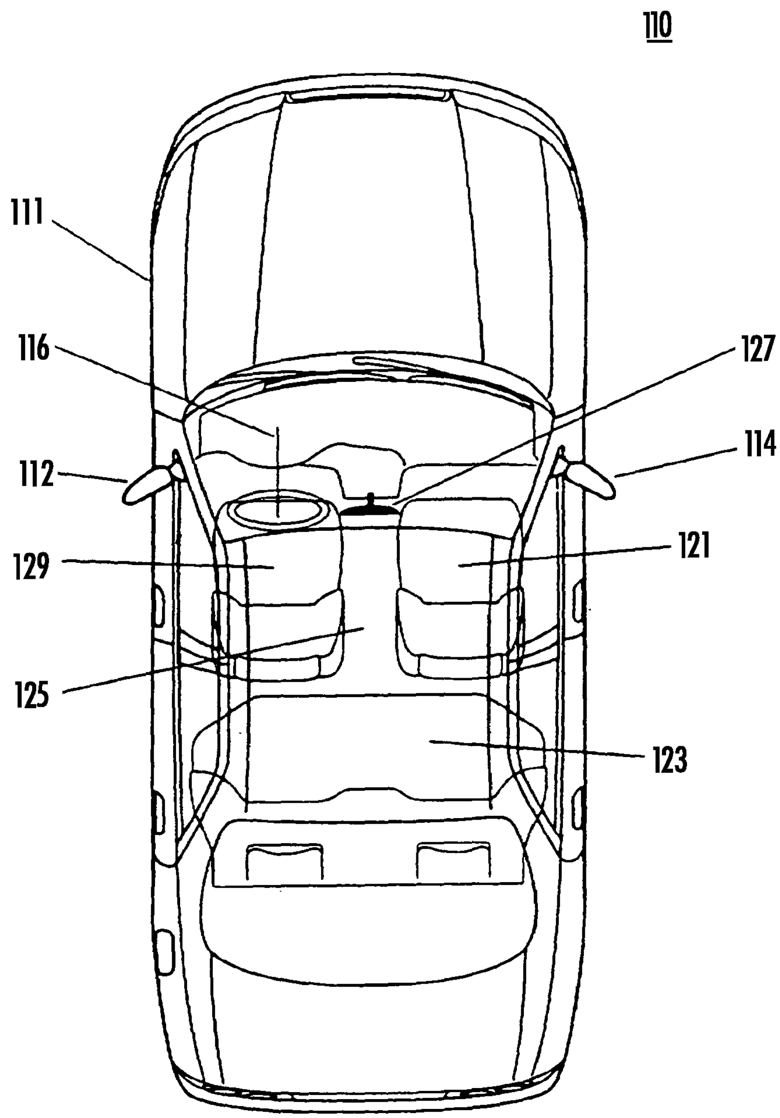


FIG. 9

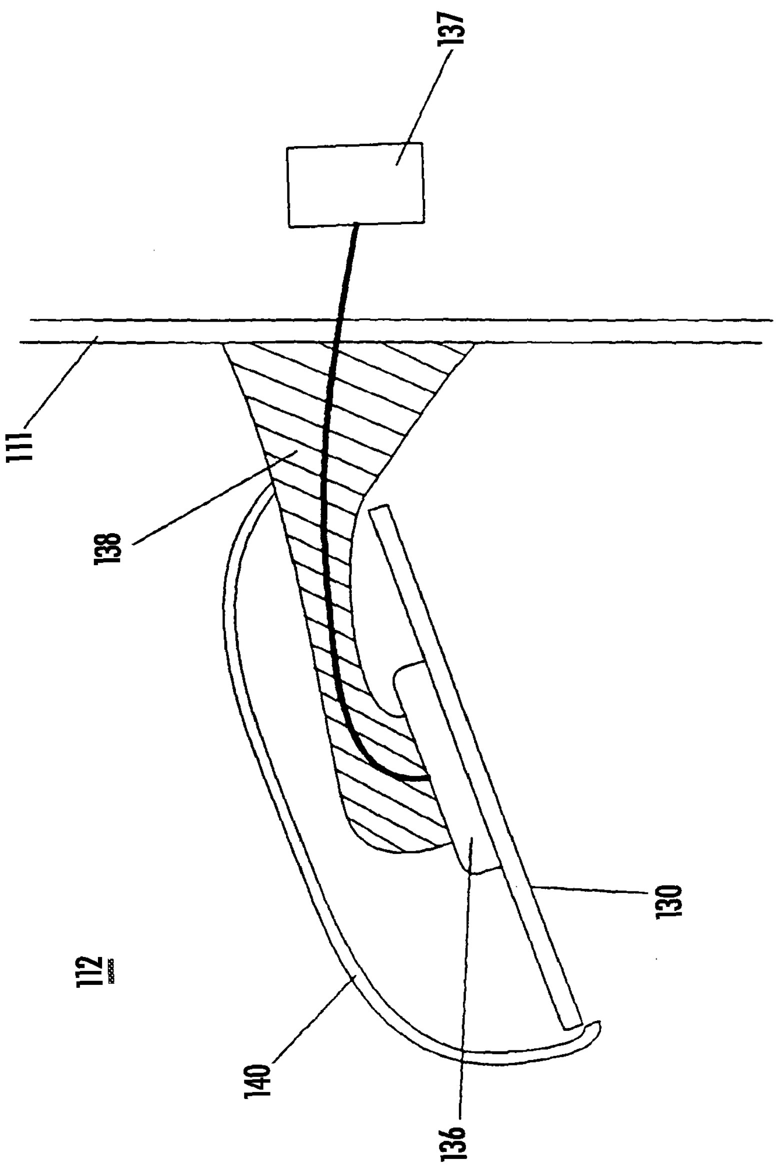


FIG. 10

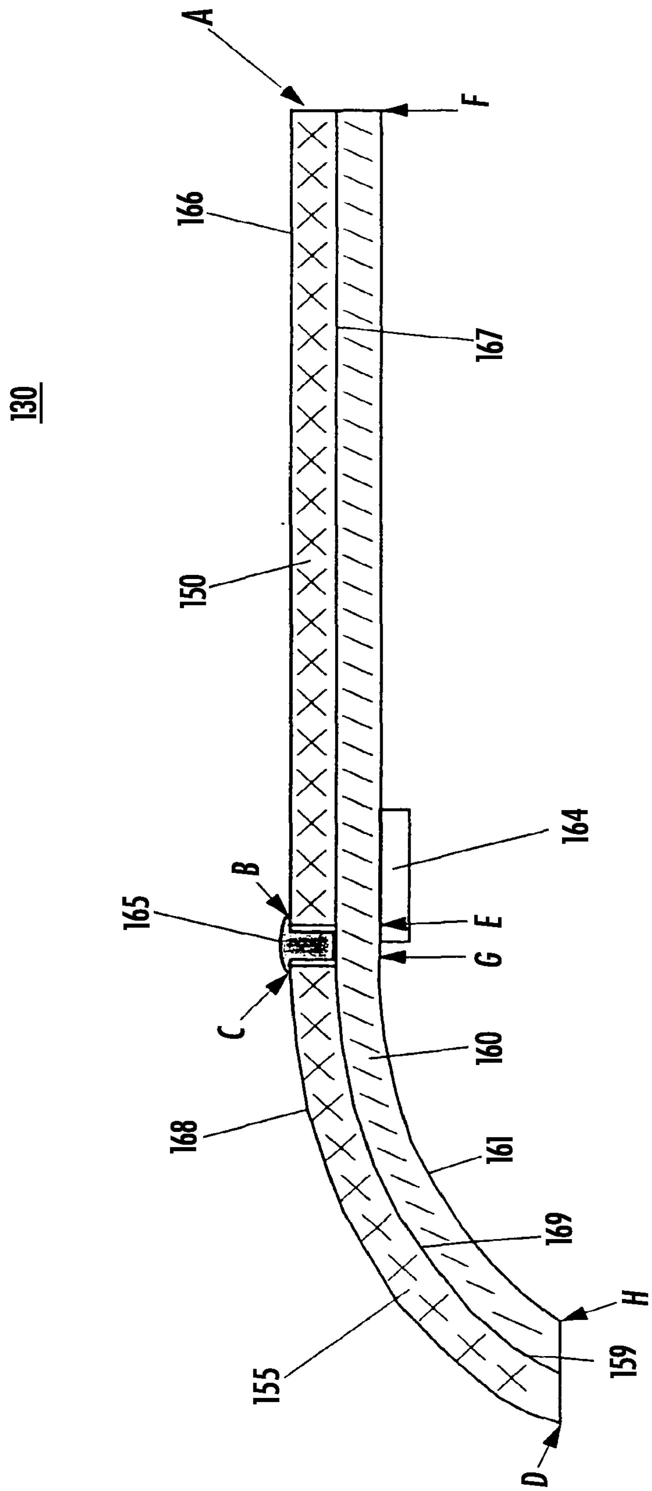


FIG. 11

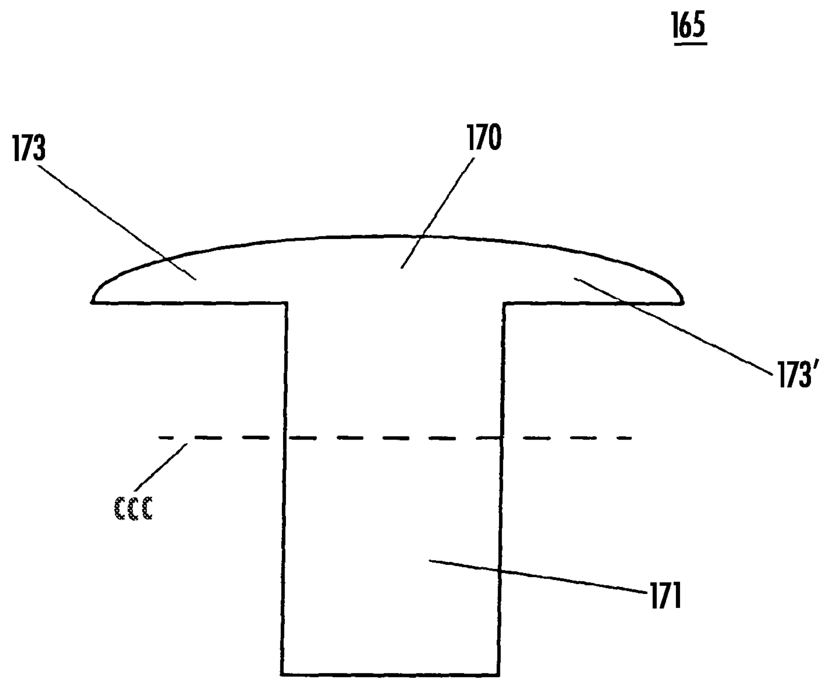


FIG. 12

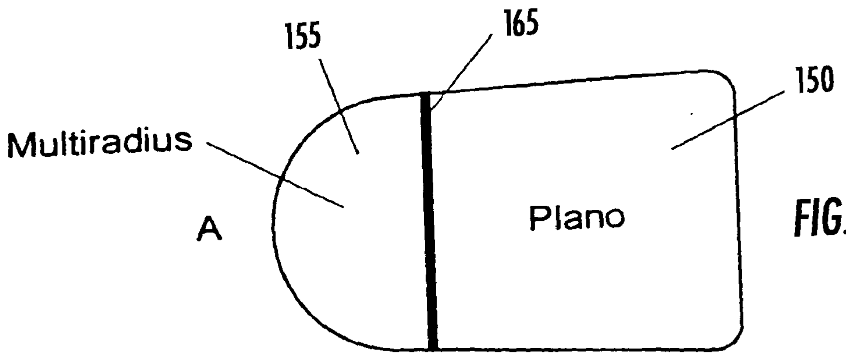


FIG. 13A

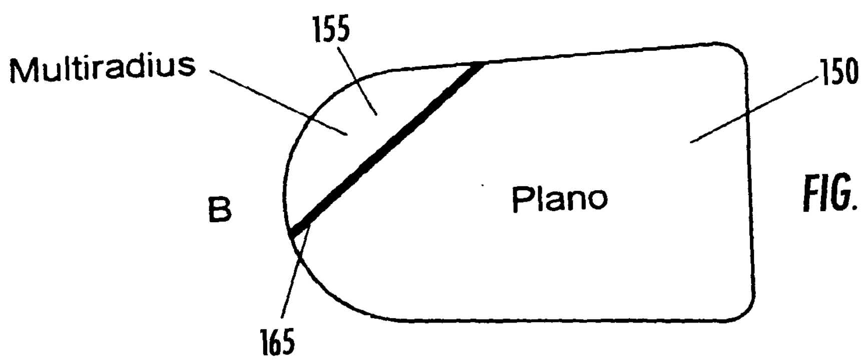


FIG. 13B

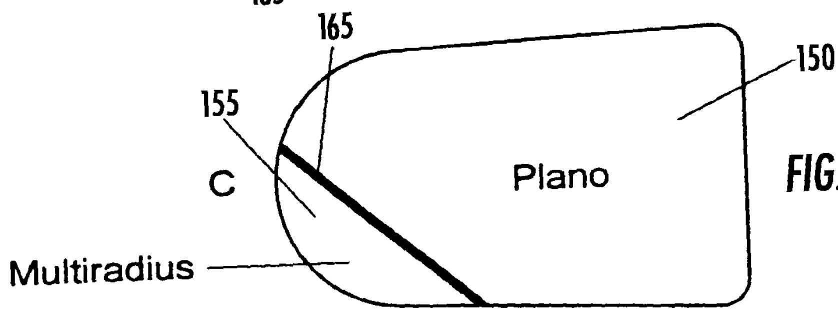


FIG. 13C

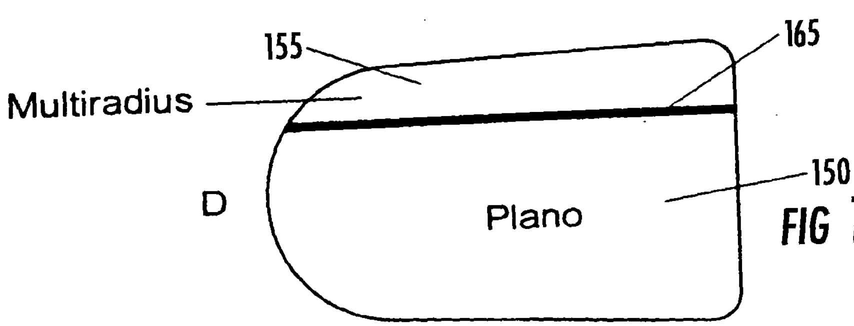


FIG 13D

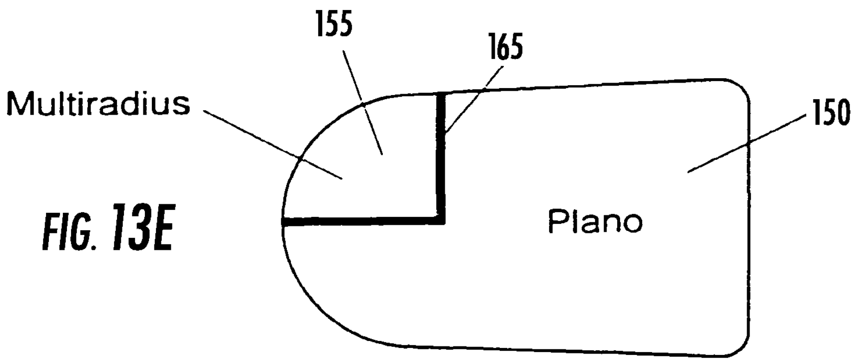


FIG. 13E

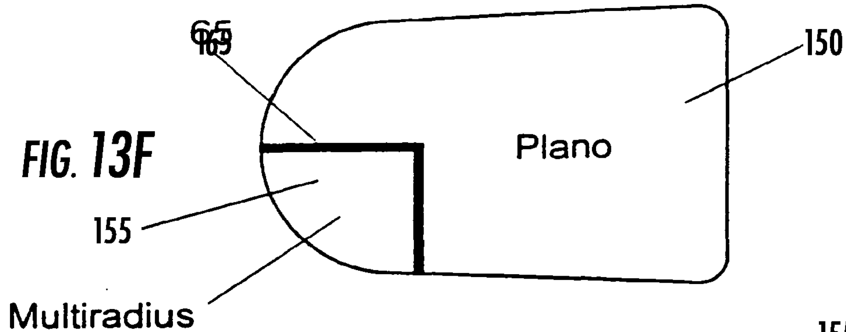


FIG. 13F

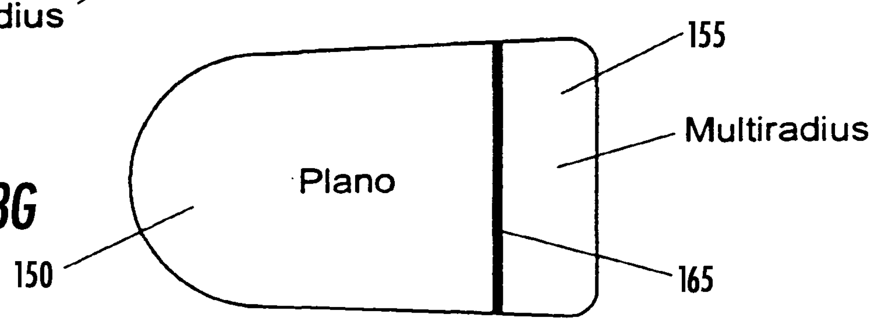


FIG. 13G

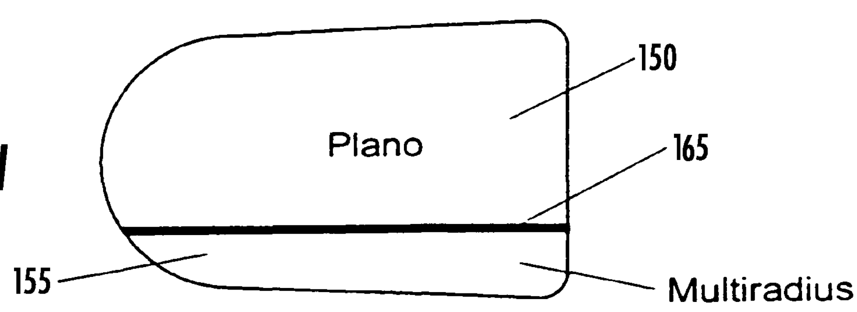


FIG. 13H

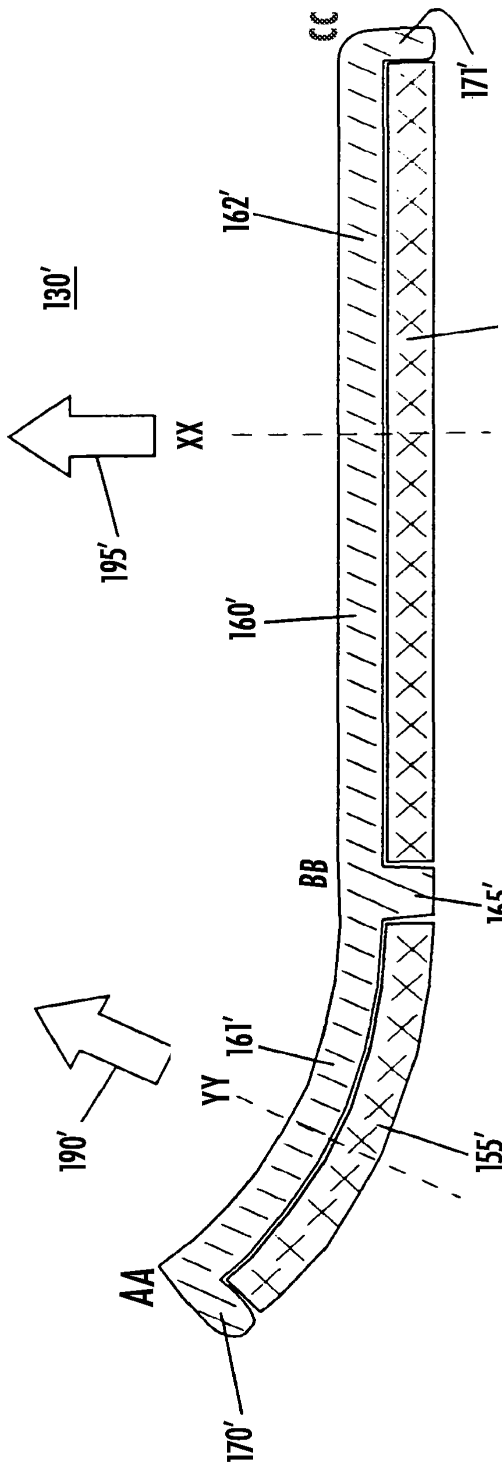


FIG. 14

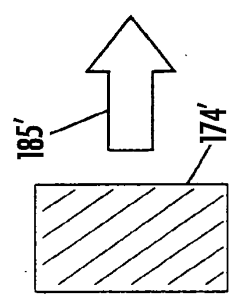


FIG. 14A

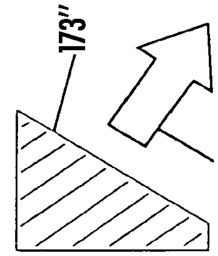


FIG. 14B

Applicant : Niall R. Lynam
Title : EXTERIOR SIDEVIEW MIRROR SYSTEM
Docket No. : DON09 P-1624
Sheet No. : 11 of 16

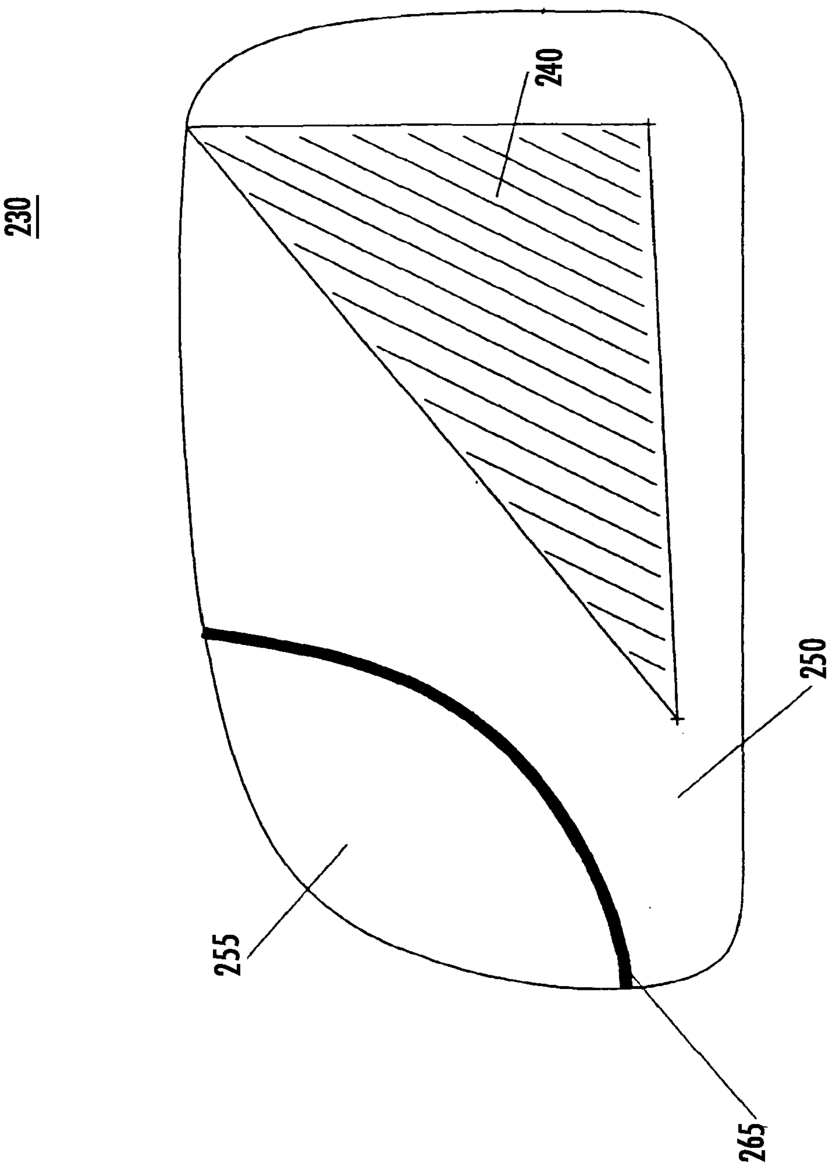
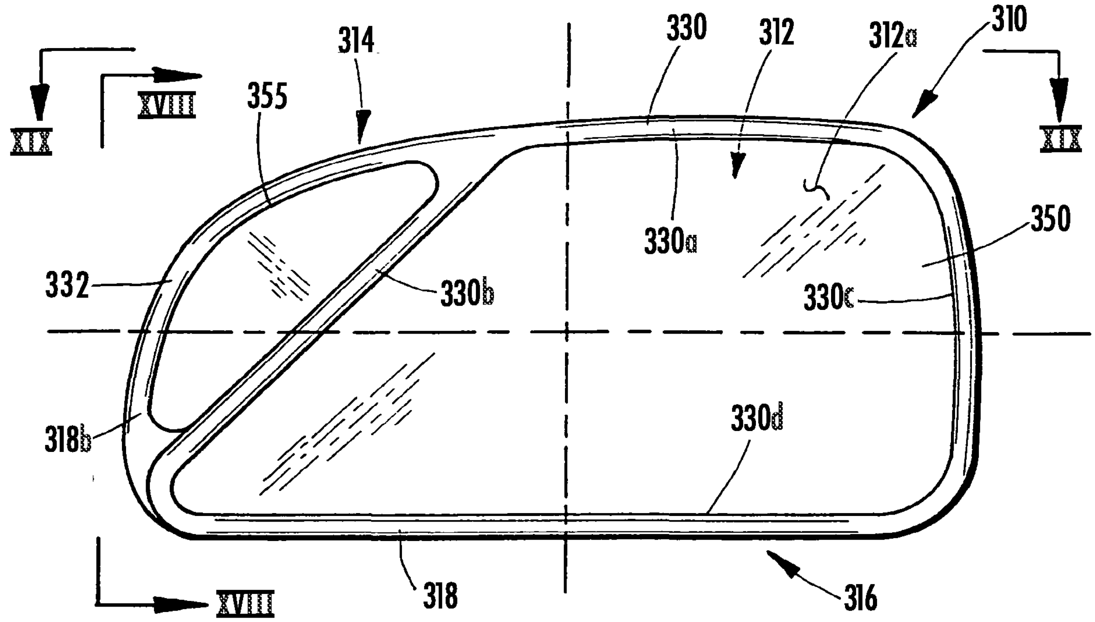


FIG. 15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316

FIG. 16

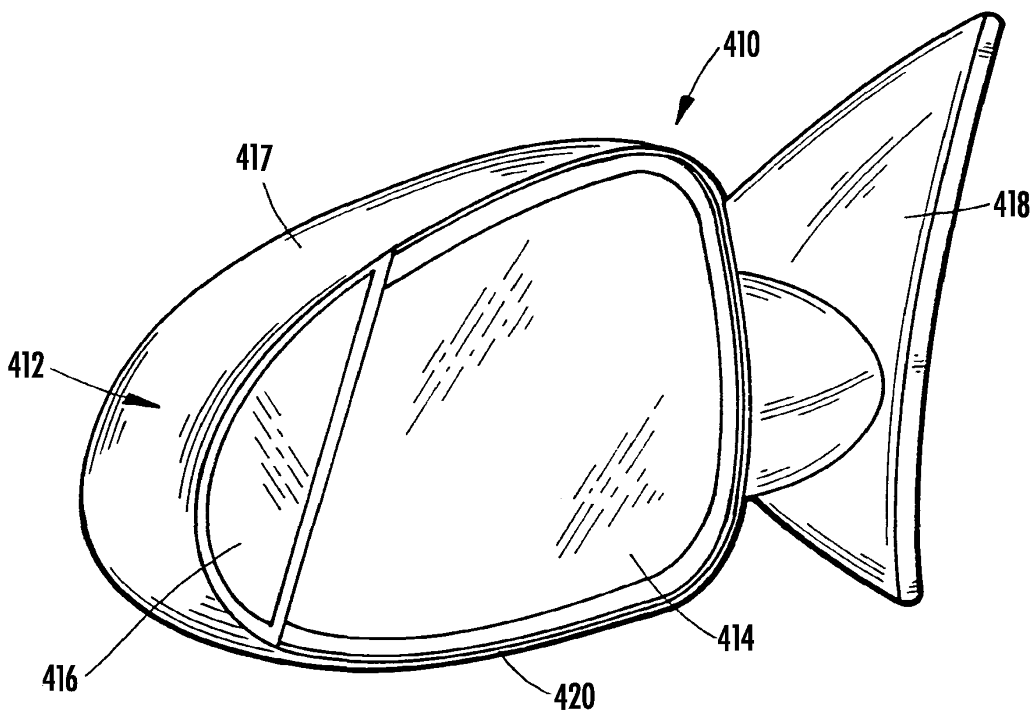
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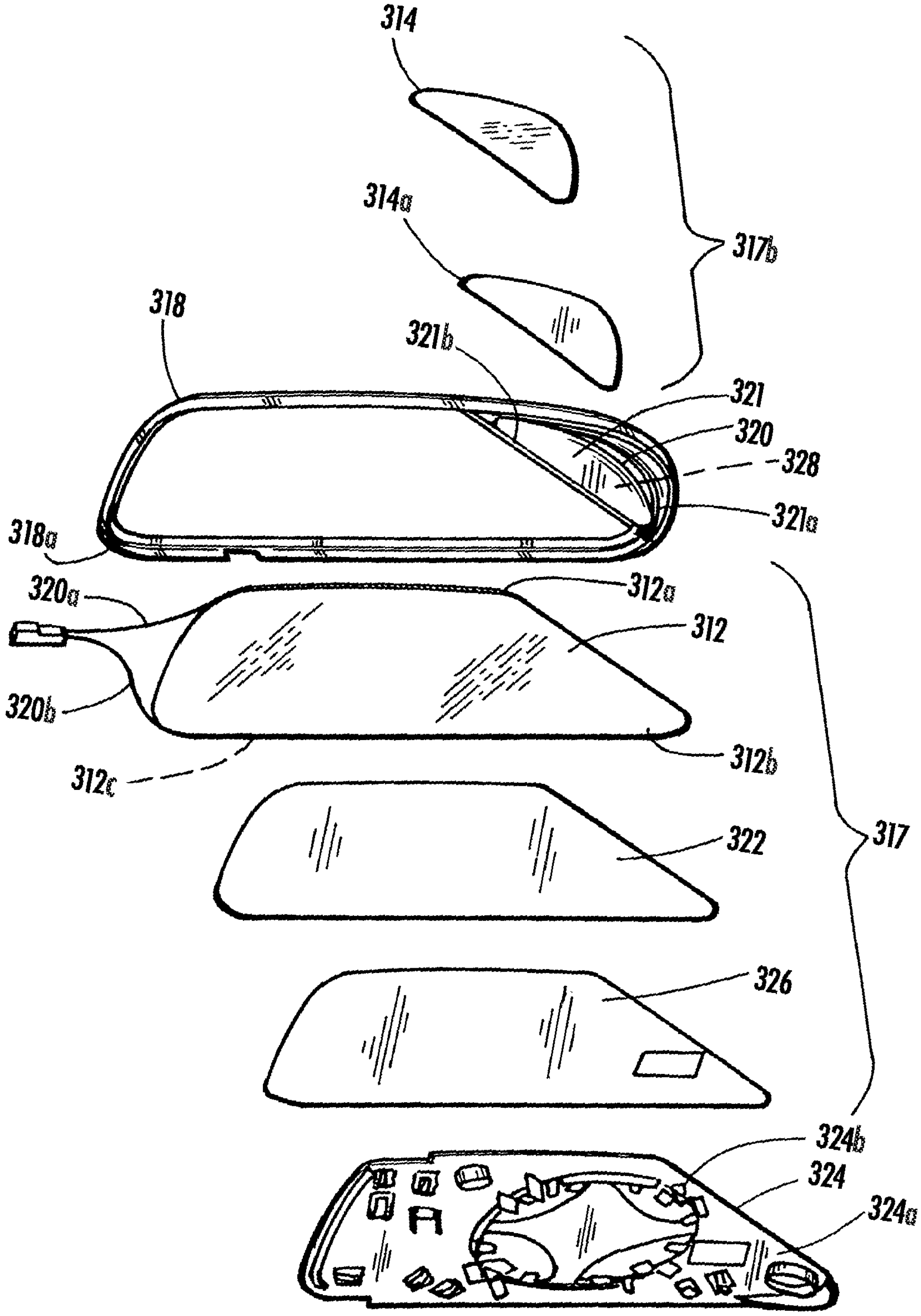
FIG. 23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324b
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324a

FIG. 17

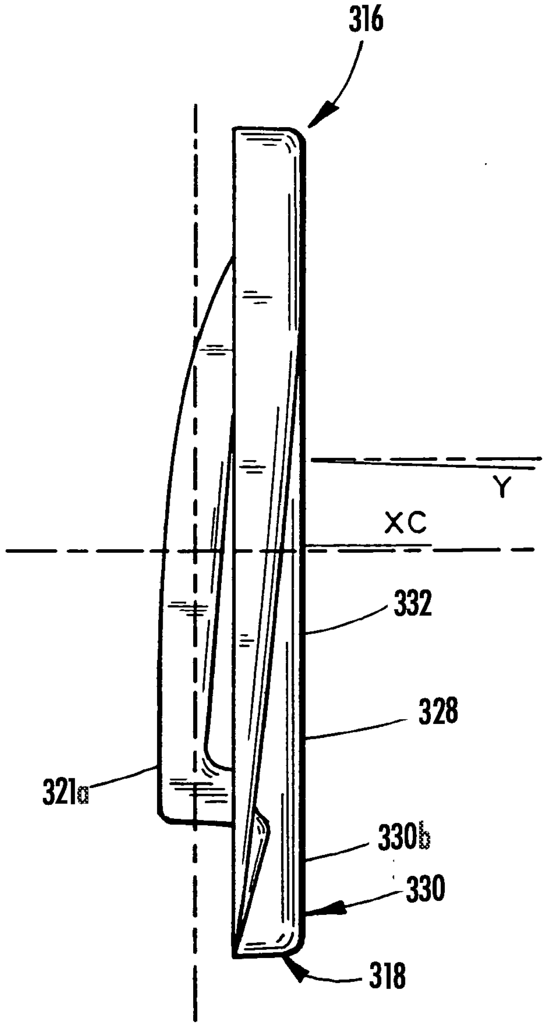
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FIG. 18

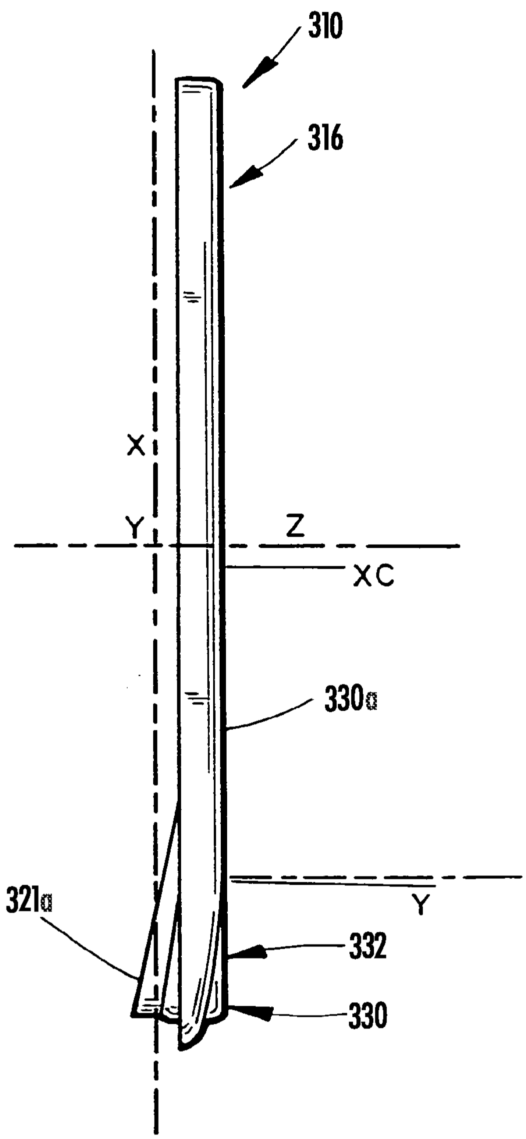
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FIG. 19

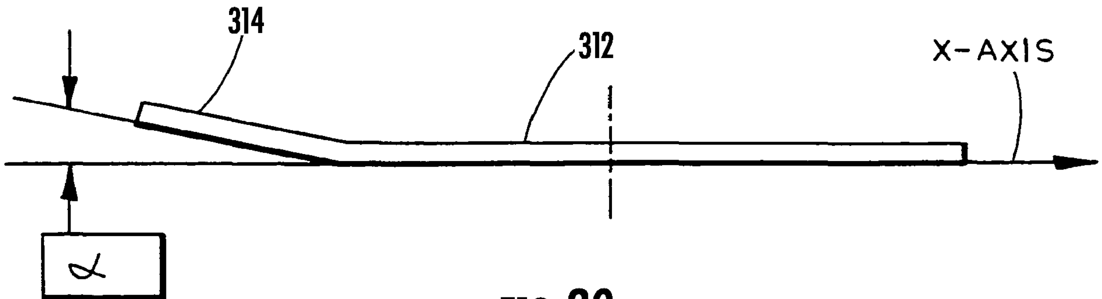

FIG. 20

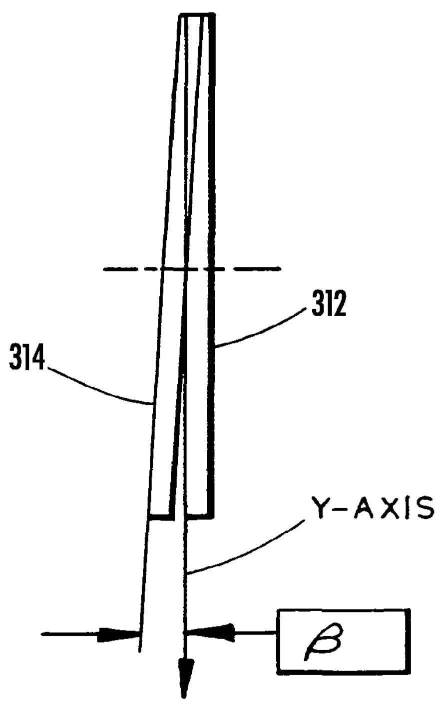

FIG. 21

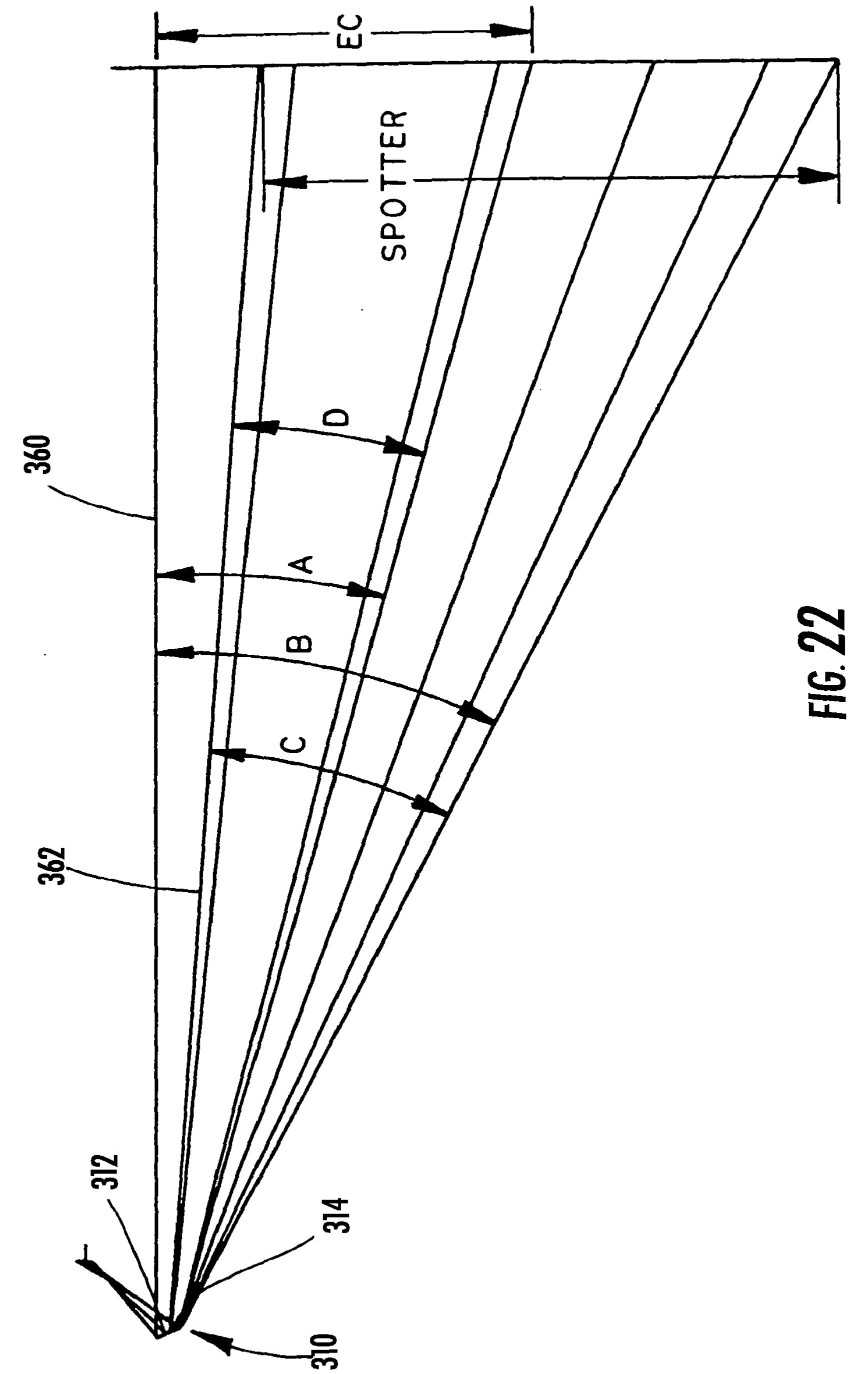

FIG. 22

Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	EXTERIOR SIDEVIEW MIRROR SYSTEM
First Named Inventor/Applicant Name:	Niall R. Lynam
Filer:	Timothy A. Flory/Amanda Sytsma
Attorney Docket Number:	DON09 P-1624
Filed as Large Entity	

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Utility application filing	1011	1	330	330
Utility Search Fee	1111	1	540	540
Utility Examination Fee	1311	1	220	220
Pages:				
Claims:				
Claims in excess of 20	1202	72	52	3744
Independent claims in excess of 3	1201	4	220	880
Miscellaneous-Filing:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**5714**

Electronic Acknowledgement Receipt

EFS ID:	8162560
Application Number:	12851045
International Application Number:	
Confirmation Number:	1992
Title of Invention:	EXTERIOR SIDEVIEW MIRROR SYSTEM
First Named Inventor/Applicant Name:	Niall R. Lynam
Customer Number:	28101
Filer:	Timothy A. Flory/Amanda Sytsma
Filer Authorized By:	Timothy A. Flory
Attorney Docket Number:	DON09 P-1624
Receipt Date:	05-AUG-2010
Filing Date:	
Time Stamp:	15:28:53
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$5714
RAM confirmation Number	1679
Deposit Account	220190
Authorized User	FLORY,TIMOTHY A

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal of New Application	Transmittal.pdf	235161 76f23922cb777460ccd80054c047fc1986082aa1	no	1
Warnings:					
Information:					
2	Miscellaneous Incoming Letter	RequestforContinuation.pdf	206984 60a95adaa1c9dcaa37a02a43273f1bd0b1251892	no	5
Warnings:					
Information:					
3	Application Data Sheet	ApplicationDataSheet.pdf	967714 fcdfd6e99b0a8d9d6ecddd9c1816ba8c8bd0f83c	no	4
Warnings:					
Information:					
4	Oath or Declaration filed	Declaration.pdf	80692 35ca2148ca4eaf900a2daf7ba8e8921e81d1bbfb	no	1
Warnings:					
Information:					
5		Specification.pdf	5812960 8bf91471598fa15b5c010497f435abfe79231402	yes	69

Multipart Description/PDF files in .zip description

Document Description	Start	End
Specification	1	37
Claims	38	68
Abstract	69	69

Warnings:					
Information:					
6	Drawings-only black and white line drawings	P1624Drawings.pdf	2649976 143d67a02a9bf5accd005eb1153042dd2994cc0f	no	16
Warnings:					
Information:					

7	Fee Worksheet (PTO-875)	fee-info.pdf	37873 b158650c55240b5e07e4aef10c83a5d80428f4e4	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	9991360	

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New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/06 (12-04)

Filing Date: 08/05/10

Approved for use through 7/31/2006. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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PATENT APPLICATION FEE DETERMINATION RECORD
Substitute for Form PTO-875

Application or Docket Number
12/851,045

APPLICATION AS FILED – PART I

FOR	NUMBER FILED (Column 1)		NUMBER EXTRA (Column 2)	SMALL ENTITY RATE ($)	SMALL ENTITY FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY FEE ($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A		N/A	N/A			N/A	330
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A		N/A	N/A			N/A	540
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A		N/A	N/A			N/A	220
TOTAL CLAIMS (37 CFR 1.16(i))	92	minus 20 =	72	x$26		OR	x$52	3744
INDEPENDENT CLAIMS (37 CFR 1.16(h))	7	minus 3 =	* 4	x$110			x$220	880
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $270 ($135 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR							
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				195			390	
				TOTAL			TOTAL	5714

* If the difference in column 1 is less than zero, enter "0" in column 2.

APPLICATION AS AMENDED – PART II

AMENDMENT A

	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE ($)	SMALL ENTITY ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X =		OR	X =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X =		OR	X =	
Application Size Fee (37 CFR 1.16(s))									
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))					N/A		OR	N/A	
					TOTAL ADD'T FEE		OR	TOTAL ADD'T FEE	

AMENDMENT B

	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE ($)	SMALL ENTITY ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X =		OR	X =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X =		OR	X =	
Application Size Fee (37 CFR 1.16(s))									
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))					N/A		OR	N/A	
					TOTAL ADD'T FEE		OR	TOTAL ADD'T FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.