US007978094B2

(12) **United States Patent**
Uken et al.

(10) **Patent No.: US 7,978,094 B2**
(45) **Date of Patent: *Jul. 12, 2011**

(54) **MIRROR ASSEMBLY FOR VEHICLE**

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(73) Assignee: **Donnelly Corporation**, Holland, MI (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 757 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **11/926,882**

(22) Filed: **Oct. 29, 2007**

(65) **Prior Publication Data**

US 2008/0055757 A1 Mar. 6, 2008

Related U.S. Application Data

(63) Continuation of application No. 10/556,754, filed as application No. PCT/US2004/015424 on May 18, 2004, now Pat. No. 7,289,037.

(60) Provisional application No. 60/556,259, filed on Mar. 25, 2004, provisional application No. 60/525,537, filed on Nov. 26, 2003, provisional application No. 60/471,546, filed on May 19, 2003.

(51) **Int. Cl.**

G05B 5/00	(2006.01)
B60Q 1/00	(2006.01)
G02B 5/00	(2006.01)

(52) **U.S. Cl.** **340/815.4**; 340/425.5; 362/494; 359/267; 359/839; 359/844

(58) **Field of Classification Search** 340/815.4
See application file for complete search history.

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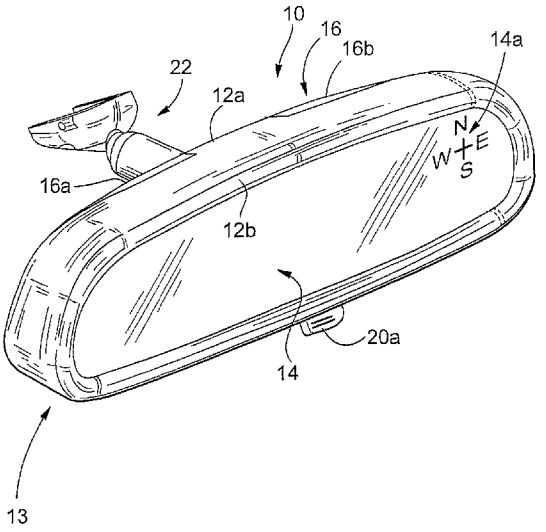
Primary Examiner — Donnie L Crosland

(74) *Attorney, Agent, or Firm* — Van Dyke, Gardner, Linn & Burkhart, LLP

(57) **ABSTRACT**

An interior rearview mirror assembly for a vehicle includes a reflective element assembly portion and at least one cap portion adapted to attach to the reflective element assembly portion. The reflective element assembly portion includes a reflective element. The reflective element assembly portion comprises a first molding that encompasses at least a perimeter portion of the reflective element. The first molding is formed by molding a first resinous material having a tool shrinkage factor equal to or greater than about 1%. The cap portion comprises at least one second molding formed by molding a second resinous material having a tool shrinkage factor of less than or equal to about 1%. The cap portion preferably includes internal structure for supporting at least one accessory.

16 Claims, 36 Drawing Sheets



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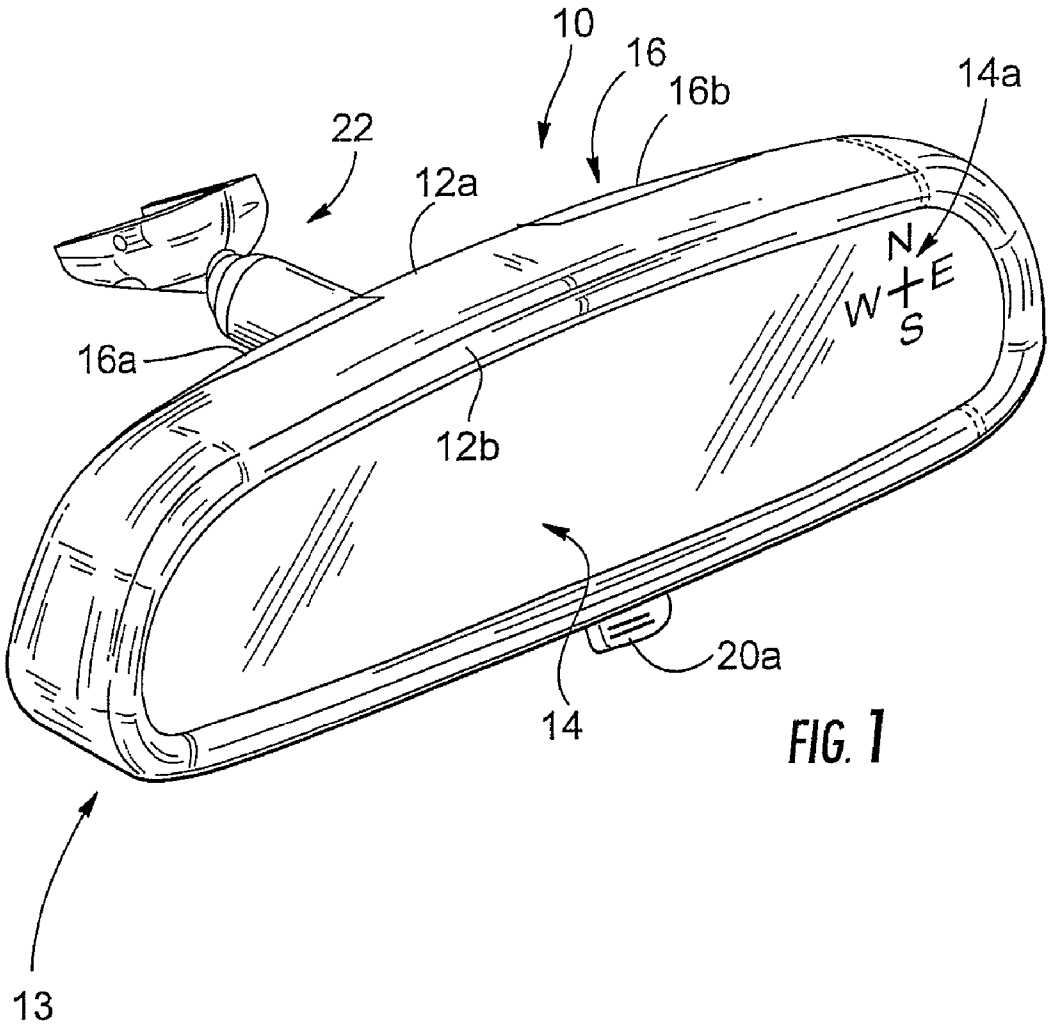


FIG. 1

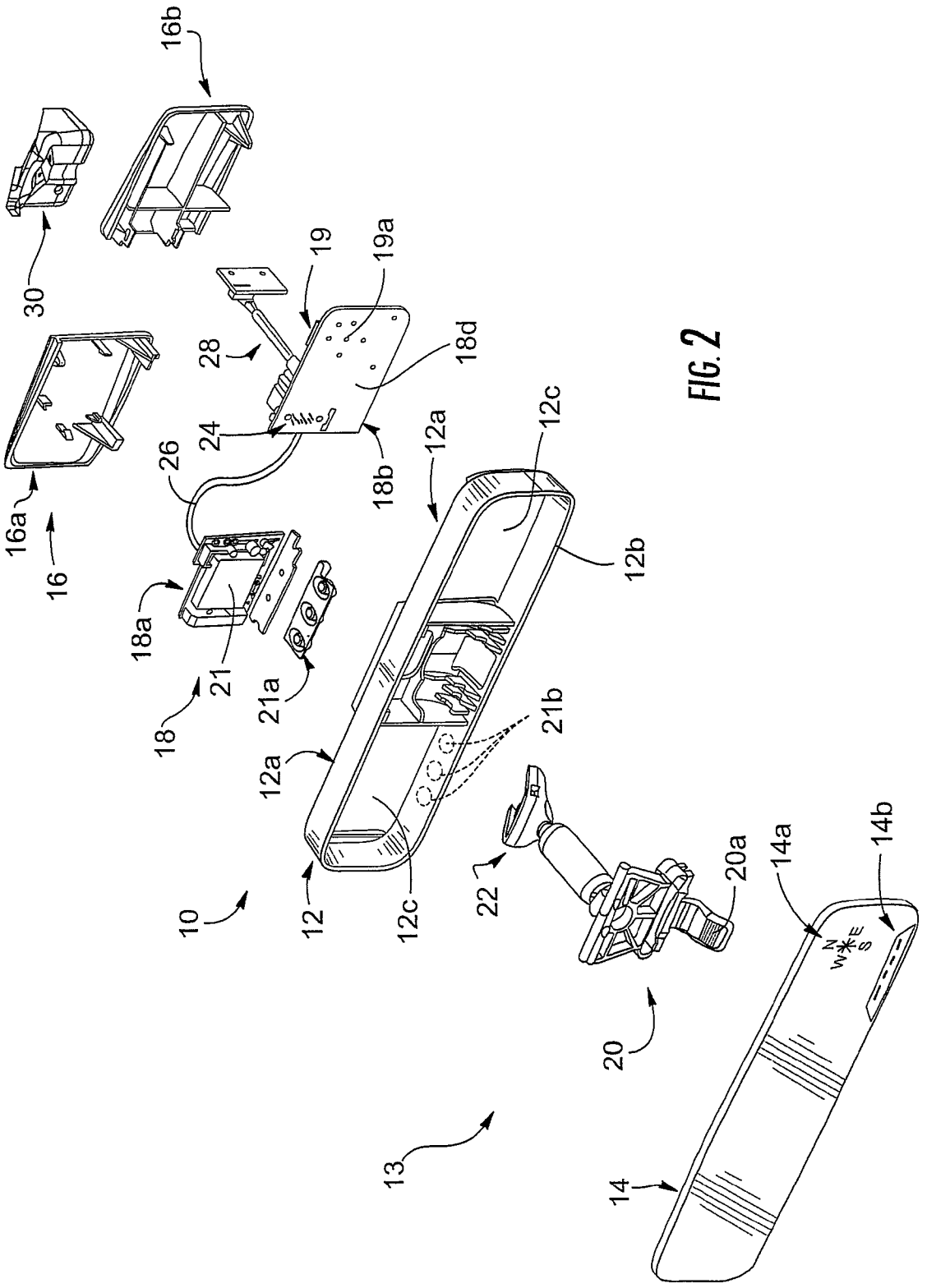

16b
30
19
19a
28
18d
24
26
18b
12a
12c
16a
16
12b
18a
21
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12
12c
22
20a
14a
14b
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13
14

FIG. 2

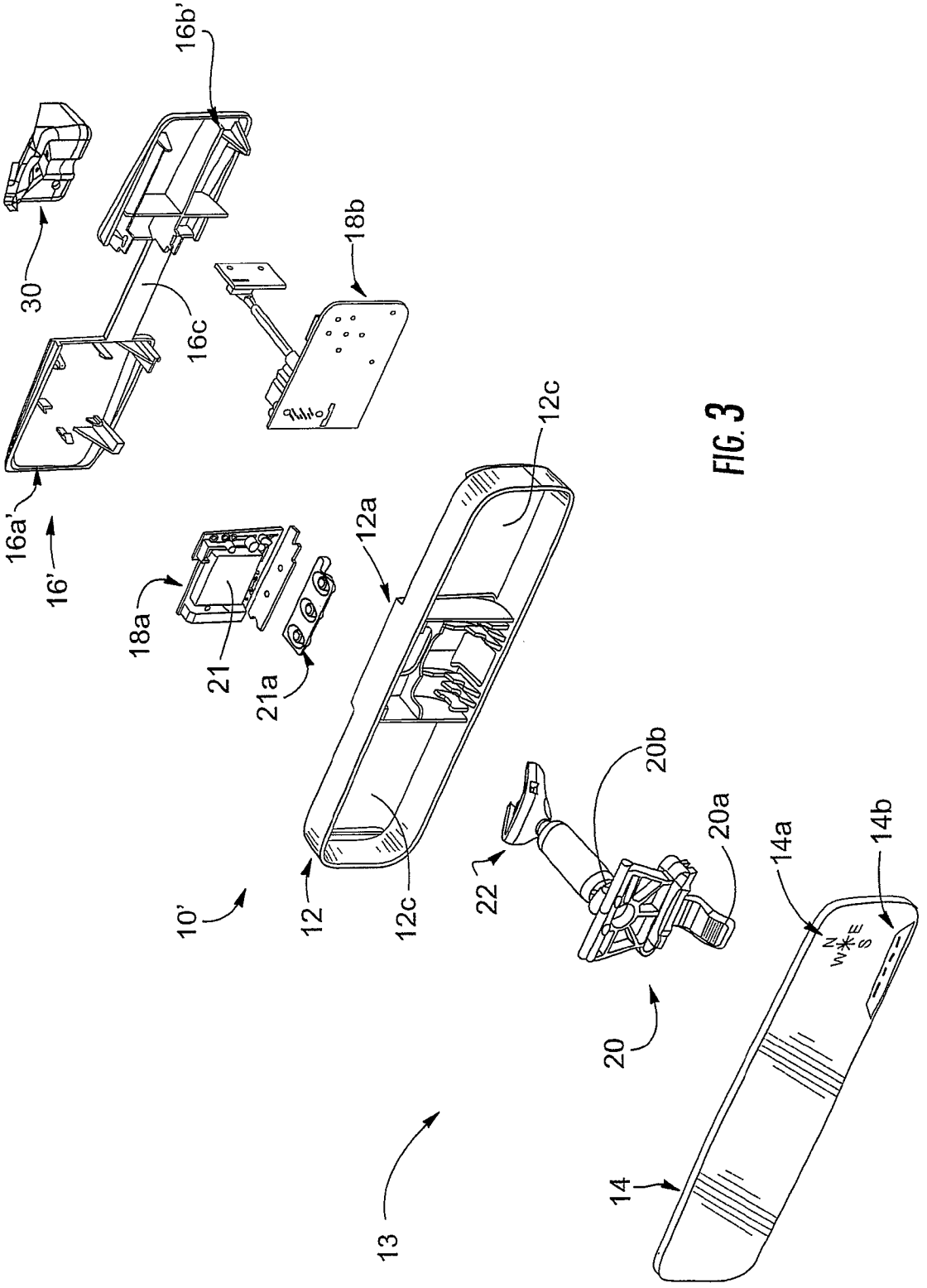

16b'
30
16c
18b
16a'
16'
18a
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21a
12a
12c
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12c
10'
22
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14b
20
14
13

FIG. 3

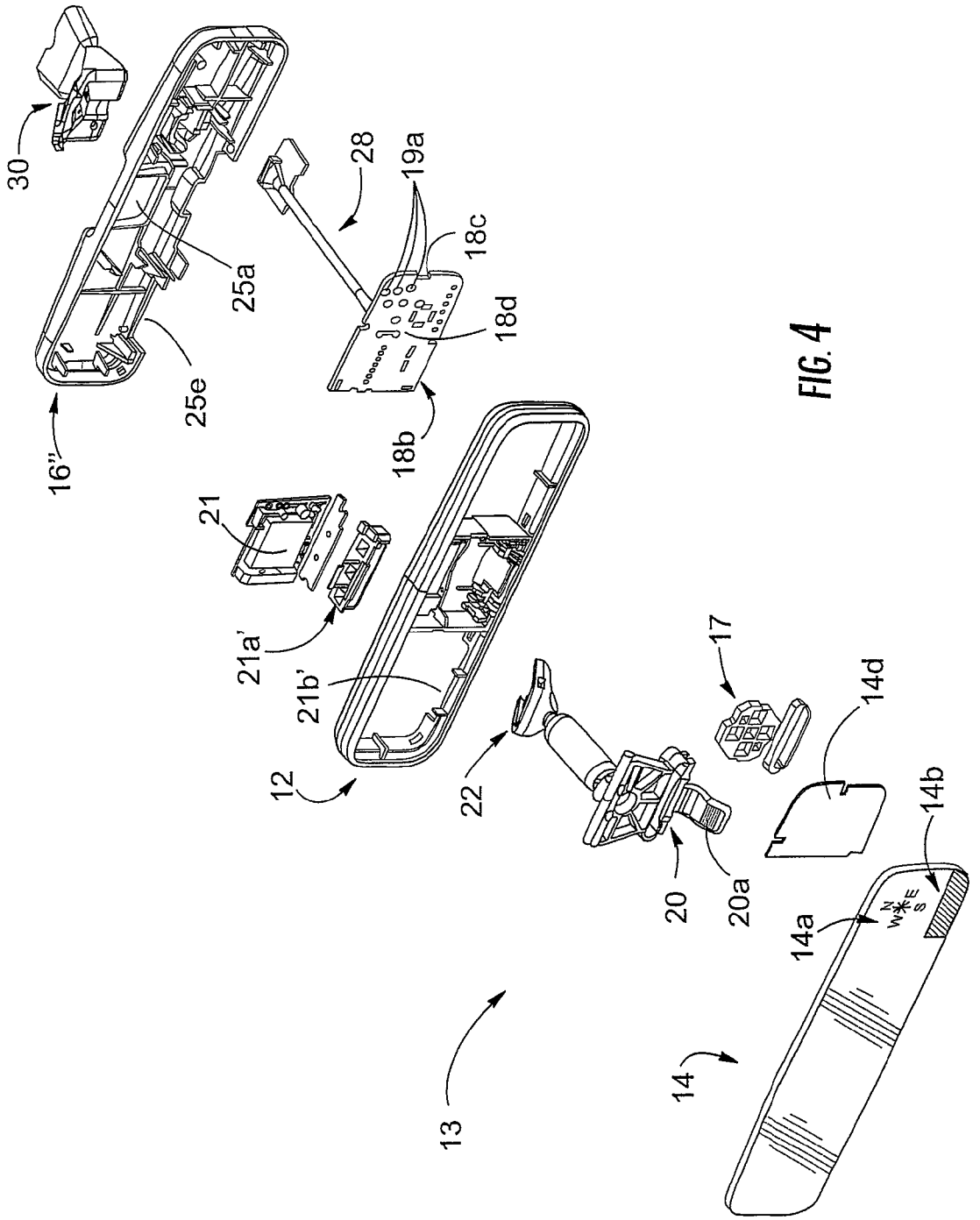

30
25a
28
19a
18c
18d
25e
16''
18b
21
21a'
21b'
12
22
17
14d
14b
20
20a
14a
14
13

FIG. 4

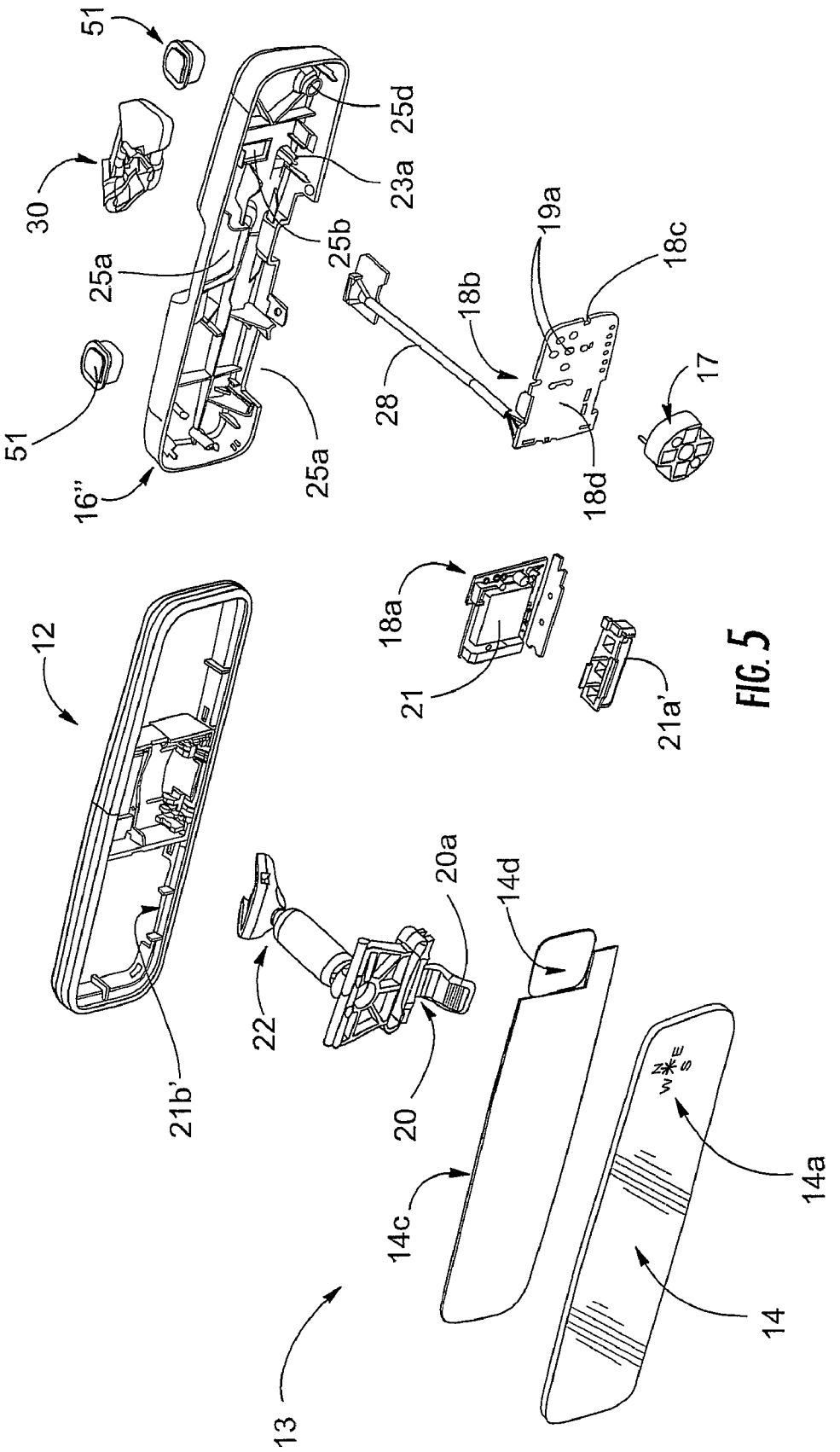

51
30
25a
51
16''
25d
23a
25b
25a
19a
18c
18b
28
18d
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18a
21
21a'
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21b'
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20a
20
14d
14c
14a
14
13

FIG. 5

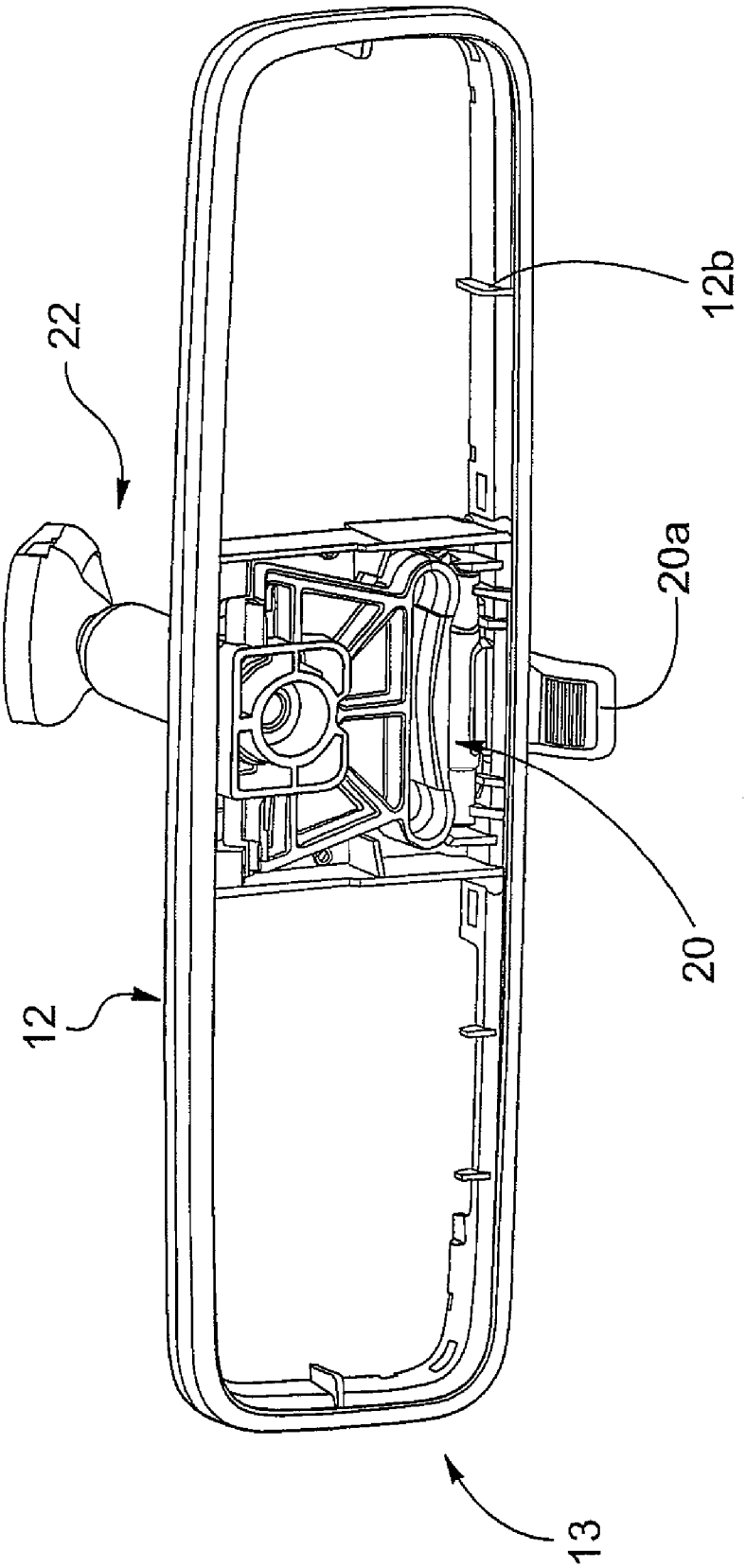


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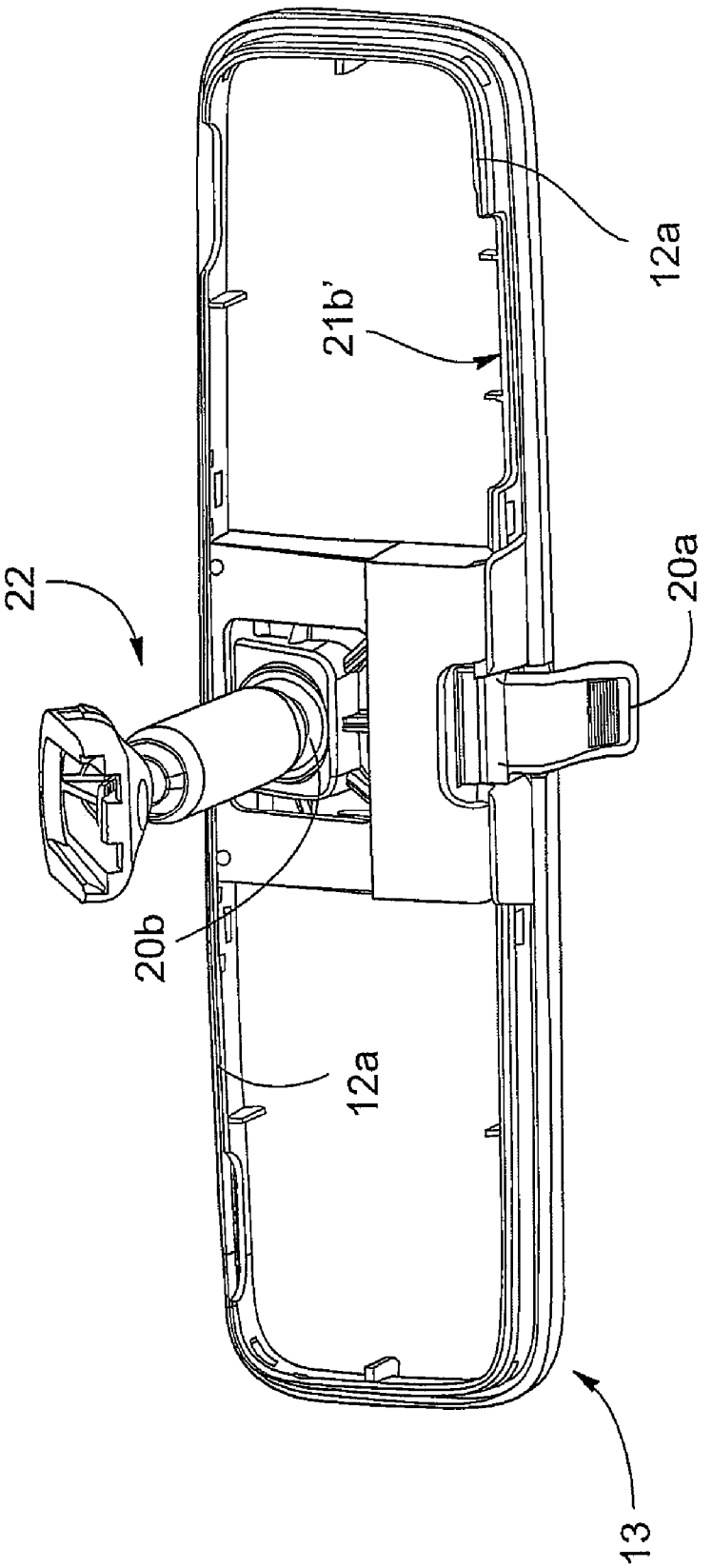


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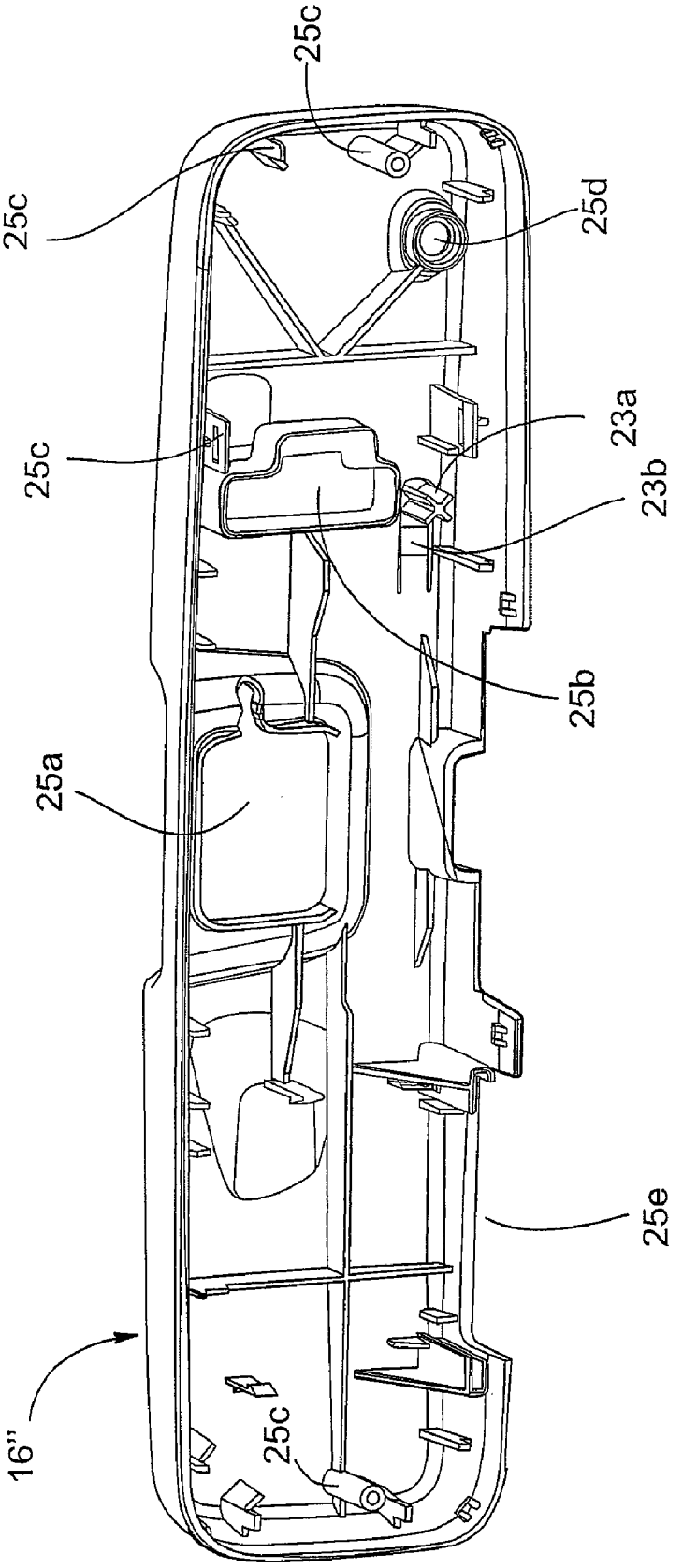


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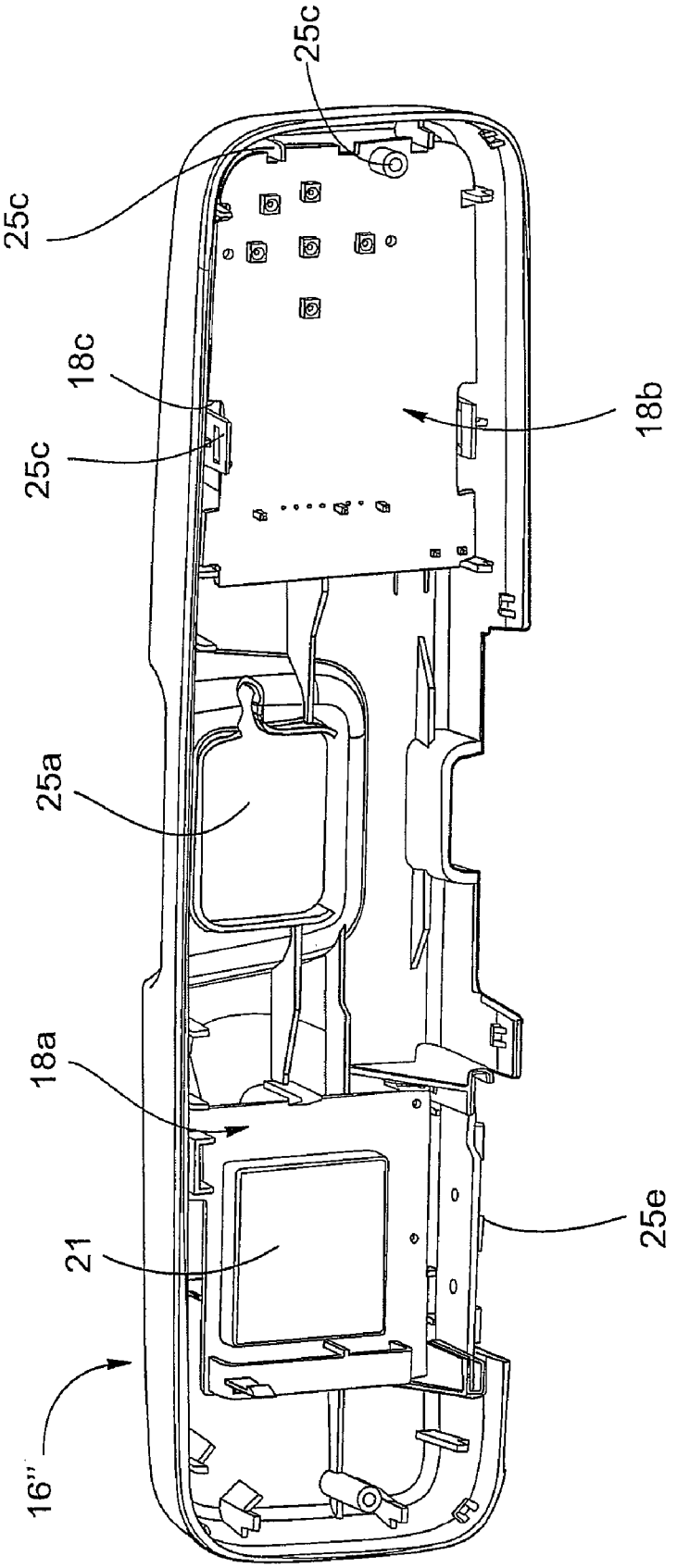


FIG. 9

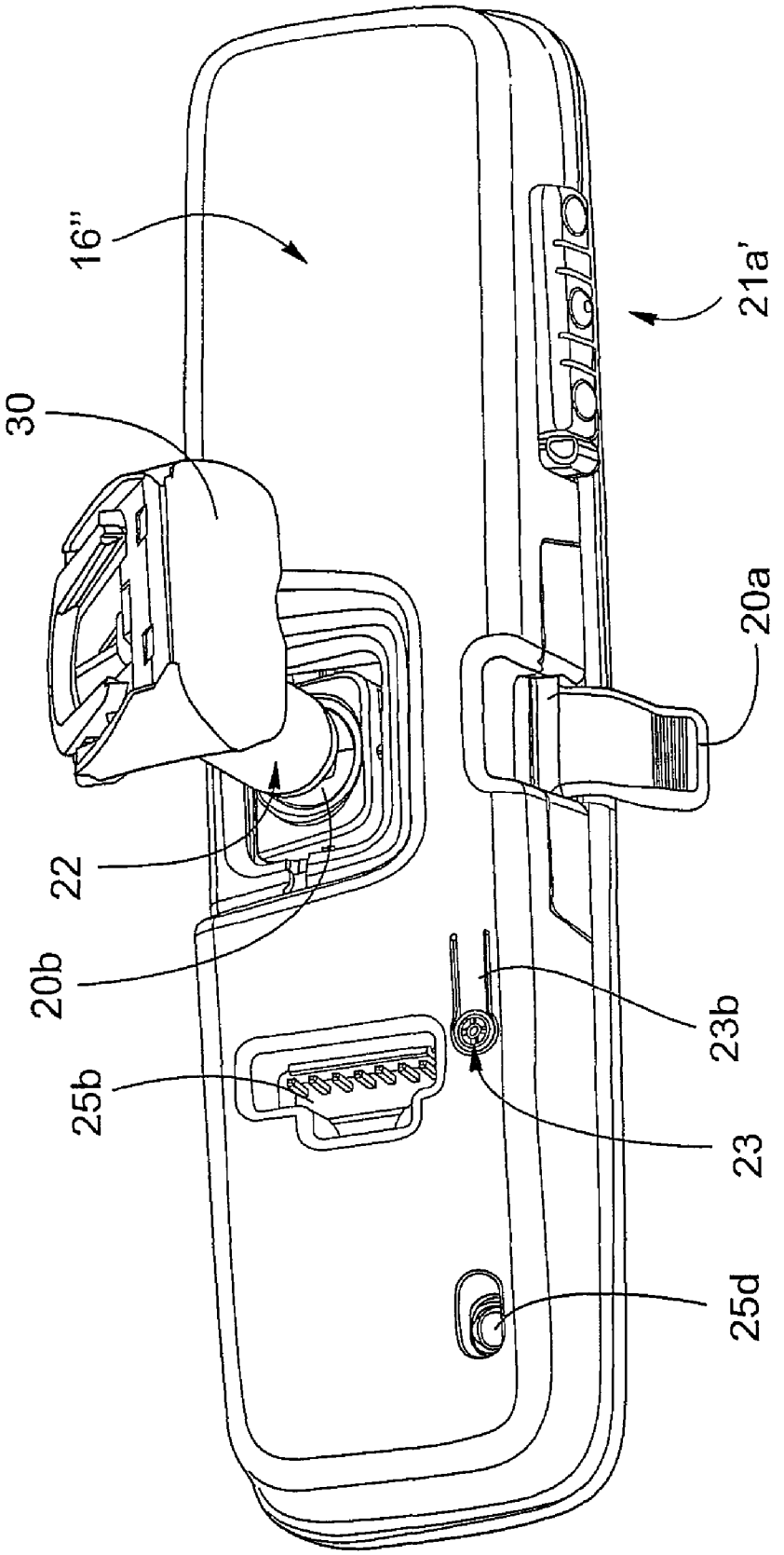


FIG. 10

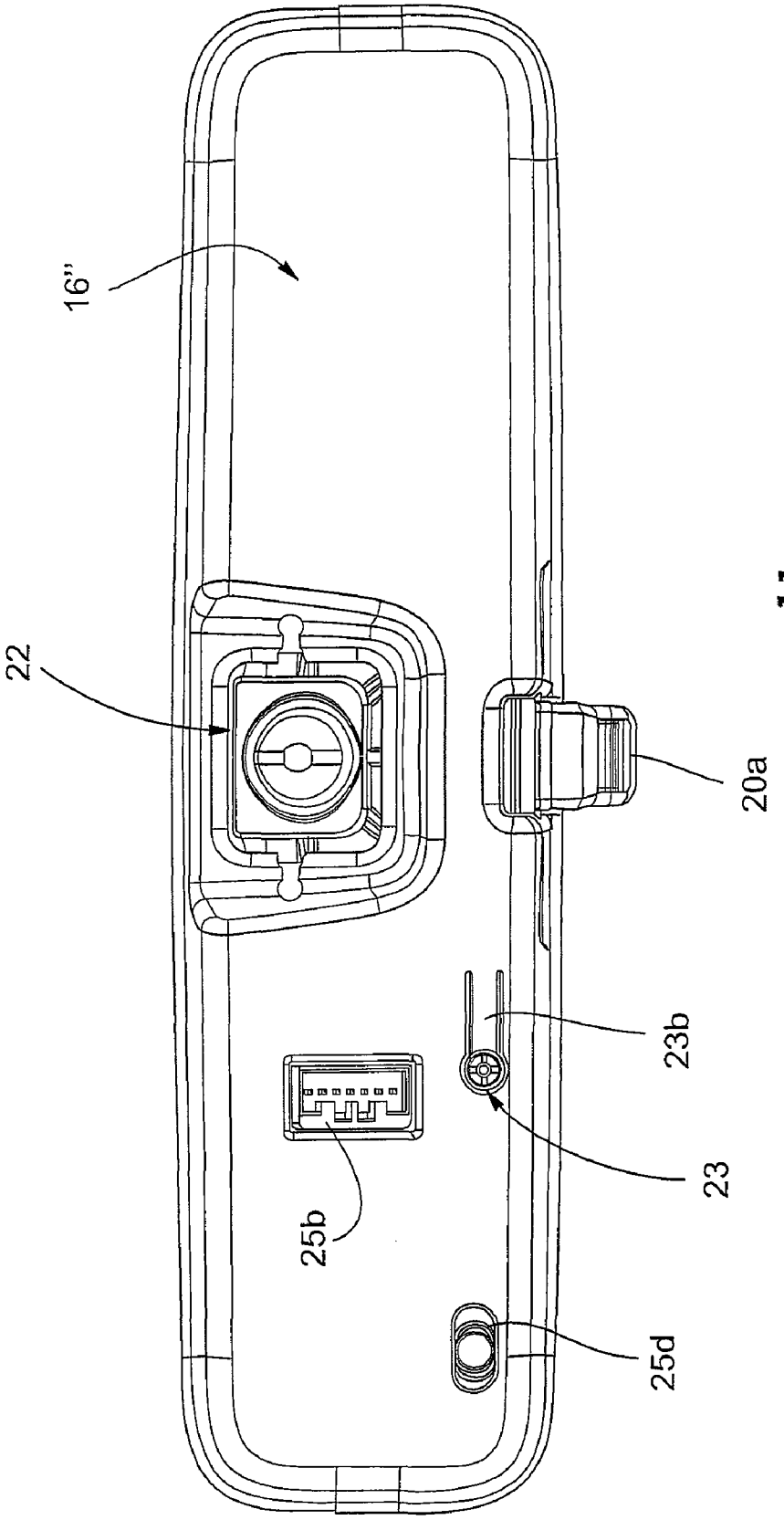


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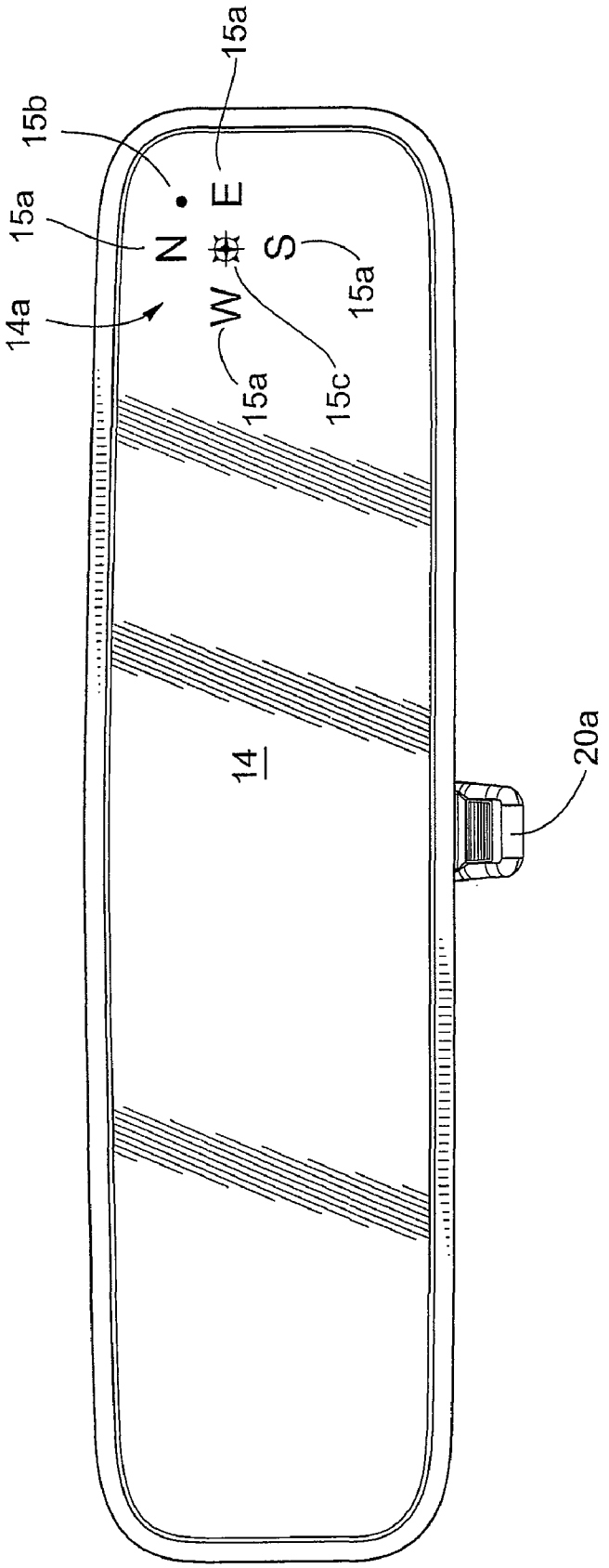


FIG. 12

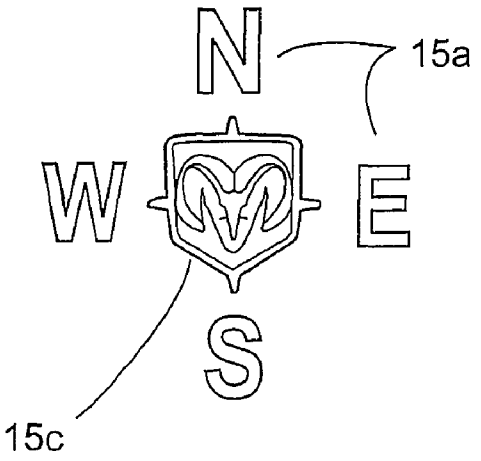


FIG. 13A

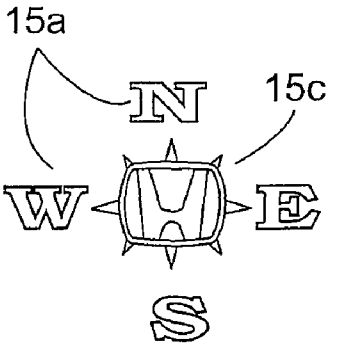


FIG. 13B

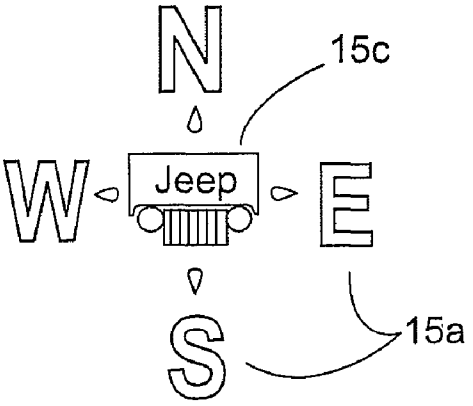


FIG. 13C

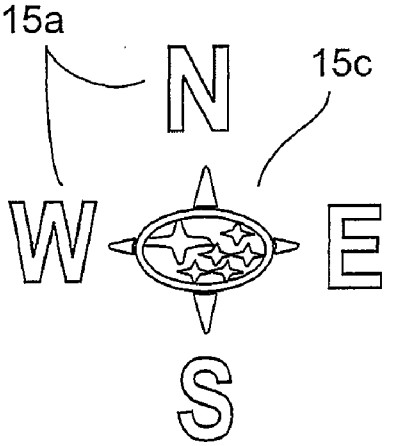


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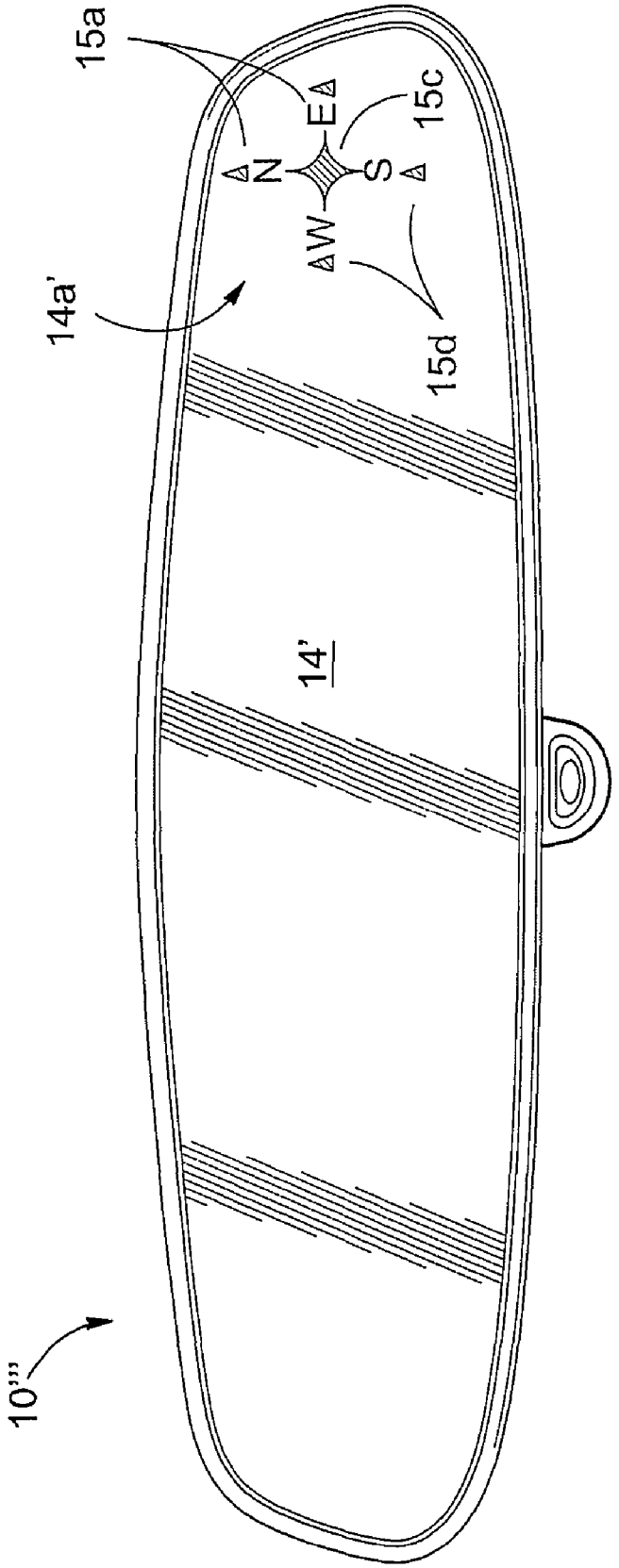


FIG. 14

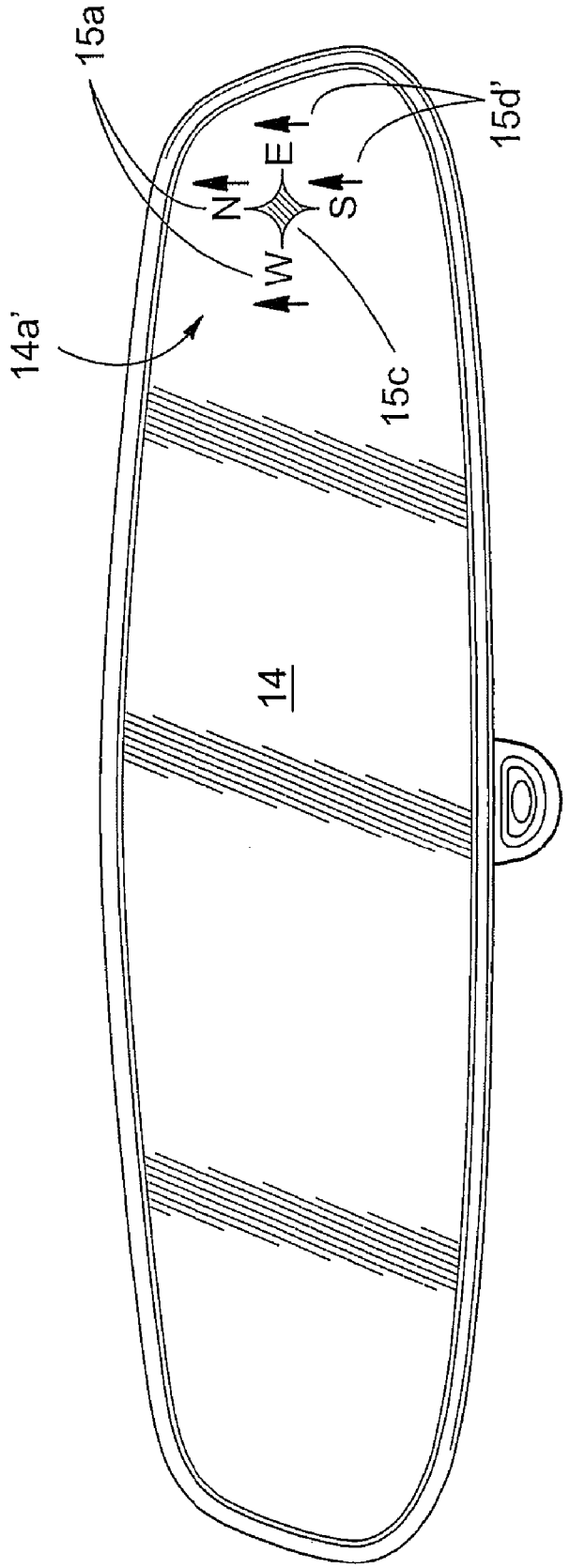


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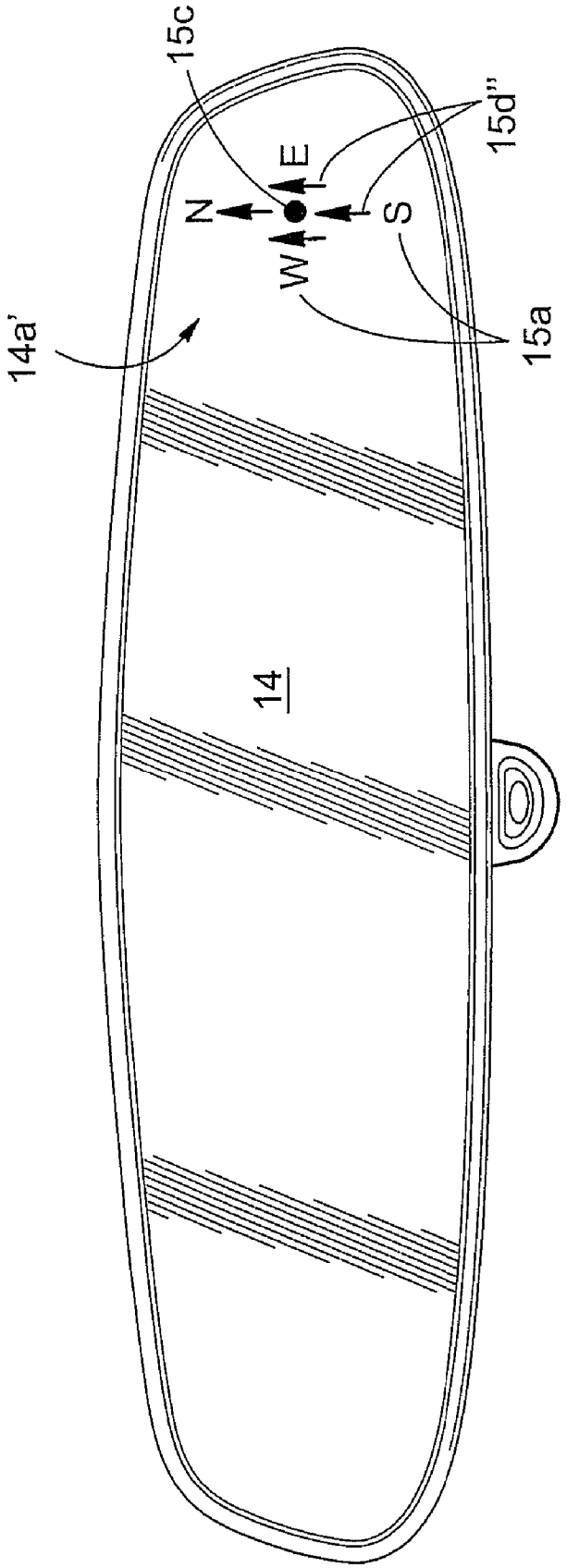


FIG. 16

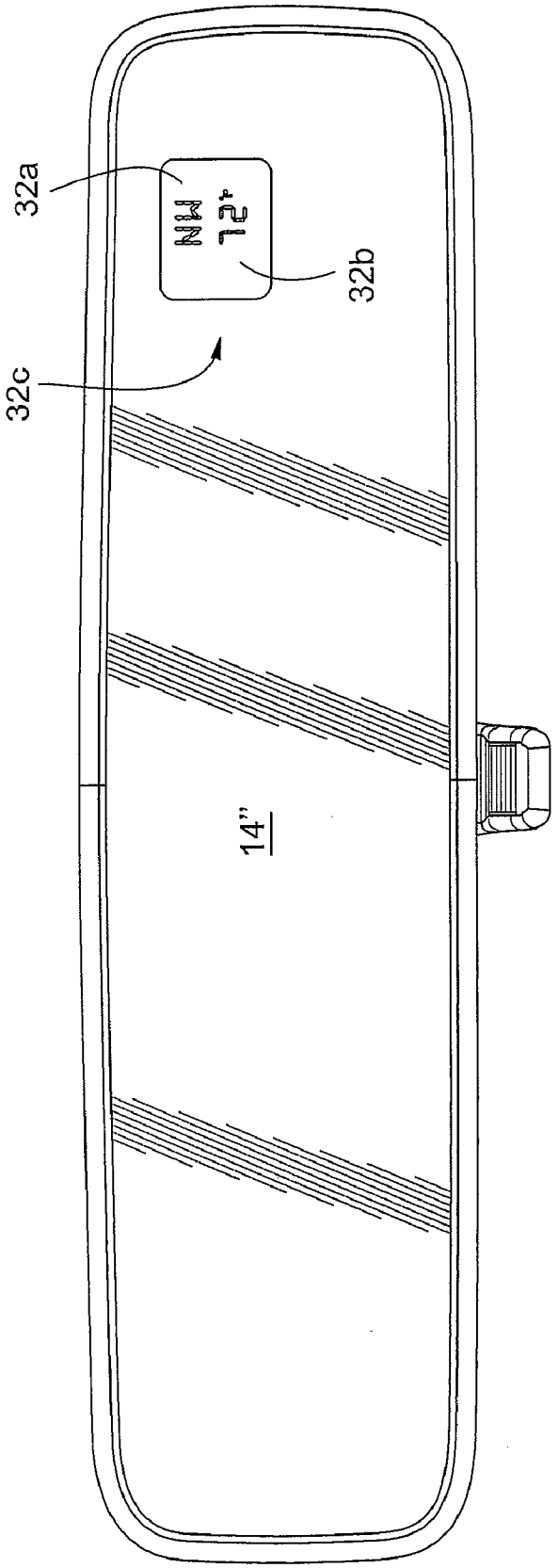


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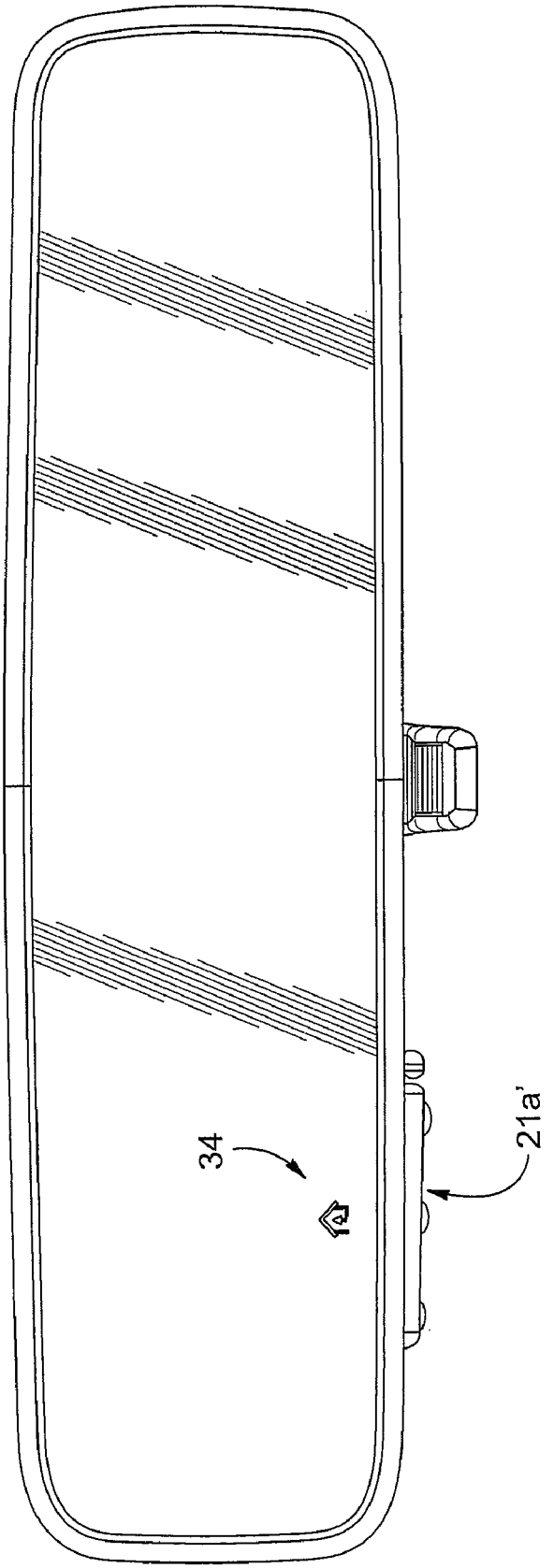


FIG. 18

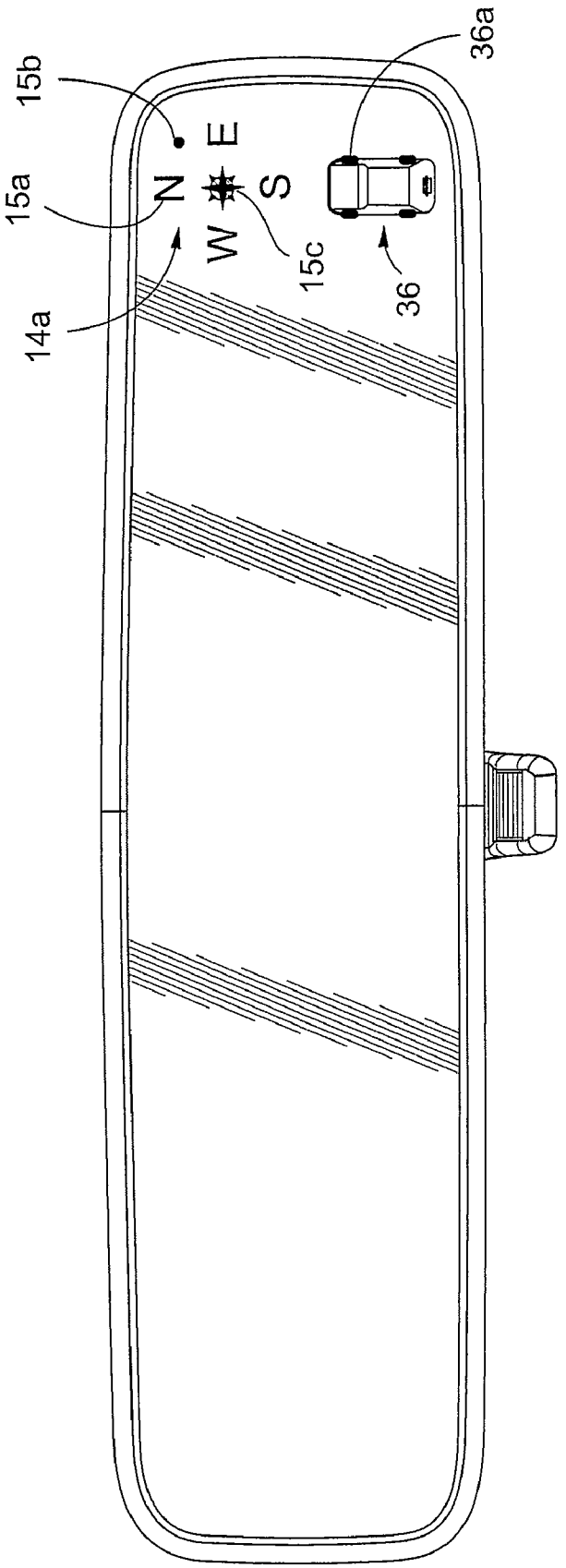


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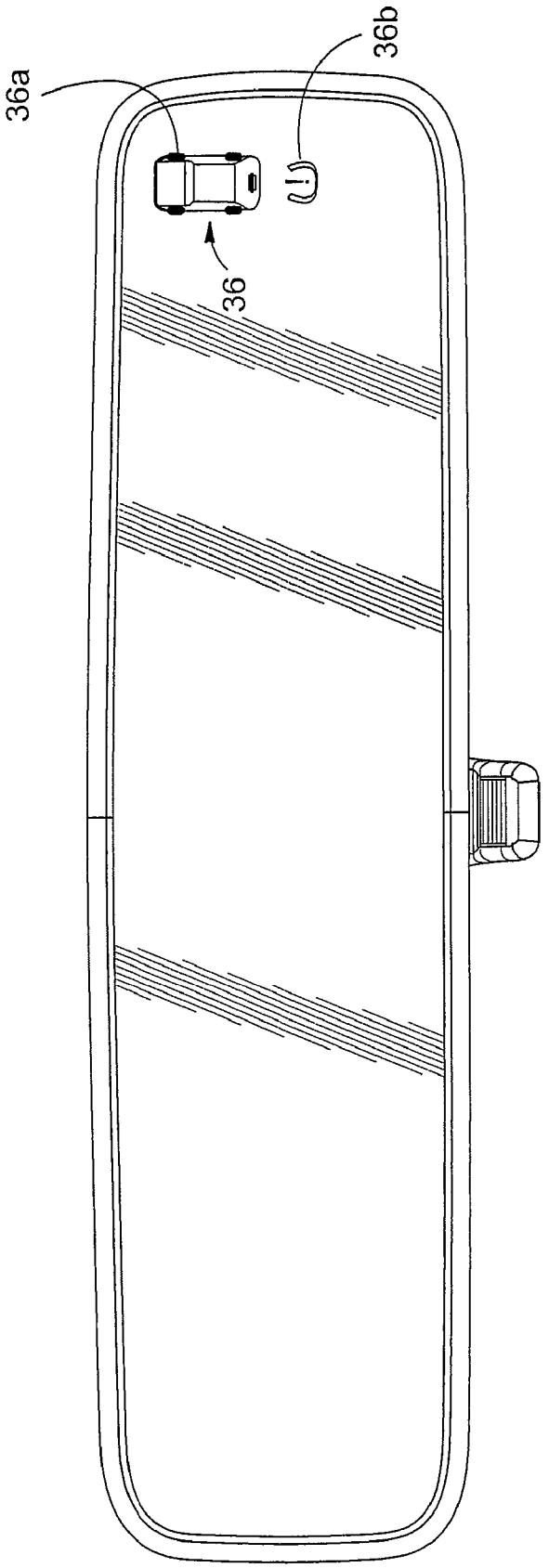


FIG. 20

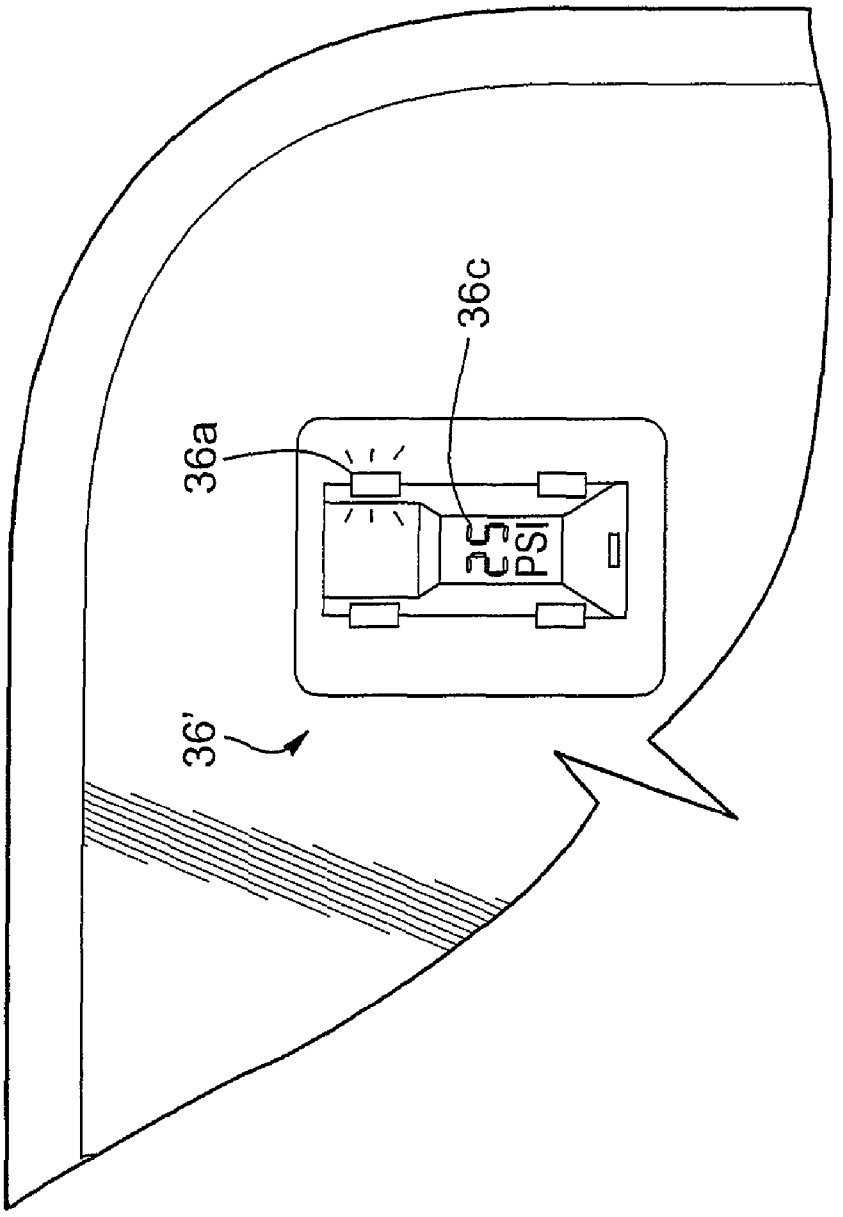


FIG. 21

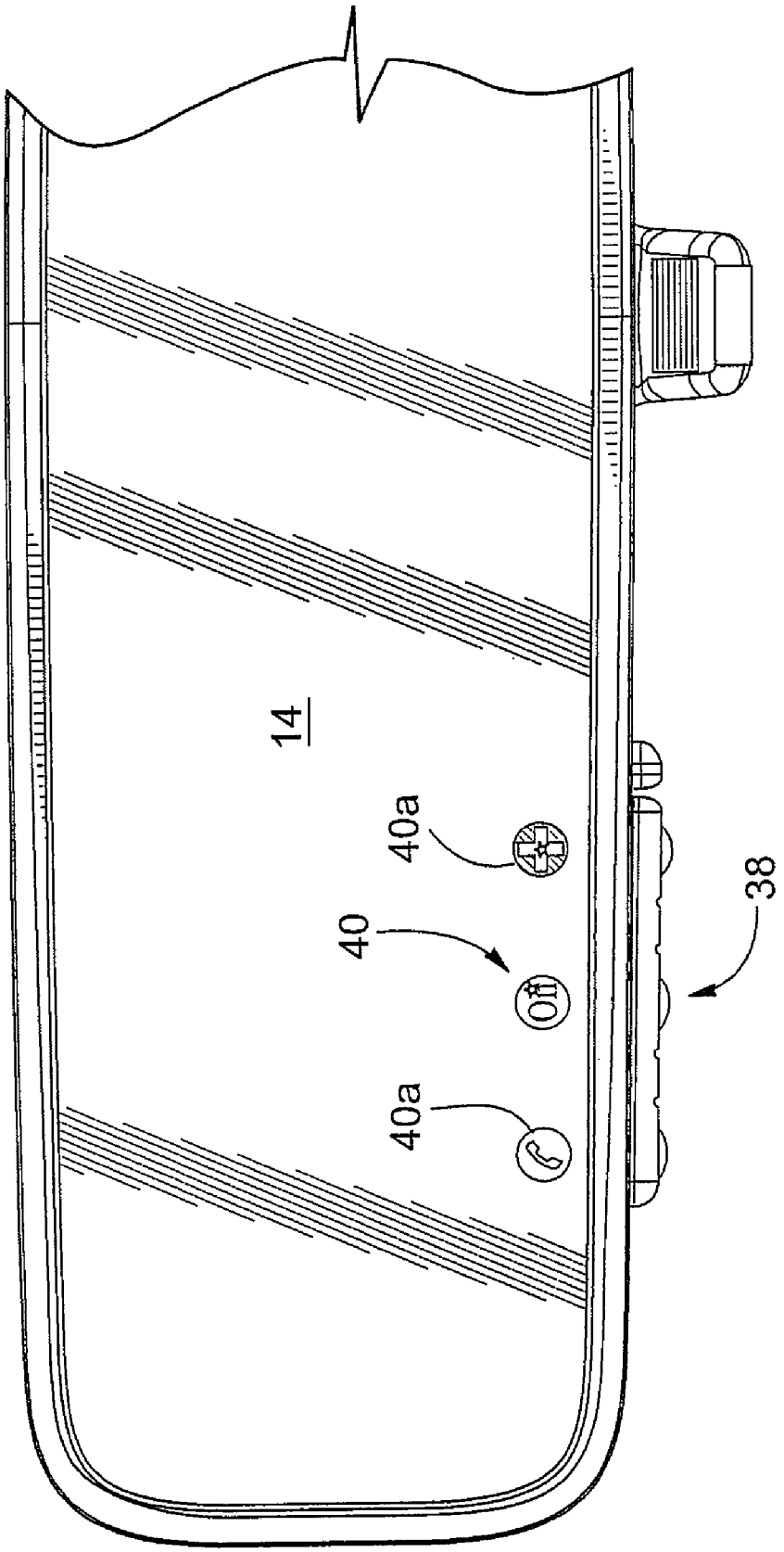


FIG. 22

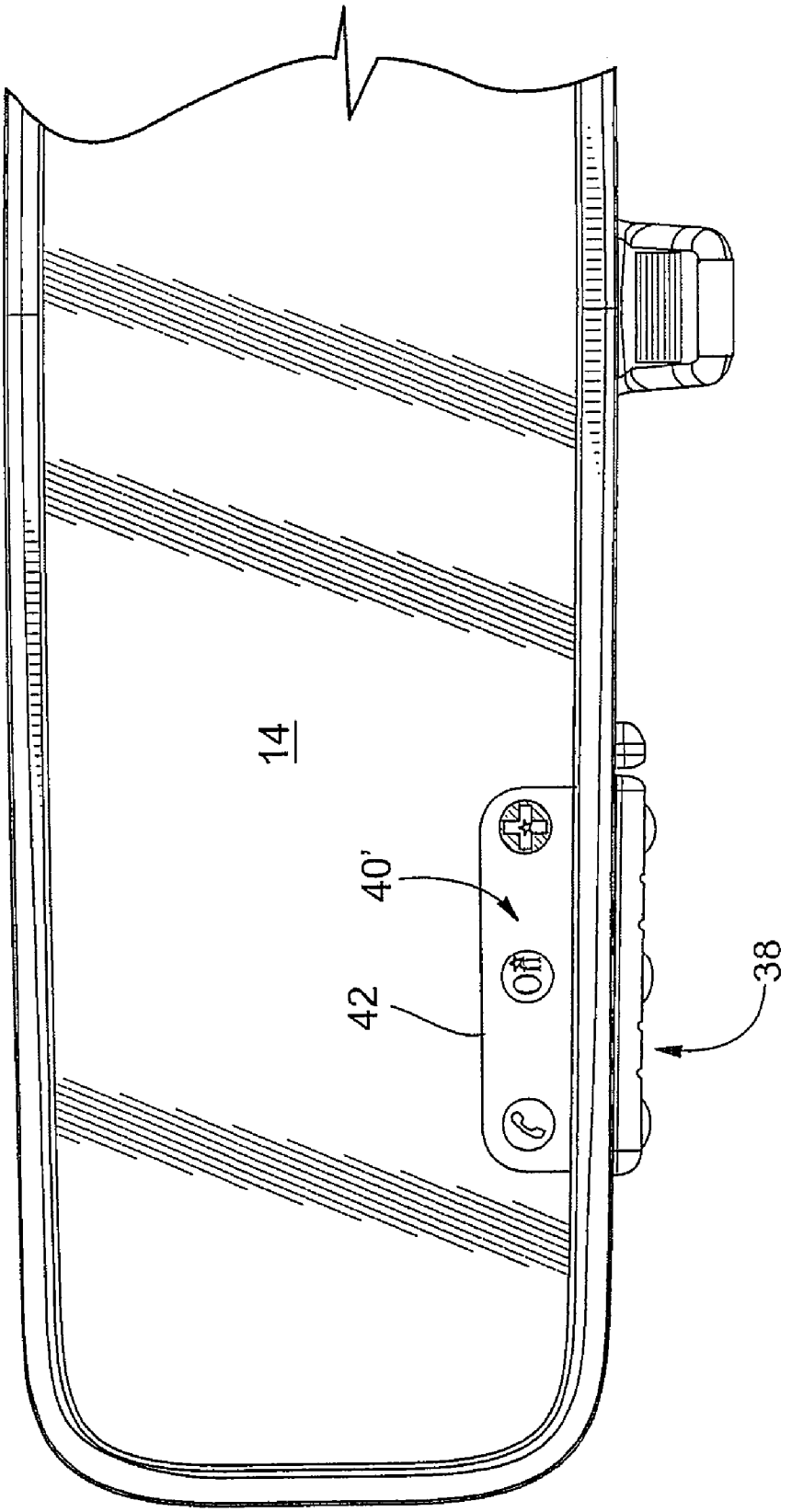


FIG. 23

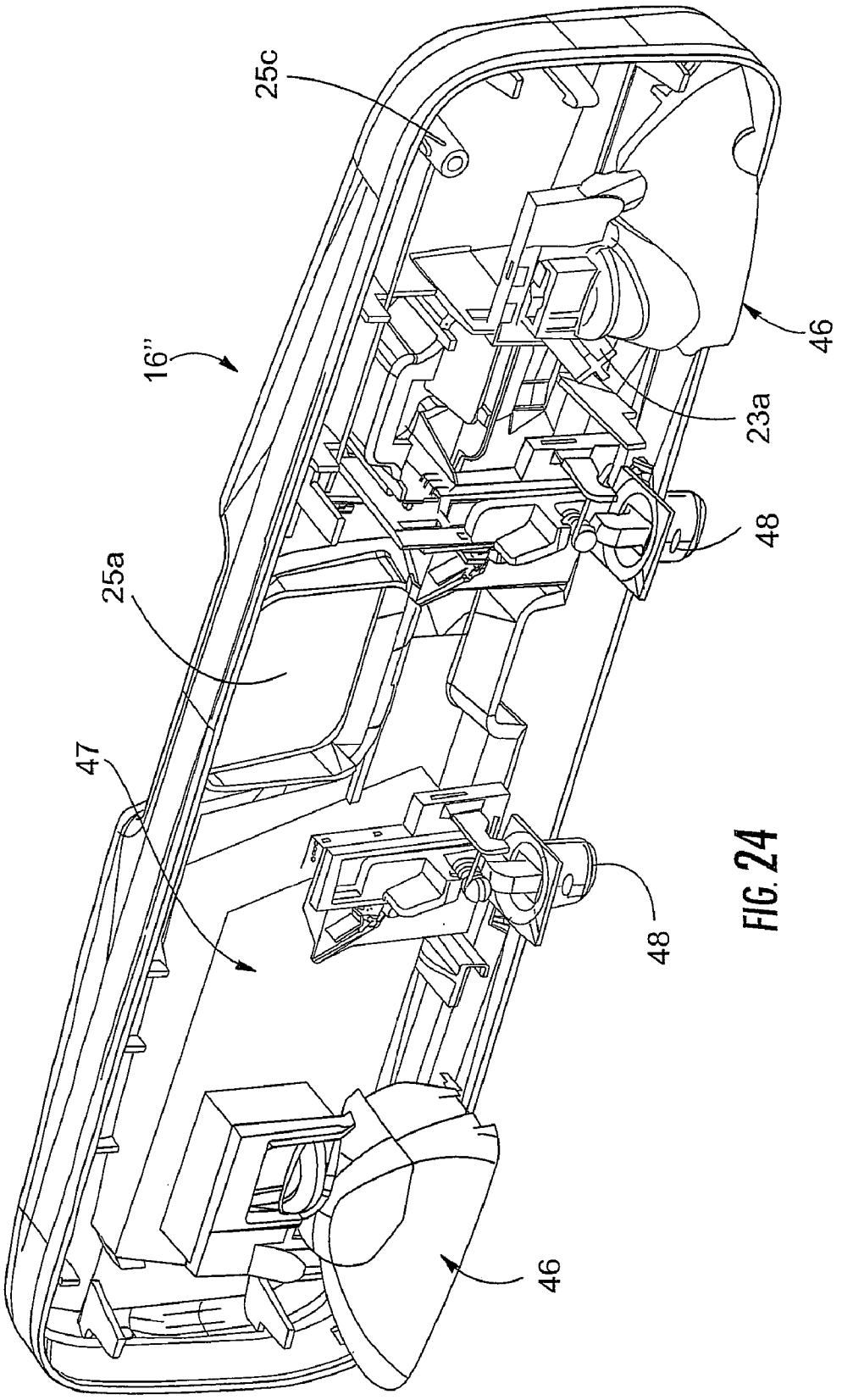


FIG. 24

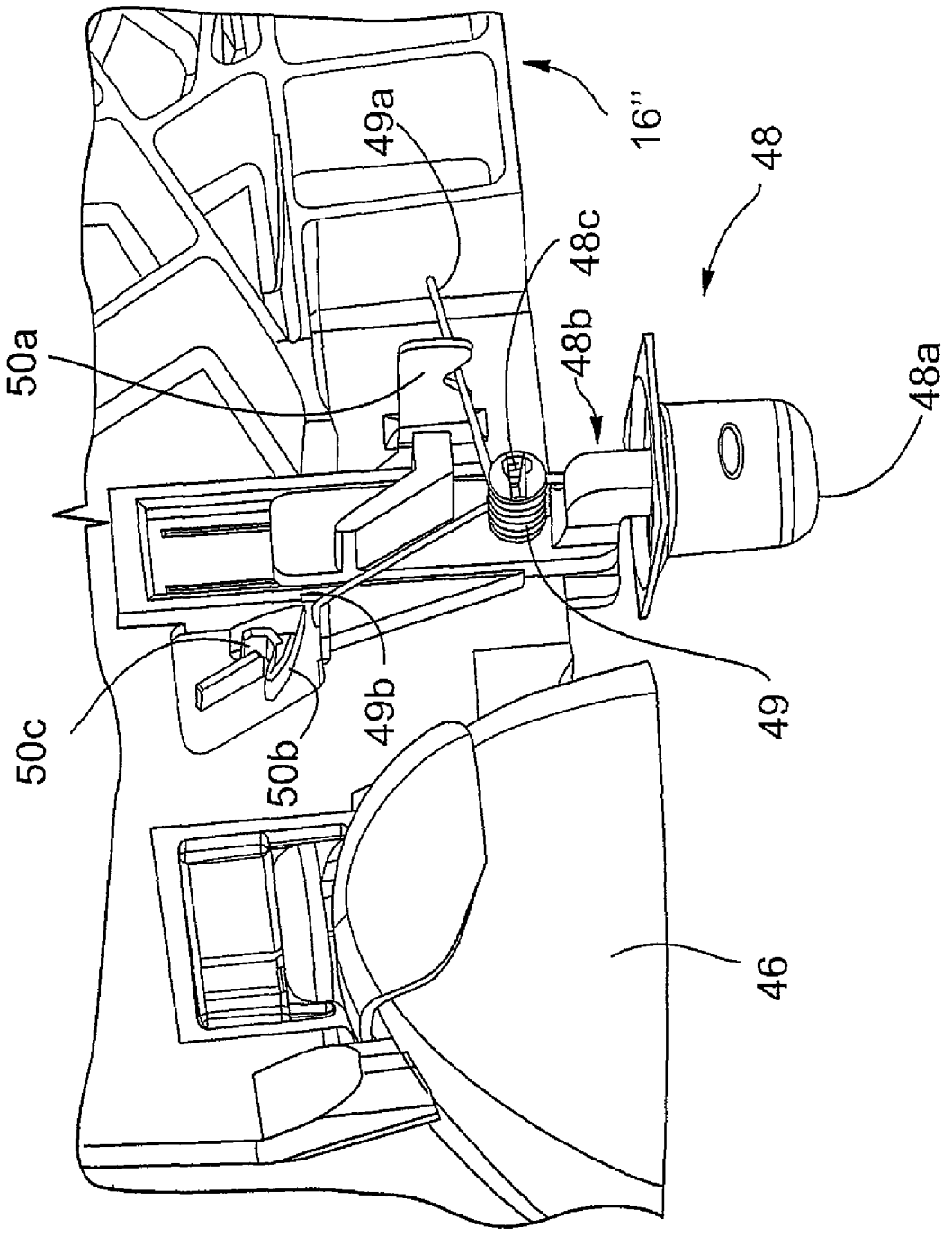


FIG. 25

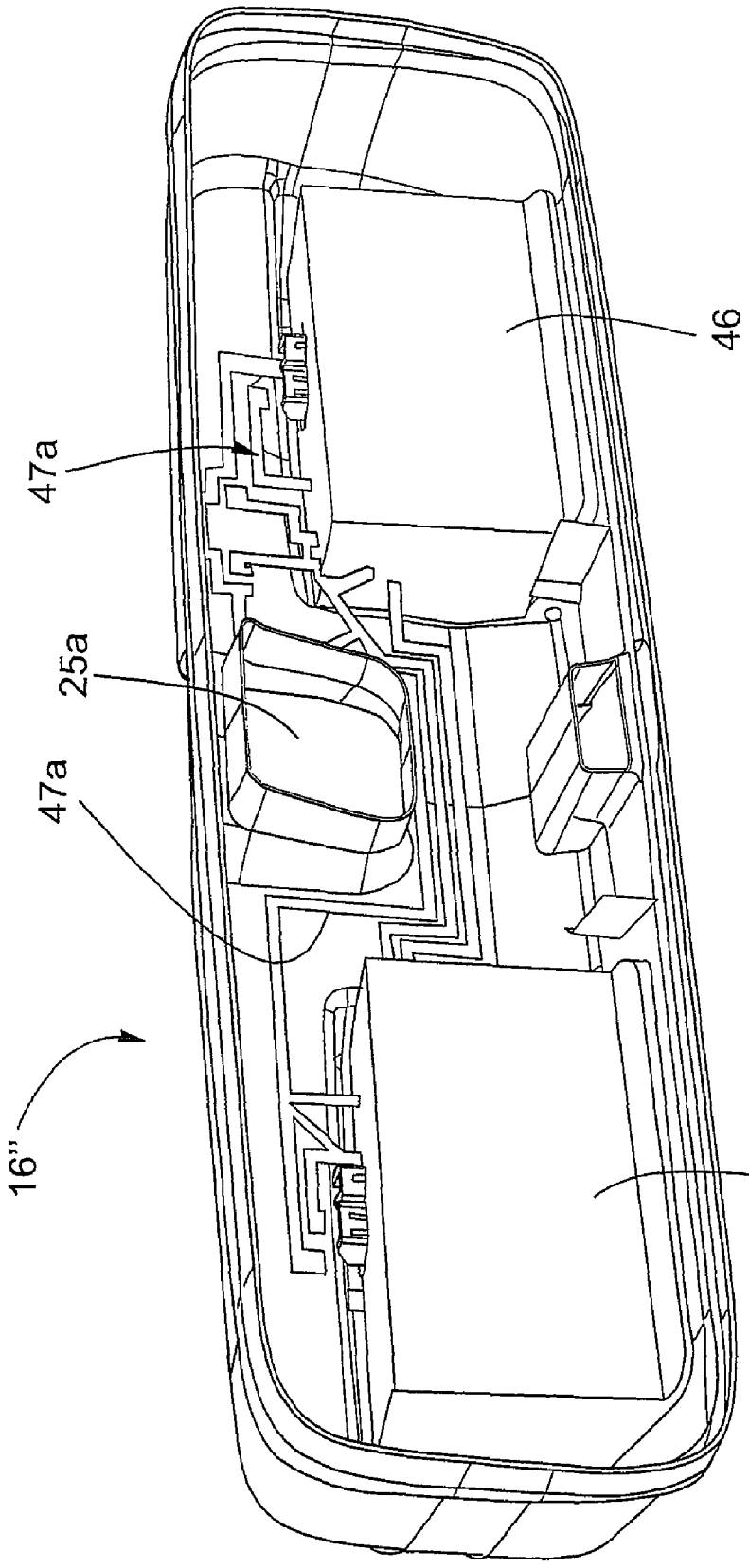


FIG. 26

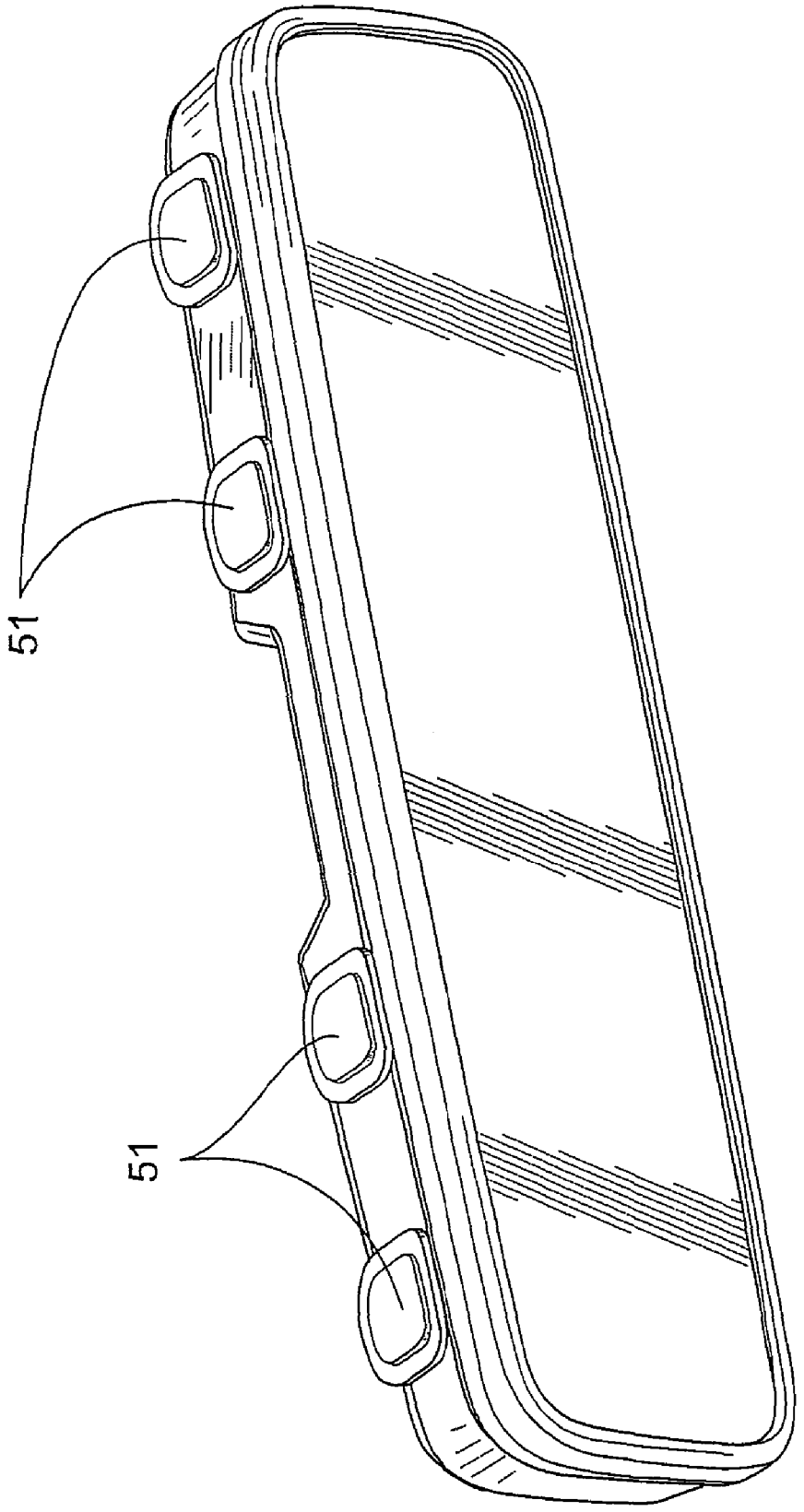


FIG. 27

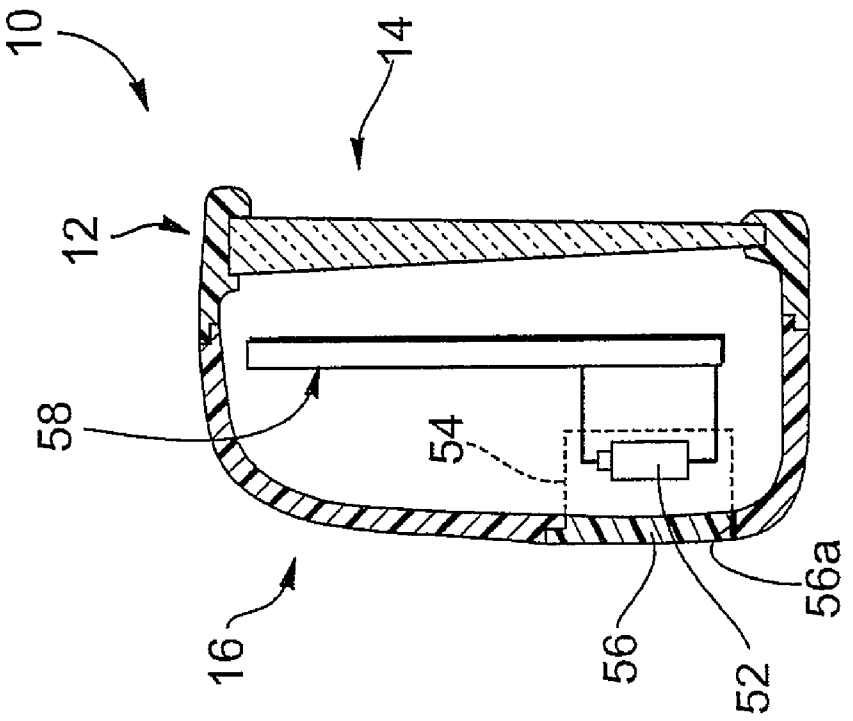


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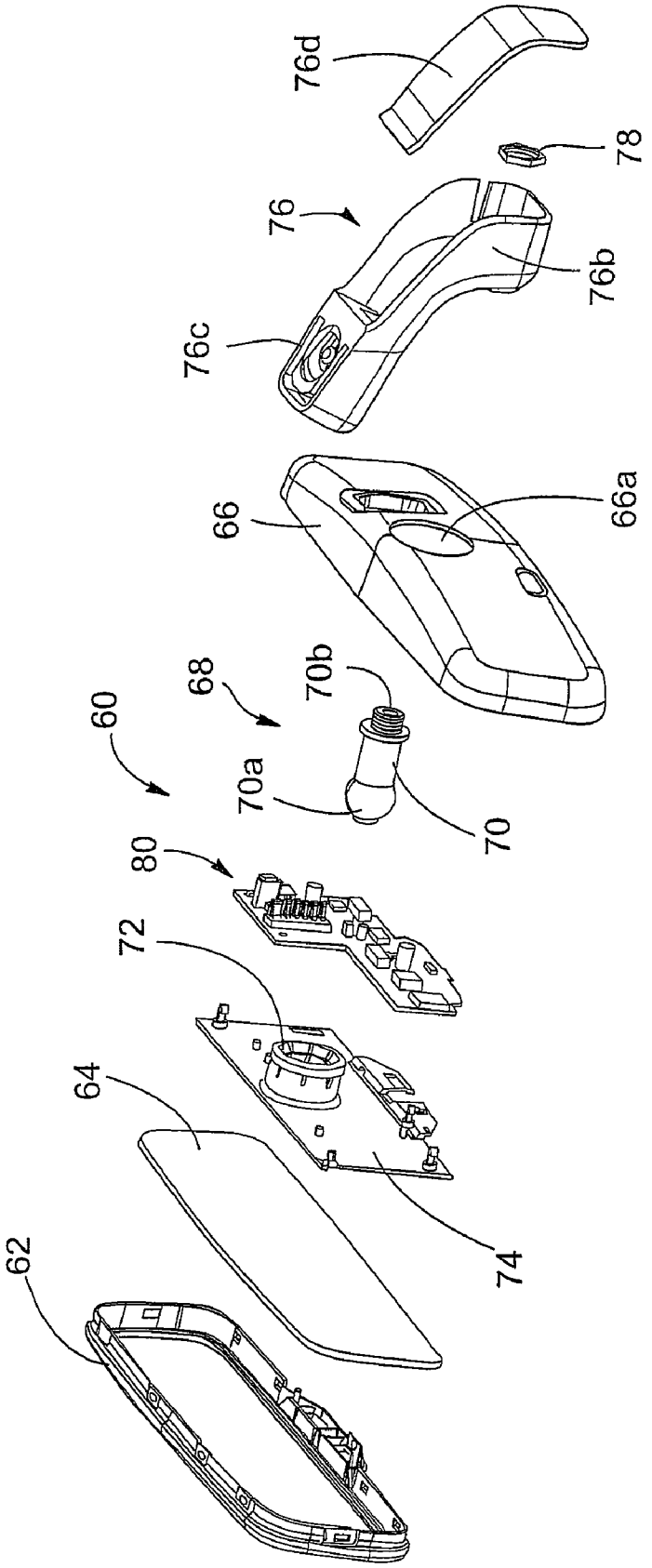


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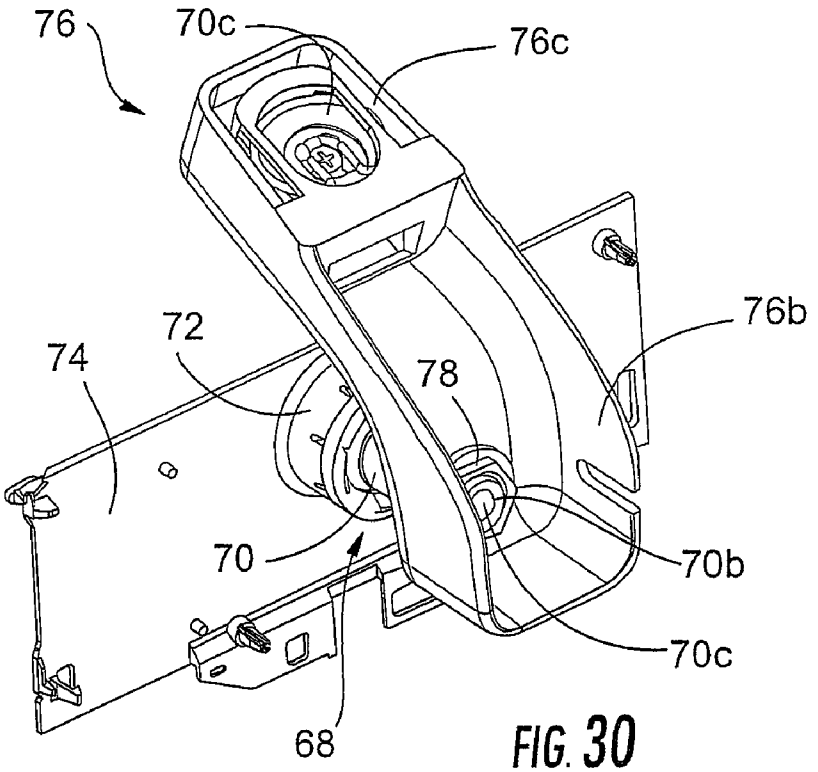

76
70c
76c
76b
72
74
78
70
70b
70c
68

FIG. 30

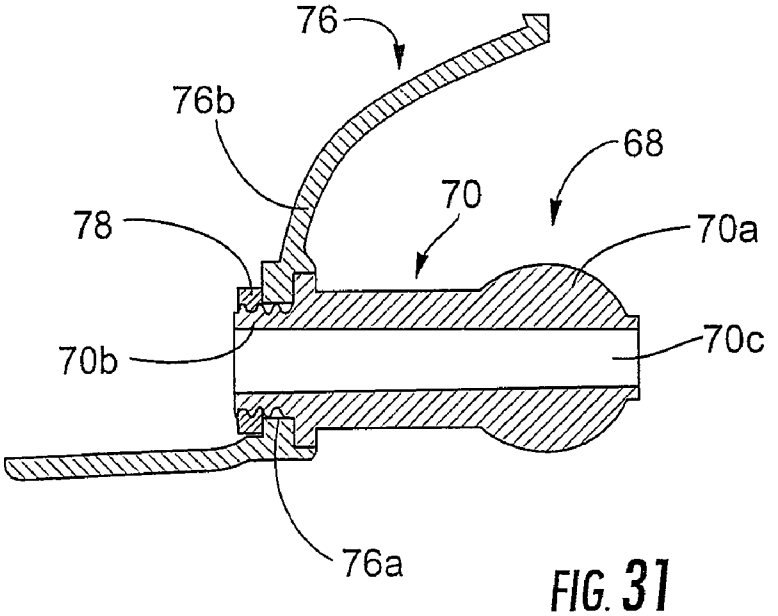

76
76b
68
70
78
70a
70b
70c
76a

FIG. 31

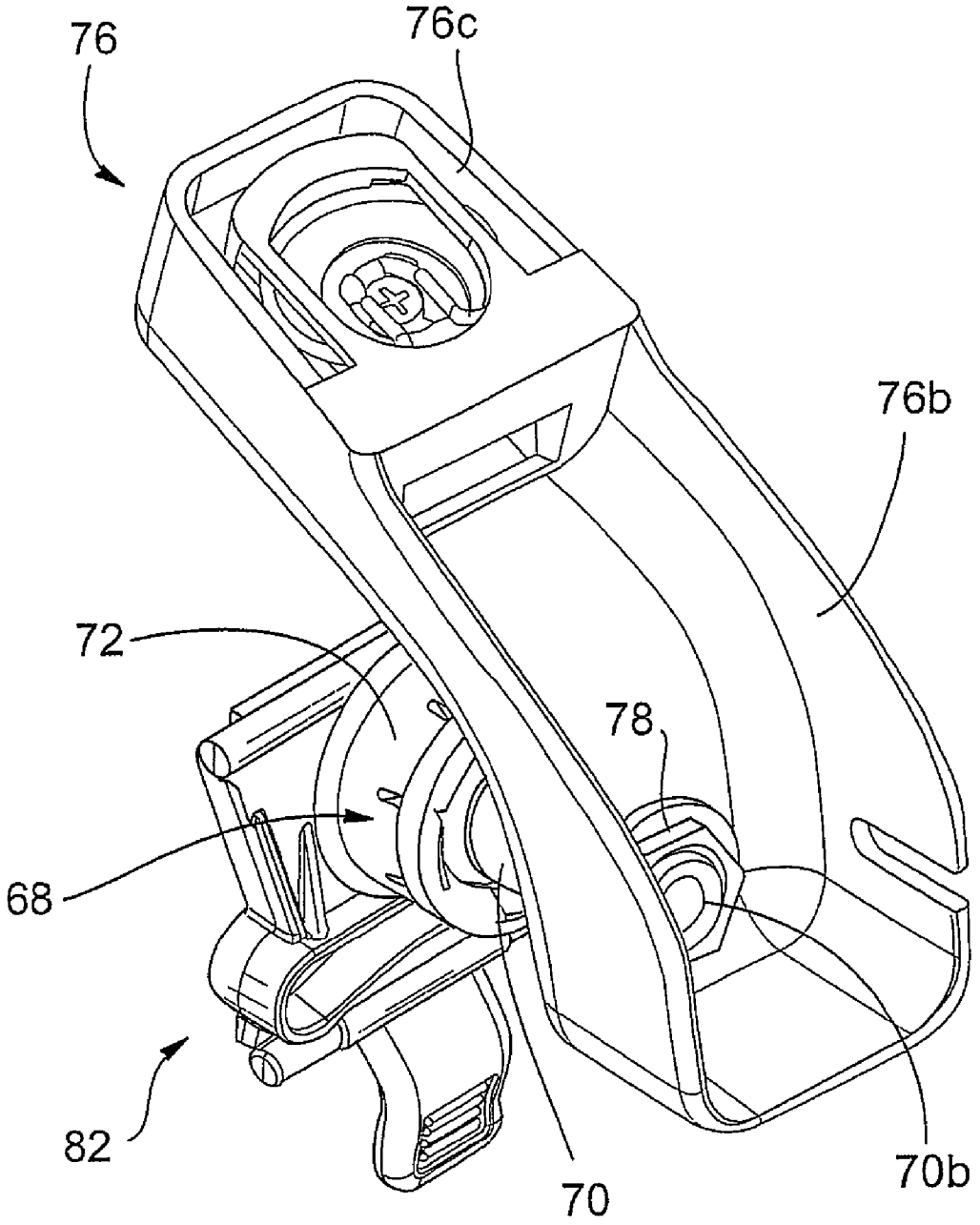


FIG. 32

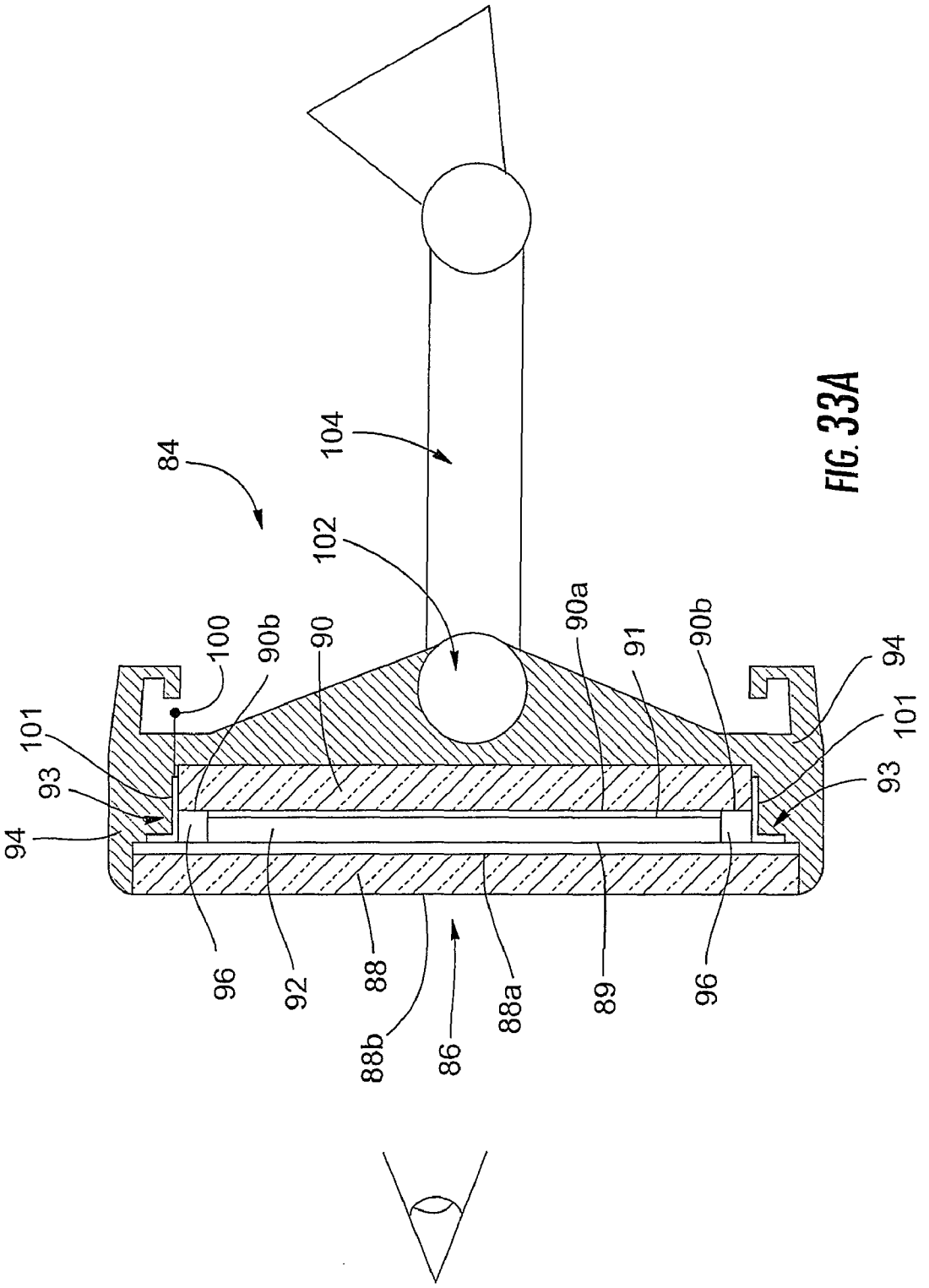

84
104
102
100
90b
90
90a
91
90b
94
101
93
101
93
94
96
92
88
88b
86
88a
89
96

FIG. 33A

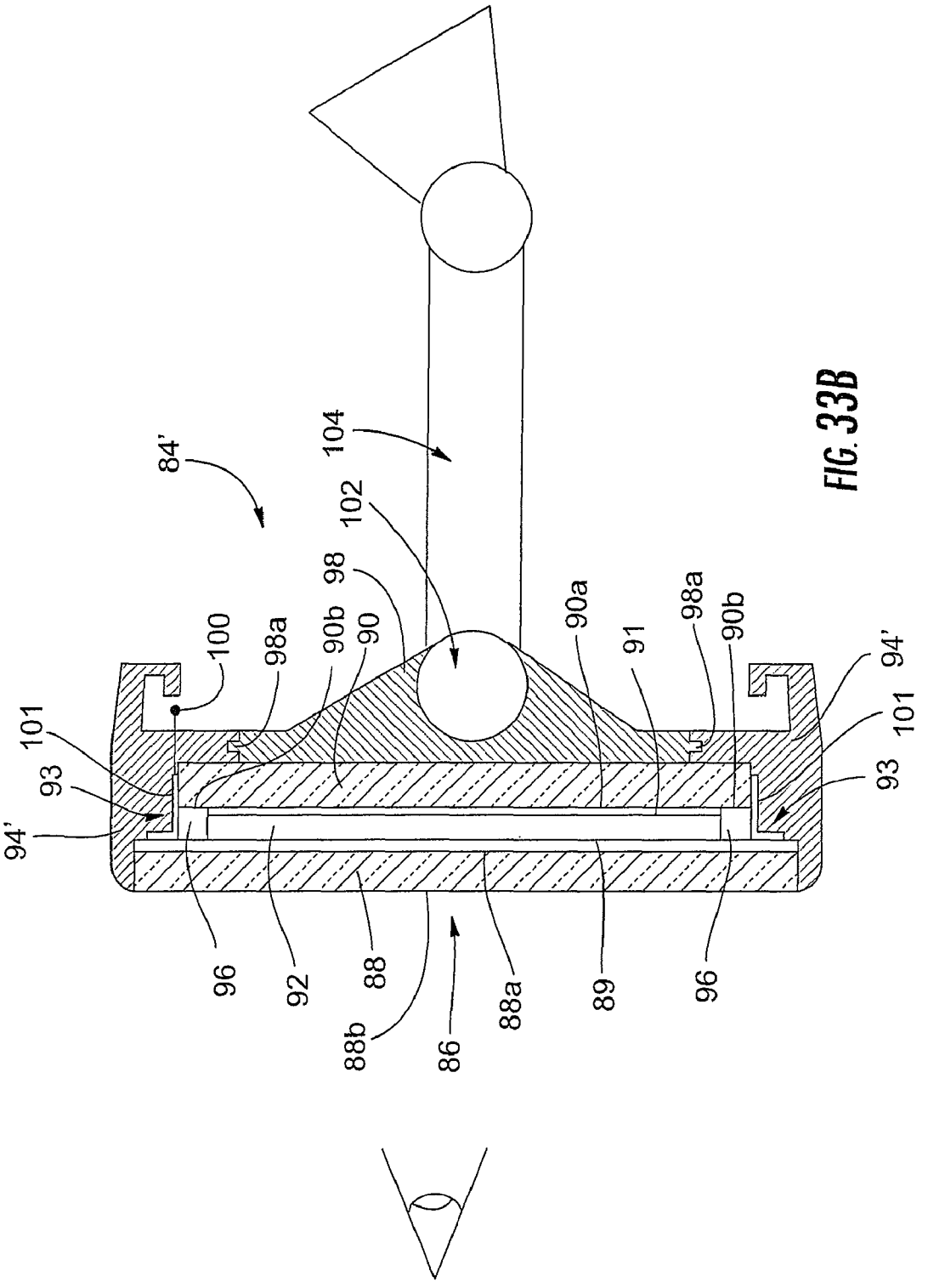

84'
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98a
90b
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90a
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98a
90b
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101
93
94'
101
93
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92
88
88b
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88a
89
96

FIG. 33B

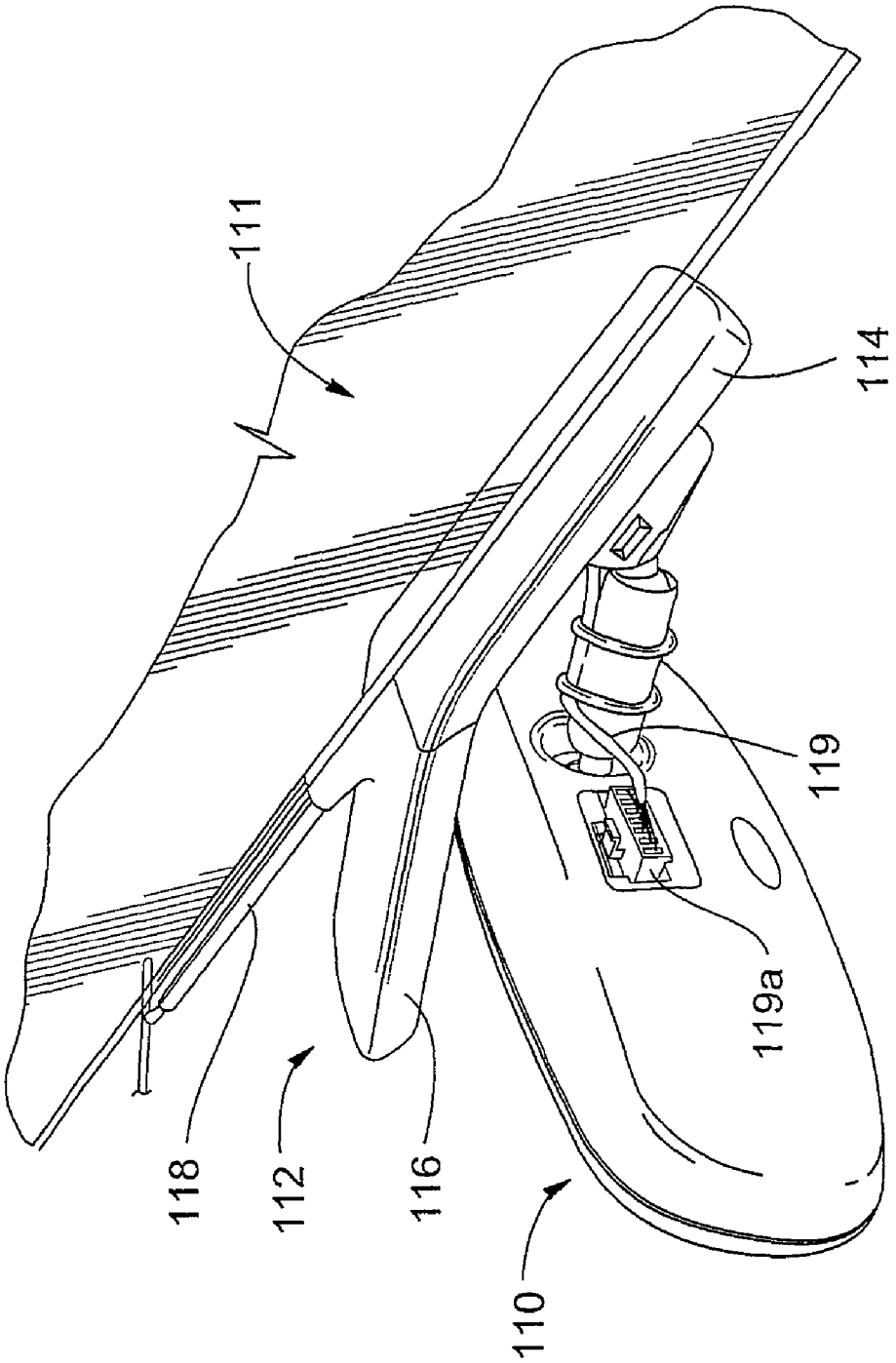


FIG. 34

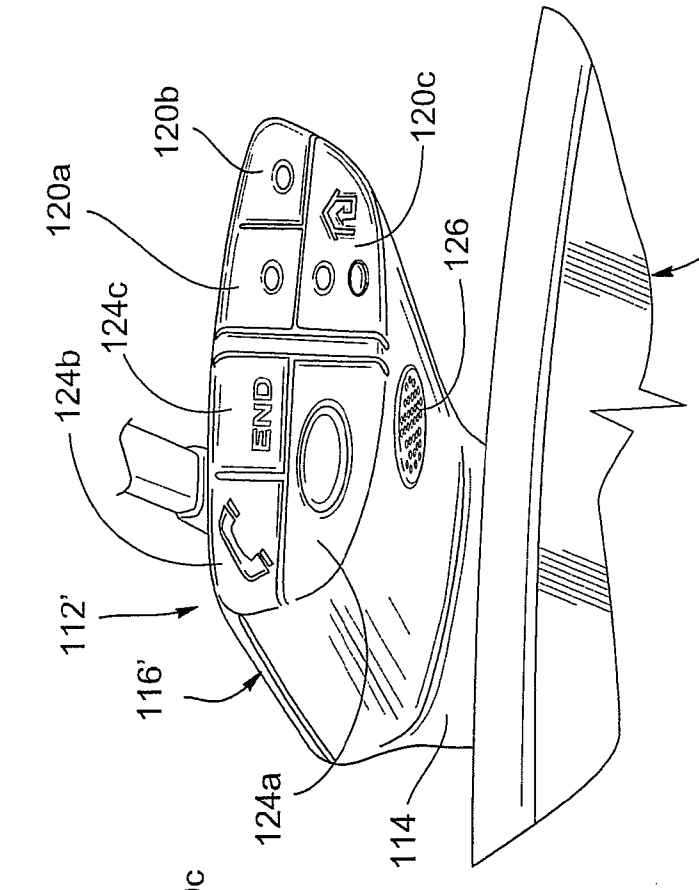


FIG. 35B

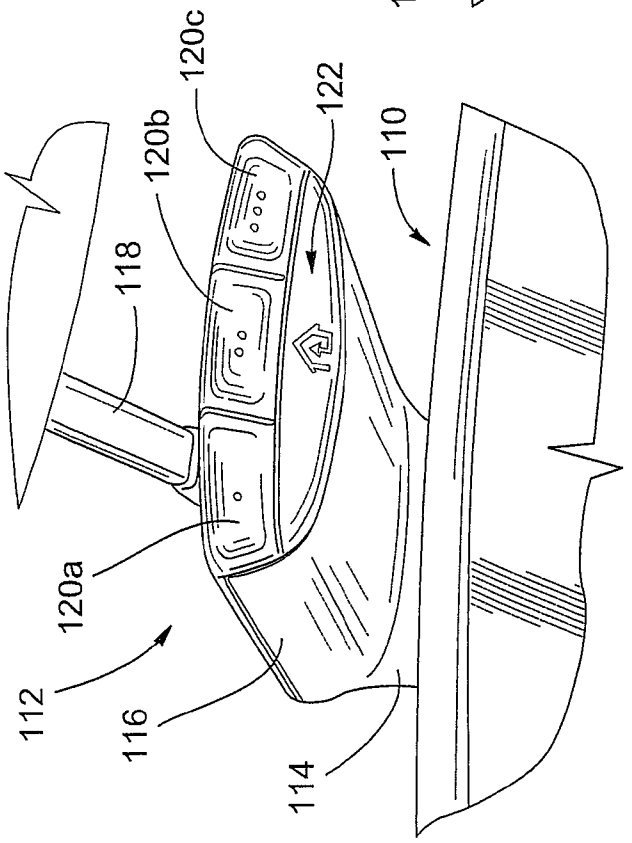


FIG. 35A

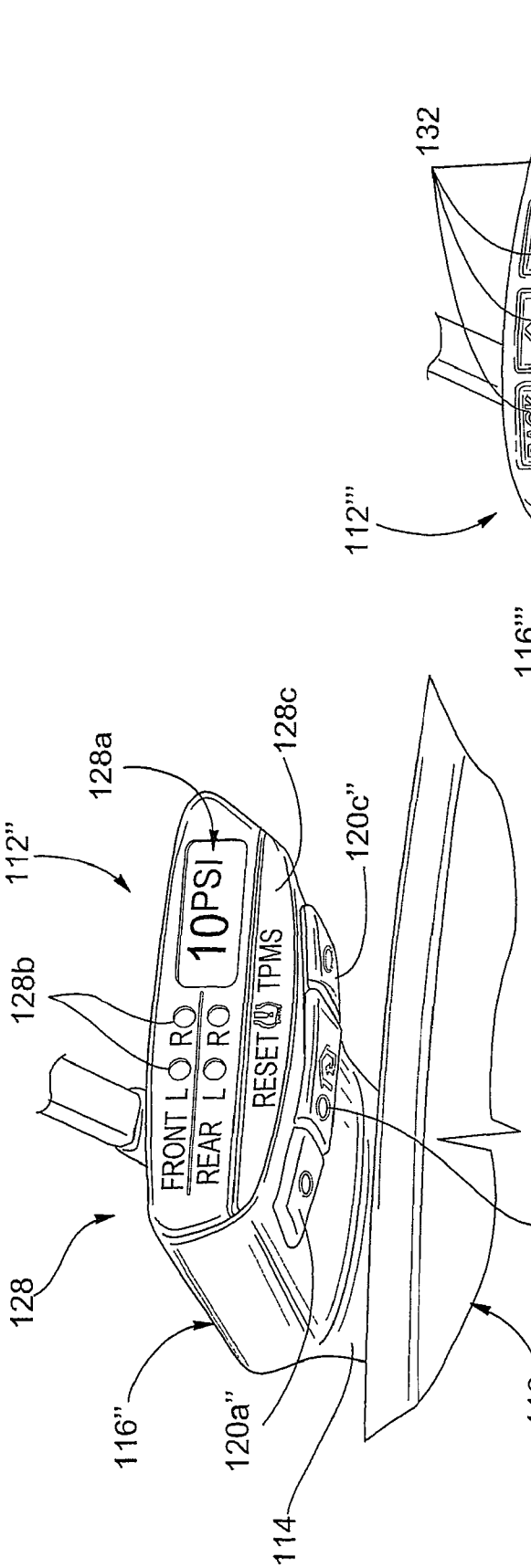


FIG. 35C

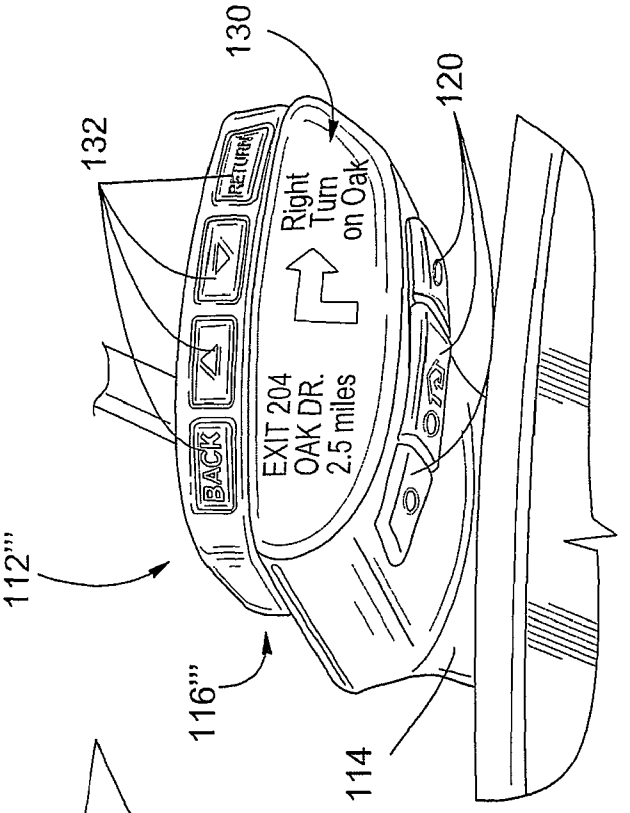


FIG. 35D

MIRROR ASSEMBLY FOR VEHICLE

CROSS REFERENCE TO RELATED APPLICATIONS

The present application is continuation of U.S. patent application Ser. No. 10/556,754, filed Nov. 15, 2005, now U.S. Pat. No. 7,289,037, which is a 371 U.S. national phase application of PCT Application No. PCT/US2004/015424, filed May 18, 2004, which claims benefit of U.S. provisional applications, 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 hereby incorporated herein by reference in their entireties.

FIELD OF THE INVENTION

The present invention relates generally to the field of interior rearview mirror assemblies for vehicles and, more particularly, to interior rearview mirror assemblies which incorporate an accessory or feature, particularly an electronic accessory or feature.

BACKGROUND OF THE INVENTION

The base level mirror for a vehicle is often a prismatic mirror assembly, which may provide a low cost mirror for the vehicle. The mirror assembly is often economically assembled by snapping or inserting the toggle assembly and prismatic reflective element into the casing at the front or bezel portion of the mirror casing substantially immediately after the casing (which may be formed of a hot molded polypropylene or the like) is formed and while the casing is still hot and pliable. As the casing cools, it shrinks to secure the reflective element in place in the casing. Because the reflective element is inserted into the casing while the casing is hot (such as after being freshly molded), the timing for the insertion process may be limited. Thus, it may be difficult to install or insert other accessories or components into the casing before the casing cools and shrinks.

It is often desirable to provide an electronic feature in the mirror assembly, such as a compass sensor and/or compass display, a tire pressure monitoring system and/or display and/or the like. In order to facilitate the addition of accessories or other components in the mirror assembly, the mirror assembly may typically have a casing and a separate bezel portion, which allows the accessory or accessories or the like to be installed into the casing (via its front opening) after it has cooled, and then allows the reflective element and bezel portion to be installed at the front portion of the casing. The bezel portion may be snapped to the casing or may be otherwise attached to the casing via sonic welding or the like to secure the bezel portion to the casing and to secure the components or accessories and the reflective element at or within the mirror casing. Although practical, this involves a less economical two-part, non-unitary casing and bezel design.

It is typically preferred to have the unitarily formed casing and bezel portion so that the reflective element is inserted into the casing while the casing is hot and pliable. However, it is also desirable to provide additional features or functions to the mirror assembly. Therefore, there is a need in the art for an improved mirror assembly which overcomes the shortcomings of the prior art.

SUMMARY OF THE INVENTION

The present invention provides an interior rearview mirror assembly which has one or more cap portions which attach or secure to a rear portion of a mirror holder. The mirror holder comprises part of a reflective element assembly portion comprising a mirror reflective element and a bezel portion or the like that preferably encompasses at least a perimeter portion of the reflective element, thereby at least partially securing the reflective element in the reflective element assembly portion. The cap portion or portions may include one or more electronic accessories or circuitry to provide additional features or functions to the mirror assembly. The additional features or functions may thus be back-loaded into the mirror holder after the mirror holder is formed and after the reflective element is attached at the bezel portion or front portion of the mirror holder.

According to an aspect of the present invention, an interior rearview mirror assembly for a vehicle comprises a mirror holder having a front portion and a rear portion, a reflective element positioned at the front portion of the mirror holder and received at least partially within the front portion of the mirror holder, and at least one cap portion. The rear portion of the mirror holder has at least one opening therethrough and the at least one cap portion is attachable to the rear portion of the mirror holder generally at the at least one opening. The at least one cap portion includes circuitry for at least one accessory. The at least one cap portion provides a rear cover for the mirror holder generally over the at least one opening.

According to another aspect of the present invention, a method of manufacturing an interior rearview mirror assembly portion includes forming a first molding by injection molding a first resinous material in a mold. The first resinous material has a tool shrinkage factor of at least approximately 1%. The first molding is at an elevated temperature when the first molding is removed from the mold. A reflective element is provided and positioned at the first molding before the first molding has cooled to approximately ambient temperature. The first molding at least partially encompasses a perimeter portion of the reflective element to form a reflective element assembly portion. The first molding is allowed to cool and shrink to retain the reflective element at the first molding. A cap portion comprises a second resinous material, which has a tool shrinkage factor of at less than or equal to approximately 1%. The cap portion includes at least one accessory. The cap portion is attached to the reflective element assembly portion after the first molding has cooled and shrunk. The cap portion is attached to the reflective element assembly portion such that the accessory is at least partially within the mirror assembly.

The accessory may comprise a compass sensor and/or display, a tire pressure monitoring system receiver/control circuitry and/or display, an antenna, a garage door opener, or any other accessory and/or accessory display and associated circuitry. For example, the circuitry may comprise compass display circuitry and the reflective element may have at least one port or icon or character etched or otherwise formed thereon, and preferably with an element of the circuitry aligned with/juxtaposed with the at least one port or icon or character etched or otherwise formed on the reflective element. The display circuitry may include at least one illumination source or lighting element for projecting illumination through a corresponding or appropriate port or icon or character on the mirror reflective element.

The cap portion or portions may be detachably attached to the mirror holder or first molding or bezel portion, such as via accessible detents or snaps or the like, and may be detachably removable from the mirror holder or first molding or bezel portion for service or replacement. However, the cap portion

may alternatively be non-detachably attached, such as by adhesive attachment or by heat staking or by ultrasonic welding or the like.

Therefore, the present invention provides an interior rearview mirror assembly which may include one or more electronic accessories or features. The accessory or feature may be installed at the rear portion of the mirror holder or bezel portion opposite the reflective element, and may be installed after the reflective element is inserted into the freshly molded or hot mirror holder or bezel portion and after the mirror holder has cooled and shrunk to secure the reflective element. Preferably, the accessory or feature may be mounted or positioned at, within or on one or more cap portions (preferably also with any associated wiring, interconnects and/or connectors and the like) which may be secured to the rear portion of the mirror holder and which may form a rear wall or surface of the mirror holder. The cap portion may be snapped to or attached to the mirror holder (which has the reflective element already inserted/installed therein) after the mirror holder has cooled, such that the assembly may be completed at a facility or assembly line that is remote from the facility or line at which the reflective element and mirror holder are assembled together. The present invention thus facilitates the addition of an electronic accessory or feature into a low cost mirror assembly with minimal additional investment to add the accessory or feature. The present invention may thus easily accommodate various features which may be selected by a customer.

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 front perspective view of an interior rearview mirror assembly in accordance with the present invention;

FIG. **2** is an exploded perspective view of the interior rearview mirror assembly of FIG. **1**;

FIG. **3** is an exploded perspective view of another interior rearview mirror assembly in accordance with the present invention;

FIG. **4** is an exploded perspective view of another interior rearview mirror assembly in accordance with the present invention;

FIG. **5** is an exploded perspective view of another interior rearview mirror assembly in accordance with the present invention;

FIG. **6** is a perspective view of a reflective element assembly portion of the mirror assembly of the present invention, with the reflective element removed to show additional details;

FIG. **7** is an opposite perspective view of the reflective element assembly portion of FIG. **6**;

FIG. **8** is a perspective view of a cap portion of the mirror assembly of FIG. **5**;

FIG. **9** is a perspective view of a cap portion and circuit boards of FIG. **5**, as assembled;

FIG. **10** is a rear perspective view of another interior rearview mirror assembly of the present invention;

FIG. **11** is a rear elevation of another interior rearview mirror assembly of the present invention;

FIG. **12** is a front elevation of an interior rearview mirror assembly, having directional heading or compass display in accordance with the present invention;

FIGS. **13**A-D are enlarged elevations of customized compass displays in accordance with the present invention;

FIG. **14** is a front elevation of another interior rearview mirror assembly, showing another compass display in accordance with the present invention;

FIG. **15** is a front elevation of another interior rearview mirror assembly, showing another compass display in accordance with the present invention; and

FIG. **16** is a front elevation of another interior rearview mirror assembly, showing another compass display in accordance with the present invention

FIG. **17** is a front elevation of another interior rearview mirror assembly having a compass and temperature display;

FIG. **18** is a front elevation of another interior rearview mirror assembly, having a garage door opening system display and user inputs in accordance with the present invention;

FIG. **19** is a front elevation of another interior rearview mirror assembly, having a compass display and a tire pressure monitoring system display in accordance with the present invention;

FIG. **20** is a front elevation of another interior rearview mirror assembly, having a tire pressure monitoring system display in accordance with the present invention;

FIG. **21** is an enlarged front elevation of another tire pressure monitoring system display in accordance with the present invention;

FIG. **22** is a front elevation of another interior rearview mirror assembly, having a telematics module and display in accordance with the present invention;

FIG. **23** is a front elevation of another interior rearview mirror assembly, having a telematics module and display in accordance with the present invention;

FIG. **24** is a perspective view of a cap portion for an interior rearview mirror assembly in accordance with the present invention;

FIG. **25** is an enlarged perspective view of alight actuator of the cap portion of FIG. **24**;

FIG. **26** is a perspective view of another cap portion of the present invention;

FIG. **27** is an upper perspective view of an interior rearview mirror assembly of the present invention, with microphones positioned along an upper cap portion;

FIG. **28** is a sectional view of an interior rearview mirror assembly having a battery in accordance with the present invention;

FIG. **29** is an exploded perspective view of another interior rearview mirror assembly in accordance with the present invention;

FIG. **30** is a rear perspective view of the mounting assembly of the mirror assembly of FIG. **29**;

FIG. **31** is a sectional view of the mounting arm and mount of FIG. **30**;

FIG. **32** is a rear perspective view of another mounting assembly of the present invention;

FIG. **33**A is a sectional view of an electrochromic reflective element assembly portion in accordance with the present invention;

FIG. **33**B is a sectional view of another electrochromic reflective element assembly portion in accordance with the present invention;

FIG. **34** is a perspective view of another interior rearview mirror assembly and a windshield accessory module in accordance with the present invention; and

FIGS. **35**A-D are perspective views of different accessory modules of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings and the illustrative embodiments depicted therein, an interior rearview mirror assembly

or modular prismatic rearview mirror assembly **10** for a vehicle includes a reflective element assembly portion **13** including a mirror holder **12** and a reflective element **14** (FIG. **1**) positioned at and at least partially within the mirror holder and/or bezel portion, that preferably is molded from a polyolefin material, such as a polypropylene material or the like. Mirror assembly **10** includes a plastic molded cap or cap portion **16**, preferably molded from an ABS material, an engineering resin material, such as a filled or unfilled nylon material, or the like (and may be integrally molded with metallic or ceramic materials or inserts or the like to provide mechanical bracing and enhanced structural rigidity). Cap portion **16** is mountable or attachable to a rear portion or open portion **12***a* of mirror holder **12**, and may include an accessory or feature or the like, such as a printed circuit board **18** having an electronic accessory or circuitry thereon or integrated therein or attached thereto. Cap portion **16** may be snapped or otherwise mounted to or attached to the open rear portion **12***a* of mirror holder **12** to install or back-load the printed circuit board and/or accessory within the mirror holder **12** of mirror assembly **10**. Cap portion **16** may be detachably mounted or attached to the mirror holder, such as via accessible detents or snaps or the like, and may be removable or detachable from the rear portion of the mirror holder, such as for service or replacement of the cap portion or one or more accessories of the cap portion.

Various cap portions of the present invention may be provided with different options or accessories, and may be selected to mount to or attach to a universal or common mirror holder to form different mirror assemblies having different content. The present invention thus allows an automobile manufacturer to order or purchase common or standard mirror holders or reflective element assembly portions and different or custom cap portions and to assemble the mirror assembly with the desired cap portion and content at the vehicle assembly plant. The automobile manufacturer may even choose to purchase the mirror holders (which may include the reflective element) from one source and the cap portions from another source, and may complete the mirror assembly at the vehicle assembly plant or at another facility, such as a mirror assembly plant or the like. The present invention thus allows an automobile manufacturer to order or purchase the mirror holder and reflective element (and may be the toggle assembly and mounting assembly as well, such as shown in FIGS. **6** and **7**) from a mirror specialist, and the cap portions and accessories (such as shown in FIG. **9**) from an electronics specialist. The cap portion may snap or otherwise attach to the mirror holder to complete the assembly of the rearview mirror assembly.

Because the cap portion or portions may be purchased separately, the present invention lends itself to aftermarket applications or to dealership or consumer customizations/personalization, where a cap portion having the desired accessories or appearance or design may be purchased and installed to a mirror holder to alter or upgrade the mirror assembly of the vehicle. It is envisioned that such an upgrade could be made to a base mirror that does not originally include any electronic accessories, whereby the cap portion could provide electrical content to the mirror assembly. In such applications, the cap portion may connect to a power source or the like of the vehicle (such as via a wire or cable that extends between the mirror assembly and the headliner or an accessory module of the vehicle when the mirror assembly is installed in the vehicle) or the cap portion may include a battery or self-contained power source to provide power to the accessories and circuitry contained within the cap portion, such as discussed below with respect to FIG. **28**.

In an aftermarket application, cap portions may be provided as aftermarket cap portions, and a consumer may purchase a desired cap portion, which may have desired content or features and/or may have a desired color or texture or appearance or the like, and may readily remove the existing cap portion from the mirror of their vehicle and replace it with the new cap portion. For example, the cap portion and/or the mirror holder may have snaps or clasps that may retain the cap portion and the mirror holder together, but that may release or detach such that the cap portion may be detachable from the mirror holder by a user. The cap portion may be pulled or detached from the mirror holder and a new cap portion may be pressed or snapped into place on the mirror holder to provide the vehicle owner with the new cap portion having the desired content or functions or features and/or the desired appearance or the like, as discussed in detail below.

Reflective element **14** may comprise a prismatic reflective element having a wedge shaped prism with a reflective coating on its rear surface, such as described in U.S. Pat. Nos. 6,318,870; 5,327,288; 4,948,242; 4,826,289; 4,436,371; and 4,435,042; and/or U.S. patent application Ser. No. 10/709,434, filed May 5, 2004 by Lynam for MIRROR REFLECTIVE ELEMENT, now U.S. Pat. No. 7,420,756; and/or U.S. provisional application Ser. No. 60/525,952, filed Nov. 26, 2003 by Lynam for MIRROR REFLECTIVE ELEMENT FOR A VEHICLE, which are all hereby incorporated herein by reference. Reflective element **14** may include one or more displays which may be laser-etched or otherwise formed thereon, such as via an appliqué or the like on the surface of the reflective element or such as a display on demand type of display (discussed below). The display may include one or more display elements, such as illumination sources, such as vacuum fluorescent (VF) elements, liquid crystal displays (LCDs), light emitting diodes (LEDs), such as inorganic LEDs or organic light emitting diodes (OLEDs), electroluminescent (EL) elements or the like. Optionally, the prismatic reflective element may comprise a display on demand or transflective prismatic element (such as 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; and/or U.S. provisional application Ser. No. 60/525,952, filed Nov. 26, 2003 by Lynam for MIRROR REFLECTIVE ELEMENT FOR A VEHICLE, which are all hereby incorporated herein by reference) so that the displays are viewable through the reflective element, while the display area still functions to substantially reflect light, in order to provide a generally uniform prismatic reflective element even in the areas that have display elements positioned behind the reflective element.

For example, as shown in FIGS. **1-5** and **12**, prismatic reflective element **14** may include a compass display **14***a* and/or other display, such as a passenger side inflatable restraint status display **14***b* (FIGS. **2-4**) or the like, formed or etched on the reflective element. For example, the compass display **14***a* may include ports **15***a*, such as icons, characters or directional headings (N, S, E, W), etched or formed in the reflective coating of the reflective element (such as via removing the reflective coating of the reflective element to form a desired port or icon or character and/or such as by utilizing aspects described in U.S. Pat. No. 4,882,565, issued to Gallmeyer, which is hereby incorporated herein by reference) to allow light from corresponding illumination sources or elements **19***a* (such as light emitting diodes or the like) to pass through the reflective element to illuminate or back light the appropriate port or icon or heading character for viewing by the driver or occupant of the vehicle, such as similar to the

compass systems disclosed in U.S. patent 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, which is hereby incorporated herein by reference in its entirety, and as discussed below.

As shown in FIG. **5**, the reflective element **14** may include an anti-scatter film or sheet or tape **14***c* applied over its rear surface. The tape **14***c* may be adhered or otherwise attached to the rear surface of the reflective element so as to limit shattering or scattering of the mirror glass if the vehicle is involved in an accident. Also, the reflective element **14** may include a display appliqué **14***d* that may be adhered or applied to the rear surface of the reflective element in the general region of the display **14***a* (and/or at the region of other displays at the reflective element). The display appliqué **14***d* may comprise a diffusing element or material, such as a white diffusing material with a smoked front or the like, to diffuse the light emitted by the display elements so that a person viewing the display **14***a* will not readily discern the individual lighting elements or filaments, but will view substantially uniform illumination provided by the lighting elements or filaments.

Interior rearview mirror assembly **10** may include a toggle assembly **20** and a mounting portion **22**, which may be pivotally connected to toggle assembly **20** and mounted to the vehicle to provide pivotal movement of the mirror holder and reflective element relative to the vehicle. Toggle assembly **20** may include a toggle member **20***a*, which may be actuated or moved by a user to adjust the mirror holder and reflective element relative to the vehicle. Optionally, toggle member **20***a* may comprise a soft touch surface or portion, such as disclosed in U.S. Pat. Nos. 6,318,870 and 6,349,450, which are hereby incorporated herein by reference. Such a soft touch surface or portion preferably comprises a soft touch material (such as a thermoplastic elastomer or other similar thermoplastic materials, such as Santoprene or the like), preferably having a Shore A durometer value of less than about 110 Shore A, more preferably less than about 90 Shore A, and most preferably less than about 70 Shore A, that may be molded over a rigid or harder material or structure, such as by utilizing aspects described in U.S. Pat. No. 6,349,450, which is hereby incorporated herein by reference. The toggle assembly or the mirror holder may also include a pivot joint or pivot element **20***b*, such as a socket and/or ball member, molded or formed thereon or attached or mounted thereto, in order to provide pivotal movement or adjustment of the mirror assembly relative to the mounting arm or portion. The mounting portion **22** may be mounted to the vehicle, such as to an interior surface of the vehicle windshield or to a header portion of the vehicle or the like, via any mounting arm and button or any other mounting arrangement or construction, such as the types disclosed in U.S. Pat. Nos. 6,499,850; 6,318,870; 6,315,421; 6,227,675; 5,671,996; 5,813,745; 5,673,994; 5,820,097; 5,708,410; 5,680,263; 5,582,383; 5,576,687; 5,555,136; 5,521,760; 5,330,149; 5,100,095; 5,058,851; 4,930,742; 4,936,533; 4,436,371; 4,524,941; 4,435,042; and/or 4,646,210; and/or PCT Publication No. WO 03/095269 A2, published Nov. 20, 2003 for REARVIEW MIRROR ASSEMBLIES; and/or PCT Publication No. WO 03/099614 A1, published Dec. 4, 2003 for MODULAR REARVIEW MIRROR ASSEMBLY, which are hereby incorporated by reference herein, without affecting the scope of the present invention. Optionally, the mirror assembly may be mounted to the vehicle portion (such as to the windshield or headliner of the vehicle) via a substantially plastic or all plastic double ball mounting arrangement, such as described in U.S. Pat. No. 6,318,870 and/or U.S. patent application Ser. No. 10/032,401, filed Dec. 20, 2001 by March et al. for INTERIOR REARVIEW MIRROR ASSEMBLY WITH POLYMERIC COMPONENTS, now U.S. Pat. No. 6,877,709, which are hereby incorporated herein by reference. The mounting arrangement may be configured to provide for wiring to the mirror assembly through the mounting arrangement and to or into the mirror assembly, without affecting the scope of the present invention.

During assembly of the reflective element assembly portion, the mounting member or arm may be inserted into the socket portion at the reflective element assembly portion (such as at the reflective element or at a backing plate of the reflective element or at a toggle assembly of the mirror assembly or the like) via an automated device or machine or by a robot. The automatic device or machine may be used to attach or snap the front end of the mounting member to the socket portion at the reflective element.

Optionally, the mirror assembly may provide or include an automatic flip prismatic reflective element, such as described in U.S. Pat. Nos. 6,717,712; 6,568,414; and/or 6,382,806, which are hereby incorporated herein by reference. Because the circuit board and any display elements positioned thereon is/are generally fixedly secured to the cap portion, which in turn is generally fixedly secured to or relative to the mirror holder and reflective element, the circuit board and display elements move with the reflective element during adjustment of the mirror, such that there is substantially no change in the juxtapositioning/alignment of the lighting or display through the prismatic reflective element.

Mirror holder **12** of interior rearview mirror assembly **10** preferably comprises a unitary or one-piece mirror holder (preferably molded from a thermoplastic resin, such as a polyolefin, such as polypropylene or the like), which may be molded or otherwise formed with a bezel portion **12***b* integrally formed therewith, and which receives the prismatic reflective element therein. As shown in FIGS. **6** and **7**, the toggle assembly **20** and mounting portion **22** may be attached to the mirror holder/bezel portion **12**, preferably while the mirror holder is still warm and pliable. Although not shown in FIGS. **6** and **7**, the reflective element **14** may be attached to or inserted into the mirror holder/bezel portion **12** at around the same time to form a mirror holder assembly that may be attached to the appropriate or desired cap portion, as discussed below. The reflective element and molded portion or bezel portion thus may define a reflective element assembly portion **13** of the mirror assembly **10**. The toggle assembly **20** and the prismatic reflective element **14** thus may be secured into place (such as by snapping together) at or in the mirror holder **12** while the molded mirror holder (preferably the freshly molded mirror holder) is still warm and pliable, such as disclosed in U.S. Pat. No. 4,436,371, issued to Wood et al., which is hereby incorporated herein by reference. When the molded mirror holder (preferably the freshly molded mirror holder and thus just exiting the injection molding press, or alternately, and less desirably, a heated mirror holder having been heated, such as in an oven or the like, to make the mirror holder warm and pliable) cools and shrinks, the mirror holder grips around the toggle assembly and the prismatic reflective element to retain the toggle assembly and the reflective element in the reflective element assembly portion.

The material of the mirror holder or bezel portion, and/or of the reflective element assembly portion in totality, may be selected to have a desired linear mold shrinkage or tool shrinkage factor to provide the desired amount or degree of shrinkage as the mirror holder cools and shrinks around the reflective element to secure the reflective element at the mirror holder or bezel portion. For example, at least the bezel

material, and preferably the reflective element assembly portion in totality, may have a linear mold shrinkage or tool shrinkage factor of preferably at least about 0.01 cm/cm or about 1%, and more preferably at least about 0.015 cm/cm or about 1.5%. For example, a UV stabilized, general purpose black polypropylene polymeric molding resinous material, such as is commercially available from Huntsman Corp. of Houston, Tex. under the trade name REXENE 17C9A, and having a tool shrinkage factor of 0.018 cm/cm or 1.8%, may be a suitable material for the bezel portion in that it provides a desired degree of shrinkage around the reflective element as the material cools, and after formation of the mirror holder or bezel portion by molding in an injection molding operation and/or after heating an already-molded mirror holder or bezel portion to an elevated temperature (such as greater than 70 degrees Celsius or higher), in order to sufficiently retain the reflective element at the bezel portion.

The linear mold shrinkage or tool shrinkage factors, as known in the material science arts, are determinable by test standards, such as by test standards set by the American Society for Testing and Materials (ASTM), such as the ASTM D 955 (Standard Test Method of Measuring Shrinkage from Mold Dimensions of Thermoplastics), which is hereby incorporated herein by reference, or such as by ISO 294-4, which is hereby incorporated herein by reference. The test measures the shrinkage from the mold cavity to the molded dimensions of thermoplastics when molded by compression or injection molding processes with specified process conditions or parameters.

As shown in FIGS. **2** and **3**, the rear portion **12***a* of mirror holder **12** may have openings or apertures **12***c* formed therethrough at either or both sides of the toggle assembly to allow for insertion of the accessory or accessories supported by the corresponding cap portions, as discussed below. Optionally, and as shown in FIGS. **4-7**, the mirror holder **12'** may be substantially open for a unitary cap portion **16"** to attach at, as also discussed below.

After the mirror holder and reflective element are assembled together, and may be after the mirror holder has cooled and shrunk (such as in applications where the reflective element/mirror holder assembly is provided or shipped from a different location than where the cap portion and electrical circuitry or electrical content are from), the cap portion **16** may be attached or secured to the rear portion **12***a* of mirror holder **12** to complete the assembly of rearview mirror assembly **10**. In comparison to the bezel material, the material selected for the cap portion need not have such shrinkage properties as described above, because the cap portion may be fabricated at and supplied from separate operations, locations and/or facilities than the bezel portion. However, the cap portion may be fabricated at the same facility or location, but could by made during a different operation and/or at a different time, without affecting the scope of the present invention. For example, the cap portion preferably is formed by injection molding of a polymeric resinous material having a tool shrinkage factor of less than and preferably substantially less than about 0.01 cm/cm or about 1% (although it may also have higher tool shrinkage factors, without affecting the scope of the present invention), and preferably less than approximately 0.008 cm/cm or about 0.8%. This enables the provision in the cap portion of material properties not readily deliverable by the higher linear mold shrinkage or tool shrinkage factor materials used for the bezel portion.

For example, the cap portion material may have a higher heat stability/higher heat deflection property/higher flexural modulus compared to the reflective element assembly portion, in order to maintain any accessories or elements mechanically attached thereto or therein. Also, the cap portion material may be selected to provide a higher structural strength if desired. For example, the cap portion material may comprise a high temperature ABS material, such as available from BASF or others under the trade name TERLURAN® GRADE-HH106, which has a tool shrinkage factor of around 0.006 cm/cm or 0.6%, or other suitable materials, such as Nylon and preferably a filled Nylon material or the like. Such a material may also provide structural characteristics that are suitable for supporting accessories or the like. For example, the cap portion material may desirably have a heat deflection temperature under load of 0.45 MPa of greater than approximately 100 degrees Celsius (and more desirably, greater than approximately 110 degrees Celsius and most desirably greater than approximately 115 degrees Celsius), as determined by standard testing, such as by ASTM 648 or ISO 75-1/-2 (which are hereby incorporated herein by reference) or the like. Such testing may determine the temperature at which an arbitrary deformation occurs when a specimen of the material is subjected to an arbitrary set of testing conditions or parameters.

The tool shrinkage factor of the resinous material molded to form the cap portion thus is preferably less than the tool shrinkage factor of the resinous material molded to form the bezel portion of the reflective element assembly portion. Also, the flexural modulus of the material that forms the cap portion may preferably be greater than the flexural modulus of the material that forms the mirror holder or bezel portion. Also, the material that forms the cap portion may preferably have a higher heat deflection temperature (such as may be determined by standard testing, such as ASTM D-790, which is hereby incorporated herein by reference) than the material that forms the bezel portion or mirror holder. Such standardized testing may determine the flexural properties or flexural strength of the material via bending or breaking of specimens of the material in accordance with the appropriate test parameters. Desirably, although the polymeric resinous materials used for the bezel portion and the cap portion may be different, the portions may have similar exterior finishes and/or textures. Alternatively, however, the portions may have different finishes and/or textures or the like as discussed below, without affecting the scope of the present invention.

Optionally, and as described above, the mirror holder and reflective element assembly portion may be packaged and moved to another facility and/or the cap portion may be received from another facility to complete the mirror assembly. The appropriate or selected cap portion (with the appropriate associated electrical circuitry/accessory/content) may then be attached to the reflective element/mirror holder assembly, such as at the vehicle assembly line, to assemble the mirror assembly for installation into the appropriate vehicle having the optional content of the mirror assembly, as discussed below. The modular mirror assembly of the present invention thus facilitates assembly of the reflective element assembly portion and of the cap portion at different assembly locations, whereby the two portions may be joined or assembled together at a different location, such as at the vehicle assembly plant, to complete the mirror assembly. The cap portion may attach to the reflective element assembly portion via a snap together connection or other type of connection, and may removably or detachably attach, so that the cap portion may be removed from the reflective element assembly portion if desired. However, the cap portion may alternatively be non-detachably attached, such as by adhesive attachment or by heat staking or by ultrasonic welding or the like, without affecting the scope of the present invention. The

cap portion may attach to the reflective element assembly portion via any manner, such as, for example, utilizing aspects described in U.S. Pat. No. 6,402,331, which is hereby incorporated herein by reference. Thus, the present invention encompasses customization/selection of material properties for the cap portion to be different from material properties selected for the reflective element assembly portion so that decorative finishes and/or functional properties may be customized/delivered to be the same or different for one or both of the portions.

Optionally, one or more accessory modules or blocks (such as discussed below) may be attached to or inserted or plugged into the cap portion and/or mirror assembly, such as at the vehicle assembly line, to provide a desired or selected or customized optional feature or accessory to the mirror assembly. The accessory module may insert or attach to the mirror assembly or cap portion utilizing aspects described in U.S. Pat. Nos. 6,672,744; 6,402,331; 6,386,742; and 6,124,886, and/or U.S. patent application 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, which are hereby incorporated herein by reference. The accessory module may include circuitry and display elements and user inputs, and may plug into the cap portion or mirror assembly in a manner whereby mechanical and electrical connections are preferably simultaneously made as the module is inserted into the cap portion or mirror assembly, such as by utilizing aspects described in U.S. Pat. No. 6,669,267, and/or U.S. patent application Ser. No. 10/727,731, filed Dec. 3, 2003 by Lynam et al. for EXTERIOR ACCESSORY MODULE FOR VEHICULAR MODULAR DOOR, now U.S. Pat. No. 6,969,101, which are hereby incorporated herein by reference. The mirror assemblies thus may be customized to particular work orders or selected options at the vehicle assembly line via insertion or attachment of the appropriate accessory module, such that the cap portion and the reflective element assembly portion may comprises common or universal components for two or more options offered for the particular mirror assembly or vehicle application.

The modular mirror assembly of the present invention thus may provide fully assembled mirror assemblies to a vehicle assembly plant and line, where the cap portion and selected content are attached to the reflective element assembly portion at a remote location, such that different mirror assemblies are provided for different options or applications. Optionally, the modular mirror assembly may provide a universal or common reflective element assembly portion to a vehicle assembly plant, and a selected cap portion (with the appropriate or desired or selected optional content) may be attached to the reflective element assembly portion at the vehicle assembly line to customize the mirror assembly for the particular selected option or application. Optionally, the modular mirror assembly of the present invention may provide a universal reflective element assembly portion and a partially or substantially universal (at least universal as to two or more selectable options) cap portion, whereby the selected accessory module may be inserted into or attached to the cap portion and/or mirror assembly at the vehicle assembly line to complete the mirror assembly and to provide the desired or selected option or feature to the mirror assembly.

As shown in FIG. **2**, cap portion **16** may comprise two separate cap portions **16***a*, **16***b*, or a cap portion **16'** (FIG. **3**) may have two cap portions **16***a'*, **16***b'* joined together by a connecting portion or wire channel **16***c*. One or both of the cap portions **16***a*, **16***b* may have an accessory or circuit board **18***a*, **18***b* attached thereto. The circuit board or boards may snap or otherwise affix or secure to the cap portion or portions. As shown in FIG. **2**, the cap portions may have retainers or pillars extending from an interior surface for retaining and supporting the circuit board or boards thereon. Optionally, the cap portion may comprise a unitary cap portion **16"** (FIGS. **4**, **5**, **8-11**, **24** and **26**) substantially covering the rear portion of the mirror holder (opposite the reflective element) and receiving or supporting one or more printed circuit boards thereon. The cap portion may receive the mounting portion **22** between the side portions of the cap portion **16'** (FIG. **3**) or through an opening **25***a* in the cap portion **16"** (FIGS. **4**, **8-11**, **24** and **26**) as the cap portion is attached to the mirror holder. For example, the mounting portion **22** may be threaded through the opening **25***a* in the cap portion as the cap portion is moved toward and into engagement with the bezel portion during the mirror assembly process. The mirror assemblies **10'** and **10"** (with cap portions **16'** and **16"**, respectively) may be substantially similar to and may have substantially similar components and accessories as mirror assembly **10** (with cap portions **16***a*, **16***b*), such that a detailed description will not be repeated for the different mirror assemblies. The common or similar components of the mirror assemblies are referred to in FIGS. **2-11** with the same reference numbers.

The cap portion **16** or portions **16***a*, **16***b* may be positioned at openings **12***c* of mirror holder **12** such that the accessories or circuitry supported by the cap portions are positioned generally within mirror holder **12**. The cap portions may snap onto the rear portion **12***a* of mirror holder **12** and generally cover the openings **12***c* in mirror holder **12**. Optionally, the unitary cap portion **16"** may snap onto or otherwise secure to the mirror holder and generally cover or define the rear portion of the mirror assembly when so assembled. The cap portion or portions thus support the circuit board or circuit boards and associated circuitry and/or accessories at or within the mirror assembly.

Optionally, the circuit boards or accessories may be provided at, within or on the cap portions at a cap portion manufacturing facility or electrical accessory manufacturing facility, such that the cap portion and circuitry assemblies are provided as a unit to the mirror assembly facility or plant. The cap portion and circuitry units may then be snapped or otherwise affixed to the mirror holder or reflective element assembly portion of an appropriate mirror assembly having features or components or displays corresponding to the cap portion and circuitry units, as discussed below. The assembly or back-loading of the cap portions to the mirror holder and reflective element assembly portion thus may be performed remote from the molding tool for molding the mirror holder, since the cap portions may be mounted to the mirror holder after the mirror holder has cooled and shrunk.

Each cap portion may support one or more desired accessories or circuit boards for providing the desired feature to the mirror assembly. The cap portions, and corresponding accessory or feature or electrical content, may be selected and attached to a universal or common mirror holder to provide different features to the mirror depending on the options selected for a particular application or vehicle. Optionally, the cap portions may be selected/configured to have accessories contained/supported therein to correspond to and be aligned with/juxtapositioned with one or more displays of a particular or respective reflective element secured in the common mirror holder and/or may correspond with a particular mirror holder for applications where the accessory includes buttons or controls which may extend through openings or recesses in the mirror holder for access thereto by the driver or occupant of the vehicle, as discussed in detail below.

The cap portion or cap portions may be snapped or otherwise secured to the rear portion **12***a* of mirror holder **12**, such

as generally at and covering corresponding openings **12***c* through the rear portion **12***a* of mirror holder **12**. The opening or openings **12***c* may be at either or both sides of the toggle assembly and mounting portion of the mirror assembly. The cap portion may snap over or otherwise interconnect with the respective opening via a plurality of hooks or snap clasps (which may extend from the cap portion or the mirror holder) engaging a plurality of corresponding slots or the like at the other of the cap portion and the mirror holder. The cap portion may be formed to provide an exterior surface which may substantially match the exterior surface of the mirror holder to provide a finished appearance to the mirror assembly when the cap portions are attached to the mirror holder and thus form the rear or back portion of the mirror holder and/or it may provide a contrast or distinctive aesthetic or functional appearance or finish. The mirror holder and the cap portions may be formed of a polypropylene material or a talc-filled polypropylene material or the like, or preferably the mirror holder is formed of a molded polyolefin, while the cap portion is formed of a molded engineering resin, such as ABS or a Nylon or the like. Optionally, the cap portion may comprise a metallic material or may comprise a polymeric molding overcoated with a metallic layer or coating, and may have ribs or ripples to provide enhanced rigidity of the cap portion, without affecting the scope of the present invention.

Optionally, the cap portion may have a different color or texture (such as a chrome or colored or textured surface or the like) than the mirror holder or bezel portion to provide a two-tone configuration to the mirror assembly. Optionally, the cap portion and/or the mirror holder may have a decorative finish, and may be painted or plated, such as electroplated or the like, or may have a film or an in mold film or coating thereon to provide the desired surface to the cap portion and/or the mirror holder. For example, the cap portion (or the mirror holder) may provide a contrast or accent color or may be chrome plated or may be brushed aluminum or the like or may provide an angle variant color (where the perceived color may change depending on the viewing angle) or may provide various colors or patterns or textures or the like as may be desired by a consumer (for example, certain colors or patterns or textures may be provided to target different demographics, such as for targeting teenagers or other age groups or genders or the like). Optionally, the cap portion or bezel portion may have a fabric cover (such as, for example, leather or cloth or denim or other cover material or the like) at and substantially over at least a portion or the entirety of its exterior surface to provide a desired appearance or texture or the like. Optionally, the cap portion and/or the mirror holder or bezel portion may have a soft touch surface, such as a soft touch surface and material similar to that described above (preferably having a Shore A durometer value of less than about 110 Shore A, more preferably less than about 90 Shore A, and most preferably less than about 70 Shore A) with respect to the toggle tab and/or similar to the types described in U.S. Pat. Nos. 6,318,870 and/or 6,349,450, which are hereby incorporated herein by reference. For example, either the mirror holder or the cap portion may have such a soft touch surface independent of the other, or both may have such a soft touch surface or neither may have a soft touch surface. Although the cap portion may be finished with a metallized reflective finish, such as a chrome or chrome-plated finish, the bezel portion desirably may not be chrome or chrome-plated or the like, in order to reduce reflections or glare at the bezel portion around the reflective element, and thus not be specularly reflecting.

It is further envisioned that the cap portion or bezel of the interior or exterior mirror assembly may include a personalization element, such as a logo or text or pattern or other indicia, thereon as desired by the consumer to provide highly personalized and unique mirror assemblies for the particular consumers that purchase the vehicles or the mirror assemblies, such as described in U.S. provisional application Ser. No. 60/553,842, filed Mar. 17, 2004 by Bareman et al. for METHOD OF MANUFACTURING ELECTRO-OPTIC MIRROR CELL; and Ser. No. 60/563,342, filed Apr. 19, 2004 by Bareman et al. for METHOD OF MANUFACTURING ELECTRO-OPTIC MIRROR CELL, which are hereby incorporated herein by reference. For example, the cap portion may include a school logo and colors, such as, for example, the letters "MSU" in green and white print/background, to provide a desirable appearance to the personalized mirror assembly for a particular consumer, such as, for example, a student or graduate of Michigan State University. Optionally, the cap portion may include other text or logos or brand names or other types of identifying indicia, such as, for example, "FORD" to identify the vehicle manufacturer, or "TOMMY HILFIGER" to identify the vehicle owner's clothing preference or the like, or other text or messages or images or trademarks or colors or patterns or indicia or the like to provide a desired appearance or identification or message or statement or advertisement or logo or sponsorship identification or style or brand identification on the interior or exterior mirror assembly. The mirror assemblies may thus be assembled to have the desired or personalized cap portion with the desired or personalized logo or color or message or indicia thereon to provide the desired or personalized finish or appearance of the interior or exterior mirror assembly.

In an aftermarket application, various cap portions as described above may be provided as aftermarket interior or exterior mirror cap portions. A consumer may then purchase a desired cap portion, which may have desired content or features and/or may have a desired color or texture or appearance or the like, and may readily remove the existing cap portion from the interior or exterior mirror assembly of their vehicle and replace it with the new cap portion. For example, the cap portion and/or the mirror holder or reflective element assembly portion (such as the mirror support arm for an interior rearview mirror assembly or a mirror mount for an exterior rearview mirror assembly) may have snaps or clasps that may retain the cap portion and mirror holder/mount/bezel together, but that may release or detach such that the cap portion may be detachable from the mirror assembly by a user/consumer. The cap portion may be pulled or detached from the mirror assembly and a new cap portion (with the desired content therein and/or personalized text or indicia or colors or the like thereon) may be pressed or snapped into place on the mirror assembly to provide the vehicle owner with the new cap portion having the desired content or functions or features and/or the desired or personalized appearance or the like.

Optionally, the modular mirror assembly of the present invention may provide customizing of other visible or viewable portions of the mirror assembly as well. For example, the flip tab or toggle tab **20***a* (or a rotary knob or the like depending on the type of toggle assembly of the particular mirror assembly) may be removably attached to the toggle assembly, such that the tab may be selected or replaced as desired. The tab may threadedly attach to a threaded stud or bolt or nut or the like at the toggle assembly (or may detachably attach via other means, such as snaps, twist-on connections, a bayonet connection or the like), such that a desired tab may be readily attached to the toggle assembly to provide the desired tab for the mirror assembly. The selectable or replaceable or customized toggle tabs may provide various styles, sizes, shapes, appearances, textures, touches/feels (such as a soft touch

material or the like), colors, patterns, indicia (such as logos or icons or the like as described below with respect to the center port **15***c* of the compass display **14***a* in FIGS. **13**A-D). The customer/consumer thus may select the desired toggle tab for attachment to the mirror assembly (such as a tab that matches or is associated with the selected cap portion and/or bezel portion and/or reflective element ports (discussed below) or the like) to customize the mirror assembly. The customization and selection or replacement of the toggle tab may occur at the reflective element assembly portion assembly plant or at the mirror assembly plant or at the vehicle assembly plant or at the vehicle dealership or at any other aftermarket facility or the like, without affecting the scope of the present invention. The custom tab may thus be selected and attached or replaced at the mirror assembly to provide a custom appearance without having to retool or mold a different toggle assembly.

Optionally, the bezel portion **12** may be molded of a universal or standard color, finish and/or material, such as a black plastic material or black polypropylene or the like, and an outer rim portion or perimeter trim portion element may attach to a forward edge of the bezel portion (at the viewable side of the reflective element) to provide a desired appearance and/or functionality of the bezel portion of the mirror assembly to the driver and passenger of the vehicle. The bezel portion **12** may be formed to have a recess or trough or lip or the like around its perimeter portion (such as at **12***b* in FIG. **2**), and the desired trim portion element may be selected and snapped to or pressed into or otherwise received in/attached to the perimeter portion of the bezel portion to provide the desired appearance/functionality to the mirror assembly. The attachable trim portion element may provide various styles, appearances, textures, touches/feels (such as a rubber or elastomeric material or soft touch material or the like), colors, patterns, indicia (such as logos, icons or the like as described below with respect to the center port **15***c* of the compass display **14***a* in FIGS. **13**A-D). The customer thus may select the desired trim portion element for attachment to the bezel portion of the mirror assembly (such as a trim portion element that matches or is associated with the selected cap portion and/or toggle tab and/or reflective element ports (discussed below) or the like) to customize the mirror assembly. The trim portion element may be selected to provide a soft material or an impact absorbing material, and may have a Shore A durometer hardness that is less than that of the bezel portion or mirror holder. The customization and selection or replacement of the trim portion element may occur at the reflective element assembly portion assembly plant or at the mirror assembly plant or at the vehicle assembly plant or at the vehicle dealership or at any other aftermarket facility or the like, without affecting the scope of the present invention. The bezel portion thus may be formed as a universal or common bezel portion, and the viewable rim of the bezel portion (such as around the perimeter of the reflective element and viewable by a driver of the vehicle when the mirror is installed in the vehicle) may be selected or replaced to provide the desired or customized appearance and/or feel of the mirror assembly.

Optionally, the cap portion, or one of the cap portions, such as the cap portion **16***b* on the side of the mirror assembly, such as the side which will be toward the passenger side of the vehicle when the mirror assembly is installed in the vehicle, may include an electrical connector for connecting the accessory or circuit board or boards **18***a*, **18***b* to a vehicle wiring harness or power source of the vehicle. Optionally, the circuit board **18***b* at the cap portion may include a multi-pin connector **24** for connecting to a corresponding multi-pin connector of the vehicle wire harness. In such applications, an opening (such as opening **25***b* of cap portion **16"** in FIGS. **4**, **5** and **8-11**) of sufficient size may be provided in the cap portion (or optionally in the mirror holder) to allow the connector on the wire harness to insert therethrough for connection to the connector on the circuit board **18***b*. The circuit board **18***b* or connector **24** may be substantially supported at the cap portion to provide sufficient support of the connector when a corresponding connector of the wire harness is pushed into engagement with connector **24**.

For example, the cap portion or mirror holder may have a connector formed therein, whereby the wire harness may then connect to or plug into the connector at the rear of the mirror assembly. The connector may be formed as a selected or appropriate connector (such as a six pin or eight pin connector or the like) depending on the accessories of the cap portions. Optionally, the connector may be formed with an insert in the mold or tool for forming the cap portion, such that an appropriate insert may be placed in the mold or tool to form the desired or appropriate connector on that particular cap portion. In the illustrated embodiment of FIGS. **4**, **5** and **8-11**, the connector **24** of the circuit board includes a plurality of pins **24***a* for connecting to a connector or plug, and the cap portion **16"** has an opening **25***b* formed therethrough so that the connector or plug may readily connect to the circuit board, and may snap or otherwise be fastened or secured thereto, such as via clasps or the like at the plug and/or at the cap portion **16"**.

In applications where both cap portions **16***a*, **16***b* support an accessory or circuit board, the circuit board **18***a* on the cap portion **16***a* (or the circuit board on one side of the unitary cap portion) opposite the connector **24** may be connected to the other circuit board **18***b* and/or connector **24** via one or more connecting wires **26**, in order to provide power and/or control to the accessory on cap portion **16***a*. The connecting wire or wires **26** may extend between the cap portions **16***a*, **16***b* within the mirror holder **12** or may extend along the rear surface of the mirror holder **12**, without affecting the scope of the present invention. As shown in FIG. **3**, cap portion **16'** of an interior rearview mirror assembly **10'** may comprise a single cap portion having a wire channel or connector **16***c* extending between opposite end caps or end portions **16***a'*, **16***b'*. The connecting wire (not shown in FIG. **3**) may extend between the circuit boards **18***a*, **18***b* or accessories supported on the end portions **16***a'*, **16***b'* and may be routed within the wire channel **16***c* or between the channel **16***c* and the rear portion **12***a* of the mirror holder **12**. Optionally, and as shown in FIGS. **4**, **5**, **8-11**, **24** and **26**, a mirror assembly **10"** may have the single or unitary cap portion **16"** in accordance with the present invention, and a connecting wire between two circuit boards or accessories may extend along the cap portion to electrically connect the circuit boards or accessories together.

As shown in FIG. **2**, printed circuit board **18***b* may include circuitry **19** for a compass display **14***a* and/or other accessory display, such as a passenger side inflatable restraint display **14***b* or the like, at reflective element **12**. More particularly, circuit board **18***b* may include compass display circuitry **19** having a plurality of illumination sources **19***a* which are individually illuminated or illuminated in combination to project illumination through respective openings in circuit board **18***b* to illuminate one or more of the ports or direction characters **15***a* etched or formed in reflective element **14**, such as in the manner disclosed in U.S. patent 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, which is hereby incorporated herein by reference in its entirety. The compass display thus may be controlled or actuated by a microcontroller or microprocessor

of the cap portion of the mirror assembly. The controller may drive or energize the illumination sources (such as light emitting diodes or the like) directly, without the need for additional display drivers. The direct energization of the illumination sources of the display thus avoids the need for other controllers or drivers within the cap portion or the mirror assembly or the vehicle.

When the cap portion **16***b* (or cap portion **16"** or the like) and circuit board **18***b* are attached to or juxtaposed with the mirror holder **12**, circuit board **18***b* may be pressed or urged toward the rear surface of reflective element **14** such that the illumination sources **19***a* (such as light emitting diodes or the like) at the circuit board may generally align with the appropriate ports or characters or icons formed in the reflective element **14**, as discussed below. For example, and as best shown in FIGS. **8** and **9**, the cap portion may include guide members or posts **25***c* for engaging corresponding guide members or tabs or holes or notches or recesses **18***c* of the circuit board for guiding the circuit board into the appropriate position and orientation on the cap portion as the circuit board is attached or snapped to the cap portion. The cap portion may then attach to the mirror holder/bezel portion via engagement and guiding of corresponding tabs and holes and the like, which function to position the cap portion in the desired location relative to the bezel portion, such that the circuit board (and any illumination devices or the like positioned thereon) is/are properly aligned with any associated display ports or switches or the like at the mirror holder/bezel portion/reflective element.

As shown in FIGS. **4** and **5**, a seal or sealing member or layer **17** or the like may be applied to the rear surface of reflective element **14** or to the forward face **18***d* of circuit board **18***b* to substantially seal the interface between the circuit board **18***b* and the reflective element **14**, in order to limit or substantially preclude light from one of the illumination sources from illuminating a port or character or icon at the reflective element other than the respective port or character or icon aligned with that illumination source and opening. The seal **17** may comprise an opaque material, and may comprise a white (or other color) silicone gasket or the like, to diffuse and/or reflect light. The seal **17** may be at least partially and preferably substantially flexible or resilient to compress and seal against the reflective element and the circuit board to limit or substantially preclude light leakage from one illumination source to one of the other ports or characters of the display.

The circuit board may also include a connecting wire **28** which may connect to a compass pod or module **30** or other accessory or accessory module or the like for communication of compass heading or control information to the compass display circuitry **19** at the circuit board or for communication of other control information between the accessory module and the circuit board of the cap portion. For example, the connecting wire **28** may extend from the cap portion and the rear of the mirror assembly to the compass module **30**, which may be attached to the mounting arm or mounting button of the mirror assembly or otherwise positioned or mounted at or near the mirror assembly. Compass module **30** may include the compass circuitry (which may include calibration circuitry, a microprocessor and the like) and magnetoresponsive compass sensors (such as magnetoresistive sensors, magnetocapacitive sensors, magnetoinductive sensors or the like or a flux gate sensor or the like), such as described in U.S. Pat. Nos. 6,513,252 and 5,802,727, and/or U.S. patent 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, which are hereby incorporated herein by reference in their entireties. The compass pod may also include an ambient light sensor, whereby the intensity of the compass display (and other displays of the mirror assembly) may be adjusted in response to the detected ambient light levels. Optionally, the compass system may utilize principles 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, which are hereby incorporated herein by reference.

Although shown and described as having a separate compass pod that may mount to the mirror mounting portion of the mirror assembly that in turn mounts to the likes of a mirror mounting button on the windshield (such as described in U.S. Pat. Nos. 6,648,478; 5,708,410 and/or 5,576,687, which are hereby incorporated herein by reference) to remain generally stationary, it is envisioned that a compass pod or module or compass circuitry and sensors may be positioned in a post or arm of a single ball mounting arrangement such that the sensors and circuitry are generally fixedly positioned relative to the mounting button and the vehicle. A wire may be routed along the generally fixed mounting arm (via and through the single ball joint) and to the display elements or illumination sources, such as in a manner similar to that shown in FIG. **34**, or a wire may be routed along the mounting arm and through the single ball and into the mirror casing or a wire or conductor may be routed or positioned along the arm and ball in any other manner to communicate electrical signals and the like to the circuitry and/or illumination sources of the cap portion, without affecting the scope of the present invention. The wire may provide slack to allow for the adjustment and movement of the mirror holder/cap portion about the single arm to avoid pulling at the wire during adjustment of the mirror.

The compass circuitry **19** on circuit board **18***b* may also include a button or switch or control or may be in communication with a button or control **23** (FIGS. **8**, **10** and **11**), such as at the rear of the cap portion **16"** or at the rear of the mirror holder, for actuating a calibration or zone function of the compass circuitry. In the illustrated embodiment, the button **23** may include an inward protrusion **23***a* (FIGS. **8** and **24**) that extends forwardly from the cap portion **16"** or inwardly toward the button or switch or control on the circuit board when the cap portion **16"** is attached to the circuit board. The button **23** may comprise a flexible tab **23***b* integrally formed with and extending partially along the cap portion **16"**. When a user presses at the button **23**, the tab **23***b* flexes and the protrusion **23***a* is moved toward and urged against the button or switch on the circuit board **18***b* to actuate the switch to control or activate/deactivate the associated function of the compass circuitry (or other circuitry or accessory or the like that may be associated with the switch on the circuit board). Although shown and described as being integrally formed with the single cap portion **16"** in FIGS. **8**, **10**, **11** and **24**, the button/flexible tab or flip actuation tab member may be integrally formed on one of the side cap portions **16***a*, **16***b* or end portions **16***a'*, **16***b'* of cap portion **16'** or the like, or on other types of casings or housings or the like, without affecting the scope of the present invention.

Optionally, an additional illumination source or lighting element may be provided on the circuit board **18***b* for projecting illumination through a corresponding port or icon or character **15***b* formed on the reflective element **14** to indicate that the compass system is in the calibration mode or zone setting mode. Optionally, the calibration mode may be indicated by a light emitting diode (LED) at the center port **15***c* of the display. For example, a dual-color LED may be provided at the center port, where illumination in one color (such as, for example, red) indicates that the compass system is in the calibration mode. Once the compass system is calibrated,

however, illumination may be provided in the other color (such as, for example, blue). Thus, when the compass system is not in the calibration mode, the other color (such as blue) indication color may be provided. Optionally, the calibration mode could be indicated without a dedicated illumination source or light emitting diode or the like (because such an indicator would be used very rarely in the life of the part). For example, the center illumination source or LED (which may be activated to provide an anchor point or focal point for the display, as discussed below) may be flashed or otherwise modulated or adjusted when the system is in the calibration mode, or other similar types of indication may be provided to convey to the driver that the compass is in its calibration mode.

The circuit board **18***b* may also have an ambient light sensor or photocell (not shown) for detecting the ambient light level at the mirror assembly, whereby the circuitry may adjust the intensity of the display in response to the detected ambient light levels. A corresponding opening in the mirror holder **12** or at the rear of the cap portion **16** (such as opening **25***d* in cap portion **16"** of FIGS. **8**, **10** and **11**) may allow the ambient light sensor to detect the ambient light levels through the opening. The light sensor may alternately be positioned at the compass pod or module **30**, without affecting the scope of the present invention.

The compass display **14***a* (FIGS. **1-5** and **12**) thus may include a plurality of direction indicating ports **15***a* (such as four such ports formed to represent the cardinal directional points or "N", "E", "S" and "W" or the like) and may include an additional port **15***b* for a calibration indicator or light source, such as described in U.S. patent 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, which is hereby incorporated herein by reference in its entirety. Compass display **14***a* may further include a center port **15***c* etched or otherwise formed at a central region of the display **14***a*. Center port **15***c* may provide an opening or port for a rearward facing photosensor positioned at the circuit board to receive light therethrough to determine the ambient light at or in the vehicle cabin (or a glare sensor for determining glare at the mirror assembly for controlling an exterior electrochromic mirror assembly or cell or the like as discussed below) when the mirror assembly is assembled and positioned in the vehicle, such as discussed below.

Optionally, center port **15***c* may align with an illumination source or light emitting diode at the circuit board to provide a visible center indicator or central anchor or focal point at the central region of the display **14***a* such that a person may readily identify the center of the compass display. For example, when one of the directional heading indicators at ports **15***a* are illuminated or energized, the indicator or light source at center port **15***c* may also be energized to provide a visible central anchor point for a person to recognize as the central region of the display. The provision of an extra illumination source or port that is central to the rosette N-E-S-W indicia thus helps to serve as a reference point for the driver, in order to aid the driver's cognitive association of the cardinal direction point that is intended to be communicated when any one (or combination of two) of the N, E, S, W icons or ports are illuminated.

Optionally, the light emitting diodes aligned with the directional indicating ports **15***a* may be one color, while the light emitting diodes at the central port **15***c* and/or at the calibration indicating port **15***b* may be another color or colors. For example, the directional indicating ports **15***a* may be illuminated or back lit via blue indicators or light emitting diodes or the like, while the central port **15***c* may be illuminated or back lit via a red or amber indicator or light emitting diode or the like, so that a person viewing the compass display in darkened conditions may readily discern which indicator is indicative of the central region of the display and thus where the center of the display is, such that the person may readily recognize which directional indicating port is illuminated, without having to look to see whether it is an "N" or an "E" or the like.

Optionally, the center port may be illuminated whenever the vehicle is on or powered, in order to provide substantially continuous illumination of the center port. Preferably, the center port is illuminated at a lower light output intensity than that of the respective cardinal N, E, S, W ports, so as to serve as a subtle eye point, but not to be confused with an actual directional indication. For this reason, a color contrast as well as an intensity contrast may be desirable.

In such applications where the center port is illuminated or back lit, an ambient sensor may be positioned elsewhere in the mirror assembly, such as elsewhere in the cap portion, and may be a forwardly facing sensor (i.e. toward the windshield when the interior rearview mirror assembly is normally mounted in the interior cabin of a vehicle) and may receive light through a port or opening **25***d* in the cap portion. Alternatively, the ambient sensor may be facing downwardly or upwardly when installed in the vehicle, without affecting the scope of the present invention. The ambient sensor may be generally aligned with or juxtaposed at the port or opening or may receive the ambient light via a light pipe or the like, without affecting the scope of the present invention.

Optionally, and with reference to FIGS. **13**A-D, the center port **15***c* of the compass display **14***a* (or other port or display area of the reflective element) may provide a graphic depiction of a desired image, such as a logo of the vehicle manufacturer or other desired image. For example, the center port **15***c* may be etched (such as by laser etching or ablation or by sandblasting or the like) or otherwise formed to provide the letters "FORD" or may be etched or otherwise formed in a pattern similar to the design or designs indicative of the manufacturer, such as the Chevrolet "bowtie" or the like. Optionally, other designs or patterns or text or logos or indicia or the like may be provided at the center port **15***c* (or elsewhere on the reflective element) to provide a desired image or logo. In the illustrated embodiments of FIGS. **13**A-D, the central port is formed to be indicative of the vehicle manufacturer, such as for Dodge (FIG. **13**A), Honda (FIG. **13**B) or Jeep (FIG. **13**C), or Subaru (FIG. **13**D). However, the central port may be formed to be indicative of other vehicle manufacturers or entities or sponsors or indicia or trademarks or emblems or signature items, or representations of a certain political views, religious beliefs, tribal affiliations, community ties, collegiate affiliations, allegiances and/or advocacy (such as, for example, a "peace" sign or other symbol or text or the like) or other views, affiliations, beliefs, etc., or other custom ports or icons may be formed elsewhere on the reflective element to convey other information or logos or the like, without affecting the scope of the present invention.

The desired image or logo may be indicative of the vehicle manufacturer, or may be selected by the user or vehicle owner to provide a customized interior rearview mirror assembly, such as described above with respect to the different logos or colors or textures or appearances or touch/feel provided on the cap portion or bezel portion of the mirror assembly, without affecting the scope of the present invention. For example, a person may select the logo or mascot of their alma mater to be etched at the center of the compass display (or elsewhere on the reflective element) to customize the mirror assembly for that particular person or owner. The customized or

selected port may be at the central port of the compass display or may at or incorporated into another display at the reflective element or may be elsewhere at the reflective element and separate from any other information display, without affecting the scope of the present invention. Optionally, the light source or indicator positioned at the circuit board behind the custom port may be selected to match the color that may be typically associated with the selected logo, such as a green or red or blue indicator or light emitting diode or the like for the school color or the like. Other forms of customized logos or indicia or the like may be etched or otherwise formed at the reflective element, without affecting the scope of the present invention.

Optionally, and with reference to FIGS. **14-16**, an interior rearview mirror assembly **10'''** may include an intuitive heading instructional icon element or display **14*a***' at the reflective element **14'**, such as the types described in U.S. provisional application Ser. No. 60/553,517, filed Mar. 16, 2004 by Schofield for MIRROR ASSEMBLY, which is hereby incorporated herein by reference. The compass display **14*a***' may be associated with or controlled or adjusted by a compass system and/or a navigational system, such as a compass and/or navigational system of the types described in U.S. Pat. Nos. 6,678,614; 6,477,464; 5,924,212; 4,862,594; 4,937,945; 5,131,154; 5,255,442; and/or 5,632,092, and/or U.S. patent 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; 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 and published Jul. 15, 2004 as International Publication No. WO 2004/058540, which are all hereby incorporated herein by reference.

Display **14*a***' includes a plurality of characters or icons or letters **15*a*** (such as N, E, S, W as shown in FIGS. **14-16**) formed or etched in the reflective coating or layer of the reflective element **14'** and includes an arrow or direction pointer **15*d*** at each of the characters **15*a***. The display **14*a***' may also include a central port **15*c*** through the reflective coating or layer reflective element **14'** behind which may be positioned an illumination source as described above or a glare sensor, such as a photo sensor or the like, such as a glare sensor and/or an ambient light sensor and electrochromic automatic dimming circuitry described in U.S. Pat. Nos. 4,793,690 and 5,193,029, and U.S. patent 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, which are all hereby incorporated herein by reference. The arrows of direction pointers may point generally upward when the mirror assembly is mounted in the vehicle with the reflective element facing generally rearward and opposite to the direction of forward travel of the vehicle. The arrows or pointers thus may be representative of the direction of forward travel of the vehicle. As shown in FIGS. **14-16**, the direction pointers of display **14*a***' may comprise generally triangular shaped icons or pointers **15*d*** positioned outward from the characters **15*a*** and opposite the characters from the center or port **15*c*** of the display (such as shown in FIG. **14**), or the direction pointers of the display may comprise arrows **15*d***' positioned next to the characters **15*a*** (such as shown in FIG. **15**), or the direction pointers of the display may comprise arrows **15*d***'' positioned inward of the characters **15*a*** and between the respective characters and the center or port **15*c*** (such as shown in FIG. **16**).

The compass/navigation system may be operable to energize one or more illumination sources positioned at and rearward of a respective one of the characters **15*a*** and corresponding direction pointer **15*d*** to illuminate or back light the respective character and direction pointer. For example, the compass/navigation system may be operable to illuminate or back light a particular character and adjacent direction pointer to indicate to an occupant of the vehicle the direction that the vehicle is currently heading. For example, if the character "W" and the arrow or direction pointer next to the "W" are illuminated, then the display indicates that the vehicle is heading west. The intuitive heading instructional icon element or display thus may provide reinforcement to a viewer that when the character (such as "W" or other character) is illuminated, it is done so to indicate that the vehicle is traveling in the direction (such as west or other direction) indicated by the character. This is reinforced by the illumination of the corresponding arrow or direction pointer that points upward so as to be representative of pointing in the direction of forward travel of the vehicle. A person viewing the display thus will not misinterpret the illumination of the characters to be indicative of a driving or turning instruction (such as an instruction to turn the vehicle right or east to follow a programmed route) in connection with the navigation system.

Optionally, the display may function as a display for providing both an indication of the directional heading of the vehicle and an indication of which direction the vehicle should be turned in order to follow a programmed route or path. For example, only a particular direction pointer may be illuminated or back lit to indicate that the vehicle is heading in the direction indicated by the non-lit character next to the illuminated pointer, while a different character (separate from the illuminated pointer) may be illuminated or back lit to indicate that the vehicle is to be turned in that direction to follow a programmed route to a desired destination. The compass/navigation system and display thus may clearly display to a driver of the vehicle which direction the vehicle is heading at that time via the directional arrows, while the compass/navigation system and display may also be operable to provide driving or turning instructions to a driver of the vehicle to instruct the driver as to which direction the driver is to turn to follow a particular route to a desired destination. For example, the compass/navigation system may be associated with a global positioning system and/or telematics system of the vehicle, and may generate and display driving instructions to the driver of the vehicle as the vehicle is driven along a generated route, such as by utilizing aspects described in U.S. Pat. Nos. 6,678,614 and 6,477,464, and/or U.S. patent 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; 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 and published Jul. 15, 2004 as International Publication No. WO 2004/058540, which are all hereby incorporated herein by reference.

During operation, the compass/navigation system thus may be operable to energize an illumination source positioned at and rearward of/behind a respective one of the characters to provide a driving instruction to the driver of the

vehicle that is separate from the directional heading indication also provided by illumination or back lighting of the arrows or pointers of the display. For example, if the vehicle is heading generally west, the compass/navigation system may illuminate or back light the arrow next to the "W" to indicate to the driver of the vehicle that the vehicle is traveling generally in that direction. If the programmed route for the vehicle involves an upcoming right turn onto a generally northbound road, the compass/navigation system may then illuminate or back light the letter "N" to indicate to the driver of the vehicle that the driver should turn the vehicle to head north.

It is further envisioned that the illuminated character may be altered or adjusted as the vehicle gets closer to the turning point or intersection, such as by flashing the illumination source or intensifying the illumination source or changing the color of the illumination as the vehicle approaches the desired or appropriate turning point or intersection. It is also further envisioned that arrows pointing sideways may be provided at one or more of the characters of the display (or elsewhere at the display), and the appropriate arrow may be illuminated or back lit to indicate that the driver is to turn right or left to stay on the desired course or route. In such an embodiment, illumination or back lighting of the character may be indicative of the directional heading of the vehicle, while illumination or back lighting of the arrows may be indicative of the driving instructions to the driver of the vehicle.

The intuitive display elements thus provide a clear indication as to which direction the vehicle is presently traveling by providing a directional heading arrow or pointer at each of the compass heading characters. The driver of the vehicle thus will not likely become confused as to the meaning of the illuminated characters or letters. The compass/navigation system and display of the present invention also may provide point-to-point driving instructions and the present directional heading of the vehicle with the same display or display icons/characters.

Optionally, the compass display may include a temperature display or another type of information display with an LED array at or near the compass display ports or icons. One or more control buttons or inputs (such as at the rear side of the mirror assembly) may be provided to allow the driver or occupant of the vehicle to select or actuate the calibration or zone or temperature display functions. The circuit board may be in communication with a temperature sensor or system, such as via a connecting wire or the like, to receive an electronic signal indicative of the temperature to be displayed. Optionally, the cap portions and circuit boards may support or provide a compass and/or temperature display utilizing vacuum fluorescent displays and filters to display the compass heading and/or temperature via two or more characters or letters or numbers. For example, and as shown in FIG. **17**, a compass heading display **32***a* and a temperature display **32***b* may be provided or formed at a display region **32***c* of a reflective element **14"** of a mirror assembly. The displays may comprise alphanumeric characters or the like to convey the directional heading information and temperature information to the driver of the vehicle.

Optionally, the circuit board may also or otherwise include circuitry for another accessory and/or display at the reflective element. The other display circuitry may illuminate or project information via illuminating ports or icons or characters or the like which are etched or otherwise formed on the reflective element, such as in a similar manner as described above. The display circuitry and associated control circuitry may be positioned at the circuit board. Optionally, some of the circuitry may be positioned outside of the mirror assembly, such as at an accessory pod or module, and may be in communication with the circuitry of the circuit board via a connecting wire or the like, such as described above with respect to the compass circuitry.

Optionally, the illumination sources utilized to back light or illuminate the display icons or characters may emit a desired color of light, such as a blue colored or tinted light or other color as may be desired. In many mirror applications, a blue light is typically preferred because it provides high visibility of the display during high lighting or daytime conditions, but may not be as favorable during low light or nighttime conditions. Optionally, a control or multiplexer may be operable to change the color of the display in response to an ambient light sensor or the like. For example, the control may deactivate a blue illumination source and activate an amber or red illumination source (or other color) when the ambient light level drops to a threshold level. The nighttime color may be selected to provide enhanced viewing of the displays and may be selected to generally match the lighting color scheme or signature color of the particular vehicle in which the display is implemented. Optionally, the colors may be ramped on and off, such that in intermediate lighting conditions, both colors may be provided and mixed, in order to provide a gradual change from one color to the next as the ambient light levels increase or decrease. Optionally, the control may activate a second illumination source (a nighttime illumination source that may be directed toward and through the same port as a daytime illumination source) in parallel with the daytime illumination source (such as a blue illumination source), which may remain activated so that the colors of the illumination sources are mixed during nighttime or darkened conditions.

As also shown in FIGS. **2-5**, one of the circuit boards, such as circuit board **18***a* supported by cap portion **16***a* (FIG. **2**) or circuit board **18***a* supported by cap portion **16"** (FIGS. **4** and **5**) or the like, may include an accessory or circuitry **21** and associated manual inputs or controls or buttons **21***a* for providing manual control of the circuitry or accessory **21**. For example, circuitry **21** may comprise circuitry for a garage door opening device or system, such as a universal garage door opener or the like. With reference to FIG. **2**, one or more buttons **21***a* (and/or one or more lights or illuminated buttons or controls) may extend or project from circuitry **21** and may extend at least partially through or may be accessible through corresponding openings or holes **21***b* in mirror holder **12**. Optionally, and as shown in FIGS. **4** and **5**, one or more buttons **21***a'* may be provided at a circuit board **18***a*, and may be positioned or received in a recessed area **21***b'* along the bezel portion or mirror holder **12** and/or in a recessed area **25***e* along the cap portion **16"**, such that the buttons may be secured in place between the mirror holder and cap portion when the cap portion is attached to or secured to the mirror holder. The buttons **21***a*, **21***a'* may be readily accessible by the driver or occupant of the vehicle to actuate or control the circuitry **21**, such as to actuate a transmitting device to open or close a garage door, such as utilizing the principles disclosed in U.S. Pat. Nos. 6,396,408; 6,362,771; 5,798,688 and 5,479,155; and/or U.S. patent 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, which are hereby incorporated herein by reference.

Optionally, and as shown in FIG. **18**, a garage door opener display **34** may be provided at the reflective element of the mirror assembly for displaying a Homelink® icon (or other icon or indicia indicative of such a system) at the buttons or inputs **21***a*, **21***a'* for the garage door opener system, such as

might be useful as an indicator to assist a user when training or operating in a learning mode of a trainable garage door opener (such as by intermittently illuminating or modulating/flashing/blinking an LED or the like behind a Homelink® icon or the like when in the learning mode) and/or as an indicator for company brand promotion/feature illustration promotion, such as by constantly illuminating the LED or the like, such as when a trainable garage door opener is not in the training or learning mode. The garage door opener display **34** may have an illumination source (such as a light emitting diode or the like) that may be activated or energized to back light or otherwise illuminate the display as desired. The display elements and circuitry and user inputs may be added to or attached to the cap portion as a module so that the desired feature or content may be readily added to a corresponding cap portion to provide the desired feature or content to the appropriate mirror assembly.

Because it is desirable that the mirror holder be a universal mirror holder for mirror assemblies having various accessories or no accessories, it is envisioned that the openings **21***b* in mirror holder **12** for the input controls **21***a* of accessory **21** (and/or other openings for other user inputs or buttons or switches or the like for other accessories or the like) may be formed in the mirror holder via inserts positioned in the mirror holder mold or tool for mirror holders which require such openings. The inserts may be removed from the tool to provide molding of a mirror holder without such openings for applications where no such accessory and associated controls or buttons is selected. Similarly, the recessed regions **21***b*' in the mirror holder and/or the cap portion may be formed via inserts placed in the molds during the forming of the mirror holder or cap portion. The different mirror holders may thus be molded or formed using the same tool, yet may receive different cap portions having or supporting different accessories or features.

In the illustrated embodiment, the buttons **21***a* are positioned at the mirror assembly so that user actuation of the buttons requires a generally vertical upward force (when the mirror assembly is installed in the vehicle) to move the button or input upwardly to actuate the electronic switch. Optionally, however, the buttons or inputs may be positioned at the mirror assembly so that actuation of the button or switch or input may be accomplished by a generally horizontal force or movement, such as a generally horizontal force toward the mirror assembly or in the direction of travel of the vehicle. For example, the user inputs may be positioned in a gondola or pod or attachment or extension of the cap portion that extends outwardly (such as downwardly or upwardly or sidewardly) from the cap portion so as to be viewable and readily accessible by the driver of the vehicle. The user inputs may be positioned within the gondola or pod so that pressing the user inputs generally horizontally actuates the switch (such as an electronic switch at the printed circuit board within the cap portion of the mirror assembly). The cap portion or attachment may include mechanical elements or structure for mechanically translating the generally horizontal movement of the input to a generally vertical actuation of an electronic switch, or the electronic switch may be oriented at the circuit board to be responsive to the generally horizontal actuation movement, without affecting the scope of the present invention. Preferably, such gondola or pod may extend upward or toward the passenger side of the minor assembly (when the mirror assembly is installed in the vehicle) to limit or reduce any interference with the forward field of view of the driver of the vehicle.

Although shown and described as having buttons such as shown in FIGS. **2-5** and **10**, it is envisioned that the mirror assembly may include buttons or inputs of the types described in U.S. provisional applications, Ser. No. 60/553,517, filed Mar. 16, 2004 by Lindahl et al. for MIRROR ASSEMBLY; and Ser. No. 60/535,559, filed Jan. 9, 2004 by Lindahl for MIRROR ASSEMBLY, which are hereby incorporated herein by reference. For example, the buttons may be integrally molded in the cap portion or bezel, or the buttons may extend downward through openings in the cap portion or bezel or between the cap portion and bezel when the cap portion is attached to the bezel, without affecting the scope of the present invention.

Optionally, the cap portions and circuit boards may support one or more other accessories and/or corresponding displays at or within the mirror holder, such as a tire pressure monitoring system and display **36**, **36'** (FIGS. **19-21**), whereby the display may indicate when a tire pressure has dropped below a set or preselected tire pressure. For example, a particular light source may be energized or activated to back light or illuminate an icon **36***a* indicative of one of the tires of the vehicle when the pressure in that tire drops below the threshold tire pressure. The individual light sources may be individually energized, such as in a similar manner as the directional heading indicators discussed above and/or described in U.S. patent 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, which is hereby incorporated herein by reference. The display may include an iconistic display that may be laser etched or otherwise formed on the reflective element (such as described above), and may provide for illumination (via one or more illumination sources at the circuit board of one of the cap portions) of one or more icons **36***a* representative of a particular tire of the vehicle. Optionally, and as shown in FIG. **21**, the tire pressure display **36'** may be printed on a screen and placed at and generally aligned with a window formed in the reflective layer of the prismatic reflective element, without affecting the scope of the present invention. The display may further provide for illumination of an additional icon or character **36***b* or may provide a different color illumination when a puncture is detected at one of the tires of the vehicle. Optionally, the tire pressure monitoring display **36'** may include a digital display **36***c* (or other type of character or alphanumeric display) for indicating the tire pressure of one of the tires. The tire pressure monitoring system may utilize principles disclosed in U.S. Pat. Nos. 6,124,647; 6,294,989; 6,445,287; 6,472,979; and/or 6,731,205, which are hereby incorporated herein by reference.

The tire pressure display thus may be controlled or actuated by a microcontroller or microprocessor of the cap portion of the mirror assembly. The controller may drive or energize the illumination sources (such as light emitting diodes or the like) directly, without the need for additional display drivers. The direct energization of the illumination sources of the display thus avoids the need for other controllers or drivers within the mirror assembly or the vehicle. The tire pressure monitoring system display **36**, **36'** may utilize aspects of the compass display disclosed in U.S. patent 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, which is hereby incorporated herein by reference in its entirety.

Optionally, the cap portion may include circuitry and user inputs associated with a telematics system, such as ONSTAR® or the like. For example, a circuit board may include circuitry for the telematics system and may be attached to or mounted to a cap portion, such as a circuit board similar to circuit board **18***a* described above. The cap portion

and/or mirror holder may include a recess or opening for one or more user inputs to be positioned when the mirror assembly is assembled, so that the user inputs may be readily accessible by a driver of the vehicle when the mirror assembly is installed in the vehicle. As shown in FIG. **22**, the user inputs or buttons **38** may extend along a lower portion of the mirror assembly and may be readily viewable and accessible at the lower portion of the mirror assembly by a driver of the vehicle. The user inputs **38** may comprise a keypad or the like that is positioned within corresponding notches or recesses along the opposed or mating edges of the mirror holder and the cap portion, such as described above with respect to user inputs **21***a*' of FIGS. **4** and **5**. A telematics display **40** may be etched or otherwise formed in the reflective element **14** to indicate to a user the function of the user inputs **38**. The display **40** may include one or more icons or images or characters **40***a* or the like that may be etched or formed in the reflective element and backlit by respective illumination sources. The illumination source or sources may be activated during low ambient lighting conditions (such as dusk or night, such as when ambient lighting is less than, for example, about 200 lux) to illuminate the display **40** so a user can see the function of the user inputs (which may also be illuminated or backlit or the like) during low lighting conditions, such as at nighttime. Optionally, individual illumination sources may be provided at each icon or port **40***a* to independently illuminate or back light the respective icon, such as in response to actuation of a respective one of the user inputs (such as in a manner as described above with respect to the individual directional icons of the compass display). Optionally, and with reference to FIG. **23**, the display **40**' may be positioned at a window **42** of the reflective element **14** and may be viewable through the reflective element window.

The cap portions of the present invention thus may provide a desired content, such as a garage door opening system and respective user inputs or a telematics feature and respective user inputs, to a particular mirror assembly. The desired system may be provided to the cap portion as a module, such as a garage door opening system module (which may include the transmitter and circuitry and user inputs) or a telematics module (which may include the circuitry and user inputs and display elements), and the module may be attached to or snapped to or mounted to the cap portion, such as at a cap portion assembly facility or at the vehicle assembly facility. Although shown as a garage door opening system module or a telematics module, clearly, the cap portion may include or incorporate other modules or displays or the like, such as, for example, a passenger side air bag status display (typically on the lower passenger side corner or area of the reflective element) or other displays, or a rear-facing sensor (which may align with an opening or port or window formed in the reflective element when the cap portion is attached to the mirror holder), or other types of displays or systems or modules, without affecting the scope of the present invention. Optionally, the user inputs or buttons or switches or the like may be positioned in the cap portion or in the bezel portion (or between the cap portion and bezel portion), or the cap portion may include an eyebrow portion or gondola portion or underbrow portion or chin portion or attachment (that may extend or protrude partially outward and/or partially around the bezel portion, and that may extend upwardly or downwardly or sidewardly therefrom) in which the inputs may be positioned, such that the inputs are contained at or in the cap portion and readily viewable and/or accessible at a desired location around the bezel portion.

The desired cap portion (with the desired features or content) may be readily attached to a common or universal mirror holder (which may include the reflective element and toggle and mounting assembly, which may be assembled at a mirror holder assembly facility) to assemble the mirror assembly, such as at a mirror assembly facility. The mirror holder may be adapted to partially receive the user inputs therein, and/or the reflective element contained in the mirror holder may have a particular display or displays formed thereon. The display icons or ports or windows formed in the reflective layer of the reflective element may generally align with the respective display elements or illumination sources of the circuitry within the cap portion when the cap portion is attached to the mirror assembly, such as described above with respect to the compass display. In applications where different modules may be provided that provide different display information at the reflective element, the reflective element may be selected to have the appropriate ports or icons or the like that correspond with the particular module, or the reflective element may have a window or windows formed in the desired or appropriate locations or may comprise a transflective prismatic reflective element (such as 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; and/or U.S. provisional application Ser. No. 60/525,952, filed Nov. 26, 2003 by Lynam for MIRROR REFLECTIVE ELEMENT FOR A VEHICLE, which are hereby incorporated herein by reference), such that the display elements (which may be illuminated alphanumeric characters or icons or indicia or the like) of the modules may be viewable through the reflective element to view the information being displayed by the display elements. The present invention thus provides for various mirror assemblies having different features or electronic content, while providing common or universal mirror holders and cap portions, where different circuitry or circuit boards or modules may be attached to the cap portion to provide the desired content to the mirror assembly.

Optionally, the cap portion or portions and circuit board or boards may support one or more other accessories or features at or within the mirror holder, such as one or more electrical or electronic devices or accessories. For example, and as can be seen in FIGS. **24-26**, illumination sources or lights, such as map reading lights **46** or one or more other lights or illumination sources (which may be positioned at or aligned with openings formed in the bottom of the mirror holder to direct illumination generally downward to illuminate the console of the vehicle), 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; and/or 5,669,698, and/or U.S. patent application Ser. No. 10/054,633, filed Jan. 22, 2002, now U.S. Pat. No. 7,195,381; and/or Ser. No. 10/745,056, filed Dec. 22, 2003 by Lynam et al. for LIGHT MODULE FOR INTERIOR REARVIEW MIRROR ASSEMBLY, now U.S. Pat. No. 6,971,775; and/or U.S. provisional application Ser. No. 60/500,858, filed Sep. 5, 2003 by Kulas et al. for INTERIOR REARVIEW MIRROR ASSEMBLY, which are hereby incorporated herein by reference, may be included with the cap portion **16**". The illumination source or sources **46** may be attachable to or positionable at or molded into the cap portion and may connect to a circuit board **47** of the cap portion **16**". The illumination sources and/or the circuit board may be connected to one or more buttons or inputs **48** for activating and deactivating the illumination sources.

Optionally, and with reference to FIG. **26**, the circuitry **47***a* may comprise a stamped circuit that is molded into and/or

along the cap portion, with the electrical connections between the lights and buttons and power source being made via stamped connectors or terminals molded into the cap portion (such as terminals of the type described in U.S. Pat. No. 6,227,689, which is hereby incorporated herein by reference) and extending between the lights **46** and/or inputs/buttons (not shown in FIG. **26**) and/or the power source/circuit board **47**. The illumination sources **46** and inputs **48** may be positioned at recesses in and along a forward edge or portion of cap portion **16"** and may be partially received in corresponding recesses along the rearward edge of the corresponding mirror holder to secure the illumination sources and buttons at the mirror assembly.

As best shown in FIGS. **24** and **25**, the light actuators or buttons **48** may comprise a push button actuator having a user actuating portion **48***a* at a lower end of a body portion **48***b*. The actuator **48** may comprise any known switch or button assembly, or may be of the type described in U.S. patent application Ser. No. 10/447,641, filed May 29, 2003 by Adams for ELECTRICAL SWITCH, now U.S. Pat. No. 6,953,905, which is hereby incorporated herein by reference. Body portion **48***b* may be slidably mounted to or positioned in or at the cap portion **16"** and may slide between an activated position, where the switch closes the circuit to activate the light source, and a deactivated position, where the switch opens the circuit to deactivate the light source. The actuator **48** includes a torsional spring **49** wrapped around a shaft **48***c* protruding from body portion **48***b*. One end **49***a* of the spring **49** engages a stop **50***a* extending from the cap portion **16"**, while the other end **49***b* is movable around a detent **50***b* as the switch body **48***b* is moved between the activated and deactivated positions. For example, when the switch is in the lowered or deactivated position, the spring may bias the switch downward (which may open the circuit) via engagement with the stop **50***a*. When the switch is pressed upward, the end **49***b* may move upward around the detent **50***b* and may rest within a recess **50***c* of the detent **50***b* when the switch is released to retain the switch in the raised or activated position (which may close the circuit). When the switch is again pressed upward by a user, the end **49***b* may move upward and out from the recess **50***c* and may move downward around the detent **50***b* as the switch is urged or moved downward in response to the biasing forces of the spring **49**. The actuator **48** thus provides a low cost actuating device that only has a few components and, thus, is less costly and less complicated and more durable than many multiple component switches in use today.

Optionally, the cap portion may provide circuitry or power for a light or illumination source, such as a map reading light or the like, and a desired or appropriate lighting capsule or module (including the light source and user input or button or switch) may be plugged into the mirror assembly (such as described in U.S. patent application Ser. No. 10/054,633, filed Jan. 22, 2002, now U.S. Pat. No. 7,195,381; and Ser. No. 10/745,056, filed Dec. 22, 2003 by Lynam et al. for LIGHT MODULE FOR INTERIOR REARVIEW MIRROR ASSEMBLY, now U.S. Pat. No. 6,971,775, which are hereby incorporated herein by reference). The circuit board of the cap portion may include prongs or connectors or the like at a lower portion of the circuit board, and the lighting capsule may be inserted through an opening in the cap portion and/or mirror holder and may engage and connect to the prongs or connectors to electrically connect the light to the circuit board. The lights thus may be readily inserted into or connected to the circuit board of the cap portion if desired or appropriate to provide the desired feature or content to the cap portion and the mirror assembly.

Optionally, the mirror assembly may include a white light emitting diode, or a cluster of LEDs may be provided, as a map/reading light or light module. Optionally, the cap portion or bezel portion may include illumination sources, such as light emitting diodes or the like, that may be embedded in the rim of the bezel portion or the lower portion of the cap portion to emit or project illumination toward the desired area of the vehicle cabin. The illumination sources may be switched on locally, such as via user inputs or switches or buttons as described above, or may be activated/deactivated/controlled by a control or system remote from the mirror assembly, such as via a vehicle electronic or communication system, and may be connected via a hard wire or via various protocols or nodes, such as Bluetooth, SCP, UBP, J1850, CAN J2284, Fire Wire 1394, MOST, LIN and/or the like, depending on the particular application.

Optionally, the illumination sources may comprise modular light sources, and may comprise one or more incandescent light sources or light emitting diodes or the like, such as described in U.S. patent application Ser. No. 10/054,633, filed Jan. 22, 2002, now U.S. Pat. No. 7,195,381; and Ser. No. 10/745,056, filed Dec. 22, 2003 by Lynam et al. for LIGHT MODULE FOR INTERIOR REARVIEW MIRROR ASSEMBLY, now U.S. Pat. No. 6,971,775, which are hereby incorporated herein by reference. Optionally, the light emitting diodes may be operable to individually emit illumination in different colors as desired, so as to provide mood lighting or the like. The illumination sources may be controlled via a user input at the lights or a separate or remote control device, such as a vehicle electronic or communication system, and may be connected via a hard wire or via various protocols or nodes, such as Bluetooth, SCP, UBP, J1850, CAN J2284, Fire Wire 1394, MOST, LIN and/or the like (which may also control the exterior mirror or mirrors of the vehicle), and may provide ramped activation and/or deactivation to provide theater like lighting or the like if desired.

Optionally, the cap portion may include or incorporate or receive other modules as selected or desired to customize the mirror assembly. For example, the cap portion and/or reflective element assembly portion may receive a microphone array module, a garage door opening system module, a telematics user access button/input module, and/or the like. The modules may be provided at the vehicle assembly plant or at the mirror assembly plant, and may be inserted or plugged into the cap portion or mirror assembly to provide the desired content to the mirror assembly. The modules and the cap portion may include connectors that provide both electrical and mechanical connection so that the modules are electrically connected to the appropriate circuitry as they are inserted or received into or snapped to or attached to the cap portion. An operator at the vehicle assembly plant thus may readily connect the appropriate module to the cap portion or to the mirror assembly to provide the desired content for that particular mirror assembly. For a base mirror that may not include such content, a blank module or plug may be inserted into or attached to the cap portion or mirror assembly, so as to fill or conceal any opening in the mirror assembly that otherwise may receive an electronic module or accessory. The modules may also be readily removed and replaced to ease repair and replacement of the accessory or circuitry, and to ease replacement or changeover to a different accessory or module, if a different option is desired, such as an aftermarket module or the like.

Optionally, the cap portion or portions and the circuit board or boards of the present invention may also or otherwise include other accessories, such as microphones **51** (such as shown in FIGS. **5** and/or **27**). The microphones may comprise

analog microphones or digital microphones or the like, and may be positioned at or aligned with one or more openings formed in the top and/or bottom of the cap portion or the mirror holder. The microphones, 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 PCT Application No. PCT/US03/308877, filed Oct. 1, 2003 by Donnelly Corp. et al. for MICROPHONE SYSTEM FOR VEHICLE and published Apr. 15, 2004 as International Publication No. WO 2004/032568, may be provided for interfacing with a vehicle telematics system or the like. Optionally, the cap portion or portions and the circuit board or boards 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 system, such as disclosed in U.S. Pat. Nos. 5,929,786 and/or 5,786,772, and/or U.S. patent application Ser. No. 10/427,051, filed Apr. 30, 2003, now U.S. Pat. No. 7,038,577; and Ser. No. 10/209,173, filed Jul. 31, 2002, now U.S. Pat. No. 6,882,287, 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, 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), an ONSTAR® system and/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). The accessory or accessories may be positioned at or on the cap portions and thus positioned at or within the mirror holder and may be included on or integrated in a printed circuit board positioned within the mirror holder.

Optionally, the cap portion or portions of the present invention may include one or more attachments, such as attachments of the types described in U.S. Pat. Nos. 6,690,268 and/or 6,428,172, which are hereby incorporated herein by reference. The attachment or attachments, such as a pen holder or display screen or the like, may be incorporated into the cap portion or may be removably attached to the cap portion and, thus, may be removable if not desired for the particular mirror application, without affecting the scope of the present invention. The desired attachment may be selected for the particular application of the cap portion and mirror assembly, and may provide additional features to the cap portion and mirror assembly as may be desired or selected for the particular mirror application.

Optionally, the cap portion or portions may include a conversation mirror that may flip up or out from the cap portion to allow the driver of the vehicle to view a person in the rear seat (such as a child in the rear seat) to see and talk to the person in the rear seat without having to adjust the reflective element of the mirror assembly. The conversation mirror may be pulled out when desired or may be spring loaded to pop up or out when actuated or depressed, or may be electronically controlled to extend out from the cap portion when an input is actuated, without affecting the scope of the present invention.

Optionally, a blind spot detection or side object detection system or circuitry and corresponding display or indicator may be provided on one of the cap portions and on the reflective element for indicating to the driver or occupant of the vehicle that another vehicle may be in a lane adjacent to the subject vehicle. The indicator may comprise any iconistic type of display which may indicate that another vehicle has been detected and/or that the subject vehicle is changing lanes toward the detected object or vehicle. The side object detection and warning system may utilize the principles disclosed in U.S. patent application Ser. No. 10/427,051, filed Apr. 30, 2003, now U.S. Pat. No. 7,038,577; and Ser. No. 10/209,173, filed Jul. 31, 2002, now U.S. Pat. No. 6,882,287, which are hereby incorporated herein by reference.

Optionally, the side object detection system may be operable to detect objects or other vehicles at one or both sides of the subject vehicle and to detect and identify a lane marker or lane markers at one or both sides of the vehicle, such as disclosed in U.S. patent application Ser. No. 10/427,051, filed Apr. 30, 2003, incorporated above. The side object detection system may be further operable to provide a visible and/or audible warning to the driver of the subject vehicle in response to the detection of another object or vehicle at a side of the subject vehicle and in response to the position or movement of the subject vehicle relative to the lane markers. The use of lane marker detection integrated with such side object detection systems can be used to reduce false positives (where the system detects a vehicle in the adjacent lane when there is no vehicle in the adjacent lane) significantly and enable longer distances of detection, which in turn improves response time for system warnings from high speed target vehicles. In known or conventional side object detection systems, the systems do not track lane markings. Known radar systems are incapable of lane tracking due to the nature of the technology, and conventional vision systems do not currently include this functionality. This forces the detection zone of such known side object detection systems to be static or non-changing regardless of any curvature in the road, and does not allow for higher warning functionality based on the lane position of the subject vehicle.

It is envisioned that the side object detection system (which may have components and/or circuitry on a cap portion or portions of the interior rearview mirror assembly, or on or at or in the mirror assembly or on or at or in an accessory module or pod mounted to or positioned at or near the mirror assembly or positioned elsewhere in the vehicle) may utilize lane marking detection and recognition to allow the side object detection system to determine or adjust a detection zone or target zone or area based on the lane markings of the adjacent lane. Such lane marking detection may accommodate a non-linear detection zone when the subject vehicle is turning or on a curve. This may provide a longer detection distance because non-linear lanes may cause false positives in a static detection zone, whereas a dynamic zone may facilitate a better area of interest at greater distances, since it may avoid tracking trailing vehicles (such as in the same lane as the subject vehicle) on sharp curves. Such a side object detection system may also allow higher human/machine interface (HMI) processing.

Known side object detection systems may be specified to warn when a vehicle is in the blind spot or will be in a short amount of time. This may force the system to warn the driver of a detected object even when a driver is not intending to make a lane change toward the detected object. This can be a source of annoyance to the driver, and it emphasizes the effect of false positives from detection of infrastructure, shadows, miscellaneous road clutter and the like. However, if the side object detection system requires the above condition or detection and also requires a close proximity to or movement toward the lane markers or adjacent lane (i.e. the subject vehicle is moving toward the lane markers and thus toward the adjacent lane) prior to providing a warning, then the system may only provide such a warning when actual danger is present (i.e. the subject vehicle is changing lanes toward an adjacent lane which is occupied by a detected vehicle or object).

Such a side object detection system may provide a large reduction of false positives over current side object detection systems, and the warning may thus represent a heightened level of risk for the current maneuver, instead of a heightened level of risk for a potential maneuver. The side object detection system thus may reduce annoyance, improve perceived reliability, and improve overall detection distances, which in turn may improve the predictive nature of the system to reduce latencies based on human response. The side object detection system, or circuitry and/or display of the side object detection system, may be incorporated into one or more cap portions mounted at the interior rearview mirror assembly, or may be incorporated into the rearview mirror assembly or an accessory module or pod positioned at or near the rearview mirror assembly. The display may be at the reflective element of the mirror assembly and may be an iconistic display of the subject vehicle and a detected object adjacent to the subject vehicle, or any other type of display, and may provide an audible signal to the driver of the vehicle, without affecting the scope of the present invention.

Optionally, the cap portion or portions may include a display element, such as a video display element or the like, that may slide out or flip up or down from the cap portion to provide a video screen that is viewable by the driver of the vehicle, such as a video display screen of the type described in PCT Application No. PCT/US03/40611, filed Dec. 19, 2003 by Donnelly Corporation for ACCESSORY SYSTEM FOR VEHICLE and published Jul. 15, 2004 as International Publication No. WO 2004/058540, which is hereby incorporated herein by reference. The video display screen may be operable to display information to the driver of the vehicle, and may be incorporated into or may be in communication with a vision system or imaging system of the vehicle, such as a rearwardly directed vehicle vision system utilizing principles disclosed in U.S. Pat. Nos. 5,550,677; 5,760,962; 5,670,935; 6,201,642; and/or 6,717,610, and/or in U.S. patent application Ser. No. 10/010,862, filed Dec. 6, 2001 by Bos for PLASTIC LENS SYSTEM FOR VEHICLE IMAGING SYSTEM, now U.S. Pat. No. 6,757,109, which are hereby incorporated herein by reference, a trailer hitching aid or tow check system, such as the type disclosed in U.S. patent 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, which is hereby incorporated herein by reference, a cabin viewing device or system, such as a baby viewing or rear seat viewing camera or device or system or the like, such as disclosed in U.S. Pat. Nos. 5,877,897 and 6,690,268, which are hereby incorporated herein by reference, a video communication device or system, such as disclosed in U.S. Pat. No. 6,690,268, which is hereby incorporated herein by reference, and/or the like. Optionally, the video display screen may also or otherwise serve as a screen for a navigation system of the vehicle or the like, such as a GPS-based navigation system, such as is known in the automotive art.

Optionally, the mirror assembly may include a heating device or element for heating the display element or the area around the display element. At low temperatures, it may be desirable to heat the display element, such as a liquid crystal display (LCD) element or the like (or such as a video screen display or illuminated display or the like), in order to enhance the performance and response of the display element in such low temperatures or cold conditions or environments. The display element may comprise any type of display element or light emitting element, such as a vacuum fluorescent (VF) display element, a light emitting diode (LED) display element (such as an inorganic LED display element or an organic light emitting diode (OLED) display element or a high intensity, high efficiency LED display element, such as disclosed in U.S. Pat. Nos. 6,690,268 and 6,428,172 and in U.S. patent application Ser. No. 10/054,633, filed Jan. 22, 2002, now U.S. Pat. No. 7,195,381, which are hereby incorporated herein by reference), a multi-pixel, dot-matrix liquid crystal display element, an electroluminescent display element, a backlit display element, such as a back lit iconistic display (such as disclosed in U.S. Pat. Nos. 6,642,851; 6,501,387 and 6,329,925, which are hereby incorporated herein by reference), a display element backlit by an incandescent light source, or a backlit liquid crystal display (LCD), a video display screen (such as the type described in PCT Application No. PCT/US03/40611, filed Dec. 19, 2003 for ACCESSORY SYSTEM FOR VEHICLE and published Jul. 15, 2004 as International Publication No. WO 2004/058540, which is hereby incorporated herein by reference) or the like, without affecting the scope of the present invention.

The heating device may be operable to heat the reflective element at the area of the display element or may heat the display element itself. For example, the rear surface of the reflective element may have a transparent conductive coating or layer, such as an indium tin oxide (ITO), a tin oxide (TO) or the like (such as transparent conductive layers of the types suitable for use in electrochromic cells and such as described in U.S. Pat. Nos. 6,690,268; 5,668,663; 5,724,187; 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; 5,910,854; 5,142,407 and 4,712,879, and/or in U.S. patent application Ser. No. 10/054,633, filed Jan. 22, 2002, now U.S. Pat. No. 7,195,381, and/or in PCT Application No. PCT/US03/29776, filed Sep. 19, 2003 by Donnelly Corporation et al. for MIRROR REFLECTIVE ELEMENT ASSEMBLY and published Apr. 1, 2004 as International Publication No. WO 2004/026633; PCT Application No. PCT/US03/35381, filed Nov. 5, 2003 by Donnelly Corporation et al. for ELECTRO-OPTIC REFLECTIVE ELEMENT ASSEMBLY and published May 21, 2004 as International Publication No. WO 2004/042457; and/or in PCT Application No. PCT/US03/036177, filed Nov. 14, 2003 by Donnelly Corporation et al. for IMAGING SYSTEM FOR VEHICLE and published Jun. 3, 2004 as International Publication No. WO 2004/047421; and/or U.S. provisional applications, Ser. No. 60/531,838, filed Dec. 23, 2003 by Bareman for METHOD OF MANUFACTURING ELECTRO-OPTIC MIRROR CELL; Ser. No. 60/553,842, filed Mar. 17, 2004 by Bareman et al. for METHOD OF MANUFACTURING ELECTRO-OPTIC MIRROR CELL; and Ser. No. 60/563,342, filed Apr. 19, 2004 by Bareman et al. for METHOD OF MANUFACTURING ELECTRO-OPTIC MIRROR CELL, which are hereby incorporated herein by reference), applied

thereto or deposited thereon in at least the area at which the display element may be positioned. An electrical current may then be applied to the transparent conductive layer (such as via a pair of terminals contacting opposite portions of the transparent conductive layer or the like) to energize the conductive layer and to heat the conductive layer. For example, the transparent conductive coating or layer may generate heat as electrons or electricity flow from a contact of a power terminal across the surface or coating or layer to a contact of a ground terminal. The contacts may be spaced apart at generally opposite sides of the transparent conductive layer and may provide for generally uniform and thorough heating of the transparent conductive layer when electricity is applied to the heating or power terminal.

The display element may be positioned behind the reflective element and transparent conductive coating and may be next to or urged against or optically coupled to the transparent conductive coating on the rear surface of the reflective element. When the electrical current is applied across the transparent conductive layer, the resistivity in the conductive layer causes the conductive layer to be heated, which functions to heat the display element to enhance the performance of the display element during low temperature conditions. Optionally, other types of heating devices may be implemented at or against the display element and/or the reflective element, or may be positioned at the printed circuit board upon which the display element may be mounted, without affecting the scope of the present invention.

Optionally, for example, a heating device may be implemented at or near a display (such as a video display screen displaying, for example, driver information such as navigational information or a view of an interior or exterior scene, such as a curb side view such as is now being required for certain vehicles in Japan, or a parking/reversing view or the like) to heat the display or display area at least initially upon start up of the vehicle in extremely cold conditions. When the vehicle is in a cold climate (such as, for example, in northern Minn. in the winter time where the temperature may drop to around thirty degrees below zero), the heater may be activated on the first ignition cycle of the vehicle or when the vehicle is first turned on or the like and when the temperature is below a threshold temperature. The heating device may include a thermometer or thermistor or the like to determine the ambient temperature at the vehicle or at or near the display, and the heater may be activatable in response to an output of the thermometer. Optionally, if the temperature is below a threshold temperature, the heater may be operable in a "quick heat mode" to rapidly heat the display so that it works properly very quickly after start up of the vehicle. The heater may be operable at a higher than normal power dissipation during the quick heat mode to provide rapid heating or thawing or defrosting of the display when the vehicle ignition is first turned on during winter or cold conditions, but after the initial rapid heating phase is completed, the heater may operate at a lower power dissipation level more suited for ongoing heating during the driving event. This is particularly useful when the display is associated with a back up aid or reverse vision system or the like (such as those described in U.S. Pat. Nos. 5,550,677; 5,760,962; 5,670,935; 6,201,642; 6,717,610; 5,877,897 and 6,690,268, and/or in U.S. patent application Ser. No. 10/010,862, filed Dec. 6, 2001 by Bos for PLASTIC LENS SYSTEM FOR VEHICLE IMAGING SYSTEM, now U.S. Pat. No. 6,757,109, and 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 in PCT Application No. PCT/US03/40611, filed Dec. 19, 2003 for ACCESSORY SYSTEM FOR VEHICLE and published Jul. 15, 2004 as International Publication No. WO 2004/058540, which are hereby incorporated herein by reference), where it is important for the display to be fully operational at the start up of the vehicle so it provides a proper or desired display of the rearward field of view of the camera as the vehicle is initially backed out of its parking space or driveway or the like.

The heating device and the construction of the mirror assembly thus may provide heating of a display or display element (such as, for example, heating of a slide out display screen such as the type described in PCT Application No. PCT/US03/40611, filed Dec. 19, 2003 for ACCESSORY SYSTEM FOR VEHICLE and published Jul. 15, 2004 as International Publication No. WO 2004/058540, which is hereby incorporated herein by reference), such as for a backup aid or rear vision system or the like, during cold temperatures to enhance the performance of the display during such cold temperatures. The heating device may provide intimate heating of the display medium, such as for a liquid crystal display element or the like, to enhance the performance of the display element. The heating device may provide such intimate heating of the display medium while not interfering with or heating other components or circuitry of the mirror assembly. The heating device may be included in the construction of the mirror assembly itself, such as a transparent conductive layer across the display screen or element or reflective element or such as a wire grid or other heating element or the like at or near the display area, to intimately heat the display element or display medium without substantially heating other components and circuitry in the vicinity of the display element. Optionally, the heating device may be activated/deactivated/controlled in conjunction with the heating elements for the exterior rearview mirrors of the vehicle (in such applications where the exterior rearview mirrors may be heated or defrosted, such as when a rear window defroster/defogger is actuated or the like). The heating device may utilize or incorporate aspects of heating devices used to heat and defrost exterior rearview mirror reflective elements, such as the heating means described in U.S. Pat. No. 5,446,576, issued to Lynam et al., which is hereby incorporated herein by reference, such as a positive thermal coefficient (PTC) heater element that is continuously connected to voltage ignition, but that principally only operates at low temperatures, such as less than about 10 degrees Celsius or lower. Optionally, a separate temperature controller, such as a thermistor, may be provided at or near the display in the interior rearview mirror assembly that powers the heater element at low temperatures.

Optionally, it is envisioned that the cap portion or portions may include a shielding element or sleeve or the like to provide shielding from external fields and unwanted radiation fields. The shielding may comprise a thin metal or foil member or sleeve or sheet or the like that is placed over and along an interior surface or portion of the cap portion (such that the shielding is within the mirror assembly and thus not readily visible when the mirror assembly is assembled). The shielding may be attached to the cap portion or portions so as to be retained thereto during the mirror assembly process. The shielding material/sheet preferably has a magnetic and/or electromagnetic permeability appropriate for shielding the accessories and the like within the cap portion and mirror assembly from external fields and unwanted radiation fields and the like.

Optionally, the cap portion or portions may include a hands free phone attachment to allow a driver of the vehicle to use a cellular or mobile telephone via circuitry and microphones and speakers of the mirror assembly and/or vehicle. The cap portion or portions may include a connector, such as a plug or socket type of connector or telephone docking device or the

like, for a user to plug their mobile telephone into, which would connect the mobile telephone to a communication system or the like of the mirror assembly or vehicle.

Optionally, and as shown in FIG. **28**, the cap portion or portions **16** may house or include a battery **52** for providing power to one or more electronic accessories or to a circuit board **58** of the cap portion or mirror assembly (such as, for example, described in U.S. Pat. No. 6,690,298, which is hereby incorporated herein by reference). The accessory or accessories of the mirror assembly thus may be powered by the battery such that the mirror assembly or circuitry of the cap portion may not have to connect to the power source of the vehicle. The battery may be contained within the cap portion and at or near an exterior or outer portion of the cap portion and may be readily accessible by a user to facilitate changing of the battery when desired or necessary. For example, the battery **52** may be within a recess **54** of cap portion **16** and may be contained therein via a trap door or panel or door **56** that may cover battery **52** and recess **54** when closed. Panel **56** may be opened and may be removable or may be hingedly attached or otherwise movably attached to cap portion **16** to facilitate access to recess **54** and battery **52**. For example, panel **56** may be molded with cap portion **16** and may be hingedly attached to cap portion **16** via a living hinge **56***a* along an edge of panel **56**. Other means for storing a battery and selectively accessing the battery may be implemented, without affecting the scope of the present invention. The various accessories and electronic content and directly driven or energized displays may function via power from the battery or internal power source of the cap portion.

Optionally, and with reference to FIGS. **29-32**, an interior rearview mirror assembly **60** may include a bezel portion **62** of a mirror casing, a reflective element **64** and a cap portion or rear portion **66** of the mirror casing. The mirror assembly **60** may include a mounting arrangement or mounting assembly **68** for pivotally or adjustably mounting or attaching the mirror assembly to the vehicle, such as to a windshield of the vehicle or the like. The mounting assembly **68** may include a mounting aim **70** having a ball member **70***a* at one end and an attachment end or mounting end **70***b* opposite to the ball member **70***a*. Ball member **70***a* may be pivotally received within a socket **72** that may be positioned at or formed with or established at or attached to an attachment plate **74** at the reflective element **64**. When so positioned, attachment end **70***b* may extend from attachment plate **74** and may insert through an opening **66***a* in rear casing portion **66**. The attachment end **70***b* may then attach or mount to a mounting portion or base portion or mounting base **76**, which in turn may be attached or mounted to the vehicle or to a mounting button or the like (not shown) at the windshield or headliner or overhead console of the vehicle.

In the illustrated embodiment, attachment end **70***b* is a threaded stud or end, and is secured to or mounted to the mounting or base portion **76** via insertion of the threaded end **70***b* through an opening **76***a* (FIG. **31**) in mounting portion **76** and tightening a female fastener or nut **78** onto threaded end **70***b*. The mounting arm **70** thus may have a narrow end for insertion through the opening **66***a* in rear casing portion **66**, such that the opening in the rear casing portion may be smaller than is typically required (because typically the ball end of the mounting arm is inserted through the opening in the rear casing and snapped into the socket at the attachment plate). The mounting arm may be inserted into the socket of the attachment plate, which may be attached to the reflective element at the bezel portion, and then may be inserted through the opening in the rear casing portion or cap portion as the rear casing portion or cap portion is moved toward and into engagement with the bezel portion, such that the attachment end of the mounting arm extends or protrudes from the rear casing portion or cap portion after the mirror is assembled. The attachment end may then be attached or secured to the mounting portion or base portion via the nut or other type of fastener. As shown in FIG. **29**, the mirror assembly may also include a circuit board **80** (with circuitry and/or accessories such as those described above), which may be attached to the attachment plate **74** or which may be attached to the cap portion for mirror assemblies of the types described above.

Although shown as having a threaded attachment end for securing the mounting arm to a mounting base via a nut or the like, it is envisioned that the mounting arm may have other forms of attachment ends for fixedly or pivotally or adjustably mounting the mounting arm to a mounting base or the like, without affecting the scope of the present invention. For example, the attachment end may provide a female fastener which may threadedly receive a male fastener or screw or bolt or stud, or the attachment end may provide a bayonet type fastener, or the attachment end and mounting base may cooperate to provide a snap together attachment or the like, or the attachment end and mounting base may otherwise attach or secure together, such as via adhesive or welding, such as ultrasonic welding or the like. Optionally, the attachment end may attach to or receive another ball member, which may be received within a socket at the mounting base, in order to provide a double ball mounting arrangement. The mounting arm, socket and/or mounting base may comprise plastic or polymeric materials, or may be die cast or otherwise formed, without affecting the scope of the present invention.

Optionally, and as shown in FIG. **32**, the ball member **70***a* of mounting arm **70** may be received in a socket **72'** attached to or positioned at or formed with or established at a toggle assembly **82**, such as for a prismatic reflective element. The toggle assembly may be any type of toggle assembly, such as described above, and may be attached to or mounted to the mirror holder or the mirror casing, whereby the attachment end of the mounting arm may extend or protrude from the mirror casing when the toggle assembly and mounting arm are mounted therein or attached thereto. The attachment end may then connect or attach to the appropriate connector or attachment (such as to the mounting base **76** via a fastener or nut **78** as shown in FIG. **32**) as described above to adapt the mirror assembly for the particular application.

The mounting arrangement of the present invention thus may provide a pre-established pivot element or member, such as a ball joint, at the attachment plate of the reflective element or at the toggle assembly or the like, whereby other attachments or mounting elements may be attached to the other end of the mounting arm to provide the desired attachment or mounting arrangement for the particular application of the mirror assembly. The mounting arm and ball member may be inserted within the socket and then the backing plate or toggle assembly (at which the socket may be formed) may be attached or secured to the reflective element with the pre-established pivot joint or element. The ball member of the mounting arm may already be inserted or snapped into the socket when the backing plate or toggle assembly is attached to or juxtaposed with the reflective element, such that the ball member need not be rammed into the socket when the socket is positioned at or juxtaposed with the reflective element, which avoids the impact or shock to the reflective element that typically occurs when a ball member is rammed into a socket that is at or attached to or juxtaposed with a reflective element.

The other end of the mounting arm may then be attached, such as via a snap together arrangement or a threaded fastener or the like, to another mounting portion or base portion or the

like at the vehicle. Optionally, the other portion may have a second pivot element or member, such as a ball member, already received within a socket at a mounting base, and the end of the mounting arm may readily attach to the end of the other ball member to mount the mirror assembly in the vehicle. For example, the attachment end of the mounting arm extending from the reflective element assembly may threadedly attach to a corresponding attachment end of another ball member extending from a socket at a base portion at the vehicle. The mounting arrangement thus may provide a single or double ball mounting arrangement without the need to press or ram the ball member or ball members into the respective socket after the socket is attached to or positioned at the reflective element. The mounting arrangement also avoids the impact or shock of ramming the opposite ball member into the respective socket at the mounting base or button.

Because the pivot element or member, such as a ball member or ball members, is/are already inserted into their respective sockets so that the pivot joints are pre-established at the reflective element and mounting base, the ball member(s) do not have to be rammed or snapped into place in their respective sockets during installation of the mirror assembly, which substantially reduces the stresses at the reflective element to substantially limit or reduce cracking of the reflective element during installation of the mirror assembly. The mounting arrangement thus may substantially reduce the stresses at the reflective element during the installation processes.

Also, because the mounting aim may have an attachment end opposite a ball member, the ball member may be received or pre-established in any suitable or corresponding socket of a substantially universal bezel portion or reflective element assembly portion, whereby the attachment end of the mounting arm may be attached to any corresponding connector or attachment at the vehicle to complete the installation process for the respective mirror assembly. The present invention thus may provide a substantially universal and pre-established ball joint or pivot joint at the reflective element (and thus lends itself to provision of a universal reflective element assembly portion) that does not require attachment or insertion of the ball member at a later time (after the socket portion is positioned at or established at or juxtaposed with the reflective element), and may provide the capability of adapting or configuring the mounting arm to fixedly or pivotally or adjustably attach to a particular mounting base or vehicle portion or console or the like for the particular mirror application. The mounting arrangement may be suitable for applications with the cap portion and mirror holder assemblies as described above, or may be suitable for applications with other types of mirror assemblies, such as a mirror assembly of the type shown in FIG. **29**, without affecting the scope of the present invention.

Optionally, and as shown in FIG. **31**, the mounting arm **70** may comprise a hollow mounting arm that provides a wiring channel or passageway **70***c* therethrough. One or more wires or cables or the like thus may be routed through the mounting aim to provide power and/or control to the circuitry and accessories within the mirror assembly. As can be seen in FIGS. **30** and **31**, the wires may route along and within the mounting base **76** and through the mounting arm and into the mirror casing or housing. Optionally, the attachment end of the mounting arm may include a connector and may plug into or connect to a corresponding connector at the mounting base or the like to establish mechanical and electrical connections (such as via utilizing aspects described in U.S. Pat. Nos. 6,672,744; 6,669,267; 6,402,331; 6,386,742; and 6,124,886, and/or U.S. patent application 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, and 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, which are hereby incorporated herein by reference) as the mirror assembly is mounted within the vehicle. The mounting arm may include wiring therethrough to electrically connect the connector or attachment end to the circuitry within the mirror assembly.

As shown in FIGS. **29** and **30**, the mounting base **76** may have a hollow body portion **76***b* that may extend along the interior surface of the windshield and that may extend generally downwardly from an attaching portion **76***c* of mounting base **76**. The attaching portion **76***c* may attach to the mounting button or other attachment element (not shown) positioned at or attached to the interior surface of the windshield or the headliner or an overhead console of the vehicle to position the mounting base at the desired or appropriate location at the vehicle. As shown in FIG. **29**, the mounting base **76** may include a cover plate **76***d* that may encase or enclose the body portion **76***b* to provide a finished appearance to the mounting base **76** along the windshield. Optionally, the body portion **76***b* may include or receive one or more electronic elements or accessories, such as a rain sensor or the like (such as a rain sensor of the types described in commonly assigned U.S. Pat. Nos. 6,516,664; 6,320,176; 6,353,392; 6,313,454; 6,341,523; and 6,250,148; and/or in U.S. patent application 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; and Ser. No. 10/348,514, filed Jan. 21, 2003 by Lynam for RAIN SENSOR MOUNTING SYSTEM, now U.S. Pat. No. 6,968,736, which are all hereby incorporated herein by reference), that may be positioned at the windshield and that may be optically coupled to the windshield, depending on the particular application. In such embodiments, the cover plate **76***d* may include one or more openings or apertures at which the rain sensor camera or sensing device may be positioned.

Although the mirror assembly may include a prismatic reflective element, it is envisioned that the cap portion or portions may include controls or circuitry for controlling electro-optic or electrochromic reflective elements, such as electrochromic reflective elements of one or more exterior rearview mirror assemblies of the vehicle. The circuitry or controls may control the dimming of the exterior mirrors, such as in a known manner, such as described in commonly assigned U.S. Pat. Nos. 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, which are hereby incorporated herein by reference. Optionally, the cap portion or portions may include one or more photo-sensors, such as an ambient light photo-sensor and a glare sensor, and the controls or circuitry may control the exterior electro-optic or electrochromic reflective elements in response to such photo-sensors.

Optionally, the exterior rearview mirror assemblies of the vehicle may comprise electrochromic mirror reflective element assemblies, while the sensors and electronic circuitry for glare detection and ambient light detection may be positioned inside the vehicle, such as at an interior electrochromic rearview mirror assembly. In applications where the exterior mirror assemblies comprise passenger and/or driver side electrochromic exterior rearview mirror assemblies, such as may be implemented in large vehicles, such as SUVs and the like, the electrochromic controls and circuitry may be contained within the exterior rearview mirror assemblies or the exterior electrochromic reflective element assemblies may be slaved

off of the controls and circuitry of an associated electrochromic interior rearview mirror assembly of the vehicle. Optionally, it is envisioned that such sensors and electronic circuitry may be positioned at or near or incorporated into an interior prismatic rearview mirror assembly having a prismatic reflective element. The circuitry and the glare sensor and/or ambient light sensor (such as a photo sensor or the like, such as a glare sensor and/or an ambient light sensor and electrochromic automatic dimming circuitry of the types described in U.S. Pat. Nos. 4,793,690 and 5,193,029, and U.S. patent 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, which are all hereby incorporated herein by reference) thus may be positioned at or in or near or incorporated into the added feature prismatic interior rearview mirror assembly. The sensors may be positioned at or within the prismatic interior rearview mirror assembly such that the glare sensor is directed generally rearwardly (in the direction opposite to the forward direction of travel of the vehicle), such as through a bezel portion of the prismatic interior rearview mirror assembly, while the ambient sensor may be directed generally forwardly (in the direction of travel of the vehicle) or downwardly toward the floor of the vehicle when the mirror assembly is installed in the vehicle.

It is further envisioned that the sensors and/or control circuitry may be provided at, on or within a cap portion of the interior rearview mirror assembly and, thus, may be provided as an option for vehicles that offer the electrochromic exterior rearview mirror assemblies with a base or prismatic interior rearview mirror assembly. The appropriate cap portion (with electrochromic control circuitry and sensors and the like incorporated therein) may be selected and attached to the interior rearview mirror reflective element assembly portion to provide glare and light sensing capability and electrochromic reflective element assembly control capability to the interior rearview mirror assembly. Optionally, the cap portion may include the glare sensor in a location therein that may extend downward or outward from the cap portion so that the glare sensor may be directed generally rearward toward the rear of the vehicle when the mirror assembly is installed in the vehicle. For example, the cap portion may include a gondola or pod extending therefrom for housing the sensor or sensors and/or control circuitry. Alternately, the cap portion may include the glare sensor at a location therein that may align with a view port or the like through the reflective element, such as for applications where, for example, the mirror assembly includes a compass/display system or other display system, such as the types described herein and/or the types disclosed in U.S. patent 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, which is hereby incorporated herein by reference. In such applications, the ambient sensor may provide a dual function of providing an input to the control circuitry for controlling the exterior electrochromic reflective element assemblies and providing an input to the control circuitry for the display element of the interior rearview mirror assembly. The cap portion may include the ambient light sensor in a location and orientation whereby the ambient light sensor is directed generally forwardly in the direction of travel of the vehicle when the mirror assembly is installed in the vehicle.

Optionally, the electrochromic controls and glare/ambient light sensors thus may be provided in a cap portion (such as in a protrusion therefrom, such as a gondola or the like) and, thus, may be provided as an option for use with a common bezel and prismatic reflective element assembly. The present invention thus provides for optional controls and circuitry and sensors for optional accessories, such as electrochromic exterior rearview mirror assemblies, while providing a common bezel and prismatic reflective element and mounting attachment. The desired or appropriate cap portion (with the desired or appropriate controls/sensors/circuitry) may be selected for a particular application and may be snapped onto or otherwise attached to the common bezel and prismatic reflective element assembly. The assembled mirror assembly may then be installed in the appropriate vehicle with the exterior electrochromic mirror assemblies. The present invention thus may provide added feature prismatic interior rearview mirror assemblies, where the desired content of the mirror assemblies may be selected and provided on a respective optional cap portion while the rest of the mirror assemblies comprise common components.

Although shown and described as having a prismatic reflective element, the interior rearview mirror assembly of the present invention may optionally have an electro-optic or electrochromic mirror assembly. The electrochromic mirror element of the electrochromic mirror assembly may utilize the principles disclosed in commonly assigned U.S. Pat. Nos. 6,690,298; 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, 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; and/or as described in U.S. patent application Ser. No. 10/054,633, filed Jan. 22, 2002, now U.S. Pat. No. 7,195,381, which is hereby incorporated herein by reference. Optionally, the electrochromic circuitry and/or a glare sensor and circuitry and/or an ambient light sensor and circuitry may be provided on one or more circuit boards at the cap portion or portions of the mirror assembly.

Optionally, the electrochromic reflective element may include one or more displays, such as for the accessories or circuitry described above. The displays may be similar to those described above, or may be of types disclosed in U.S. Pat. Nos. 5,530,240 and/or 6,329,925, which are hereby incorporated herein by reference, and/or may be display-on-demand or transflective type displays, such as the types disclosed in U.S. Pat. Nos. 6,690,298; 5,668,663 and/or 5,724,187, and/or in U.S. patent application Ser. No. 10/054,633, filed Jan. 22, 2002, now U.S. Pat. No. 7,195,381; and/or in U.S. provisional application Ser. No. 60/525,952, filed Nov. 26, 2003 by Lynam for MIRROR REFLECTIVE ELEMENT FOR A VEHICLE, and/or 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, which are all hereby incorporated herein by reference.

Optionally, and with reference to FIG. **33**A, a reflective element assembly portion **84** may hold or receive or comprise an electrochromic reflective element assembly or cell **86**, which includes a front substrate **88** and a rear substrate **90** and an electrochromic medium **92** sandwiched therebetween. In the illustrated embodiment, the reflective element assembly

or cell **86** comprises a front substrate **88** that is larger than the rear substrate **90** so as to create a relief region or overhang region or ledge **93** around the perimeter of the reflective element assembly, such as described in PCT Application No. PCT/US03/35381, filed Nov. 5, 2003 by Donnelly Corporation et al. for ELECTRO-OPTIC REFLECTIVE ELEMENT ASSEMBLY and published May 21, 2004 as International Publication No. WO 2004/042457; and/or in U.S. provisional applications, Ser. No. 60/553,842, filed Mar. 17, 2004 by Bareman et al. for METHOD OF MANUFACTURING ELECTRO-OPTIC MIRROR CELL; and Ser. No. 60/563,342, filed Apr. 19, 2004 by Bareman et al. for METHOD OF MANUFACTURING ELECTRO-OPTIC MIRROR CELL, which are hereby incorporated herein by reference.

The larger front substrate **88** allows the bezel portion or molding **94** to be molded around the electrochromic reflective element assembly and allows the bezel portion to shrink and directly stress the front substrate **88** without placing the interpane seal **96** under the hoop stresses and shear stresses that typically occur with conventional electrochromic cells or reflective element assemblies (where the front and rear substrates are offset one to another such that any bezel shrinkage typically places the front substrate in shear stress relative to the rear substrate, potentially leading to failure of the seal therebetween that protects the electrochromic medium from the outside environment) when the bezel portion cools and contracts around the cell. The bezel portion or molding **94** thus may be formed around the reflective element assembly or cell, and the cap portion (not shown in FIG. **33**A) may be provided at a later step after the bezel portion has cooled around the reflective element assembly (such as described above) to provide a modular electrochromic mirror assembly in accordance with the present invention. Optionally, the bezel portion may be formed of a soft polymer or impact absorbing material (such as a soft touch material as described above, and/or preferably having a Shore A durometer value of less than about 110 Shore A, more preferably less than about 90 Shore A, and most preferably less than about 70 Shore A) at or around the perimeter of the front substrate **88** or of the front or first surface **88***b* of the front substrate **88**, or a soft or impact absorbing trim portion or element may be provided at or around the perimeter of the front substrate **88**, without affecting the scope of the present invention.

The front substrate **88** includes a transparent conductive coating or layer **89** (such as an indium tin oxide (ITO), a tin oxide (TO) or the like) on its rear surface **88***a* (the second surface of the cell), while the rear substrate **90** includes a metallic conductive coating or layer or layers or stack of coatings or layers **91** on its front surface **90***a* (the third surface of the cell), such as is generally done with electrochromic reflective element assemblies, and such as by utilizing aspects described in U.S. Pat. Nos. 6,690,268; 5,668,663; 5,724,187; 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; 5,910,854; 5,142,407 and 4,712,879, and/or in U.S. patent application Ser. No. 10/054,633, filed Jan. 22, 2002, now U.S. Pat. No. 7,195,381, and/or in PCT Application No. PCT/US03/29776, filed Sep. 19, 2003 by Donnelly Corporation et al. for MIRROR REFLECTIVE ELEMENT ASSEMBLY and published Apr. 1, 2004 as International Publication No. WO 2004/026633; PCT Application No. PCT/US03/35381, filed Nov. 5, 2003 by Donnelly Corporation et al. for ELECTRO-OPTIC REFLECTIVE ELEMENT ASSEMBLY and published May 21, 2004 as International Publication No. WO 2004/042457; and/or in PCT Application No. PCT/US03/036177, filed Nov. 14, 2003 by Donnelly Corporation et al. for IMAGING SYSTEM FOR VEHICLE and published Jun. 3, 2004 as International Publication No. WO 2004/047421; and/or U.S. provisional applications, Ser. No. 60/531,838, filed Dec. 23, 2003 by Bareman for METHOD OF MANUFACTURING ELECTRO-OPTIC MIRROR CELL; Ser. No. 60/553,842, filed Mar. 17, 2004 by Bareman et al. for METHOD OF MANUFACTURING ELECTRO-OPTIC MIRROR CELL; and Ser. No. 60/563,342, filed Apr. 19, 2004 by Bareman et al. for METHOD OF MANUFACTURING ELECTRO-OPTIC MIRROR CELL, which are hereby incorporated herein by reference.

As shown in FIG. **33**A, the metallic conductive coating or layer or layers **91** may be removed from (or not disposed at) a perimeter region **90***b* of the front surface **90***a* of rear substrate **90**, and the interpane seal **96** may be disposed around the masked or uncoated perimeter region, in order to electrically isolate the conductive coatings **91** from the perimeter edge of the rear substrate **90**, such as described in U.S. provisional applications, Ser. No. 60/553,842, filed Mar. 17, 2004 by Bareman et al. for METHOD OF MANUFACTURING ELECTRO-OPTIC MIRROR CELL; and Ser. No. 60/563,342, filed Apr. 19, 2004 by Bareman et al. for METHOD OF MANUFACTURING ELECTRO-OPTIC MIRROR CELL, which are hereby incorporated herein by reference. The conductive coatings or layers **91** may provide a tab out region (not shown in FIG. **33**A) along the front surface of the rear substrate to provide for electrical connection between the third surface coating **91** and the perimeter edge of the substrate (such as described in U.S. provisional applications, Ser. No. 60/553,842, filed Mar. 17, 2004 by Bareman et al. for METHOD OF MANUFACTURING ELECTRO-OPTIC MIRROR CELL; and Ser. No. 60/563,342, filed Apr. 19, 2004 by Bareman et al. for METHOD OF MANUFACTURING ELECTRO-OPTIC MIRROR CELL, which are hereby incorporated herein by reference. A conductor or electrical connector **100** may connect to the conductive coating **89** via a solder or conductive strip **101** around the overhang region, while a second conductor or electrical connector (not shown in FIG. **33**A) may connect to the conductive coating **91** via connection to the tab out region. The reflective element assembly may include a reflective perimeter region around the perimeter of the reflective element assembly or may have an opaque or blackened or darkened perimeter region, such as by utilizing the principles described in U.S. Pat. No. 5,066,112, which is hereby incorporated herein by reference, in order to at least partially conceal the seal **96** from being readily viewable by the driver of the vehicle.

Optionally, and with reference to FIG. **33**B, a reflective element assembly portion **84'** may hold an electro-optic reflective element assembly **86**, such as an electrochromic reflective element assembly or cell, and may include a mounting or attachment plate **98** positioned at the rear surface of the reflective element assembly **86** (the fourth surface of the cell). The bezel portion or molding **94'** may be molded or formed around the reflective element assembly **86** and around or at the attachment plate **98** to retain the attachment plate **98** and the reflective element assembly **86** within the bezel portion or molding **94'**. As can be seen in FIG. **33**B, the mounting plate **98** may include protrusions or recesses or the like **98***a* at least partially around its perimeter edge to facilitate mechanical connection and securement of the bezel portion **94'** (such as by snap on or snap in) to the mounting plate **98** when the bezel portion **94'** is molded around the mounting plate **98**. The attachment plate **98** may include a pivot joint or element **102** established or formed thereon. The reflective element assembly portion **84'** may be otherwise substantially similar to reflective element assembly portion **84**, discussed above,

such that a detailed description of the reflective element assembly will not be repeated herein. The components that are common with the reflective element assemblies **84** and **84'** are shown with the same reference numbers in FIGS. **33**A and **33**B.

Therefore, the reflective element assembly portion may be formed or molded with the molding or bezel portion molded or formed around the larger front substrate to contain the reflective element assembly or cell within or at the bezel portion. The pivot element or joint **102** may be formed or established at the rear of the reflective element assembly, such as in the manners described above, and the mounting arm **104** may extend generally rearwardly from the pivot joint. The cap portion may then receive the mounting arm through an opening or the like in the cap portion such that the mounting arm extends from the cap portion after the cap portion is attached to or snapped to the reflective element assembly portion. The electrical connectors of the reflective element assembly portion may connect to the appropriate electrical connectors or terminals or circuitry of the cap portion as the cap portion is assembled to or attached to the reflective element assembly portion, such as in the manners described above, in order to provide electrical power and/or control to the electrochromic cell.

The electrochromic reflective element assembly portion of the present invention thus may comprise a standard or universal or common reflective element assembly or cell and mirror holder or bezel portion, which may then be attached to a customized or selected or desired cap portion, as described above. Optionally, the reflective element assembly portion may be customized as well. For example, a selected bezel material may be molded around a common reflective element assembly or cell. The reflective element assembly portion may be formed by placing an electrochromic cell into a mold cavity (such as face down into the mold cavity with the rear surface of the rear substrate facing upward), and the plastic piece or mounting plate (preferably with a pivot element or member already established therein or thereon) may be inserted into the mold or placed generally at or on the rear surface of the rear substrate of the reflective element assembly or cell (i.e. the fourth surface of the cell). The mounting plate may be generally smaller than the profile of the rear substrate and may include the pivot element or socket formed thereon (or such pivot components may be added or attached or molded later). Optionally, the mounting plate may include electronic circuitry and the like, such as for making the electrical connection to the electrical connectors of the cell and/or for providing other electronic content or features or functions as may be desired (such as display elements for displaying information through the cell to a driver of the vehicle or the like, or such as ports or aperture for aligning with display elements of the cap portion so that information may be displayed or projected through the apertures in the mounting plate and through the cell to a driver of the vehicle). The bezel portion or molding may then be molded (such as via injection molding or reaction injection molding of a desired or selected or appropriate material into the mold cavity) to form the bezel portion around the perimeter of the front substrate (such as described above).

Optionally, the electrochromic reflective element assembly portion may be readily customized by injection molding a selected material into the mold to form the bezel portion of a selected or customized material. For example, the material may be selected to be a desired color, or may be selected to have desired properties, such as, for example, a soft touch or desired feel or appearance or finish or the like. The present invention thus may provide a common cell and attachment or mounting plate (and pivot element or joint), but may readily customize the appearance and/or feel of the bezel portion or molding to provide a particular, selected and customized reflective element assembly portion, while utilizing the same molding tool or mold to form the customized molding or bezel portion. Optionally, the reflective element assembly or cell and attachment or backing plate may comprise standard or common components for multiple mirror assemblies, and may be placed in desired or appropriate molds for molding the appropriate bezel portion for a particular mirror application. The customized reflective element assembly portion may then be attached to the desired or selected or customized cap portion as described above, and the electrical connections of the electronic circuitry and the like at the plate of the reflective element assembly portion may be made to the corresponding or appropriate connectors or circuitry of the cap portion as the cap portion is attached to the reflective element assembly portion. Although shown and described as molding a bezel portion around the perimeter region of a larger front substrate (which is larger than the rear substrate) of an electrochromic reflective element assembly or cell, it is envisioned that the bezel portion or molding may be molded or formed around other types of electrochromic reflective element assemblies or cells (such as flush cells or offset or staggered cells or the like), and/or may be molded or formed around prismatic reflective elements and the like, without affecting the scope of the present invention.

Optionally, and such as described in PCT Publication No. WO 03/095269 A2, published Nov. 20, 2003 for REARVIEW MIRROR ASSEMBLIES, which is hereby incorporated by reference herein, an electro-optic rearview mirror assembly portion may comprise an electro-optic reflective element assembly or unit or cell, such as an electrochromic reflective unit or cell (whose reflectivity is variable in response to an electrical voltage applied thereto), and an electrical circuit for controlling operation of the mirror cell in response to one or more one light sensors. The interior mirror assembly portion may also comprise at least one pivot element or member, such as a ball and socket member, which allows angular adjustment of the mirror reflective element when the mirror assembly is mounted in the vehicle. Optionally, the ball member may include a plurality of electrical contacts on an exposed surface thereof for sliding engagement by respective counter-contacts over a range of angular movement of the mirror unit for supplying power to the electrical circuit from a vehicle electrical system external to the mirror assembly. Optionally, other means for providing electrical power and/or control to the circuitry/accessories of the mirror assembly may be provided (such as a wire or cable along an exterior surface or portion of the mounting arm or member or the like), without affecting the scope of the present invention.

Optionally, a prismatic mirror assembly portion and cap portion of the present invention may include electrochromic drive circuitry for controlling the exterior electrochromic reflective elements of the exterior rearview mirror assemblies of the vehicle, such as described above. The cap portion may include a glare sensor and an ambient sensor to determine the glare levels and ambient light levels and the control circuitry may adjust the dimming of the exterior mirrors accordingly. The glare sensor may receive the light through an aligned port in the reflective element or may receive light via a light pipe or the like, without affecting the scope of the present invention. The cap portion thus may provide electrochromic control circuitry for applications where the vehicle may have exterior electrochromic mirror assemblies, while the interior rearview mirror assembly may comprise a base or prismatic mirror that may otherwise not include such control circuitry.

The cap portion of the present invention thus may provide a low cost conversion of an interior rearview mirror to provide electrochromic mirror control for the exterior rearview mirrors of the vehicle.

Optionally, and with reference to FIGS. **34** and **35**A-D, an interior rearview mirror assembly **110** may be attachable or mountable to a windshield accessory module **112**, which may be attachable or mountable to an interior surface of the windshield of a vehicle, such as at a mounting button or the like. Windshield accessory module **112** may include a body portion **114** that extends generally along the windshield and may include a head portion **116** at the upper end of the body portion **114** generally above the mirror assembly **110** and viewable by a driver of the vehicle when the windshield accessory module **112** and mirror assembly **110** are mounted in a vehicle, such as in a similar manner as described in U.S. patent application 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, which is hereby incorporated herein by reference. Windshield accessory module **112** may include one or more accessories or circuitry therein, and may include one or more user interface controls or inputs and/or a display or indicator or indicators or the like at the head portion that are readily viewable and/or accessible above the mirror assembly, such as discussed below and as shown in FIGS. **35**A-D and/or as described in U.S. patent application 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, which is hereby incorporated herein by reference. As shown in FIGS. **34** and **35**A, a wiring or cabling conduit **118** may extend upward from the body portion **114** and along the windshield **111** to conceal and route the wiring harness between the headliner of the vehicle and the windshield accessory module **112**.

Preferably, the windshield accessory module may be configured to attach to a typical mounting button or the like for an interior rearview mirror assembly, and may include a replica of the mounting button or the like for the mirror assembly to mount thereto. The accessory module thus may attach to the existing button on the windshield and the mirror assembly may be attached to the button on the accessory module in the same manner. The mirror assembly may comprise a modular mirror assembly as described above, or may comprise other types of prismatic or electro-optic or electrochromic mirror assembly, without affecting the scope of the present invention. As shown in FIG. **34**, a wiring harness **119** and connector or plug **119***a* may extend from accessory module **112** and plug into the back of the mirror casing or cap portion, such as in a similar manner as described above. The accessory module thus may provide an aftermarket addition to add additional electronic content or accessories, without having to replace the mirror assembly. The accessory module of the present invention thus may provide the desired accessories or options, while providing the vehicle manufacturer and/or the customer the freedom to select any mirror assembly. Optionally, for aftermarket applications, the windshield accessory module may be battery-operated and may include a battery compartment for receiving and connecting to a battery or power source or the like.

As shown in FIG. **35**A, windshield accessory module **112** may include or may be associated with a garage door opening system, and head portion **116** may include one or more user actuatable inputs **120***a-c* for controlling or actuating the garage door opening system. Head portion **116** may also include an icon or indicia **122** or the like, which may be illuminated or back lit via a light source in head portion **116** to indicate to the user of the garage door opening system that the system is activated or that the button or input was successfully actuated. The garage door opening system may comprise a trainable garage door opening system and/or may utilize principles disclosed in U.S. Pat. Nos. 6,396,408; 6,362,771; 5,798,688 and 5,479,155; and/or U.S. patent 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, which are hereby incorporated herein by reference.

Optionally, and with reference to FIG. **35**B, the windshield accessory module **112'** may also or otherwise include or be associated with a telematics system or cellular telephone system or the like. The head portion **116'** thus may provide user inputs **124***a*, **124***b*, **124***c* for actuating the system, placing a telephone call and ending a telephone call, respectively. The head portion **116'** may also include a microphone **126** for receiving voice or audio signals from within the cabin of the vehicle, such as via a microphone system of the types described in U.S. Pat. Nos. 6,243,003; 6,278,377; and/or 6,420,975, and/or in PCT Application No. PCT/US03/308877, filed Oct. 1, 2003 by Donnelly Corp. et al. for MICROPHONE SYSTEM FOR VEHICLE and published Apr. 15, 2004 as International Publication No. WO 2004/032568, which are hereby incorporated herein by reference. In the illustrated embodiment of FIG. **35**B, the head portion **116'** includes user inputs and/or indicators **120***a'*, **120***b'*, **120***c'* for controlling and actuating the garage door opening system and/or for indicating successful operation of the garage door opening system, such as described above.

Optionally, and with reference to FIG. **35**C, the windshield accessory module **112"** may also or otherwise include or be associated with a tire pressure monitoring system. The head portion **116"** may include a display **128** that includes a pressure display **128***a* for displaying the tire pressure of a particular tire of the vehicle and indicators or light sources **128***b* for indicating which tire the display **128***a* is showing the pressure for. Head portion **116"** may also include a reset button or input **128***c* for resetting the tire pressure monitoring system. The tire pressure monitoring system may comprise any tire pressure monitoring system, and may utilize the principles described in U.S. Pat. Nos. 6,124,647; 6,294,989; 6,445,287; 6,472,979; and/or 6,731,205, which are hereby incorporated herein by reference. The head portion **116"** may also include one or more user inputs and/or indicators **120***a"*, **120***b"*, **120***c"* for controlling and actuating the garage door opening system and/or for indicating successful operation of the garage door opening system, such as described above.

Optionally, and with reference to FIG. **35**D, the windshield accessory module **112"** may also or otherwise include or be associated with a navigational system for providing instructions to the driver to follow to arrive at a desired or input destination. The head portion **116'"** may include a display screen or display device **130** for providing directional heading or driving instructions to the driver. For example, the display device **130** may display the next step to follow and may indicate how far the vehicle has to travel until it arrives at the next turn or intersection. The head portion **116'"** may also include one or more user inputs or buttons **132** for controlling the navigational display and/or for scrolling through the instructions being displayed by the display device **130**. The navigational system may be associated with or controlled or adjusted by a global positioning system of the vehicle and/or a telematics system of the vehicle and/or a compass system of the vehicle, and may utilize principles such as used in the compass and/or navigational systems of the types described in U.S. Pat. Nos. 6,678,614; 6,477,464; 5,924,212; 4,862,594; 4,937,945; 5,131,154; 5,255,442; and/or 5,632,092,

and/or U.S. patent 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; 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 and published Jul. 15, 2004 as International Publication No. WO 2004/058540, which are all hereby incorporated herein by reference. As shown in FIG. **35**D, head portion **116'''** may also include one or more user inputs and/or indicators **120** for controlling and actuating the garage door opening system and/or for indicating successful operation of the garage door opening system, such as described above.

The desired accessory module or content may be used with any mirror assembly and, for aftermarket applications, may be used with an existing mirror assembly in the vehicle. The existing mirror assembly may be removed from the mounting button and the windshield module may be attached to the windshield button and the mirror assembly may be attached to the button of the module. Optionally, and particularly for aftermarket applications, the accessory module may include a power source or battery for providing power to the electronic accessories contained within the module and/or within an associated mirror assembly.

Although certain examples of the controls and/or displays that may be provided at the head portion of the windshield accessory module are shown in FIGS. **35**A-D and described above, clearly other displays and/or user inputs and/or accessories or functions or features may be provided within or at the windshield accessory module, without affecting the scope of the present invention. The desired features or content may be provided on a circuit board and may include display elements and/or display screens or panels or the like. The circuit board and associated display elements and circuitry and inputs (or appropriate or selected or desired display elements and the like) may be mounted to or attached to or snapped into a common or universal body or base portion to convert or form the desired windshield electronics module for the particular application. If the screen or circuitry is larger than the standard head size of the module, a larger cap portion (such as shown in FIGS. **35**B and **35**D) may be implemented to contain and conceal the circuitry and the like within the head portion. The windshield electronics module or accessory module of the present invention thus provides various modules with the desired features or content, while utilizing common or universal components.

The windshield electronics module of the present invention thus eases assembly of various modules having varied content, and eases disassembly and repair of the modules. Optionally, however, the module may be sealed to contain the circuit board and display elements therewithin, without affecting the scope of the present invention. The components of the module, such as the telematics controls and the like, may be associated with other components and/or circuitry and/or systems of vehicle, such as a vehicle electronic or communication system, and may be connected via a hard wire or via various protocols or nodes, such as Bluetooth, SCP, UBP, J1850, CAN J2284, Fire Wire 1394, MOST, LIN and/or the like, depending on the particular application.

Therefore, the present invention provides a modular prismatic interior rearview mirror assembly which may have features, such as electronic accessories and/or displays or the like. The accessories or circuitry may be attached to one or more cap portions which may snap or otherwise affix or secure or mount to the rear portion of the mirror holder or bezel portion or reflective element assembly portion. The mirror holder may receive the reflective element, which may be a prismatic reflective element or an electro-optic or electrochromic reflective element, soon after the mirror holder is formed or heated, such that the reflective element may be installed to the mirror holder without a separate bezel portion. The cap portions and associated accessories and/or circuitry may be mounted to the mirror holder after the reflective element is installed and after the mirror holder has cooled and shrunk. The cap portion of the present invention thus avoids the increased costs associated with a two piece mirror holder having a separate bezel portion which is secured to the mirror holder to secure the reflective element at the mirror holder. The cap portions may be selected to have accessories and/or circuitry corresponding to openings in the mirror holder and/or to displays or display icons or the like at the reflective element. The cap portion may be selected to be formed of a different material than the bezel portion or molding, so as to provide the desired material properties and characteristics to both the bezel portion and the cap portion.

Changes and modification in 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.

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

1. An interior rearview mirror assembly for a vehicle, said interior rearview mirror assembly comprising:

a reflective element assembly portion, said reflective element assembly portion including a mirror reflective element;

said reflective element assembly portion comprising at least one pivot element, said pivot element providing adjustability of said reflective element when said reflective element assembly portion is mounted within the interior cabin of the vehicle;

at least one cap portion, said at least one cap portion adapted to attach to said reflective element assembly portion; and

wherein at least one of (a) said reflective element assembly portion comprises a personalized mirror portion and (b) said at least one cap portion comprises a personalized mirror portion.

2. The interior rearview mirror assembly of claim **1**, wherein said personalized mirror portion has at least one of (i) a color indicative of a user selection for a particular interior rearview mirror assembly, (ii) indicia indicative of a user selection for a particular interior rearview mirror assembly and (iii) a surface texture indicative of a user selection for a particular interior rearview mirror assembly.

3. The interior rearview mirror assembly of claim **1**, wherein said at least one cap portion comprises a single cap portion substantially encasing a rear portion of said reflective element assembly portion of said mirror assembly and having an aperture therethrough, wherein a mounting member extends from said pivot element and through said aperture when said cap portion is attached to said reflective element assembly portion.

4. The interior rearview mirror assembly of claim **1**, wherein at least one of (a) said reflective element assembly portion comprises at least one accessory including circuitry operable to control a display at said reflective element and (b)

said at least one cap portion comprises at least one accessory including circuitry operable to control a display at said reflective element.

5. The interior rearview mirror assembly of claim **4**, wherein said display comprises at least one of a compass display, a tire pressure monitoring display, a telematics display, a navigation system display, a garage door opening system display, a temperature display, a supplemental inflatable restraint system status display, and an object detection display.

6. The interior rearview mirror assembly of claim **5**, wherein at least one illumination source is positioned to align with at least one port formed on said reflective element when said cap portion is attached to said reflective element assembly portion.

7. The interior rearview mirror assembly of claim **6**, wherein said display comprises a compass display.

8. The interior rearview mirror assembly of claim **7**, wherein said circuitry is in communication with compass circuitry.

9. The interior rearview mirror assembly of claim **1**, wherein said at least one cap portion comprises at least one accessory and wherein said at least one accessory comprises an accessory module insertable at least partially into said cap portion.

10. The interior rearview mirror assembly of claim **9**, wherein said accessory module includes at least one user input for selectively actuating an accessory of the vehicle.

11. The interior rearview mirror assembly of claim **10**, wherein insertion of said accessory module into said cap portion interconnects said accessory module to said cap portion both mechanically and electrically.

12. The interior rearview mirror assembly of claim **1**, wherein said at least one cap portion is detachably attached to said reflective element assembly portion.

13. The interior rearview mirror assembly of claim **1**, wherein said personalized mirror portion comprises indicia, said indicia comprising at least one of a logo, text and a pattern.

14. The interior rearview mirror assembly of claim **1**, wherein said personalized mirror portion comprises at least one of a logo, a school logo, a brand identification, a sponsorship identification, a vehicle manufacturer brand emblem, an affiliation emblem and a mascot.

15. An interior rearview mirror assembly for a vehicle, said interior rearview mirror assembly comprising:

a reflective element assembly portion, said reflective element assembly portion including a mirror reflective element;

said reflective element assembly portion comprising at least one pivot element, said pivot element providing adjustability of said reflective element when said reflective element assembly portion is mounted within the interior cabin of the vehicle;

a cap portion, said cap portion adapted to attach to said reflective element assembly portion, wherein said cap portion substantially encases a rear portion of said reflective element assembly portion of said mirror assembly and has an aperture therethrough; and

wherein said cap portion comprises a personalized mirror portion having indicia and wherein said indicia comprises at least one of a logo, a school logo, a brand identification, a sponsorship identification, a vehicle manufacturer brand emblem, an affiliation emblem and a mascot.

16. The interior rearview mirror assembly of claim **15**, wherein a mounting member extends from said pivot element and through said aperture when said cap portion is attached to said reflective element assembly portion.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 7,978,094 B2
APPLICATION NO. : 11/926882
DATED : July 12, 2011
INVENTOR(S) : John T. Uken et al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 5
Line 43, "may be" should be --maybe--
Line 53, "personalization" should be --personalizations--

Column 9
Line 39, "may be" should be --maybe--

Column 25
Line 62, "minor" should be --mirror--

Column 37
Line 39, "aim" should be --arm--

Column 39
Line 28, "aim" should be --arm--
Line 56, "aim" should be --arm--

Signed and Sealed this
Thirteenth Day of March, 2012

David J. Kappos

David J. Kappos
Director of the United States Patent and Trademark Office