



(51) International Patent Classification:

F21V 29/00 (2006.01) F21V 7/00 (2006.01)  
F21K 99/00 (2010.01) H05K 1/02 (2006.01)

(21) International Application Number:

PCT/CA2012/000801

(22) International Filing Date:

28 August 2012 (28.08.2012)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

2751759 2 September 2011 (02.09.2011) CA

(72) Inventor; and

(71) Applicant : **BEAUCHAMP, Pierre J.** [CA/CA]; 9500 Place Jade, Brossard, Québec J4Y 3C1 (CA).

(74) Agent: **NORTON ROSE CANADA LLP/S.E.N.C.R.L., S.R.L.**; Suite 2500, 1 place Ville-Marie, Montreal, Québec H3B 1R1 (CA).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY,

BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

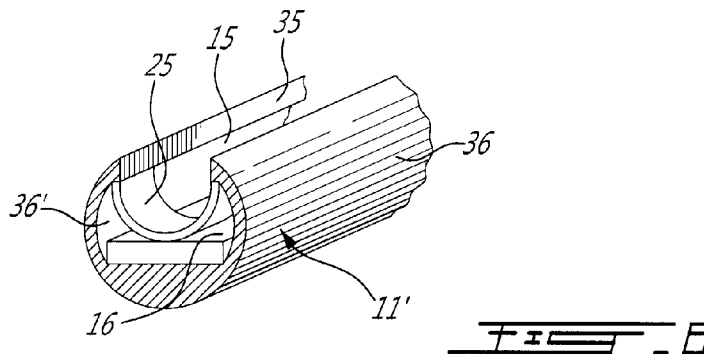
Published:

- with international search report (Art. 21(3))
- with amended claims (Art. 19(1))



WO 2013/029156 A1

(54) Title: MINIATURE LUMINAIRE ASSEMBLY



(57) Abstract: A miniature luminaire assembly comprising a heat dissipating support member which is fabricated, at least in part, from a heat conductive material, is described. A printed circuit board having electronic circuit components including one or more light emitting diodes (LED's) are supported on a top surface of the circuit board. The circuit board has a bottom surface being formed of a thermally conductive and electrically insulating member. The bottom surface is secured against a support surface of the heat dissipating support member. The ratio of the bottom surface to the mass of the heat conductive material of the support member provides for the LED's to generate a high luminous flux of from about 160 to 230 lm at 700 mA current supply and from about 250 to 320 lm at 1000 mA current supply.

## MINIATURE LUMINAIRE ASSEMBLY

TECHNICAL FIELD

5 The present invention relates to a miniature luminaire assembly comprised of a heat dissipating support member having a printed circuit board with light emitting diodes secured thereto and having a life expectancy capable of exceeding 100,000 hours.

BACKGROUND ART

10 There is need to provide miniature luminaires wherein the source of light are diodes and to provide good heat dissipation for the diodes to increase the longevity of the luminaire. Such miniature luminaires are intended for use in display cases for jewelers, under kitchen cabinets, and other lighting applications, such as concealed lighting, as well as applications where there is a need to provide high luminous flux with  
15 a small power supply capable of generating from about 700 to 1000 mA current. There is also a need to provide such miniature luminaires to replace fluorescent lighting which requires a supply of 110 volts AC. When using fluorescent lamps it is also necessary to install large lamp housings and to provide electrical accessories such as a ballast which requires replacement from time-to-time not to mention the replacement of the  
20 fluorescent tubes. Concealing the housings and wires for such large fluorescent tube luminaires often presents problems. There is therefore a need to provide a miniature luminaire which can generate a high luminous flux with a small power supply and packaged in a very small space and wherein the life cycle of the LED's can be extended to the range of about 100,000 hours.

25

SUMMARY OF INVENTION

It is a feature of the present invention to provide a miniature luminaire assembly which provides the above needs.

30 According to the above feature, from a broad aspect, the present invention provides a miniature luminaire assembly which comprises a heat dissipating support member fabricated, at least in part, from a heat conductive material. A printed circuit board having electronic circuit components including one or more light emitting diodes is supported on a top surface of the circuit board. The circuit board has a bottom surface which is formed of a thermally conductive and electrically insulating  
35 material. The bottom surface is secured against a support surface of the heat dissipating support member by retention means. The ratio of the bottom surface to the

- 2 -

mass of the heat conductive material of the support member provides for the LED's to generate a high luminous flux of from about 160 to 230 lm at 700 mA current supply and from about 250 to 320 lm at 1000 mA current supply.

## 5 BRIEF DESCRIPTION OF DRAWINGS

A preferred embodiment of the present invention will now be described with reference to the accompanying drawings in which:

FIG. 1 is a perspective view of the miniature luminaire heat dissipating support member;

10 FIG. 2 is a plan view of the printed circuit board having electronic circuit components including light emitting diodes secured to the top surface thereof;

FIG. 3 is a perspective view showing the printed circuit board secured in a channel formed in the heat dissipating support member;

15 FIG. 4 is a section view showing a typical assembly of the printed circuit board of Figure 2;

FIG. 5 is a plan view of a section of the printed circuit board showing a typical example of the electronic circuit component connections to be electrically isolated;

20 FIG. 6 is a schematic block diagram showing the current controller for driving the LED's secured to the circuit board;

FIG. 7 is an exploded view showing an example of how the circuit board can be retained in the heat dissipating support member;

25 FIG. 8 is a further perspective view showing another example of the construction of the heat dissipating support member and the retention means for securing the circuit board therein;

FIG. 9 is an example of the miniature luminaire assembly mounted over a display base; and

30 FIG. 10 is a fragmented side view showing the heat dissipating support member mounted on a rotating support to angulate the light beam of the luminaire.

## DESCRIPTION OF PREFERRED EMBODIMENTS

Referring now to the drawings, and particularly to Figures 1 to 4, there is shown more specifically at Figure 3, the miniature luminaire assembly 10 of the present invention. The assembly comprises a heat dissipating support member 11, which is shown in Figure 1, formed by an aluminum extrusion having a part circular outline with

- 3 -

an elongated channel 12 formed therealong. The channel 12 defines opposed side walls 13 and 13', a bottom wall 14 and an open end 15 for access to the channel 12.

As shown in Figure 2, an elongated circuit board 16 is provided with electronic circuit components 17 for driving four miniature LED's 18 disposed equidistantly apart along the circuit board 16. The LED's 18 may also be positioned differently as well as the circuit components 17.

As shown in Figure 4, which is a fragmented section view of the circuit board 16, the top wafer 19 of the circuit board has the electronic components 17 and LED's 18 secured thereto and the bottom surface 20, as shown in Figure 5, is provided with the conductors 21 deposited thereon. The circuit board 16 may also comprise other wafers 22 providing further wiring, etc. These wafers 19 and 22 are insulated from one another by electrically insulating and heat conductive material 24. The bottom surface 23 of the printed circuit board is also provided with this electrically insulating and heat conductive material 24 which is a sheet of Arlon 24 (registered trademark), or the like material, capable of providing good electrically insulating properties and thermal conductivity.

The printed circuit board 16 is glued or otherwise retained in the channel 12 with the bottom surface 23 in flush contact with the bottom wall 14 of the channel 12. It may be retained in flush contact by a suitable glue or, as shown in Figure 9, by a retention clip 25. The opposed side walls 13 and 13' of the heat dissipating support member 11 constitute reflectors whereby to direct light towards the open end 15 to form a beam of light. The outer surface of the support member is herein shown as an arcuate outer surface but it can also be a rectangular outer surface or any other convenient shape provided that there is sufficient mass in the heat dissipating support member to dissipate heat sufficiently to provide for the LED's to have a life cycle of at least 100,000 hours. This is achieved because of the construction of the circuit board with its Arlon base 24. The ratio of the bottom surface 23 of the circuit board to the mass of the heat conductive material of the support member 11 provides for the LED's 18 to have a long life while generating a high luminous flux of from about 160 to 230 lm with a current supply of 700 mA and from about 250 to 320 lm with a current supply of 1,000 mA. The electronic components and LED's can be packaged in a very small space.

Figure 7 shows a block diagram representing an electronic control circuit 28 providing a supply to four LED's 18 serially connected. The current controller operates from a source of 24 volts DC and generates an output of from between 350 mA to 1000 mA at 3 to 18 volts DC whereby the LED's generate a luminous flux of from

- 4 -

about 160 to 230 lm at 700 mA and 250 to 320 lm at 1000 mA. The circuit board 16 is provided with wire clip connectors 29 at opposed ends thereof for interconnecting the wiring of circuit boards when disposed on an end-to-end series relationship and to connect to the supply leads 44 as shown in Figure 10. Also, the circuit board 16 may be of different shape such as rectangular or square shape and mounted in a heat dissipating support member having a cavity or mounting surface of complementary shape while providing substantially the same ratio of heat transmitting surface of the circuit board to the mass of the support member.

The LED's 18 are selected to function in an environment temperature of about 25°C while generating this high luminous flux and providing a life cycle of about 100,000 hours. This result is achieved by the construction of a very small circuit board which in the embodiment illustrated in Figure 2 has a width of about ¼ inch and wherein the diameter of the heat dissipating support member 11 is about 3/8 inch. Therefore, this miniature luminaire may be defined as an "ultra" miniature luminaire.

As shown in Figure 8, the heat dissipating support member 11' is hereinshown as an aluminum extrusion of U-shaped cross-section having opposed parallel side walls 30 and 30' which constitutes reflectors above the flat bottom wall 31. The circuit board 16 is received within the rectangular channel 32 and retained therein by clamping protrusions 33 positioning the Arlon bottom wall 23 against the flat bottom face 34 of the heat dissipating support member 11'. Figure 9 shows a different configuration of the heat dissipating support member 11" wherein the circuit board 16 is retained by the retention spring clips 23. The support member 11" is provided with opposed retention ridges 35 to place the retention clips 25 in retention engagement against the circuit board 16. As shown, the cross-section of the heat dissipating support member 11" is slightly different than the extrusion as shown in Figure 1 but the ratio of the mass of this support member provides adequate dissipation to provide the long life of the LED's. As also shown in Figure 9, the open end 15 may be made narrower by converging the outer free ends of the side walls 36 and 36' closer to one another. The circuit board is slid into the channel from the end of the extrusion.

Figure 10 shows one application of the miniature luminaire assembly 10 of the present invention. As hereinshown, the heat dissipating support member 11 is retained between end brackets 40 which are rotating brackets mounted on a support 41. The supports 41 are each secured to a vertical hollow post 42 mounted on a display base 43 and through one of which the wiring 44 of the power supply extends into the post 42 and then connects to the circuit board by a flexible connection. The

- 5 -

end brackets 50 are supported on a rotating support 45 to permit the axial rotation of the extrusion and the channel open end 15 to adjust the direction of the light beam 46.

It is within the ambit of the present invention to cover any obvious modifications of the preferred embodiment described herein provided such  
5 modifications fall within the scope of the appended claims. For example, the heat dissipating support members 11, 11' or 11" may be constructed of other heat conductive materials capable of good heat conductivity and dissipation. As well, the miniature luminaire assembly may be mounted for different applications such as in  
10 aircrafts where a small power supply is all that would be required to drive the luminaire while providing a high luminous flux in a small space and requiring very little maintenance as compared to existing lighting systems. The applications of such miniature luminaires are thus unlimited. Being of such small size, as herein described, these miniature luminaires can be easily concealed in very small spaces.

15

## CLAIMS,

1. A miniature luminaire assembly comprising a heat dissipating support member fabricated, at least in part, from a heat conductive material, a printed circuit board having electronic circuit components including one or more light emitting diodes (LED's) supported on a top surface of said circuit board, said circuit board having a bottom surface being formed of a thermally conductive and electrically insulating material, said bottom surface being secured against a support surface of said heat dissipating support member by retention means, the ratio of said bottom surface to the mass of said heat conductive material of said support member providing for said LED's to generate a high luminous flux of from about 160 to 230 lm (lumens) at 700 mA current supply and from about 250 to 320 lm (lumens) at 1000 mA current supply.
2. A miniature luminaire assembly as claimed in claim 1 wherein there is further provided light beam reflector means.
3. A miniature luminaire assembly as claimed in claim 2 wherein said light beam reflector means are integrally formed with said heat dissipating support member.
4. A miniature luminaire assembly as claimed in claim 1 wherein the support member has an elongated channel formed therealong; said channel defining opposed side walls, a bottom wall and an open end for access to said channel; said printed circuit board being an elongated board secured in said channel with said bottom surface thereof being in flush contact with said bottom wall for the dissipation of heat into said support member, and wherein said opposed side walls protrude above said circuit board to form a light beam reflector.
5. A miniature luminaire assembly as claimed in claim 4 wherein an outer surface of said support member is an arcuate outer surface.
6. A miniature luminaire assembly as claimed in claim 1 wherein said LED's are selected to function in an environment temperature of about 25°C and capable of generating said minimum luminous flux, said LED's having a life cycle of about 100,000 hours.

- 7 -

7. A miniature luminaire assembly as claimed in claim 1 wherein said electronic circuit components are supplied through a current controller circuit, said current controller being an electronic control circuit having a supply of 24 Vdc at an input thereof and generating an output current of between 350 mA to 1000 mA at 3-18 Vdc.
8. A miniature luminaire assembly as claimed in claim 1 wherein said heat conductive material is aluminum, said support member being an aluminum extruded member.
9. A miniature luminaire assembly as claimed in claim 1 wherein said printed circuit is comprised of at least two wafers having electrically conductive material thereon, said wafers being electrically insulated from one another by said thermally conductive and electrically insulating material, said bottom surface is comprised by a sheet of Arlon (registered trademark) or the like material.
10. A miniature luminaire assembly as claimed in claim 1 wherein said retention means is a heat conductive adhesive.
11. A miniature luminaire assembly as claimed in claim 1 wherein said retention means is a retention clip securing said circuit board to said heat dissipating support member with said bottom surface in flush contact with a flat conductive surface of said support member.
12. A miniature luminaire assembly as claimed in claim 4 wherein said printed circuit board has a width of about  $\frac{1}{4}$  inch, said support member having an arcuate outer surface with a diameter of about  $\frac{3}{8}$  inch.

## CLAIMS,

1. A miniature luminaire assembly comprising a heat dissipating solid mass support member fabricated from a heat conductive material, a printed circuit board having electronic circuit components including one or more light emitting diodes (LED's) supported on a top surface of said circuit board, said circuit board having a flat bottom surface being formed of a thermally conductive and electrically insulating material, said bottom surface being secured against a flat support surface of said heat dissipating support member by retention means, the ratio of said bottom surface area to the mass of said heat conductive material of said support member providing for said LED's to generate a high luminous flux of from about 160 to 230 lm (lumens) at 700 mA current supply and from about 250 to 320 lm (lumens) at 1000 mA current supply, said LED's being selected to function in an environment temperature of about 25°C and capable of generating said high luminous flux, said ratio of said bottom surface area to the mass of said support member providing for said LED's to have a life cycle of at least 100,000 hours.
2. A miniature luminaire assembly as claimed in claim 1 wherein there is further provided light beam reflector means.
3. A miniature luminaire assembly as claimed in claim 2 wherein said light beam reflector means are integrally formed with said heat dissipating support member.
4. A miniature luminaire assembly as claimed in claim 1 wherein the support member has an elongated channel formed therealong; said channel defining opposed side walls, a bottom wall and an open end for access to said channel; said printed circuit board being an elongated board secured in said channel with said bottom surface thereof being in flush contact with said bottom wall for the dissipation of heat into said support member, and wherein said opposed side walls protrude above said circuit board to form a light beam reflector.
5. A miniature luminaire assembly as claimed in claim 4 wherein an outer surface of said support member is an arcuate outer surface.

6. A miniature luminaire assembly as claimed in claim 1 wherein said electronic circuit components are supplied through a current controller circuit, said current controller being an electronic control circuit having a supply of 24 Vdc at an input thereof and generating an output current of between 350 mA to 1000 mA at 3-18 Vdc.
7. A miniature luminaire assembly as claimed in claim 1 wherein said heat conductive material is aluminum, said support member being an aluminum extruded member.
8. A miniature luminaire assembly as claimed in claim 1 wherein said printed circuit is comprised of at least two wafers having electrically conductive material thereon, said wafers being electrically insulated from one another by said thermally conductive and electrically insulating material, said bottom surface is comprised by a sheet of Arlon (registered trademark).
9. A miniature luminaire assembly as claimed in claim 1 wherein said retention means is a heat conductive adhesive.
10. A miniature luminaire assembly as claimed in claim 1 wherein said retention means is a retention clip securing said circuit board to said heat dissipating support member with said bottom surface in flush contact with a flat conductive surface of said support member.
11. A miniature luminaire assembly as claimed in claim 4 wherein said printed circuit board has a width of about 0.635 cm, said support member having an arcuate outer surface with a diameter of about 0.95 cm.



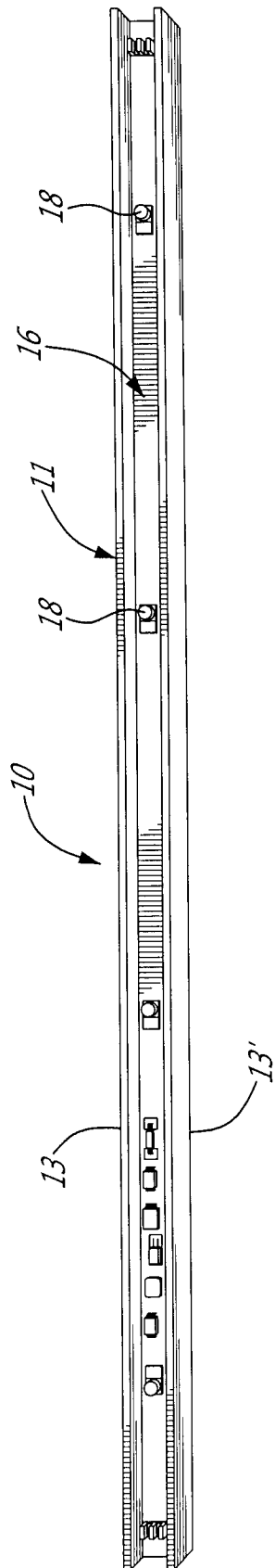


FIG. 3

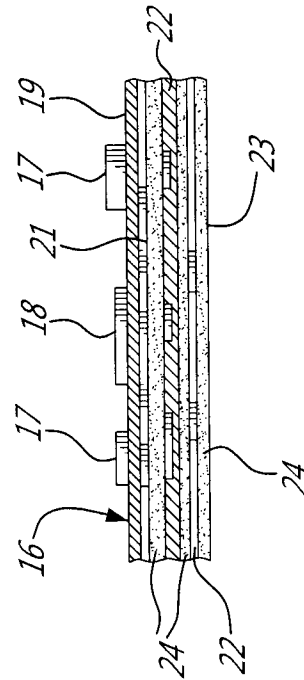
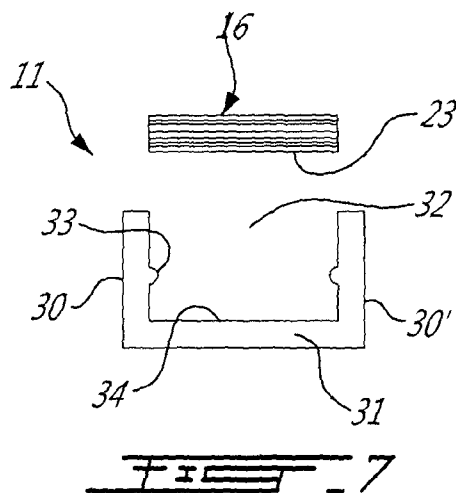
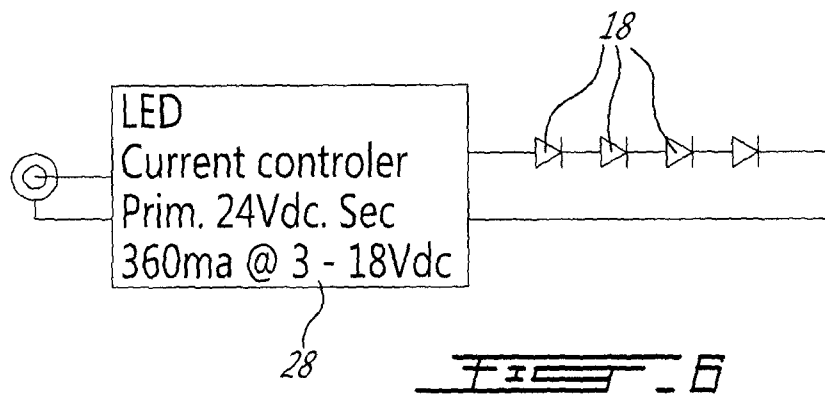
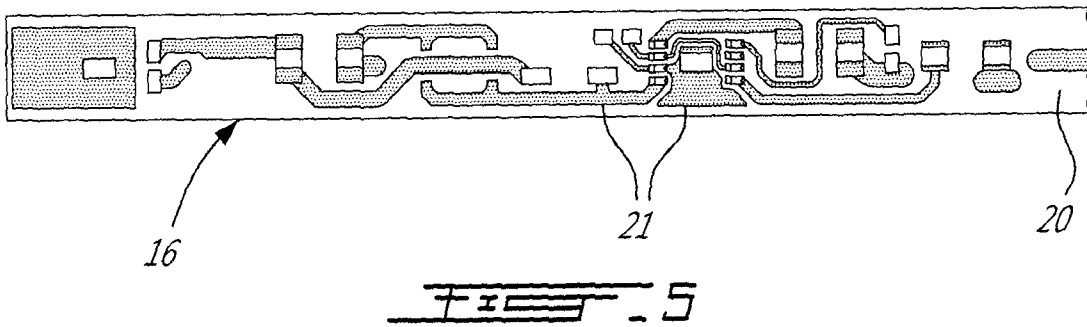
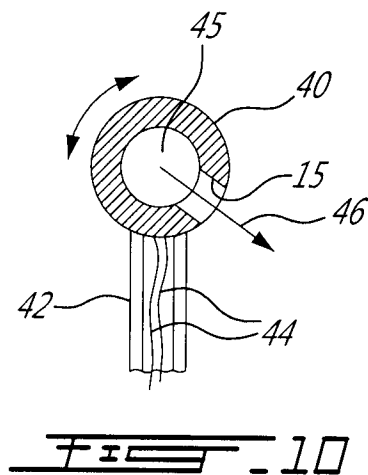
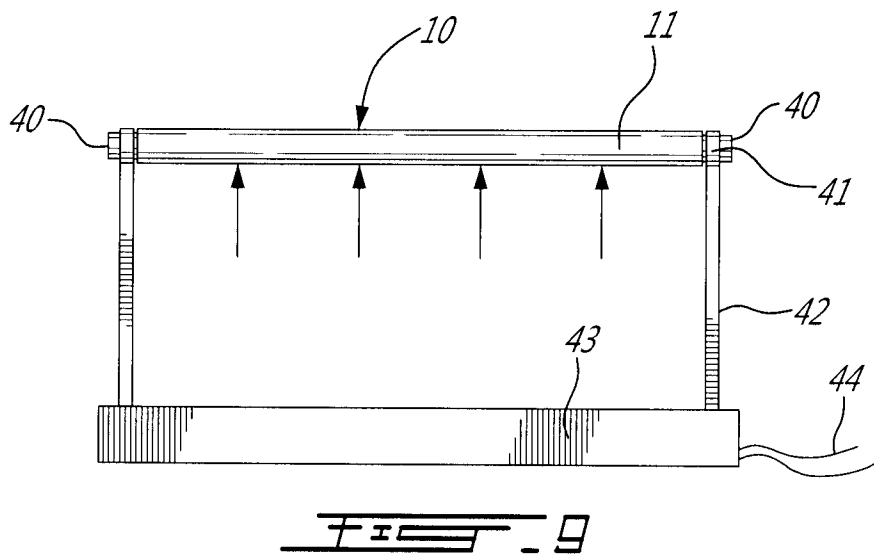
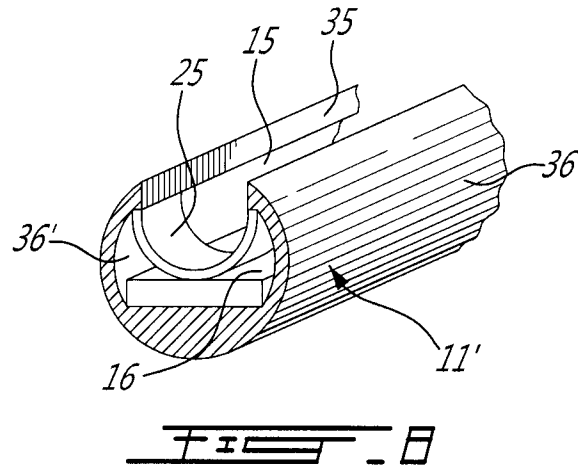


FIG. 4

3/4



4 / 4



**INTERNATIONAL SEARCH REPORT**

International application No.  
PCT/CA2012/000801

<p>A. CLASSIFICATION OF SUBJECT MATTER  <b>IPC: F21V 29/00 (2006.01) , F21K 99/00 (2010.01) , F21V 7/00 (2006.01) , H05K 1/02 (2006.01)</b>                  According to International Patent Classification (IPC) or to both national classification and IPC</p>																									
<p>B. FIELDS SEARCHED</p> <p>Minimum documentation searched (classification system followed by classification symbols)  <b>IPC: F21V 29/00 (2006.01) , F21K 99/00 (2010.01) , F21V 7/00 (2006.01) , H05K 1/02 (2006.01)</b>                  According to International Patent Classification (IPC) or to both national classification and IPC</p> <p>Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched</p> <p>Electronic database(s) consulted during the international search (name of database(s) and, where practicable, search terms used)                  Canadian Patents Database, Epoque (EPODOC, English FullText)                  Keywords : (luminaire or light+ or lamp or LED or (light 2d diode)), (heat or thermal), pcb or (circuit 1w board), adhesive, clip, channel, trough, reflector</p>																									
<p>C. DOCUMENTS CONSIDERED TO BE RELEVANT</p> <table border="1"> <thead> <tr> <th>Category*</th> <th>Citation of document, with indication, where appropriate, of the relevant passages</th> <th>Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td>X Y</td> <td>US2009/0103299A1 (BOYER, J.D. et al.) 23 April 2009 (23-04-2009) *Abstract; para[0014], [0027-0035]; Fig. 1*</td> <td>1, 4, 6, 7, 10, 12 2, 3, 5, 8, 9, 11</td> </tr> <tr> <td>Y</td> <td>WO2010/012999A2 (McKENZIE, J.S. et al.) 4 February 2010 (04-02-2010) *Abstract; Page 16, lines 11-20, Page 18, lines 16-18; Fig. 2b*</td> <td>2, 3, 8</td> </tr> <tr> <td>Y</td> <td>WO2005/059436A1 (SEABROOK, B.) 30 June 2005 (30-06-2005) *Abstract; Page 6, lines 10-15; Fig. 1*</td> <td>5</td> </tr> <tr> <td>Y</td> <td>WO2007/128126A1 (KLIPSTEIN, D.L. et al.) 15 November 2007 (15-11-2007) *Abstract; Page 13, lines 3-9; Fig. 1*</td> <td>9</td> </tr> <tr> <td>Y</td> <td>US2005/0258440A1 (DRY, J.M.) 24 November 2005 (24-11-2005) *Abstract; para[0044]; Figs. 4 and 5*</td> <td>11</td> </tr> <tr> <td>A</td> <td>US2011/0096533A1 (SEKELA, W. et al.) 28 April 2011 (28-04-2011) *Abstract*</td> <td>1</td> </tr> <tr> <td>A</td> <td>US2007/0064428A1 (BEAUCHAMP, P.) 22 March 2007 (22-03-2007) *Same inventor* *Abstract*</td> <td>1</td> </tr> </tbody> </table>		Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	X Y	US2009/0103299A1 (BOYER, J.D. et al.) 23 April 2009 (23-04-2009) *Abstract; para[0014], [0027-0035]; Fig. 1*	1, 4, 6, 7, 10, 12 2, 3, 5, 8, 9, 11	Y	WO2010/012999A2 (McKENZIE, J.S. et al.) 4 February 2010 (04-02-2010) *Abstract; Page 16, lines 11-20, Page 18, lines 16-18; Fig. 2b*	2, 3, 8	Y	WO2005/059436A1 (SEABROOK, B.) 30 June 2005 (30-06-2005) *Abstract; Page 6, lines 10-15; Fig. 1*	5	Y	WO2007/128126A1 (KLIPSTEIN, D.L. et al.) 15 November 2007 (15-11-2007) *Abstract; Page 13, lines 3-9; Fig. 1*	9	Y	US2005/0258440A1 (DRY, J.M.) 24 November 2005 (24-11-2005) *Abstract; para[0044]; Figs. 4 and 5*	11	A	US2011/0096533A1 (SEKELA, W. et al.) 28 April 2011 (28-04-2011) *Abstract*	1	A	US2007/0064428A1 (BEAUCHAMP, P.) 22 March 2007 (22-03-2007) *Same inventor* *Abstract*	1
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.																							
X Y	US2009/0103299A1 (BOYER, J.D. et al.) 23 April 2009 (23-04-2009) *Abstract; para[0014], [0027-0035]; Fig. 1*	1, 4, 6, 7, 10, 12 2, 3, 5, 8, 9, 11																							
Y	WO2010/012999A2 (McKENZIE, J.S. et al.) 4 February 2010 (04-02-2010) *Abstract; Page 16, lines 11-20, Page 18, lines 16-18; Fig. 2b*	2, 3, 8																							
Y	WO2005/059436A1 (SEABROOK, B.) 30 June 2005 (30-06-2005) *Abstract; Page 6, lines 10-15; Fig. 1*	5																							
Y	WO2007/128126A1 (KLIPSTEIN, D.L. et al.) 15 November 2007 (15-11-2007) *Abstract; Page 13, lines 3-9; Fig. 1*	9																							
Y	US2005/0258440A1 (DRY, J.M.) 24 November 2005 (24-11-2005) *Abstract; para[0044]; Figs. 4 and 5*	11																							
A	US2011/0096533A1 (SEKELA, W. et al.) 28 April 2011 (28-04-2011) *Abstract*	1																							
A	US2007/0064428A1 (BEAUCHAMP, P.) 22 March 2007 (22-03-2007) *Same inventor* *Abstract*	1																							
<p><input type="checkbox"/> Further documents are listed in the continuation of Box C.      <input checked="" type="checkbox"/> See patent family annex.</p> <table border="1"> <tbody> <tr> <td>* Special categories of cited documents :</td> <td>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</td> </tr> <tr> <td>"A" document defining the general state of the art which is not considered to be of particular relevance</td> <td>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</td> </tr> <tr> <td>"E" earlier application or patent but published on or after the international filing date</td> <td>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</td> </tr> <tr> <td>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</td> <td>"&amp;" document member of the same patent family</td> </tr> <tr> <td>"O" document referring to an oral disclosure, use, exhibition or other means</td> <td></td> </tr> <tr> <td>"P" document published prior to the international filing date but later than the priority date claimed</td> <td></td> </tr> </tbody> </table>		* Special categories of cited documents :	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention	"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone	"E" earlier application or patent but published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art	"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family	"O" document referring to an oral disclosure, use, exhibition or other means		"P" document published prior to the international filing date but later than the priority date claimed													
* Special categories of cited documents :	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention																								
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone																								
"E" earlier application or patent but published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art																								
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family																								
"O" document referring to an oral disclosure, use, exhibition or other means																									
"P" document published prior to the international filing date but later than the priority date claimed																									
<p>Date of the actual completion of the international search</p> <p>05 October 2012 (05-10-2012)</p>	<p>Date of mailing of the international search report</p> <p>13 December 2012 (13-12-2012)</p>																								
<p>Name and mailing address of the ISA/CA</p> <p>Canadian Intellectual Property Office                  Place du Portage I, C114 - 1st Floor, Box PCT                  50 Victoria Street                  Gatineau, Quebec K1A 0C9                  Facsimile No.: 001-819-953-2476</p>	<p>Authorized officer</p> <p><b>William Tse (819) 934-6355</b></p>																								

**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

International application No.  
PCT/CA2012/000801

Patent Document Cited in Search Report	Publication Date	Patent Family Member(s)	Publication Date
US2009103299A1  (24-11-2011)	23 April 2009 (23-04-2009)	AU2008317040A1	30 April 2009 (30-04-2009)
		AU2008317040B2	24 November 2011
		CA2702483A1	30 April 2009 (30-04-2009)
		CA2702483C	24 April 2012 (24-04-2012)
		CN101680620A	24 March 2010 (24-03-2010)
		EP2201285A1	30 June 2010 (30-06-2010)
		EP2201285A4	21 March 2012 (21-03-2012)
		IL204972D0	30 November 2010 (30-11-2010)
		JP2011501385A	06 January 2011 (06-01-2011)
		MX2010004432A	13 May 2010 (13-05-2010)
		NZ584489A	24 February 2012 (24-02-2012)
		US8066406B2	29 November 2011 (29-11-2011)
		WO2009055314A1	30 April 2009 (30-04-2009)
		WO2010012999A2	04 February 2010 (04-02-2010)
GB0813919D0	03 September 2008 (03-09-2008)		
GB2462411A	10 February 2010 (10-02-2010)		
US2011133654A1	09 June 2011 (09-06-2011)		
WO2010012999A3	27 May 2010 (27-05-2010)		
WO2005059436A1	30 June 2005 (30-06-2005)	CA2591569A1	30 June 2005 (30-06-2005)
		EP1706666A1	04 October 2006 (04-10-2006)
		EP1706666A4	28 March 2007 (28-03-2007)
		US2007285920A1	13 December 2007 (13-12-2007)
		US7780314B2	24 August 2010 (24-08-2010)
WO2007128126A1	15 November 2007 (15-11-2007)	CA2501447A1	18 September 2005 (18-09-2005)
		CA2652218A1	15 November 2007 (15-11-2007)
		EP2021682A1	11 February 2009 (11-02-2009)
		US2005265035A1	01 December 2005 (01-12-2005)
		US7553051B2	30 June 2009 (30-06-2009)
		US2010008082A1	14 January 2010 (14-01-2010)
		US8033681B2	11 October 2011 (11-10-2011)
		US2009147519A1	11 June 2009 (11-06-2009)
		US2012113636A1	10 May 2012 (10-05-2012)
		US2012212944A1	23 August 2012 (23-08-2012)
		WO2007128126A9	14 February 2008 (14-02-2008)
US2005258440A1  (15-09-2005)  (18-12-2003)	24 November 2005 (24-11-2005)	AU2003222647A1	19 December 2003 (19-12-2003)
		CA2486266A1	11 December 2003 (11-12-2003)
		CN1656622A	17 August 2005 (17-08-2005)
		EP1508174A1	23 February 2005 (23-02-2005)
		EP1508174A4	12 October 2005 (12-10-2005)
		JP2005527987A	15 September 2005
		US6573536B1	03 June 2003 (03-06-2003)
		US2003230765A1	18 December 2003

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/CA2012/000801*Continued from page 3 of 4...*

Patent Document Cited in Search Report	Publication Date	Patent Family Member(s)	Publication Date
US2005258440A1 (14-12-2004) (continued)  (01-09-2005)	24 November 2005 (24-11-2005)	US6831303B2  US2005189550A1 US2005189550A1  US7242028B2 US2005189554A1 US7288796B2 US2004026721A1 US2004141326A1 US2005258439A1 US2005269581A1 WO03103064A1 WO2004100220A2 WO2004100220A3	14 December 2004  01 September 2005 01 September 2005  0 July 2007 (10-07-2007) 01 September 2005 (01-09-2005) 30 October 2007 (30-10-2007) 12 February 2004 (12-02-2004) 22 July 2004 (22-07-2004) 24 November 2005 (24-11-2005) 08 December 2005 (08-12-2005) 11 December 2003 (11-12-2003) 18 November 2004 (18-11-2004) 20 January 2005 (20-01-2005)
US2011096533A1  (05-09-2012)  (05-09-2012)	28 April 2011 (28-04-2011)	AU2010313518A1 CA2778983A1 CN102656404A  EP2494267A1  US2011096551A1 WO2011053638A1	31 May 2012 (31-05-2012) 05 May 2011 (05-05-2011) 05 September 2012  05 September 2012  28 April 2011 (28-04-2011) 05 May 2011 (05-05-2011)
US2007064428A1  (20-11-2007)	22 March 2007 (22-03-2007)	US2007064428A1 US7296912B2	22 March 2007 (22-03-2007) 20 November 2007