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Mandy et al.

(10) **Patent No.: US 9,453,639 B2**
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(54) **RECTILINEAR LIGHT SOURCE FOR ELEVATOR INTERIOR**

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Related U.S. Application Data

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F21V 29/77 (2015.01)
F21S 8/02 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC ***F21V 29/773*** (2015.01); ***B66B 11/0233*** (2013.01); ***F21S 8/026*** (2013.01);
(Continued)

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CPC F21V 29/773; F21V 29/75; F21V 29/507; F21V 7/048; F21V 7/09; F21V 7/04; F21V 7/0025; F21V 7/10; F21V 7/005; F21V 21/046; F21V 21/04; F21V 21/30; F21V 13/04; F21V 15/01; B66B 11/0233; F21S 8/026; F21S 8/02; F21Y 2103/003; F21Y 2101/02
USPC 362/147–150, 157, 190–191, 217.01, 362/219, 217.02, 217.05–217.07, 362/217.1–217.17, 249.01–249.02, 249.11, 362/257, 296.01, 297, 300, 302, 307, 310, 362/296.05–296.08, 341, 343, 350, 362, 362/364–366, 368
See application file for complete search history.

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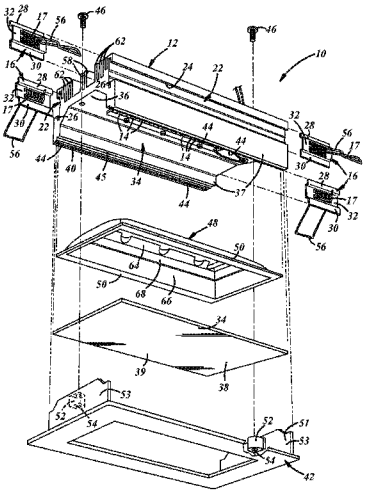
(57) **ABSTRACT**

An elevator interior illumination assembly for providing a rectilinear source of illumination in an elevator ceiling panel. An LED, reflector, and a rectilinear lens are carried by the housing, and the reflector and lens are configured to direct light emitted by the LED into an evenly-distributed rectilinear light emission image across the lens.

20 Claims, 5 Drawing Sheets



(51) **Int. Cl.**

B66B 11/02	(2006.01)
F21Y 101/02	(2006.01)
F21V 7/00	(2006.01)
F21V 7/04	(2006.01)
F21V 21/04	(2006.01)
F21Y 103/00	(2016.01)
F21V 29/507	(2015.01)
F21V 29/75	(2015.01)

(52) **U.S. Cl.**

CPC *F21V 7/005* (2013.01); *F21V 7/048* (2013.01); *F21V 21/046* (2013.01); *F21V 29/507* (2015.01); *F21V 29/75* (2015.01); *F21Y 2101/02* (2013.01); *F21Y 2103/003* (2013.01)

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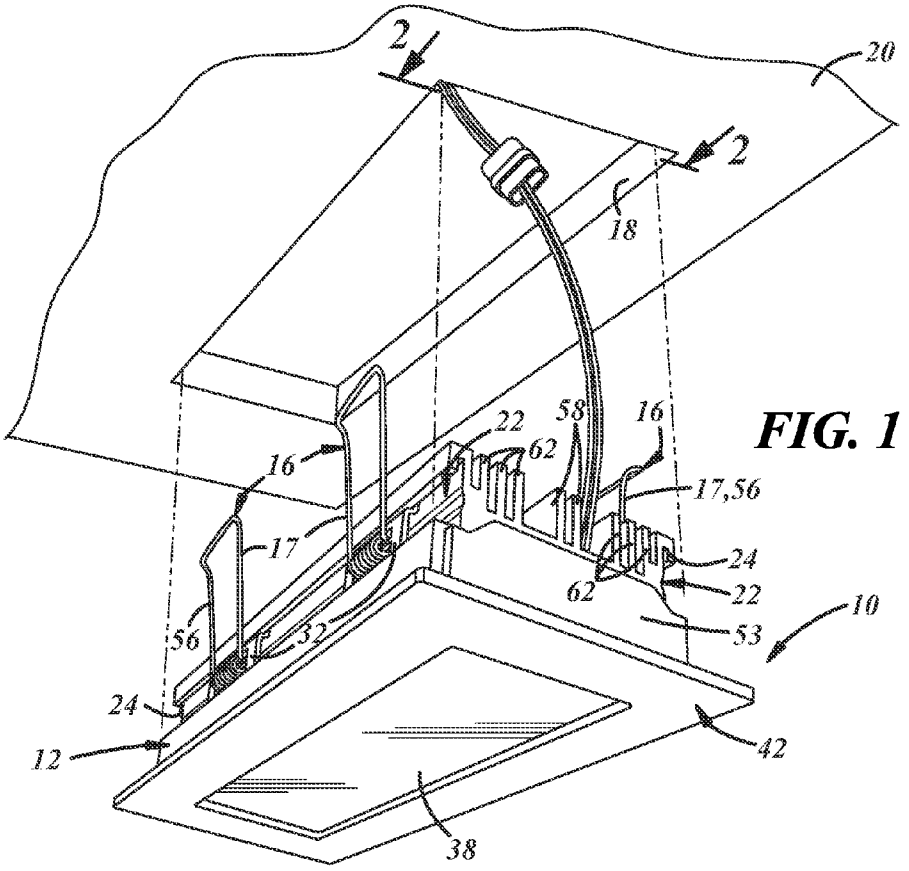
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FIG. 1

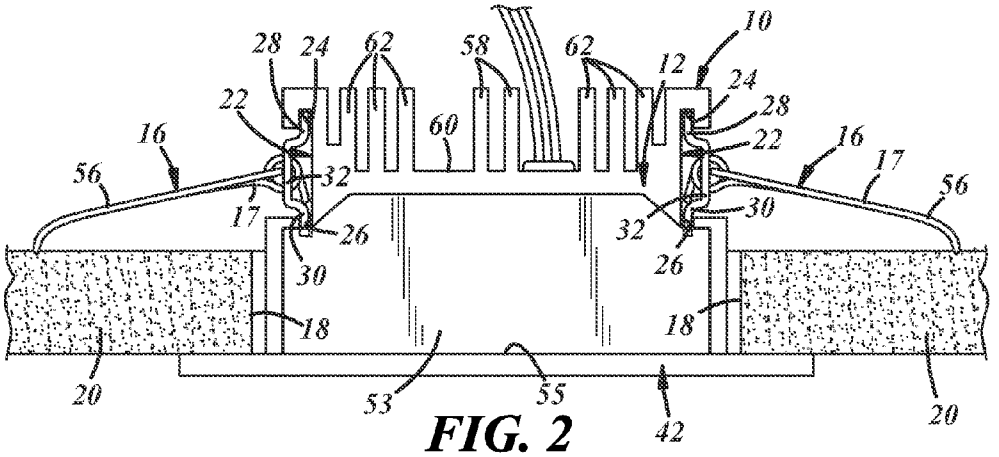
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FIG. 2

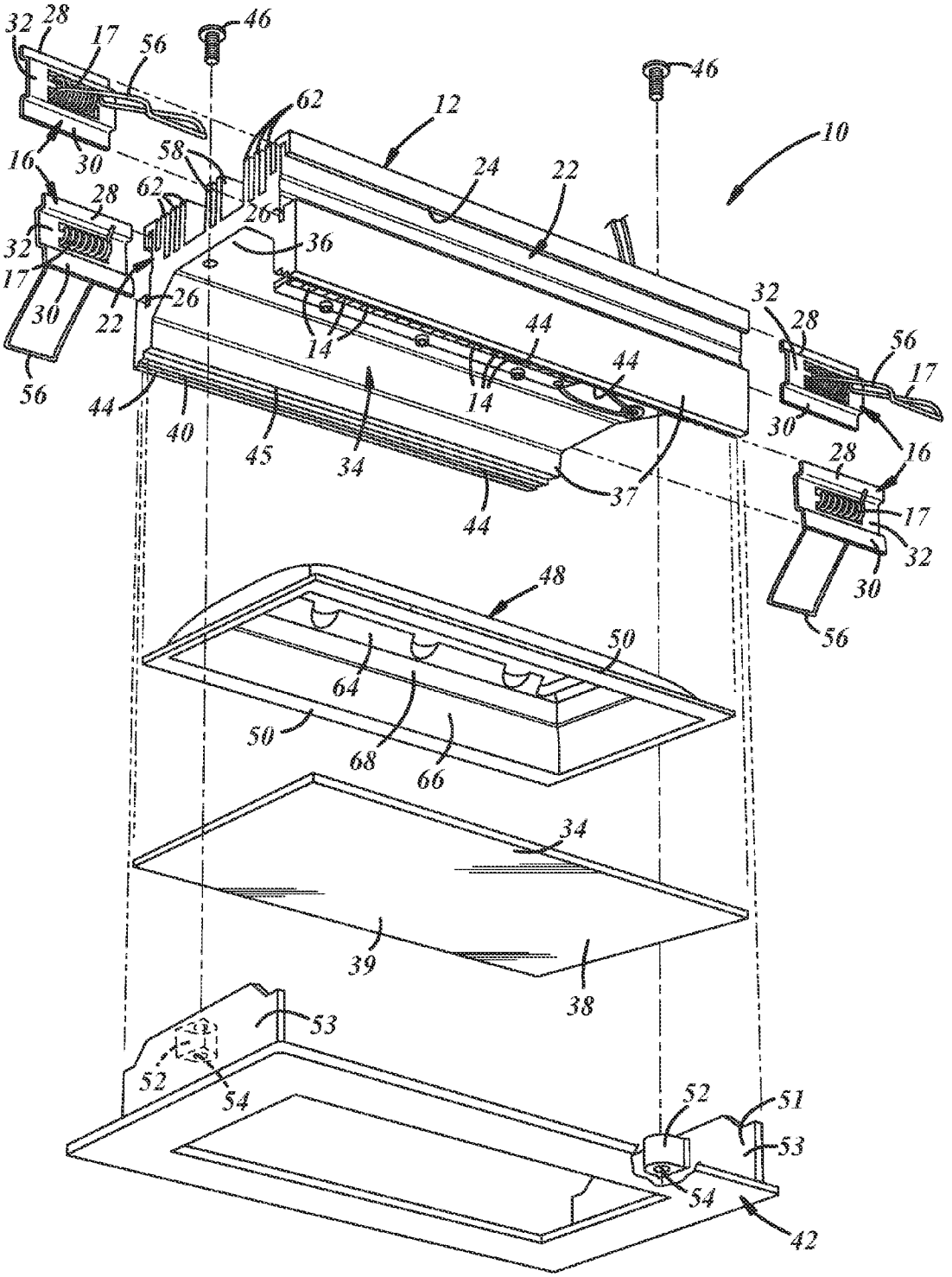
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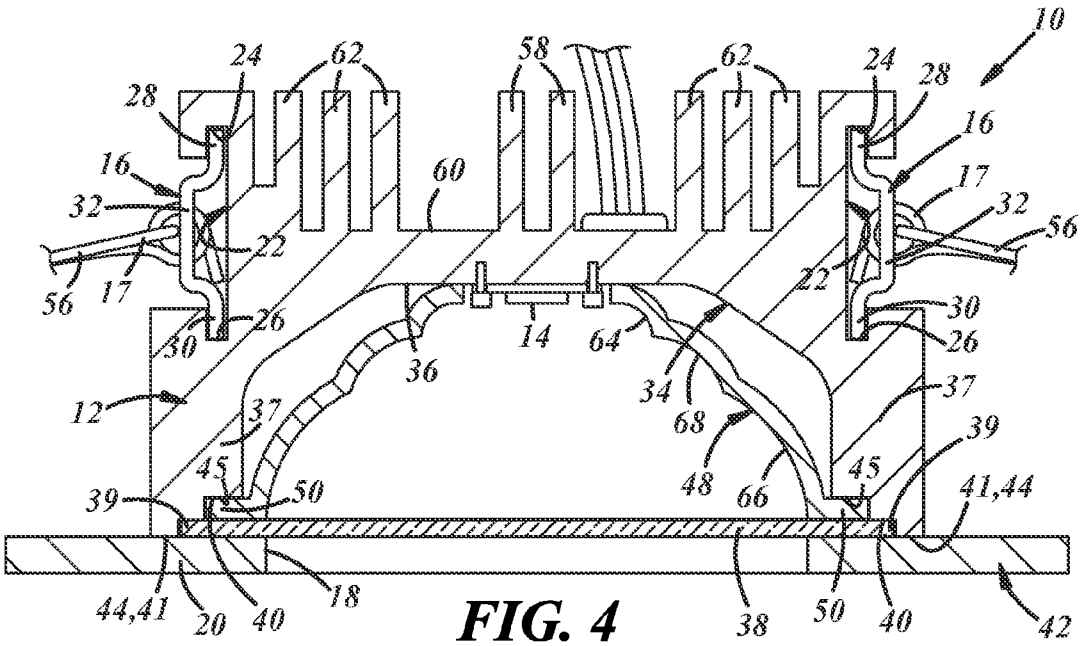
FIG. 3



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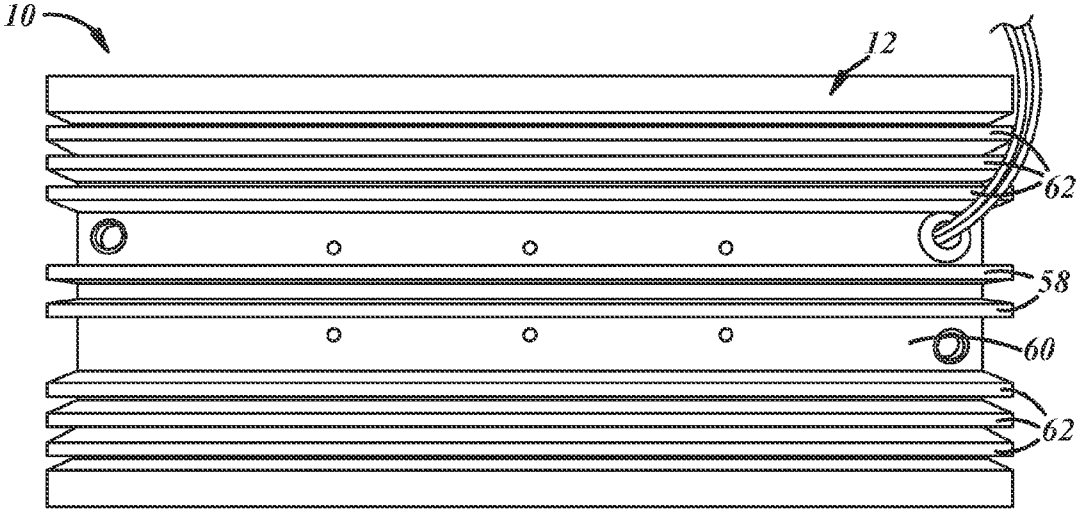

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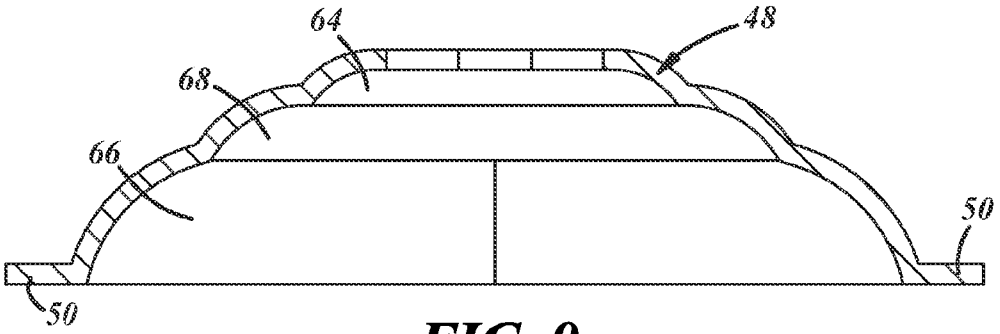

FIG. 9

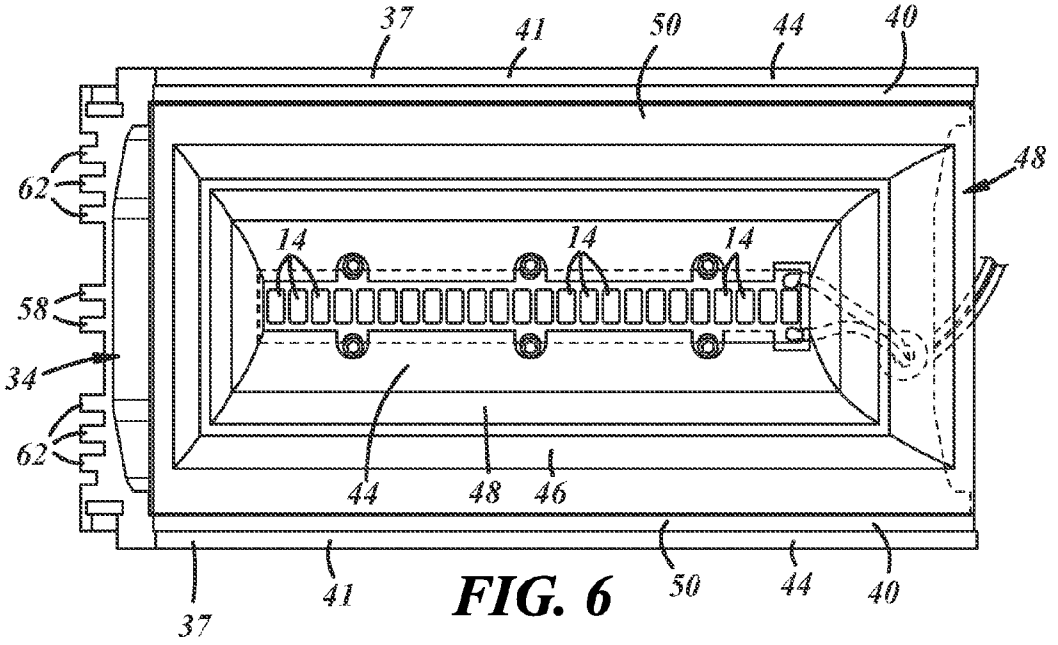
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FIG. 6

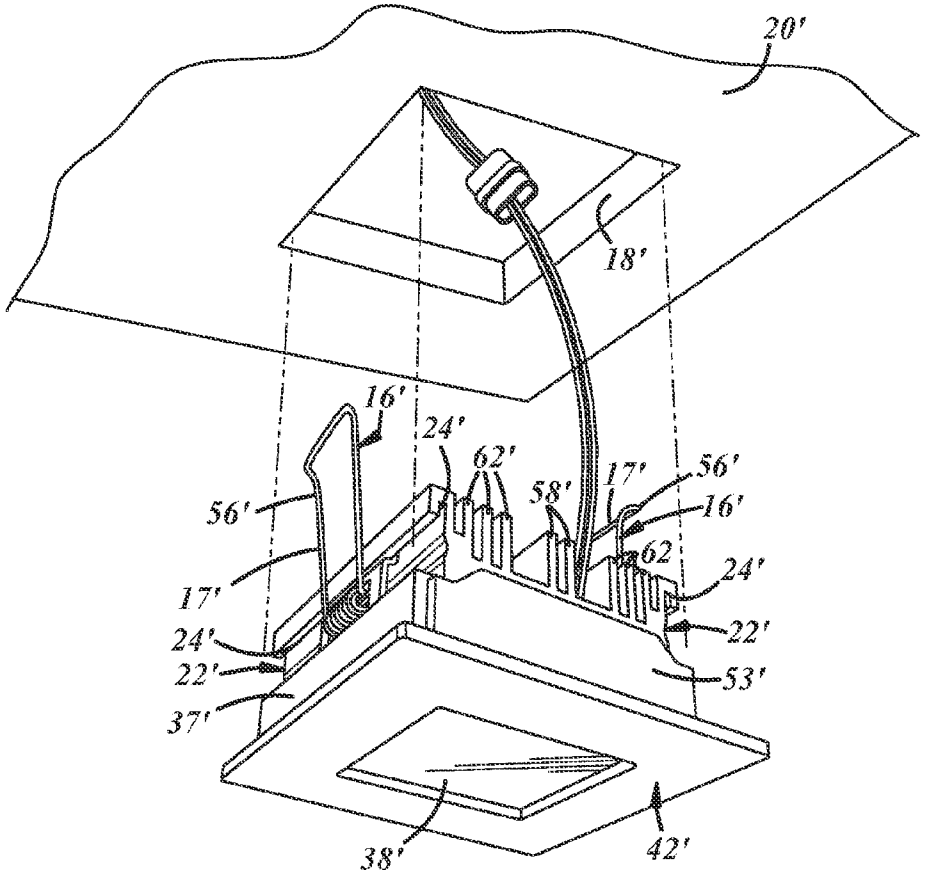
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FIG. 7

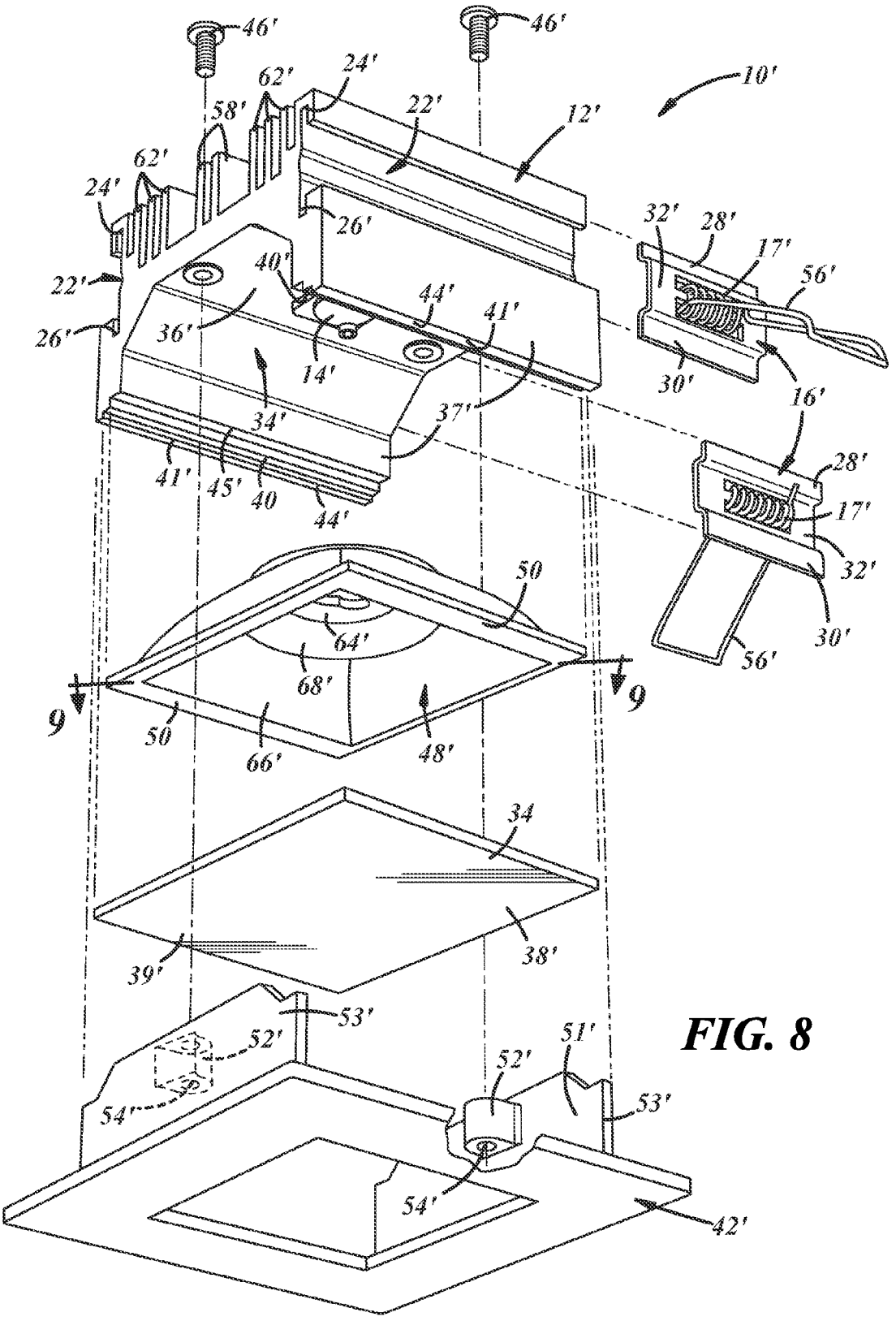
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FIG. 8

RECTILINEAR LIGHT SOURCE FOR ELEVATOR INTERIOR

CROSS-REFERENCES TO RELATED APPLICATIONS

This patent application claims the benefit of the filing date of U.S. Provisional Patent Application Ser. No. 61/881,865 filed Sep. 24, 2013.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

Not Applicable

BACKGROUND

1. Field

This application relates generally to elevator interior illumination.

2. Description of Related Art including Information Disclosed under 37 CFR 1.97 and 1.98

Elevator illumination assemblies or fixtures that include LED lamps as light sources and that are installed such that they are at least partially recessed in elevator ceiling panels, generally have circular face plates, lenses, and reflectors so that, as viewed from below, a circular illumination image is presented at the lens. Those having rectangular or square frames or face plates and/or square lenses also generally have circular reflectors—resulting in a circular illumination image being transmitted through a square lens and or face plate with dark areas presented in corners of the lens.

SUMMARY

An elevator interior illumination assembly is provided for providing a rectilinear source of illumination in an elevator ceiling panel. The assembly comprises a housing, an LED carried by the housing, a reflector carried by the housing, and a rectilinear lens carried by the housing. The reflector and lens are configured to direct light emitted by the LED into an evenly-distributed rectilinear light emission image across the lens.

DRAWING DESCRIPTIONS

These and other features and advantages will become apparent to those skilled in the art in connection with the following detailed description and drawings of one or more embodiments of the invention, in which:

FIG. **1** is a perspective view of an elevator interior illumination assembly having a rectangular housing and shown spaced below a rectangular ceiling panel hole into which the assembly is to be received;

FIG. **2** is an end view of the assembly of FIG. **1** shown installed in a ceiling panel;

FIG. **3** is an exploded view of the assembly of FIG. **1**;

FIG. **4** is an cross-sectional end view of the assembly of FIG. **1**;

FIG. **5** is a top view of the assembly of FIG. **1**;

FIG. **6** is a bottom view of the assembly with lens and front face plate components of the assembly removed to show the relationship between LEDs and a reflector of the assembly;

FIG. **7** is a perspective view of an elevator interior illumination assembly having a square housing and shown spaced below a square ceiling panel hole into which the assembly is to be received;

FIG. **8** is an exploded view of the assembly of FIG. **7**; and

FIG. **9** is a cross-sectional view of a reflector of FIG. **7**.

DETAILED DESCRIPTION

A first embodiment of an elevator interior illumination assembly for providing a rectilinear, rather than circular, source of illumination in an elevator ceiling panel is generally shown at **10** in FIGS. **1-6**. A second embodiment is generally shown at **10'** (**10** prime) in FIGS. **7-9**. According to the first embodiment, the assembly **10** has a generally rectangular configuration and produces a rectangular illumination image. According to the second embodiment, the assembly **10'** has a generally square configuration and a produces a square illumination image. Reference numerals with the designation prime (') in FIGS. **7-9** indicate elements of the second embodiment that are alternative configurations of elements that appear in the first embodiment, in FIGS. **1-6**. Unless indicated otherwise, where a portion of the following description uses a reference numeral to refer to FIGS. **1-6**, that portion of the description applies equally to elements designated by primed numerals in FIGS. **7-9**. Additionally, the descriptions of the embodiments are incorporated by reference into one another and the common subject matter generally may not be repeated here.

As shown in FIGS. **1-6**, the assembly may include a housing **12** carrying at least one, and preferably a plurality, of LEDs **14**. The housing **12** may comprise aluminum or any other suitable extrudable material. The assembly **10** may also include at least one, and preferably a plurality, of retainers **16** adapted to be carried by the housing **12** and to secure the housing **12** in a hole **18** in a panel **20**. Each retainer **16** may comprise a spring clip **17**. The housing **12** may comprise a length of extruded material. Accordingly, the housing **12** can be fabricated in a broad range of lengths to suit various applications and aesthetic preferences by extruding a desired material, preferably aluminum, in a desired cross-sectional shape, and then cutting the extrusion to a desired length.

As best shown in FIGS. **1-4**, the housing **12** may include at least one side channel **22**, and preferably a pair of opposite side channels **22**, each configured to slidably receive the retainers **16**. The side channels **22** may each comprise an elongated track of generally T-shaped cross-section and having upper and lower grooves **24**, **26** configured to receive respective upper and lower edges **28**, **30** of a base **32** of each retainer **16**. This allows for different quantities of retainers **16** to be installed in the side channels **22** to suit different mounting applications and also provides a way of rapidly attaching any one of a number of different types of retainers **16** capable of holding the assembly **10** in a hole **18** in a panel **20**. As best shown in FIG. **3**, four retainers may be carried by the housing **12** with two retainers **16** received in spaced-apart positions in each of the two side channels **22**.

Any suitable number of retainers **16** may be mounted on the assembly **10**, and the number selected for mounting may be based on a selected length of the housing **12**. The retainer **16** and housing **12** may be configured to be slightly smaller in lateral dimensions than a ceiling panel hole **18** into which they are to be received and then secured by the retainers **16**.

As shown in FIGS. **3** and **4**, each housing **12** may include a front channel **34** defined by a channel floor **36** and channel side walls **37**. The LEDs **14** may be carried on the channel floor **36**. The front channel **34** may be closed by a lens **38** received in a pair of outer step surfaces **40** disposed along respective forward edges **41** of the channel side walls **37**. As best shown in FIG. **4**, the lens **38**, which may comprise a

polycarbonate sheet or any other suitable material, may be held at opposite side edges **39** against the outer step surfaces **40** by a front face plate **42**. The front face plate **42** may comprise a frame-shaped trim piece shaped to frame the lens **38** while securing the opposite side edges **39** of the lens **38** against the outer step surfaces **40** of the channel side walls **37**. The lens **38** may be cut to a length generally equal to that of the housing **12**, and the front face plate **42** may be fabricated to have a length and width greater than a length and width of the housing **12**. The lens **38** may be sealed against the outer step surfaces **40** by the front face plate **42**.

As shown in FIGS. **3**, **4**, and **6**, the forward edges **41** of the channel side walls **37** may include respective front surfaces **44** disposed in a common front plane. As best shown in FIG. **4**, the respective outer step surfaces **40** may be recessed from the respective front surfaces **44** and disposed in a common inner recessed plane spaced from and generally parallel to the front plane. As best shown in FIG. **3**, the front face plate **42** may be drawn toward and/or engaged against the front surfaces **44** of the side wall forward edges **41** by fasteners **46** extending between the housing **12** and the front face plate **42**, such that the opposite side edges **39** of the lens **38** are held by the front face plate **42** against the outer step surfaces **40**. The distance between the front plane and the inner recessed plane may be slightly less than a thickness of the lens **38**, such that the side edges **39** of the lens **38** may be tightly clamped between the front face plate **42** and the outer step surfaces **40** when the front face plate **42** is drawn toward and/or against the front surfaces **44** by the fasteners **46**.

As shown in FIGS. **3**, **4**, and **6**, the forward edges **41** of the channel side walls **37** may include respective inner step surfaces **45** recessed from the outer step surfaces **40** and disposed in a common inner recessed plane spaced from and generally parallel to the inner recessed plane. As best shown in FIG. **4**, the assembly **10** may include a reflector **48** sized so that opposite side edges **50** of the reflector **48** may be received on the inner step surfaces **45** where they can be sandwiched between the lens **38** and the inner step surfaces **45** to secure the reflector **48** in a desired position within the front channel **34** of the housing **12**. The distance between the inner and outer recessed planes may be slightly less than a thickness of the opposite side edges **50** of the reflector **48**, such that the opposite side edges **50** of the reflector **48** may be tightly clamped between the lens **38** and the inner step surfaces **45** when the front face plate **42** is drawn toward and/or against the front surfaces **44** by the fasteners **45**. This arrangement prevents rattling or chattering noises from being generated by adjacent components during movement, and precludes any need for the use of secondary adhesion methods to secure the components against relative movement.

The front face plate **42** may comprise an aluminum die casting so that the front face plate **42** can readily be fabricated in a width and length corresponding to a selected width and length of the housing **12**. As best shown in FIG. **3**, the front face plate **42** may comprise at least one boss and preferably two bosses **52** disposed on respective inner-facing surfaces **51** of end walls **53** that extend integrally from a back surface **55** of the front face plate **42** at opposite ends of the front face plate **42**. The bosses **52** may comprise respective threaded holes **54** configured to receive and threadedly engage threaded shafts of the fasteners **46**.

The front face plate **42** may have a rectilinear shape sized to cover a panel hole **18** in which the assembly **10** is to be received. This allows the assembly **10** to be mounted in a panel hole **18** without leaving gaps showing between an inner edge of the hole **18** and an outer edge of the assembly **10**. A panel hole **18**, therefore, need not be cut to precisely match the dimensions of the assembly **10**, and may be large enough to ease passage of the assembly during installation. The retainer spring clips **17** may be selected or fabricated to have spring clip arms **56** long enough to reach across and span gaps between the housing **12** and the hole **18**.

As shown in FIGS. **1-5**, the housing **12** may include at least one, but preferably two parallel spaced-apart longitudinal heat dissipation fins **58** integrally extending from a back surface **60** of the housing **12** opposite the floor **36** of the front channel **34** where the LEDs **14** are mounted. The fins **58** may be configured to reject LED-generated heat via conduction of heat energy from the LEDs **14** through the housing **12** to the fins and via convective heat transfer from the fins to ambient air. The fins **58** may be disposed directly opposite the LEDs **14** to improve heat rejection efficiency by minimizing heat conduction distance between the LEDs **14** and the fins **58**. Additional fins **62** may extend from the back surface **60** of the housing **12** and may be spaced to either side of the fins **58** disposed generally opposite the LEDs **14**. Preferably, all the fins **58**, **62** may be formed with the housing **12** as a single unitary piece. In other embodiments, where heat rejection either isn't an issue or other means are employed to reject LED-generated heat, there may be fewer fins or no fins extending from the housing **12**.

As shown in FIGS. **3**, **4**, and **6**, the reflector **48** may comprise a series of rectangular annular reflector surface terraces **64**, **66**, **68** of increasing dimension extending diagonally forward and outward from a reflector inner edge adjacent and surrounding the LEDs **14**, toward the forward edges **41** of the channel side walls **37**. As best shown in FIG. **4**, each of the reflector surface terraces **64**, **66**, **68** may have an arcuate cross-section, and may be shaped and positioned to assist in evening-out the concentration of light from the LEDs **14** across the lens **38** to provide a smooth, evenly-distributed rectangular light emission image across the lens **38**. The lens **38** may be configured to further diffuse light received from the LEDs **14** and the lens **38**.

According to the second embodiment shown in FIGS. **7-9**, the assembly **10'** may comprise a housing **12'** that is cut to a length approximately equal to its width and that may carry a single LED **14'** on its channel floor **36'**. Accordingly, a front face plate **42'** of the assembly **10'** may be fabricated in a square shape having outer dimensions greater than those of the housing **12'**, and inner "window" dimensions less than those of the housing **12'**. A lens **38'** of the assembly **10'** may also be fabricated or cut in a square shape, and may have outer dimensions slightly greater than the inner window dimensions of the front face plate **42'**. As shown in FIGS. **8** and **9**, a reflector **48'** of the second embodiment assembly **10'** may comprise an inner reflective surface **64'** having a generally circular annular shape having an inner edge disposed adjacent and surrounding the LED **14'**. The reflector **48'** may also comprise an outer reflective surface **66'** having a generally rectilinear annular shape having opposite outer edges disposed adjacent (and approximating the dimensions of) opposite channel side walls **37'** of the housing **12'**. Between the inner reflective surface **64'** and the outer reflective surface **66'** the reflector **48'** may include a transition portion **68'** that smoothly transitions from the circular annular shape of the inner reflective surface **64'** to the rectilinear annular shape of the outer reflective surface **66'**. As best shown in FIG. **9**, the inner and outer reflective surfaces **64'**, **66'**, and transition portion **68'** may have arcuate cross-sections. This reflector design precludes dark corners

by permitting light to reach the corners, thus providing a consistent, evenly-distributed square light emission image across the lens **38'**.

An elevator interior illumination assembly as described above provides even illumination from one or more LEDs across a rectilinear lens, and may be easily installed in a hole in an elevator ceiling panel.

This description, rather than describing limitations of an invention, only illustrates embodiments of the invention recited in the claims. The language of this description is therefore exclusively descriptive and is non-limiting. Obviously, it's possible to modify this invention from what the description teaches. Within the scope of the claims, one may practice the invention other than as described above.

What is claimed is:

1. An elevator interior illumination assembly for providing a rectilinear source of illumination in an elevator ceiling panel, the assembly comprising:

a housing carrying at least one LED and including a front channel;

a reflector carried by the housing;

a rectilinear lens carried by the housing and closing the front channel, the lens being sandwiched against opposite forward edges of the channel side walls by a front face plate; and

the reflector and lens being configured to direct light emitted by the LED into an evenly-distributed rectilinear light emission image across the lens.

2. An elevator interior illumination assembly as defined in claim **1** in which:

at least one retainer is carried by the housing and adapted to secure the housing in a hole in a panel; and

the housing includes at least one side channel configured to receive the retainer.

3. An elevator interior illumination assembly as defined in claim **2** in which the side channel comprises an elongated track configured to receive 2 or more retainers.

4. An elevator interior illumination assembly as defined in claim **1** in which the retainer comprises a spring clip.

5. An elevator interior illumination assembly as defined in claim **1** in which the at least one LED is carried on a floor of the front channel. channel side walls by a front face plate.

6. An elevator interior illumination assembly as defined in claim **5** in which the lens is sealed against the opposite forward edges of the channel side walls by the front face plate.

7. An elevator interior illumination assembly as defined in claim **5** in which the lens comprises a polycarbonate sheet.

8. An elevator interior illumination assembly as defined in claim **5** in which:

the forward edges of the channel side walls include:

respective front surfaces disposed in a common front plane; and

respective outer step surfaces recessed from the front surfaces and disposed in a common inner recessed plane spaced from and generally parallel to the front plane; and

opposite side edges of the lens are received in the outer step surfaces and sandwiched between the front face plate and the outer step surfaces; and

the front face plate is engaged against the front surfaces.

9. An elevator interior illumination assembly as defined in claim **8** in which the distance between the front plane and the inner recessed plane is slightly less than a thickness of the lens.

10. An elevator interior illumination assembly as defined in claim **5** in which the front face plate is an aluminum die casting.

11. An elevator interior illumination assembly as defined in claim **5** in which the front face plate comprises at least one boss disposed on a back surface of the front face plate and configured to engage a fastener.

12. An elevator interior illumination assembly as defined in claim **5** in which the front face plate has a rectilinear shape sized to cover a panel hole in which the assembly is to be received.

13. An elevator interior illumination assembly as defined in claim **8** in which:

the forward edges of the channel side walls include respective inner step surfaces recessed from the outer step surfaces and disposed in a common second recessed plane spaced from and generally parallel to the inner recessed plane; and

opposite side edges of the reflector are received in the inner step surfaces and sandwiched between the lens and the inner step surfaces.

14. An elevator interior illumination assembly as defined in claim **1** in which the housing includes at least one longitudinal heat dissipation fin integrally extending from a back surface of the housing opposite the floor of the front channel and opposite a location for mounting at least one LED.

15. An elevator interior illumination assembly comprising:

a housing carrying an LED; and

a reflector carried in a channel of the housing and comprising:

an inner reflective surface having a circular annular shape having an inner edge disposed adjacent and surrounding the LED,

an outer reflective surface having a rectilinear annular shape, and

a transition portion that smoothly transitions from the circular annular shape of the inner reflective surface to the square annular shape of the outer reflective surface.

16. An elevator interior illumination assembly as defined in claim **15** comprising retainers adapted to secure the housing in a hole in a panel.

17. An elevator interior illumination assembly as defined in claim **16** in which the housing has a front channel configured to carry LEDs and to be closed by a lens sandwiched against opposite forward edges of the channel side walls by a front face plate.

18. An elevator interior illumination assembly as defined in claim **17** in which the forward edges of the channel side walls each include first and second steps configured to receive and position the lens and front face plate.

19. An elevator interior illumination assembly as defined in claim **18** in which each of the forward edges of the channel side walls includes a third step configured to receive and position a reflector.

20. An elevator interior illumination assembly as defined in claim **17** in which at least one longitudinal fin integrally extends from a back surface of the housing opposite the front channel floor.

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