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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/483,368	04/17/2018	9945520	6246-40007US8	4470

25570 7590 03/28/2018
Roberts Mlotkowski Safran Cole & Calderon, P.C.
7918 Jones Branch Drive
Suite 500
McLean, VA 22102

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (application filed on or after May 29, 2000)

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site <http://pair.uspto.gov> for additional applicants):

TAO JIANG, Zhejiang, CHINA;
JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.,LTD, Zhejiang, CHINA;
HONG XU, Zhejiang, CHINA;
LIQIN LI, Zhejiang, CHINA;
CHANG YANG, Zhejiang, CHINA;

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number		
Filing Date		
First Named Inventor	Tao JIANG et al.	
Art Unit		
Examiner Name		
Attorney Docket Number	6246-40007US8	

Change(s) applied
to document,
P.K.
11/28/2017

73	20160290609	2016-10-06	~~JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.~~ Jiang et al.
74	20160290567	2016-10-06	~~JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.~~ Jiang et al.
75	20160290568	2016-10-06	~~JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.~~ Jiang et al.
76	20160290566	2016-10-06	~~JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.~~ Jiang et al.

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Examiner Initial*	Cite No	Foreign Document Number ³	Country Code ² i	Kind Code ⁴	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear	T ⁵
	1	2013125803	WO		2013-08-29	Ryu		×
	2	2014001475	WO		2014-01-03	Hao et al.		☒
	3	2015036478	WO		2015-03-19	YUAN		☒
	4	2011132120	WO		2011-10-27	VAN DER WEL, Pieter, J., C. et al.		☒
	5	102518972	CN		2012-06-27	PAN		☒

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number		
Filing Date		
First Named Inventor	Tao JIANG et al.	
Art Unit		
Examiner Name		
Attorney Docket Number	6246-40007US8	

	62	20130170196		2013-07-04	HUANG JEN-MIN et al.	
Change(s) applied to document, P.K./ 11/28/2017	63	20160215936		2016-07-28	~~JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.~~ Jiang	
	64	20160215937		2016-07-28	~~JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.~~ Jiang	
	65	20160290598		2016-10-06	~~JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.~~ Jiang	
	66	20160290569		2016-10-06	~~JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.~~ Jiang et al.	
	67	20160290570		2016-10-06	~~JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.~~ Jiang et al.	
	68	20160295706		2016-10-06	~~JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.~~ Jiang	
	69	20160341414		2016-11-24	~~JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.~~ Jiang	
	70	20170038013		2017-02-09	~~JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.~~ Liu et al.	
	71	20170038014		2017-02-09	~~JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.~~ Jiang et al.	
	72	20170038012		2017-02-09	~~JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.~~ Jiang et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)

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Attorney Docket Number	6246-40007US8	

Change(s) applied
to document,
P.K./
11/28/2017

20	D761216	2016-07-12	~~JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.~~ Jiang
21	9447929	2016-09-20	~~JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.~~ Jiang
22	D768891	2016-10-11	~~JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.~~ Jiang et al.

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	1	20020044456		2002-04-18	Balestriero et al.	
	2	20030231485		2003-12-18	Tseng-Lu Chien	
	3	20040095078		2004-05-20	Susan Leong	
	4	20040189218		2004-09-30	Susan Leong	
	5	20050128751		2005-06-16	Roberge et al.	
	6	20050162850		2005-07-28	Luk et al.	

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number	15483368
Filing Date	2017-04-10
First Named Inventor	TAO JIANG et al.
Art Unit	2844
Examiner Name	TRAN, ANH Q
Attorney Docket Number	6246-40007US8

Change(s) applied
to document,
/P.K./
1/17/2018

26	20170167664	2017-06-15	~~JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.~~ Li et al.
27	20170211753	2017-07-27	~~JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.~~ Jiang et al.
28	20170219169	2017-08-03	~~JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.~~ Jiang
29	20170311398	2017-10-26	~~JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO., LTD~~ Jiang et al.

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Examiner Initial*	Cite No	Foreign Document Number ³	Country Code ²ⁱ	Kind Code ⁴	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear	T ⁵
	1	2015081809	WO		2015-06-11	CHEN HONGCHANG		×
	2	102052652	CN		2011-05-11	WUJUN ZHANG et al.		☒
	3	1020120055349	KR		2012-05-31	AMOLUXE CO LTD		☒
	4	2012129301	WO		2012-09-27	ELECTRALED INC		☒
	5	202302841	CN		2012-07-04	SHENZHEN REFOND OPTOELECTRONICS CO LTD		☒

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number	15483368
Filing Date	2017-04-10
First Named Inventor	TAO JIANG et al.
Art Unit	2844
Examiner Name	TRAN, ANH Q
Attorney Docket Number	6246-40007US8

	15	20110279063		2011-11-17	WANG JUN et al.	
	16	20110084608		2011-04-14	LIN JERRY et al.	
Change(s) applied to document, /P.K./ 1/17/2018	17	20140192526		2014-07-10	~~NINBO FUTAI ELECTRIC LTD~~ Qiu	
	18	20130230995		2013-09-05	~~LUMISYS INC~~ Ivey et al.	
	19	20130223053		2013-08-29	LIU CHUN-CHEN et al.	
	20	20110309745		2011-12-22	WESTERMARCK JOEL C	
	21	20110084554		2011-04-14	~~FU ZHUN PRECISION IND SHENZHEN~~ Tian et al.	
	22	20110084627		2011-04-14	~~SLOAN LED INC~~ Sloan et al.	
	23	20170089521		2017-03-30	~~JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.~~ Jiang	
	24	20170130911		2017-05-11	~~JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.~~ Li et al.	
	25	20170159894		2017-06-08	~~JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.~~ Jiang	

Doc code: IDS

PTO/SB/08a (01-10)

Doc description: Information Disclosure Statement (IDS) Filed

Approved for use through 07/31/2012. OMB 0651-0031

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	15483368
	Filing Date	2017-04-10
	First Named Inventor	TAO JIANG et al.
	Art Unit	2844
	Examiner Name	TRAN, ANH Q
	Attorney Docket Number	6246-40007US8

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Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear
	1	6186649		2001-02-13	ZOU HAN et al.	
Change(s) applied to document, /P.K./ 1/17/2018	2	9618168		2017-04-11	~~JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.~~ Jiang et al.	
	3	0797323		2017-09-12	~~JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.~~ Yang et al.	

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Examiner Initial*	Cite No	Publication Number	Kind Code ¹	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear
	1	20100085772		2010-04-08	SONG HO YOUNG et al.	
	2	20130135852		2013-05-30	CHAN KAM-KWAN	
	3	20030189829		2003-10-09	SHIMIZU MASANORI et al.	

Issue Classification 	Application/Control No. 15483368	Applicant(s)/Patent Under Reexamination JIANG ET AL.	
	Examiner ANH TRAN	Art Unit 2844	

CPC						
Symbol					Type	Version
F21K		9	/	272	F	2016-08-01
F21K		9	/	278	I	2016-08-01
F21V		29	/	83	I	2015-01-15
F21V		3	/	0418	I	2013-01-01
F21V		23	/	06	I	2013-01-01
F21V		17	/	101	I	2013-01-01
F21V		3	/	02	I	2013-01-01
F21Y		2115	/	10	A	2016-08-01
F21Y		2103	/	10	A	2016-08-01
F21V		3	/	061	I	2018-02-01
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CPC Combination Sets				
Symbol	Type	Set	Ranking	Version

NONE		Total Claims Allowed:	
		68	
(Assistant Examiner)	(Date)	O.G. Print Claim(s)	O.G. Print Figure
/ANH TRAN/ Primary Examiner.Art Unit 2844	3/5/18	1	5 & 7
(Primary Examiner)	(Date)		

Issue Classification 	Application/Control No. 15483368	Applicant(s)/Patent Under Reexamination JIANG ET AL.
	Examiner ANH TRAN	Art Unit 2844

☐ Claims renumbered in the same order as presented by applicant															
☐ CPA															
☐ T.D.															
☐ R.1.47															
Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1	15	17	29	33	45	49	61	65						
2	2	16	18	30	34	46	50	62	66						
3	3	17	19	31	35	47	51	63	67						
4	4	18	20	32	36	48	52	64	68						
5	5		21	33	37	49	53	65	69						
6	6	19	22	34	38	50	54	66	70						
7	7	20	23	35	39	51	55	67	71						
8	8	21	24	36	40	52	56	68	72						
9	9	22	25	37	41	53	57								
	10	23	26	38	42	54	58								
10	11	24	27	39	43	55	59								
11	12	25	28	40	44	56	60								
12	13	26	29	41	45	57	61								
13	14	27	30	42	46	58	62								
	15	28	31	43	47	59	63								
14	16		32	44	48	60	64								

NONE		Total Claims Allowed: 68	
(Assistant Examiner)	(Date)		
/ANH TRAN/ Primary Examiner.Art Unit 2844	3/5/18	O.G. Print Claim(s) 1	O.G. Print Figure 5 & 7
(Primary Examiner)	(Date)		

<i>Index of Claims</i> 	Application/Control No. 15483368	Applicant(s)/Patent Under Reexamination JIANG ET AL.
	Examiner ANH TRAN	Art Unit 2844

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant					☐ CPA					☐ T.D.					☐ R.1.47				
CLAIM		DATE																	
Final	Original	06/29/2017	11/11/2017	03/05/2018															
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29	33	✓	=	=															
30	34	✓	=	=															
31	35		=	=															
32	36		=	=															

<i>Index of Claims</i> 	Application/Control No. 15483368	Applicant(s)/Patent Under Reexamination JIANG ET AL.
	Examiner ANH TRAN	Art Unit 2844

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
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☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47										
CLAIM		DATE								
Final	Original	06/29/2017	11/11/2017	03/05/2018						
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35	39		=	=						
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68	72			=						

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s)	:	Tao JIANG et al.	Group Art Unit: 2844
Appln. No.	:	15/483,368	Examiner: Anh Q. TRAN
Filed	:	April 10, 2017	Confirmation No.: 4470
For	:	LED TUBE LAMP	

AMENDMENT AFTER NOTICE OF ALLOWANCE UNDER 37 C.F.R. §1.312

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Randolph Building
401 Dulany Street
Alexandria, VA 22314

OK TO ENTER: /A.Q.T/
03/05/2018

Sir:

In response to the Examiner's Notice of Allowability dated November 17, 2017 and the Corrected Notice of Allowability dated January 17, 2018, please amend the above-identified application as follows.

A listing of the claims begins on page 2.

Remarks begin on page 11.

If extensions of time are necessary to prevent abandonment of this application, then such extensions of time are hereby petitioned under 37 C.F.R. §1.136(a), and any fees required thereof (including fees for net addition of claims) are hereby authorized to be charged to our Deposit Account No. 50-2478.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s)	:	Tao JIANG et al.	Group Art Unit: 2844
Appln. No.	:	15/483,368	Examiner: Anh Q. TRAN
Filed	:	April 10, 2017	Confirmation No.: 4470
For	:	LED TUBE LAMP	

AMENDMENT AFTER NOTICE OF ALLOWANCE UNDER 37 C.F.R. §1.312

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AMENDMENTS TO THE CLAIMS

Please **AMEND** claims 41 and 42 as follows.

Please **ADD** claims 53-72 as follows.

A copy of all pending claims and a status of the claims are provided below.

1. (Previously presented) An LED tube lamp, comprising:
 - a glass tube covered by a heat shrink sleeve and having two end portions;
 - a plurality of LED light sources;
 - two end caps respectively sleeving the two end portions of the glass tube;
 - a power supply in one of the end caps or separately in both of the end caps; and
 - an LED light strip on an inner surface of the glass tube forming a freely extending end portion at one end along a longitudinal direction of the glass tube, the freely extending end portion directly soldered to the power supply, the plurality of LED light sources being on the LED light strip;wherein each of the end caps comprises:
 - an end wall; and
 - two pins on the end wall.
2. (Previously presented) The LED tube lamp according to claim 1, further comprising at least two openings on the end wall symmetric to each other with respect to a plane passing through the middle of a line connecting the two pins and perpendicular to the line connecting the two pins.
3. (Previously presented) The LED tube lamp according to claim 2, wherein the at least two openings are on a surface of the end wall on which the two pins are disposed.
4. (Previously presented) The LED tube lamp according to claim 3, wherein the at least two openings are separately in a shape of an arc.
5. (Previously presented) The LED tube lamp according to claim 4, wherein the at least two openings are in a shape of arcs with different sizes.

6. (Previously presented) The LED tube lamp according to claim 5, wherein the sizes of the arcs of the at least two openings gradually vary.
7. (Original) The LED tube lamp according to claim 6, wherein the heat shrink sleeve is substantially transparent with respect to the wavelength of light from the LED light sources.
8. (Previously presented) The LED tube lamp according to claim 1, wherein the number of the at least two openings is six in two sets, and the three openings in one set are in a shape of three arcs with gradually varying sizes.
9. (Original) The LED tube lamp according to claim 1, wherein at least a part of the openings are arranged along an arc and spaced apart from each other.
10. (Canceled)
11. (Previously presented) An LED tube lamp, comprising:
 - a glass tube comprising an inner surface and an outer surface, at least part of the inner surface of the glass tube has a rough surface, the glass tube having two end portions;
 - a plurality of LED light sources;
 - two end caps respectively sleeving the two end portions of the glass tube;
 - a power supply in one of the end caps or separately in both of the end caps; and
 - an LED light strip on the inner surface of the glass tube forming a freely extending end portion at one end along a longitudinal direction of the glass tube, the freely extending end portion directly soldered to the power supply, the plurality of LED light sources being on the LED light strip.
12. (Original) The LED tube lamp according to claim 11, wherein the roughness of the rough surface is substantially from 0.1 to 40 μm .

13. (Previously presented) The LED tube lamp according to claim 11, wherein each of the end caps comprises a plurality of openings thereon, and the two sets of the plurality of openings are symmetric to each other with respect to a virtual central axis of the end cap.

14. (Previously presented) The LED tube lamp according to claim 13, wherein the plurality of openings dissipate heat resulted from the power supply.

15. (Canceled)

16. (Original) The LED tube lamp according to claim 11, wherein the plurality of openings are separately in a shape of an arc.

17. (Original) The LED tube lamp according to claim 16, wherein the number of the plurality of openings is three, and the three openings are in a shape of three arcs with gradually varying sizes.

18. (Original) The LED tube lamp according to claim 11, wherein the plurality of openings are separately in a shape of a circle.

19. (Original) The LED tube lamp according to claim 18, wherein the number of the plurality of openings is three, and the three openings are arranged in a shape of an arc.

20. (Previously presented) The LED tube lamp according to claim 13, wherein at least a part of the openings are arranged along an arc and spaced apart from each other.

21. (Canceled)

22. (Previously presented) An LED tube lamp, comprising:
a glass tube having two end portions;
a plurality of LED light sources;

two end caps respectively sleeving the two end portions of the glass tube, each of the end caps comprising two pins and a plurality of openings, the two pins being on a surface of the end cap, the plurality of openings being on the surface of the end cap and divided into two sets, and the two sets of the openings being symmetric to each other with respect to a plane passing through the two pins;

a power supply disposed in at least one of the end caps; and

an LED light strip on an inner surface of the glass tube forming a freely extending end portion at one end along a longitudinal direction of the glass tube, the freely extending end portion directly soldered to the power supply, the plurality of LED light sources being on the LED light strip.

23. (Previously presented) The LED tube lamp according to claim 22, wherein the power supply comprises a current-limiting element, and the plurality of openings dissipate heat resulted from the power supply.

24. (Previously presented) The LED tube lamp according to claim 23, wherein the plurality of openings are separately in a shape of an arc.

25. (Original) The LED tube lamp according to claim 23, wherein the surface of the end cap is vertical to the length direction of the glass tube.

26. (Previously presented) The LED tube lamp according to claim 24, wherein the plurality of openings are in a shape of arcs with different sizes.

27. (Previously presented) The LED tube lamp according to claim 26, wherein the sizes of the arcs of the plurality of openings gradually vary.

28. (Previously presented) The LED tube lamp according to claim 23, wherein the plurality of openings are separately in a shape of a circle.

29. (Previously presented) The LED tube lamp according to claim 28, wherein the number of the plurality of openings is three, and the three openings are arranged in a shape of an arc.
30. (Previously presented) The LED tube lamp according to claim 23, wherein the plurality of openings are a combination in a shape of an arc and a circle.
31. (Original) The LED tube lamp according to claim 23, wherein at least a part of the openings are arranged along an arc and spaced apart from each other.
32. (Canceled)
33. (Previously presented) An LED tube lamp, comprising:
a glass tube;
a plurality of LED light sources;
two end caps respectively at two opposite ends of the glass tube;
a power supply in one of the end caps or separately in both of the end caps; and
an LED light strip on an inner surface of the glass tube forming a freely extending end portion at one end along a longitudinal direction of the glass tube, the freely extending end portion directly soldered to the power supply, the plurality of LED light sources being on the LED light strip;
wherein each of the end caps comprises:
an end wall;
two pins on the end wall; and
at least two openings on the end wall symmetric to each other with respect to a plane passing through the middle of a line connecting the two pins and perpendicular to the line connecting the two pins.
34. (Previously presented) The LED tube lamp according to claim 33, wherein the at least two openings are separately in a shape of an arc.

35. (Previously presented) The LED tube lamp according to claim 1, wherein the LED light strip is a bendable circuit sheet.

36. (Previously presented) The LED tube lamp according to claim 1, wherein the end cap comprises a metal part.

37. (Previously presented) The LED tube lamp according to claim 11, wherein the LED light strip is a bendable circuit sheet.

38. (Previously presented) The LED tube lamp according to claim 11, wherein the end cap comprises a metal part.

39. (Previously presented) The LED tube lamp according to claim 22, wherein the LED light strip is a bendable circuit sheet.

40. (Previously presented) The LED tube lamp according to claim 22, wherein the end cap comprises a metal part.

41. (Currently Amended) The LED tube lamp according to claim ~~[[22]]~~ 33, wherein the LED light strip is a bendable circuit sheet.

42. (Currently Amended) The LED tube lamp according to claim ~~[[22]]~~ 33, wherein the end cap comprises a metal part.

43. (Previously presented) The LED tube lamp according to claim 23, wherein the current-limiting element comprises a resistor, a capacitor, an inductor, or any combination thereof.

44. (Previously presented) The LED tube lamp according to claim 23, wherein the current-limiting element is configured for reducing EMI (electromagnetic interference).

45. (Previously presented) The LED tube lamp according to claim 23, wherein the current-limiting element is an element of, or constitutes, a terminal adapter circuit.
46. (Previously presented) The LED tube lamp according to claim 22, wherein the power supply comprises a rectifying circuit and a filtering circuit disposed in at least one of the end caps, and the plurality of openings are for dissipating heat from the power supply.
47. (Previously presented) The LED tube lamp according to claim 22, wherein the power supply comprises a fuse connected to one of the two pins of one of the end caps, and the plurality of openings are for dissipating heat from the power supply.
48. (Previously presented) The LED tube lamp according to claim 33, wherein the power supply comprises a current-limiting element disposed in at least one of the end caps, and the at least two openings are for dissipating heat from the power supply.
49. (Previously presented) The LED tube lamp according to claim 48, wherein the current-limiting element comprises a resistor, a capacitor, an inductor, or any combination thereof.
50. (Previously presented) The LED tube lamp according to claim 48, wherein the current-limiting element is configured for reducing EMI.
51. (Previously presented) The LED tube lamp according to claim 33, wherein the power supply comprises a rectifying circuit and a filtering circuit disposed in at least one of the end caps, and the at least two openings are for dissipating heat from the power supply.
52. (Previously presented) The LED tube lamp according to claim 33, wherein the power supply comprises a fuse connected to one of the two pins of one of the end caps, and the at least two openings are for dissipating heat from the power supply.
53. (New) The LED tube lamp according to claim 22, wherein the power supply further comprises a circuit board with two second bond pads.

54. (New) The LED tube lamp according to claim 53, wherein each of the second bond pads comprises a through-hole.

55. (New) The LED tube lamp according to claim 54, wherein the circuit board comprises an electrically insulating hole formed and disposed between the two second bond pads.

56. (New) The LED tube lamp according to claim 22, wherein the power supply further comprises a circuit board with an electrically insulating hole.

57. (New) The LED tube lamp according to claim 56, wherein the electrically insulating hole is formed and disposed near the edge of the circuit board.

58. (New) The LED tube lamp according to claim 22, wherein the light bar comprises two first bond pads at a first end.

59. (New) The LED tube lamp according to claim 58, wherein each of the first bond pads comprises a notch at an edge of the LED light bar.

60. (New) The LED tube lamp according to claim 59, wherein at least one of the first bond pads is formed with a solder ball above the notch after soldering is completed, and a diameter of the solder ball is larger than a diameter of the notch.

61. (New) The LED tube lamp according to claim 22, wherein the power supply further comprises a circuit board with a different width from the width of the light bar.

62. (New) The LED tube lamp according to claim 22, wherein the power supply comprises a printed circuit board and the light bar comprises a bendable circuit sheet.

63. (New) The LED tube lamp according to claim 33, wherein the power supply further comprises a circuit board with two second bond pads.

64. (New) The LED tube lamp according to claim 63, wherein each of the second bond pads comprises a through-hole.
65. (New) The LED tube lamp according to claim 64, wherein the circuit board comprises an electrically insulating hole formed and disposed between the two second bond pads.
66. (New) The LED tube lamp according to claim 33, wherein the power supply further comprises a circuit board with an electrically insulating hole.
67. (New) The LED tube lamp according to claim 66, wherein the electrically insulating hole is formed and disposed near the edge of the circuit board.
68. (New) The LED tube lamp according to claim 33, wherein the light bar comprises two first bond pads at a first end.
69. (New) The LED tube lamp according to claim 68, wherein each of the first bond pads comprises a notch at an edge of the LED light bar.
70. (New) The LED tube lamp according to claim 69, wherein at least one of the first bond pads is formed with a solder ball above the notch after soldering is completed, and a diameter of the solder ball is larger than a diameter of the notch.
71. (New) The LED tube lamp according to claim 33, wherein the power supply further comprises a circuit board with a different width from the width of the light bar.
72. (New) The LED tube lamp according to claim 33, wherein the power supply comprises a printed circuit board and the light bar comprises a bendable circuit sheet.

REMARKS

Upon entry of this amendment, claims 1-9, 11-20, 22-31 and 33-72 will be pending in the application. By this Amendment, claims 41 and 42 are amended to correct their dependencies and claims 53-72 are added to further define the allowed subject matter. No new matter is added.

Concerning the requirements of MPEP §714.16, the above amendments are needed to obtain further protection. Further, the above amendments do not require additional search or examination since the amendments are only for dependent claims, depending from already allowed subject matter. In addition, the amendments are patentable since the amendments are only for dependent claims, which depend from already allowed subject matter. Additionally, the amendments were not presented earlier because Applicant focused on arguing that the original claim 34 and previously claim 52 were allowable, with Applicant not knowing which claims are allowable. Hence, Applicant did not present the current amendments earlier. Upon receipt of the Notice of Allowance (NOA), Applicant reviewed the allowed subject matter and determined that Applicant could obtain more complete protection based on the allowed subject matter indicated in the NOA. Accordingly, Applicant submits that the requirements of MPEP §714.16 are satisfied.

Applicant respectfully requests entry of the present amendment under the provisions of 37 C.F.R. §1.312. Specifically, 37 C.F.R. §1.312 permits entry of an amendment before payment of the Issue Fee and on the recommendation of the Primary Examiner, approved by the Director. Accordingly, entry of this amendment for the reasons discussed below is respectfully requested.

Respectfully submitted,



Andrew M. Calderon
Registration No. 38,093

Roberts Mlotkowski Safran Cole & Calderon PC
P.O. Box 10064
McLean, VA 22102
Phone: 703.584.8023
Fax: 703.848.2981
Email: acalderon@rmcsc2.com



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/483,368	04/10/2017	TAO JIANG	6246-40007US8	4470
25570	7590	01/17/2018		
Roberts Mlotkowski Safran Cole & Calderon, P.C. 7918 Jones Branch Drive Suite 500 McLean, VA 22102			EXAMINER TRAN, ANH Q	
			ART UNIT	PAPER NUMBER
			2844	
			NOTIFICATION DATE	DELIVERY MODE
			01/17/2018	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

lgallaugh@rmc2.com
docketing@rmc2.com
secretaries@rmc2.com

Corrected Notice of Allowability	Application No. 15/483,368	Applicant(s) JIANG ET AL.	
	Examiner ANH TRAN	Art Unit 2844	AIA (First Inventor to File) Status Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 11/16/17.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☐ The allowed claim(s) is/are _____. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a) ☐ All b) ☐ Some *c) ☐ None of the:

1. ☐ Certified copies of the priority documents have been received.

2. ☐ Certified copies of the priority documents have been received in Application No. _____.

3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.

☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892) 2. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____ 3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material 4. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____	5. ☐ Examiner's Amendment/Comment 6. ☐ Examiner's Statement of Reasons for Allowance 7. ☐ Other _____
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/ANH TRAN/ Primary Examiner, Art Unit 2844	1/8/18
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s) : TAO JIANG et al. Group Art Unit: 2844
Appln. No. : 15/483,368 Examiner: TRAN, ANH Q
Filed : April 10, 2017 Confirmation No.: 4470
For : **LED TUBE LAMP**

REDACTION OF CERTIFICATION FOR SUBMISSION OF REFERENCES

U.S. Patent and Trademark Office
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

On November 16, 2017, the undersigned attorney filed an Information Disclosure Statement with several references for consideration by the Examiner. In this Information Disclosure Statement, Applicants' undersigned attorney inadvertently made the following certification:

That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

This certification was made in error and is hereby being withdrawn. To this end, Applicant requests that such certification be redacted from the record. Otherwise, with the payment submitted with the Information Disclosure Statement, Applicant submits that the Information Disclosure Statement was timely submitted and all of the references should be considered by the Patent Office.

Respectfully submitted,



Andrew M. Calderon
Reg. No. 38,093

Roberts, Mlotkowski, Safran, Cole & Calderon PC
P.O. Box 10064
McLean, VA 22102
Phone: 703.677.3011
Fax: 703.848.2981
Email: acalderon@rmcs2.com



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

25570 7590 11/17/2017
Roberts Mlotkowski Safran Cole & Calderon, P.C.
7918 Jones Branch Drive
Suite 500
McLean, VA 22102

EXAMINER

TRAN, ANH Q

ART UNIT

PAPER NUMBER

2844

DATE MAILED: 11/17/2017

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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15/483,368

04/10/2017

TAO JIANG

6246-40007US8

4470

TITLE OF INVENTION: LED TUBE LAMP

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
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nonprovisional

UNDISCOUNTED

\$960

\$0

\$0

\$960

02/20/2018

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: **Mail** **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

25570 7590 11/17/2017
Roberts Mlotkowski Safran Cole & Calderon, P.C.
7918 Jones Branch Drive
Suite 500
McLean, VA 22102

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/483,368	04/10/2017	TAO JIANG	6246-40007US8	4470

TITLE OF INVENTION: LED TUBE LAMP

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$960	\$0	\$0	\$960	02/20/2018

EXAMINER	ART UNIT	CLASS-SUBCLASS
TRAN, ANH Q	2844	315-201000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

- (1) The names of up to 3 registered patent attorneys or agents OR, alternatively, 1 _____
- (2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed. 2 _____
- 3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

- ☐ Issue Fee
- ☐ Publication Fee (No small entity discount permitted)
- ☐ Advance Order - # of Copies _____

4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above)

- ☐ A check is enclosed.
- ☐ Payment by credit card. Form PTO-2038 is attached.
- ☐ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. Change in Entity Status (from status indicated above)

- ☐ Applicant certifying micro entity status. See 37 CFR 1.29
- ☐ Applicant asserting small entity status. See 37 CFR 1.27
- ☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____

Date _____

Typed or printed name _____

Registration No. _____



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UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/483,368	04/10/2017	TAO JIANG	6246-40007US8	4470

25570 7590 11/17/2017
Roberts Mlotkowski Safran Cole & Calderon, P.C.
7918 Jones Branch Drive
Suite 500
McLean, VA 22102

EXAMINER

TRAN, ANH Q

ART UNIT	PAPER NUMBER
----------	--------------

2844

DATE MAILED: 11/17/2017

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

<i>Notice Requiring Inventor's Oath or Declaration</i>	Application No. 15/483,368	Applicant(s) TAO JIANG	
	Examiner TRAN, ANH Q	Art Unit 2844	

This notice is an attachment to the Notice of Allowability (PTOL-37), or the Notice of Allowability For A Design Application (PTOL-37D).

An inventor's oath or declaration in compliance with 37 CFR 1.63 or 1.64 executed by or with respect to each inventor has not yet been submitted.

An oath or declaration in compliance with 37 CFR 1.63, or a substitute statement in compliance with 37 CFR 1.64, executed by or with respect to each inventor (for any inventor for which a compliant oath, declaration, or substitute statement has not yet been submitted) **MUST** be filed no later than the date on which the issue fee is paid. See 35 U.S.C. 115(f). Failure to timely comply will result in ABANDONMENT of this application.

A properly executed inventor's oath to declaration has not been received for the following inventor(s):

If applicant previously filed one or more oaths, declarations, or substitute statements, applicant may have received an informational notice regarding deficiencies therein.

The following deficiencies are noted:

INFORMAL ACTION PROBLEMS

- A properly executed inventor's oath or declaration has not been received for the following inventor(s): **LI-QIN LI**.

Applicant may submit the inventor's oath or declaration at any time before the Notice of Allowance and Fee(s) Due, PTOL-85, is mailed.

Questions relating to this Notice should be directed to the Application Assistance Unit at 571-272-4200.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

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

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

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No. 15/483,368	Applicant(s) JIANG ET AL.	
	Examiner ANH TRAN	Art Unit 2844	AIA (First Inventor to File) Status Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 10/06/17.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on ____.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on ____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are 1-9, 11-14, 16-20, 22-31, 33-52. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.
4. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

- a) ☒ All b) ☐ Some *c) ☐ None of the:
 1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: ____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date ____.
Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

- | | |
|--|--|
| 1. ☐ Notice of References Cited (PTO-892) | 5. ☐ Examiner's Amendment/Comment |
| 2. ☐ Information Disclosure Statements (PTO/SB/08),
Paper No./Mail Date ____ | 6. ☒ Examiner's Statement of Reasons for Allowance |
| 3. ☐ Examiner's Comment Regarding Requirement for Deposit
of Biological Material | 7. ☐ Other ____. |
| 4. ☐ Interview Summary (PTO-413),
Paper No./Mail Date ____. | |

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1. The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

DETAILED ACTION

Allowable Subject Matter

2. Claims 1-9, 11-14, 16-20, 22-31, 33-52 are allowed.
3. The following is an examiner's statement of reasons for allowance: with respect to claims 1, 11, 22, and 33, in addition to other limitations in the claims, the prior art of record fails to teach, disclose or render obvious the applicant's invention as claimed, particularly the feature describing: an LED light strip on an inner surface of the glass tube forming a freely extending end portion at one end along a longitudinal direction of the glass tube, the freely extending end portion directly soldered to the power supply, the plurality of LED sources being on the LED light strip.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ANH TRAN whose telephone number is (571)272-1813. The examiner can normally be reached on M-Th (8:00-6:30).

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an

Art Unit: 2844

interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at <http://www.uspto.gov/interviewpractice>.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Alexander Taningco can be reached on 571-272-2048. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/ANH TRAN/
Primary Examiner, Art Unit 2844
11/11/17

<i>Index of Claims</i> 	Application/Control No. 15483368	Applicant(s)/Patent Under Reexamination JIANG ET AL.
	Examiner ANH TRAN	Art Unit 2844

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant				☐ CPA		☐ T.D.		☐ R.1.47	
CLAIM		DATE							
Final	Original	06/29/2017	11/11/2017						
1	1	✓	=						
2	2	✓	=						
3	3	✓	=						
4	4	✓	=						
5	5	✓	=						
6	6	✓	=						
7	7	✓	=						
8	8	✓	=						
9	9	✓	=						
	10	✓							
10	11	✓	=						
11	12	✓	=						
12	13	✓	=						
13	14	✓	=						
	15	✓							
14	16	✓	=						
15	17	✓	=						
16	18	✓	=						
17	19	✓	=						
18	20	✓	=						
	21	✓							
19	22	✓	=						
20	23	✓	=						
21	24	✓	=						
22	25	✓	=						
23	26	✓	=						
24	27	✓	=						
25	28	✓	=						
26	29	✓	=						
27	30	✓	=						
28	31	✓	=						
	32	✓							
29	33	✓	=						
30	34	✓	=						
31	35		=						
32	36		=						

<i>Index of Claims</i> 	Application/Control No. 15483368	Applicant(s)/Patent Under Reexamination JIANG ET AL.
	Examiner ANH TRAN	Art Unit 2844

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant				☐ CPA		☐ T.D.		☐ R.1.47	
CLAIM		DATE							
Final	Original	06/29/2017	11/11/2017						
33	37		=						
34	38		=						
35	39		=						
36	40		=						
37	41		=						
38	42		=						
39	43		=						
40	44		=						
41	45		=						
42	46		=						
43	47		=						
44	48		=						
45	49		=						
46	50		=						
47	51		=						
48	52		=						

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	3911	jiang-tao.in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/16 19:36
S2	36	S1 and (LED.u/c. NEAR2 tub\$4 NEAR2 lamp)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/16 19:38
S3	20	US-5087088-\$.DID. OR US-3118072-\$.DID. OR US-3211262-\$.DID. OR US-3294518-\$.DID. OR US-1647399-\$.DID. OR US-3936855-\$.DID. OR US-20160178137-\$.DID. OR WO-20140807-\$.DID. OR US-2523275-\$.DID. OR US-3120169-\$.DID. OR US-1331018-\$.DID.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	OFF	2016/11/16 19:49
S4	1	("9480109").PN.	USPAT; USOCR	OR	OFF	2016/11/16 19:53
S5	6	((("6118072") or ("6211262") or ("3294518") or ("4647399") or ("7067032") or ("6936855"))).PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2016/11/16 19:59
S6	11	((("20160178138") or ("20160178137") or ("20160178135") or ("20160091156") or ("20160102813") or ("20160091147") or ("20160091179") or ("20070001709") or ("20060028837") or ("20120169968") or ("20110038146"))).PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2016/11/16 20:02
S7	1	("9447929").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2016/11/16 20:06
S8	48	("20020044456" "20020176262" "20030102819" "20030231485" "20040095078" "20040189218" "20050128751" "20050162850" "20050207166" "20050213321" "20070001709" "20070145915" "20070210687" "20070274084" "20080030981" "20080192476" "20080278941" "20090161359" "20090290334" "20100103673" "20100253226" "20110038146" "20110057572" "20110090684" "20110148313" "20110216538" "20120069556" "20120106157" "20120153873" "20120235578"	US-PGPUB; USPAT; USOCR	OR	OFF	2016/11/16 20:06

		"20130050998" "20130170245" "20130182425" "20130200797" "20130313983" "20140071667" "20140153231" "20140226320" "20150009688" "20160081147" "5575459" "5921660" "6127783" "6609813" "6796680" "7033239" "8360599" "8579463").PN. OR ("9447929").URPN.				
S9	9	("3602759" "4276102" "4804886" "5173637" "5536998" "6078136" "6406167").PN. OR ("7033239").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2016/11/16 20:25
S10	41	("2135696" "2363109" "2581959" "3358167" "3453470" "3602759" "3720826" "3808495" "4048537" "4916352" "4924368" "5173637").PN. OR ("5536998").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2016/11/16 20:42
S11	11533	(LED.u/c. NEAR2 tub\$4 NEAR2 lamp)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/17 10:06
S12	119	S11 AND ((end-cap or (end\$2 adj1 cap)) SAME ((hous\$3 or tub\$3 or cas\$3 or globe or envelop\$2) NEAR3 (len\$3 or glass\$2 or plastic\$4)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/17 10:10
S13	48	("20020044456" "20020176262" "20030102819" "20030231485" "20040095078" "20040189218" "20050128751" "20050162850" "20050207166" "20050213321" "20070001709" "20070145915" "20070210687" "20070274084" "20080030981" "20080192476" "20080278941" "20090161359" "20090290334" "20100103673" "20100253226" "20110038146" "20110057572" "20110090684" "20110148313" "20110216538" "20120069556" "20120106157" "20120153873" "20120235578" "20130050998" "20130170245" "20130182425" "20130200797" "20130313983" "20140071667" "20140153231" "20140226320" "20150009688" "20160081147" "5575459" "5921660" "6127783" "6609813" "6796680" "7033239" "8360599" "8579463").PN. OR ("9447929").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2016/11/17 12:12
S14	10	S11 AND ((end-cap or (end\$2 adj1 cap)) WITH ((air or heat\$2 or vent\$3 or thermal\$4 or temperature) NEAR2 (open\$3 or hole or outlet)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/17 13:16

S15	14	S11 AND ((end-cap or (end\$2 adj1 cap)) SAME ((air or heat\$2 or vent\$3 or thermal\$4 or temperature or cool\$4) NEAR3 (open\$3 or hole or outlet)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/17 13:28
S16	27	S11 AND ((end-cap or (end\$2 adj1 cap)) SAME ((air or heat\$2 or vent\$3 or thermal\$4 or temperature or cool\$4) WITH (open\$3 or hole or outlet)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/17 13:36
S17	29	S11 AND ((end-cap or (end\$2 adj1 cap)) SAME ((hous\$3 or tub\$3 or cas\$3 or pipe or len\$3 or glass\$3) WITH ((thermal\$3 or heat\$3 or melt\$3) NEAR3 (seal\$4 or adhesive or bond\$3 or glu\$3))))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/17 13:47
S18	48	S11 AND ((end-cap or (end\$2 adj1 cap)) SAME (hous\$3 or tub\$3 or cas\$3 or pipe or len\$3 or glass\$3) SAME ((thermal\$3 or heat\$3 or melt\$3) WITH (seal\$4 or adhesive or bond\$3 or glu\$3)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/17 13:51
S19	23628	(LED.u/c. or (light adj emitting adj diode) or (light-emitting adj diode)) NEAR3 (tub\$4 or straight or pipe or cyclind\$5 or retrofit\$4 or replac\$4) NEAR3 (lamp or bulb)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/17 14:05
S20	52	S19 AND ((end-cap or (end\$2 adj1 cap)) SAME ((air or heat\$2 or vent\$3 or thermal\$4 or temperature or cool\$4) WITH (open\$3 or hole or outlet)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/17 14:06
S21	66	S19 AND ((end-cap or (end\$2 adj1 cap)) SAME (hous\$3 or tub\$3 or cas\$3 or pipe or len\$3 or glass\$3) SAME ((thermal\$3 or heat\$3 or melt\$3 or temperature) WITH (seal\$4 or adhesive or bond\$3 or glu\$3)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/17 14:18
S22	959	S19 and 315/\$.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/17 14:38
S23	16	S22 AND ((end-cap or (end\$2 adj1 cap)) SAME ((air or heat\$2 or vent\$3 or thermal\$4 or temperature or cool\$4) WITH (open\$3 or hole or outlet)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2016/11/17 14:39

			DERWENT; IBM_TDB			
S24	2364	S19 and 362/\$.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/17 14:42
S25	20	S24 AND ((end-cap or (end\$2 adj1 cap)) SAME ((air or heat\$2 or vent\$3 or thermal\$4 or temperature or cool\$4) WITH (open\$3 or hole or outlet)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/17 14:42
S26	3189	S19 and (362/\$.ccls. or 315/\$.ccls.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/17 14:44
S27	29	S26 AND ((end-cap or (end\$2 adj1 cap)) SAME ((air or heat\$2 or vent\$3 or thermal\$4 or temperature or cool\$4) WITH (open\$3 or hole or outlet)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/17 14:45
S28	5	S27 AND ((end-cap or (end\$2 adj1 cap)) SAME (hous\$3 or tub\$3 or cas\$3 or pipe or len\$3 or glass\$3) SAME ((thermal\$3 or heat\$3 or melt\$3) WITH (seal\$4 or adhesive or bond\$3 or glu\$3)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/17 14:46
S29	1	S27 AND ((end-cap or (end\$2 adj1 cap)) SAME ((thermal\$3 or heat\$3 or melt\$3) NEAR3 (seal\$4 or adhesive or bond\$3 or glu\$3)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/17 14:47
S30	17	S26 AND ((end-cap or (end\$2 adj1 cap)) SAME (hous\$3 or tub\$3 or cas\$3 or pipe or len\$3 or glass\$3) SAME ((thermal\$3 or heat\$3 or melt\$3) WITH (seal\$4 or adhesive or bond\$3 or glu\$3)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/17 14:48
S31	6	S26 AND ((end-cap or (end\$2 adj1 cap)) SAME ((thermal\$3 or heat\$3 or melt\$3) NEAR3 (seal\$4 or adhesive or bond\$3 or glu\$3)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/17 14:49
S32	170177	H05B\$/\$.CPC. or F21V\$/\$.CPC. or F21S\$/\$.CPC.	US-PGPUB; USPAT	OR	ON	2016/11/17 14:51

S33	1705	S24 AND S32	US-PGPUB; USPAT	OR	ON	2016/11/17 14:51
S34	19	S33 AND ((end-cap or (end\$2 adj1 cap)) SAME ((air or heat\$2 or vent\$3 or thermal\$4 or temperature or cool\$4) WITH (open\$3 or hole or outlet)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/17 14:52
S35	5	S33 AND ((end-cap or (end\$2 adj1 cap)) SAME ((thermal\$3 or heat\$3 or melt\$3) NEAR5 (seal\$4 or adhesive or bond\$3 or glu\$3)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/17 14:54
S36	38	S19 AND ((end-cap or (end\$2 adj1 cap)) SAME ((thermal\$3 or heat\$3 or melt\$3 or hot or hot-melt\$3) NEAR3 (seal\$4 or adhesive or bond\$3 or glu\$3)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/17 15:12
S37	121	S19 AND ((melt\$3 or hot or hot-melt\$3) NEAR3 (seal\$4 or adhesive or bond\$3 or glu\$3))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/17 15:21
S38	45	(315/\$.ccls. or 362/\$.ccls.) AND ((end- cap or (end\$2 adj1 cap)) SAME ((light or ambien\$3 or color) NEAR2 (sensor or detector)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/18 17:06
S39	0	((LED.u/c. or (light adj emitting adj diode) or (light-emitting adj diode)) NEAR3 (tub\$4 or straight or pipe or cyclind\$5 or retrofit\$4 or replac\$4) NEAR3 (lamp or bulb)) AND ((end-cap or (end\$2 adj1 cap)) WITH ((air or heat\$2 or vent\$3 or thermal\$4 or temperature) NEAR2 (open\$3 or hole or outlet)) SAME sensor)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/18 21:41
S40	0	((LED.u/c. or (light adj emitting adj diode) or (light-emitting adj diode)) NEAR3 (tub\$4 or straight or pipe or cyclind\$5 or retrofit\$4 or replac\$4) NEAR3 (lamp or bulb)) AND ((end-cap or (end\$2 adj1 cap)) SAME ((air or heat\$2 or vent\$3 or thermal\$4 or temperature) NEAR3 (open\$3 or hole or outlet)) SAME sensor)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/18 21:46
S41	33	((LED.u/c. or (light adj emitting adj diode) or (light-emitting adj diode)) NEAR3 (tub\$4 or straight or pipe or cyclind\$5 or retrofit\$4 or replac\$4) NEAR3 (lamp or bulb)) AND ((end-cap or (end\$2 adj1 cap)) SAME sensor)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	OR	ON	2016/11/18 21:48

			IBM_TDB			
S42	13	("20090200950" "20100045191" "20100083073" "20100220046" "20100308737" "20100327757" "20110170283" "20110175536" "20120200225" "6091200" "8207676" "8461513" "8531386").PN. OR ("9488355").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2016/11/18 23:08
S43	82	((LED.u/c. or (light adj emitting adj diode) or (light-emitting adj diode)) NEAR3 (tub\$4 or straight or pipe or cyclind\$5 or retrofit\$4 or replac\$4) NEAR3 (lamp or bulb)) AND ((end-cap or ((end\$2 or edge) adj1 (cap or cover\$2 or hous\$3)) or edge-cap) SAME (air-hole or ((air or heat\$2 or vent\$3 or thermal\$4 or temperature) NEAR5 (open\$3 or hole or outlet or space)) or air-open\$3))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/19 10:08
S44	2	S43 AND ((end-cap or ((end\$2 or edge) adj1 (cap or cover\$2 or hous\$3)) or edge-cap) SAME (air-hole or ((air or heat\$2 or vent\$3 or thermal\$4 or temperature) NEAR5 (open\$3 or hole or outlet or space)) or air-open\$3) SAME ((light or ambien\$3 or photo or \$2lumin\$4) NEAR2 (detect\$3 or sens\$3)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/19 10:12
S45	2	S43 AND ((end-cap or ((end\$2 or edge) adj1 (cap or cover\$2 or hous\$3)) or edge-cap) SAME (air-hole or ((air or heat\$2 or vent\$3 or thermal\$4 or temperature) NEAR5 (open\$3 or hole or outlet or space)) or air-open\$3) SAME ((light or ambien\$3 or photo or \$2lumin\$4) WITH (detect\$3 or sens\$3)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/19 10:14
S46	5	S43 AND ((end-cap or ((end\$2 or edge) adj1 (cap or cover\$2 or hous\$3)) or edge-cap) SAME ((light or ambien\$3 or photo or \$2lumin\$4) WITH (detect\$3 or sens\$3)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/19 10:14
S47	6	US-20080278943-\$.DID. OR US-20100246186-\$.DID. OR US-20100309647-\$.DID.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	OFF	2016/11/19 10:27
S48	4	US-20060164841-\$.DID. OR US-8016456-\$.DID.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	OFF	2016/11/19 10:28
S49	20	US-5134553-\$.DID. OR US-6536924-\$.DID. OR US-7670032-\$.DID. OR US-7862198-\$.DID. OR US-8057061-\$.DID. OR US-8061867-\$.DID. OR US-6221717-\$.DID. OR US-20050201088-\$.DID. OR US-20070189015-\$.DID. OR US-	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	OFF	2016/11/19 10:29

		20070247856-\$.DI.D.				
S50	107	("20040032220" "5463280" "5811942" "6580228" "6608453" "6828733" "6936968").PN. OR ("7067992").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2016/11/19 11:03
S51	67	S50 and sensor	US-PGPUB; USPAT; USOCR	OR	ON	2016/11/19 11:37
S52	15	((("20130050998") or ("20140009923") or ("20160081147") or ("20150176770") or ("20140226320") or ("20100253226") or ("20080290814") or ("20110038146") or ("20150285479") or ("20150028751") or ("20140346972") or ("20140268748") or ("20130051008") or ("20130021809") or ("20120195032")).PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2016/11/20 12:39
S53	17	((("20130050998") or ("20140009923") or ("20160081147") or ("20150176770") or ("20140226320") or ("20100253226") or ("20080290814") or ("20110038146") or ("20150285479") or ("20150028751") or ("20140346972") or ("20140268748") or ("20130051008") or ("20130021809") or ("20120195032") or ("20100253226") or ("5536998") or ("8288949") or ("20160081147")).PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2016/11/20 12:47
S54	2	((("20110149548") or ("20130170196")).PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2016/11/21 18:31
S55	70	(LED.u/c. or (light adj emitting adj diode) or (light-emitting adj diode)) NEAR3 (tub\$4 or straight or pipe or cyclind\$5 or retrofit\$4 or replac\$4) NEAR3 (lamp or bulb) AND ((end-cap or (end adj1 cap)) SAME (PCB.u/c. or (circuit adj1 board) or (print-circuit adj1 board)) SAME (heat-sink\$3 or ((heat\$3 or temperature or thermal\$3) adj1 (sink\$3 or dissipat\$4)) or heat-dissipat\$4))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/21 18:37
S56	54	(LED.u/c. or (light adj emitting adj diode) or (light-emitting adj diode)) NEAR3 (tub\$4 or straight or pipe or cyclind\$5 or retrofit\$4 or replac\$4) NEAR3 (lamp or bulb) AND ((end-cap or (end\$2 adj1 cap)) SAME ((air or heat\$2 or vent\$3 or thermal\$4 or temperature or cool\$4 or pressur\$3) WITH (open\$3 or hole or outlet)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/25 16:34
S57	20	("1830084" "20050070172" "20100277918" "20110194278" "2716226" "4728835" "5009614" "6283612" "6531810" "7354001" "7484980" "7490957" "8167452" "8220956" "8220976").PN. OR ("8827486").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2016/11/25 17:39
S58	27010	((end-cap or (end\$2 adj1 cap)) SAME ((air or heat\$2 or vent\$3 or thermal\$4 or temperature or cool\$4 or pressur\$3) WITH (open\$3 or hole or outlet)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	OR	ON	2016/11/25 18:13

			IBM_TDB			
S59	1034	S58 AND (LED.u/c. or (light adj emitting adj diode) or (light-emitting adj diode))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/25 18:14
S60	123	S59 AND ((LED.u/c. or (light adj emitting adj diode) or (light-emitting adj diode)) NEAR3 (tub\$4 or straight or pipe or cyclind\$5 or retrofit\$4 or replac\$4))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/25 18:17
S61	33	S59 AND 315/\$.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/25 19:00
S62	155	S59 AND 362/\$.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/25 19:05
S63	4	((("20130135822") or ("7611260") or ("20160081147") or ("20080290814")).PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2017/05/16 15:32
S64	11	((LED.u/c. ADJ1 tube) AND sleeve).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/06/28 17:13
S65	96	((LED.u/c. or (light adj emitting adj diode) or (light-emitting adj diode)) NEAR3 (tub\$4 or straight or pipe or cyclind\$5 or retrofit\$4 or replac\$4 or fluorescen\$3)) AND ((end-cap or (end adj1 (cap or holder or cover\$2))) SAME ((heat or air or pressure) NEAR2 (vent or ventilat\$3 or outlet or hole)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/06/28 17:51
S66	138	((LED.u/c. or (light adj emitting adj diode) or (light-emitting adj diode)) NEAR3 (tub\$4 or straight or pipe or cyclind\$5 or retrofit\$4 or replac\$4 or fluorescen\$3)) AND ((end-cap or (end adj1 (cap or holder or cover\$2))) SAME ((heat or air or pressure or vent or ventilat\$4 or radiat\$4 or cool\$3) NEAR2 (outlet or hole or opening)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/06/28 18:34
S67	8	((("20150176770") or ("20100220469") or ("20100253226") or ("20100135015") or ("20130050998") or ("20080290814") or ("20110038146") or ("20160081147")).PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2017/06/28 21:38

S68	111	((LED.u/c. or (light adj emitting adj diode) or (light-emitting adj diode)) NEAR3 (tub\$4 or straight or pipe or cyclind\$5 or retrofit\$4 or replac\$4)) AND ((end-cap or (end\$2 NEAR1 (cap or cover\$3))) SAME ((air or heat\$2 or vent\$3 or thermal\$4 or temperature or pressure) NEAR2 (open\$3 or hole or outlet or exhaust\$3)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/07/03 13:29
S73	2	((("20120212951") or ("9671072")).PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2017/07/04 10:08
S74	1	("8827486").PN.	USPAT; USOCR	OR	OFF	2017/07/04 10:53
S75	22	("1830084" "20050070172" "20100277918" "20110194278" "2716226" "4728835" "5009614" "6283612" "6531810" "7354001" "7484980" "7490957" "8167452" "8220956" "8220976").PN. OR ("8827486").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2017/07/04 10:53
S76	7	("5138245" "5904415" "7097508").PN. OR ("7484980").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2017/07/04 11:01
S77	19	("20100295468" "4393323" "6078136" "6472823" "7114830" "7267461" "7611260" "7810953" "7976185" "8047674").PN. OR ("8220956").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2017/07/04 11:04
S78	3	((("20120212951") or ("9671072") or ("20100277918")).PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2017/07/05 10:37
S79	1	("20070242466").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2017/07/05 10:42
S80	210	chen-chien-yuan.in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/07/05 10:43
S81	28	S80 AND (LED.u/c. or (light adj emitting adj diode) or (light-emitting adj diode))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/07/05 10:44
S82	175	("20020096347" "20040095078" "20060012981" "20070159828" "20070246714" "20070258202" "20100003860" "20100039813" "20100072921" "20100079075" "20100112845" "20100190455" "20100254148" "20100327768" "20110019421" "20110199005" "20110199769" "20110280020" "20110292647" "20120049739" "20120069557" "20120147598"	US-PGPUB; USPAT; USOCR	OR	OFF	2017/07/05 10:46

		"20120201022" "20120229025" "20130119896" "20130141906" "20130258668" "20130279160" "20130343037" "20140056009" "20140133400" "20140218905" "20140268752" "20140293595" "20150049475" "20150351205" "20160227629" "20170023193" "3131871" "3404268" "4156553" "5434762" "5457905" "5624274" "5947761" "6231373" "6257735" "6283612" "6350158" "6548967" "6577080" "6578979" "6623151" "6969954" "7049761" "7195370" "7309965" "7476004" "7507001" "7510299" "7513637" "7559790" "7587289" "7637636" "7712918" "7815338" "7918580" "7926975" "7938562" "7946729" "7976185" "7976187" "7976196" "7989827" "8011794" "8052295" "8093823" "8118447" "8164281" "8186847" "8203260" "8214084" "8235539" "8247985" "8251544" "8256924" "8282247" "8287144" "8324817" "8330381" "8344641" "8360599" "8382327" "8398253" "8408742" "8434891" "8444292" "8454193" "8523394" "8534873" "8547036" "8556452" "8558413" "8560261" "8571716" "8573813" "8596813" "8616720" "8628216" "8643298" "8653984" "8664880").PN. OR ("8674626" "8678610" "8702265" "8710759" "8742680" "8807785" "8827486" "8830080" "8836476" "8866414" "8915756" "8919991" "8941330" "8956005" "8967825" "9080760" "9101028" "9155171" "9215755" "9228727" "9247623" "9285085" "9295142" "9295144" "9307621" "9328882" "9338860" "9464791" "9464792" "9464793" "9470401" "D246930" "D397481" "D421815" "D430326" "D438326" "D459012" "D459517" "D500883" "D500884" "D503009" "D523165" "D543305" "D565785" "D574105" "D575898" "D581569" "D589199" "D605343" "D607145" "D616382" "D627095" "D634470" "D642326" "D649282" "D654208" "D682463" "D691750" "D692597" "D698075" "D701639").PN. OR ("9671072").URPN.				
S83	4	((("20100253226") or ("20130050998") or ("20080290814") or ("20110038146")).PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2017/07/05 13:34
S84	5	((LED.u/c. or (light adj emitting adj diode) or (light-emitting adj diode)) NEAR3 (tub\$4 or straight or pipe or cyclind\$5 or retrofit\$4 or replac\$4)) AND ((end-cap or (end\$2 NEAR1 (cap or cover\$3))) SAME ((air or heat\$2 or vent\$3 or thermal\$4 or temperature or	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/09/27 12:42

		pressure) NEAR2 (open\$3 or hole or outlet or exhaust\$3)) SAME (adhes\$4 or bond\$4 or glu\$3 or weld\$3))				
S85	126	((LED.u/c. or (light adj emitting adj diode) or (light-emitting adj diode)) NEAR3 (tub\$4 or straight or pipe or cyclind\$5 or retrofit\$4 or replac\$4)) AND ((end-cap or (end\$2 NEAR1 (cap or cover\$3))) SAME ((air or heat\$2 or vent\$3 or thermal\$4 or temperature or pressure) NEAR2 (open\$3 or hole or outlet or exhaust\$3)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/09/27 12:47
S86	9	S85 AND ((heat\$3 or melt\$3 or thermal\$3 or temperature or mud or powder) NEAR1 (adhes\$4 or bond\$4 or glu\$3 or weld\$3))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/09/27 12:55
S88	32	(end-cap or (end\$2 adj1 (cap\$3 or cover\$3)) or end-cover\$3) SAME ((hous\$3 or tub\$3 or cas\$3 or pipe) NEAR3 (len\$3 or glass\$3)) SAME ((LED.u/c. or (light adj1 diode) or (light-emitting adj diode)) WITH (PCB.u/c. or ((print\$3 or circuit) ADJ1 (board or card)) or carrier or strip)) SAME solder\$3 SAME (power adj1 (supply or circuit or unit or module or source))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/11/11 11:14
S89	111	(end-cap or (end\$2 adj1 (cap\$3 or cover\$3)) or end-cover\$3) SAME ((hous\$3 or tub\$3 or cas\$3 or pipe) NEAR3 (len\$3 or glass\$3)) SAME ((LED.u/c. or (light adj1 diode) or (light-emitting adj diode)) WITH (PCB.u/c. or ((print\$3 or circuit) ADJ1 (board or card)) or carrier or strip)) SAME (power adj1 (supply or circuit or unit or module or source))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/11/11 11:18
S90	58	S89 AND ((LED.u/c. or (light adj1 diode) or (light-emitting adj diode)) SAME (PCB.u/c. or ((print\$3 or circuit) ADJ1 (board or card)) or carrier or strip or bar) SAME solder\$3 SAME (converter or ((power or volt\$3 or current or energy or electric\$4) adj1 (supply or circuit or unit or module or source)) or buck or boost or buck-boost or rectific\$5 or rectif\$4))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/11/11 11:28

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S69	98	(315/\$.ccls. or 362/\$.ccls.) AND (LED.u/c. or (light adj emitting adj diode) or (light-emitting adj diode)) AND ((end-cap or (end\$2 NEAR1 (cap or cover\$3))) SAME ((air or heat\$2 or vent\$3 or thermal\$4 or temperature or pressure) NEAR2 (open\$3 or hole or outlet or exhaust\$3)))	US-PGPUB; USPAT	OR	ON	2017/07/03 14:53
S70	60	((LED.u/c. or (light adj emitting adj diode) or	US-	OR	ON	2017/07/03

		((light-emitting adj diode)) NEAR3 (tub\$4 or straight or pipe or cyclind\$5 or retrofit\$4 or replac\$4)) AND ((end-cap or (end\$2 NEAR1 (cap or cover\$3))) SAME ((air or heat\$2 or vent\$3 or thermal\$4 or temperature or pressure) NEAR2 (open\$3 or hole or outlet or exhaust\$3)))	PGPUB; USPAT			15:15
S71	20	("1830084" "20050070172" "20100277918" "20110194278" "2716226" "4728835" "5009614" "6283612" "6531810" "7354001" "7484980" "7490957" "8167452" "8220956" "8220976").PN. OR ("8827486").URPN.	US-PGPUB; USPAT	OR	OFF	2017/07/03 18:18
S72	13	("20080158870" "20100008085" "6078136" "6472823" "6612717" "7387403" "7611260" "7658509").PN. OR ("8047674").URPN.	US-PGPUB; USPAT	OR	OFF	2017/07/03 18:22
S87	1	((LED.u/c. or (light adj emitting adj diode) or (light-emitting adj diode)) NEAR3 (tub\$4 or straight or pipe or cyclind\$5 or retrofit\$4 or replac\$4)) AND ((end-cap or (end\$2 NEAR1 (cap or cover\$3))) SAME ((air or heat\$2 or vent\$3 or thermal\$4 or temperature or pressure) NEAR2 (open\$3 or hole or outlet or exhaust\$3)) SAME (adhes\$4 or bond\$4 or glu\$3 or weld\$3))	US-PGPUB; USPAT	OR	ON	2017/09/27 13:22
S91	35	(end-cap or (end\$2 adj1 (cap\$3 or cover\$3)) or end-cover\$3) SAME ((hous\$3 or tub\$3 or cas\$3 or pipe) NEAR3 (len\$3 or glass\$3)) SAME (LED.u/c. or (light adj1 diode) or (light-emitting adj diode)) SAME (PCB.u/c. or ((print\$3 or circuit) ADJ1 (board or card)) or carrier or strip or bar) SAME solder\$3 SAME (converter or ((power or volt\$3 or current or energy or electric\$4) adj1 (supply or circuit or unit or module or source)) or buck or boost or buck-boost or rectific\$5 or rectif\$4)	US-PGPUB; USPAT	OR	ON	2017/11/11 11:36

Issue Classification 	Application/Control No. 15483368	Applicant(s)/Patent Under Reexamination JIANG ET AL.	
	Examiner ANH TRAN	Art Unit 2844	

CPC						
Symbol					Type	Version
F21K		9	/	272	F	2016-08-01
F21K		9	/	278	I	2016-08-01
F21V		29	/	83	I	2015-01-15
F21V		3	/	0418	I	2013-01-01
F21V		23	/	06	I	2013-01-01
F21V		17	/	101	I	2013-01-01
F21V		3	/	02	I	2013-01-01
F21Y		2115	/	10	A	2016-08-01
F21Y		2103	/	10	A	2016-08-01
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CPC Combination Sets				
Symbol	Type	Set	Ranking	Version

NONE		Total Claims Allowed:	
		48	
(Assistant Examiner)	(Date)	O.G. Print Claim(s)	O.G. Print Figure
/ANH TRAN/ Primary Examiner.Art Unit 2844	11/11/17	1	5 & 7
(Primary Examiner)	(Date)		

Issue Classification 	Application/Control No. 15483368	Applicant(s)/Patent Under Reexamination JIANG ET AL.
	Examiner ANH TRAN	Art Unit 2844

☐ Claims renumbered in the same order as presented by applicant															
☐ CPA															
☐ T.D.															
☐ R.1.47															
Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1	15	17	29	33	45	49								
2	2	16	18	30	34	46	50								
3	3	17	19	31	35	47	51								
4	4	18	20	32	36	48	52								
5	5		21	33	37										
6	6	19	22	34	38										
7	7	20	23	35	39										
8	8	21	24	36	40										
9	9	22	25	37	41										
	10	23	26	38	42										
10	11	24	27	39	43										
11	12	25	28	40	44										
12	13	26	29	41	45										
13	14	27	30	42	46										
	15	28	31	43	47										
14	16		32	44	48										

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	48	
/ANH TRAN/ Primary Examiner.Art Unit 2844	11/11/17	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	5 & 7

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	15483368
	Filing Date	2017-04-10
	First Named Inventor	TAO JIANG et al.
	Art Unit	2844
	Examiner Name	TRAN, ANH Q
	Attorney Docket Number	6246-40007US8

U.S.PATENTS						Remove
Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	6186649		2001-02-13	ZOU HAN et al.	
	2	9618168		2017-04-11	JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.	
	3	D797323		2017-09-12	JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.	

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Examiner Initial*	Cite No	Publication Number	Kind Code ¹	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20100085772		2010-04-08	SONG HO YOUNG et al.	
	2	20130135852		2013-05-30	CHAN KAM-KWAN	
	3	20030189829		2003-10-09	SHIMIZU MASANORI et al.	

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number		15483368
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First Named Inventor	TAO JIANG et al.	
Art Unit	2844	
Examiner Name	TRAN, ANH Q	
Attorney Docket Number	6246-40007US8	

4	20130258650	2013-10-03	SHARRAH RAYMOND L
5	20050185396	2005-08-25	KUTLER MURRAY
6	20140225519	2014-08-14	Chung-Hung Yu, Chin-Tsai Liu
7	20100201269	2010-08-12	Hua-Lung Tzou, Meng-Chai Wu
8	20150327368	2015-11-12	Kuo-Fu Su, Gwun-Jin Lin
9	20050168123	2005-08-04	TANIWA KENICHIRO
10	20150176770	2015-06-25	WILCOX KURT et al.
11	20100277918	2010-11-04	CHEN CHIEN-YUAN et al.
12	20120212951	2012-08-23	LAI CHUN-MING et al.
13	20100220469	2010-09-02	Ivey John et al.
14	20130293098	2013-11-07	LI YI-QUN et al.

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
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Art Unit	2844	
Examiner Name	TRAN, ANH Q	
Attorney Docket Number	6246-40007US8	

15	20110279063		2011-11-17	WANG JUN et al.	
16	20110084608		2011-04-14	LIN JERRY et al.	
17	20140192526		2014-07-10	NINGBO FUTAI ELECTRIC LTD	
18	20130230995		2013-09-05	LUMISYS INC	
19	20130223053		2013-08-29	LIU CHUN-CHEN et al.	
20	20110309745		2011-12-22	WESTERMARCK JOEL C	
21	20110084554		2011-04-14	FU ZHUN PRECISION IND SHENZHEN	
22	20110084627		2011-04-14	SLOANLED INC	
23	20170089521		2017-03-30	JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.	
24	20170130911		2017-05-11	JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.	
25	20170159894		2017-06-08	JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.	

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Examiner Name	TRAN, ANH Q
Attorney Docket Number	6246-40007US8

26	20170167664	2017-06-15	JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.
27	20170211753	2017-07-27	JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.
28	20170219169	2017-08-03	JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.
29	20170311398	2017-10-26	JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO., LTD

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Examiner Initial*	Cite No	Foreign Document Number ³	Country Code ²	Kind Code ⁴	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear	T ⁵
	1	2015081809	WO		2015-06-11	CHEN HONGCHANG		×
	2	102052652	CN		2011-05-11	WUJUN ZHANG et al.		☒
	3	1020120055349	KR		2012-05-31	AMOLUXE CO LTD		☒
	4	2012129301	WO		2012-09-27	ELECTRALED INC		☒
	5	202302841	CN		2012-07-04	SHENZHEN REFOND OPTOELECTRONICS CO LTD		☒

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number	15483368
Filing Date	2017-04-10
First Named Inventor	TAO JIANG et al.
Art Unit	2844
Examiner Name	TRAN, ANH Q
Attorney Docket Number	6246-40007US8

6	3146803	EP		2017-03-29	JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO LTD		☒
7	202216003	CN		2012-05-09	BEIJING TONGFANG LANSEN LIGHTING TECHNOLOGY CO LTD		☒
8	203464014	CN		2014-03-05	ZHANG WEI et al.		☒
9	201363601	CN		2009-12-16	YINGCHENG RUILU TECHNOLOGY CO		☒
10	2519258	GB		2015-04-15	UNITY OPTO TECHNOLOGY CO LTD		☒
11	203068187	CN		2013-07-17	HUANG YINGFENG		☒
12	203549435	CN		2014-04-16	HU FEILIN		☒
13	2531425	GB		2016-04-20	JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO LTD		☒
14	2554899	EP		2013-02-06	QBAS TECH CO LTD		☒

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*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

¹ See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. ² Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). ³ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁴ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁵ Applicant is to place a check mark here if English language translation is attached.

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number	15483368
Filing Date	2017-04-10
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Examiner Name	TRAN, ANH Q
Attorney Docket Number	6246-40007US8

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☒ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

SIGNATURE

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

Signature	/Andrew M. Calderon/	Date (YYYY-MM-DD)	2017-11-16
Name/Print	Andrew M. Calderon	Registration Number	38,093

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s) : Tao JIANG et al.

Group Art Unit: 2844

Appln. No. : 15/483,368

Examiner: Anh Q. TRAN

Filed : April 10, 2017

Confirmation No.: 4470

For : LED TUBE LAMP

AMENDMENT UNDER 37 C.F.R. §1.111

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401 Dulany Street
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In response to the Office Action dated July 7, 2017, please amend the above-identified application as follows.

A notice of a substitute specification is on page 2.

A notice of new drawings is on page 3.

Amendments to the claims begin on page 4.

Remarks begin on page 12.

If extensions of time are necessary to prevent abandonment of this application, then such extensions of time are hereby petitioned under 37 C.F.R. §1.136(a), and any fees required therefor (including fees for net addition of claims) are hereby authorized to be charged to Deposit Account No. 50-2478.

SUBSTITUTE SPECIFICATION

Please **SUBSTITUTE** the specification with the attached substitute specification.

The Support for the amendments made in the substitute specification can be found in one of parent applications of the subject application, U.S. Application No. 14/865,387, filed on 2015/9/25, which was incorporated by reference at the time the subject application was filed. Specifically, Figs. 49-52 and their corresponding descriptions of the parent application paragraphs [0445]-[0492] of publication version of the parent application, or the last paragraph of page 94 to the third paragraph of page 108 of the original filed specification of the parent application) are incorporated into the substitute specification with appropriate renumbering. Figs. 49-52 are renumbered into Fig. 17-20 in order, respectively. The corresponding descriptions are inserted after original paragraph [0048] and become paragraphs [0049] - [0098]. The original paragraphs [0049] - [0050] are changed to [0099] - [0100]. The original paragraph [0022] is amended accordingly. No new matter is introduced. Attached herewith are a “Marked-Up” copy and a “Clean” copy of a substitute specification. Entry of the amendments to the specification is respectfully requested.

NEW DRAWINGS

Please **ADD** the new sheets of the drawings as attached.

The Support for the new drawings can be found in one of parent applications of the subject application, U.S. Application no. 14/865,387 filed on 2015/9/25, which was incorporated by reference at the time the subject application was filed. Specifically, Figs. 49-52 and their corresponding descriptions of the parent application (paragraph [0445-492] of publication version of the parent application. Figs. 49-52 are renumbered into Fig. 17-20 in order, respectively. No new matter is introduced. Entry of the new drawings is respectfully requested.

AMENDMENT TO CLAIMS

Please **AMEND** claims 1-6, 8, 11, 13, 20, 22-24, 26-30 and 33 as follows.

Please **CANCEL** claims 10, 15, 21 and 32 without prejudice or disclaimer.

Please **ADD** claims 35-52 as follows.

A copy of all pending claims (including status identifiers) is provided below.

1. (Currently amended) An LED tube lamp, comprising:
 - a glass tube covered by a heat shrink sleeve and having two end portions; a plurality of LED light sources;
 - two end caps respectively ~~sleeve~~ sleeving the two end portions of the glass tube, ~~the glass tube and the end cap are secured by a hot melt adhesive;~~
 - a power supply in one of the end caps or separately in both of the end caps; and
 - an LED light strip on an inner surface of the glass tube forming a freely extending end portion at one end along a longitudinal direction of the glass tube, the freely extending end portion directly soldered to the power supply, the plurality of LED light sources being on the LED light strip;
 - wherein each of the end caps comprises:
 - an ~~electrically insulating tube end wall;~~ and
 - two conductive pins on the ~~electrically insulating tube end wall;~~ and
 - ~~at least two heat dissipating openings on the electrically insulating tube~~
 - ~~symmetric to each other with respect to a plane passing through the middle of a~~
 - ~~line connecting the two conductive pins and perpendicular to the line connecting the two~~
 - ~~conductive pins.~~
2. (Currently amended) The LED tube lamp according to claim 1, ~~wherein the hot melt adhesive is, respectively, disposed on the outer surface of the end portions, and the shape of the disposed hot melt adhesive is substantially a circle from the side view of the glass tube~~ further comprising at least two openings on the end wall symmetric to each other with respect to a plane passing through the middle of a line connecting the two pins and perpendicular to the line connecting the two pins.

3. (Currently amended) The LED tube lamp according to claim 2, wherein the at least two ~~heat-dissipating~~ openings are on a surface of the ~~electrically-insulating tube~~ end wall on which the two ~~conductive~~ pins are disposed.
4. (Currently amended) The LED tube lamp according to claim 3, wherein the at least two ~~heat-dissipating~~ openings are separately in a shape of an arc.
5. (Currently amended) The LED tube lamp according to claim 4, wherein the at least two ~~heat-dissipating~~ openings are in a shape of arcs with different sizes.
6. (Currently amended) The LED tube lamp according to claim 5, wherein the sizes of the arcs of the at least two ~~heat-dissipating~~ openings gradually vary.
7. (Original) The LED tube lamp according to claim 6, wherein the heat shrink sleeve is substantially transparent with respect to the wavelength of light from the LED light sources.
8. (Currently amended) The LED tube lamp according to claim 1, wherein the number of the at least two ~~heat-dissipating~~ openings is six in two sets, and the three ~~heat-dissipating~~ openings in one set are in a shape of three arcs with gradually varying sizes.
9. (Original) The LED tube lamp according to claim 1, wherein at least a part of the openings are arranged along an arc and spaced apart from each other.
10. (Canceled)
11. (Currently amended) An LED tube lamp, comprising:
 - a glass tube comprising an inner surface and an outer surface, at least part of the inner surface of the glass tube has a rough surface, the glass tube having two end portions;
 - a plurality of LED light sources;
 - two end caps respectively ~~sleeve~~ sleeving the two end portions of the glass tube;
 - a power supply in one of the end caps or separately in both of the end caps; and

an LED light strip on the inner surface of the glass tube forming a freely extending end portion at one end along a longitudinal direction of the glass tube, the freely extending end portion directly soldered to the power supply, the plurality of LED light sources being on the LED light strip;

~~wherein each of the end caps comprises a plurality of openings thereon, and the two sets of the plurality of openings are symmetric to each other with respect to a virtual central axis of the end cap.~~

12. (Original) The LED tube lamp according to claim 11, wherein the roughness of the rough surface is substantially from 0.1 to 40 μm .

13. (Currently amended) The LED tube lamp according to claim 12, ~~further comprising a hot melt adhesive, wherein the end cap is adhered to one end of the glass tube via the hot melt adhesive~~ 11, wherein each of the end caps comprises a plurality of openings thereon, and the two sets of the plurality of openings are symmetric to each other with respect to a virtual central axis of the end cap.

14. (Original) The LED tube lamp according to claim 13, wherein the plurality of openings dissipate heat resulted from the power supply.

15. (Canceled)

16. (Original) The LED tube lamp according to claim 11, wherein the plurality of openings are separately in a shape of an arc.

17. (Original) The LED tube lamp according to claim 16, wherein the number of the plurality of openings is three, and the three openings are in a shape of three arcs with gradually varying sizes.

18. (Original) The LED tube lamp according to claim 11, wherein the plurality of openings are separately in a shape of a circle.

19. (Original) The LED tube lamp according to claim 18, wherein the number of the plurality of openings is three, and the three openings are arranged in a shape of an arc.
20. (Currently amended) The LED tube lamp according to claim ~~[[12]]~~ 13, wherein at least a part of the openings are arranged along an arc and spaced apart from each other.
21. (Canceled)
22. (Currently amended) An LED tube lamp, comprising:
a glass tube having two end portions;
a plurality of LED light sources;
two end caps respectively ~~sleeve~~ sleeving the two end portions of the glass tube, ~~the glass tube and the end cap being secured by a hot melt adhesive~~, each of the end caps comprising two ~~conductive~~ pins and a plurality of ~~heat-dissipating~~ openings, the two ~~conductive~~ pins being on a surface of the end cap, the plurality of ~~heat-dissipating~~ openings being on the surface of the end cap and divided into two sets, and the two sets of the ~~heat-dissipating~~ openings being symmetric to each other with respect to a plane passing through the two ~~conductive~~ pins;
a power supply disposed in at least one of the end caps; and
an LED light strip on an inner surface of the glass tube forming a freely extending end portion at one end along a longitudinal direction of the glass tube, the freely extending end portion directly soldered to the power supply, the plurality of LED light sources being on the LED light strip.
23. (Currently amended) The LED tube lamp according to claim 22, ~~further comprising a power supply in one of the end caps or separately in both of the end caps~~, wherein the power supply comprises a current-limiting element, and the plurality of ~~heat-dissipating~~ openings dissipate heat resulted from the power supply.
24. (Currently amended) The LED tube lamp according to claim 23, wherein the plurality of ~~heat-dissipating~~ openings are separately in a shape of an arc.

25. (Original) The LED tube lamp according to claim 23, wherein the surface of the end cap is vertical to the length direction of the glass tube.

26. (Currently amended) The LED tube lamp according to claim 24, wherein the plurality of ~~heat-dissipating~~ openings are in a shape of arcs with different sizes.

27. (Currently amended) The LED tube lamp according to claim 26, wherein the sizes of the arcs of the plurality of ~~heat-dissipating~~ openings gradually vary.

28. (Currently amended) The LED tube lamp according to claim 23, wherein the plurality of ~~heat-dissipating~~ openings are separately in a shape of a circle.

29. (Currently amended) The LED tube lamp according to claim 28, wherein the number of the plurality of ~~heat-dissipating~~ openings is three, and the three ~~heat-dissipating~~ openings are arranged in a shape of an arc.

30. (Currently amended) The LED tube lamp according to claim 23, wherein the plurality of ~~heat-dissipating~~ openings are a combination in a shape of an arc and a circle.

31. (Original) The LED tube lamp according to claim 23, wherein at least a part of the openings are arranged along an arc and spaced apart from each other.

32. (Canceled)

33. (Currently amended) An LED tube lamp, comprising:
a glass tube ~~covered by a heat shrink sleeve~~;
a plurality of LED light sources;
two end caps respectively at two opposite ends of the glass tube, ~~the glass tube and the end cap are secured by a hot melt adhesive~~;
a power supply in one of the end caps or separately in both of the end caps; and

an LED light strip on an inner surface of the glass tube forming a freely extending end portion at one end along a longitudinal direction of the glass tube, the freely extending end portion directly soldered to the power supply, the plurality of LED light sources being on the LED light strip;

wherein each of the end caps comprises:

an ~~electrically insulating tube~~ end wall;

two ~~conductive~~ pins on the ~~electrically insulating tube~~ end wall; and

at least two ~~heat-dissipating~~ openings on the ~~electrically insulating tube~~ end wall symmetric to each other with respect to a plane passing through the middle of a line connecting the two ~~conductive~~ pins and perpendicular to the line connecting the two ~~conductive~~ pins.

34. (Currently amended) The LED tube lamp according to claim 33, wherein ~~the hot melt adhesive is, respectively, disposed on the outer surface of the glass tube, the shape of the disposed hot melt adhesive is substantially a circle from the side view of the glass tube, and the~~ at least two ~~heat-dissipating~~ openings are separately in a shape of an arc.

35. (New) The LED tube lamp according to claim 1, wherein the LED light strip is a bendable circuit sheet.

36. (New) The LED tube lamp according to claim 1, wherein the end cap comprises a metal part.

37. (New) The LED tube lamp according to claim 11, wherein the LED light strip is a bendable circuit sheet.

38. (New) The LED tube lamp according to claim 11, wherein the end cap comprises a metal part.

39. (New) The LED tube lamp according to claim 22, wherein the LED light strip is a bendable circuit sheet.

40. (New) The LED tube lamp according to claim 22, wherein the end cap comprises a metal part.
41. (New) The LED tube lamp according to claim 22, wherein the LED light strip is a bendable circuit sheet.
42. (New) The LED tube lamp according to claim 22, wherein the end cap comprises a metal part.
43. (New) The LED tube lamp according to claim 23, wherein the current-limiting element comprises a resistor, a capacitor, an inductor, or any combination thereof.
44. (New) The LED tube lamp according to claim 23, wherein the current-limiting element is configured for reducing EMI (electromagnetic interference).
45. (New) The LED tube lamp according to claim 23, wherein the current-limiting element is an element of, or constitutes, a terminal adapter circuit.
46. (New) The LED tube lamp according to claim 22, wherein the power supply comprises a rectifying circuit and a filtering circuit disposed in at least one of the end caps, and the plurality of openings are for dissipating heat from the power supply.
47. (New) The LED tube lamp according to claim 22, wherein the power supply comprises a fuse connected to one of the two pins of one of the end caps, and the plurality of openings are for dissipating heat from the power supply.
48. (New) The LED tube lamp according to claim 33, wherein the power supply comprises a current-limiting element disposed in at least one of the end caps, and the at least two openings are for dissipating heat from the power supply.

49. (New) The LED tube lamp according to claim 48, wherein the current-limiting element comprises a resistor, a capacitor, an inductor, or any combination thereof.

50. (New) The LED tube lamp according to claim 48, wherein the current-limiting element is configured for reducing EMI.

51. (New) The LED tube lamp according to claim 33, wherein the power supply comprises a rectifying circuit and a filtering circuit disposed in at least one of the end caps, and the at least two openings are for dissipating heat from the power supply.

52. (New) The LED tube lamp according to claim 33, wherein the power supply comprises a fuse connected to one of the two pins of one of the end caps, and the at least two openings are for dissipating heat from the power supply.

REMARKS

Upon entry of this Amendment, claims 1-9, 11-20, 22-31 and 33-52 will be pending in the application. By this Amendment, claims 1-6, 8, 11, 13, 20, 22-24, 26-30 and 33 are amended and claims 35-52 are added for the Examiner's consideration. Claims 10, 15, 21 and 32 are canceled without prejudice or disclaimer. The above amendments do not add new matter to the application and are fully supported by the specification. For example, support for the amendment is provided in at least Applicant's FIGS. Figs. 1, 2, 5-7 and 16 and their corresponding descriptions in the subject application of the originally filed disclosure. Reconsideration of the rejected claims in view of the above amendments and the following remarks is respectfully requested.

Amendments to the Claims

Applicant has amended claims and canceled claims to facilitate expeditious prosecution of the application. Applicant is not conceding that the subject matter encompassed by the claims prior to this Amendment is unpatentable over the art cited by the Examiner. Applicant respectfully reserves the right to pursue claims in one or more continuing applications, including claims capturing the subject matter encompassed by claims prior to this Amendment and additional claims.

The amendments to each of claims 1, 11, 22 and 33 further recite "forming a freely extending end portion at one end along a longitudinal direction of the glass tube, the freely extending end portion directly soldered to the power supply." Support for the amendments can be found in paragraph [0038] of the subject application, duplicated below:

[0038] In one embodiment, as shown in FIG. 5, two opposite, short edges of the bendable circuit sheet 205 may be formed as two freely extending end portions 210, and two parts of a power supply 400 are respectively disposed in the two end caps 300. The two freely extending end portions 210 respectively extends outside the glass tube 100 through two opposite ends of the glass tube 100 along the axial direction of the glass tube 100, such that can respectively extend into the two end caps 300 and be respectively electrically connected to the two parts of a power supply 400 directly.

The other amendments to each of claims 1, 11, 22 and 33 are deletion of certain features. Amendments to claims 3-6, 8, 23-24, 26-30 and 34 are deletion of certain features. No new matter is introduced.

The replacement of “electrically insulating tube” with “end wall” in claims 1 and 33 is supported by FIGS. 1-2, 5-6 and 16. No new matter is introduced. The support for “the LED light strip is a bendable circuit sheet” recited in new claims 35, 37, 39, and 41 can be found in FIG. 7 and its corresponding descriptions of the subject application. No new matter is introduced.

The support for “the end cap comprises a metal part” recited new claims 36, 38, 40 and 42 can be found in paragraph [0047] duplicated below. No new matter is introduced.

[0047] Referring to Figs. 16, in one embodiment, *each end cap 3 includes an electrically insulating tube 302, a thermal conductive member 303* sleeving over the electrically insulating tube 302, and two hollow conductive pins 301 disposed on the electrically insulating tube 302. *The thermal conductive member 303 can be a metal ring* that is tubular in shape. According to Fig. 15 and 16, the openings 304 on the electrically insulating tube symmetric to each other with respect to a vertical central plane passing through the middle of a line connecting the two conductive pins 301 and the vertical central plane is perpendicular to the line connecting the two conductive pins 301. The openings 304 are on a surface of the electrically insulating tube 302 on which the two conductive pins 301 are disposed. (Emphasis added, paragraph [0047] of the subject application)

The support for new claims 43-52 can be found in new paragraphs [0049]-[0098] which are incorporated by reference. No new matter is introduced.

Accordingly, Entry of the amendments is respectfully requested.

35 U.S.C. §103 Rejections

Claims 1-10 and 22-34 are rejected under 35 U.S.C. §103 for being unpatentable over U.S. Publication No. 2016/0081147 to Guang (“Guang”) in view of U.S. Publication No. 2015/0176770 to Wilcox, *et al.* (“Wilcox”), in view of U.S. Publication No. 2008/0290814 to Leong, *et al.* (“Leong”) and further in view of U.S. Publication No. 2011/0038146 to Chen (“Chen”). Claims 11 and 12 are rejected under 35 U.S.C. §103 for being unpatentable over Guang in view of Wilcox and further in view of Leong. Claims 13-21 are rejected under 35

U.S.C. §103 for being unpatentable over Guang in view of Wilcox in view of Leong and further in view of Chen. These rejections are respectfully traversed.

To establish a *prima facie* case of obviousness, all claim limitations must be taught or suggested by the prior art. *See, In re Royka*, 490 F.2d 981, 985, 180 USPQ 580, 583 (CCPA 1974); *see also, In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).¹ If the prior art reference(s) do not teach or suggest all of the claim limitations, Office personnel must explain why the differences between the prior art and the claimed invention would have been obvious to one of ordinary skill in the art (MPEP 2141). Applicants submit that no proper combination of the applied art teaches or suggests each and every feature of the claimed invention.

Rejection of Claims 1-10 and 22-34 under Guang in view of Wilcox in view of Leong and further in view of Chen

Independent Claim 1

Claim 1 recites:

An LED tube lamp, comprising:
a glass tube covered by a heat shrink sleeve and having two end portions; a plurality of LED light sources;
two end caps respectively sleeving the two end portions of the glass tube;
a power supply in one of the end caps or separately in both of the end caps; and
an LED light strip on an inner surface of the glass tube forming a freely extending end portion at one end along a longitudinal direction of the glass tube, the freely extending end portion directly soldered to the power supply, the plurality of LED light sources being on the LED light strip;
wherein each of the end caps comprises:
an end wall; and
two conductive pins on the end wall.

Notwithstanding the Examiner's rejection, Applicant's claimed invention recites features not met by the combination of Guang, Wilcox, Leong and Chen. Specifically, Applicant's independent claim 1 recites the feature of "forming a freely extending end portion at one end along a longitudinal direction of the glass tube, the freely extending end portion directly soldered

¹ While the *KSR* court rejected a rigid application of the teaching, suggestion, or motivation ("TSM") test in an obviousness inquiry, the [Supreme] Court acknowledged the importance of identifying "a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does" in an obviousness determination. *Takeda Chemical Industries, Ltd. v. Alphapharm Pty., Ltd.*, 492 F.3d 1350, 1356-1357 (Fed. Cir. 2007) (quoting *KSR International Co. v. Teleflex Inc.*, 127 S.Ct. 1727, 1731 (2007)).

to the power supply.” This feature is not met by the combination of Guang, Wilcox, Leong and Chen.

For at least this reason, the combination of Guang, Wilcox, Leong and Chen does not meet the features of the claimed invention. Accordingly, Applicant respectfully requests that the rejection of independent claim 1 under §103 be withdrawn.

Dependent Claims 2-10

Claims 2-10 depend from independent claim 1 and are distinguishable from the combination of Guang, Wilcox, Leong and Chen by virtue of their dependencies from claim 1. Accordingly, Applicant respectfully requests that the rejection of claims 2-10 under §103 be withdrawn for at least this reason.

Independent Claim 22

Claim 22 recites:

An LED tube lamp, comprising:
a glass tube having two end portions;
a plurality of LED light sources;
two end caps respectively sleeving the two end portions of the glass tube, each of the end caps comprising two pins and a plurality of openings, the two pins being on a surface of the end cap, the plurality of openings being on the surface of the end cap and divided into two sets, and the two sets of the openings being symmetric to each other with respect to a plane passing through the two pins;
a power supply disposed in at least one of the end caps; and
an LED light strip on an inner surface of the glass tube forming a freely extending end portion at one end along a longitudinal direction of the glass tube, the freely extending end portion directly soldered to the power supply, the plurality of LED light sources being on the LED light strip.

Notwithstanding the Examiner’s rejection, Applicant’s claimed invention recites features not met by the combination of Guang, Wilcox, Leong and Chen. Specifically, Applicant’s independent claim 22 recites the feature of “forming a freely extending end portion at one end along a longitudinal direction of the glass tube, the freely extending end portion directly soldered to the power supply.” This feature is not met by the combination of Guang, Wilcox, Leong and Chen.

For at least this reason, the combination of Guang, Wilcox, Leong and Chen does not meet the features of the claimed invention. Accordingly, Applicant respectfully requests that the rejection of independent claim 22 under §103 be withdrawn.

Dependent Claims 23-32

Claims 23-32 depend from independent claim 22 and are distinguishable from the combination of Guang, Wilcox, Leong and Chen by virtue of their dependencies from claim 22. Accordingly, Applicant respectfully requests that the rejection of claims 23-32 under §103 be withdrawn for at least this reason.

Independent Claim 33

Claim 33 recites:

An LED tube lamp, comprising:
a glass tube;
a plurality of LED light sources;
two end caps respectively at two opposite ends of the glass tube;
a power supply in one of the end caps or separately in both of the end caps; and
an LED light strip on an inner surface of the glass tube forming a freely extending end portion at one end along a longitudinal direction of the glass tube, the freely extending end portion directly soldered to the power supply, the plurality of LED light sources being on the LED light strip;
wherein each of the end caps comprises:
an end wall;
two pins on the end wall; and
at least two openings on the end wall symmetric to each other with respect to a plane passing through the middle of a line connecting the two pins and perpendicular to the line connecting the two pins.

Notwithstanding the Examiner's rejection, Applicant's claimed invention recites features not met by the combination of Guang, Wilcox, Leong and Chen. Specifically, Applicant's independent claim 33 recites the feature of "forming a freely extending end portion at one end along a longitudinal direction of the glass tube, the freely extending end portion directly soldered to the power supply." This feature is not met by the combination of Guang, Wilcox, Leong and Chen.

For at least this reason, the combination of Guang, Wilcox, Leong and Chen does not meet the features of the claimed invention. Accordingly, Applicant respectfully requests that the rejection of independent claim 33 under §103 be withdrawn.

Dependent Claim 34

Claim 34 depends from independent claim 33 and is distinguishable from the combination of Guang, Wilcox, Leong and Chen by virtue of its dependency from claim 33. Accordingly, Applicant respectfully requests that the rejection of claim 34 under §103 be withdrawn for at least this reason.

Rejection of Claims 11 and 12 under Guang in view of Wilcox and further in view of Leong

Independent Claim 11

Claim 11 recites:

An LED tube lamp, comprising:
a glass tube comprising an inner surface and an outer surface, at least part of the inner surface of the glass tube has a rough surface, the glass tube having two end portions;
a plurality of LED light sources;
two end caps respectively sleeving the two end portions of the glass tube;
a power supply in one of the end caps or separately in both of the end caps; and
an LED light strip on the inner surface of the glass tube forming a freely extending end portion at one end along a longitudinal direction of the glass tube, the freely extending end portion directly soldered to the power supply, the plurality of LED light sources being on the LED light strip.

Notwithstanding the Examiner's rejection, Applicant's claimed invention recites features not met by the combination of Guang, Wilcox and Leong. Specifically, Applicant's independent claim 11 recites the feature of "forming a freely extending end portion at one end along a longitudinal direction of the glass tube, the freely extending end portion directly soldered to the power supply." This feature is not met by the combination of Guang, Wilcox, Leong and Chen.

For at least this reason, the combination of Guang, Wilcox and Leong does not meet the features of the claimed invention. Accordingly, Applicant respectfully requests that the rejection of independent claim 11 under §103 be withdrawn.

Dependent Claim 12

Claim 12 recites:

The LED tube lamp according to claim 11, wherein the roughness of the rough surface is substantially from 0.1 to 40 μm .

In the rejection on page 8 of the Office Action, the Examiner asserts:

Claim 12, Guang, Wilcox, and Leong fails to disclose wherein the roughness of the rough surface is substantially from 0.1 to 40 μm . It would have been obvious to one having ordinary skill in the art at the time the effective filing date of the invention was made to provide a roughness of the rough surface substantially from 0.1 to 40 μm , since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art.

Claim 12 recites “the roughness of the rough surface is substantially from 0.1 to 40 μm .” The Examiner considers that this feature is routine optimization. The Applicant respectfully disagrees.

In accordance with *In re: Stepan Company* (Appeal no. 2016-1811) decided on August 25, 2017 by Court of Appeal Federal Circuit, it rules “[A]n obviousness determination requires finding both “that a skilled artisan would have been *motivated* to combine the teachings of the prior art . . . and that the skilled artisan would *have had a reasonable expectation of success* in doing so.” *Intelligent Bio-Sys., Inc. v. Illumina Cambridge Ltd.*, 821 F.3d 1359, 1367–68 (Fed. Cir. 2016)),” “whether a rejection is based on combining disclosures from multiple references, combining multiple embodiments from a single reference, or selecting from large lists of elements in a single reference, there must be a motivation to make the combination and a reasonable expectation that such a combination would be successful, otherwise a skilled artisan would not arrive at the claimed combination,” and “to have a reasonable expectation of success, one must be motivated to do more than merely to vary all parameters or try each of numerous possible choices until one possibly arrived at a successful result.” (*Emphasis added*)

In claim 12, there is no motivation to combine Guang, Wilcox, and Leong, nor any reasonable expectation of success. Therefore, claim 12 is not obvious over Guang in view of Wilcox, and Leong.

Additionally, claim 12 depends from independent claim 11 and is distinguishable from the combination of Guang, Wilcox and Leong by virtue of its dependency from claim 11. Accordingly, Applicant respectfully requests that the rejection of claim 12 under §103 be withdrawn for at least this reason.

For all these reasons, the combination of Guang, Wilcox and Leong does not meet the features of the claimed invention. Accordingly, Applicant respectfully requests that the rejection of claim 12 under §103 be withdrawn.

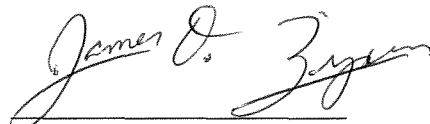
Newly Added Claims 35-52

Claims 35-52 are newly added claims. Claims 35-52 are dependent claims, with claims 35 and 36 depending from distinguishable independent claim 1, claims 37 and 38 depending from distinguishable independent claim 11, claims 39-47 depending from distinguishable independent claim 22 and claims 48-52 depending from distinguishable independent claim 33. By virtue of their dependencies, claims 35-52 are also distinguishable, and hence are allowable. Claims 35-52 also include allowable subject matter in their own merits.

CONCLUSION

In view of the foregoing amendments and remarks, Applicant submits that all of the claims are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue. Further, any amendments to the claims which have been made in this response and which have not been specifically noted to overcome a rejection based upon the prior art, should be considered to have been made for a purpose unrelated to patentability, and no estoppel should be deemed to attach thereto. The Examiner is invited to contact the undersigned at the telephone number listed below, if needed. Applicant hereby makes a written conditional petition for extension of time, if required. Please charge any deficiencies in fees and credit any overpayment of fees to Attorney's Deposit Account No. 50-2478.

Respectfully submitted,



James O. Zigouris
Registration No. 71,402 ←

Andrew M. Calderon
Registration No. 38,093

Roberts Mlotkowski Safran Cole & Calderon PC
P.O. Box 10064
McLean, VA 22102
Phone: 703.584.8023
Fax: 703.848.2981

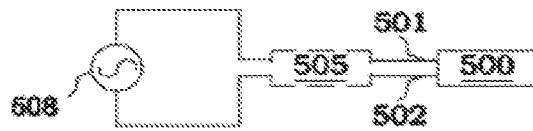


Fig. 17A

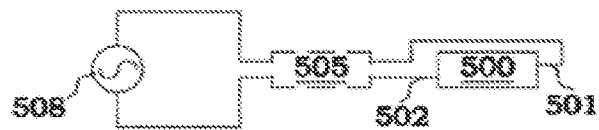


Fig. 17B

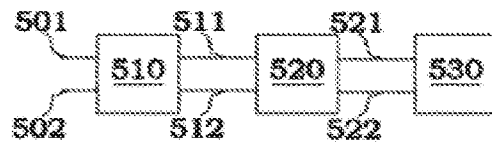


Fig. 17C

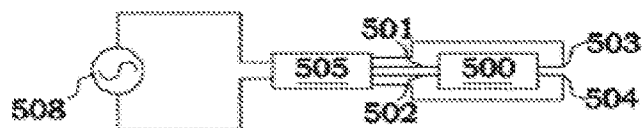


Fig. 17D

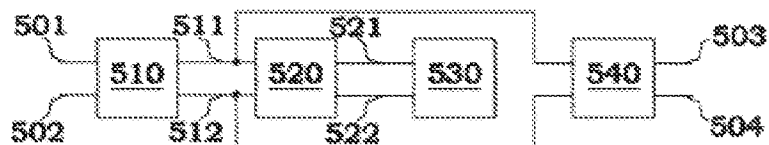


Fig. 17E

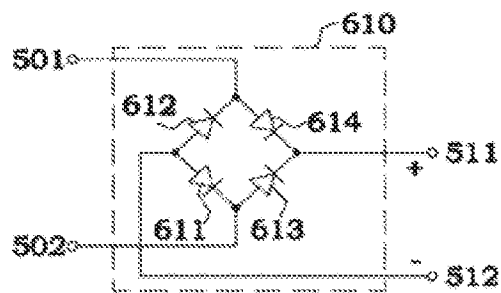


Fig. 18A

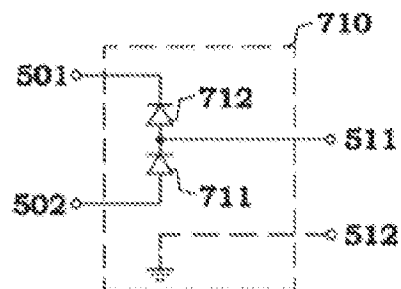


Fig. 18B

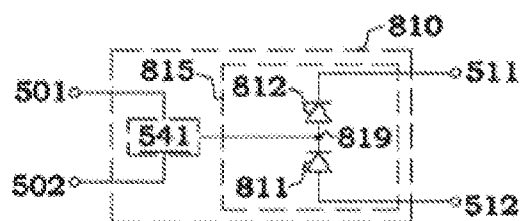


Fig. 18C

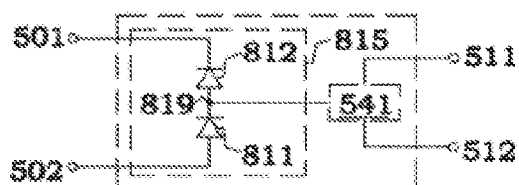


Fig. 18D

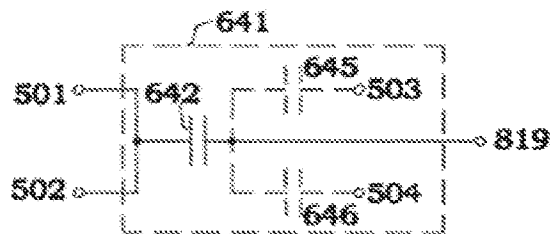


Fig. 19A

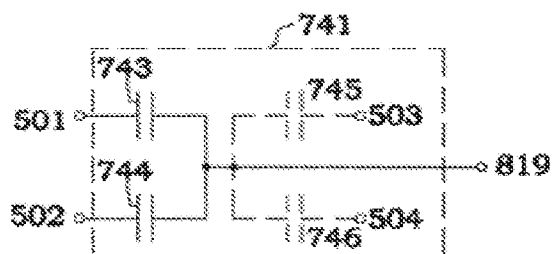


Fig. 19B

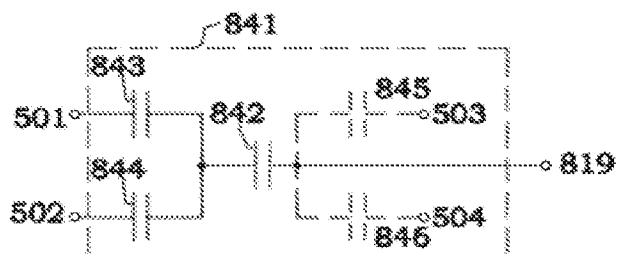


Fig. 19C

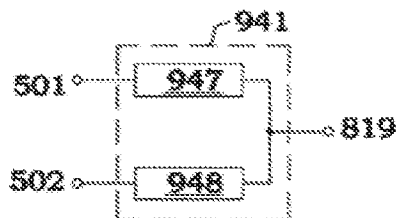


Fig. 19D

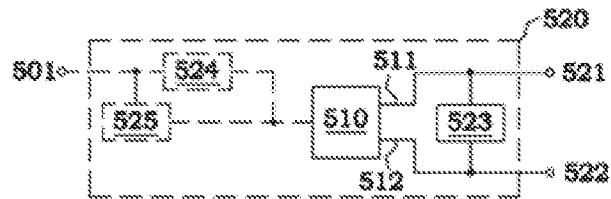


Fig. 20A

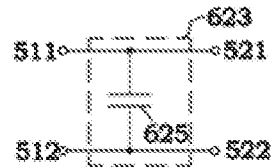


Fig. 20B

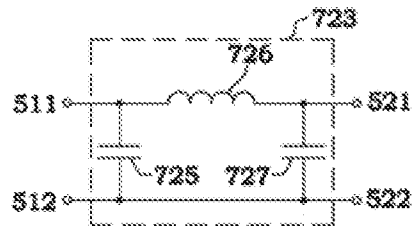


Fig. 20C

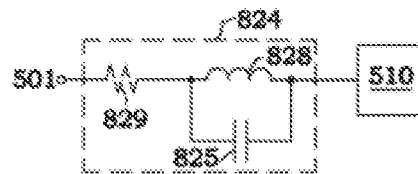


Fig. 20D

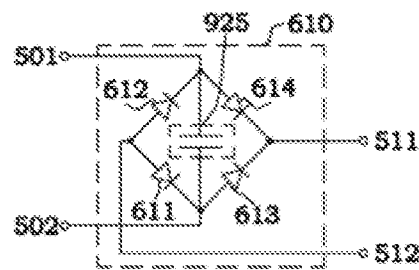


Fig. 20E

LED TUBE LAMP

Cross-Reference to Related Applications

This application is continuation application of U.S. application no. 15/211,717 filed on July 15, 2016 which is a continuation-in-part application claiming benefits of U.S. Application no. 14/865,387 filed on 2015/9/25, U.S. Application no. 15/056,121 filed on 2016/2/29, and U.S. Application no. 15/168,962 filed on 2016/5/31, the disclosures of which are incorporated herein in their entirety by reference.

Technical Field

[0001] The instant disclosure relates to illumination devices, and, more particularly, to an LED tube lamp and components thereof comprising the LED light sources, a tube, electronic components, and end caps.

Related Art

[0002] LED lighting technology is rapidly developing to replace traditional incandescent and fluorescent lightings. LED tube lamps are mercury-free in comparison with fluorescent tube lamps that need to be filled with inert air and mercury. Thus, it is not surprising that LED tube lamps are becoming a highly desired illumination option among different available lighting systems used in homes and workplaces, which used to be dominated by traditional lighting options such as compact fluorescent light bulbs (CFLs) and fluorescent tube lamps. Benefits of LED tube lamps include improved durability and longevity and far less energy consumption; therefore, when taking into account all factors, they would typically be considered as a cost effective lighting option.

[0003] The basic structure of the traditional LED tube lamps include a tube, two end caps at two ends of the tube, a substrate inside the tube, LEDs on the substrate, and a power supply inside the end caps. The substrate disposed inside the tube and

having LEDs mounted on is rigid and straight printed circuit board, which makes the tube remain a straight appearance even it is partially ruptured or broken. As a result, user cannot easily aware that the tube is damaged and might be exposed to a dangerous situation.

5 [0004] In addition, the rigid substrate of the traditional LED tube lamp is typically electrically connected with the end caps by way of wire bonding, in which the wires may be easily damaged and even broken due to any move during manufacturing, transportation, and usage of the LED tube lamp and therefore may disable the LED tube lamp.

10 [0005] As the development of LED chips, electro-optical conversion efficiency becomes higher and heat generated from the conversion becomes less. Accordingly, apparatuses utilizing LED chips seldom use ventilating holes to dissipating the heat.

[0006] Further, the tube and the end caps of the traditional LED tube lamp are often secured together by tight fit, making the reliability cannot be further improved.

15 **SUMMARY**

[0007] To address the above issue, the instant disclosure provides embodiments of an LED tube lamp.

[0008] According to an embodiment, an LED tube lamp includes a glass tube having two end portions, a plurality of LED light sources, two end caps respectively sleeve the two end portions of the glass tube, a power supply in one of the end caps or separately in both of the end caps, and an LED light strip on an inner surface of the glass tube. The glass tube is covered by a heat shrink sleeve. The glass tube and the end cap are secured by a hot melt adhesive. The plurality of LED light sources is on the LED light strip. Each of the end caps comprises an electrically insulating tube,
20 two conductive pins on the electrically insulating tube; and at least two
25

heat-dissipating openings on the electrically insulating tube symmetric to each other with respect to a plane passing through the middle of a line connecting the two conductive pins and perpendicular to the line connecting the two conductive pins.

[0009] According to an embodiment, the hot melt adhesive is, respectively,
5 disposed on the outer surface of the end portions and the shape of the disposed hot melt adhesive is substantially a circle from the side view of the glass tube.

[0010] According to an embodiment, the at least two heat-dissipating openings are on a surface of the electrically insulating tube on which the two conductive pins are disposed.

10 [0011] According to an embodiment, the at least two heat-dissipating openings are separately in a shape of an arc.

[0012] According to an embodiment, the at least two heat-dissipating openings are in a shape of arcs with different sizes.

[0013] According to an embodiment, the sizes of the arcs of the at least two
15 heat-dissipating openings gradually vary.

[0014] According to an embodiment, the heat shrink sleeve is substantially transparent with respect to the wavelength of light from the LED light sources.

[0015] According to an embodiment, at least a part of the openings are arranged along an arc and spaced apart from each other.

20 [0016] According to an embodiment, the heat and pressure inside the end cap increase during the heating and solidification of the hot melt adhesive, and are then released through at least one opening on the end cap.

[0017] According to an embodiment, an LED tube lamp includes a glass tube having an inner surface and an outer surface, a plurality of LED light sources, two end
25 caps respectively at two opposite ends of the glass tube, a power supply in one of the

end caps or separately in both of the end caps, and an LED light strip on the inner surface of the glass tube. The plurality of LED light sources is on the LED light strip. Each of the end caps comprises a plurality of openings formed thereon. The plurality of openings dissipating heat resulted from the power supply are divided into two sets.

- 5 The two sets of the plurality of openings are symmetric to each other with respect to a virtual central axis of the end cap. At least part of the inner surface of the glass tube is formed with a rough surface.

[0018] According to an embodiment, the LED tube lamp comprises a hot melt adhesive. The end cap is adhered to one end of the glass tube via the hot melt
10 adhesive.

[0019] According to another embodiment, the plurality of openings dissipate heat resulted from the power supply.

[0020] According to another embodiment, the hot melt adhesive is heated to be expansive and flowing during a process of having the glass tube and the end cap
15 adhered. The plurality of openings dissipate heat to have the hot melt adhesive cooled and solidified.

[0021] According to another embodiment, an LED tube lamp includes a glass tube, a plurality of LED light sources, two end caps respectively at two opposite ends of the glass tube, a power supply in one of the end caps or separately in both of the end caps,
20 and an LED light strip in the glass tube. The plurality of LED light sources is on the LED light strip. Each of the end caps comprises two conductive pins and a plurality of heat-dissipating openings. The two conductive pins are on a surface of the end cap. The plurality of heat-dissipating openings is on the surface of the end cap and divided into two sets. The two sets of the heat-dissipating openings are symmetric to each
25 other with respect to a plane passing through the two conductive pins.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] FIG. 1 illustrates a perspective view of an LED tube lamp according to an embodiment of the instant disclosure;

FIG. 2 illustrates an exploded view of an LED tube lamp according to an
5 embodiment of the instant disclosure;

FIG. 3 illustrates a part of cross section of FIG. 2 along line A-A';

FIG. 4 illustrates a part of cross section of FIG. 2 along line B-B';

FIG. 5 illustrates an exploded view of an LED tube lamp including two parts
of a power supply according to an embodiment of the instant disclosure;

10 FIG. 6 illustrates an exploded view of an LED tube lamp including a heat
shrink sleeve according to an embodiment of the instant disclosure;

FIG. 7 illustrates a partial view of a bendable circuit sheet of an LED light
strip and a power supply apart from each other according to an embodiment of the
instant disclosure;

15 FIG. 8 illustrates a partial view of the bendable circuit sheet of the LED
light strip and the power supply soldered to each other according to an embodiment of
the instant disclosure;

FIGS. 9 to 11 illustrate a soldering process of the bendable circuit sheet of
the LED light strip and the power supply according to an embodiment of the instant
20 disclosure;

FIGS. 12 and 13 illustrate a bendable circuit sheet of an LED light strip and
a power supply electrically connected to each other by a pair of jack/plug connectors
according to an embodiment of the instant disclosure;

FIG. 14 is a perspective view schematically illustrating an LED tube lamp
25 according to an embodiment of the instant disclosure;

FIG. 15 an exemplary exploded view schematically illustrating the LED tube lamp shown in Fig. 14; and

FIG. 16 is a perspective view schematically illustrating front and top of an end cap of the LED tube lamp according to one embodiment of the instant disclosure; and

5

FIG. 17A is a block diagram of an exemplary power supply module 400 in an LED tube lamp according to some embodiments of the present invention;

FIG. 17B is a block diagram of an exemplary power supply module 400 in an LED tube lamp according to some embodiments of the present invention;

10 FIG. 17C is a block diagram of an exemplary LED lamp according to some embodiments of the present invention;

FIG. 17D is a block diagram of an exemplary power supply module 400 in an LED tube lamp according to some embodiments of the present invention;

15 FIG. 17E is a block diagram of an LED lamp according to some embodiments of the present invention;

FIG. 18A is a schematic diagram of a rectifying circuit according to some embodiments of the present invention;

FIG. 18B is a schematic diagram of a rectifying circuit according to some embodiments of the present invention;

20 FIG. 18C is a schematic diagram of a rectifying circuit according to some embodiments of the present invention;

FIG. 18D is a schematic diagram of a rectifying circuit according to some embodiments of the present invention;

25 FIG. 19A is a schematic diagram of a terminal adapter circuit according to some embodiments of the present invention;

FIG. 19B is a schematic diagram of a terminal adapter circuit according to some embodiments of the present invention;

FIG. 19C is a schematic diagram of a terminal adapter circuit according to some embodiments of the present invention;

5 FIG. 19D is a schematic diagram of a terminal adapter circuit according to some embodiments of the present invention;

FIG. 20A is a block diagram of a filtering circuit according to some embodiments of the present invention;

10 FIG. 20B is a schematic diagram of a filtering unit according to some embodiments of the present invention;

FIG. 20C is a schematic diagram of a filtering unit according to some embodiments of the present invention;

FIG. 20D is a schematic diagram of a filtering unit according to some embodiments of the present invention; and

15 FIG. 20E is a schematic diagram of a filtering unit according to some embodiments of the present invention.

DETAILED DESCRIPTION

[0023] The instant disclosure provides an LED tube lamp to solve the
20 abovementioned problems. The instant disclosure will now be described more fully
hereinafter with reference to the accompanying drawings, in which exemplary
embodiments of the disclosure are shown. This disclosure may, however, be embodied
in many different forms and should not be construed as limitation to the embodiments
set forth herein. Rather, these embodiments are provided so that this disclosure will be
25 thorough and complete, and will fully convey the scope of the disclosure to those

skilled in the art. Like reference numerals refer to like elements throughout.

[0024] The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the disclosure. As used herein, the singular forms “a”, “an” and “the” are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms “comprises” and/or “comprising,” or “includes” and/or “including” or “has” and/or “having” when used herein, specify the presence of stated features, regions, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, regions, integers, steps, operations, elements, components, and/or groups thereof.

[0025] It will be understood that the term “and/or” includes any and all combinations of one or more of the associated listed items. It will also be understood that, although the terms first, second, third etc. may be used herein to describe various elements, components, regions, parts and/or sections, these elements, components, regions, parts and/or sections should not be limited by these terms. These terms are only used to distinguish one element, component, region, part or section from another element, component, region, part or section. Thus, a first element, component, region, part or section discussed below could be termed a second element, component, region, part or section without departing from the teachings of the present disclosure.

[0026] The following description with reference to the accompanying drawings is provided to explain the exemplary embodiments of the disclosure. Note that in the case of no conflict, the embodiments of the present disclosure and the features of the embodiments may be arbitrarily combined with each other.

[0027] Referring to FIG. 1, FIG. 2, and FIG. 3, the instant disclosure provides an embodiment of an LED tube lamp 50 including a glass tube 100, an LED light strip

200, two end caps 300, and a power supply 400. The glass tube 100 includes an inner surface 100a and an outer surface 100b. The LED light strip 200 is disposed inside the glass tube 100 and has a bendable circuit sheet 205 mounted on the inner surface 100a of the glass tube 100. The two end caps 300, which can have the same size or have
5 different sizes, are respectively disposed on two ends of the glass tube 100 and secured with the glass tube 100 by a hot melt adhesive. The hot melt adhesive may be disposed around the surrounding surfaces between the glass tube 100 and the end caps 300, respectively. In this embodiment, the end caps 300 sleeve, respectively, two end portions of the glass tube 100 and the hot melt adhesive may be surrounding
10 disposed on the outer surface of the end portions of the glass tube 100. Accordingly, the shape of the disposed hot melt adhesive is substantially a circle from the side view of the glass tube 100 (like the view of FIG. 4). The heat generated during the heating process of the hot melt adhesive will be in a shape of a circle. The degree of vacuum of the glass tube 100 is below 0.001 Pa~ 1 Pa, and reduce the problem of internal
15 damp. After heating up the hot melt adhesive, and upon expansion due to heat absorption, the hot melt adhesive flows, and then solidifies upon cooling, thereby bonding together the end cap 300 to the glass tube 100 (not shown). The volume of the hot melt adhesive may expand to about 1.3 times the original size when heated from room temperature (e.g., between about 15 and 30 degrees Celsius) to about 200
20 to 250 degrees Celsius. The end cap 300 and the end of the glass tube 100 could be secured by using the hot melt adhesive and therefore qualified in a torque test of about 1.5 to about 5 newton-meters (Nt-m) and/or in a bending test of about 5 to about 10 newton-meters (Nt-m). During the heating and solidification of the hot melt adhesive, the heat and pressure inside the end cap increase and are then released through at least
25 one opening on the end cap 300. After the hot melt adhesive hardens, the end cap 300

can be firmly fixed to the glass tube 100. Under the circumstances, the end cap 300 and the glass tube 100 is hard to disassemble unless the hardened hot melt adhesive returns to liquid state by certain process. The design of the LED tube lamp 50 is to take into account both the convenience regarding the assembling process of the LED tube lamp 50 and the robustness regarding the assembled LED tube lamp 50. Several LED light sources 202 are disposed on the bendable circuit sheet 205 of the LED light strip 200, and the power supply 400 is disposed in one of the end caps 300. The LED light sources 202 and the power supply 400 can be electrically connected to each other directly via the bendable circuit sheet 205 of the LED light strip 200. Middle part of the bendable circuit sheet 205 can be mounted on the inner surface 100a of the glass tube 100. Instead, at least one of the two opposite, short edges of the bendable circuit sheet 205 is not mounted on the inner surface 100a of the glass tube 100 and may be formed as a freely extending end portion 210. The freely extending end portions 210 extends outside the glass tube 100 through one of two opposite ends of the glass tube 100 along the axial direction of the glass tube 100. The freely extending end portion 210 can extend into the end caps 300 and can be electrically connected to the power supply 400 directly. The power supply 400 may be in the form of a single integrated unit (e.g., with all components of the power supply 400 are within a body) disposed in an end cap 300 at one end of the glass tube 100. Alternatively, the power supply 400 may be in form of two separate parts (e.g., with the components of the power supply 400 are separated into two pieces) respectively disposed in two end caps 300. The power supply may supply or provide power from external signal(s), such as from an AC power line or from a ballast, to an LED module and the LED light sources. Each of the end caps 300 includes a pair of hollow conductive pins 310 utilized for being connected to an outer electrical power source. When the LED tube

lamp 50 is installed to a lamp base, the hollow conductive pins 310 are plugged into corresponding conductive sockets of the lamp base such that the LED tube lamp 50 can be electrically connected to the lamp base.

[0028] In one embodiment, the LED light strip 200 comprises a bendable circuit sheet 205 which includes a wiring layer and a dielectric layer that are in a stacked arrangement, wherein the wiring layer and the dielectric layer have same area or the wiring layer has a bit less area (not shown) than the dielectric layer. The LED light source 202 is disposed on a surface of the wiring layer away from the dielectric layer. In other words, the dielectric layer is disposed on the wiring layer away from the LED light sources 202. The wiring layer is electrically connected to the power supply 400 to carry direct current (DC) signals. Meanwhile, an adhesive sheet is disposed on a surface of the dielectric layer away from the wiring layer to bond and to fix the dielectric layer to the inner circumferential surface of the glass tube 100. The wiring layer can be a metal layer serving as a power supply layer, or can be bonding wires such as copper wire. In an alternative embodiment, the LED light strip 200 further includes a circuit protection layer (not shown) cover each outer surface of the wiring layer and the dielectric layer. In another alternative embodiment, the dielectric layer can be omitted, in which the wiring layer is directly bonded to the inner circumferential surface of the glass tube 100. The circuit protection layer can be an ink material, possessing functions as solder resist and optical reflectance. Alternatively, the bendable circuit sheet 205 is a one-layered structure which is consist of one wiring layer only, and then the surface of the wiring layer is covered with a circuit protection layer of ink material as mentioned above, wherein an opening is configured over the circuit protection layer to electrically connect the LED light source 202 with the wiring layer. Whether the wiring layer has a one-layered, or

two-layered structure, the circuit protective layer can be adopted. The circuit protection layer can be disposed on the side/surface of the LED light strip 200, such as the same surface of the wiring layer which has the LED light source 202 disposed thereon.

5 [0029] It should be noted that, in the present embodiment, the bendable circuit sheet 205 is a one-layered structure made of just one layer of the wiring layer, or a two-layered structure (made of one layer of the wiring layer and one layer of the dielectric layer), and thus would be more bendable or flexible to curl than the conventional three-layered flexible substrate. As a result, the bendable circuit sheet 10 205 (the LED light strip 200) of the present embodiment can be installed in a glass tube 100 that is of a customized shape or non-linear shape, and the bendable circuit sheet 205 can be mounted touching the sidewall of the glass tube 100. The bendable circuit sheet 205 mounted closely to the inner surface of the tube wall is one preferred configuration, and the fewer number of layers thereof, the better the heat dissipation 15 effect, and the lower the material cost. Of course, the bendable circuit sheet 205 is not limited to being a one-layered or two-layered structure only; in other embodiments, the bendable circuit sheet 205 can include multiple layers of the wiring layers and multiple layers of the dielectric layers, in which the dielectric layers and the wiring layers are sequentially stacked in a staggered manner, respectively, to be disposed on 20 the surface of the one wiring layer that is opposite from the surface of the one wiring layer which has the LED light source 202 disposed thereon.

[0030] In one embodiment, the LED light strip 200 includes a bendable circuit sheet 205 having in sequence a first wiring layer, a dielectric layer, and a second wiring layer (not shown). The thickness of the second wiring layer is greater than that 25 of the first wiring layer, and/or the projected length of the LED light strip 200 is

greater than that of the glass tube 100. The end region of the light strip 200 extending beyond the end portion of the glass tube 100 without disposition of the LED light source 202 is formed with two separate through holes to respectively electrically communicate the first wiring layer and the second wiring layer (not shown). The through holes are not communicated to each other to avoid short.

[0031] In this way, the greater thickness of the second wiring layer allows the second wiring layer to support the first wiring layer and the dielectric layer, and meanwhile allow the LED light strip 200 to be mounted onto the inner circumferential surface without being liable to shift or deform, and thus the yield rate of product can be improved. In addition, the first wiring layer and the second wiring layer are in electrical communication such that the circuit layout of the first wiring layer can be extended downward to the second wiring layer to reach the circuit layout of the entire LED light strip 200. In some circumstances, the first wiring layer connects the anode and the second wiring layer connects the cathode. Moreover, since the land for the circuit layout becomes two-layered, the area of each single layer and therefore the width of the LED light strip 200 can be reduced such that more LED light strips 200 can be put on a production line to increase productivity. Furthermore, the first wiring layer and the second wiring layer of the end region of the LED light strip 200 that extends beyond the end portion of the tube 100 without disposition of the LED light source 202 can be used to accomplish the circuit layout of a power supply 400 so that the power supply 400 can be directly disposed on the bendable circuit sheet 205 of the LED light strip 200.

[0032] In another embodiment, the projected length of the bendable circuit sheet 205 as the LED light strip 200 in a longitudinal projection is larger than the length of the glass tube 100. The LED light source 202 is disposed on the uppermost layer of

the wiring layers, and is electrically connected to the power supply 400 through the (uppermost) wiring layer. Furthermore, the inner peripheral surface of the glass tube 100 or the outer circumferential surface thereof is covered with an adhesive film (not shown), for the sake of isolating the inner content from outside content of the glass tube 100 after the glass tube 100 has been ruptured. The present embodiment has the adhesive film coated on the inner peripheral surface of the glass tube 100 (not shown).

[0033] Moreover, in some embodiments, the projected length of the bendable circuit sheet is greater than the length of the glass tube 100 (not including the length of the two end caps 300 respectively connected to two ends of the glass tube 100), or at least greater than a central portion of the glass tube 100 between two transition regions (e.g., where the circumference of the tube narrows) on either end. In one embodiment, the longitudinally projected length of the bendable circuit sheet as the LED light strip 200 is larger than the length of the glass tube 100.

[0034] As shown in FIG. 3, the glass tube 100 includes a main body region 102, two rear end regions 101, and two two-arc-shaped transition regions 103 narrowed down or tapering smoothly and continuously from the main body region to the rear end regions connecting the main body region 102 and the rear end regions 101. In other words, in the transition regions 103, the glass tube 100 narrows, or tapers to have a smaller diameter when moving along the length of the glass tube 100 from the main body region 102 to the rear end regions 101. The tapering/narrowing may occur in a continuous, smooth manner (e.g., to be a smooth curve without any linear angles). By avoiding angles, in particular any acute angles, the glass tube 100 is less likely to break or crack under pressure. Furthermore, the transition region 103 is formed by two curves at both ends, wherein one curve is toward inside of the glass tube 100 and the other curve is toward outside of the glass tube 100. For example,

one curve closer to the main body region 102 is convex from the perspective of an inside of the glass tube 100 and one curve closer to the rear end region 101 is concave from the perspective of an inside of the glass tube 100. The transition region 103 of the glass tube 100 in one embodiment includes only smooth curves, and does not include any angled surface portions. The outer diameter of the rear end region 101 is smaller than that of the main body region 102. Therefore, a height difference between the rear end region 101 and the main body region 102 is formed to avoid adhesives applied on the rear end region 101 being overflowed onto the main body region 102, and thereby saves manpower for removing the overflowed adhesive and increases productivity.

[0035] In one embodiment, at least part of the inner surface 100a of the glass tube 100 has a rough surface and the roughness of the inner surface 100a is higher than that of the outer surface 100b, such that the light from the LED light sources 202 can be uniformly spread when transmitting through the glass tube 100. Since LED light sources 202 consists of several point light sources (LED dies), each LED light source 202 casts a cone of light, which results in non-uniformity of light output intensity. With the rough surface, the light from LED light sources 202 will be diffused before transmitting through the glass tube 100 and the uniformity of light output is improved thereby. In one embodiment, the roughness of the inner surface 100a may be substantially from 0.1 to 40 μm , the light from LED light sources 202 will be well diffused before entirely transmitting through the glass tube 100 and the uniformity of light output is substantially improved. However, in some embodiments, the inner surface 100a of the glass tube 100 does not have the roughness surface.

[0036] In one embodiment, as shown in FIG. 4, the rough surface may be formed with a light scattering region 130. Since LED light sources 202 consists of several

point light sources (LED dies), each LED light source 202 casts a cone of light, which results in non-uniformity of light output intensity. With the light scattering region 130, the light from LED light sources 202 will be scattered before entirely transmitting through the glass tube 100 and the uniformity of light output is substantially improved.

[0037] In one embodiment, as shown in FIG. 4, the glass tube 100 may further include a reflective film 120 disposed on a part of the inner surface 100a of the glass tube 100. In some embodiments, the reflective film 120 may be positioned on two sides of the LED light strip 200. As shown in FIG. 4, part of light 209 from LED light sources 202 are reflected by the reflective films 120 such that the light 209 from the LED light sources 202 can be centralized to a determined direction. And, in some embodiment, a ratio of a length of the reflective film 120 disposed on the inner surface 100a of the glass tube 100 extending along the circumferential direction of the glass tube 100 to a circumferential length of the glass tube 100 may be about 0.3 to 0.5, which means about 30% to 50% of the inner surface area may be covered by the reflective film 120. The reflective film 120 may be made of PET with some refractive materials such as strontium phosphate or barium sulfate or any combination thereof, with a thickness between about 140 μm and about 350 μm or between about 150 μm and about 220 μm for a more preferred effect in some embodiments. In some embodiments, only the part of the inner surface 100a which is not covered by the reflective film 120 is formed with the light scattering region 130 as shown in FIG. 4. In other words, the reflective film 120 is disposed on a part of the inner surface 100a of the glass tube 100 which is not formed with the rough surface or the light scattering region 130.

[0038] In one embodiment, as shown in FIG. 5, two opposite, short edges of the

bendable circuit sheet 205 may be formed as two freely extending end portions 210, and two parts of a power supply 400 are respectively disposed in the two end caps 300. The two freely extending end portions 210 respectively extends outside the glass tube 100 through two opposite ends of the glass tube 100 along the axial direction of the glass tube 100, such that can respectively extend into the two end caps 300 and be respectively electrically connected to the two parts of a power supply 400 directly.

[0039] Referring to FIG. 6, the LED tube lamp 50 may have a heat shrink sleeve 190 covering on the outer surface 100b of the glass tube 100. In some embodiments, the heat shrink sleeve 190 may have a thickness ranging between 20 μm and 200 μm and is substantially transparent with respect to the wavelength of light from the LED light sources 202. In some embodiments, the heat shrink sleeve 190 may be made of PFA (perfluoroalkoxy) or PTFE (polytetrafluoroethylene). The heat shrink sleeve 190 may be slightly larger than the glass tube 100, and may be shrunk and tightly cover the outer surface 100b of the glass tube 100 while being heated to an appropriate temperature (ex, 260°C for PFA and PTFE).

[0040] Referring to FIG. 7 to FIG. 11, FIG. 7 and FIG. 8 are respectively partial views of the bendable circuit sheet 205 of the LED light strip 200 and the printed circuit board 420 of the power supply 400 apart from and soldered to each other. FIG. 9 to FIG. 11 illustrate a soldering process of the bendable circuit sheet 205 of the LED light strip 200 and the printed circuit board 420 of the power supply 400. In the embodiment, the bendable circuit sheet 205 of the LED light strip 200 and the freely extending end portions 210 have the same structure. In some embodiments, the power supply 400 includes at least one electronic component 430 disposed on one side of the printed circuit board 420, and the freely extending end portion 210 is electrically connected to the printed circuit board 420 directly through the other side which has no

electronic component 430 disposed thereon. The freely extending end portions 210 are the portions of two opposite ends of the bendable circuit sheet 205 of the LED light strip 200 and are utilized for being connected to the printed circuit board 420 of the power supply 400. The LED light strip 200 and the power supply 400 can be

5 electrically connected to each other by soldering. Two opposite ends of the bendable circuit sheet 205 of the LED light strip 200 are utilized for being respectively soldered directly to the printed circuit board 420 of the two parts of a power supply 400. In other embodiments, only one end of the bendable circuit sheet 205 of the LED light strip 200 is soldered directly to the printed circuit board 420 of the power supply 400.

10 The bendable circuit sheet 205 of the LED light strip 200 includes a circuit layer 200a and a circuit protecting layer 200c over a side of the circuit layer 200a. Moreover, the bendable circuit sheet 205 of the LED light strip 200 includes two opposite surfaces which are a first surface 2001 and a second surface 2002. The first surface 2001 is the one on the circuit layer 200a and away from the circuit protecting layer 200c. The

15 second surface 2002 is the other one on the circuit protecting layer 200c and away from the circuit layer 200a. Several LED light sources 202 are disposed on the first surface 2001 and are electrically connected to circuits of the circuit layer 200a. The circuit protecting layer 200c has less electrical and thermal conductivity but being beneficial to protect the circuits. The first surface 2001 of the bendable circuit sheet

20 205 of the LED light strip 200 includes soldering pads "b". Soldering material "g" can be placed on the soldering pads "b". In the embodiment, the LED light strip 200 further includes a notch "f". The notch "f" is disposed on an edge of the end of the bendable circuit sheet 205 of the LED light strip 200 soldered directly to the printed circuit board 420 of the power supply 400. The printed circuit board 420 includes a

25 power circuit layer 420a and soldering pads "a". Moreover, the printed circuit board

420 includes two opposite surfaces which are a first surface 421 and a second surface 422. The second surface 422 is the one on the power circuit layer 420a. The soldering pads “a” are respectively disposed on the first surface 421 and the second surface 422. The soldering pads “a” on the first surface 421 are corresponding to those on the
5 second surface 422. Soldering material “g” can be placed on the soldering pad “a”. In the embodiment, considering the stability of soldering and the optimization of automatic process, the bendable circuit sheet 205 of LED light strip 200 is disposed below the printed circuit board 420 (the direction is referred to FIG. 9). That is to say, the first surface 2001 of the bendable circuit sheet 205 of the LED light strip 200 is
10 connected to the second surface 422 of the printed circuit board 420 of the power supply 400.

[0041] As shown in FIG. 10 and FIG. 11, in the soldering process of the bendable circuit sheet 205 of the LED light strip 200 and the printed circuit board 420 of the power supply 400, the circuit protecting layer 200c of the bendable circuit sheet 205
15 of the LED light strip 200 is placed on a supporting table 52 (i.e., the second surface 2002 of the bendable circuit sheet 205 of the LED light strip 200 contacts the supporting table 52) in advance. The soldering pads “a” on the second surface 422 of the printed circuit board 420 of the power supply 400 directly sufficiently contact the soldering pads “b” on the first surface 2001 of the bendable circuit sheet 205 of the
20 LED light strip 200. A thermo-compression heating head 51 presses on a portion where the bendable circuit sheet 205 of the LED light strip 200 and the printed circuit board 420 of the power supply 400 are soldered to each other. When soldering, the soldering pads “b” on the first surface 2001 of the bendable circuit sheet 205 of the LED light strip 200 contact the soldering pads “a” on the second surface 422 of the
25 printed circuit board 420 of the power supply 400, and the soldering pads “a” on the

first surface 421 of the printed circuit board 420 of the power supply 400 contact the thermo-compression heating head 51. Under the circumstances, the heat from the soldering thermo-compression heating head 51 can directly transmit through the soldering pads “a” on the first surface 421 of the printed circuit board 420 of the power supply 400 and the soldering pads “a” on the second surface 422 of the printed circuit board 420 of the power supply 400 to the soldering pads “b” on the first surface 2001 of the bendable circuit sheet 205 of the LED light strip 200. The transmission of the heat between the thermo-compression heating head 51 and the soldering pads “a” and b is not likely to be affected by the circuit protecting layer 200c which has relatively less thermal conductivity, and, consequently, the efficiency and stability regarding the connections and soldering process of the soldering pads “a” and “b” of the printed circuit board 420 of the power supply 400 and the bendable circuit sheet 205 of the LED light strip 200 can be improved. As shown in FIG. 10, the printed circuit board 420 of the power supply 400 and the bendable circuit sheet 205 of the LED light strip 200 are firmly connected to each other by the soldering material “g”. Components between the virtual line M and the virtual line N of FIG. 10 from top to bottom are the soldering pads “a” on the first surface 421 of printed circuit board 420, the printed circuit board 420, the power circuit layer 420a, the soldering pads “a” on the second surface 422 of printed circuit board 420, the soldering pads “b” on the first surface 2001 of the bendable circuit sheet 205 of the LED light strip 200, the circuit layer 200a of the bendable circuit sheet 205 of the LED light strip 200, and the circuit protecting layer 200c of the bendable circuit sheet 205 of the LED light strip 200. The connection of the printed circuit board 420 of the power supply 400 and the bendable circuit sheet 205 of LED light strip 200 are firm and stable.

[0042] In other embodiments, an additional circuit protecting layer can be disposed

over the first surface 2001 of the circuit layer 200a. In other words, the circuit layer 200a is sandwiched between two circuit protecting layers, and therefore the first surface 2001 of the circuit layer 200a can be protected by the circuit protecting layer. A part of the circuit layer 200a (the part having the soldering pads “b”) is exposed for
5 being connected to the soldering pads “a” of the printed circuit board 420 of the power supply 400. Under the circumstances, a part of the bottom of the LED light source 202 contacts the circuit protecting layer on the first surface 2001 of the circuit layer 200a, and the other part of the bottom of the LED light source 202 contacts the circuit layer 200a.

10 [0043] In addition, according to the embodiment shown in FIG. 7 to FIG. 11, the printed circuit board 420 of the power supply 400 further includes through holes “h” passing through the soldering pads “a”. In an automatic soldering process, when the thermo-compression heating head 51 automatically presses the printed circuit board 420 of the power supply 400, the soldering material “g” on the soldering pads “a” can
15 be pushed into the through holes “h” by the thermo-compression heating head 51 accordingly, which fits the needs of automatic process.

[0044] Referring to FIG. 12 and FIG. 13, in some embodiments, the bendable circuit sheet 205 of the LED light strip 200 and the printed circuit board 420 of the power supply 400 are electrically connected to each other by a pair of jack/plug
20 connectors rather than by soldering. As shown in FIG. 12, the freely extending end portion 210 of the bendable circuit sheet 205 of the LED light strip 200 has a first electric connector 2300, and the printed circuit board 420 of the power supply 400 has a second electric connector 4300 which is capable of being connected with the first connector 2300. Since the LED light strip 200 and the power supply 400 are
25 electrically connected to each other by a pair of jack/plug connectors rather than by

soldering, the end cap 300 and the power supply 400 can be replaceable.

[0045] Referring to Figs. 14 and 15, an LED tube lamp of one embodiment of the present invention includes a glass tube 1, an LED light strip 2 disposed inside the glass tube 1, and two end caps 3 respectively disposed at two ends of the glass tube 1.

5 [0046] Referring to Figs. 15 and 16, in one embodiment, the end cap 3 may have openings 304 to dissipate heat generated by the power supply modules inside the end cap 3 so as to prevent a high temperature condition inside the end cap 3 that might reduce reliability. In some embodiments, the openings 304 are in a shape of an arc; especially in a shape of three arcs with different size. In one embodiment, the
10 openings 304 are in a shape of three arcs with gradually varying size. The openings 304 on the end cap 3 can be in any one of the above-mentioned shape or any combination thereof. At least a part of the openings are arranged along an arc and spaced apart from each other.

[0047] Referring to Figs. 16, in one embodiment, each end cap 3 includes an
15 electrically insulating tube 302, a thermal conductive member 303 sleeving over the electrically insulating tube 302, and two hollow conductive pins 301 disposed on the electrically insulating tube 302. The thermal conductive member 303 can be a metal ring that is tubular in shape. According to Fig. 15 and 16, the openings 304 on the electrically insulating tube symmetric to each other with respect to a vertical central
20 plane passing through the middle of a line connecting the two conductive pins 301 and the vertical central plane is perpendicular to the line connecting the two conductive pins 301. The openings 304 are on a surface of the electrically insulating tube 302 on which the two conductive pins 301 are disposed.

[0048] The openings 304 symmetrically disposed on the electrically insulating tube
25 302 is capable of efficiently dissipating heat generated during the heating and

solidification of the hot melt adhesive. Specifically, during heating and solidification of the hot melt adhesive, the hot melt adhesive circularly surrounding the end portions of the glass tube 100 will be heated and generates heat which is circularly surrounding the glass tube 100. Since the holes 304 are symmetrically arranged on the electrically insulating tube 302, the heat could be efficiently dissipated through the opening 304 which is the closest to the heat-generating sources (hot melt adhesive). In addition, the holes 304 may be used to dissipate heat generated by power supply 400 during the use of the LED tube lamp 50. In one embodiment, the components of the power supply 400 may be arranged symmetrically in one of the end caps, separately in both of the end caps, or in the glass tube 100 in accordance with the symmetrical arrangement of the holes 304. Accordingly, the heat generated from the components of the power supply can be dissipated through the hole 301 which is the closest to the component.

[0049] Accordingly, the heat generated from the components of the power supply 400 can be dissipated through the hole 301 which is the closest to the component.

[0050] Next, examples of the circuit design and using of the power supply (module) 400 (or 5 in Fig. 15) are described as follows.

[0051] FIG. 17A is a block diagram of a power supply module or power supply 400 in an LED tube lamp according to an embodiment of the present invention. Referring to FIG. 17A, an AC power supply 508 is used to supply an AC supply signal, and may be an AC powerline with a voltage rating, for example, in 100-277 volts and a frequency rating, for example, of 50 or 60 Hz. A lamp driving circuit 505 receives and then converts the AC supply signal into an AC driving signal as an external driving signal. Lamp driving circuit 505 may be for example an electronic ballast used to convert the AC powerline into a high-frequency high-voltage AC driving signal.

Common types of electronic ballast include instant-start ballast, program-start or

rapid-start ballast, etc., which may all be applicable to the LED tube lamp of the present invention. The voltage of the AC driving signal is likely higher than 300 volts, and is in some embodiments in the range of about 400-700 volts. The frequency of the AC driving signal is likely higher than 10 k Hz, and is in some embodiments in the range of about 20 k-50 k Hz. The LED tube lamp 500 receives an external driving signal and is thus driven to emit light. In one embodiment, the external driving signal comprises the AC driving signal from lamp driving circuit 505. In one embodiment, LED tube lamp 500 is in a driving environment in which it is power-supplied at its one end cap having two conductive pins 501 and 502, which are coupled to lamp driving circuit 505 to receive the AC driving signal. The two conductive pins 501 and 502 may be electrically connected to, either directly or indirectly, the lamp driving circuit 505.

[0052] It is worth noting that lamp driving circuit 505 may be omitted and is therefore depicted by a dotted line. In one embodiment, if lamp driving circuit 505 is omitted, AC power supply 508 is directly connected to pins 501 and 502, which then receive the AC supply signal as an external driving signal.

[0053] In addition to the above use with a single-end power supply, LED tube lamp 500 may instead be used with a dual-end power supply to one pin at each of the two ends of an LED lamp tube. FIG. 17B is a block diagram of a power supply module 400 in an LED tube lamp according to one embodiment of the present invention. Referring to FIG. 17B, compared to that shown in FIG. 17A, pins 501 and 502 are respectively disposed at the two opposite end caps of LED tube lamp 500, forming a single pin at each end of LED tube lamp 500, with other components and their functions being the same as those in FIG. 17A.

[0054] FIG. 17C is a block diagram of an LED lamp according to one embodiment

of the present invention. Referring to FIG. 17C, the power supply module of the LED lamp summarily includes a rectifying circuit 510, a filtering circuit 520, and an LED driving module 530. Rectifying circuit 510 is coupled to pins 501 and 502 to receive and then rectify an external driving signal, so as to output a rectified signal at output terminals 511 and 512. The external driving signal may be the AC driving signal or the AC supply signal described with reference to FIGS. 17A and 17B, or may even be a DC signal, which embodiments do not alter the LED lamp of the present invention. Filtering circuit 520 is coupled to the first rectifying circuit for filtering the rectified signal to produce a filtered signal, as recited in the claims. For instance, filtering circuit 520 is coupled to terminals 511 and 512 to receive and then filter the rectified signal, so as to output a filtered signal at output terminals 521 and 522. LED driving module 530 is coupled to filtering circuit 520, to receive the filtered signal for emitting light. For instance, LED driving module 530 may be a circuit coupled to terminals 521 and 522 to receive the filtered signal and thereby to drive an LED unit (not shown) in LED driving module 530 to emit light. Details of these operations are described in below descriptions of certain embodiments.

[0055] It is worth noting that although there are two output terminals 511 and 512 and two output terminals 521 and 522 in embodiments of these Figs., in practice the number of ports or terminals for coupling between rectifying circuit 510, filtering circuit 520, and LED driving module 530 may be one or more depending on the needs of signal transmission between the circuits or devices.

[0056] In addition, the power supply module of the LED lamp described in FIG. 17C, and embodiments of the power supply module of an LED lamp described below, may each be used in the LED tube lamp 500 in FIGS. 17A and 17B, and may instead be used in any other type of LED lighting structure having two conductive pins used

to conduct power, such as LED light bulbs, personal area lights (PAL), plug-in LED lamps with different types of bases (such as types of PL-S, PL-D, PL-T, PL-L, etc.), etc.

[0057] FIG. 17D is a block diagram of a power supply module 400 in an LED tube lamp according to an embodiment of the present invention. Referring to FIG. 17D, an AC power supply 508 is used to supply an AC supply signal. A lamp driving circuit 505 receives and then converts the AC supply signal into an AC driving signal. An LED tube lamp 500 receives an AC driving signal from lamp driving circuit 505 and is thus driven to emit light. In this embodiment, LED tube lamp 500 is power-supplied at its both end caps respectively having two pins 501 and 502 and two pins 503 and 504, which are coupled to lamp driving circuit 505 to concurrently receive the AC driving signal to drive an LED unit (not shown) in LED tube lamp 500 to emit light. AC power supply 508 may be e.g. the AC powerline, and lamp driving circuit 505 may be a stabilizer or an electronic ballast.

[0058] FIG. 17E is a block diagram of an LED lamp according to an embodiment of the present invention. Referring to FIG. 17E, the power supply module of the LED lamp summarily includes a rectifying circuit 510, a filtering circuit 520, an LED driving module 530, and a filtering circuit 540. Rectifying circuit 510 is coupled to pins 501 and 502 to receive and then rectify an external driving signal conducted by pins 501 and 502. Rectifying circuit 540 is coupled to pins 503 and 504 to receive and then rectify an external driving signal conducted by pins 503 and 504. Therefore, the power supply module of the LED lamp may include two rectifying circuits 510 and 540 configured to output a rectified signal at output terminals 511 and 512. Filtering circuit 520 is coupled to terminals 511 and 512 to receive and then filter the rectified signal, so as to output a filtered signal at output terminals 521 and 522. LED driving

module 530 is coupled to terminals 521 and 522 to receive the filtered signal and thereby to drive an LED unit (not shown) in LED driving module 530 to emit light.

[0059] The power supply module of the LED lamp in this embodiment of FIG. 17E may be used in LED tube lamp 500 with a dual-end power supply in FIG. 17D. It is worth noting that since the power supply module of the LED lamp comprises rectifying circuits 510 and 540, the power supply module of the LED lamp may be used in LED tube lamp 500 with a single-end power supply in FIGS. 17A and 17B, to receive an external driving signal (such as the AC supply signal or the AC driving signal described above). The power supply module of an LED lamp in this embodiment and other embodiments herein may also be used with a DC driving signal.

[0060] FIG. 18A is a schematic diagram of a rectifying circuit according to an embodiment of the present invention. Referring to FIG. 18A, rectifying circuit 610 includes rectifying diodes 611, 612, 613, and 614, configured to full-wave rectify a received signal. Diode 611 has an anode connected to output terminal 512, and a cathode connected to pin 502. Diode 612 has an anode connected to output terminal 512, and a cathode connected to pin 501. Diode 613 has an anode connected to pin 502, and a cathode connected to output terminal 511. Diode 614 has an anode connected to pin 501, and a cathode connected to output terminal 511.

[0061] When pins 501 and 502 receive an AC signal, rectifying circuit 610 operates as follows. During the connected AC signal's positive half cycle, the AC signal is input through pin 501, diode 614, and output terminal 511 in sequence, and later output through output terminal 512, diode 611, and pin 502 in sequence. During the connected AC signal's negative half cycle, the AC signal is input through pin 502, diode 613, and output terminal 511 in sequence, and later output through output

terminal 512, diode 612, and pin 501 in sequence. Therefore, during the connected AC signal's full cycle, the positive pole of the rectified signal produced by rectifying circuit 610 remains at output terminal 511, and the negative pole of the rectified signal remains at output terminal 512. Accordingly, the rectified signal produced or output by rectifying circuit 610 is a full-wave rectified signal.

[0062] When pins 501 and 502 are coupled to a DC power supply to receive a DC signal, rectifying circuit 610 operates as follows. When pin 501 is coupled to the anode of the DC supply and pin 502 to the cathode of the DC supply, the DC signal is input through pin 501, diode 614, and output terminal 511 in sequence, and later output through output terminal 512, diode 611, and pin 502 in sequence. When pin 501 is coupled to the cathode of the DC supply and pin 502 to the anode of the DC supply, the DC signal is input through pin 502, diode 613, and output terminal 511 in sequence, and later output through output terminal 512, diode 612, and pin 501 in sequence. Therefore, no matter what the electrical polarity of the DC signal is between pins 501 and 502, the positive pole of the rectified signal produced by rectifying circuit 610 remains at output terminal 511, and the negative pole of the rectified signal remains at output terminal 512.

[0063] Therefore, rectifying circuit 610 in this embodiment can output or produce a proper rectified signal regardless of whether the received input signal is an AC or DC signal.

[0064] FIG. 18B is a schematic diagram of a rectifying circuit according to an embodiment of the present invention. Referring to FIG. 18B, rectifying circuit 710 includes rectifying diodes 711 and 712, configured to half-wave rectify a received signal. Diode 711 has an anode connected to pin 502, and a cathode connected to output terminal 511. Diode 712 has an anode connected to output terminal 511, and a

cathode connected to pin 501. Output terminal 512 may be omitted or grounded depending on actual applications.

[0065] Next, exemplary operation(s) of rectifying circuit 710 is described as follows.

5 [0066] In one embodiment, during a received AC signal's positive half cycle, the electrical potential at pin 501 is higher than that at pin 502, so diodes 711 and 712 are both in a cutoff state as being reverse-biased, making rectifying circuit 710 not outputting a rectified signal. During a received AC signal's negative half cycle, the electrical potential at pin 501 is lower than that at pin 502, so diodes 711 and 712 are
10 both in a conducting state as being forward-biased, allowing the AC signal to be input through diode 711 and output terminal 511, and later output through output terminal 512, a ground terminal, or another end of the LED tube lamp not directly connected to rectifying circuit 710. Accordingly, the rectified signal produced or output by rectifying circuit 710 is a half-wave rectified signal.

15 [0067] FIG. 18C is a schematic diagram of a rectifying circuit according to an embodiment of the present invention. Referring to FIG. 18C, rectifying circuit 810 includes a rectifying unit 815 and a terminal adapter circuit 541. In this embodiment, rectifying unit 815 comprises a half-wave rectifier circuit including diodes 811 and 812 and configured to half-wave rectify. Diode 811 has an anode connected to an
20 output terminal 512, and a cathode connected to a half-wave node 819. Diode 812 has an anode connected to half-wave node 819, and a cathode connected to an output terminal 511. Terminal adapter circuit 541 is coupled to half-wave node 819 and pins 501 and 502, to transmit a signal received at pin 501 and/or pin 502 to half-wave node 819. By means of the terminal adapting function of terminal adapter circuit 541,
25 rectifying circuit 810 allows of two input terminals (connected to pins 501 and 502)

and two output terminals 511 and 512.

[0068] Next, in certain embodiments, rectifying circuit 810 operates as follows.

[0069] During a received AC signal's positive half cycle, the AC signal may be input through pin 501 or 502, terminal adapter circuit 541, half-wave node 819, diode 812, and output terminal 511 in sequence, and later output through another end or circuit of the LED tube lamp. During a received AC signal's negative half cycle, the AC signal may be input through another end or circuit of the LED tube lamp, and later output through output terminal 512, diode 811, half-wave node 819, terminal adapter circuit 541, and pin 501 or 502 in sequence.

[0070] It's worth noting that terminal adapter circuit 541 may comprise a resistor, a capacitor, an inductor, or any combination thereof, for performing functions of voltage/current regulation or limiting, types of protection, current/voltage regulation, etc. Descriptions of these functions are presented below.

[0071] In practice, rectifying unit 815 and terminal adapter circuit 541 may be interchanged in position (as shown in FIG. 18D), without altering the function of half-wave rectification. FIG. 18D is a schematic diagram of a rectifying circuit according to an embodiment of the present invention. Referring to FIG. 18D, diode 811 has an anode connected to pin 502 and diode 812 has a cathode connected to pin 501. A cathode of diode 811 and an anode of diode 812 are connected to half-wave node 819. Terminal adapter circuit 541 is coupled to half-wave node 819 and output terminals 511 and 512. During a received AC signal's positive half cycle, the AC signal may be input through another end or circuit of the LED tube lamp, and later output through output terminal 512 or 512, terminal adapter circuit 541, half-wave node 819, diode 812, and pin 501 in sequence. During a received AC signal's negative half cycle, the AC signal may be input through pin 502, diode 811, half-wave node

819, terminal adapter circuit 541, and output node 511 or 512 in sequence, and later output through another end or circuit of the LED tube lamp.

[0072] It is worth noting that terminal adapter circuit 541 in embodiments shown in FIGS. 18C and 18D may be omitted and is therefore depicted by a dotted line. If

5 terminal adapter circuit 541 of FIG. 18C is omitted, pins 501 and 502 will be coupled to half-wave node 819. If terminal adapter circuit 541 of FIG. 18D is omitted, output terminals 511 and 512 will be coupled to half-wave node 819.

[0073] Rectifying circuit 510 as shown and explained in FIGS. 18A-D can constitute or be the rectifying circuit 540 shown in FIG. 17E, as having pins 503 and
10 504 for conducting instead of pins 501 and 502.

[0074] Next, an explanation follows as to choosing embodiments and their combinations of rectifying circuits 510 and 540, with reference to FIGS. 17C and 17E.

[0075] Rectifying circuit 510 in embodiments shown in FIG. 17C may comprise the
15 rectifying circuit 610 in FIG. 18A.

[0076] Rectifying circuits 510 and 540 in embodiments shown in FIG. 17E may each comprise any one of the rectifying circuits in FIGS. 18A-D, and terminal adapter circuit 541 in FIGS. 18C-D may be omitted without altering the rectification function needed in an LED tube lamp. When rectifying circuits 510 and 540 each comprise a
20 half-wave rectifier circuit described in FIGS. 18B-D, during a received AC signal's positive or negative half cycle, the AC signal may be input from one of rectifying circuits 510 and 540, and later output from the other rectifying circuit 510 or 540. Further, when rectifying circuits 510 and 540 each comprise the rectifying circuit described in FIG. 18C or 18D, or when they comprise the rectifying circuits in FIGS.

25 18C and 18D respectively, only one terminal adapter circuit 541 may be needed for

functions of voltage/current regulation or limiting, types of protection, current/voltage regulation, etc. within rectifying circuits 510 and 540, omitting another terminal adapter circuit 541 within rectifying circuit 510 or 540.

[0077] FIG. 19A is a schematic diagram of the terminal adapter circuit according to

5 an embodiment of the present invention. Referring to FIG. 19A, terminal adapter circuit 641 comprises a capacitor 642 having an end connected to pins 501 and 502, and another end connected to half-wave node 819. Capacitor 642 has an equivalent impedance to an AC signal, which impedance increases as the frequency of the AC signal decreases, and decreases as the frequency increases. Therefore, capacitor 642 in
10 terminal adapter circuit 641 in this embodiment works as a high-pass filter. Further, terminal adapter circuit 641 is connected in series to an LED unit in the LED tube lamp, producing an equivalent impedance of terminal adapter circuit 641 to perform a current/voltage limiting function on the LED unit, thereby preventing damaging of the LED unit by an excessive voltage across and/or current in the LED unit. In addition,
15 choosing the value of capacitor 642 according to the frequency of the AC signal can further enhance voltage/current regulation.

[0078] It's worth noting that terminal adapter circuit 641 may further include a

capacitor 645 and/or capacitor 646. Capacitor 645 has an end connected to half-wave

node 819, and another end connected to pin 503. Capacitor 646 has an end connected

20 to half-wave node 819, and another end connected to pin 504. For example, half-wave

node 819 may be a common connective node between capacitors 645 and 646. And

capacitor 642 acting as a current regulating capacitor is coupled to the common

connective node and pins 501 and 502. In such a structure, series-connected

capacitors 642 and 645 exist between one of pins 501 and 502 and pin 503, and/or

25 series-connected capacitors 642 and 646 exist between one of pins 501 and 502 and

pin 504. Through equivalent impedances of series-connected capacitors, voltages from the AC signal are divided. Referring to FIGS. 17E and 19A, according to ratios between equivalent impedances of the series-connected capacitors, the voltages respectively across capacitor 642 in rectifying circuit 510, filtering circuit 520, and LED driving module 530 can be controlled, making the current flowing through an LED module in LED driving module 530 being limited within a current rating, and then protecting/preventing filtering circuit 520 and LED driving module 530 from being damaged by excessive voltages.

[0079] FIG. 19B is a schematic diagram of the terminal adapter circuit according to an embodiment of the present invention. Referring to FIG. 19B, terminal adapter circuit 741 comprises capacitors 743 and 744. Capacitor 743 has an end connected to pin 501, and another end connected to half-wave node 819. Capacitor 744 has an end connected to pin 502, and another end connected to half-wave node 819. Compared to terminal adapter circuit 641 in FIG. 19A, terminal adapter circuit 741 has capacitors 743 and 744 in place of capacitor 642. Capacitance values of capacitors 743 and 744 may be the same as each other, or may differ from each other depending on the magnitudes of signals to be received at pins 501 and 502.

[0080] Similarly, terminal adapter circuit 741 may further comprise a capacitor 745 and/or a capacitor 746, respectively connected to pins 503 and 504. Thus, each of pins 501 and 502 and each of pins 503 and 504 may be connected in series to a capacitor, to achieve the functions of voltage division and other protections.

[0081] FIG. 19C is a schematic diagram of the terminal adapter circuit according to an embodiment of the present invention. Referring to FIG. 19C, terminal adapter circuit 841 comprises capacitors 842, 843, and 844. Capacitors 842 and 843 are connected in series between pin 501 and half-wave node 819. Capacitors 842 and 844

are connected in series between pin 502 and half-wave node 819. In such a circuit structure, if any one of capacitors 842, 843, and 844 is shorted, there is still at least one capacitor (of the other two capacitors) between pin 501 and half-wave node 819 and between pin 502 and half-wave node 819, which performs a current-limiting function. Therefore, in the event that a user accidentally gets an electric shock, this circuit structure will prevent an excessive current flowing through and then seriously hurting the body of the user.

[0082] Similarly, terminal adapter circuit 841 may further comprise a capacitor 845 and/or a capacitor 846, respectively connected to pins 503 and 504. Thus, each of pins 501 and 502 and each of pins 503 and 504 may be connected in series to a capacitor, to achieve the functions of voltage division and other protections.

[0083] FIG. 19D is a schematic diagram of the terminal adapter circuit according to an embodiment of the present invention. Referring to FIG. 19D, terminal adapter circuit 941 comprises fuses 947 and 948. Fuse 947 has an end connected to pin 501, and another end connected to half-wave node 819. Fuse 948 has an end connected to pin 502, and another end connected to half-wave node 819. With the fuses 947 and 948, when the current through each of pins 501 and 502 exceeds a current rating of a corresponding connected fuse 947 or 948, the corresponding fuse 947 or 948 will accordingly melt and then break the circuit to achieve overcurrent protection.

[0084] Each of the embodiments of the terminal adapter circuits as in rectifying circuits 510 and 810 coupled to pins 501 and 502 and shown and explained above can be used or included in the rectifying circuit 540 shown in FIG. 17E, as when conductive pins 503 and 504 and conductive pins 501 and 502 are interchanged in position.

[0085] Capacitance values of the capacitors in the embodiments of the terminal

adapter circuits shown and described above are in some embodiments in the range, for example, of about 100 pF-100 nF. Also, a capacitor used in embodiments may be equivalently replaced by two or more capacitors connected in series or parallel. For example, each of capacitors 642 and 842 may be replaced by two series-connected
5 capacitors, one having a capacitance value chosen from the range, for example of about 1.0 nF to about 2.5 nF and which may be in some embodiments preferably 1.5 nF, and the other having a capacitance value chosen from the range, for example of about 1.5 nF to about 3.0 nF, and which is in some embodiments about 2.2 nF.

[0086] FIG. 20A is a block diagram of the filtering circuit according to an
10 embodiment of the present invention. Rectifying circuit 510 is shown in FIG. 20A for illustrating its connection with other components, without intending filtering circuit 520 to include rectifying circuit 510. Referring to FIG. 20A, filtering circuit 520 includes a filtering unit 523 coupled to rectifying output terminals 511 and 512 to receive, and to filter out ripples of, a rectified signal from rectifying circuit 510,
15 thereby outputting a filtered signal whose waveform is smoother than the rectified signal. Filtering circuit 520 may further comprise another filtering unit 524 coupled between a rectifying circuit and a pin, which are for example rectifying circuit 510 and pin 501, rectifying circuit 510 and pin 502, rectifying circuit 540 and pin 503, or rectifying circuit 540 and pin 504. Filtering unit 524 is for filtering of a specific
20 frequency, in order to filter out a specific frequency component of an external driving signal. In this embodiment of FIG. 20A, filtering unit 524 is coupled between rectifying circuit 510 and pin 501. Filtering circuit 520 may further comprise another filtering unit 525 coupled between one of pins 501 and 502 and a diode of rectifying circuit 510, or between one of pins 503 and 504 and a diode of rectifying circuit 540,
25 for reducing or filtering out electromagnetic interference (EMI). In this embodiment,

filtering unit 525 is coupled between pin 501 and a diode (not shown in FIG. 20A) of rectifying circuit 510. Since filtering units 524 and 525 may be present or omitted depending on actual circumstances of their uses, they are depicted by a dotted line in FIG. 20A.

5 [0087] FIG. 20B is a schematic diagram of the filtering unit according to an embodiment of the present invention. Referring to FIG. 20B, filtering unit 623 includes a capacitor 625 having an end coupled to output terminal 511 and a filtering output terminal 521 and another end coupled to output terminal 512 and a filtering output terminal 522, and is configured to low-pass filter a rectified signal from output
10 terminals 511 and 512, so as to filter out high-frequency components of the rectified signal and thereby output a filtered signal at output terminals 521 and 522.

[0088] FIG. 20C is a schematic diagram of the filtering unit according to an embodiment of the present invention. Referring to FIG. 20C, filtering unit 723 comprises a pi filter circuit including a capacitor 725, an inductor 726, and a capacitor
15 727. As is well known, a pi filter circuit looks like the symbol π in its shape or structure. Capacitor 725 has an end connected to output terminal 511 and coupled to output terminal 521 through inductor 726, and has another end connected to output terminals 512 and 522. Inductor 726 is coupled between output terminals 511 and 521. Capacitor 727 has an end connected to output terminal 521 and coupled to output
20 terminal 511 through inductor 726, and has another end connected to output terminals 512 and 522.

[0089] As seen between output terminals 511 and 512 and output terminals 521 and 522, filtering unit 723 compared to filtering unit 623 in FIG. 20B additionally has inductor 726 and capacitor 727, which are like capacitor 725 in performing low-pass
25 filtering. Therefore, filtering unit 723 in this embodiment compared to filtering unit

623 in FIG. 20B has a better ability to filter out high-frequency components to output a filtered signal with a smoother waveform.

[0090] Inductance values of inductor 726 in the embodiment described above are chosen in some embodiments in the range of about 10 nH to about 10 mH. And capacitance values of capacitors 625, 725, and 727 in the embodiments described above are chosen in some embodiments in the range, for example, of about 100 pF to about 1 μ F.

[0091] FIG. 20D is a schematic diagram of the filtering unit according to an embodiment of the present invention. Referring to FIG. 20D, filtering unit 824 includes a capacitor 825 and an inductor 828 connected in parallel. Capacitor 825 has an end coupled to pin 501, and another end coupled to rectifying output terminal 511, and is configured to high-pass filter an external driving signal input at pin 501, so as to filter out low-frequency components of the external driving signal. Inductor 828 has an end coupled to pin 501 and another end coupled to rectifying output terminal 511, and is configured to low-pass filter an external driving signal input at pin 501, so as to filter out high-frequency components of the external driving signal. Therefore, the combination of capacitor 825 and inductor 828 works to present high impedance to an external driving signal at one or more specific frequencies. Thus, the parallel-connected capacitor and inductor work to present a peak equivalent impedance to the external driving signal at a specific frequency.

[0092] Through appropriately choosing a capacitance value of capacitor 825 and an inductance value of inductor 828, a center frequency f on the high-impedance band may be set at a specific value given by $f = \frac{1}{2\pi\sqrt{LC}}$, where L denotes inductance of inductor 828 and C denotes capacitance of capacitor 825. The center frequency is in some embodiments in the range of about 20 ~ 30 kHz, and may be preferably about 25 kHz.

And an LED lamp with filtering unit 824 is able to be certified under safety standards, for a specific center frequency, as provided by Underwriters Laboratories (UL).

[0093] It's worth noting that filtering unit 824 may further comprise a resistor 829, coupled between pin 501 and filtering output terminal 511. In FIG. 20D, resistor 829 is connected in series to the parallel-connected capacitor 825 and inductor 828. For example, resistor 829 may be coupled between pin 501 and parallel-connected capacitor 825 and inductor 828, or may be coupled between filtering output terminal 511 and parallel-connected capacitor 825 and inductor 828. In this embodiment, resistor 829 is coupled between pin 501 and parallel-connected capacitor 825 and inductor 828. Further, resistor 829 is configured for adjusting the quality factor (Q) of the LC circuit comprising capacitor 825 and inductor 828, to better adapt filtering unit 824 to application environments with different quality factor requirements. Since resistor 829 is an optional component, it is depicted in a dotted line in FIG. 20D.

[0094] Capacitance values of capacitor 825 are in some embodiments in the range of about 10 nF-2 μ F. Inductance values of inductor 828 are in some embodiments smaller than 2 mH, and may be preferably smaller than 1 mH. Resistance values of resistor 829 are in some embodiments larger than 50 ohms, and are may be preferably larger than 500 ohms.

[0095] Besides the filtering circuits shown and described in the above embodiments, traditional low-pass or band-pass filters can be used as the filtering unit in the filtering circuit in the present invention.

[0096] FIG. 20E is a schematic diagram of the filtering unit according to an embodiment of the present invention. Referring to FIG. 20E, in this embodiment filtering unit 925 is disposed in rectifying circuit 610 as shown in FIG. 18A, and is configured for reducing the EMI (Electromagnetic interference) caused by rectifying

circuit 610 and/or other circuits. In this embodiment, filtering unit 925 includes an EMI-reducing capacitor coupled between pin 501 and the anode of rectifying diode 613, and also between pin 502 and the anode of rectifying diode 614, to reduce the EMI associated with the positive half cycle of the AC driving signal received at pins 501 and 502. The EMI-reducing capacitor of filtering unit 925 is also coupled between pin 501 and the cathode of rectifying diode 611, and between pin 502 and the cathode of rectifying diode 612, to reduce the EMI associated with the negative half cycle of the AC driving signal received at pins 501 and 502. In some embodiments, rectifying circuit 610 comprises a full-wave bridge rectifier circuit including four rectifying diodes 611, 612, 613, and 614. The full-wave bridge rectifier circuit has a first filtering node connecting an anode and a cathode respectively of two diodes 613 and 611 of the four rectifying diodes 611, 612, 613, and 614, and a second filtering node connecting an anode and a cathode respectively of the other two diodes 614 and 612 of the four rectifying diodes 611, 612, 613, and 614. And the EMI-reducing capacitor of the filtering unit 925 is coupled between the first filtering node and the second filtering node.

[0097] Similarly, with reference to FIGS. 18C, and 19A-19C, any capacitor in each of the circuits in FIGS. 19A-19C is coupled between pins 501 and 502 (or pins 503 and 504) and any diode in FIG. 18C, so any or each capacitor in FIGS. 19A-19C can work as an EMI-reducing capacitor to achieve the function of reducing EMI. For example, rectifying circuit 510 in FIGS. 17C and 17E may comprise a half-wave rectifier circuit including two rectifying diodes and having a half-wave node connecting an anode and a cathode respectively of the two rectifying diodes, and any or each capacitor in FIGS. 19A-19C may be coupled between the half-wave node and at least one of the first pin and the second pin. And rectifying circuit 540 in FIG. 17E

may comprise a half-wave rectifier circuit including two rectifying diodes and having a half-wave node connecting an anode and a cathode respectively of the two rectifying diodes, and any or each capacitor in FIGS. 19A-19C may be coupled between the half-wave node and at least one of the third pin and the fourth pin...

5 {0048}{0098} It's worth noting that the EMI-reducing capacitor in the embodiment of FIG. 20E may also act as capacitor 825 in filtering unit 824, so that in combination with inductor 828 the capacitor 825 performs the functions of reducing EMI and presenting high impedance to an external driving signal at specific frequencies. For example, when the rectifying circuit comprises a full-wave bridge rectifier circuit, 10 capacitor 825 of filtering unit 824 may be coupled between the first filtering node and the second filtering node of the full-wave bridge rectifier circuit. When the rectifying circuit comprises a half-wave rectifier circuit, capacitor 825 of filtering unit 824 may be coupled between the half-wave node of the half-wave rectifier circuit and at least one of the first pin and the second pin.

15 {0049}{0099} If any terms in this application conflict with terms used in any application(s) from which this application claims priority, or terms incorporated by reference into this application or the application(s) from which this application claims priority, a construction based on the terms as used or defined in this application should be applied.

20 {0050}{00100} While the instant disclosure related to an LED tube lamp has been described by way of example and in terms of the preferred embodiments, it is to be understood that the instant disclosure needs not be limited to the disclosed embodiments. For anyone skilled in the art, various modifications and improvements within the spirit of the instant disclosure are covered under the scope of the instant 25 disclosure. The covered scope of the instant disclosure is based on the appended

claims.

ABSTRACT

An LED tube lamp includes a glass tube, a plurality of LED light sources, two end caps respectively sleeving two end portions of the glass tube, a power supply in one of the end caps or separately in both of the end caps, and an LED light strip in the glass tube. The plurality of LED light sources is on the LED light strip. Each of the end caps comprises a plurality of openings formed thereon. The plurality of openings dissipating heat resulted from the power supply are divided into two sets. The two sets of the plurality of openings are symmetric to each other with respect to a virtual central axis of the end cap.

LED TUBE LAMP

Cross-Reference to Related Applications

This application is continuation application of U.S. application no. 15/211,717 filed on July 15, 2016 which is a continuation-in-part application claiming benefits of U.S.

5 Application no. 14/865,387 filed on 2015/9/25, U.S. Application no. 15/056,121 filed on 2016/2/29, and U.S. Application no. 15/168,962 filed on 2016/5/31, the disclosures of which are incorporated herein in their entirety by reference.

Technical Field

[0001] The instant disclosure relates to illumination devices, and, more particularly,
10 to an LED tube lamp and components thereof comprising the LED light sources, a tube, electronic components, and end caps.

Related Art

[0002] LED lighting technology is rapidly developing to replace traditional incandescent and fluorescent lightings. LED tube lamps are mercury-free in
15 comparison with fluorescent tube lamps that need to be filled with inert air and mercury. Thus, it is not surprising that LED tube lamps are becoming a highly desired illumination option among different available lighting systems used in homes and workplaces, which used to be dominated by traditional lighting options such as compact fluorescent light bulbs (CFLs) and fluorescent tube lamps. Benefits of LED
20 tube lamps include improved durability and longevity and far less energy consumption; therefore, when taking into account all factors, they would typically be considered as a cost effective lighting option.

[0003] The basic structure of the traditional LED tube lamps include a tube, two end caps at two ends of the tube, a substrate inside the tube, LEDs on the substrate,
25 and a power supply inside the end caps. The substrate disposed inside the tube and

having LEDs mounted on is rigid and straight printed circuit board, which makes the tube remain a straight appearance even it is partially ruptured or broken. As a result, user cannot easily aware that the tube is damaged and might be exposed to a dangerous situation.

5 [0004] In addition, the rigid substrate of the traditional LED tube lamp is typically electrically connected with the end caps by way of wire bonding, in which the wires may be easily damaged and even broken due to any move during manufacturing, transportation, and usage of the LED tube lamp and therefore may disable the LED tube lamp.

10 [0005] As the development of LED chips, electro-optical conversion efficiency becomes higher and heat generated from the conversion becomes less. Accordingly, apparatuses utilizing LED chips seldom use ventilating holes to dissipating the heat.

[0006] Further, the tube and the end caps of the traditional LED tube lamp are often secured together by tight fit, making the reliability cannot be further improved.

15 SUMMARY

[0007] To address the above issue, the instant disclosure provides embodiments of an LED tube lamp.

[0008] According to an embodiment, an LED tube lamp includes a glass tube having two end portions, a plurality of LED light sources, two end caps respectively sleeve the two end portions of the glass tube, a power supply in one of the end caps or separately in both of the end caps, and an LED light strip on an inner surface of the glass tube. The glass tube is covered by a heat shrink sleeve. The glass tube and the end cap are secured by a hot melt adhesive. The plurality of LED light sources is on the LED light strip. Each of the end caps comprises an electrically insulating tube,
20 two conductive pins on the electrically insulating tube; and at least two
25

heat-dissipating openings on the electrically insulating tube symmetric to each other with respect to a plane passing through the middle of a line connecting the two conductive pins and perpendicular to the line connecting the two conductive pins.

[0009] According to an embodiment, the hot melt adhesive is, respectively,
5 disposed on the outer surface of the end portions and the shape of the disposed hot melt adhesive is substantially a circle from the side view of the glass tube.

[0010] According to an embodiment, the at least two heat-dissipating openings are on a surface of the electrically insulating tube on which the two conductive pins are disposed.

10 [0011] According to an embodiment, the at least two heat-dissipating openings are separately in a shape of an arc.

[0012] According to an embodiment, the at least two heat-dissipating openings are in a shape of arcs with different sizes.

[0013] According to an embodiment, the sizes of the arcs of the at least two
15 heat-dissipating openings gradually vary.

[0014] According to an embodiment, the heat shrink sleeve is substantially transparent with respect to the wavelength of light from the LED light sources.

[0015] According to an embodiment, at least a part of the openings are arranged along an arc and spaced apart from each other.

20 [0016] According to an embodiment, the heat and pressure inside the end cap increase during the heating and solidification of the hot melt adhesive, and are then released through at least one opening on the end cap.

[0017] According to an embodiment, an LED tube lamp includes a glass tube having an inner surface and an outer surface, a plurality of LED light sources, two end
25 caps respectively at two opposite ends of the glass tube, a power supply in one of the

end caps or separately in both of the end caps, and an LED light strip on the inner surface of the glass tube. The plurality of LED light sources is on the LED light strip. Each of the end caps comprises a plurality of openings formed thereon. The plurality of openings dissipating heat resulted from the power supply are divided into two sets.

- 5 The two sets of the plurality of openings are symmetric to each other with respect to a virtual central axis of the end cap. At least part of the inner surface of the glass tube is formed with a rough surface.

[0018] According to an embodiment, the LED tube lamp comprises a hot melt adhesive. The end cap is adhered to one end of the glass tube via the hot melt
10 adhesive.

[0019] According to another embodiment, the plurality of openings dissipate heat resulted from the power supply.

[0020] According to another embodiment, the hot melt adhesive is heated to be expansive and flowing during a process of having the glass tube and the end cap
15 adhered. The plurality of openings dissipate heat to have the hot melt adhesive cooled and solidified.

[0021] According to another embodiment, an LED tube lamp includes a glass tube, a plurality of LED light sources, two end caps respectively at two opposite ends of the glass tube, a power supply in one of the end caps or separately in both of the end caps,
20 and an LED light strip in the glass tube. The plurality of LED light sources is on the LED light strip. Each of the end caps comprises two conductive pins and a plurality of heat-dissipating openings. The two conductive pins are on a surface of the end cap. The plurality of heat-dissipating openings is on the surface of the end cap and divided into two sets. The two sets of the heat-dissipating openings are symmetric to each
25 other with respect to a plane passing through the two conductive pins.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] FIG. 1 illustrates a perspective view of an LED tube lamp according to an embodiment of the instant disclosure;

FIG. 2 illustrates an exploded view of an LED tube lamp according to an embodiment of the instant disclosure;

FIG. 3 illustrates a part of cross section of FIG. 2 along line A-A';

FIG. 4 illustrates a part of cross section of FIG. 2 along line B-B';

FIG. 5 illustrates an exploded view of an LED tube lamp including two parts of a power supply according to an embodiment of the instant disclosure;

FIG. 6 illustrates an exploded view of an LED tube lamp including a heat shrink sleeve according to an embodiment of the instant disclosure;

FIG. 7 illustrates a partial view of a bendable circuit sheet of an LED light strip and a power supply apart from each other according to an embodiment of the instant disclosure;

FIG. 8 illustrates a partial view of the bendable circuit sheet of the LED light strip and the power supply soldered to each other according to an embodiment of the instant disclosure;

FIGS. 9 to 11 illustrate a soldering process of the bendable circuit sheet of the LED light strip and the power supply according to an embodiment of the instant disclosure;

FIGS. 12 and 13 illustrate a bendable circuit sheet of an LED light strip and a power supply electrically connected to each other by a pair of jack/plug connectors according to an embodiment of the instant disclosure;

FIG. 14 is a perspective view schematically illustrating an LED tube lamp according to an embodiment of the instant disclosure;

FIG. 15 an exemplary exploded view schematically illustrating the LED tube lamp shown in Fig. 14; [[and]]

FIG. 16 is a perspective view schematically illustrating front and top of an end cap of the LED tube lamp according to one embodiment of the instant
5 disclosure;[.]

FIG. 17A is a block diagram of an exemplary power supply module 400 in an LED tube lamp according to some embodiments of the present invention;

FIG. 17B is a block diagram of an exemplary power supply module 400 in an LED tube lamp according to some embodiments of the present invention;

10 FIG. 17C is a block diagram of an exemplary LED lamp according to some embodiments of the present invention;

FIG. 17D is a block diagram of an exemplary power supply module 400 in an LED tube lamp according to some embodiments of the present invention;

15 FIG. 17E is a block diagram of an LED lamp according to some embodiments of the present invention;

FIG. 18A is a schematic diagram of a rectifying circuit according to some embodiments of the present invention;

FIG. 18B is a schematic diagram of a rectifying circuit according to some embodiments of the present invention;

20 FIG. 18C is a schematic diagram of a rectifying circuit according to some embodiments of the present invention;

FIG. 18D is a schematic diagram of a rectifying circuit according to some embodiments of the present invention;

25 FIG. 19A is a schematic diagram of a terminal adapter circuit according to some embodiments of the present invention;

FIG. 19B is a schematic diagram of a terminal adapter circuit according to some embodiments of the present invention;

FIG. 19C is a schematic diagram of a terminal adapter circuit according to some embodiments of the present invention;

5 FIG. 19D is a schematic diagram of a terminal adapter circuit according to some embodiments of the present invention;

FIG. 20A is a block diagram of a filtering circuit according to some embodiments of the present invention;

10 FIG. 20B is a schematic diagram of a filtering unit according to some embodiments of the present invention;

FIG. 20C is a schematic diagram of a filtering unit according to some embodiments of the present invention;

FIG. 20D is a schematic diagram of a filtering unit according to some embodiments of the present invention; and

15 FIG. 20E is a schematic diagram of a filtering unit according to some embodiments of the present invention.

DETAILED DESCRIPTION

[0023] The instant disclosure provides an LED tube lamp to solve the
20 abovementioned problems. The instant disclosure will now be described more fully hereinafter with reference to the accompanying drawings, in which exemplary embodiments of the disclosure are shown. This disclosure may, however, be embodied in many different forms and should not be construed as limitation to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be
25 thorough and complete, and will fully convey the scope of the disclosure to those

skilled in the art. Like reference numerals refer to like elements throughout.

[0024] The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the disclosure. As used herein, the singular forms “a”, “an” and “the” are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms “comprises” and/or “comprising,” or “includes” and/or “including” or “has” and/or “having” when used herein, specify the presence of stated features, regions, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, regions, integers, steps, operations, elements, components, and/or groups thereof.

[0025] It will be understood that the term “and/or” includes any and all combinations of one or more of the associated listed items. It will also be understood that, although the terms first, second, third etc. may be used herein to describe various elements, components, regions, parts and/or sections, these elements, components, regions, parts and/or sections should not be limited by these terms. These terms are only used to distinguish one element, component, region, part or section from another element, component, region, part or section. Thus, a first element, component, region, part or section discussed below could be termed a second element, component, region, part or section without departing from the teachings of the present disclosure.

[0026] The following description with reference to the accompanying drawings is provided to explain the exemplary embodiments of the disclosure. Note that in the case of no conflict, the embodiments of the present disclosure and the features of the embodiments may be arbitrarily combined with each other.

[0027] Referring to FIG. 1, FIG. 2, and FIG. 3, the instant disclosure provides an embodiment of an LED tube lamp 50 including a glass tube 100, an LED light strip

200, two end caps 300, and a power supply 400. The glass tube 100 includes an inner surface 100a and an outer surface 100b. The LED light strip 200 is disposed inside the glass tube 100 and has a bendable circuit sheet 205 mounted on the inner surface 100a of the glass tube 100. The two end caps 300, which can have the same size or have
5 different sizes, are respectively disposed on two ends of the glass tube 100 and secured with the glass tube 100 by a hot melt adhesive. The hot melt adhesive may be disposed around the surrounding surfaces between the glass tube 100 and the end caps 300, respectively. In this embodiment, the end caps 300 sleeve, respectively, two end portions of the glass tube 100 and the hot melt adhesive may be surrounding
10 disposed on the outer surface of the end portions of the glass tube 100. Accordingly, the shape of the disposed hot melt adhesive is substantially a circle from the side view of the glass tube 100 (like the view of FIG. 4). The heat generated during the heating process of the hot melt adhesive will be in a shape of a circle. The degree of vacuum of the glass tube 100 is below 0.001 Pa~ 1 Pa, and reduce the problem of internal
15 damp. After heating up the hot melt adhesive, and upon expansion due to heat absorption, the hot melt adhesive flows, and then solidifies upon cooling, thereby bonding together the end cap 300 to the glass tube 100 (not shown). The volume of the hot melt adhesive may expand to about 1.3 times the original size when heated from room temperature (e.g., between about 15 and 30 degrees Celsius) to about 200
20 to 250 degrees Celsius. The end cap 300 and the end of the glass tube 100 could be secured by using the hot melt adhesive and therefore qualified in a torque test of about 1.5 to about 5 newton-meters (Nt-m) and/or in a bending test of about 5 to about 10 newton-meters (Nt-m). During the heating and solidification of the hot melt adhesive, the heat and pressure inside the end cap increase and are then released through at least
25 one opening on the end cap 300. After the hot melt adhesive hardens, the end cap 300

can be firmly fixed to the glass tube 100. Under the circumstances, the end cap 300 and the glass tube 100 is hard to disassemble unless the hardened hot melt adhesive returns to liquid state by certain process. The design of the LED tube lamp 50 is to take into account both the convenience regarding the assembling process of the LED tube lamp 50 and the robustness regarding the assembled LED tube lamp 50. Several LED light sources 202 are disposed on the bendable circuit sheet 205 of the LED light strip 200, and the power supply 400 is disposed in one of the end caps 300. The LED light sources 202 and the power supply 400 can be electrically connected to each other directly via the bendable circuit sheet 205 of the LED light strip 200. Middle part of the bendable circuit sheet 205 can be mounted on the inner surface 100a of the glass tube 100. Instead, at least one of the two opposite, short edges of the bendable circuit sheet 205 is not mounted on the inner surface 100a of the glass tube 100 and may be formed as a freely extending end portion 210. The freely extending end portions 210 extends outside the glass tube 100 through one of two opposite ends of the glass tube 100 along the axial direction of the glass tube 100. The freely extending end portion 210 can extend into the end caps 300 and can be electrically connected to the power supply 400 directly. The power supply 400 may be in the form of a single integrated unit (e.g., with all components of the power supply 400 are within a body) disposed in an end cap 300 at one end of the glass tube 100. Alternatively, the power supply 400 may be in form of two separate parts (e.g., with the components of the power supply 400 are separated into two pieces) respectively disposed in two end caps 300. The power supply may supply or provide power from external signal(s), such as from an AC power line or from a ballast, to an LED module and the LED light sources. Each of the end caps 300 includes a pair of hollow conductive pins 310 utilized for being connected to an outer electrical power source. When the LED tube

lamp 50 is installed to a lamp base, the hollow conductive pins 310 are plugged into corresponding conductive sockets of the lamp base such that the LED tube lamp 50 can be electrically connected to the lamp base.

[0028] In one embodiment, the LED light strip 200 comprises a bendable circuit sheet 205 which includes a wiring layer and a dielectric layer that are in a stacked arrangement, wherein the wiring layer and the dielectric layer have same area or the wiring layer has a bit less area (not shown) than the dielectric layer. The LED light source 202 is disposed on a surface of the wiring layer away from the dielectric layer. In other words, the dielectric layer is disposed on the wiring layer away from the LED light sources 202. The wiring layer is electrically connected to the power supply 400 to carry direct current (DC) signals. Meanwhile, an adhesive sheet is disposed on a surface of the dielectric layer away from the wiring layer to bond and to fix the dielectric layer to the inner circumferential surface of the glass tube 100. The wiring layer can be a metal layer serving as a power supply layer, or can be bonding wires such as copper wire. In an alternative embodiment, the LED light strip 200 further includes a circuit protection layer (not shown) cover each outer surface of the wiring layer and the dielectric layer. In another alternative embodiment, the dielectric layer can be omitted, in which the wiring layer is directly bonded to the inner circumferential surface of the glass tube 100. The circuit protection layer can be an ink material, possessing functions as solder resist and optical reflectance. Alternatively, the bendable circuit sheet 205 is a one-layered structure which is consist of one wiring layer only, and then the surface of the wiring layer is covered with a circuit protection layer of ink material as mentioned above, wherein an opening is configured over the circuit protection layer to electrically connect the LED light source 202 with the wiring layer. Whether the wiring layer has a one-layered, or

two-layered structure, the circuit protective layer can be adopted. The circuit protection layer can be disposed on the side/surface of the LED light strip 200, such as the same surface of the wiring layer which has the LED light source 202 disposed thereon.

5 [0029] It should be noted that, in the present embodiment, the bendable circuit sheet 205 is a one-layered structure made of just one layer of the wiring layer, or a two-layered structure (made of one layer of the wiring layer and one layer of the dielectric layer), and thus would be more bendable or flexible to curl than the conventional three-layered flexible substrate. As a result, the bendable circuit
10 205 (the LED light strip 200) of the present embodiment can be installed in a glass tube 100 that is of a customized shape or non-linear shape, and the bendable circuit sheet 205 can be mounted touching the sidewall of the glass tube 100. The bendable circuit sheet 205 mounted closely to the inner surface of the tube wall is one preferred configuration, and the fewer number of layers thereof, the better the heat dissipation
15 effect, and the lower the material cost. Of course, the bendable circuit sheet 205 is not limited to being a one-layered or two-layered structure only; in other embodiments, the bendable circuit sheet 205 can include multiple layers of the wiring layers and multiple layers of the dielectric layers, in which the dielectric layers and the wiring layers are sequentially stacked in a staggered manner, respectively, to be disposed on
20 the surface of the one wiring layer that is opposite from the surface of the one wiring layer which has the LED light source 202 disposed thereon.

[0030] In one embodiment, the LED light strip 200 includes a bendable circuit sheet 205 having in sequence a first wiring layer, a dielectric layer, and a second wiring layer (not shown). The thickness of the second wiring layer is greater than that
25 of the first wiring layer, and/or the projected length of the LED light strip 200 is

greater than that of the glass tube 100. The end region of the light strip 200 extending beyond the end portion of the glass tube 100 without disposition of the LED light source 202 is formed with two separate through holes to respectively electrically communicate the first wiring layer and the second wiring layer (not shown). The through holes are not communicated to each other to avoid short.

[0031] In this way, the greater thickness of the second wiring layer allows the second wiring layer to support the first wiring layer and the dielectric layer, and meanwhile allow the LED light strip 200 to be mounted onto the inner circumferential surface without being liable to shift or deform, and thus the yield rate of product can be improved. In addition, the first wiring layer and the second wiring layer are in electrical communication such that the circuit layout of the first wiring layer can be extended downward to the second wiring layer to reach the circuit layout of the entire LED light strip 200. In some circumstances, the first wiring layer connects the anode and the second wiring layer connects the cathode. Moreover, since the land for the circuit layout becomes two-layered, the area of each single layer and therefore the width of the LED light strip 200 can be reduced such that more LED light strips 200 can be put on a production line to increase productivity. Furthermore, the first wiring layer and the second wiring layer of the end region of the LED light strip 200 that extends beyond the end portion of the tube 100 without disposition of the LED light source 202 can be used to accomplish the circuit layout of a power supply 400 so that the power supply 400 can be directly disposed on the bendable circuit sheet 205 of the LED light strip 200.

[0032] In another embodiment, the projected length of the bendable circuit sheet 205 as the LED light strip 200 in a longitudinal projection is larger than the length of the glass tube 100. The LED light source 202 is disposed on the uppermost layer of

the wiring layers, and is electrically connected to the power supply 400 through the (uppermost) wiring layer. Furthermore, the inner peripheral surface of the glass tube 100 or the outer circumferential surface thereof is covered with an adhesive film (not shown), for the sake of isolating the inner content from outside content of the glass tube 100 after the glass tube 100 has been ruptured. The present embodiment has the adhesive film coated on the inner peripheral surface of the glass tube 100 (not shown).

[0033] Moreover, in some embodiments, the projected length of the bendable circuit sheet is greater than the length of the glass tube 100 (not including the length of the two end caps 300 respectively connected to two ends of the glass tube 100), or at least greater than a central portion of the glass tube 100 between two transition regions (e.g., where the circumference of the tube narrows) on either end. In one embodiment, the longitudinally projected length of the bendable circuit sheet as the LED light strip 200 is larger than the length of the glass tube 100.

[0034] As shown in FIG. 3, the glass tube 100 includes a main body region 102, two rear end regions 101, and two two-arc-shaped transition regions 103 narrowed down or tapering smoothly and continuously from the main body region to the rear end regions connecting the main body region 102 and the rear end regions 101. In other words, in the transition regions 103, the glass tube 100 narrows, or tapers to have a smaller diameter when moving along the length of the glass tube 100 from the main body region 102 to the rear end regions 101. The tapering/narrowing may occur in a continuous, smooth manner (e.g., to be a smooth curve without any linear angles). By avoiding angles, in particular any acute angles, the glass tube 100 is less likely to break or crack under pressure. Furthermore, the transition region 103 is formed by two curves at both ends, wherein one curve is toward inside of the glass tube 100 and the other curve is toward outside of the glass tube 100. For example,

one curve closer to the main body region 102 is convex from the perspective of an inside of the glass tube 100 and one curve closer to the rear end region 101 is concave from the perspective of an inside of the glass tube 100. The transition region 103 of the glass tube 100 in one embodiment includes only smooth curves, and does not include any angled surface portions. The outer diameter of the rear end region 101 is smaller than that of the main body region 102. Therefore, a height difference between the rear end region 101 and the main body region 102 is formed to avoid adhesives applied on the rear end region 101 being overflowed onto the main body region 102, and thereby saves manpower for removing the overflowed adhesive and increases productivity.

[0035] In one embodiment, at least part of the inner surface 100a of the glass tube 100 has a rough surface and the roughness of the inner surface 100a is higher than that of the outer surface 100b, such that the light from the LED light sources 202 can be uniformly spread when transmitting through the glass tube 100. Since LED light sources 202 consists of several point light sources (LED dies), each LED light source 202 casts a cone of light, which results in non-uniformity of light output intensity. With the rough surface, the light from LED light sources 202 will be diffused before transmitting through the glass tube 100 and the uniformity of light output is improved thereby. In one embodiment, the roughness of the inner surface 100a may be substantially from 0.1 to 40 μm , the light from LED light sources 202 will be well diffused before entirely transmitting through the glass tube 100 and the uniformity of light output is substantially improved. However, in some embodiments, the inner surface 100a of the glass tube 100 does not have the roughness surface.

[0036] In one embodiment, as shown in FIG. 4, the rough surface may be formed with a light scattering region 130. Since LED light sources 202 consists of several

point light sources (LED dies), each LED light source 202 casts a cone of light, which results in non-uniformity of light output intensity. With the light scattering region 130, the light from LED light sources 202 will be scattered before entirely transmitting through the glass tube 100 and the uniformity of light output is substantially improved.

[0037] In one embodiment, as shown in FIG. 4, the glass tube 100 may further include a reflective film 120 disposed on a part of the inner surface 100a of the glass tube 100. In some embodiments, the reflective film 120 may be positioned on two sides of the LED light strip 200. As shown in FIG. 4, part of light 209 from LED light sources 202 are reflected by the reflective films 120 such that the light 209 from the LED light sources 202 can be centralized to a determined direction. And, in some embodiment, a ratio of a length of the reflective film 120 disposed on the inner surface 100a of the glass tube 100 extending along the circumferential direction of the glass tube 100 to a circumferential length of the glass tube 100 may be about 0.3 to 0.5, which means about 30% to 50% of the inner surface area may be covered by the reflective film 120. The reflective film 120 may be made of PET with some refractive materials such as strontium phosphate or barium sulfate or any combination thereof, with a thickness between about 140 μm and about 350 μm or between about 150 μm and about 220 μm for a more preferred effect in some embodiments. In some embodiments, only the part of the inner surface 100a which is not covered by the reflective film 120 is formed with the light scattering region 130 as shown in FIG. 4. In other words, the reflective film 120 is disposed on a part of the inner surface 100a of the glass tube 100 which is not formed with the rough surface or the light scattering region 130.

[0038] In one embodiment, as shown in FIG. 5, two opposite, short edges of the

bendable circuit sheet 205 may be formed as two freely extending end portions 210, and two parts of a power supply 400 are respectively disposed in the two end caps 300. The two freely extending end portions 210 respectively extends outside the glass tube 100 through two opposite ends of the glass tube 100 along the axial direction of the glass tube 100, such that can respectively extend into the two end caps 300 and be respectively electrically connected to the two parts of a power supply 400 directly.

[0039] Referring to FIG. 6, the LED tube lamp 50 may have a heat shrink sleeve 190 covering on the outer surface 100b of the glass tube 100. In some embodiments, the heat shrink sleeve 190 may have a thickness ranging between 20 μm and 200 μm and is substantially transparent with respect to the wavelength of light from the LED light sources 202. In some embodiments, the heat shrink sleeve 190 may be made of PFA (perfluoroalkoxy) or PTFE (polytetrafluoroethylene). The heat shrink sleeve 190 may be slightly larger than the glass tube 100, and may be shrunk and tightly cover the outer surface 100b of the glass tube 100 while being heated to an appropriate temperature (ex, 260°C for PFA and PTFE).

[0040] Referring to FIG. 7 to FIG. 11, FIG. 7 and FIG. 8 are respectively partial views of the bendable circuit sheet 205 of the LED light strip 200 and the printed circuit board 420 of the power supply 400 apart from and soldered to each other. FIG. 9 to FIG. 11 illustrate a soldering process of the bendable circuit sheet 205 of the LED light strip 200 and the printed circuit board 420 of the power supply 400. In the embodiment, the bendable circuit sheet 205 of the LED light strip 200 and the freely extending end portions 210 have the same structure. In some embodiments, the power supply 400 includes at least one electronic component 430 disposed on one side of the printed circuit board 420, and the freely extending end portion 210 is electrically connected to the printed circuit board 420 directly through the other side which has no

electronic component 430 disposed thereon. The freely extending end portions 210 are the portions of two opposite ends of the bendable circuit sheet 205 of the LED light strip 200 and are utilized for being connected to the printed circuit board 420 of the power supply 400. The LED light strip 200 and the power supply 400 can be

5 electrically connected to each other by soldering. Two opposite ends of the bendable circuit sheet 205 of the LED light strip 200 are utilized for being respectively soldered directly to the printed circuit board 420 of the two parts of a power supply 400. In other embodiments, only one end of the bendable circuit sheet 205 of the LED light strip 200 is soldered directly to the printed circuit board 420 of the power supply 400.

10 The bendable circuit sheet 205 of the LED light strip 200 includes a circuit layer 200a and a circuit protecting layer 200c over a side of the circuit layer 200a. Moreover, the bendable circuit sheet 205 of the LED light strip 200 includes two opposite surfaces which are a first surface 2001 and a second surface 2002. The first surface 2001 is the one on the circuit layer 200a and away from the circuit protecting layer 200c. The

15 second surface 2002 is the other one on the circuit protecting layer 200c and away from the circuit layer 200a. Several LED light sources 202 are disposed on the first surface 2001 and are electrically connected to circuits of the circuit layer 200a. The circuit protecting layer 200c has less electrical and thermal conductivity but being beneficial to protect the circuits. The first surface 2001 of the bendable circuit sheet

20 205 of the LED light strip 200 includes soldering pads “b”. Soldering material “g” can be placed on the soldering pads “b”. In the embodiment, the LED light strip 200 further includes a notch “f”. The notch “f” is disposed on an edge of the end of the bendable circuit sheet 205 of the LED light strip 200 soldered directly to the printed circuit board 420 of the power supply 400. The printed circuit board 420 includes a

25 power circuit layer 420a and soldering pads “a”. Moreover, the printed circuit board

420 includes two opposite surfaces which are a first surface 421 and a second surface 422. The second surface 422 is the one on the power circuit layer 420a. The soldering pads “a” are respectively disposed on the first surface 421 and the second surface 422. The soldering pads “a” on the first surface 421 are corresponding to those on the
5 second surface 422. Soldering material “g” can be placed on the soldering pad “a”. In the embodiment, considering the stability of soldering and the optimization of automatic process, the bendable circuit sheet 205 of LED light strip 200 is disposed below the printed circuit board 420 (the direction is referred to FIG. 9). That is to say, the first surface 2001 of the bendable circuit sheet 205 of the LED light strip 200 is
10 connected to the second surface 422 of the printed circuit board 420 of the power supply 400.

[0041] As shown in FIG. 10 and FIG. 11, in the soldering process of the bendable circuit sheet 205 of the LED light strip 200 and the printed circuit board 420 of the power supply 400, the circuit protecting layer 200c of the bendable circuit sheet 205
15 of the LED light strip 200 is placed on a supporting table 52 (i.e., the second surface 2002 of the bendable circuit sheet 205 of the LED light strip 200 contacts the supporting table 52) in advance. The soldering pads “a” on the second surface 422 of the printed circuit board 420 of the power supply 400 directly sufficiently contact the soldering pads “b” on the first surface 2001 of the bendable circuit sheet 205 of the
20 LED light strip 200. A thermo-compression heating head 51 presses on a portion where the bendable circuit sheet 205 of the LED light strip 200 and the printed circuit board 420 of the power supply 400 are soldered to each other. When soldering, the soldering pads “b” on the first surface 2001 of the bendable circuit sheet 205 of the LED light strip 200 contact the soldering pads “a” on the second surface 422 of the
25 printed circuit board 420 of the power supply 400, and the soldering pads “a” on the

first surface 421 of the printed circuit board 420 of the power supply 400 contact the thermo-compression heating head 51. Under the circumstances, the heat from the soldering thermo-compression heating head 51 can directly transmit through the soldering pads “a” on the first surface 421 of the printed circuit board 420 of the power supply 400 and the soldering pads “a” on the second surface 422 of the printed circuit board 420 of the power supply 400 to the soldering pads “b” on the first surface 2001 of the bendable circuit sheet 205 of the LED light strip 200. The transmission of the heat between the thermo-compression heating head 51 and the soldering pads “a” and b is not likely to be affected by the circuit protecting layer 200c which has relatively less thermal conductivity, and, consequently, the efficiency and stability regarding the connections and soldering process of the soldering pads “a” and “b” of the printed circuit board 420 of the power supply 400 and the bendable circuit sheet 205 of the LED light strip 200 can be improved. As shown in FIG. 10, the printed circuit board 420 of the power supply 400 and the bendable circuit sheet 205 of the LED light strip 200 are firmly connected to each other by the soldering material “g”. Components between the virtual line M and the virtual line N of FIG. 10 from top to bottom are the soldering pads “a” on the first surface 421 of printed circuit board 420, the printed circuit board 420, the power circuit layer 420a, the soldering pads “a” on the second surface 422 of printed circuit board 420, the soldering pads “b” on the first surface 2001 of the bendable circuit sheet 205 of the LED light strip 200, the circuit layer 200a of the bendable circuit sheet 205 of the LED light strip 200, and the circuit protecting layer 200c of the bendable circuit sheet 205 of the LED light strip 200. The connection of the printed circuit board 420 of the power supply 400 and the bendable circuit sheet 205 of LED light strip 200 are firm and stable.

[0042] In other embodiments, an additional circuit protecting layer can be disposed

over the first surface 2001 of the circuit layer 200a. In other words, the circuit layer 200a is sandwiched between two circuit protecting layers, and therefore the first surface 2001 of the circuit layer 200a can be protected by the circuit protecting layer. A part of the circuit layer 200a (the part having the soldering pads “b”) is exposed for
5 being connected to the soldering pads “a” of the printed circuit board 420 of the power supply 400. Under the circumstances, a part of the bottom of the LED light source 202 contacts the circuit protecting layer on the first surface 2001 of the circuit layer 200a, and the other part of the bottom of the LED light source 202 contacts the circuit layer 200a.

10 [0043] In addition, according to the embodiment shown in FIG. 7 to FIG. 11, the printed circuit board 420 of the power supply 400 further includes through holes “h” passing through the soldering pads “a”. In an automatic soldering process, when the thermo-compression heating head 51 automatically presses the printed circuit board 420 of the power supply 400, the soldering material “g” on the soldering pads “a” can
15 be pushed into the through holes “h” by the thermo-compression heating head 51 accordingly, which fits the needs of automatic process.

[0044] Referring to FIG. 12 and FIG. 13, in some embodiments, the bendable circuit sheet 205 of the LED light strip 200 and the printed circuit board 420 of the power supply 400 are electrically connected to each other by a pair of jack/plug
20 connectors rather than by soldering. As shown in FIG. 12, the freely extending end portion 210 of the bendable circuit sheet 205 of the LED light strip 200 has a first electric connector 2300, and the printed circuit board 420 of the power supply 400 has a second electric connector 4300 which is capable of being connected with the first connector 2300. Since the LED light strip 200 and the power supply 400 are
25 electrically connected to each other by a pair of jack/plug connectors rather than by

soldering, the end cap 300 and the power supply 400 can be replaceable.

[0045] Referring to Figs. 14 and 15, an LED tube lamp of one embodiment of the present invention includes a glass tube 1, an LED light strip 2 disposed inside the glass tube 1, and two end caps 3 respectively disposed at two ends of the glass tube 1.

5 [0046] Referring to Figs. 15 and 16, in one embodiment, the end cap 3 may have openings 304 to dissipate heat generated by the power supply modules inside the end cap 3 so as to prevent a high temperature condition inside the end cap 3 that might reduce reliability. In some embodiments, the openings 304 are in a shape of an arc; especially in a shape of three arcs with different size. In one embodiment, the
10 openings 304 are in a shape of three arcs with gradually varying size. The openings 304 on the end cap 3 can be in any one of the above-mentioned shape or any combination thereof. At least a part of the openings are arranged along an arc and spaced apart from each other.

[0047] Referring to Figs. 16, in one embodiment, each end cap 3 includes an
15 electrically insulating tube 302, a thermal conductive member 303 sleeving over the electrically insulating tube 302, and two hollow conductive pins 301 disposed on the electrically insulating tube 302. The thermal conductive member 303 can be a metal ring that is tubular in shape. According to Fig. 15 and 16, the openings 304 on the electrically insulating tube symmetric to each other with respect to a vertical central
20 plane passing through the middle of a line connecting the two conductive pins 301 and the vertical central plane is perpendicular to the line connecting the two conductive pins 301. The openings 304 are on a surface of the electrically insulating tube 302 on which the two conductive pins 301 are disposed.

[0048] The openings 304 symmetrically disposed on the electrically insulating tube
25 302 is capable of efficiently dissipating heat generated during the heating and

solidification of the hot melt adhesive. Specifically, during heating and solidification of the hot melt adhesive, the hot melt adhesive circularly surrounding the end portions of the glass tube 100 will be heated and generates heat which is circularly surrounding the glass tube 100. Since the holes 304 are symmetrically arranged on the electrically insulating tube 302, the heat could be efficiently dissipated through the opening 304 which is the closest to the heat-generating sources (hot melt adhesive). In addition, the holes 304 may be used to dissipate heat generated by power supply 400 during the use of the LED tube lamp 50. In one embodiment, the components of the power supply 400 may be arranged symmetrically in one of the end caps, separately in both of the end caps, or in the glass tube 100 in accordance with the symmetrical arrangement of the holes 304. Accordingly, the heat generated from the components of the power supply can be dissipated through the hole 301 which is the closest to the component.

[0049] Accordingly, the heat generated from the components of the power supply 400 can be dissipated through the hole 301 which is the closest to the component.

15 [0050] Next, examples of the circuit design and using of the power supply (module) 400 (or 5 in Fig. 15) are described as follows.

[0051] FIG. 17A is a block diagram of a power supply module or power supply 400 in an LED tube lamp according to an embodiment of the present invention. Referring to FIG. 17A, an AC power supply 508 is used to supply an AC supply signal, and may be an AC powerline with a voltage rating, for example, in 100-277 volts and a frequency rating, for example, of 50 or 60 Hz. A lamp driving circuit 505 receives and then converts the AC supply signal into an AC driving signal as an external driving signal. Lamp driving circuit 505 may be for example an electronic ballast used to convert the AC powerline into a high-frequency high-voltage AC driving signal.

25 Common types of electronic ballast include instant-start ballast, program-start or

rapid-start ballast, etc., which may all be applicable to the LED tube lamp of the present invention. The voltage of the AC driving signal is likely higher than 300 volts, and is in some embodiments in the range of about 400-700 volts. The frequency of the AC driving signal is likely higher than 10 k Hz, and is in some embodiments in the range of about 20 k-50 k Hz. The LED tube lamp 500 receives an external driving signal and is thus driven to emit light. In one embodiment, the external driving signal comprises the AC driving signal from lamp driving circuit 505. In one embodiment, LED tube lamp 500 is in a driving environment in which it is power-supplied at its one end cap having two conductive pins 501 and 502, which are coupled to lamp driving circuit 505 to receive the AC driving signal. The two conductive pins 501 and 502 may be electrically connected to, either directly or indirectly, the lamp driving circuit 505.

[0052] It is worth noting that lamp driving circuit 505 may be omitted and is therefore depicted by a dotted line. In one embodiment, if lamp driving circuit 505 is omitted, AC power supply 508 is directly connected to pins 501 and 502, which then receive the AC supply signal as an external driving signal.

[0053] In addition to the above use with a single-end power supply, LED tube lamp 500 may instead be used with a dual-end power supply to one pin at each of the two ends of an LED lamp tube. FIG. 17B is a block diagram of a power supply module 400 in an LED tube lamp according to one embodiment of the present invention. Referring to FIG. 17B, compared to that shown in FIG. 17A, pins 501 and 502 are respectively disposed at the two opposite end caps of LED tube lamp 500, forming a single pin at each end of LED tube lamp 500, with other components and their functions being the same as those in FIG. 17A.

[0054] FIG. 17C is a block diagram of an LED lamp according to one embodiment

of the present invention. Referring to FIG. 17C, the power supply module of the LED lamp summarily includes a rectifying circuit 510, a filtering circuit 520, and an LED driving module 530. Rectifying circuit 510 is coupled to pins 501 and 502 to receive and then rectify an external driving signal, so as to output a rectified signal at output terminals 511 and 512. The external driving signal may be the AC driving signal or the AC supply signal described with reference to FIGS. 17A and 17B, or may even be a DC signal, which embodiments do not alter the LED lamp of the present invention. Filtering circuit 520 is coupled to the first rectifying circuit for filtering the rectified signal to produce a filtered signal, as recited in the claims. For instance, filtering circuit 520 is coupled to terminals 511 and 512 to receive and then filter the rectified signal, so as to output a filtered signal at output terminals 521 and 522. LED driving module 530 is coupled to filtering circuit 520, to receive the filtered signal for emitting light. For instance, LED driving module 530 may be a circuit coupled to terminals 521 and 522 to receive the filtered signal and thereby to drive an LED unit (not shown) in LED driving module 530 to emit light. Details of these operations are described in below descriptions of certain embodiments.

[0055] It is worth noting that although there are two output terminals 511 and 512 and two output terminals 521 and 522 in embodiments of these Figs., in practice the number of ports or terminals for coupling between rectifying circuit 510, filtering circuit 520, and LED driving module 530 may be one or more depending on the needs of signal transmission between the circuits or devices.

[0056] In addition, the power supply module of the LED lamp described in FIG. 17C, and embodiments of the power supply module of an LED lamp described below, may each be used in the LED tube lamp 500 in FIGS. 17A and 17B, and may instead be used in any other type of LED lighting structure having two conductive pins used

to conduct power, such as LED light bulbs, personal area lights (PAL), plug-in LED lamps with different types of bases (such as types of PL-S, PL-D, PL-T, PL-L, etc.), etc.

[0057] FIG. 17D is a block diagram of a power supply module 400 in an LED tube lamp according to an embodiment of the present invention. Referring to FIG. 17D, an AC power supply 508 is used to supply an AC supply signal. A lamp driving circuit 505 receives and then converts the AC supply signal into an AC driving signal. An LED tube lamp 500 receives an AC driving signal from lamp driving circuit 505 and is thus driven to emit light. In this embodiment, LED tube lamp 500 is power-supplied at its both end caps respectively having two pins 501 and 502 and two pins 503 and 504, which are coupled to lamp driving circuit 505 to concurrently receive the AC driving signal to drive an LED unit (not shown) in LED tube lamp 500 to emit light. AC power supply 508 may be e.g. the AC powerline, and lamp driving circuit 505 may be a stabilizer or an electronic ballast.

[0058] FIG. 17E is a block diagram of an LED lamp according to an embodiment of the present invention. Referring to FIG. 17E, the power supply module of the LED lamp summarily includes a rectifying circuit 510, a filtering circuit 520, an LED driving module 530, and a filtering circuit 540. Rectifying circuit 510 is coupled to pins 501 and 502 to receive and then rectify an external driving signal conducted by pins 501 and 502. Rectifying circuit 540 is coupled to pins 503 and 504 to receive and then rectify an external driving signal conducted by pins 503 and 504. Therefore, the power supply module of the LED lamp may include two rectifying circuits 510 and 540 configured to output a rectified signal at output terminals 511 and 512. Filtering circuit 520 is coupled to terminals 511 and 512 to receive and then filter the rectified signal, so as to output a filtered signal at output terminals 521 and 522. LED driving

module 530 is coupled to terminals 521 and 522 to receive the filtered signal and thereby to drive an LED unit (not shown) in LED driving module 530 to emit light.

[0059] The power supply module of the LED lamp in this embodiment of FIG. 17E may be used in LED tube lamp 500 with a dual-end power supply in FIG. 17D. It is worth noting that since the power supply module of the LED lamp comprises rectifying circuits 510 and 540, the power supply module of the LED lamp may be used in LED tube lamp 500 with a single-end power supply in FIGS. 17A and 17B, to receive an external driving signal (such as the AC supply signal or the AC driving signal described above). The power supply module of an LED lamp in this embodiment and other embodiments herein may also be used with a DC driving signal.

[0060] FIG. 18A is a schematic diagram of a rectifying circuit according to an embodiment of the present invention. Referring to FIG. 18A, rectifying circuit 610 includes rectifying diodes 611, 612, 613, and 614, configured to full-wave rectify a received signal. Diode 611 has an anode connected to output terminal 512, and a cathode connected to pin 502. Diode 612 has an anode connected to output terminal 512, and a cathode connected to pin 501. Diode 613 has an anode connected to pin 502, and a cathode connected to output terminal 511. Diode 614 has an anode connected to pin 501, and a cathode connected to output terminal 511.

[0061] When pins 501 and 502 receive an AC signal, rectifying circuit 610 operates as follows. During the connected AC signal's positive half cycle, the AC signal is input through pin 501, diode 614, and output terminal 511 in sequence, and later output through output terminal 512, diode 611, and pin 502 in sequence. During the connected AC signal's negative half cycle, the AC signal is input through pin 502, diode 613, and output terminal 511 in sequence, and later output through output

terminal 512, diode 612, and pin 501 in sequence. Therefore, during the connected AC signal's full cycle, the positive pole of the rectified signal produced by rectifying circuit 610 remains at output terminal 511, and the negative pole of the rectified signal remains at output terminal 512. Accordingly, the rectified signal produced or output
5 by rectifying circuit 610 is a full-wave rectified signal.

[0062] When pins 501 and 502 are coupled to a DC power supply to receive a DC signal, rectifying circuit 610 operates as follows. When pin 501 is coupled to the anode of the DC supply and pin 502 to the cathode of the DC supply, the DC signal is input through pin 501, diode 614, and output terminal 511 in sequence, and later
10 output through output terminal 512, diode 611, and pin 502 in sequence. When pin 501 is coupled to the cathode of the DC supply and pin 502 to the anode of the DC supply, the DC signal is input through pin 502, diode 613, and output terminal 511 in sequence, and later output through output terminal 512, diode 612, and pin 501 in sequence. Therefore, no matter what the electrical polarity of the DC signal is
15 between pins 501 and 502, the positive pole of the rectified signal produced by rectifying circuit 610 remains at output terminal 511, and the negative pole of the rectified signal remains at output terminal 512.

[0063] Therefore, rectifying circuit 610 in this embodiment can output or produce a proper rectified signal regardless of whether the received input signal is an AC or DC
20 signal.

[0064] FIG. 18B is a schematic diagram of a rectifying circuit according to an embodiment of the present invention. Referring to FIG. 18B, rectifying circuit 710 includes rectifying diodes 711 and 712, configured to half-wave rectify a received signal. Diode 711 has an anode connected to pin 502, and a cathode connected to
25 output terminal 511. Diode 712 has an anode connected to output terminal 511, and a

cathode connected to pin 501. Output terminal 512 may be omitted or grounded depending on actual applications.

[0065] Next, exemplary operation(s) of rectifying circuit 710 is described as follows.

5 [0066] In one embodiment, during a received AC signal's positive half cycle, the electrical potential at pin 501 is higher than that at pin 502, so diodes 711 and 712 are both in a cutoff state as being reverse-biased, making rectifying circuit 710 not outputting a rectified signal. During a received AC signal's negative half cycle, the electrical potential at pin 501 is lower than that at pin 502, so diodes 711 and 712 are
10 both in a conducting state as being forward-biased, allowing the AC signal to be input through diode 711 and output terminal 511, and later output through output terminal 512, a ground terminal, or another end of the LED tube lamp not directly connected to rectifying circuit 710. Accordingly, the rectified signal produced or output by rectifying circuit 710 is a half-wave rectified signal.

15 [0067] FIG. 18C is a schematic diagram of a rectifying circuit according to an embodiment of the present invention. Referring to FIG. 18C, rectifying circuit 810 includes a rectifying unit 815 and a terminal adapter circuit 541. In this embodiment, rectifying unit 815 comprises a half-wave rectifier circuit including diodes 811 and 812 and configured to half-wave rectify. Diode 811 has an anode connected to an
20 output terminal 512, and a cathode connected to a half-wave node 819. Diode 812 has an anode connected to half-wave node 819, and a cathode connected to an output terminal 511. Terminal adapter circuit 541 is coupled to half-wave node 819 and pins 501 and 502, to transmit a signal received at pin 501 and/or pin 502 to half-wave node 819. By means of the terminal adapting function of terminal adapter circuit 541,
25 rectifying circuit 810 allows of two input terminals (connected to pins 501 and 502)

and two output terminals 511 and 512.

[0068] Next, in certain embodiments, rectifying circuit 810 operates as follows.

[0069] During a received AC signal's positive half cycle, the AC signal may be input through pin 501 or 502, terminal adapter circuit 541, half-wave node 819, diode 812, and output terminal 511 in sequence, and later output through another end or circuit of the LED tube lamp. During a received AC signal's negative half cycle, the AC signal may be input through another end or circuit of the LED tube lamp, and later output through output terminal 512, diode 811, half-wave node 819, terminal adapter circuit 541, and pin 501 or 502 in sequence.

[0070] It's worth noting that terminal adapter circuit 541 may comprise a resistor, a capacitor, an inductor, or any combination thereof, for performing functions of voltage/current regulation or limiting, types of protection, current/voltage regulation, etc. Descriptions of these functions are presented below.

[0071] In practice, rectifying unit 815 and terminal adapter circuit 541 may be interchanged in position (as shown in FIG. 18D), without altering the function of half-wave rectification. FIG. 18D is a schematic diagram of a rectifying circuit according to an embodiment of the present invention. Referring to FIG. 18D, diode 811 has an anode connected to pin 502 and diode 812 has a cathode connected to pin 501. A cathode of diode 811 and an anode of diode 812 are connected to half-wave node 819. Terminal adapter circuit 541 is coupled to half-wave node 819 and output terminals 511 and 512. During a received AC signal's positive half cycle, the AC signal may be input through another end or circuit of the LED tube lamp, and later output through output terminal 512 or 512, terminal adapter circuit 541, half-wave node 819, diode 812, and pin 501 in sequence. During a received AC signal's negative half cycle, the AC signal may be input through pin 502, diode 811, half-wave node

819, terminal adapter circuit 541, and output node 511 or 512 in sequence, and later output through another end or circuit of the LED tube lamp.

[0072] It is worth noting that terminal adapter circuit 541 in embodiments shown in FIGS. 18C and 18D may be omitted and is therefore depicted by a dotted line. If
5 terminal adapter circuit 541 of FIG. 18C is omitted, pins 501 and 502 will be coupled to half-wave node 819. If terminal adapter circuit 541 of FIG. 18D is omitted, output terminals 511 and 512 will be coupled to half-wave node 819.

[0073] Rectifying circuit 510 as shown and explained in FIGS. 18A-D can constitute or be the rectifying circuit 540 shown in FIG. 17E, as having pins 503 and
10 504 for conducting instead of pins 501 and 502.

[0074] Next, an explanation follows as to choosing embodiments and their combinations of rectifying circuits 510 and 540, with reference to FIGS. 17C and 17E.

[0075] Rectifying circuit 510 in embodiments shown in FIG. 17C may comprise the
15 rectifying circuit 610 in FIG. 18A.

[0076] Rectifying circuits 510 and 540 in embodiments shown in FIG. 17E may each comprise any one of the rectifying circuits in FIGS. 18A-D, and terminal adapter circuit 541 in FIGS. 18C-D may be omitted without altering the rectification function needed in an LED tube lamp. When rectifying circuits 510 and 540 each comprise a
20 half-wave rectifier circuit described in FIGS. 18B-D, during a received AC signal's positive or negative half cycle, the AC signal may be input from one of rectifying circuits 510 and 540, and later output from the other rectifying circuit 510 or 540. Further, when rectifying circuits 510 and 540 each comprise the rectifying circuit described in FIG. 18C or 18D, or when they comprise the rectifying circuits in FIGS.
25 18C and 18D respectively, only one terminal adapter circuit 541 may be needed for

functions of voltage/current regulation or limiting, types of protection, current/voltage regulation, etc. within rectifying circuits 510 and 540, omitting another terminal adapter circuit 541 within rectifying circuit 510 or 540.

[0077] FIG. 19A is a schematic diagram of the terminal adapter circuit according to an embodiment of the present invention. Referring to FIG. 19A, terminal adapter circuit 641 comprises a capacitor 642 having an end connected to pins 501 and 502, and another end connected to half-wave node 819. Capacitor 642 has an equivalent impedance to an AC signal, which impedance increases as the frequency of the AC signal decreases, and decreases as the frequency increases. Therefore, capacitor 642 in terminal adapter circuit 641 in this embodiment works as a high-pass filter. Further, terminal adapter circuit 641 is connected in series to an LED unit in the LED tube lamp, producing an equivalent impedance of terminal adapter circuit 641 to perform a current/voltage limiting function on the LED unit, thereby preventing damaging of the LED unit by an excessive voltage across and/or current in the LED unit. In addition, choosing the value of capacitor 642 according to the frequency of the AC signal can further enhance voltage/current regulation.

[0078] It's worth noting that terminal adapter circuit 641 may further include a capacitor 645 and/or capacitor 646. Capacitor 645 has an end connected to half-wave node 819, and another end connected to pin 503. Capacitor 646 has an end connected to half-wave node 819, and another end connected to pin 504. For example, half-wave node 819 may be a common connective node between capacitors 645 and 646. And capacitor 642 acting as a current regulating capacitor is coupled to the common connective node and pins 501 and 502. In such a structure, series-connected capacitors 642 and 645 exist between one of pins 501 and 502 and pin 503, and/or series-connected capacitors 642 and 646 exist between one of pins 501 and 502 and

pin 504. Through equivalent impedances of series-connected capacitors, voltages from the AC signal are divided. Referring to FIGS. 17E and 19A, according to ratios between equivalent impedances of the series-connected capacitors, the voltages respectively across capacitor 642 in rectifying circuit 510, filtering circuit 520, and
5 LED driving module 530 can be controlled, making the current flowing through an LED module in LED driving module 530 being limited within a current rating, and then protecting/preventing filtering circuit 520 and LED driving module 530 from being damaged by excessive voltages.

[0079] FIG. 19B is a schematic diagram of the terminal adapter circuit according to
10 an embodiment of the present invention. Referring to FIG. 19B, terminal adapter circuit 741 comprises capacitors 743 and 744. Capacitor 743 has an end connected to pin 501, and another end connected to half-wave node 819. Capacitor 744 has an end connected to pin 502, and another end connected to half-wave node 819. Compared to terminal adapter circuit 641 in FIG. 19A, terminal adapter circuit 741 has capacitors
15 743 and 744 in place of capacitor 642. Capacitance values of capacitors 743 and 744 may be the same as each other, or may differ from each other depending on the magnitudes of signals to be received at pins 501 and 502.

[0080] Similarly, terminal adapter circuit 741 may further comprise a capacitor 745 and/or a capacitor 746, respectively connected to pins 503 and 504. Thus, each of pins
20 501 and 502 and each of pins 503 and 504 may be connected in series to a capacitor, to achieve the functions of voltage division and other protections.

[0081] FIG. 19C is a schematic diagram of the terminal adapter circuit according to an embodiment of the present invention. Referring to FIG. 19C, terminal adapter circuit 841 comprises capacitors 842, 843, and 844. Capacitors 842 and 843 are
25 connected in series between pin 501 and half-wave node 819. Capacitors 842 and 844

are connected in series between pin 502 and half-wave node 819. In such a circuit structure, if any one of capacitors 842, 843, and 844 is shorted, there is still at least one capacitor (of the other two capacitors) between pin 501 and half-wave node 819 and between pin 502 and half-wave node 819, which performs a current-limiting function. Therefore, in the event that a user accidentally gets an electric shock, this circuit structure will prevent an excessive current flowing through and then seriously hurting the body of the user.

[0082] Similarly, terminal adapter circuit 841 may further comprise a capacitor 845 and/or a capacitor 846, respectively connected to pins 503 and 504. Thus, each of pins 501 and 502 and each of pins 503 and 504 may be connected in series to a capacitor, to achieve the functions of voltage division and other protections.

[0083] FIG. 19D is a schematic diagram of the terminal adapter circuit according to an embodiment of the present invention. Referring to FIG. 19D, terminal adapter circuit 941 comprises fuses 947 and 948. Fuse 947 has an end connected to pin 501, and another end connected to half-wave node 819. Fuse 948 has an end connected to pin 502, and another end connected to half-wave node 819. With the fuses 947 and 948, when the current through each of pins 501 and 502 exceeds a current rating of a corresponding connected fuse 947 or 948, the corresponding fuse 947 or 948 will accordingly melt and then break the circuit to achieve overcurrent protection.

[0084] Each of the embodiments of the terminal adapter circuits as in rectifying circuits 510 and 810 coupled to pins 501 and 502 and shown and explained above can be used or included in the rectifying circuit 540 shown in FIG. 17E, as when conductive pins 503 and 504 and conductive pins 501 and 502 are interchanged in position.

[0085] Capacitance values of the capacitors in the embodiments of the terminal

adapter circuits shown and described above are in some embodiments in the range, for example, of about 100 pF-100 nF. Also, a capacitor used in embodiments may be equivalently replaced by two or more capacitors connected in series or parallel. For example, each of capacitors 642 and 842 may be replaced by two series-connected
5 capacitors, one having a capacitance value chosen from the range, for example of about 1.0 nF to about 2.5 nF and which may be in some embodiments preferably 1.5 nF, and the other having a capacitance value chosen from the range, for example of about 1.5 nF to about 3.0 nF, and which is in some embodiments about 2.2 nF.

[0086] FIG. 20A is a block diagram of the filtering circuit according to an
10 embodiment of the present invention. Rectifying circuit 510 is shown in FIG. 20A for illustrating its connection with other components, without intending filtering circuit 520 to include rectifying circuit 510. Referring to FIG. 20A, filtering circuit 520 includes a filtering unit 523 coupled to rectifying output terminals 511 and 512 to receive, and to filter out ripples of, a rectified signal from rectifying circuit 510,
15 thereby outputting a filtered signal whose waveform is smoother than the rectified signal. Filtering circuit 520 may further comprise another filtering unit 524 coupled between a rectifying circuit and a pin, which are for example rectifying circuit 510 and pin 501, rectifying circuit 510 and pin 502, rectifying circuit 540 and pin 503, or rectifying circuit 540 and pin 504. Filtering unit 524 is for filtering of a specific
20 frequency, in order to filter out a specific frequency component of an external driving signal. In this embodiment of FIG. 20A, filtering unit 524 is coupled between rectifying circuit 510 and pin 501. Filtering circuit 520 may further comprise another filtering unit 525 coupled between one of pins 501 and 502 and a diode of rectifying circuit 510, or between one of pins 503 and 504 and a diode of rectifying circuit 540,
25 for reducing or filtering out electromagnetic interference (EMI). In this embodiment,

filtering unit 525 is coupled between pin 501 and a diode (not shown in FIG. 20A) of rectifying circuit 510. Since filtering units 524 and 525 may be present or omitted depending on actual circumstances of their uses, they are depicted by a dotted line in FIG. 20A.

5 [0087] FIG. 20B is a schematic diagram of the filtering unit according to an embodiment of the present invention. Referring to FIG. 20B, filtering unit 623 includes a capacitor 625 having an end coupled to output terminal 511 and a filtering output terminal 521 and another end coupled to output terminal 512 and a filtering output terminal 522, and is configured to low-pass filter a rectified signal from output
10 terminals 511 and 512, so as to filter out high-frequency components of the rectified signal and thereby output a filtered signal at output terminals 521 and 522.

[0088] FIG. 20C is a schematic diagram of the filtering unit according to an embodiment of the present invention. Referring to FIG. 20C, filtering unit 723 comprises a pi filter circuit including a capacitor 725, an inductor 726, and a capacitor
15 727. As is well known, a pi filter circuit looks like the symbol π in its shape or structure. Capacitor 725 has an end connected to output terminal 511 and coupled to output terminal 521 through inductor 726, and has another end connected to output terminals 512 and 522. Inductor 726 is coupled between output terminals 511 and 521. Capacitor 727 has an end connected to output terminal 521 and coupled to output
20 terminal 511 through inductor 726, and has another end connected to output terminals 512 and 522.

[0089] As seen between output terminals 511 and 512 and output terminals 521 and 522, filtering unit 723 compared to filtering unit 623 in FIG. 20B additionally has inductor 726 and capacitor 727, which are like capacitor 725 in performing low-pass
25 filtering. Therefore, filtering unit 723 in this embodiment compared to filtering unit

623 in FIG. 20B has a better ability to filter out high-frequency components to output a filtered signal with a smoother waveform.

[0090] Inductance values of inductor 726 in the embodiment described above are chosen in some embodiments in the range of about 10 nH to about 10 mH. And
5 capacitance values of capacitors 625, 725, and 727 in the embodiments described above are chosen in some embodiments in the range, for example, of about 100 pF to about 1 uF.

[0091] FIG. 20D is a schematic diagram of the filtering unit according to an embodiment of the present invention. Referring to FIG. 20D, filtering unit 824
10 includes a capacitor 825 and an inductor 828 connected in parallel. Capacitor 825 has an end coupled to pin 501, and another end coupled to rectifying output terminal 511, and is configured to high-pass filter an external driving signal input at pin 501, so as to filter out low-frequency components of the external driving signal. Inductor 828 has an end coupled to pin 501 and another end coupled to rectifying output terminal
15 511, and is configured to low-pass filter an external driving signal input at pin 501, so as to filter out high-frequency components of the external driving signal. Therefore, the combination of capacitor 825 and inductor 828 works to present high impedance to an external driving signal at one or more specific frequencies. Thus, the parallel-connected capacitor and inductor work to present a peak equivalent
20 impedance to the external driving signal at a specific frequency.

[0092] Through appropriately choosing a capacitance value of capacitor 825 and an inductance value of inductor 828, a center frequency f on the high-impedance band may be set at a specific value given by $f = \frac{1}{2\pi\sqrt{LC}}$, where L denotes inductance of inductor 828 and C denotes capacitance of capacitor 825. The center frequency is in some
25 embodiments in the range of about 20 ~ 30 kHz, and may be preferably about 25 kHz.

And an LED lamp with filtering unit 824 is able to be certified under safety standards, for a specific center frequency, as provided by Underwriters Laboratories (UL).

[0093] It's worth noting that filtering unit 824 may further comprise a resistor 829, coupled between pin 501 and filtering output terminal 511. In FIG. 20D, resistor 829 is connected in series to the parallel-connected capacitor 825 and inductor 828. For example, resistor 829 may be coupled between pin 501 and parallel-connected capacitor 825 and inductor 828, or may be coupled between filtering output terminal 511 and parallel-connected capacitor 825 and inductor 828. In this embodiment, resistor 829 is coupled between pin 501 and parallel-connected capacitor 825 and inductor 828. Further, resistor 829 is configured for adjusting the quality factor (Q) of the LC circuit comprising capacitor 825 and inductor 828, to better adapt filtering unit 824 to application environments with different quality factor requirements. Since resistor 829 is an optional component, it is depicted in a dotted line in FIG. 20D.

[0094] Capacitance values of capacitor 825 are in some embodiments in the range of about 10 nF-2 uF. Inductance values of inductor 828 are in some embodiments smaller than 2 mH, and may be preferably smaller than 1 mH. Resistance values of resistor 829 are in some embodiments larger than 50 ohms, and are may be preferably larger than 500 ohms.

[0095] Besides the filtering circuits shown and described in the above embodiments, traditional low-pass or band-pass filters can be used as the filtering unit in the filtering circuit in the present invention.

[0096] FIG. 20E is a schematic diagram of the filtering unit according to an embodiment of the present invention. Referring to FIG. 20E, in this embodiment filtering unit 925 is disposed in rectifying circuit 610 as shown in FIG. 18A, and is configured for reducing the EMI (Electromagnetic interference) caused by rectifying

circuit 610 and/or other circuits. In this embodiment, filtering unit 925 includes an EMI-reducing capacitor coupled between pin 501 and the anode of rectifying diode 613, and also between pin 502 and the anode of rectifying diode 614, to reduce the EMI associated with the positive half cycle of the AC driving signal received at pins 501 and 502. The EMI-reducing capacitor of filtering unit 925 is also coupled between pin 501 and the cathode of rectifying diode 611, and between pin 502 and the cathode of rectifying diode 612, to reduce the EMI associated with the negative half cycle of the AC driving signal received at pins 501 and 502. In some embodiments, rectifying circuit 610 comprises a full-wave bridge rectifier circuit including four rectifying diodes 611, 612, 613, and 614. The full-wave bridge rectifier circuit has a first filtering node connecting an anode and a cathode respectively of two diodes 613 and 611 of the four rectifying diodes 611, 612, 613, and 614, and a second filtering node connecting an anode and a cathode respectively of the other two diodes 614 and 612 of the four rectifying diodes 611, 612, 613, and 614. And the EMI-reducing capacitor of the filtering unit 925 is coupled between the first filtering node and the second filtering node.

[0097] Similarly, with reference to FIGS. 18C, and 19A-19C, any capacitor in each of the circuits in FIGS. 19A-19C is coupled between pins 501 and 502 (or pins 503 and 504) and any diode in FIG. 18C, so any or each capacitor in FIGS. 19A-19C can work as an EMI-reducing capacitor to achieve the function of reducing EMI. For example, rectifying circuit 510 in FIGS. 17C and 17E may comprise a half-wave rectifier circuit including two rectifying diodes and having a half-wave node connecting an anode and a cathode respectively of the two rectifying diodes, and any or each capacitor in FIGS. 19A-19C may be coupled between the half-wave node and at least one of the first pin and the second pin. And rectifying circuit 540 in FIG. 17E

may comprise a half-wave rectifier circuit including two rectifying diodes and having a half-wave node connecting an anode and a cathode respectively of the two rectifying diodes, and any or each capacitor in FIGS. 19A-19C may be coupled between the half-wave node and at least one of the third pin and the fourth pin.

5 [0098] It's worth noting that the EMI-reducing capacitor in the embodiment of FIG. 20E may also act as capacitor 825 in filtering unit 824, so that in combination with inductor 828 the capacitor 825 performs the functions of reducing EMI and presenting high impedance to an external driving signal at specific frequencies. For example, when the rectifying circuit comprises a full-wave bridge rectifier circuit, capacitor 825
10 of filtering unit 824 may be coupled between the first filtering node and the second filtering node of the full-wave bridge rectifier circuit. When the rectifying circuit comprises a half-wave rectifier circuit, capacitor 825 of filtering unit 824 may be coupled between the half-wave node of the half-wave rectifier circuit and at least one of the first pin and the second pin.

15 [0099] If any terms in this application conflict with terms used in any application(s) from which this application claims priority, or terms incorporated by reference into this application or the application(s) from which this application claims priority, a construction based on the terms as used or defined in this application should be applied.

20 [00100] While the instant disclosure related to an LED tube lamp has been described by way of example and in terms of the preferred embodiments, it is to be understood that the instant disclosure needs not be limited to the disclosed embodiments. For anyone skilled in the art, various modifications and improvements within the spirit of the instant disclosure are covered under the scope of the instant disclosure. The
25 covered scope of the instant disclosure is based on the appended claims.

ABSTRACT

An LED tube lamp includes a glass tube, a plurality of LED light sources, two end caps respectively sleeving two end portions of the glass tube, a power supply in one of the end caps or separately in both of the end caps, and an LED light strip in the glass tube. The plurality of LED light sources is on the LED light strip. Each of the end caps comprises a plurality of openings formed thereon. The plurality of openings dissipating heat resulted from the power supply are divided into two sets. The two sets of the plurality of openings are symmetric to each other with respect to a virtual central axis of the end cap.



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Roberts Mlotkowski Safran Cole & Calderon, P.C.
7918 Jones Branch Drive
Suite 500
McLean, VA 22102

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Status

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☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on ____; the restriction requirement and election have been incorporated into this action.
- 4) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

- 5) ☒ Claim(s) 1-34 is/are pending in the application.
5a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 6) ☐ Claim(s) ____ is/are allowed.
- 7) ☒ Claim(s) 1-34 is/are rejected.
- 8) ☐ Claim(s) ____ is/are objected to.
- 9) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

- 10) ☐ The specification is objected to by the Examiner.
- 11) ☒ The drawing(s) filed on 4/10/17 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

- a) ☒ All b) ☐ Some** c) ☐ None of the:
1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) ☒ Notice of References Cited (PTO-892) | 3) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____. |
| 2) ☒ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b)
Paper No(s)/Mail Date ____. | 4) ☐ Other: ____. |

1. The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

DETAILED ACTION

Claim Rejections - 35 USC § 103

2. In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

3. The following is a quotation of 35 U.S.C. 103 which forms the basis for all obviousness rejections set forth in this Office action:

A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 1-10, 22-34 is/are rejected under 35 U.S.C. 103 as being unpatentable over Guang (2016/0081147) in view of Wilcox et al. (2015/0176770) in view of Leong et al. (2008/0290814) and further in view of Chen (2011/0038146).

Claim 1, Guang shows an LED tube lamp (Figs. 1-4), comprising:

a glass tube (12, Fig. 3) having two end portions (47); a plurality of LED light sources (LED array 20); two end caps (14 and 16) respectively sleeve the two end portions of the glass tube (see Figs. 3-4), the glass tube and the end cap are secured (see Fig. 4); a power supply in one of the end caps or separately in both of the end caps (18 and 19, Fig. 3); and an LED light strip (LED PCB, P[0048]) on an inner surface of

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the glass tube (the LED PCB is in the tube, see 20, Fig. 3), the plurality of LED light sources being on the LED light strip (LED array 20 is on the LED PCB); wherein each of the end caps comprises: an electrically insulating tube (14 and 16); two conductive pins (30, 32, 34, and 36) on the electrically insulating tube.

Guang discloses the claimed invention except for the glass tube covered by a heat shrink sleeve, the glass tube and the end cap are secured by a hot melt adhesive, and at least two heat-dissipating openings on the electrically insulating tube symmetric to each other with respect to a plane passing through the middle of a line connecting the two conductive pins and perpendicular to the line connecting the two conductive pins.

Wilcox discloses a glass tube (2, Fig. 5) is covered by a heat shrink sleeve (14, Fig. 5 and see,...The film layer may comprise a cylindrical PET film tube into which the tube 2 is inserted. The PET tube may be heat shrunk to the exterior of tube 2..., P[0050]).

Chen discloses the glass lamp tube and the end cap are secured by a hot melt adhesive (...the ends and the elementary glass tube 11...gas-tight sealing of low melting glass..., P[0082]).

Leong shows at least two heat-dissipating openings (vent holes 224A and 224B, Fig. 19A, and 496A and 496B, Fig. 45A) and on the electrically insulating tube symmetric to each other with respect to a plane passing through the middle of a line connecting the two conductive pins (138A, 140A, Fig. 19A and 430A, 430B, Fig. 45A) and perpendicular to the line connecting the two conductive pins.

It would have been obvious to one having ordinary skill in the art at the time the effective filing date of the invention was made to provide the glass tube of Guang with the heat shrink sleeve of Wilcox, in order to provide a desired diffusive quality and a shatter-proof coating; further, to secure the glass tube and the end caps with a hot melt adhesive, as taught by Chen in order to provide tight sealing between the tube and the end caps; also, to provide the end caps of Guang with the two or more vent holes, as taught by Leong in order to provide heat dissipating outlets to the outside for cooling which enhance a performance and life of the LED lamp.

Claim 2, Guang, Wilcox, Leong, and Chen disclose the LED tube lamp according to claim 1, wherein the hot melt adhesive is, respectively, disposed on the outer surface of the end portions, and the shape of the disposed hot melt adhesive is substantially a circle from the side view of the glass tube (inherent limitation for applying adhesive between two cylindrical tubes).

Claim 3, Guang, Wilcox, Leong, and Chen disclose the LED tube lamp according to claim 2, wherein the at least two heat-dissipating openings (vent holes 224A and 224B, Fig. 19A, and 496A and 496B, Fig. 45A) are on a surface of the electrically insulating tube on which the two conductive pins (138A, 140A, Fig. 19A and 430A, 430B, Fig. 45A) are disposed.

Claims 4-6, and 9, Guang, Wilcox, Leong, and Chen fails to disclose the at least two heat-dissipating opening are separately in a shape of an arcs with different and gradually vary in sizes or at least a part of the openings are arranged along an arc and space apart from each other. It would have been an obvious matter of design choice to

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modify the vent holes into a shape of an arcs with different and gradually vary sizes or at least a part of the openings are arranged along an arc and space apart from each other or any pattern of shapes, since applicant has not disclosed that this difference solves any stated problem or is for any particular purpose other than for heat dissipated outlets to the outside of the tube lamp and it appears that the invention would perform equally well with the arcs shape openings with different and gradually vary sizes or at least a part of the openings are arranged along an arc and space apart from each other or any pattern of shapes.

Claim 7, Guang, Wilcox, Leong, and Chen disclose the LED tube lamp according to claim 6, wherein the heat shrink sleeve is substantially transparent with respect to the wavelength of light from the LED light sources (...transparent...semitransparent...light patterns, intensities, mixing color... see, P[0050] of Wilcox).

Claims 8-9, Guang, Wilcox, Leong, and Chen fails to disclose the at least two heat-dissipating opening is six in two sets, and the three heat-dissipating openings in one set are in a shape of three arcs with gradually varying sizes or a combination in a shape of an arc and a circle. It would have been an obvious matter of design choice to modify the at least two heat-dissipating openings into six and into two sets, and three heat-dissipating openings in one set are in a shape of three arcs with gradually varying sizes or a combination in a shape of an arc and a circle or any pattern of shapes, since applicant has not disclosed that this difference solves any stated problem or is for any particular purpose other than for heat dissipated outlets to the outside of the tube lamp and it appears that the invention would perform equally well with six heat-dissipating

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openings into two sets, and three heat-dissipating openings in one set are in a shape of three arcs with gradually varying sizes or a combination in a shape of an arc and a circle or any pattern of shapes.

Claim 10, Guang, Wilcox, Leong, and Chen disclose the LED tube lamp according to claim 1, wherein the heat and pressure inside the end cap increase during heating and solidification of the hot melt adhesive or/and resulted from the power supply, and are then released through at least one of the heat-dissipating openings (the vent holes are for cooling the inside of the lamp, released heat and pressure during heating and solidification of the hot melt adhesive or/and resulted from the power supply is an inherent process of cooling the inside of the lamp).

Claims 22-34 are rejected as above because the elements and limitations are similar.

5. Claims 11-12 is/are rejected under 35 U.S.C. 103 as being unpatentable over Guang (2016/0081147) in view of Wilcox et al. (2015/0176770) and further in view of Leong et al. (2008/0290814).

Claim 11, Guang shows an LED tube lamp (Fig. 1-4), comprising:

a glass tube (12, Fig. 3) comprising an inner surface (inside of the tube) and an outer surface (outer side of the tube), the glass tube having two end portions (47, Fig. 3); a plurality of LED light sources (LED array 20); two end caps (14 and 16) respectively sleeve the two end portions of the glass tube (see Fig. 4); a power supply

in one of the end caps or separately in both of the end caps (18 and 19, Fig. 1); and an LED light strip (LED PCB, P[0048]) on the inner surface of the glass tube, the plurality of LED light sources being on the LED light strip (see Fig. 3).

Guang discloses the claimed invention except for at least part of the inner surface of the glass tube has a rough surface and wherein each of the end caps comprises a plurality of openings thereon, and the two sets of the plurality of openings are symmetric to each other with respect to a virtual central axis of the end cap.

Wilcox discloses a glass tube (2, Fig. 5) at least part of the inner surface of the glass tube has a rough surface (12, Fig. 5 and see P[0050]...cross hatching 12...on an inside surface to provide a first diffusing layer...).

Leong shows a plurality of heat-dissipating openings (vent holes 224A and 224B, Fig. 19A, and 496A and 496B, Fig. 45A) and the openings are symmetric to each other with respect to a virtual central axis of the end cap for cooling the lamp tube, but fails to disclose the plurality of openings with two sets of the plurality of openings.

It would have been obvious to one having ordinary skill in the art at the time the effective filing date of the invention was made to provide the glass tube of Guang with at least part of the inner surface having a rough surface, as taught by Wilcox in order to provide uniform, high optical efficiency and prevents pixilation of the LED light sources; further, to provide a plurality of heat-dissipating openings on the end caps of Guang, as taught by Leong in order to provide heat dissipating outlets to the outside for cooling which enhance a performance and life of the LED lamp; also, It would have been an obvious matter of design choice to modify the plurality of heat-dissipating openings into

two sets of the plurality of openings, since applicant has not disclosed that this difference solves any stated problem or is for any particular purpose other than for heat dissipated outlets to the outside of the tube lamp and it appears that the invention would perform equally well with two sets of the plurality of openings.

Claim 12, Guang, Wilcox, and Leong fails to disclose wherein the roughness of the rough surface is substantially from 0.1 to 40 pm. It would have been obvious to one having ordinary skill in the art at the time the effective filing date of the invention was made to provide a roughness of the rough surface substantially from 0.1 to 40 pm, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art.

1. Claims 13-21 is/are rejected under 35 U.S.C. 103 as being unpatentable over Guang (2016/0081147) in view of Wilcox et al. (2015/0176770) in view of Leong et al. (2008/0290814) and further in view of Chen (2011/0038146).

Claim 13, Guang, Wilcox, and Leong disclose the claimed invention except for wherein the end cap is adhered to one end of the glass tube via the hot melt adhesive.

Chen discloses the glass lamp tube and the end cap are secured by a hot melt adhesive (...the ends and the elementary glass tube 11...gas-tight sealing of low melting glass..., P[0082]).

It would have been obvious to one having ordinary skill in the art at the time the effective filing date of the invention was made to provide to secure the glass tube and the end caps with a hot melt adhesive of Guang, as taught by Chen in order to provide tight sealing between the tube and the end caps.

Claims 14-15, and 21, Guang, Wilcox, Leong, and Chen disclose the LED tube lamp according to claim 13, wherein the heat and pressure inside the end cap increase during heating and solidification of the hot melt adhesive or/and resulted from the power supply, and are then released through at least one of the heat-dissipating openings (the vent holes are for cooling the inside of the lamp, released heat and pressure during heating and solidification of the hot melt adhesive or/and resulted from the power supply is an inherent process of cooling the inside of the lamp).

Claims 16-20, Guang, Wilcox, Leong, and Chen disclose the claimed invention except for the plurality of openings are openings are separately three shape arcs with gradually varying sizes or the plurality of openings are separately in a shape of a circle with three openings arranged in a shape of an arc or at least a part of the openings are arranged along an arc and spaced apart from each other. It would have been an obvious matter of design choice to modify the plurality of heat-dissipating openings into two sets of the plurality of openings which are separately three shape arcs with gradually varying sizes or the plurality of openings are separately in a shape of a circle with three openings arranged in a shape of an arc or at least a part of the openings are arranged along an arc and spaced apart from each other, since applicant has not disclosed that this difference solves any stated problem or is for any particular purpose other than for heat dissipated outlets to the outside of the tube lamp and it appears that the invention would perform equally well with the plurality of openings which are separately three shape arcs with gradually varying sizes or the plurality of openings are separately in a shape of a circle with three openings arranged in a shape of an arc or at

least a part of the openings are arranged along an arc and spaced apart from each other.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ANH TRAN whose telephone number is (571)272-1813. The examiner can normally be reached on M-Th (8:00-6:30).

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at <http://www.uspto.gov/interviewpractice>.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Alexander Taningco can be reached on 571-272-2048. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/ANH TRAN/

Primary Examiner, Art Unit 2844

6/29/17

Notice of References Cited	Application/Control No. 15/483,368		Applicant(s)/Patent Under Reexamination JIANG ET AL.	
	Examiner ANH TRAN		Art Unit 2844	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-2016/0081147 A1	03-2016	GUANG; Luo Hua	H05B33/0803	315/123
*	B	US-2015/0173770 A1	06-2015	Warner; Sheila	A61B17/12136	606/200
*	C	US-2011/0038146 A1	02-2011	Chen; Zonglie	F21V19/001	362/225
*	D	US-2008/0290814 A1	11-2008	Leong; Susan J.	F21K9/00	315/294
*	E	US-2010/0135015 A1	06-2010	LIU; TAY-JIAN	F21V29/006	362/235
	F	US-				
	G	US-				
	H	US-				
	I	US-				
	J	US-				
	K	US-				
	L	US-				
	M	US-				

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	3911	jiang-tao.in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/16 19:36
S2	36	S1 and (LED.u/c. NEAR2 tub\$4 NEAR2 lamp)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/16 19:38
S3	20	US-5087088-\$.DID. OR US-3118072-\$.DID. OR US-3211262-\$.DID. OR US-3294518-\$.DID. OR US-1647399-\$.DID. OR US-3936855-\$.DID. OR US-20160178137-\$.DID. OR WO-20140807-\$.DID. OR US-2523275-\$.DID. OR US-3120169-\$.DID. OR US-1331018-\$.DID.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	OFF	2016/11/16 19:49
S4	1	("9480109").PN.	USPAT; USOCR	OR	OFF	2016/11/16 19:53
S5	6	((("6118072") or ("6211262") or ("3294518") or ("4647399") or ("7067032") or ("6936855")).PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2016/11/16 19:59
S6	11	((("20160178138") or ("20160178137") or ("20160178135") or ("20160091156") or ("20160102813") or ("20160091147") or ("20160091179") or ("20070001709") or ("20060028837") or ("20120169968") or ("20110038146")).PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2016/11/16 20:02
S7	1	("9447929").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2016/11/16 20:06
S8	48	("20020044456" "20020176262" "20030102819" "20030231485" "20040095078" "20040189218" "20050128751" "20050162850" "20050207166" "20050213321" "20070001709" "20070145915" "20070210687" "20070274084" "20080030981" "20080192476" "20080278941" "20090161359" "20090290334" "20100103673" "20100253226" "20110038146" "20110057572" "20110090684" "20110148313" "20110216538" "20120069556" "20120106157" "20120153873" "20120235578"	US-PGPUB; USPAT; USOCR	OR	OFF	2016/11/16 20:06

		"20130050998" "20130170245" "20130182425" "20130200797" "20130313983" "20140071667" "20140153231" "20140226320" "20150009688" "20160081147" "5575459" "5921660" "6127783" "6609813" "6796680" "7033239" "8360599" "8579463").PN. OR ("9447929").URPN.				
S9	9	("3602759" "4276102" "4804886" "5173637" "5536998" "6078136" "6406167").PN. OR ("7033239").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2016/11/16 20:25
S10	41	("2135696" "2363109" "2581959" "3358167" "3453470" "3602759" "3720826" "3808495" "4048537" "4916352" "4924368" "5173637").PN. OR ("5536998").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2016/11/16 20:42
S11	11533	(LED.u/c. NEAR2 tub\$4 NEAR2 lamp)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/17 10:06
S12	119	S11 AND ((end-cap or (end\$2 adj1 cap)) SAME ((hous\$3 or tub\$3 or cas\$3 or globe or envelop\$2) NEAR3 (len\$3 or glass\$2 or plastic\$4)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/17 10:10
S13	48	("20020044456" "20020176262" "20030102819" "20030231485" "20040095078" "20040189218" "20050128751" "20050162850" "20050207166" "20050213321" "20070001709" "20070145915" "20070210687" "20070274084" "20080030981" "20080192476" "20080278941" "20090161359" "20090290334" "20100103673" "20100253226" "20110038146" "20110057572" "20110090684" "20110148313" "20110216538" "20120069556" "20120106157" "20120153873" "20120235578" "20130050998" "20130170245" "20130182425" "20130200797" "20130313983" "20140071667" "20140153231" "20140226320" "20150009688" "20160081147" "5575459" "5921660" "6127783" "6609813" "6796680" "7033239" "8360599" "8579463").PN. OR ("9447929").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2016/11/17 12:12
S14	10	S11 AND ((end-cap or (end\$2 adj1 cap)) WITH ((air or heat\$2 or vent\$3 or thermal\$4 or temperature) NEAR2 (open\$3 or hole or outlet)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/17 13:16

S15	14	S11 AND ((end-cap or (end\$2 adj1 cap)) SAME ((air or heat\$2 or vent\$3 or thermal\$4 or temperature or cool\$4) NEAR3 (open\$3 or hole or outlet)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/17 13:28
S16	27	S11 AND ((end-cap or (end\$2 adj1 cap)) SAME ((air or heat\$2 or vent\$3 or thermal\$4 or temperature or cool\$4) WITH (open\$3 or hole or outlet)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/17 13:36
S17	29	S11 AND ((end-cap or (end\$2 adj1 cap)) SAME ((hous\$3 or tub\$3 or cas\$3 or pipe or len\$3 or glass\$3) WITH ((thermal\$3 or heat\$3 or melt\$3) NEAR3 (seal\$4 or adhesive or bond\$3 or glu\$3))))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/17 13:47
S18	48	S11 AND ((end-cap or (end\$2 adj1 cap)) SAME (hous\$3 or tub\$3 or cas\$3 or pipe or len\$3 or glass\$3) SAME ((thermal\$3 or heat\$3 or melt\$3) WITH (seal\$4 or adhesive or bond\$3 or glu\$3)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/17 13:51
S19	23628	(LED.u/c. or (light adj emitting adj diode) or (light-emitting adj diode)) NEAR3 (tub\$4 or straight or pipe or cyclind\$5 or retrofit\$4 or replac\$4) NEAR3 (lamp or bulb)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/17 14:05
S20	52	S19 AND ((end-cap or (end\$2 adj1 cap)) SAME ((air or heat\$2 or vent\$3 or thermal\$4 or temperature or cool\$4) WITH (open\$3 or hole or outlet)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/17 14:06
S21	66	S19 AND ((end-cap or (end\$2 adj1 cap)) SAME (hous\$3 or tub\$3 or cas\$3 or pipe or len\$3 or glass\$3) SAME ((thermal\$3 or heat\$3 or melt\$3 or temperature) WITH (seal\$4 or adhesive or bond\$3 or glu\$3)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/17 14:18
S22	959	S19 and 315/\$.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/17 14:38
S23	16	S22 AND ((end-cap or (end\$2 adj1 cap)) SAME ((air or heat\$2 or vent\$3 or thermal\$4 or temperature or cool\$4) WITH (open\$3 or hole or outlet)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2016/11/17 14:39

			DERWENT; IBM_TDB			
S24	2364	S19 and 362/\$.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/17 14:42
S25	20	S24 AND ((end-cap or (end\$2 adj1 cap)) SAME ((air or heat\$2 or vent\$3 or thermal\$4 or temperature or cool\$4) WITH (open\$3 or hole or outlet)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/17 14:42
S26	3189	S19 and (362/\$.ccls. or 315/\$.ccls.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/17 14:44
S27	29	S26 AND ((end-cap or (end\$2 adj1 cap)) SAME ((air or heat\$2 or vent\$3 or thermal\$4 or temperature or cool\$4) WITH (open\$3 or hole or outlet)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/17 14:45
S28	5	S27 AND ((end-cap or (end\$2 adj1 cap)) SAME (hous\$3 or tub\$3 or cas\$3 or pipe or len\$3 or glass\$3) SAME ((thermal\$3 or heat\$3 or melt\$3) WITH (seal\$4 or adhesive or bond\$3 or glu\$3)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/17 14:46
S29	1	S27 AND ((end-cap or (end\$2 adj1 cap)) SAME ((thermal\$3 or heat\$3 or melt\$3) NEAR3 (seal\$4 or adhesive or bond\$3 or glu\$3)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/17 14:47
S30	17	S26 AND ((end-cap or (end\$2 adj1 cap)) SAME (hous\$3 or tub\$3 or cas\$3 or pipe or len\$3 or glass\$3) SAME ((thermal\$3 or heat\$3 or melt\$3) WITH (seal\$4 or adhesive or bond\$3 or glu\$3)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/17 14:48
S31	6	S26 AND ((end-cap or (end\$2 adj1 cap)) SAME ((thermal\$3 or heat\$3 or melt\$3) NEAR3 (seal\$4 or adhesive or bond\$3 or glu\$3)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/17 14:49
S32	170177	H05B\$/\$.CPC. or F21V\$/\$.CPC. or F21S\$/\$.CPC.	US-PGPUB; USPAT	OR	ON	2016/11/17 14:51

S33	1705	S24 AND S32	US-PGPUB; USPAT	OR	ON	2016/11/17 14:51
S34	19	S33 AND ((end-cap or (end\$2 adj1 cap)) SAME ((air or heat\$2 or vent\$3 or thermal\$4 or temperature or cool\$4) WITH (open\$3 or hole or outlet)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/17 14:52
S35	5	S33 AND ((end-cap or (end\$2 adj1 cap)) SAME ((thermal\$3 or heat\$3 or melt\$3) NEAR5 (seal\$4 or adhesive or bond\$3 or glu\$3)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/17 14:54
S36	38	S19 AND ((end-cap or (end\$2 adj1 cap)) SAME ((thermal\$3 or heat\$3 or melt\$3 or hot or hot-melt\$3) NEAR3 (seal\$4 or adhesive or bond\$3 or glu\$3)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/17 15:12
S37	121	S19 AND ((melt\$3 or hot or hot-melt\$3) NEAR3 (seal\$4 or adhesive or bond\$3 or glu\$3))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/17 15:21
S38	45	(315/\$.ccls. or 362/\$.ccls.) AND ((end- cap or (end\$2 adj1 cap)) SAME ((light or ambien\$3 or color) NEAR2 (sensor or detector)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/18 17:06
S39	0	((LED.u/c. or (light adj emitting adj diode) or (light-emitting adj diode)) NEAR3 (tub\$4 or straight or pipe or cyclind\$5 or retrofit\$4 or replac\$4) NEAR3 (lamp or bulb)) AND ((end-cap or (end\$2 adj1 cap)) WITH ((air or heat\$2 or vent\$3 or thermal\$4 or temperature) NEAR2 (open\$3 or hole or outlet)) SAME sensor)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/18 21:41
S40	0	((LED.u/c. or (light adj emitting adj diode) or (light-emitting adj diode)) NEAR3 (tub\$4 or straight or pipe or cyclind\$5 or retrofit\$4 or replac\$4) NEAR3 (lamp or bulb)) AND ((end-cap or (end\$2 adj1 cap)) SAME ((air or heat\$2 or vent\$3 or thermal\$4 or temperature) NEAR3 (open\$3 or hole or outlet)) SAME sensor)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/18 21:46
S41	33	((LED.u/c. or (light adj emitting adj diode) or (light-emitting adj diode)) NEAR3 (tub\$4 or straight or pipe or cyclind\$5 or retrofit\$4 or replac\$4) NEAR3 (lamp or bulb)) AND ((end-cap or (end\$2 adj1 cap)) SAME sensor)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	OR	ON	2016/11/18 21:48

			IBM_TDB			
S42	13	("20090200950" "20100045191" "20100083073" "20100220046" "20100308737" "20100327757" "20110170283" "20110175536" "20120200225" "6091200" "8207676" "8461513" "8531386").PN. OR ("9488355").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2016/11/18 23:08
S43	82	((LED.u/c. or (light adj emitting adj diode) or (light-emitting adj diode)) NEAR3 (tub\$4 or straight or pipe or cyclind\$5 or retrofit\$4 or replac\$4) NEAR3 (lamp or bulb)) AND ((end-cap or ((end\$2 or edge) adj1 (cap or cover\$2 or hous\$3)) or edge-cap) SAME (air-hole or ((air or heat\$2 or vent\$3 or thermal\$4 or temperature) NEAR5 (open\$3 or hole or outlet or space)) or air-open\$3))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/19 10:08
S44	2	S43 AND ((end-cap or ((end\$2 or edge) adj1 (cap or cover\$2 or hous\$3)) or edge-cap) SAME (air-hole or ((air or heat\$2 or vent\$3 or thermal\$4 or temperature) NEAR5 (open\$3 or hole or outlet or space)) or air-open\$3) SAME ((light or ambien\$3 or photo or \$2lumin\$4) NEAR2 (detect\$3 or sens\$3)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/19 10:12
S45	2	S43 AND ((end-cap or ((end\$2 or edge) adj1 (cap or cover\$2 or hous\$3)) or edge-cap) SAME (air-hole or ((air or heat\$2 or vent\$3 or thermal\$4 or temperature) NEAR5 (open\$3 or hole or outlet or space)) or air-open\$3) SAME ((light or ambien\$3 or photo or \$2lumin\$4) WITH (detect\$3 or sens\$3)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/19 10:14
S46	5	S43 AND ((end-cap or ((end\$2 or edge) adj1 (cap or cover\$2 or hous\$3)) or edge-cap) SAME ((light or ambien\$3 or photo or \$2lumin\$4) WITH (detect\$3 or sens\$3)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/19 10:14
S47	6	US-20080278943-\$.DID. OR US-20100246186-\$.DID. OR US-20100309647-\$.DID.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	OFF	2016/11/19 10:27
S48	4	US-20060164841-\$.DID. OR US-8016456-\$.DID.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	OFF	2016/11/19 10:28
S49	20	US-5134553-\$.DID. OR US-6536924-\$.DID. OR US-7670032-\$.DID. OR US-7862198-\$.DID. OR US-8057061-\$.DID. OR US-8061867-\$.DID. OR US-6221717-\$.DID. OR US-20050201088-\$.DID. OR US-20070189015-\$.DID. OR US-	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT	OR	OFF	2016/11/19 10:29

		20070247856-\$.DID.				
S50	107	("20040032220" "5463280" "5811942" "6580228" "6608453" "6828733" "6936968").PN. OR ("7067992").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2016/11/19 11:03
S51	67	S50 and sensor	US-PGPUB; USPAT; USOCR	OR	ON	2016/11/19 11:37
S52	15	((("20130050998") or ("20140009923") or ("20160081147") or ("20150176770") or ("20140226320") or ("20100253226") or ("20080290814") or ("20110038146") or ("20150285479") or ("20150028751") or ("20140346972") or ("20140268748") or ("20130051008") or ("20130021809") or ("20120195032")).PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2016/11/20 12:39
S53	17	((("20130050998") or ("20140009923") or ("20160081147") or ("20150176770") or ("20140226320") or ("20100253226") or ("20080290814") or ("20110038146") or ("20150285479") or ("20150028751") or ("20140346972") or ("20140268748") or ("20130051008") or ("20130021809") or ("20120195032") or ("20100253226") or ("5536998") or ("8288949") or ("20160081147")).PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2016/11/20 12:47
S54	2	((("20110149548") or ("20130170196")).PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2016/11/21 18:31
S55	70	(LED.u/c. or (light adj emitting adj diode) or (light-emitting adj diode)) NEAR3 (tub\$4 or straight or pipe or cyclind\$5 or retrofit\$4 or replac\$4) NEAR3 (lamp or bulb) AND ((end-cap or (end adj1 cap)) SAME (PCB.u/c. or (circuit adj1 board) or (print-circuit adj1 board)) SAME (heat-sink\$3 or ((heat\$3 or temperature or thermal\$3) adj1 (sink\$3 or dissipat\$4)) or heat-dissipat\$4))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/21 18:37
S56	54	(LED.u/c. or (light adj emitting adj diode) or (light-emitting adj diode)) NEAR3 (tub\$4 or straight or pipe or cyclind\$5 or retrofit\$4 or replac\$4) NEAR3 (lamp or bulb) AND ((end-cap or (end\$2 adj1 cap)) SAME ((air or heat\$2 or vent\$3 or thermal\$4 or temperature or cool\$4 or pressur\$3) WITH (open\$3 or hole or outlet)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/25 16:34
S57	20	("1830084" "20050070172" "20100277918" "20110194278" "2716226" "4728835" "5009614" "6283612" "6531810" "7354001" "7484980" "7490957" "8167452" "8220956" "8220976").PN. OR ("8827486").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2016/11/25 17:39
S58	27010	((end-cap or (end\$2 adj1 cap)) SAME ((air or heat\$2 or vent\$3 or thermal\$4 or temperature or cool\$4 or pressur\$3) WITH (open\$3 or hole or outlet)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	OR	ON	2016/11/25 18:13

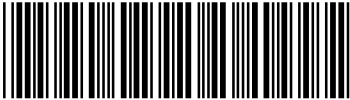
			IBM_TDB			
S59	1034	S58 AND (LED.u/c. or (light adj emitting adj diode) or (light-emitting adj diode))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/25 18:14
S60	123	S59 AND ((LED.u/c. or (light adj emitting adj diode) or (light-emitting adj diode)) NEAR3 (tub\$4 or straight or pipe or cyclind\$5 or retrofit\$4 or replac\$4))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/25 18:17
S61	33	S59 AND 315/\$.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/25 19:00
S62	155	S59 AND 362/\$.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/11/25 19:05
S63	4	((("20130135822") or ("7611260") or ("20160081147") or ("20080290814")).PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2017/05/16 15:32
S64	11	((LED.u/c. ADJ1 tube) AND sleeve).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/06/28 17:13
S65	96	((LED.u/c. or (light adj emitting adj diode) or (light-emitting adj diode)) NEAR3 (tub\$4 or straight or pipe or cyclind\$5 or retrofit\$4 or replac\$4 or fluorescen\$3)) AND ((end-cap or (end adj1 (cap or holder or cover\$2))) SAME ((heat or air or pressure) NEAR2 (vent or ventilat\$3 or outlet or hole)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/06/28 17:51
S66	138	((LED.u/c. or (light adj emitting adj diode) or (light-emitting adj diode)) NEAR3 (tub\$4 or straight or pipe or cyclind\$5 or retrofit\$4 or replac\$4 or fluorescen\$3)) AND ((end-cap or (end adj1 (cap or holder or cover\$2))) SAME ((heat or air or pressure or vent or ventilat\$4 or radiat\$4 or cool\$3) NEAR2 (outlet or hole or opening)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/06/28 18:34
S67	8	((("20150176770") or ("20100220469") or ("20100253226") or ("20100135015") or ("20130050998") or ("20080290814") or ("20110038146") or ("20160081147")).PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2017/06/28 21:38

EAST Search History (Interference)

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6/ 29/ 2017 9:11:54 PM

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Search Notes 	Application/Control No. 15483368	Applicant(s)/Patent Under Reexamination JIANG ET AL.
	Examiner ANH TRAN	Art Unit 2844

CPC- SEARCHED		
Symbol	Date	Examiner
H05B\$/\$, F21VS/\$, F21S\$/ text search - see printout	6/29/17	AT

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
315 & 362	all- east search- see printout	6/29/17	AT

SEARCH NOTES		
Search Notes	Date	Examiner
east search- see printout	6/29/17	AT

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

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Doc code: IDS

PTO/SB/08a (01-10)

Doc description: Information Disclosure Statement (IDS) Filed

Approved for use through 07/31/2012. OMB 0651-0031

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	Filing Date		
	First Named Inventor	Tao JIANG et al.	
	Art Unit		
	Examiner Name		
	Attorney Docket Number	6246-40007US8	

U.S.PATENTS						Remove
Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	5575459		1996-11-19	ANDERSON	
	2	5921660		1999-07-13	YU	
	3	6127783		2000-10-03	Pashley et al.	
	4	6609813		2003-08-26	Showers et al.	
	5	6796680		2004-09-28	Showers et al.	
	6	7033239		2006-04-25	Cunkelman et al.	
	7	8360599		2013-01-29	Ivey et al.	
	8	8579463		2013-11-12	CLOUGH	

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10	7067032		2006-06-27	Bremont et al.	
11	4647399		1987-03-03	Peters et al.	
12	3294518		1966-12-27	Laseck Frank B et al.	
13	6211262		2001-04-03	Mejiritski et al.	
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15	2454049		1948-11-16	FLOYD JR GEORGE H	
16	7594738		2009-09-29	Lin et al.	
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20	D761216	2016-07-12	JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.
21	9447929	2016-09-20	JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.
22	D768891	2016-10-11	JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.

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	1	20020044456		2002-04-18	Balestriero et al.	
	2	20030231485		2003-12-18	Tseng-Lu Chien	
	3	20040095078		2004-05-20	Susan Leong	
	4	20040189218		2004-09-30	Susan Leong	
	5	20050128751		2005-06-16	Roberge et al.	
	6	20050162850		2005-07-28	Luk et al.	

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8	20050213321		2005-09-29	Lin	
9	20070001709		2007-01-04	Shen	
10	20070145915		2007-06-28	Roberge et al.	
11	20070210687		2007-09-13	Axelsson	
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14	20080192476		2008-08-14	Hiratsuka	
15	20080278941		2008-11-13	Logan et al.	
16	20090161359		2009-06-25	Siemiet et al.	
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18	20110090684		2011-04-21	Logan et al.	
19	20110216538		2011-09-08	Logan et al.	
20	20120069556		2012-03-22	Bertram et al.	
21	20120106157		2012-05-03	Simon et al.	
22	20120153873		2012-06-21	Hayashi et al.	
23	20130170245		2013-07-04	HONG et al.	
24	20130182425		2013-07-18	Seki et al.	
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30	20130050998		2013-02-28	Chu et al.	
31	20110057572		2011-03-10	Kit et al.	
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41	20120319150		2012-12-20	SHIMOMURA et al.	
42	20100253226		2010-10-07	OKI et al.	
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52	20120049684		2012-03-01	Bodenstein et al.	
53	20130033881		2013-02-07	Terazawa et al.	
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Examiner Name		
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63	20160215936		2016-07-28	JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.	
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65	20160290598		2016-10-06	JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.	
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First Named Inventor	Tao JIANG et al.	
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73	20160290609	2016-10-06	JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.
74	20160290567	2016-10-06	JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.
75	20160290568	2016-10-06	JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.
76	20160290566	2016-10-06	JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.

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FOREIGN PATENT DOCUMENTS

Examiner Initial*	Cite No	Foreign Document Number ³	Country Code ² i	Kind Code ⁴	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear	T ⁵
	1	2013125803	WO		2013-08-29	Ryu		×
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EXAMINER SIGNATURE

Examiner Signature	/ANH Q TRAN/	Date Considered	06/29/2017
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¹ See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. ² Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). ³ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁴ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁵ Applicant is to place a check mark here if English language translation is attached.

<i>Index of Claims</i> 	Application/Control No. 15483368	Applicant(s)/Patent Under Reexamination JIANG ET AL.
	Examiner ANH TRAN	Art Unit 2844

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant		☐ CPA		☐ T.D.		☐ R.1.47			
CLAIM		DATE							
Final	Original	06/29/2017							
	1	✓							
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LED TUBE LAMP

Cross-Reference to Related Applications

This application is continuation application of U.S. application no. 15/211,717 filed on July 15, 2016 which is a continuation-in-part application claiming benefits of U.S. Application no. 14/865,387 filed on 2015/9/25, U.S. Application no. 15/056,121 filed on 2016/2/29, and U.S. Application no. 15/168,962 filed on 2016/5/31, the disclosures of which are incorporated herein in their entirety by reference.

Technical Field

[0001] The instant disclosure relates to illumination devices, and, more particularly, to an LED tube lamp and components thereof comprising the LED light sources, a tube, electronic components, and end caps.

Related Art

[0002] LED lighting technology is rapidly developing to replace traditional incandescent and fluorescent lightings. LED tube lamps are mercury-free in comparison with fluorescent tube lamps that need to be filled with inert air and mercury. Thus, it is not surprising that LED tube lamps are becoming a highly desired illumination option among different available lighting systems used in homes and workplaces, which used to be dominated by traditional lighting options such as compact fluorescent light bulbs (CFLs) and fluorescent tube lamps. Benefits of LED tube lamps include improved durability and longevity and far less energy consumption; therefore, when taking into account all factors, they would typically be considered as a cost effective lighting option.

[0003] The basic structure of the traditional LED tube lamps include a tube, two end caps at two ends of the tube, a substrate inside the tube, LEDs on the substrate, and a power supply inside the end caps. The substrate disposed inside the tube and

having LEDs mounted on is rigid and straight printed circuit board, which makes the tube remain a straight appearance even it is partially ruptured or broken. As a result, user cannot easily aware that the tube is damaged and might be exposed to a dangerous situation.

5 [0004] In addition, the rigid substrate of the traditional LED tube lamp is typically electrically connected with the end caps by way of wire bonding, in which the wires may be easily damaged and even broken due to any move during manufacturing, transportation, and usage of the LED tube lamp and therefore may disable the LED tube lamp.

10 [0005] As the development of LED chips, electro-optical conversion efficiency becomes higher and heat generated from the conversion becomes less. Accordingly, apparatuses utilizing LED chips seldom use ventilating holes to dissipating the heat.

[0006] Further, the tube and the end caps of the traditional LED tube lamp are often secured together by tight fit, making the reliability cannot be further improved.

15 SUMMARY

[0007] To address the above issue, the instant disclosure provides embodiments of an LED tube lamp.

[0008] According to an embodiment, an LED tube lamp includes a glass tube having two end portions, a plurality of LED light sources, two end caps respectively sleeve the two end portions of the glass tube, a power supply in one of the end caps or separately in both of the end caps, and an LED light strip on an inner surface of the glass tube. The glass tube is covered by a heat shrink sleeve. The glass tube and the end cap are secured by a hot melt adhesive. The plurality of LED light sources is on the LED light strip. Each of the end caps comprises an electrically insulating tube,
25 two conductive pins on the electrically insulating tube; and at least two

heat-dissipating openings on the electrically insulating tube symmetric to each other with respect to a plane passing through the middle of a line connecting the two conductive pins and perpendicular to the line connecting the two conductive pins.

[0009] According to an embodiment, the hot melt adhesive is, respectively,
5 disposed on the outer surface of the end portions and the shape of the disposed hot melt adhesive is substantially a circle from the side view of the glass tube.

[0010] According to an embodiment, the at least two heat-dissipating openings are on a surface of the electrically insulating tube on which the two conductive pins are disposed.

10 [0011] According to an embodiment, the at least two heat-dissipating openings are separately in a shape of an arc.

[0012] According to an embodiment, the at least two heat-dissipating openings are in a shape of arcs with different sizes.

[0013] According to an embodiment, the sizes of the arcs of the at least two
15 heat-dissipating openings gradually vary.

[0014] According to an embodiment, the heat shrink sleeve is substantially transparent with respect to the wavelength of light from the LED light sources.

[0015] According to an embodiment, at least a part of the openings are arranged along an arc and spaced apart from each other.

20 [0016] According to an embodiment, the heat and pressure inside the end cap increase during the heating and solidification of the hot melt adhesive, and are then released through at least one opening on the end cap.

[0017] According to an embodiment, an LED tube lamp includes a glass tube having an inner surface and an outer surface, a plurality of LED light sources, two end
25 caps respectively at two opposite ends of the glass tube, a power supply in one of the

end caps or separately in both of the end caps, and an LED light strip on the inner surface of the glass tube. The plurality of LED light sources is on the LED light strip. Each of the end caps comprises a plurality of openings formed thereon. The plurality of openings dissipating heat resulted from the power supply are divided into two sets.

5 The two sets of the plurality of openings are symmetric to each other with respect to a virtual central axis of the end cap. At least part of the inner surface of the glass tube is formed with a rough surface.

[0018] According to an embodiment, the LED tube lamp comprises a hot melt adhesive. The end cap is adhered to one end of the glass tube via the hot melt
10 adhesive.

[0019] According to another embodiment, the plurality of openings dissipate heat resulted from the power supply.

[0020] According to another embodiment, the hot melt adhesive is heated to be expansive and flowing during a process of having the glass tube and the end cap
15 adhered. The plurality of openings dissipate heat to have the hot melt adhesive cooled and solidified.

[0021] According to another embodiment, an LED tube lamp includes a glass tube, a plurality of LED light sources, two end caps respectively at two opposite ends of the glass tube, a power supply in one of the end caps or separately in both of the end caps,
20 and an LED light strip in the glass tube. The plurality of LED light sources is on the LED light strip. Each of the end caps comprises two conductive pins and a plurality of heat-dissipating openings. The two conductive pins are on a surface of the end cap. The plurality of heat-dissipating openings is on the surface of the end cap and divided into two sets. The two sets of the heat-dissipating openings are symmetric to each
25 other with respect to a plane passing through the two conductive pins.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] FIG. 1 illustrates a perspective view of an LED tube lamp according to an embodiment of the instant disclosure;

FIG. 2 illustrates an exploded view of an LED tube lamp according to an embodiment of the instant disclosure;

FIG. 3 illustrates a part of cross section of FIG. 2 along line A-A’;

FIG. 4 illustrates a part of cross section of FIG. 2 along line B-B’;

FIG. 5 illustrates an exploded view of an LED tube lamp including two parts of a power supply according to an embodiment of the instant disclosure;

FIG. 6 illustrates an exploded view of an LED tube lamp including a heat shrink sleeve according to an embodiment of the instant disclosure;

FIG. 7 illustrates a partial view of a bendable circuit sheet of an LED light strip and a power supply apart from each other according to an embodiment of the instant disclosure;

FIG. 8 illustrates a partial view of the bendable circuit sheet of the LED light strip and the power supply soldered to each other according to an embodiment of the instant disclosure;

FIGS. 9 to 11 illustrate a soldering process of the bendable circuit sheet of the LED light strip and the power supply according to an embodiment of the instant disclosure;

FIGS. 12 and 13 illustrate a bendable circuit sheet of an LED light strip and a power supply electrically connected to each other by a pair of jack/plug connectors according to an embodiment of the instant disclosure;

FIG. 14 is a perspective view schematically illustrating an LED tube lamp according to an embodiment of the instant disclosure;

FIG. 15 an exemplary exploded view schematically illustrating the LED tube lamp shown in Fig. 14; and

FIG. 16 is a perspective view schematically illustrating front and top of an end cap of the LED tube lamp according to one embodiment of the instant disclosure.

5 DETAILED DESCRIPTION

[0023] The instant disclosure provides an LED tube lamp to solve the abovementioned problems. The instant disclosure will now be described more fully hereinafter with reference to the accompanying drawings, in which exemplary embodiments of the disclosure are shown. This disclosure may, however, be embodied
10 in many different forms and should not be construed as limitation to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the disclosure to those skilled in the art. Like reference numerals refer to like elements throughout.

[0024] The terminology used herein is for the purpose of describing particular
15 embodiments only and is not intended to be limiting of the disclosure. As used herein, the singular forms “a”, “an” and “the” are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms “comprises” and/or “comprising,” or “includes” and/or “including” or “has” and/or “having” when used herein, specify the presence of stated features, regions,
20 integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, regions, integers, steps, operations, elements, components, and/or groups thereof.

[0025] It will be understood that the term “and/or” includes any and all combinations of one or more of the associated listed items. It will also be understood
25 that, although the terms first, second, third etc. may be used herein to describe various

elements, components, regions, parts and/or sections, these elements, components, regions, parts and/or sections should not be limited by these terms. These terms are only used to distinguish one element, component, region, part or section from another element, component, region, part or section. Thus, a first element, component, region, part or section discussed below could be termed a second element, component, region, part or section without departing from the teachings of the present disclosure.

[0026] The following description with reference to the accompanying drawings is provided to explain the exemplary embodiments of the disclosure. Note that in the case of no conflict, the embodiments of the present disclosure and the features of the embodiments may be arbitrarily combined with each other.

[0027] Referring to FIG. 1, FIG. 2, and FIG. 3, the instant disclosure provides an embodiment of an LED tube lamp 50 including a glass tube 100, an LED light strip 200, two end caps 300, and a power supply 400. The glass tube 100 includes an inner surface 100a and an outer surface 100b. The LED light strip 200 is disposed inside the glass tube 100 and has a bendable circuit sheet 205 mounted on the inner surface 100a of the glass tube 100. The two end caps 300, which can have the same size or have different sizes, are respectively disposed on two ends of the glass tube 100 and secured with the glass tube 100 by a hot melt adhesive. The hot melt adhesive may be disposed around the surrounding surfaces between the glass tube 100 and the end caps 300, respectively. In this embodiment, the end caps 300 sleeve, respectively, two end portions of the glass tube 100 and the hot melt adhesive may be surroundingly disposed on the outer surface of the end portions of the glass tube 100. Accordingly, the shape of the disposed hot melt adhesive is substantially a circle from the side view of the glass tube 100 (like the view of FIG. 4). The heat generated during the heating process of the hot melt adhesive will be in a shape of a circle. The degree of vacuum

of the glass tube 100 is below 0.001 Pa~ 1 Pa, and reduce the problem of internal damp. After heating up the hot melt adhesive, and upon expansion due to heat absorption, the hot melt adhesive flows, and then solidifies upon cooling, thereby bonding together the end cap 300 to the glass tube 100 (not shown). The volume of the hot melt adhesive may expand to about 1.3 times the original size when heated from room temperature (e.g., between about 15 and 30 degrees Celsius) to about 200 to 250 degrees Celsius. The end cap 300 and the end of the glass tube 100 could be secured by using the hot melt adhesive and therefore qualified in a torque test of about 1.5 to about 5 newton-meters (Nt-m) and/or in a bending test of about 5 to about 10 newton-meters (Nt-m). During the heating and solidification of the hot melt adhesive, the heat and pressure inside the end cap increase and are then released through at least one opening on the end cap 300. After the hot melt adhesive hardens, the end cap 300 can be firmly fixed to the glass tube 100. Under the circumstances, the end cap 300 and the glass tube 100 is hard to disassemble unless the hardened hot melt adhesive returns to liquid state by certain process. The design of the LED tube lamp 50 is to take into account both the convenience regarding the assembling process of the LED tube lamp 50 and the robustness regarding the assembled LED tube lamp 50. Several LED light sources 202 are disposed on the bendable circuit sheet 205 of the LED light strip 200, and the power supply 400 is disposed in one of the end caps 300. The LED light sources 202 and the power supply 400 can be electrically connected to each other directly via the bendable circuit sheet 205 of the LED light strip 200. Middle part of the bendable circuit sheet 205 can be mounted on the inner surface 100a of the glass tube 100. Instead, at least one of the two opposite, short edges of the bendable circuit sheet 205 is not mounted on the inner surface 100a of the glass tube 100 and may be formed as a freely extending end portion 210. The freely extending end

portions 210 extends outside the glass tube 100 through one of two opposite ends of the glass tube 100 along the axial direction of the glass tube 100. The freely extending end portion 210 can extend into the end caps 300 and can be electrically connected to the power supply 400 directly. The power supply 400 may be in the form of a single integrated unit (e.g., with all components of the power supply 400 are within a body) disposed in an end cap 300 at one end of the glass tube 100. Alternatively, the power supply 400 may be in form of two separate parts (e.g., with the components of the power supply 400 are separated into two pieces) respectively disposed in two end caps 300. The power supply may supply or provide power from external signal(s), such as from an AC power line or from a ballast, to an LED module and the LED light sources. Each of the end caps 300 includes a pair of hollow conductive pins 310 utilized for being connected to an outer electrical power source. When the LED tube lamp 50 is installed to a lamp base, the hollow conductive pins 310 are plugged into corresponding conductive sockets of the lamp base such that the LED tube lamp 50 can be electrically connected to the lamp base.

[0028] In one embodiment, the LED light strip 200 comprises a bendable circuit sheet 205 which includes a wiring layer and a dielectric layer that are in a stacked arrangement, wherein the wiring layer and the dielectric layer have same area or the wiring layer has a bit less area (not shown) than the dielectric layer. The LED light source 202 is disposed on a surface of the wiring layer away from the dielectric layer. In other words, the dielectric layer is disposed on the wiring layer away from the LED light sources 202. The wiring layer is electrically connected to the power supply 400 to carry direct current (DC) signals. Meanwhile, an adhesive sheet is disposed on a surface of the dielectric layer away from the wiring layer to bond and to fix the dielectric layer to the inner circumferential surface of the glass tube 100. The wiring

layer can be a metal layer serving as a power supply layer, or can be bonding wires such as copper wire. In an alternative embodiment, the LED light strip 200 further includes a circuit protection layer (not shown) cover each outer surface of the wiring layer and the dielectric layer. In another alternative embodiment, the dielectric layer
5 can be omitted, in which the wiring layer is directly bonded to the inner circumferential surface of the glass tube 100. The circuit protection layer can be an ink material, possessing functions as solder resist and optical reflectance. Alternatively, the bendable circuit sheet 205 is a one-layered structure which is consist of one wiring layer only, and then the surface of the wiring layer is covered
10 with a circuit protection layer of ink material as mentioned above, wherein an opening is configured over the circuit protection layer to electrically connect the LED light source 202 with the wiring layer. Whether the wiring layer has a one-layered, or two-layered structure, the circuit protective layer can be adopted. The circuit protection layer can be disposed on the side/surface of the LED light strip 200, such
15 as the same surface of the wiring layer which has the LED light source 202 disposed thereon.

[0029] It should be noted that, in the present embodiment, the bendable circuit sheet 205 is a one-layered structure made of just one layer of the wiring layer, or a two-layered structure (made of one layer of the wiring layer and one layer of the
20 dielectric layer), and thus would be more bendable or flexible to curl than the conventional three-layered flexible substrate. As a result, the bendable circuit sheet 205 (the LED light strip 200) of the present embodiment can be installed in a glass tube 100 that is of a customized shape or non-linear shape, and the bendable circuit sheet 205 can be mounted touching the sidewall of the glass tube 100. The bendable
25 circuit sheet 205 mounted closely to the inner surface of the tube wall is one preferred

configuration, and the fewer number of layers thereof, the better the heat dissipation effect, and the lower the material cost. Of course, the bendable circuit sheet 205 is not limited to being a one-layered or two-layered structure only; in other embodiments, the bendable circuit sheet 205 can include multiple layers of the wiring layers and multiple layers of the dielectric layers, in which the dielectric layers and the wiring layers are sequentially stacked in a staggered manner, respectively, to be disposed on the surface of the one wiring layer that is opposite from the surface of the one wiring layer which has the LED light source 202 disposed thereon.

[0030] In one embodiment, the LED light strip 200 includes a bendable circuit sheet 205 having in sequence a first wiring layer, a dielectric layer, and a second wiring layer (not shown). The thickness of the second wiring layer is greater than that of the first wiring layer, and/or the projected length of the LED light strip 200 is greater than that of the glass tube 100. The end region of the light strip 200 extending beyond the end portion of the glass tube 100 without disposition of the LED light source 202 is formed with two separate through holes to respectively electrically communicate the first wiring layer and the second wiring layer (not shown). The through holes are not communicated to each other to avoid short.

[0031] In this way, the greater thickness of the second wiring layer allows the second wiring layer to support the first wiring layer and the dielectric layer, and meanwhile allow the LED light strip 200 to be mounted onto the inner circumferential surface without being liable to shift or deform, and thus the yield rate of product can be improved. In addition, the first wiring layer and the second wiring layer are in electrical communication such that the circuit layout of the first wiring layer can be extended downward to the second wiring layer to reach the circuit layout of the entire LED light strip 200. In some circumstances, the first wiring layer connects the anode

and the second wiring layer connects the cathode. Moreover, since the land for the circuit layout becomes two-layered, the area of each single layer and therefore the width of the LED light strip 200 can be reduced such that more LED light strips 200 can be put on a production line to increase productivity. Furthermore, the first wiring layer and the second wiring layer of the end region of the LED light strip 200 that extends beyond the end portion of the tube 100 without disposition of the LED light source 202 can be used to accomplish the circuit layout of a power supply 400 so that the power supply 400 can be directly disposed on the bendable circuit sheet 205 of the LED light strip 200.

[0032] In another embodiment, the projected length of the bendable circuit sheet 205 as the LED light strip 200 in a longitudinal projection is larger than the length of the glass tube 100. The LED light source 202 is disposed on the uppermost layer of the wiring layers, and is electrically connected to the power supply 400 through the (uppermost) wiring layer. Furthermore, the inner peripheral surface of the glass tube 100 or the outer circumferential surface thereof is covered with an adhesive film (not shown), for the sake of isolating the inner content from outside content of the glass tube 100 after the glass tube 100 has been ruptured. The present embodiment has the adhesive film coated on the inner peripheral surface of the glass tube 100 (not shown).

[0033] Moreover, in some embodiments, the projected length of the bendable circuit sheet is greater than the length of the glass tube 100 (not including the length of the two end caps 300 respectively connected to two ends of the glass tube 100), or at least greater than a central portion of the glass tube 100 between two transition regions (e.g., where the circumference of the tube narrows) on either end. In one embodiment, the longitudinally projected length of the bendable circuit sheet as the LED light strip 200 is larger than the length of the glass tube 100.

[0034] As shown in FIG. 3, the glass tube 100 includes a main body region 102, two rear end regions 101, and two two-arc-shaped transition regions 103 narrowed down or tapering smoothly and continuously from the main body region to the rear end regions connecting the main body region 102 and the rear end regions 101. In other words, in the transition regions 103, the glass tube 100 narrows, or tapers to have a smaller diameter when moving along the length of the glass tube 100 from the main body region 102 to the rear end regions 101. The tapering/narrowing may occur in a continuous, smooth manner (e.g., to be a smooth curve without any linear angles). By avoiding angles, in particular any acute angles, the glass tube 100 is less likely to break or crack under pressure. Furthermore, the transition region 103 is formed by two curves at both ends, wherein one curve is toward inside of the glass tube 100 and the other curve is toward outside of the glass tube 100. For example, one curve closer to the main body region 102 is convex from the perspective of an inside of the glass tube 100 and one curve closer to the rear end region 101 is concave from the perspective of an inside of the glass tube 100. The transition region 103 of the glass tube 100 in one embodiment includes only smooth curves, and does not include any angled surface portions. The outer diameter of the rear end region 101 is smaller than that of the main body region 102. Therefore, a height difference between the rear end region 101 and the main body region 102 is formed to avoid adhesives applied on the rear end region 101 being overflowed onto the main body region 102, and thereby saves manpower for removing the overflowed adhesive and increases productivity.

[0035] In one embodiment, at least part of the inner surface 100a of the glass tube 100 has a rough surface and the roughness of the inner surface 100a is higher than that of the outer surface 100b, such that the light from the LED light sources 202 can be

uniformly spread when transmitting through the glass tube 100. Since LED light sources 202 consists of several point light sources (LED dies), each LED light source 202 casts a cone of light, which results in non-uniformity of light output intensity. With the rough surface, the light from LED light sources 202 will be diffused before transmitting through the glass tube 100 and the uniformity of light output is improved thereby. In one embodiment, the roughness of the inner surface 100a may be substantially from 0.1 to 40 μm , the light from LED light sources 202 will be well diffused before entirely transmitting through the glass tube 100 and the uniformity of light output is substantially improved. However, in some embodiments, the inner surface 100a of the glass tube 100 does not have the roughness surface.

[0036] In one embodiment, as shown in FIG. 4, the rough surface may be formed with a light scattering region 130. Since LED light sources 202 consists of several point light sources (LED dies), each LED light source 202 casts a cone of light, which results in non-uniformity of light output intensity. With the light scattering region 130, the light from LED light sources 202 will be scattered before entirely transmitting through the glass tube 100 and the uniformity of light output is substantially improved.

[0037] In one embodiment, as shown in FIG. 4, the glass tube 100 may further include a reflective film 120 disposed on a part of the inner surface 100a of the glass tube 100. In some embodiments, the reflective film 120 may be positioned on two sides of the LED light strip 200. As shown in FIG. 4, part of light 209 from LED light sources 202 are reflected by the reflective films 120 such that the light 209 from the LED light sources 202 can be centralized to a determined direction. And, in some embodiment, a ratio of a length of the reflective film 120 disposed on the inner surface 100a of the glass tube 100 extending along the circumferential direction of the

glass tube 100 to a circumferential length of the glass tube 100 may be about 0.3 to 0.5, which means about 30% to 50% of the inner surface area may be covered by the reflective film 120. The reflective film 120 may be made of PET with some refractive materials such as strontium phosphate or barium sulfate or any combination thereof,
5 with a thickness between about 140 μm and about 350 μm or between about 150 μm and about 220 μm for a more preferred effect in some embodiments. In some embodiments, only the part of the inner surface 100a which is not covered by the reflective film 120 is formed with the light scattering region 130 as shown in FIG. 4. In other words, the reflective film 120 is disposed on a part of the inner surface 100a
10 of the glass tube 100 which is not formed with the rough surface or the light scattering region 130.

[0038] In one embodiment, as shown in FIG. 5, two opposite, short edges of the bendable circuit sheet 205 may be formed as two freely extending end portions 210, and two parts of a power supply 400 are respectively disposed in the two end caps 300.
15 The two freely extending end portions 210 respectively extends outside the glass tube 100 through two opposite ends of the glass tube 100 along the axial direction of the glass tube 100, such that can respectively extend into the two end caps 300 and be respectively electrically connected to the two parts of a power supply 400 directly.

[0039] Referring to FIG. 6, the LED tube lamp 50 may have a heat shrink sleeve
20 190 covering on the outer surface 100b of the glass tube 100. In some embodiments, the heat shrink sleeve 190 may have a thickness ranging between 20 μm and 200 μm and is substantially transparent with respect to the wavelength of light from the LED light sources 202. In some embodiments, the heat shrink sleeve 190 may be made of PFA (perfluoroalkoxy) or PTFE (polytetrafluoroethylene). The heat shrink sleeve 190
25 may be slightly larger than the glass tube 100, and may be shrunk and tightly cover

the outer surface 100b of the glass tube 100 while being heated to an appropriate temperature (ex, 260°C for PFA and PTFE).

[0040] Referring to FIG. 7 to FIG. 11, FIG. 7 and FIG. 8 are respectively partial views of the bendable circuit sheet 205 of the LED light strip 200 and the printed circuit board 420 of the power supply 400 apart from and soldered to each other. FIG. 9 to FIG. 11 illustrate a soldering process of the bendable circuit sheet 205 of the LED light strip 200 and the printed circuit board 420 of the power supply 400. In the embodiment, the bendable circuit sheet 205 of the LED light strip 200 and the freely extending end portions 210 have the same structure. In some embodiments, the power supply 400 includes at least one electronic component 430 disposed on one side of the printed circuit board 420, and the freely extending end portion 210 is electrically connected to the printed circuit board 420 directly through the other side which has no electronic component 430 disposed thereon. The freely extending end portions 210 are the portions of two opposite ends of the bendable circuit sheet 205 of the LED light strip 200 and are utilized for being connected to the printed circuit board 420 of the power supply 400. The LED light strip 200 and the power supply 400 can be electrically connected to each other by soldering. Two opposite ends of the bendable circuit sheet 205 of the LED light strip 200 are utilized for being respectively soldered directly to the printed circuit board 420 of the two parts of a power supply 400. In other embodiments, only one end of the bendable circuit sheet 205 of the LED light strip 200 is soldered directly to the printed circuit board 420 of the power supply 400. The bendable circuit sheet 205 of the LED light strip 200 includes a circuit layer 200a and a circuit protecting layer 200c over a side of the circuit layer 200a. Moreover, the bendable circuit sheet 205 of the LED light strip 200 includes two opposite surfaces which are a first surface 2001 and a second surface 2002. The first surface 2001 is the

one on the circuit layer 200a and away from the circuit protecting layer 200c. The second surface 2002 is the other one on the circuit protecting layer 200c and away from the circuit layer 200a. Several LED light sources 202 are disposed on the first surface 2001 and are electrically connected to circuits of the circuit layer 200a. The circuit protecting layer 200c has less electrical and thermal conductivity but being beneficial to protect the circuits. The first surface 2001 of the bendable circuit sheet 205 of the LED light strip 200 includes soldering pads "b". Soldering material "g" can be placed on the soldering pads "b". In the embodiment, the LED light strip 200 further includes a notch "f". The notch "f" is disposed on an edge of the end of the bendable circuit sheet 205 of the LED light strip 200 soldered directly to the printed circuit board 420 of the power supply 400. The printed circuit board 420 includes a power circuit layer 420a and soldering pads "a". Moreover, the printed circuit board 420 includes two opposite surfaces which are a first surface 421 and a second surface 422. The second surface 422 is the one on the power circuit layer 420a. The soldering pads "a" are respectively disposed on the first surface 421 and the second surface 422. The soldering pads "a" on the first surface 421 are corresponding to those on the second surface 422. Soldering material "g" can be placed on the soldering pad "a". In the embodiment, considering the stability of soldering and the optimization of automatic process, the bendable circuit sheet 205 of LED light strip 200 is disposed below the printed circuit board 420 (the direction is referred to FIG. 9). That is to say, the first surface 2001 of the bendable circuit sheet 205 of the LED light strip 200 is connected to the second surface 422 of the printed circuit board 420 of the power supply 400.

[0041] As shown in FIG. 10 and FIG. 11, in the soldering process of the bendable circuit sheet 205 of the LED light strip 200 and the printed circuit board 420 of the

power supply 400, the circuit protecting layer 200c of the bendable circuit sheet 205 of the LED light strip 200 is placed on a supporting table 52 (i.e., the second surface 2002 of the bendable circuit sheet 205 of the LED light strip 200 contacts the supporting table 52) in advance. The soldering pads “a” on the second surface 422 of the printed circuit board 420 of the power supply 400 directly sufficiently contact the soldering pads “b” on the first surface 2001 of the bendable circuit sheet 205 of the LED light strip 200. A thermo-compression heating head 51 presses on a portion where the bendable circuit sheet 205 of the LED light strip 200 and the printed circuit board 420 of the power supply 400 are soldered to each other. When soldering, the soldering pads “b” on the first surface 2001 of the bendable circuit sheet 205 of the LED light strip 200 contact the soldering pads “a” on the second surface 422 of the printed circuit board 420 of the power supply 400, and the soldering pads “a” on the first surface 421 of the printed circuit board 420 of the power supply 400 contact the thermo-compression heating head 51. Under the circumstances, the heat from the soldering thermo-compression heating head 51 can directly transmit through the soldering pads “a” on the first surface 421 of the printed circuit board 420 of the power supply 400 and the soldering pads “a” on the second surface 422 of the printed circuit board 420 of the power supply 400 to the soldering pads “b” on the first surface 2001 of the bendable circuit sheet 205 of the LED light strip 200. The transmission of the heat between the thermo-compression heating head 51 and the soldering pads “a” and b is not likely to be affected by the circuit protecting layer 200c which has relatively less thermal conductivity, and, consequently, the efficiency and stability regarding the connections and soldering process of the soldering pads “a” and “b” of the printed circuit board 420 of the power supply 400 and the bendable circuit sheet 205 of the LED light strip 200 can be improved. As shown in FIG. 10, the

printed circuit board 420 of the power supply 400 and the bendable circuit sheet 205 of the LED light strip 200 are firmly connected to each other by the soldering material “g”. Components between the virtual line M and the virtual line N of FIG. 10 from top to bottom are the soldering pads “a” on the first surface 421 of printed circuit board 420, the printed circuit board 420, the power circuit layer 420a, the soldering pads “a” on the second surface 422 of printed circuit board 420, the soldering pads “b” on the first surface 2001 of the bendable circuit sheet 205 of the LED light strip 200, the circuit layer 200a of the bendable circuit sheet 205 of the LED light strip 200, and the circuit protecting layer 200c of the bendable circuit sheet 205 of the LED light strip 200. The connection of the printed circuit board 420 of the power supply 400 and the bendable circuit sheet 205 of LED light strip 200 are firm and stable.

[0042] In other embodiments, an additional circuit protecting layer can be disposed over the first surface 2001 of the circuit layer 200a. In other words, the circuit layer 200a is sandwiched between two circuit protecting layers, and therefore the first surface 2001 of the circuit layer 200a can be protected by the circuit protecting layer. A part of the circuit layer 200a (the part having the soldering pads “b”) is exposed for being connected to the soldering pads “a” of the printed circuit board 420 of the power supply 400. Under the circumstances, a part of the bottom of the LED light source 202 contacts the circuit protecting layer on the first surface 2001 of the circuit layer 200a, and the other part of the bottom of the LED light source 202 contacts the circuit layer 200a.

[0043] In addition, according to the embodiment shown in FIG. 7 to FIG. 11, the printed circuit board 420 of the power supply 400 further includes through holes “h” passing through the soldering pads “a”. In an automatic soldering process, when the thermo-compression heating head 51 automatically presses the printed circuit board

420 of the power supply 400, the soldering material “g” on the soldering pads “a” can be pushed into the through holes “h” by the thermo-compression heating head 51 accordingly, which fits the needs of automatic process.

[0044] Referring to FIG. 12 and FIG. 13, in some embodiments, the bendable circuit sheet 205 of the LED light strip 200 and the printed circuit board 420 of the power supply 400 are electrically connected to each other by a pair of jack/plug connectors rather than by soldering. As shown in FIG. 12, the freely extending end portion 210 of the bendable circuit sheet 205 of the LED light strip 200 has a first electric connector 2300, and the printed circuit board 420 of the power supply 400 has a second electric connector 4300 which is capable of being connected with the first connector 2300. Since the LED light strip 200 and the power supply 400 are electrically connected to each other by a pair of jack/plug connectors rather than by soldering, the end cap 300 and the power supply 400 can be replaceable.

[0045] Referring to Figs. 14 and 15, an LED tube lamp of one embodiment of the present invention includes a glass tube 1, an LED light strip 2 disposed inside the glass tube 1, and two end caps 3 respectively disposed at two ends of the glass tube 1.

[0046] Referring to Figs. 15 and 16, in one embodiment, the end cap 3 may have openings 304 to dissipate heat generated by the power supply modules inside the end cap 3 so as to prevent a high temperature condition inside the end cap 3 that might reduce reliability. In some embodiments, the openings 304 are in a shape of an arc; especially in a shape of three arcs with different size. In one embodiment, the openings 304 are in a shape of three arcs with gradually varying size. The openings 304 on the end cap 3 can be in any one of the above-mentioned shape or any combination thereof. At least a part of the openings are arranged along an arc and spaced apart from each other.

[0047] Referring to Figs. 16, in one embodiment, each end cap 3 includes an electrically insulating tube 302, a thermal conductive member 303 sleeving over the electrically insulating tube 302, and two hollow conductive pins 301 disposed on the electrically insulating tube 302. The thermal conductive member 303 can be a metal ring that is tubular in shape. According to Fig. 15 and 16, the openings 304 on the electrically insulating tube symmetric to each other with respect to a vertical central plane passing through the middle of a line connecting the two conductive pins 301 and the vertical central plane is perpendicular to the line connecting the two conductive pins 301. The openings 304 are on a surface of the electrically insulating tube 302 on which the two conductive pins 301 are disposed.

[0048] The openings 304 symmetrically disposed on the electrically insulating tube 302 is capable of efficiently dissipating heat generated during the heating and solidification of the hot melt adhesive. Specifically, during heating and solidification of the hot melt adhesive, the hot melt adhesive circularly surrounding the end portions of the glass tube 100 will be heated and generates heat which is circularly surrounding the glass tube 100. Since the holes 304 are symmetrically arranged on the electrically insulating tube 302, the heat could be efficiently dissipated through the opening 304 which is the closest to the heat-generating sources (hot melt adhesive). In addition, the holes 304 may be used to dissipate heat generated by power supply 400 during the use of the LED tube lamp 50. In one embodiment, the components of the power supply 400 may be arranged symmetrically in one of the end caps, separately in both of the end caps, or in the glass tube 100 in accordance with the symmetrical arrangement of the holes 304. Accordingly, the heat generated from the components of the power supply can be dissipated through the hole 301 which is the closest to the component.

[0049] If any terms in this application conflict with terms used in any application(s)

from which this application claims priority, or terms incorporated by reference into this application or the application(s) from which this application claims priority, a construction based on the terms as used or defined in this application should be applied.

- 5 [0050] While the instant disclosure related to an LED tube lamp has been described by way of example and in terms of the preferred embodiments, it is to be understood that the instant disclosure needs not be limited to the disclosed embodiments. For anyone skilled in the art, various modifications and improvements within the spirit of the instant disclosure are covered under the scope of the instant disclosure. The
- 10 covered scope of the instant disclosure is based on the appended claims.

CLAIMS

What is claimed is:

1. An LED tube lamp, comprising:
 - a glass tube covered by a heat shrink sleeve and having two end portions;
 - 5 a plurality of LED light sources;
 - two end caps respectively sleeve the two end portions of the glass tube, the glass tube and the end cap are secured by a hot melt adhesive;
 - a power supply in one of the end caps or separately in both of the end caps;
 - and
 - 10 an LED light strip on an inner surface of the glass tube, the plurality of LED light sources being on the LED light strip;
 - wherein each of the end caps comprises:
 - an electrically insulating tube;
 - two conductive pins on the electrically insulating tube; and
 - 15 at least two heat-dissipating openings on the electrically insulating tube symmetric to each other with respect to a plane passing through the middle of a line connecting the two conductive pins and perpendicular to the line connecting the two conductive pins.
2. The LED tube lamp according to claim 1, wherein the hot melt adhesive is,
20 respectively, disposed on the outer surface of the end portions, and the shape of the disposed hot melt adhesive is substantially a circle from the side view of the glass tube.
3. The LED tube lamp according to claim 2, wherein the at least two heat-dissipating openings are on a surface of the electrically insulating tube on which the two
25 conductive pins are disposed.

4. The LED tube lamp according to claim 3, wherein the at least two heat-dissipating openings are separately in a shape of an arc.
5. The LED tube lamp according to claim 4, wherein the at least two heat-dissipating openings are in a shape of arcs with different sizes.
- 5 6. The LED tube lamp according to claim 5, wherein the sizes of the arcs of the at least two heat-dissipating openings gradually vary.
7. The LED tube lamp according to claim 6, wherein the heat shrink sleeve is substantially transparent with respect to the wavelength of light from the LED light sources.
- 10 8. The LED tube lamp according to claim 1, wherein the number of the at least two heat-dissipating openings is six in two sets, and the three heat-dissipating openings in one set are in a shape of three arcs with gradually varying sizes.
9. The LED tube lamp according to claim 1, wherein at least a part of the openings are arranged along an arc and spaced apart from each other.
- 15 10. The LED tube lamp according to claim 1, wherein the heat and pressure inside the end cap increase during heating and solidification of the hot melt adhesive, and are then released through at least one of the heat-dissipating openings.
11. An LED tube lamp, comprising:
 - a glass tube comprising an inner surface and an outer surface, at least part of
 - 20 the inner surface of the glass tube has a rough surface, the glass tube having two end portions;
 - a plurality of LED light sources;
 - two end caps respectively sleeve the two end portions of the glass tube;
 - a power supply in one of the end caps or separately in both of the end caps;
 - 25 and

an LED light strip on the inner surface of the glass tube, the plurality of LED light sources being on the LED light strip;

wherein each of the end caps comprises a plurality of openings thereon, and the two sets of the plurality of openings are symmetric to each other with respect to a virtual central axis of the end cap.

12. The LED tube lamp according to claim 11, wherein the roughness of the rough surface is substantially from 0.1 to 40 μm .

13. The LED tube lamp according to claim 12, further comprising a hot melt adhesive, wherein the end cap is adhered to one end of the glass tube via the hot melt adhesive.

14. The LED tube lamp according to claim 13, wherein the plurality of openings dissipate heat resulted from the power supply.

15. The LED tube lamp according to claim 13, wherein the hot melt adhesive is heated to be expansive and flowing during a process of having the glass tube and the end cap adhered, and the plurality of openings dissipate heat to have the hot melt adhesive cooled and solidified.

16. The LED tube lamp according to claim 11, wherein the plurality of openings are separately in a shape of an arc.

17. The LED tube lamp according to claim 16, wherein the number of the plurality of openings is three, and the three openings are in a shape of three arcs with gradually varying sizes.

18. The LED tube lamp according to claim 11, wherein the plurality of openings are separately in a shape of a circle.

19. The LED tube lamp according to claim 18, wherein the number of the plurality of openings is three, and the three openings are arranged in a shape of an arc.

20. The LED tube lamp according to claim 12, wherein at least a part of the openings are arranged along an arc and spaced apart from each other.
21. The LED tube lamp according to claim 12, wherein the heat and pressure inside the end cap increase during the heating and solidification of the hot melt adhesive, and are then released through at least one opening on the end cap.
22. An LED tube lamp, comprising:
- a glass tube having two end portions;
 - a plurality of LED light sources;
 - two end caps respectively sleeve the two end portions of the glass tube, the glass tube and the end cap being secured by a hot melt adhesive, each of the end caps comprising two conductive pins and a plurality of heat-dissipating openings, the two conductive pins being on a surface of the end cap, the plurality of heat-dissipating openings being on the surface of the end cap and divided into two sets, and the two sets of the heat-dissipating openings being symmetric to each other with respect to a plane passing through the two conductive pins; and
 - an LED light strip on an inner surface of the glass tube, the plurality of LED light sources being on the LED light strip.
23. The LED tube lamp according to claim 22, further comprising a power supply in one of the end caps or separately in both of the end caps, wherein the plurality of heat-dissipating openings dissipate heat resulted from the power supply.
24. The LED tube lamp according to claim 23, wherein the plurality of heat-dissipating openings are separately in a shape of an arc.
25. The LED tube lamp according to claim 23, wherein the surface of the end cap is vertical to the length direction of the glass tube.
26. The LED tube lamp according to claim 24, wherein the plurality of

- heat-dissipating openings are in a shape of arcs with different sizes.
27. The LED tube lamp according to claim 26, wherein the sizes of the arcs of the plurality of heat-dissipating openings gradually vary.
28. The LED tube lamp according to claim 23, wherein the plurality of
- 5 heat-dissipating openings are separately in a shape of a circle.
29. The LED tube lamp according to claim 28, wherein the number of the plurality of heat-dissipating openings is three, and the three heat-dissipating openings are arranged in a shape of an arc.
30. The LED tube lamp according to claim 23, wherein the plurality of
- 10 heat-dissipating openings are a combination in a shape of an arc and a circle.
31. The LED tube lamp according to claim 23, wherein at least a part of the openings are arranged along an arc and spaced apart from each other.
32. The LED tube lamp according to claim 23, wherein the heat and pressure inside the end cap increase during the heating and solidification of the hot melt adhesive,
- 15 and are then released through at least one opening on the end cap.
33. An LED tube lamp, comprising:
- a glass tube covered by a heat shrink sleeve;
 - a plurality of LED light sources;
 - two end caps respectively at two opposite ends of the glass tube, the glass
 - 20 tube and the end cap are secured by a hot melt adhesive;
 - a power supply in one of the end caps or separately in both of the end caps;
 - and
 - an LED light strip on an inner surface of the glass tube, the plurality of LED
 - light sources being on the LED light strip;
 - 25 wherein each of the end caps comprises:

an electrically insulating tube;
two conductive pins on the electrically insulating tube; and
at least two heat-dissipating openings on the electrically insulating tube
symmetric to each other with respect to a plane passing through the middle
5 of a line connecting the two conductive pins and perpendicular to the line
connecting the two conductive pins.

34. The LED tube lamp according to claim 33, wherein the hot melt adhesive is,
respectively, disposed on the outer surface of the glass tube, the shape of the
disposed hot melt adhesive is substantially a circle from the side view of the glass
10 tube, and the at least two heat-dissipating openings are separately in a shape of an
arc.

ABSTRACT

An LED tube lamp includes a glass tube, a plurality of LED light sources, two end caps respectively sleeving two end portions of the glass tube, a power supply in one of the end caps or separately in both of the end caps, and an LED light strip in the glass tube. The plurality of LED light sources is on the LED light strip. Each of the end caps comprises a plurality of openings formed thereon. The plurality of openings dissipating heat resulted from the power supply are divided into two sets. The two sets of the plurality of openings are symmetric to each other with respect to a virtual central axis of the end cap.

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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	6246-40007US8
		Application Number	
Title of Invention	LED TUBE LAMP		
The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76. This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.			

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Prefix	Given Name	Middle Name	Family Name	Suffix	
	TAO		JIANG		
Residence Information (Select One) US Residency ☒ Non US Residency Active US Military Service					
City	Zhejiang		Country of Residence ⁱ	CN	
Mailing Address of Inventor:					
Address 1		No.1288 Jiachuang Rd. Xiuzhou Area, Jiaxing			
Address 2					
City	Zhejiang		State/Province		
Postal Code		Country ⁱ	CN		
Inventor	2				Remove
Legal Name					
Prefix	Given Name	Middle Name	Family Name	Suffix	
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Residence Information (Select One) US Residency ☒ Non US Residency Active US Military Service					
City	Zhejiang		Country of Residence ⁱ	CN	
Mailing Address of Inventor:					
Address 1		No.1288 Jiachuang Rd. Xiuzhou Area, Jiaxing			
Address 2					
City	Zhejiang		State/Province		
Postal Code		Country ⁱ	CN		
Inventor	3				Remove
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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	6246-40007US8
		Application Number	
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	LI-QIN		LI	
Residence Information (Select One) US Residency ☒ Non US Residency Active US Military Service				
City	Zhejiang	Country of Residence ⁱ	CN	

Mailing Address of Inventor:

Address 1	No.1288 Jiachuang Rd. Xiuzhou Area, Jiaxing			
Address 2				
City	Zhejiang	State/Province		
Postal Code		Country ⁱ	CN	
Inventor	4			Remove
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Residence Information (Select One) US Residency ☒ Non US Residency Active US Military Service				
City	Zhejiang	Country of Residence ⁱ	CN	

Mailing Address of Inventor:

Address 1	No.1288 Jiachuang Rd. Xiuzhou Area, Jiaxing			
Address 2				
City	Zhejiang	State/Province		
Postal Code		Country ⁱ	CN	
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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	6246-40007US8
		Application Number	
Title of Invention	LED TUBE LAMP		

Application Information:

Title of the Invention	LED TUBE LAMP		
Attorney Docket Number	6246-40007US8	Small Entity Status Claimed	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	10	Suggested Figure for Publication (if any)	1

Filing By Reference:

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For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

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Title of Invention	LED TUBE LAMP		

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Prior Application Status		Patented			Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
	Continuation in part of	14865387	2015-09-25	9609711	2017-03-08
Prior Application Status		Patented			Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
	Continuation in part of	15056121	2016-02-29	9447929	2016-09-20
Prior Application Status		Pending			Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)		
	Continuation in part of	15168962	2016-05-31		
Prior Application Status		Pending			Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)		
	Continuation in part of	PCT/CN2015/096502	2015-12-05		
Prior Application Status		Pending			Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)		
	Continuation in part of	15087092	2016-03-31		
Prior Application Status		Pending			Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)		
	Continuation of	15211717	2016-07-15		
Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the Add button.					Add

Foreign Priority Information:

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	6246-40007US8
		Application Number	
Title of Invention	LED TUBE LAMP		

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)ⁱ the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Remove Access Code ⁱ (if applicable)
201510595173.7	CN	2015-09-18	
Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Remove Access Code ⁱ (if applicable)
201510557717.0	CN	2015-09-06	
Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Remove Access Code ⁱ (if applicable)
201510555543.4	CN	2015-09-02	
Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Remove Access Code ⁱ (if applicable)
201510483475.5	CN	2015-08-08	
Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Remove Access Code ⁱ (if applicable)
201510486115.0	CN	2015-08-08	
Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Remove Access Code ⁱ (if applicable)
201510482944.1	CN	2015-08-07	
Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Remove Access Code ⁱ (if applicable)
201510428680.1	CN	2015-07-20	
Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Remove Access Code ⁱ (if applicable)
201510406595.5	CN	2015-07-10	
Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Remove Access Code ⁱ (if applicable)
201510391910.1	CN	2015-07-02	
Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Remove Access Code ⁱ (if applicable)
201510378322.4	CN	2015-06-29	

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	6246-40007US8
		Application Number	
Title of Invention	LED TUBE LAMP		

Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Remove Access Code ^j (if applicable)
201510364735.7	CN	2015-06-26	
Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Remove Access Code ^j (if applicable)
201510373492.3	CN	2015-06-26	
Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Remove Access Code ^j (if applicable)
201510372375.5	CN	2015-06-26	
Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Remove Access Code ^j (if applicable)
201510338027.6	CN	2015-06-17	
Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Remove Access Code ^j (if applicable)
201510315636.X	CN	2015-06-10	
Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Remove Access Code ^j (if applicable)
201510284720.X	CN	2015-05-29	
Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Remove Access Code ^j (if applicable)
201510268927.8	CN	2015-05-22	
Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Remove Access Code ^j (if applicable)
201510259151.3	CN	2015-05-19	
Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Remove Access Code ^j (if applicable)
201510193980.6	CN	2015-04-22	
Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Remove Access Code ^j (if applicable)
201510173861.4	CN	2015-04-14	
Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Remove Access Code ^j (if applicable)
201510155807.7	CN	2015-04-03	
Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Remove Access Code ^j (if applicable)
201510136796.8	CN	2015-03-27	

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	6246-40007US8
		Application Number	
Title of Invention	LED TUBE LAMP		

Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Remove Access Code ^j (if applicable)
201510134586.5	CN	2015-03-26	
Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Remove Access Code ^j (if applicable)
201510133689.X	CN	2015-03-25	
Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Remove Access Code ^j (if applicable)
201510104823.3	CN	2015-03-10	
Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Remove Access Code ^j (if applicable)
201510075925.7	CN	2015-02-12	
Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Remove Access Code ^j (if applicable)
201410734425.5	CN	2014-12-05	
Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Remove Access Code ^j (if applicable)
201410623355.6	CN	2014-11-06	
Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Remove Access Code ^j (if applicable)
201410508899.8	CN	2014-09-28	
Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Remove Access Code ^j (if applicable)
201410507660.9	CN	2014-09-28	
Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Remove Access Code ^j (if applicable)
201610327806.0	CN	2016-05-18	
Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Remove Access Code ^j (if applicable)
201610044148.4	CN	2016-01-22	
Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Remove Access Code ^j (if applicable)
201510848766.X	CN	2015-11-27	
Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Remove Access Code ^j (if applicable)
201610177706.4	CN	2016-03-25	

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	6246-40007US8
		Application Number	
Title of Invention	LED TUBE LAMP		

Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Remove Access Code ^j (if applicable)
201510868263.9	CN	2015-12-02	
Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Remove Access Code ^j (if applicable)
201510716899.1	CN	2015-10-29	
Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Remove Access Code ^j (if applicable)
201510645134.3	CN	2015-10-08	
Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Remove Access Code ^j (if applicable)
201510499512.1	CN	2015-08-14	
Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Remove Access Code ^j (if applicable)
201510448220.5	CN	2015-07-27	
Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Remove Access Code ^j (if applicable)
201510324394.0	CN	2015-06-12	
Additional Foreign Priority Data may be generated within this form by selecting the Add button.			Add

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013. NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	6246-40007US8
		Application Number	
Title of Invention	LED TUBE LAMP		

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	6246-40007US8
		Application Number	
Title of Invention	LED TUBE LAMP		

Applicant Information:

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

Applicant	1	Remove
If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section. Clear		
☒ Assignee	Legal Representative under 35 U.S.C. 117	Joint Inventor
Person to whom the inventor is obligated to assign.		Person who shows sufficient proprietary interest
If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:		
Name of the Deceased or Legally Incapacitated Inventor:		
If the Applicant is an Organization check here. ☒		
Organization Name	JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.,LTD	
Mailing Address Information For Applicant:		
Address 1	No.1288 Jiachuang Rd. Xiuzhou Area, Jiaxing	
Address 2		
City	Zhejiang	State/Province
Country	CN	Postal Code
Phone Number		Fax Number
Email Address		
Additional Applicant Data may be generated within this form by selecting the Add button. Add		

Assignee Information including Non-Applicant Assignee Information:

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

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	6246-40007US8
		Application Number	
Title of Invention	LED TUBE LAMP		

Assignee	1			
Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.				
				Remove
If the Assignee or Non-Applicant Assignee is an Organization check here.				☐
Prefix	Given Name	Middle Name	Family Name	Suffix
Mailing Address Information For Assignee including Non-Applicant Assignee:				
Address 1				
Address 2				
City		State/Province		
Country ⁱ		Postal Code		
Phone Number		Fax Number		
Email Address				
Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button.				Add

Signature:

NOTE: This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). However, if this Application Data Sheet is submitted with the **INITIAL** filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/Andrew M. Calderon/		Date (YYYY-MM-DD)	2017-04-10
First Name	Andrew M.	Last Name	Calderon	Registration Number
				38093
Additional Signature may be generated within this form by selecting the Add button.				Add

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	6246-40007US8
		Application Number	
Title of Invention	LED TUBE LAMP		

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

Privacy Act Statement

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

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

- 1 The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
- 2 A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
- 3 A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
- 4 A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
- 5 A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
- 6 A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
- 7 A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
- 8 A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
- 9 A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.