PTO/AIA/15 (10-17)
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UTILITY PATENT APPLICATION TRANSMITTAL

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

Attorney Docket No.	S19141USUC01T
First Named Inventor	JIANG, Tao
Title	LED TUBE LAMP
Priority Mail Express® Label No.	

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

1. [✔] **Fee Transmittal Form** (PTO/SB/17 or equivalent)
2. [ ] **Applicant asserts small entity status.** See 37 CFR 1.27
3. [ ] **Applicant certifies micro entity status.** See 37 CFR 1.29. Applicant must attach form PTO/SB/15A or B or equivalent.
4. [✔] **Specification** [*Total Pages* 35] Both the claims and abstract must start on a new page. *(See MPEP § 608.01(a) for information on the preferred arrangement)*
5. [✔] **Drawing(s)** (35 U.S.C. 113) [*Total Sheets* 27]
6. **Inventor's Oath or Declaration** [*Total Pages* 3] *(including substitute statements under 37 CFR 1.64 and assignments serving as an oath or declaration under 37 CFR 1.63(e))*
   a. [ ] Newly executed (original or copy)
   b. [✔] A copy from a prior application (37 CFR 1.63(d))
7. [✔] **Application Data Sheet** ** See note below.* See 37 CFR 1.76 (PTO/AIA/14 or equivalent)
8. **CD-ROM or CD-R** in duplicate, large table, or Computer Program (*Appendix*)
   [ ] Landscape Table on CD
9. **Nucleotide and/or Amino Acid Sequence Submission** (*if applicable, items a. – c. are required*)
   a. [ ] Computer Readable Form (CRF)
   b. [ ] Specification Sequence Listing on:
      i. [ ] CD-ROM or CD-R (2 copies); or
      ii. [ ] Paper
   c. [ ] Statements verifying identity of above copies

ADDRESS TO:

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

ACCOMPANYING APPLICATION PAPERS

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

Note: (1) Benefit claims under 37 CFR 1.78 and foreign priority claims under 1.55 **must** be included in an Application Data Sheet (ADS).
(2) For applications filed under 35 U.S.C. 111, the application must contain an ADS specifying the applicant if the applicant is an assignee, person to whom the inventor is under an obligation to assign, or person who otherwise shows sufficient proprietary interest in the matter. See 37 CFR 1.46(b).

19. CORRESPONDENCE ADDRESS

[✔] The address associated with Customer Number: 147274 **OR** [ ] Correspondence address below

Name					
Address	1380 Charles Willard Street, Carson				
City		State	California	Zip Code	90746
Country		Telephone		Email	

Signature	/Simon Kuang Lu/	Date	2019-12-18
Name (Print/Type)	Simon Kuang Lu	Registration No. (Attorney/Agent)	51,974

This collection of information is required by 37 CFR 1.53(b). 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 1.11 and 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, 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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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.

Doc Code: PA..
Document Description: Power of Attorney

PTO/AIA/82A (07-13)
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TRANSMITTAL FOR POWER OF ATTORNEY TO ONE OR MORE REGISTERED PRACTITIONERS

NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5, unless the application number and filing date are identified in the Power of Attorney by Applicant form. If neither form PTO/AIA/82A nor form PTO/AIA82B identifies the application to which the Power of Attorney is directed, the Power of Attorney will not be recognized in the application.

Application Number	Not Yet Assigned
Filing Date	Herewith
First Named Inventor	JIANG, Tao
Title	LED TUBE LAMP
Art Unit	Not Yet Assigned
Examiner Name	Not Yet Assigned
Attorney Docket Number	S19141USUC01T

SIGNATURE of Applicant or Patent Practitioner

Signature	/Simon Kuang Lu/	Date (Optional)	
Name	Simon Kuang Lu	Registration Number	51,974
Title (if Applicant is a juristic entity)			
Applicant Name (if Applicant is a juristic entity)			

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. If more than one applicant, use multiple forms.

☑ *Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. 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 1.11 and 1.14. This collection is estimated to take 3 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, 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.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Doc Code: PA..
Document Description: Power of Attorney

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POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

Application Number	Filing Date

(Note: The boxes above may be left blank if information is provided on form PTO/AIA/82A.)

☑ I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above: 147274

OR

☐ I hereby appoint Practitioner(s) named in the attached list (form PTO/AIA/82C) as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the patent application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above. (Note: Complete form PTO/AIA/82C.)

Please recognize or change the correspondence address for the application identified in the attached transmittal letter or the boxes above to:

☑ The address associated with the above-mentioned Customer Number

OR

☐ The address associated with Customer Number:

OR

☐ Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Email			

I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.,LTD

☐ Inventor or Joint Inventor (title not required below)

☐ Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)

☑ Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)

☐ Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document) (provide signer's title if applicant is a juristic entity)

SIGNATURE of Applicant for Patent

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

Signature	Tao Jiang	Date (Optional)	10/18/2016
Name	Tao Jiang		
Title	Chairman of the Board, JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.,LTD		

NOTE: Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. If more than one applicant, use multiple forms.

☑ Total of 1 forms are submitted.

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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.
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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.

Doc Code: WFEE
Document Description: Fee Worksheet (PTO-875)

PTO/SB/06 (09-16)
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number S19141USUC01T

APPLICATION AS FILED – PART I

☑ LARGE ENTITY ☐ MICRO ENTITY ☐ SMALL ENTITY

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	RATE ($)	FEE ($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	300
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	660
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	760
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	* 0	x =	0
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	* 0	x =	0
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $400 ($200 for small entity or $100 for micro entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).		0	0
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))			N/A	0
			TOTAL	1720

* If the difference in column 1 is less than zero, enter "0" in column 2.

APPLICATION AS AMENDED – PART II

☐ LARGE ENTITY ☐ MICRO ENTITY ☐ SMALL ENTITY

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
AMENDMENT A	TOTAL (37 CFR 1.16(i))	*	Minus	**	=	x =	
	INDEPENDENT (37 CFR 1.16(h))	*	Minus	***	=	x =	
	APPLICATION SIZE FEE (37 CFR 1.16(s))					0	
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))					N/A	
						TOTAL ADD'L FEE	

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
AMENDMENT B	TOTAL (37 CFR 1.16(i))	*	Minus	**	=	x =	
	INDEPENDENT (37 CFR 1.16(h))	*	Minus	***	=	x =	
	APPLICATION SIZE FEE (37 CFR 1.16(s))					0	
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))					N/A	
						TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

The information is required by 37 CFR 1.16. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 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, 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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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of JIANG et al.

Attorney Docket: S19141USUC01T

Serial Number: Herewith

Group Art Unit: Not Yet Assigned

Filed: December 18, 2019

Examiner: Not Yet Assigned

Confirmation Number: Herewith

For: LED TUBE LAMP

STATEMENT ON FOREIGN PRIORITY DOCUMENTS

Commissioner for Patents

P.O. Box 1450, Alexandria, VA 22313

Dear Sir,

Applicant believes that all of foreign priority documents listed in the Application Data Sheet, and in pages 1-2 of the instant specification were successfully received by the USPTO. In particular, Applicant notes that the Examiner has acknowledged the claim to foreign priority and the receipt of all the priority documents in the parent application (16/051,826) of the instant application, in its Notice of Allowance and Fee Due issued on September 11, 2019.

If any fees required in connection with this paper, please charge the Deposit Account No. 602062.

Date: December 18, 2019

Respectfully submitted,

By: /Simon Kuang Lu/
Simon Kuang Lu
Registration No. 51,974
1380 Charles Willard St.,
Carson, CA 90746
(650) 315-4468

COMBINED DECLARATION AND ASSIGNMENT

Title of Invention: **LED TUBE LAMP**

As a below named inventor, I hereby declare that:

This declaration is directed to:
☒ The attached application; or
☐ United States application number or PCT international application number _____, filed on _____.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

WHEREAS, JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO., LTD. of No.1288 Jiachuang Rd. Xiuzhou Area, Jiaxing, Zhejiang, China, its heirs, successors, legal representatives and assigns (hereinafter designated as the Assignee) is desirous of acquiring the entire right, title and interest in and to said invention and in and to any Letters Patent(s) that may be granted therefor in the United States of America and ☐ in any foreign countries.

NOW, THEREFORE, in consideration of the sum of Ten Dollars ($10.00) to the undersigned in hand paid, the receipt of which is hereby acknowledged, and other good and valuable consideration, the undersigned has (have) sold, assigned and transferred, and by these presents does sell, assign and transfer unto said Assignee the full and exclusive right to the said invention in the United States of America, its territories, dependencies and possessions and the entire right, title and interest in and to any and all Letters Patent(s) which may be granted therefor in the United States of America, its territories, dependencies and possessions, and if the box above is designated, in any and all foreign countries; and to any and all divisions, reissues,

continuations, conversions and extensions thereof for the full term or terms for which the same may be granted.

The undersigned agree(s) to execute all papers necessary in connection with this application and any continuing, divisional, conversion or reissue applications thereof and also to execute separate assignments in connection with such applications as the Assignee may deem necessary or expedient.

The undersigned agree(s) to execute all papers necessary in connection with any interference which may be declared concerning this application or continuation, division, conversion or reissue thereof or Letter Patent(s) or reissue patent issued thereon and to cooperate with the Assignee in every way possible in obtaining and producing evidence and proceeding with such interference.

The undersigned agree(s) to execute all papers and documents and to perform any act which may be necessary in connection with claims or provisions of the International Convention for the Protection of Industrial Property or similar agreements.

The undersigned agree(s) to perform all affirmative acts which may be necessary to obtain a grant of a valid United States of America patent(s) or a grant of a valid United States of America and any foreign patent(s) to the Assignee and to vest all rights therein hereby conveyed to said Assignee as fully and entirely as the same would have been held by the undersigned if this Assignment and sale had not been made.

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In witness whereof, executed by the undersigned on the date(s) opposite the undersigned name(s).

LEGAL NAME OF FIRST OR SOLE INVENTOR:

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Signature: JIANG TAO Date: 7/27/2018

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Signature: _____ Date: _____

☐ Additional inventors are being named on separately numbered sheets attached hereto.

ABSTRACT

An LED tube lamp includes a glass lamp tube, two end caps, an LED light strip, a power supply, and a reflective film. At least a portion of an inner surface of the glass lamp tube is formed with a rough surface, and the roughness of the rough surface is higher than that of the outer surface. The glass lamp tube includes a main body region and two rear end regions, each of the two rear end regions coupled to a respective end of the main body region and each of the two end caps coupled to a respective rear end region. A length of the light strip is longer than the length of a main body region of the glass lamp tube. Each of the two end caps is coupled to a respective end of the glass lamp tube by a gel. The LED light strip is disposed on an inner surface of the glass lamp tube with a plurality of LED light sources mounted on the LED light strip.

WHAT IS CLAIMED IS

1. An LED tube lamp, comprising:

a glass lamp tube, wherein at least a portion of an inner surface of the glass lamp tube is covered by a rough surface and the roughness of the rough surface is higher than that of the outer surface of the glass lamp tube;

two end caps, each of the two end caps coupled to a respective end of the glass lamp tube;

an LED light strip disposed on an inner surface of the glass lamp tube with a plurality of LED light sources mounted on the LED light strip;

a power supply disposed at one end or two ends of the glass lamp tube, the power supply electrically connected to the plurality of LED light sources; and

a reflective film disposed on a portion of the inner surface of the glass lamp tube,

wherein the glass lamp tube comprises a main body region and two rear end regions, each of the two rear end regions coupled to a respective end of the main body region and each of the two end caps coupled to a respective rear end region, and further wherein a length of the light strip is longer than a length of the main body region of the glass lamp tube.

2. The LED tube lamp of claim 1, wherein a portion of the inner surface of the glass lamp tube is covered by the rough surface and another portion of the inner surface of the glass lamp tube is covered by the reflective film.

3. The LED tube lamp of claim 2, wherein a portion of the inner surface which is not covered by the reflective film is covered by the rough surface.

4. The LED tube lamp of claim 3, wherein the roughness of the rough surface

ranges from 0.1 to 40 μm.

5. The LED tube lamp of claim 4, wherein each of the two end caps comprises an insulating end wall, two conductive pins and at least one opening, the insulating end wall is substantially perpendicular to an axial direction of the glass lamp tube, and the two conductive pins and the opening are arranged on the insulating end wall.

6. The LED tube lamp of claim 5, wherein each of the two end caps sleeves with a respective rear end region, and wherein an outer diameter of each of the end cap is substantially the same as the outer diameter of the main body region.

7. The LED tube lamp of claim 6, wherein the outer diameter of each of the two rear end regions is less than the outer diameter of the main body region.

8. An LED tube lamp, comprising:

a glass lamp tube;

a diffusion film coated on an inner surface of the glass lamp tube;

an LED light strip disposed on the inner surface of the glass lamp tube with a plurality of LED light sources mounted on the LED light strip;

a reflective film disposed on the inner surface of the glass lamp tube;

two end caps, each of the two end caps coupled to a respective end of the glass lamp tube; and

a power supply disposed at one end or two ends of the glass lamp tube, the power supply electrically connected to the plurality of LED light sources,

wherein the diffusion film has a rough surface, the roughness of the rough surface is

higher than that of an outer surface of the glass lamp tube, and wherein a portion of the inner surface of the glass lamp tube is covered by the rough surface and a portion of the inner surface of the glass lamp tube is covered by the reflective film,

wherein the glass lamp tube comprises a main body region and two rear end regions, each of the two rear end regions coupled to a respective end of the main body region and each of the two end caps coupled to a respective rear end region, and further wherein a length of the light strip is longer than a length of the main body region of the glass lamp tube.

9. The LED tube lamp of claim 8, wherein a portion of the inner surface of the glass lamp tube not covered by the reflective film is covered by the rough surface

10. The LED tube lamp of claim 9, wherein the glass lamp tube and the two end caps are secured by a gel, and the gel is disposed between an inner surface of each of the two end caps and an outer surface of each of the two rear end regions.

11. The LED tube lamp of claim 10, wherein each of the two end caps comprises an insulating end wall, two conductive pins and at least one opening, the insulating end wall is substantially perpendicular to an axial direction of the glass lamp tube, and the two conductive pins and the opening are arranged on the insulating end wall.

12. The LED tube lamp of claim 10, wherein each of the two end caps sleeves with a respective rear end region, and wherein an outer diameter of each of the end cap is substantially the same as an outer diameter of the main body region.

13. The LED tube lamp of claim 12, wherein the outer diameter of each of the two

rear end regions is less than the outer diameter of the main body region.

14. An LED tube lamp, comprising:

a glass lamp tube having an inner surface;

an LED light strip disposed on the inner surface of the glass lamp tube with a plurality of LED light sources mounted on the LED light strip;

two end caps, each of the two end caps coupled to a respective end of the glass lamp tube; and

a power supply disposed at one end or two ends of the glass lamp tube, the power supply electrically connected to the plurality of LED light sources,

wherein the inner surface of the glass lamp tube is covered by a reflective layer and a rough layer, the roughness of the rough layer is higher than that of an outer surface of the glass lamp tube,

wherein the glass lamp tube comprises a main body region and two rear end regions, each of the two rear end regions coupled to a respective end of the main body region and each of the two end caps coupled to a respective rear end region, and further wherein a length of the light strip is longer than a length of the main body region of the glass lamp tube.

15. The LED tube lamp of claim 14, wherein a portion of the inner surface which is not covered by the reflective layer is covered by the rough layer.

16. The LED tube lamp of claim 15, wherein the glass lamp tube and the two end caps are secured by a gel, wherein the gel is disposed between an inner surface of each of the two end caps and an outer surface of each of the two rear end regions.

17. The LED tube lamp of claim 16, wherein each of the two end caps comprises an insulating end wall, two conductive pins and at least one opening, the insulating end wall is substantially perpendicular to an axial direction of the glass lamp tube, and the two conductive pins and the opening are arranged on the insulating end wall.

18. The LED tube lamp of claim 16, wherein each of the two end caps sleeves with a respective rear end region, and wherein an outer diameter of each of the end cap is substantially the same as an outer diameter of the main body region.

19. The LED tube lamp of claim 18, wherein the outer diameter of each of the two rear end regions is less than the outer diameter of the main body region.

LED TUBE LAMP

CROSS-REFERENCE TO RELATED APPLICATIONS

【0001】 This application is a continuation application of U.S. patent application No. 16/051,826, filed on 2018/08/01, which is a continuation-in-part (CIP) application claiming benefit of non-provisional application serial no. 15/087,092, filed on 2016/03/31; and is also a continuation-in-part (CIP) application claiming benefit of non-provisional application serial no. 15/437,084, filed on 2017/02/20. The U.S. non-provisional application serial no. 15/087,092, filed on 2016/03/31 is a continuation-in-part (CIP) application claiming benefit of PCT Application No. PCT/CN2015/096502, filed on 2015/12/05. The U.S. non-provisional application serial no. 15/437,084, filed on 2017/02/20 is a continuation application claiming benefit of non-provisional application serial no. 15/056,106, filed on 2016/02/29, which is a continuation-in-part (CIP) application claiming benefit of PCT Application No. PCT/CN2015/096502, filed on 2015/12/05, which claims priority to Chinese Patent Applications No. CN 201410734425.5 filed on 2014/12/05; CN 201510075925.7 filed on 2015/02/12; CN 201510136796.8 filed on 2015/03/27; CN 201510259151.3 filed on 2015/05/19; CN 201510324394.0 filed on 2015/06/12; CN 201510338027.6 filed on 2015/06/17; CN 201510373492.3 filed on 2015/06/26; CN 201510448220.5 filed on 2015/07/27; CN 201510482944.1 filed on 2015/08/07; CN 201510483475.5 filed on 2015/08/08; CN 201510499512.1 filed on 2015/08/14; CN 201510555543.4 filed on 2015/09/02; CN 201510557717.0 filed on 2015/09/06; CN 201510595173.7 filed on 2015/09/18; CN 201510645134.3 filed on 2015/10/08; CN 201510716899.1 filed on 2015/10/29; CN 201510726365.7 filed on 2015/10/30 and CN 201510868263.9 filed on 2015/12/02, the disclosures of which are incorporated herein in their entirety by reference.

【0002】 This application claims priority under 35 U.S.C. 119(e) to Chinese Patent Applications No. CN 201410734425.5 filed on 2014/12/05; CN 201510075925.7 filed on 2015/02/12; CN 201510136796.8 filed on 2015/03/27; CN 201510259151.3 filed

on 2015/05/19; CN 201510324394.0 filed on 2015/06/12; CN 201510338027.6 filed on 2015/06/17; CN 201510373492.3 filed on 2015/06/26; CN 201510448220.5 filed on 2015/07/27; CN 201510482944.1 filed on 2015/08/07; CN 201510483475.5 filed on 2015/08/08; CN 201510499512.1 filed on 2015/08/14; CN 201510555543.4 filed on 2015/09/02; CN 201510557717.0 filed on 2015/09/06; CN 201510595173.7 filed on 2015/09/18; CN 201510645134.3 filed on 2015/10/08; CN 201510716899.1 filed on 2015/10/29; CN 201510726365.7 filed on 2015/10/30 and CN 201510868263.9 filed on 2015/12/02, the contents of which priority applications are incorporated herein by reference in their entirety.

FIELD OF THE INVENTION

【0003】 The present disclosure relates to illumination devices, and more particularly to an LED tube lamp and its components including the light sources, electronic components, and end caps.

BACKGROUND OF THE INVENTION

【0004】 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 gas 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.

【0005】 Typical LED tube lamps have a lamp tube, a circuit board disposed inside the lamp tube with light sources being mounted on the circuit board, and end caps accompanying a power supply provided at two ends of the lamp tube with the electricity from the power supply transmitting to the light sources through the circuit board. However, existing LED tube lamps have certain drawbacks.

【0006】 First, the typical circuit board is rigid and allows the entire lamp tube to maintain a straight tube configuration when the lamp tube is partially ruptured or broken, and this gives the user a false impression that the LED tube lamp remains usable and is likely to cause the user to be electrically shocked upon handling or installation of the LED tube lamp.

【0007】 Second, the rigid circuit board 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.

【0008】 Third, the existing LED tube lamps are bad in heat dissipation, especially have problem in dissipating heat resulting from the power supply components inside the end caps. The heat resulting from the power supply components may cause a high temperature around end cap and therefore reduces life span of the adhesive and simultaneously disables the adhesion between the lamp tube and the end caps.

【0009】 In addition, an LED light source is a point light source. Light rays emitted from the LED light source are highly concentrated and are hard to be evenly distributed.

【0010】 Accordingly, the present disclosure and its embodiments are herein provided.

SUMMARY OF THE INVENTION

【0011】 **It's specially noted that the present disclosure may actually include** one or more inventions claimed currently or not yet claimed, and for avoiding confusion due to unnecessarily distinguishing between those possible inventions at the stage of preparing the specification, the possible plurality of inventions herein may be collectively referred **to as "the (present) invention" herein.**

【0012】 Various embodiments are summarized in this section, and are described **with respect to the "present invention," which terminology is used to describe certain** presently disclosed embodiments, whether claimed or not, and is not necessarily an

exhaustive description of all possible embodiments, but rather is merely a summary of certain embodiments. Certain of the embodiments described below as various aspects **of the "present invention" can be combined** in different manners to form an LED tube lamp or a portion thereof.

【0013】 The present invention provides a novel LED tube lamp, and aspects thereof.

【0014】 The present invention provides an LED tube lamp. According to one embodiment, the LED lamp includes a glass lamp tube, an end cap, a power supply, and an LED light strip. The end cap is disposed at one end of the glass lamp tube. The end cap includes a socket for connection with a power supply, and includes at least one opening on surface to dissipate heat resulting from the power supply. The power supply is provided inside the end cap and has a metal pin at one end, while the end cap has a hollow conductive pin to accommodate the metal pin of the power supply. The LED light strip is disposed inside the glass lamp tube with a plurality of LED light sources mounted on the LED light strip. The LED light strip has a bendable circuit sheet electrically connecting the LED light sources with the power supply. The length of the bendable circuit sheet is larger than the length of the glass lamp tube. The glass lamp tube and the end cap are secured by a highly thermal conductive silicone gel.

【0015】 In some embodiments, the at least one opening may be adjacent to an edge of the end surface of the end cap.

【0016】 In some embodiments, the at least one opening comprises openings arranged to form a circle or a partial circle.

【0017】 In some embodiments, the at least one opening comprises openings arranged to form concentric circles or concentric partial circles.

【0018】 In some embodiments, the at least one opening may be in a shape of arc, line or partial circle.

【0019】 In some embodiments, at least one opening is located on an end surface

of the end cap, and at least one opening is located on an outer circumferential surface of the end cap.

【0020】 The present invention also provides an LED tube lamp, according to one embodiment, includes a glass lamp tube, two end caps with different sizes, a power supply, and an LED light strip. The two end caps are respectively disposed at one end of the glass lamp tube. At least one of the two end caps includes an electrically insulating tubular part sleeved with the end of the lamp tube, and at least one opening on surface to dissipate heat resulting from the power supply. The power supply is provided inside the end cap. The LED light strip is disposed inside the glass lamp tube with a plurality of LED light sources mounted on the LED light strip. The LED light strip has a bendable circuit sheet electrically connecting the LED light sources with the power supply. The length of the bendable circuit sheet is larger than the length of the glass lamp tube. The glass lamp tube and the end cap are secured by a highly thermal conductive silicone gel.

【0021】 In some embodiments, the size of one end cap is 30%-80% of the size of the other end cap.

【0022】 In some embodiments, the at least one opening is located on an end surface of the electrically insulating tubular part of the end cap.

【0023】 In some embodiments, the at least one opening is adjacent to an edge of the end surface of the electrically insulating tubular part of the end cap.

【0024】 In some embodiments, at least one opening is located on an end surface of the electrically insulating tubular part of the end cap, and at least one opening is located on an outer circumferential surface of the electrically insulating tubular part of the end cap.

【0025】 The present invention also provides an LED tube lamp, according to one embodiment, includes a glass lamp tube, an end cap, a power supply, and an LED light strip. The end cap is disposed at one end of the glass lamp tube. The end cap includes a socket for connection with a power supply, and at least one opening on surface to

dissipate heat resulting from the power supply. The power supply is provided inside the end cap and has a metal pin at one end, while the end cap has a hollow conductive pin to accommodate the metal pin of the power supply. The LED light strip is disposed inside the glass lamp tube with a plurality of LED light sources mounted on the LED light strip. The LED light strip electrically connects the LED light sources with the power supply.

【0026】 In the above-mentioned embodiments, the at least one opening disposed on the surface of the end cap may help to dissipate heat resulting from the power supply by passing through the end cap such that the reliability of the LED tube lamp could be improved. While in some embodiments, the openings disposed on the surface of the end cap may not pass through the end cap for heat dissipation. In the embodiments using highly thermal conductive silicone gel to secure the glass lamp tube and the end cap, the at least one opening may also accelerate the solidification process of the highly thermal conductive gel.

【0027】 In addition, the present invention further provides an LED tube lamp to overcome the issue that light rays emitted from the LED light source are highly concentrated and are hard to be evenly distributed.

【0028】 In some embodiments, an LED tube lamp comprises a lamp tube, two end caps, an LED light strip, a power supply, and a reflective film. At least a portion of an inner surface of the lamp tube is formed with a rough surface, and the roughness of the rough surface is higher than that of the outer surface. Each of the two end caps is coupled to a respective end of the lamp tube by a gel. The LED light strip is disposed on an inner surface of the lamp tube with a plurality of LED light sources mounted on the LED light strip. The power supply is disposed at one or two of the end caps. The power supply is electrically connected to the plurality of LED light sources. The reflective film is disposed on the inner surface of the lamp tube.

【0029】 In some embodiments, an LED tube lamp comprises a lamp tube, a diffusion film, a reflective film, two end caps, an LED light strip, and a power supply. The diffusion film is coated on an inner surface of the lamp tube. The LED light strip is

disposed on the inner surface of the lamp tube with a plurality of LED light sources mounted on the LED light strip. The reflective film is disposed on the inner surface of the lamp tube. The two end caps are coupled to two ends of the lamp tube, respectively. The power supply is disposed at one or two of the end caps. The power supply is electrically connected to the plurality of LED light sources. The lamp tube with diffusion film has a rough inner surface. The roughness of the rough inner surface is higher than that of an outer surface of the lamp tube. A portion of the inner surface of the lamp tube is covered by the rough inner surface and another portion of the inner surface of the lamp tube is covered by the reflective film.

【0030】 In some embodiments, an LED tube lamp comprises a lamp tube, a reflective film, two end caps, an LED light strip, and a power supply. The lamp tube has an inner surface. The LED light strip is disposed on the inner surface of the lamp tube with a plurality of LED light sources mounted on the LED light strip. The reflective film is disposed on the inner surface of the lamp tube. The two end caps are coupled to two ends of the lamp tube, respectively. The power supply is disposed at one or two of the end caps. The power supply is electrically connected to the plurality of LED light sources. The portion of the inner surface which is not covered by the reflective film is formed with a rough surface. The roughness of the rough surface of the inner surface is higher than that of an outer surface of the lamp tube.

【0031】 In the above-mentioned embodiments, light rays emitted from the LED light source in the lamp tube can be distributed in a more even manner by the rough surface, the reflective film, and/or the diffusion film.

Brief Description of the Drawings

【0032】

Fig. 1 is an exploded view schematically illustrating the LED tube lamp according to the first embodiment of the present invention;

【0033】 Fig. 2 is a perspective view schematically illustrating the end cap according

to one embodiment of the present invention;

【0034】 Fig. 3 is a side view schematically illustrating the end cap according to one embodiment of the present invention;

【0035】 Fig. 4A is a perspective view schematically illustrating the soldering pad of the bendable circuit sheet of the LED light strip for soldering connection with the printed circuit board of the power supply of the LED tube lamp according to one embodiment of the present invention;

【0036】 FIG. 4B is a plane cross-sectional view schematically illustrating a single-layered structure of the bendable circuit sheet of the LED light strip of the LED tube lamp according to an embodiment of the present invention;

【0037】 Fig. 5 is a perspective view schematically illustrating the openings of end cap of the LED tube lamp according to the first embodiment of the present invention which are arranged to form a circle;

【0038】 Fig. 6 is a perspective view schematically illustrating the openings of end cap of the LED tube lamp according to the first embodiment of the present invention which are arranged to form a partial circle;

【0039】 Fig. 7 is a perspective view schematically illustrating the openings of end cap of the LED tube lamp according to the first embodiment of the present invention which are arranged to form two partial circles;

【0040】 Fig. 8 is a perspective view schematically illustrating the openings of end cap of the LED tube lamp according to the first embodiment of the present invention which are arranged to form two concentric circles;

【0041】 Fig. 9 is a perspective view schematically illustrating the openings of end cap of the LED tube lamp according to the first embodiment of the present invention which are arranged to form concentric partial circles;

【0042】 Fig. 10 is a perspective view schematically illustrating the openings of end cap of the LED tube lamp according to the first embodiment of the present invention

which are arranged to form concentric partial circles;

【0043】 Fig. 11 is a perspective view schematically illustrating at least one opening is located on an end surface of the end cap, and at least one opening is located on an outer circumferential surface of the end cap of the LED tube lamp according to the first embodiment of the present invention;

【0044】 Fig. 12 is an exploded view schematically illustrating the LED tube lamp according to the second embodiment of the present invention;

【0045】 Fig. 13 is a perspective view schematically illustrating the openings of end cap of the LED tube lamp according to the second embodiment of the present invention which are arranged to form a circle;

【0046】 Fig. 14 is a perspective view schematically illustrating the openings of end cap of the LED tube lamp according to the second embodiment of the present invention which are arranged to form a partial circle;

【0047】 Fig. 15 is a perspective view schematically illustrating the openings of end cap of the LED tube lamp according to the second embodiment of the present invention which are arranged to form two partial circles;

【0048】 Fig. 16 is a perspective view schematically illustrating the openings of end cap of the LED tube lamp according to the second embodiment of the present invention which are arranged to form two concentric circles;

【0049】 Fig. 17 is a perspective view schematically illustrating the openings of end cap of the LED tube lamp according to the second embodiment of the present invention which are arranged to form concentric partial circles;

【0050】 Fig. 18 is a perspective view schematically illustrating the openings of end cap of the LED tube lamp according to the second embodiment of the present invention which are arranged to form concentric partial circles;

【0051】 Fig. 19 is a perspective view schematically illustrating at least one opening is located on an end surface of the electrically insulating tubular part of the end cap of

the LED tube lamp according to the second embodiment of the present invention, and at least one opening is located on an outer circumferential surface of the electrically insulating tubular part of the end cap;

【0052】 Fig. 20 is an exploded view schematically illustrating the LED tube lamp according to the third embodiment of the present invention;

【0053】 Figs.21-26 are perspective views schematically illustrating the at least one opening of end cap of the LED tube lamp according to the third embodiment of the present invention which is in a shape of arc;

【0054】 Fig. 27 is a perspective view schematically illustrating the openings of end cap of the LED tube lamp according to the third embodiment of the present invention which are in a shape of partial circle;

【0055】 Fig. 28 is a perspective view schematically illustrating openings on the outer circumferential surface of the electrically insulating tubular part of the end cap of the LED tube lamp according to the third embodiment of the present invention may be in a shape of line, and at least one opening on the end surface of the electrically insulating tubular part of end cap is in a shape of partial circle;

【0056】 FIG.29A is an exploded view schematically illustrating the LED tube lamp according to one embodiment of the present invention, wherein the glass lamp tube has only one inlets located at its one end while the other end is entirely sealed or integrally formed with tube body;

【0057】 FIG.29B is an exploded view schematically illustrating the LED tube lamp according to one embodiment of the present invention, wherein the glass lamp tube has two inlets respectively located at its two ends;

【0058】 FIG.29C is an exploded view schematically illustrating the LED tube lamp according to one embodiment of the present invention, wherein the glass lamp tube has two inlets respectively located at its two ends, and two power supplies are respectively disposed in two end caps;

【0059】 FIG. 30 is a plane cross-sectional view schematically illustrating inside structure of the glass lamp tube of the LED tube lamp according to one embodiment of the present invention, wherein two reflective films are respectively adjacent to two sides of the LED light strip along the circumferential direction of the glass lamp tube;

【0060】 FIG. 31 is a plane cross-sectional view schematically illustrating inside structure of the glass lamp tube of the LED tube lamp according to one embodiment of the present invention, wherein two reflective films are respectively adjacent to two sides of the LED light strip along the circumferential direction of the glass lamp tube and a diffusion film is disposed covering the LED light sources;

【0061】 FIG. 32 is an exemplary exploded view schematically illustrating the LED tube lamp according to another embodiment of the present invention;

【0062】 FIG. 33 is a plane cross-sectional view schematically illustrating end structure of a lamp tube of the LED tube lamp according to one embodiment of the present invention;

【0063】 FIG. 34 is a plane cross-sectional partial view schematically illustrating a connecting region of the end cap and the lamp tube of the LED tube lamp according to one embodiment of the present invention; and

【0064】 FIG. 35 is a plane sectional view schematically illustrating the LED light strip is a bendable circuit sheet with ends thereof passing across the transition region of the lamp tube of the LED tube lamp to be soldering bonded to the output terminals of the power supply according to one embodiment of the present invention.

Detailed Description of preferred Embodiments

【0065】 The present disclosure provides a novel LED tube lamp based on the glass made lamp tube to solve the abovementioned problems. The present disclosure will now be described in the following embodiments with reference to the drawings. The following descriptions of various embodiments of this invention are presented herein for purpose of illustration and giving examples only. It is not intended to be exhaustive or to be limited

to the precise form disclosed. These example embodiments are just that – examples – and many implementations and variations are possible that do not require the details provided herein. It should also be emphasized that the disclosure provides details of alternative examples, but such listing of alternatives is not exhaustive. Furthermore, any consistency of detail between various examples should not be interpreted as requiring such detail – it is impracticable to list every possible variation for every feature described herein. The language of the claims should be referenced in determining the requirements of the invention.

【0066】 **"Terms such as "about" or "approximately" may reflect sizes, orientations,** or layouts that vary only in a small relative manner, and/or in a way that does not significantly alter the operation, functionality, or structure of certain elements. For **example, a range from "about 0.1 to about 1" may encompass a range such as a 0% to** 5% deviation around 0.1 and a 0% to 5% deviation around 1, especially if such deviation **maintains the same effect as the listed range."**

【0067】 **"Unless otherwise def**ined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this disclosure belongs. It will be further understood that terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and/or the present application, and will not be interpreted in an idealized or overly formal sense unless expressly **so defined herein."**

【0068】 Referring to Fig. 1, an LED tube lamp in accordance with a first embodiment of the present invention includes a glass lamp tube 1, two end caps 3 respectively disposed at two ends of the glass lamp tube 1, a power supply 5, and an LED light strip 2 disposed inside the glass lamp tube 1.

【0069】 Referring to Fig. 1 to Fig. 3, the end cap 3 includes a socket 305 for connection with a power supply 5. The power supply 5 is provided inside the end cap 3 and can be fixed in the socket 305. The power supply 5 has a metal pin 52 at one end,

while the end cap 3 has a hollow conductive pin 301 to accommodate the metal pin 52 of the power supply 5. In one embodiment, the electrically insulating tubular part 302 is not limited to being made of plastic or ceramic, any material that is not a good electrical conductor can be used. In some one embodiment, the end cap 3 may further include an electrically insulating tubular part 302.

【0070】 Referring to Fig. 1 and Fig. 4A, the LED light strip 2 is disposed inside the glass lamp tube 1 with a plurality of LED light sources 202 mounted on the LED light strip 2. The LED light strip 2 has a bendable circuit sheet 205 electrically connecting the LED light sources 202 with the power supply 5. The length of the bendable circuit sheet 205 is larger than the length of the glass lamp tube 1. The glass lamp tube 1 and the end cap 3 are secured by a highly thermal conductive silicone gel. The bendable circuit sheet 205 has at least one end extending beyond one of two ends of the glass lamp tube 1 to form a freely extending end portions 21. In one embodiment, the bendable circuit sheet 205 has a first end 2051 and a second end 2052 opposite to each other along the first direction, and at least the first end 2051 of the bendable circuit sheet 205 is bent away from the glass lamp tube 1 to form the freely extending end portion 21 along a longitudinal direction of the glass lamp tube 1. In some embodiments, if two power supplies 5 are adopted, then the second end 2052 might be bent away from the glass lamp tube 1 to form another freely extending end portion 21 along the longitudinal direction of the glass lamp tube 1. The freely extending end portion 21 is electrically **connected to the power supply 5. Specifically, the power supply 5 has soldering pads "a" which are capable of being soldered with the soldering pads "b" of the freely extending end portion 21 by soldering material "g".**

【0071】 Referring to FIG. 4B, in the third embodiment, the bendable circuit sheet 205 is made of a metal layer structure 2a. The thickness range of the metal layer **structure 2a may be 10μm to 50μm and the metal layer structure 2a may be a patterned** wiring layer.

【0072】 Referring to Fig. 5 to Fig. 11, in order to dissipate heat resulting from the

power supply 5, the end cap 3 has openings 304. In some embodiments, the openings 304 may be located on end surface 3021 of the electrically insulating tubular part 302 of the end cap 3. In some embodiments, the openings 304 may be adjacent to an edge of the end surface 3021 of the electrically insulating tubular part 302 of the end cap 3. In some embodiments, the openings 304 may be arranged to form a circle as shown in Fig. 5, or a partial circle as shown in Fig. 6 and Fig. 7. In some embodiments, the openings 304 may be arranged to form two concentric circles as shown in Fig. 8, or two concentric partial circles as shown in Fig. 9 and Fig. 10.

【0073】 Referring to Fig. 11, in some embodiments, at least one of the openings 304 is located on end surface 3021 of the electrically insulating tubular part 302 of the end cap 3, and at least one of the openings 304 is located on outer circumferential surface 3023 of the electrically insulating tubular part 302 of the end cap 3.

【0074】 Referring to Fig. 12, an LED tube lamp in accordance with a second embodiment of the present invention includes a glass lamp tube 1, end cap 30a and end cap 30b, a power supply 5, and an LED light strip 2 disposed inside the glass lamp tube 1.

【0075】 Referring to Fig. 12, the end caps 30a and 30b are different in size, in which the end cap 30a is smaller than the end cap 30b. The end caps 30a and 30b are respectively disposed at two ends of the glass lamp tube 1. The larger end cap 30b includes an electrically insulating tubular part 302. The electrically insulating tubular part 302 is sleeved with the end of the glass lamp tube 1. In one embodiment, the electrically insulating tubular part 302 is not limited to being made of plastic or ceramic, any material that is not a good electrical conductor can be used.

【0076】 Referring to Fig. 12, the power supply 5 is fixed inside the larger end cap 30b. The power supply 5 has two metal pins 52 at one end, while the end cap 30b has two hollow conductive pins 301 to accommodate the metal pins 52 of the power supply 5. In some embodiments, even though only one power supply 5 is needed, the smaller end cap 30a may also have two dummy hollow conductive pins 301 for the purpose of fixing

and installation.

【0077】 Referring to Fig. 4A and Fig. 12, the LED light strip 2 is disposed inside the glass lamp tube 1 with a plurality of LED light sources 202 mounted on the LED light strip 2. The LED light strip 2 has a bendable circuit sheet 205 electrically connect the LED light sources 202 with the power supply 5. The length of the bendable circuit sheet 205 is larger than the length of the glass lamp tube 1. The glass lamp tube 1 and the end cap 3 are secured by a highly thermal conductive silicone gel. In one embodiment, the bendable circuit sheet 205 has a first end 2051 and a second end 2052 opposite to each other along the first direction, and at least the first end 2051 of the bendable circuit sheet 205 is bent away from the glass lamp tube 1 to form a freely extending end portion 21 along a longitudinal direction of the glass lamp tube 1. In some embodiments, if two power supplies 5 are adopted, then the second end 2052 might be bent away from the glass lamp tube 1 to form another freely extending end portion 21 along the longitudinal direction of the glass lamp tube 1. The freely extending end portion 21 is electrically **connected to the power supply 5. Specifically, the power supply 5 has soldering pads "a"** which are capable of being soldered with the **soldering pads "b" of the freely extending end portion 21 by soldering material "g".**

【0078】 Referring to Fig. 13 to Fig. 19, in order to dissipate heat resulting from the power supply 5, the larger end cap 30b has openings 304. In some embodiments, the openings 304 may be located on end surface 3021 of the electrically insulating tubular part 302. In some embodiments, the openings 304 may be adjacent to an edge of the end surface 3021 of the electrically insulating tubular part 302. In some embodiments, the openings 304 may be arranged to form a circle as shown in Fig. 13, or a partial circle as shown in Fig. 14 and Fig. 15. In some embodiments, the openings 304 may be arranged to form concentric circles as shown in Fig. 16, or concentric partial circles as shown in Fig. 17 and Fig. 18.

【0079】 Referring to Fig. 19, in some embodiments, at least one of the openings 304 is located on an end surface 3021 of the electrically insulating tubular part 302, and

at least one of the openings 304 is located on an outer circumferential surface 3023 of the electrically insulating tubular part 302.

【0080】 Referring to Fig. 20, an LED tube lamp in accordance with a third embodiment of the present invention includes a glass lamp tube 1, two end caps 3, a power supply 5, and an LED light strip 2.

【0081】 Referring to Fig. 2, Fig. 3, and Fig. 20, the two end caps 3 are respectively disposed at one end of the glass lamp tube 1. At least one of the end caps 3 includes a socket 305 for connection with a power supply 5. The power supply 5 is provided inside the end cap 3 and can be fixed in the socket 305. The power supply 5 has a metal pin 52 at one end, while the end cap 3 has a hollow conductive pin 301 to accommodate the metal pin 52 of the power supply 5. In one embodiment, the electrically insulating tubular part 302 is not limited to being made of plastic or ceramic, any material that is not a good electrical conductor can be used.

【0082】 Referring to Fig. 4A and Fig. 20, the LED light strip 2 is disposed inside the glass lamp tube 1 with a plurality of LED light sources 202 mounted on the LED light strip 2. The LED light strip 2 is electrically connected with the power supply 5. In some embodiments, the light strip 2 has a bendable circuit sheet 205. The length of the bendable circuit sheet 205 is larger than the length of the glass lamp tube 1. The bendable circuit sheet 205 has a first end 2051 and a second end 2052 opposite to each other along the first direction, and at least the first end 2051 of the bendable circuit sheet 205 is bent away from the glass lamp tube 1 to form a freely extending end portion 21 along a longitudinal direction of the glass lamp tube 1. In some embodiments, if two power supplies 5 are adopted, then the second end 2052 might be bent away from the glass lamp tube 1 to form another freely extending end portion 21 along the longitudinal direction of the glass lamp tube 1. The freely extending end portion 21 is electrically **connected to the power supply 5. Specifically, the power supply 5 has soldering pads "a" which are capable of being soldered with the soldering pads "b" of the freely extending end portion 21 by soldering material "g"**. In some embodiments, the glass lamp tube 1

and the end caps 3 are secured by a highly thermal conductive silicone gel.

【0083】 In the above-mentioned embodiments, the shape of opening 304 is not limited to be a circle. The openings 304 can be designed to be in a shape of arc as shown in Fig. 21 to Fig. 26, or in a shape of partial circle as shown in Fig. 27. In some embodiments, as shown in Fig. 28, the openings 304 on the outer circumferential surface 3023 of the electrically insulating tubular part 302 may be in a shape of line, and the opening 304 on the end surface 3021 of the electrically insulating tubular part 302 is in a shape of partial circle.

【0084】 In the above-mentioned embodiments, the openings 304 disposed on the surface of the end cap 3 may help to dissipate heat resulting from the power supply 5 by passing through the end cap 3 such that the reliability of the LED tube lamp could be improved. While in some embodiments, the openings 304 disposed on the surface of the end cap 3 may not pass through the end cap 3 for heat dissipation. In those embodiments using highly thermal conductive silicone gel to secure the glass lamp tube 1 and the end caps 3, the openings 304 may also accelerate the solidification process of the melted highly thermal conductive gel.

【0085】 Referring to FIG. 29A ,FIG. 29B, and FIG. 29C, an LED tube lamp in accordance with a first embodiment of the present invention includes a glass lamp tube 1, an LED light strip 2 disposed inside the glass lamp tube 1, and one end cap 3 disposed at one end of the glass lamp tube 1. Each of the end caps 3 has at least one pin. As shown in FIG.1 A, FIG. 29B, and FIG. 29C, there are two pins on each end cap 3 to be connected with an outer electrical power source. In this embodiment, as shown in FIG. 29A, the glass lamp tube 1 may have only one inlet located at one end while the other end is entirely sealed or integrally formed with tube body. The LED light strip 2 is disposed inside the glass lamp tube 1 with a plurality of LED light sources 202 mounted on the LED light strip 2. The end cap 3 is disposed at the end of the glass lamp tube 1 where the inlet located, and the power supply 5 is provided inside the end cap 3. In another embodiment, as shown in FIG. 29B, the glass lamp tube 1 may have two inlets,

two end caps 3 respectively disposed at two ends of the glass lamp tube 1, and one power supply 5 provided inside one of the end caps 3. In another embodiment, as shown in FIG. 29C, the glass lamp tube 1 may have two inlets, two end caps 3 respectively disposed at two ends of the glass lamp tube 1, and two power supplies 5 respectively provided inside the two end caps 3.

【0086】 The glass lamp tube 1 is covered by a heat shrink sleeve 19. The **thickness of the heat shrink sleeve 19 may range from 20 μm to 200 μm. The heat shrink** sleeve 19 is substantially transparent with respect to the wavelength of light from the LED light sources 202 such that only a slight part of the lights transmitting through the glass lamp tube is absorbed by the heat shrink sleeve 19. The heat shrink sleeve 19 may be made of PFA (perfluoroalkoxy) or PTFE (poly tetra fluoro ethylene). Since the **thickness of the heat shrink sleeve 19 is only 20 μm to 200 μm, the light absorbed by the** heat shrink sleeve 19 is negligible. At least a part of the inner surface of the glass lamp tube 1 is formed with a rough surface and the roughness of the inner surface is higher than that of the outer surface, such that the light from the LED light sources 202 can be uniformly spread when transmitting through the glass lamp tube 1. In some embodiments, the roughness of the inner surface of the glass lamp tube 1 may range from 0.1 μm to 40 μm.

【0087】 The glass lamp tube 1 and the end cap 3 are secured by a highly thermal conductive silicone gel disposed between an inner surface of the end cap 3 and outer surfaces of the glass lamp tube 1. In some embodiments, the highly thermal conductive silicone gel has a thermal conductivity not less than 0.7 w/mk. In some embodiments, the thermal conductivity of the highly thermal conductive silicone gel is not less than 2 w/mk. In some embodiments, the highly thermal conducive silicone gel is of high viscosity, and the end cap 3 and the end of the glass lamp tube 1 could be secured by using the highly thermal conductive silicone gel and therefore qualified in a torque test of 1.5 to 5 newton-meters (Nt-m) and/or in a bending test of 5 to 10 newton-meters (Nt-m). The highly thermal conductive silicone gel has excellent weatherability and can prevent

moisture from entering inside of the glass lamp tube 1, which improves the durability and reliability of the LED tube lamp.

【0088】 In some embodiments, the inner surface of the glass lamp tube 1 is coated with an anti-reflection layer with a thickness of one quarter of the wavelength range of light coming from the LED light sources 202. With the anti-reflection layer, more light from the LED light sources 202 can transmit through the glass lamp tube 1. In some embodiments, the refractive index of the anti-reflection layer is a square root of the refractive index of the glass lamp tube 1 with a tolerance of ±20%.

【0089】 Referring to FIG. 29A, FIG. 29B, and FIG. 29C, an LED tube lamp in accordance with another embodiment of the present invention includes a glass lamp tube 1, an LED light strip 2, and one end cap 3 disposed at one end of the glass lamp tube 1. At least a part of the inner surface of the glass lamp tube 1 is formed with a rough surface and the roughness of the inner surface is higher than that of the outer surface.

【0090】 Referring to FIG. 30, in some embodiments, the glass lamp tube 1 may further include one or more reflective films 12 disposed on the inner surface of the glass lamp tube 1. The reflective film 12 can be positioned on two sides of the LED light strip 2. And in some embodiments, a ratio of a length of the reflective film 12 disposed on the inner surface of the glass lamp tube 1 extending along the circumferential direction of the glass lamp tube 1 to a circumferential length of the glass lamp tube 1 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(s) 12. The reflective film 12 may be made of PET with some reflective materials such as strontium phosphate or barium sulfate or any combination thereof, **with a thickness between about 140μm and about 350μm or between about 150μ**m and **about 220μm for a more preferred effect in some embodiments. In some embodiments,** the part of the inner surface which is not covered by the reflective film 12 is formed with the rough surface. As shown in FIG. 30, a part of light 209 from LED light sources 202 are reflected by two reflective films 12 such that the light 209 from the LED light sources 202 can be centralized to a determined direction.

【0091】 Referring to FIG. 31, in some embodiments, the glass lamp tube 1 may further include a diffusion film 13 so that the light emitted from the plurality of LED light sources 202 is transmitted through the diffusion film 13 and the glass lamp tube 1. The diffusion film 13 can be in form of various types, such as a coating onto the inner wall or outer wall of the glass lamp tube 1, or a diffusion coating layer (not shown) coated at the surface of each LED light sources 202, or a separate membrane covering the LED light sources 202.The glass lamp tube 1 also includes a heat shrink sleeve 19 and a plurality of inner roughness 17.

【0092】 As shown in FIG. 31, the diffusion film 13 is in form of a sheet, and it covers but not in contact with the LED light sources 202. In some embodiments, the diffusion film 13 can be disposed on the inner surface or the outer surface of the lamp tube. The diffusion film 13 in form of a sheet is usually called an optical diffusion sheet or board, usually a composite made of mixing diffusion particles into polystyrene (PS), polymethyl methacrylate (PMMA), polyethylene terephthalate (PET), and/or polycarbonate (PC), and/or any combination thereof. The light passing through such composite is diffused to expand in a wide range of space such as a light emitted from a plane source, and therefore makes the brightness of the LED tube lamp uniform.

【0093】 The diffusion film 13 may be in form of an optical diffusion coating, which is composed of any one of calcium carbonate, halogen calcium phosphate and aluminum oxide, or any combination thereof. When the optical diffusion coating is made from a calcium carbonate with suitable solution, an excellent light diffusion effect and transmittance to exceed 90% can be obtained.

【0094】 In some embodiments, the composition of the diffusion film 13 in form of the optical diffusion coating may include calcium carbonate, strontium phosphate, thickener, and a ceramic activated carbon. Specifically, such an optical diffusion coating on the inner circumferential surface of the glass lamp tube 1 has an average thickness **ranging from about 20 to about 30 μm. A light transmittance of the** diffusion film 13 using this optical diffusion coating may be about 90%. Generally speaking, the light

transmittance of the diffusion film 13 may range from 85% to 96%. In addition, this diffusion film 13 can also provide electrical isolation for reducing risk of electric shock to a user upon breakage of the glass lamp tube 1. Furthermore, the diffusion film 13 provides an improved illumination distribution uniformity of the light outputted by the LED light sources 202 such that the light can illuminate the back of the light sources 202 and the side edges of the bendable circuit sheet 205 so as to avoid the formation of dark regions inside the glass lamp tube 1 and improve the illumination comfort. In another possible embodiment, the light transmittance of the diffusion film can be 92% to 94% **while the thickness ranges from about 200 to about 300 μm.**

【0095】 In another embodiment, the optical diffusion coating can also be made of a mixture including calcium carbonate-based substance, some reflective substances like strontium phosphate or barium sulfate, a thickening agent, ceramic activated carbon, and deionized water. The mixture is coated on the inner circumferential surface of the glass lamp tube 1 and may have an average thickness ranging from about 20 to about **30 μm. In view of the diffusion phenomena in microscopic terms, light is reflected by** particles. The particle size of the reflective substance such as strontium phosphate or barium sulfate will be much larger than the particle size of the calcium carbonate. Therefore, adding a small amount of reflective substance in the optical diffusion coating can effectively increase the diffusion effect of light.

【0096】 Halogen calcium phosphate or aluminum oxide can also serve as the main material for forming the diffusion film 13. The particle size of the calcium carbonate may **be about 2 to 4 μm, while the particle size of the halogen calcium phosphate and** aluminum oxid**e may be about 4 to 6 μm and 1 to 2 μm, respectively. When the light** transmittance is required to be 85% to 92%, the required average thickness for the optical diffusion coating mainly having the calcium carbonate may be about 20 to about **30 μm, while the** required average thickness for the optical diffusion coating mainly **having the halogen calcium phosphate may be about 25 to about 35 μm, the required** average thickness for the optical diffusion coating mainly having the aluminum oxide

may be about 10 to about 15 μm. However, when the required light transmittance is up to 92% and even higher, the optical diffusion coating mainly having the calcium carbonate, the halogen calcium phosphate, or the aluminum oxide must be thinner.

【0097】 The main material and the corresponding thickness of the optical diffusion coating can be decided according to the place for which the glass lamp tube 1 is used and the light transmittance required. It is to be noted that the higher the light transmittance of the diffusion film 13 is required, the more apparent the grainy visual of the light sources is.

【0098】 In some embodiments the inner peripheral surface or the outer circumferential surface of the glass lamp tube 1 may be further covered or coated with an adhesive film (not shown) to isolate the inside from the outside of the glass lamp tube 1. In this embodiment, the adhesive film is coated on the inner peripheral surface of the glass lamp tube 1. The material for the coated adhesive film includes methyl vinyl silicone oil, hydro silicone oil, xylene, and calcium carbonate, wherein xylene is used as an auxiliary material. The xylene will be volatilized and removed when the coated adhesive film on the inner surface of the glass lamp tube 1 solidifies or hardens. The xylene is mainly used to adjust the capability of adhesion and therefore to control the thickness of the coated adhesive film.

【0099】 In some embodiments, the thickness of the coated adhesive film may be between about 100 and about 140 micrometers (μm). The adhesive film having a thickness being less than 100 micrometers may not have sufficient shatterproof capability for the glass lamp tube 1, and the glass lamp tube 1 is thus prone to crack or shatter. The adhesive film having a thickness being larger than 140 micrometers may reduce the light transmittance and also increases material cost. The thickness of the coated adhesive film may be between about 10 and about 800 micrometers (μm) when the shatterproof capability and the light transmittance are not strictly demanded.

【00100】 In some embodiments, the LED tube lamp according to the embodiment of present invention can include an optical adhesive sheet. Various kinds of

the optical adhesive sheet can be combined to constitute various embodiments of the present invention. The optical adhesive sheet, which is a clear or transparent material, is applied or coated on the surface of the LED light source 202 in order to ensure optimal light transmittance. After being applied to the LED light sources 202, the optical adhesive sheet may have a granular, strip-like or sheet-like shape. The performance of the optical adhesive sheet depends on its refractive index and thickness. The refractive index of the optical adhesive sheet is in some embodiments between 1.22 and 1.6. In some embodiments, it is better for the optical adhesive sheet to have a refractive index being a square root of the refractive index of the housing or casing of the LED light source 202, or the square root of the refractive index of the housing or casing of the LED light source 202 plus or minus 15%, to contribute better light transmittance. The housing/casing of the LED light sources 202 is a structure to accommodate and carry the LED dies (or chips) such as a LED lead frame. The refractive index of the optical adhesive sheet may range from 1.225 to 1.253. In some embodiments, the thickness of the optical adhesive sheet may range from 1.1 mm to 1.3 mm. The optical adhesive sheet having a thickness less than 1.1 mm may not be able to cover the LED light sources 202, while the optical adhesive sheet having a thickness more than 1.3 mm may reduce light transmittance and increases material cost.

【00101】 In process of assembling the LED light sources to the LED light strip 2, the optical adhesive sheet is firstly applied on the LED light sources 202; then an insulation adhesive sheet is coated on one side of the LED light strip 2; then the LED light sources 202 are fixed or mounted on the LED light strip 2; the other side of the LED light strip 2 being opposite to the side of mounting the LED light sources 202 is bonded and affixed to the inner surface of the lamp tube 1 by an adhesive sheet; finally, the end cap 3 is fixed to the end portion of the lamp tube 1, and the LED light sources 202 and the power supply 5 are electrically connected by the LED light strip 2.

【00102】 In one embodiment, each of the LED light sources 202 may be provided with a LED lead frame having a recess, and an LED chip disposed in the

recess. The recess may be one or more than one in amount. The recess may be filled with phosphor covering the LED chip to convert emitted light therefrom into a desired light color. Compared with a conventional LED chip being a substantial square, the LED chip in this embodiment is in some embodiments rectangular with the dimension of the length side to the width side at a ratio ranges generally from about 2:1 to about 10:1, in some embodiments from about 2.5:1 to about 5:1, and in some more desirable embodiments from 3:1 to 4.5:1. Moreover, the LED chip is in some embodiments arranged with its length direction extending along the length direction of the glass lamp tube 1 to increase the average current density of the LED chip and improve the overall illumination field shape of the glass lamp tube 1. The glass lamp tube 1 may have a number of LED light sources 202 arranged into one or more rows, and each row of the LED light sources 202 is arranged along the length direction (Y-direction) of the glass lamp tube 1.

【00103】 Referring to FIG. 32 and FIG. 33, a glass made lamp tube of an LED tube lamp according to one embodiment of the present invention has structure-strengthened end regions described as follows. The glass made lamp tube 1 includes a main body region 102, two rear end regions 101 (or just end regions 101) respectively formed at two ends of the main body region 102, and end caps 3 that respectively sleeve the rear end regions 101. The outer diameter of at least one of the rear end regions 101 is less than the outer diameter of the main body region 102. In the embodiment of FIGS. 2 and 15, the outer diameters of the two rear end regions 101 are less than the outer diameter of the main body region 102. In addition, the surface of the rear end region 101 is in substantially parallel with the surface of the main body region 102 in a cross-sectional view. Specifically, the glass made lamp tube 1 is strengthened at both ends, such that the rear end regions 101 are formed to be strengthened structures. In certain embodiments, the rear end regions 101 with strengthened structure are respectively sleeved with the end caps 3, and the outer diameters of the end caps 3 and the main body region 102 have little or no differences. For example, the end caps 3 may have the same or substantially the same outer diameters as that of the main body

region 102 such that there is no gap between the end caps 3 and the main body region 102. In this way, a supporting seat in a packing box for transportation of the LED tube lamp contacts not only the end caps 3 but also the lamp tube 1 and makes uniform the loadings on the entire LED tube lamp to avoid situations where only the end caps 3 are forced, therefore preventing breakage at the connecting portion between the end caps 3 and the rear end regions 101 due to stress concentration. The quality and the appearance of the product are therefore improved.

【00104】 Referring FIG. 34, in one embodiment, one end of the thermal conductive member 303 extends away from the electrically insulating tube 302 of the end cap 3 and towards one end of the lamp tube 1, and is bonded and adhered to the end of the lamp tube 1 using a hot melt adhesive 6. In this way, the end cap 3 by way of the thermal conductive member 303 extends to the transition region 103 of the lamp tube 1. In one embodiment, the thermal conductive member 303 and the transition region 103 are closely connected such that the hot melt adhesive 6 would not overflow out of the end cap 3 and remain on the main body region 102 when using the hot melt adhesive 6 to join the thermal conductive member 303 and the lamp tube 1. In addition, the electrically insulating tube 302 facing toward the lamp tube 1 does not have an end extending to the transition region 103, and that there is a gap between the electrically insulating tube 302 and the transition region 103. In one embodiment, the electrically insulating tube 302 is not limited to being made of plastic or ceramic, any material that is not a good electrical conductor can be used.

【00105】 The hot melt adhesive 6 is a composite including a so-called **commonly known as "welding mud powder", and in some embodiments inc**ludes one or more of phenolic resin 2127#, shellac, rosin, calcium carbonate powder, zinc oxide, and ethanol. Rosin is a thickening agent with a feature of being dissolved in ethanol but not dissolved in water. In one embodiment, a hot melt adhesive 6 having rosin could be expanded to change its physical status to become solidified when being heated to high temperature in addition to the intrinsic viscosity. Therefore, the end cap 3 and the lamp

tube 1 can be adhered closely by using the hot melt adhesive to accomplish automatic manufacture for the LED tube lamps. In one embodiment, the hot melt adhesive 6 may be expansive and flowing and finally solidified after cooling. In this embodiment, the volume of the hot melt adhesive 6 expands to about 1.3 times the original size when heated from room temperature to about 200 to 250 degrees Celsius. The hot melt adhesive 6 is not limited to the materials recited herein. Alternatively, a material for the hot melt adhesive 6 to be solidified immediately when heated to a predetermined temperature can be used. The hot melt adhesive 6 provided in each embodiments of the present invention is durable with respect to high temperature inside the end caps 3 due to the heat resulted from the power supply. Therefore, the lamp tube 1 and the end caps 3 could be secured to each other without decreasing the reliability of the LED tube lamp.

【00106】 Furthermore, there is formed an accommodation space between the inner surface of the thermal conductive member 303 and the outer surface of the lamp tube 1 to accommodate the hot melt adhesive 6, as indicated by the dotted line B in FIG. 34. For example, the hot melt adhesive 6 can be filled into the accommodation space at a location where a first hypothetical plane (as indicated by the dotted line B in FIG. 34) being perpendicular to the axial direction of the lamp tube 1 would pass through the thermal conductive member, the hot melt adhesive 6, and the outer surface of the lamp tube 1. The hot melt adhesive 6 may have a thickness, for example, of about 0.2 mm to about 0.5 mm. In one embodiment, the hot melt adhesive 6 will be expansive to solidify in and connect with the lamp tube 1 and the end cap 3 to secure both. The transition region 103 brings a height difference between the rear end region 101 and the main body region 102 to avoid the hot melt adhesives 6 being overflowed onto the main body region 102, and thereby saves manpower to remove the overflowed adhesive and increase the LED tube lamp productivity. The hot melt adhesive 6 is heated by receiving heat from the thermal conductive member 303 to which an electricity from an external heating equipment is applied, and then expands and finally solidifies after cooling, such that the end caps 3 are adhered to the lamp tube 1.

【00107】 Referring to FIG. 34, in one embodiment, the electrically insulating tube 302 of the end cap 3 includes a first tubular part 302a and a second tubular part 302b connected along an axial direction of the lamp tube 1. The outer diameter of the second tubular part 302b is less than the outer diameter of the first tubular part 302a. In some embodiments, the outer diameter difference between the first tubular part 302a and the second tubular part 302b is between about 0.15 mm and about 0.30 mm. The thermal conductive member 303 sleeves over the outer circumferential surface of the second tubular part 302b. The outer surface of the thermal conductive member 303 is coplanar or substantially flush with respect to the outer circumferential surface of the first tubular part 302a. For example, the thermal conductive member 303 and the first tubular part 302a have substantially uniform exterior diameters from end to end. As a result, the entire end cap 3 and thus the entire LED tube lamp may be smooth with respect to the outer appearance and may have a substantially uniform tubular outer surface, such that the loading during transportation on the entire LED tube lamp is also uniform. In one embodiment, a ratio of the length of the thermal conductive member 303 along the axial direction of the end cap 3 to the axial length of the electrically insulating tube 302 ranges from about 1:2.5 to about 1:5.

【00108】 In one embodiment, for the sake of securing adhesion between the end cap 3 and the lamp tube 1, the second tubular part 302b is at least partially disposed around the lamp tube 1, and the accommodation space further includes a space encompassed by the inner surface of the second tubular part 302b and the outer surface of the rear end region 101 of the lamp tube 1. The hot melt adhesive 6 is at least partially **filled in an overlapped region (shown by a dotted line "A" in** FIG. 34) between the inner surface of the second tubular part 302b and the outer surface of the rear end region 101 of the lamp tube 1. For example, the hot melt adhesive 6 may be filled into the accommodation space at a location where a second hypothetical plane (shown by the dotted line A in FIG. 34) being perpendicular to the axial direction of the lamp tube 1 would pass through the thermal conductive member 303, the second tubular part 302b, the hot melt adhesive 6, and the rear end region 101.

【00109】 The hot melt adhesive 6 is not required to completely fill the entire accommodation space as shown in FIG. 34, especially where a gap is reserved or formed between the thermal conductive member 303 and the second tubular part 302b. For example, in some embodiments, the hot melt adhesive 6 can be only partially filled into the accommodation space. During manufacturing of the LED tube lamp, the amount of the hot melt adhesive 6 coated and applied between the thermal conductive member 303 and the rear end region 101 may be appropriately increased, such that in the subsequent heating process, the hot melt adhesive 6 can be caused to expand and flow in between the second tubular part 302b and the rear end region 101, and thereby solidify after cooling to join the second tubular part 302b and the rear end region 101.

【00110】 Referring to FIG. 35, in the embodiment, the bendable circuit sheet 2 passes the transition region 103 to be soldered or traditionally wire-bonded with the power supply 5. The ends of the LED light strip 2 including the bendable circuit sheet are arranged to pass over the strengthened transition region 103 and directly soldering bonded to an output terminal of the power supply 5 such that the product quality is improved without using wires. In the embodiment, the lamp tube 1 includes the rear end region 101, the main body region 102, and the transition region 103. The length of the LED light strip 2 is greater than that of the main body region 102 of the lamp tube 1 along the axial direction of the LED tube lamp. The freely extending end portions 21 of the LED light strip 2 extends beyond the interface between the main body region 102 and the transition region 103 while the LED light strip 2 is properly positioned in the lamp tube 1.

【00111】 In addition, in some embodiments, the length of the LED light strip 2 is greater than that of the sum of the rear end region 101, the main body region 102, and the transition region 103 of the lamp tube 1 along the axial direction of the LED tube lamp. The freely extending end portions 21 of the LED light strip 2 extends beyond the rear end region 101 towards inside of the end cap 3 while the LED light strip 2 is properly positioned in the lamp tube 1.

【00112】 The above-mentioned features of the present invention can be

accomplished in any combination to improve the LED tube lamp, and the above embodiments are described by way of example only. The present invention is not herein limited, and many variations are possible without departing from the spirit of the present invention and the scope as defined in the appended claims.

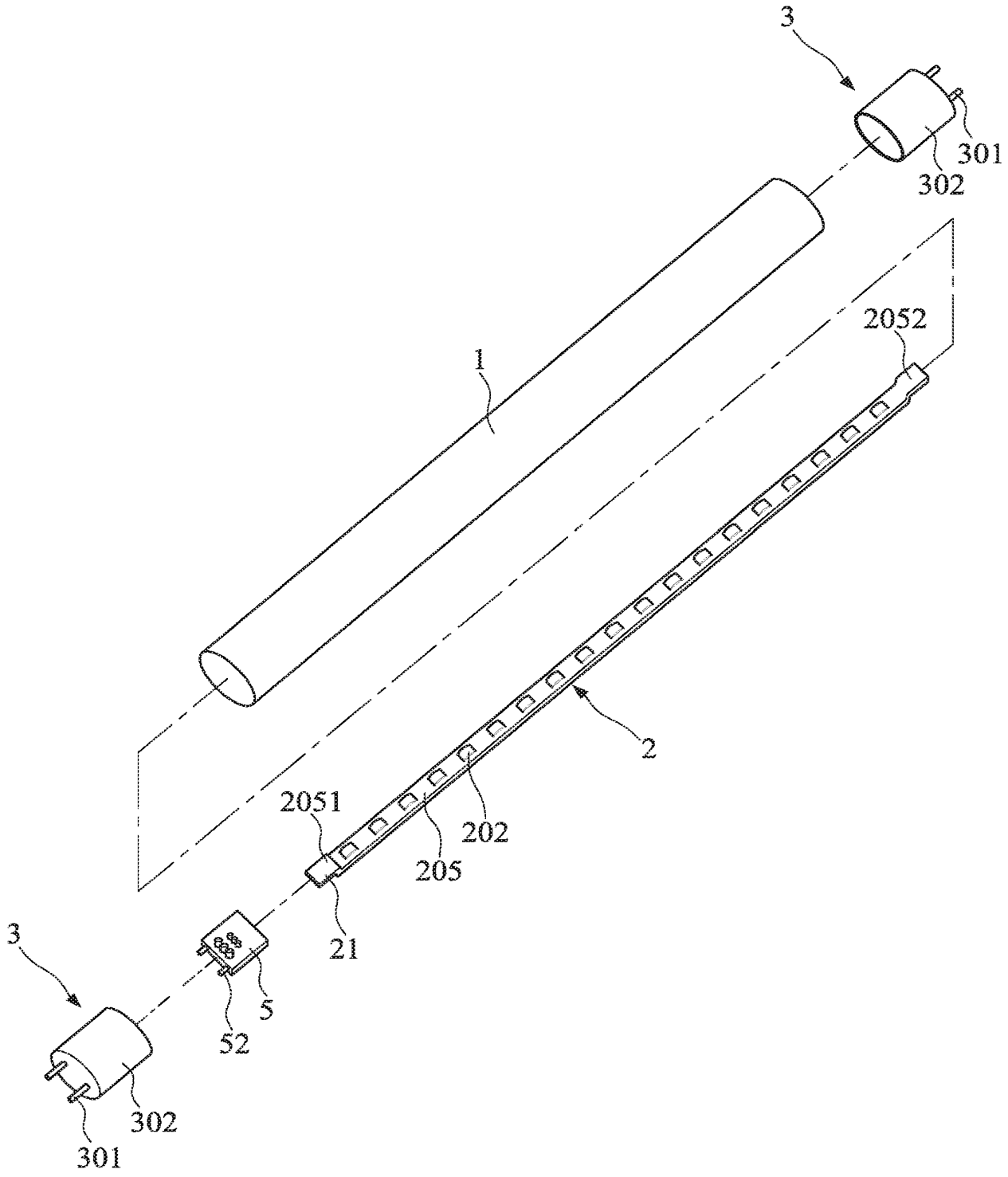


FIG.1

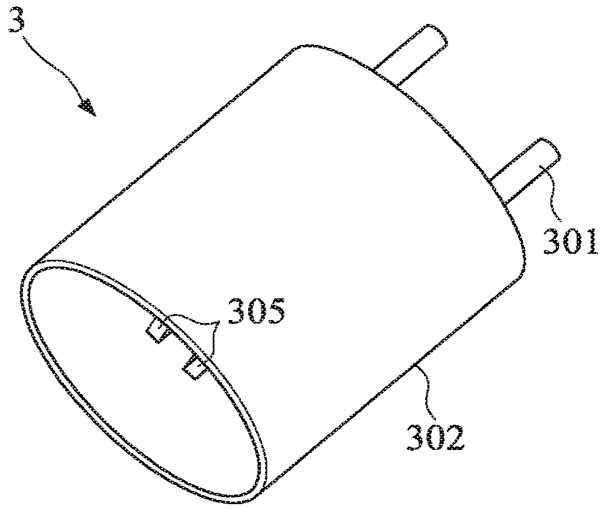


FIG.2

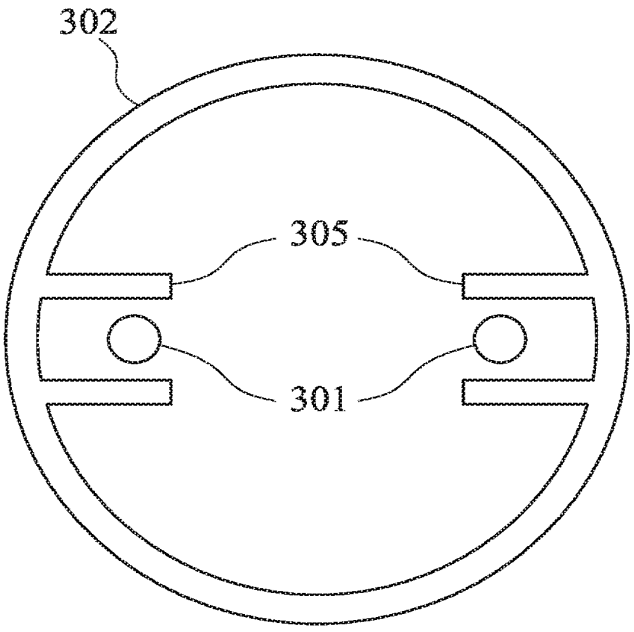


FIG.3

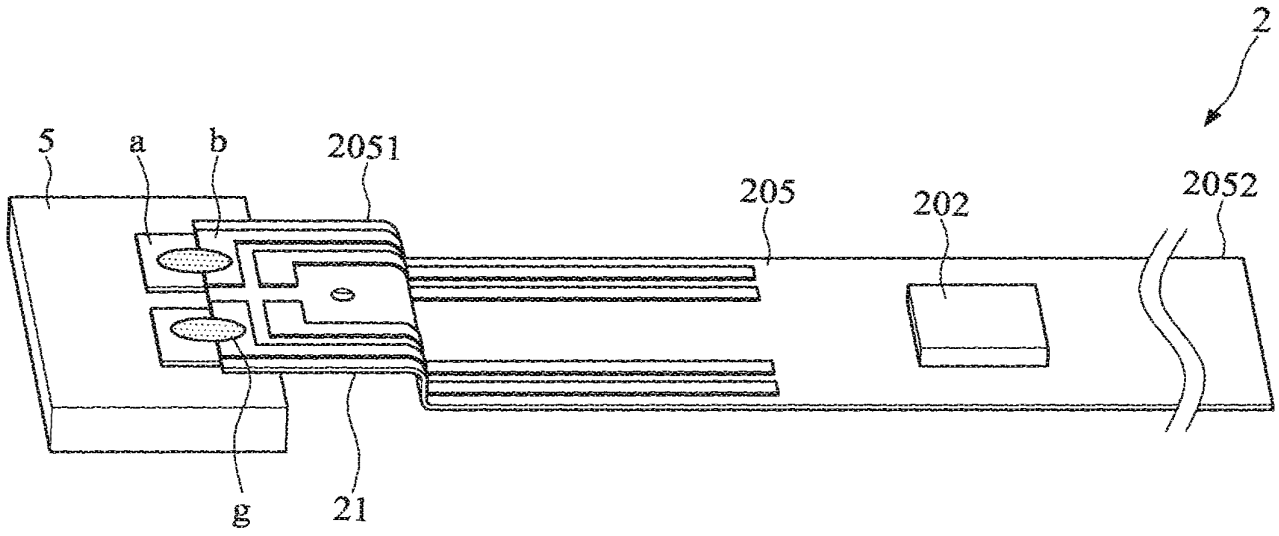


FIG.4A

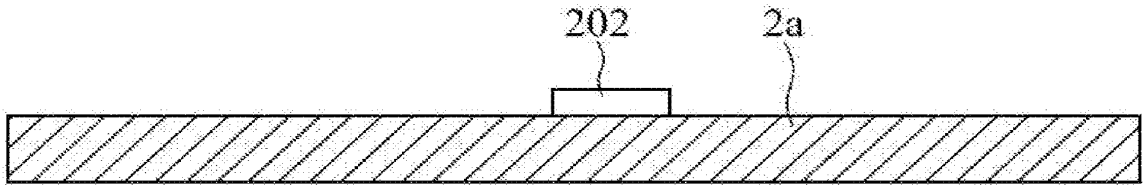


FIG.4B

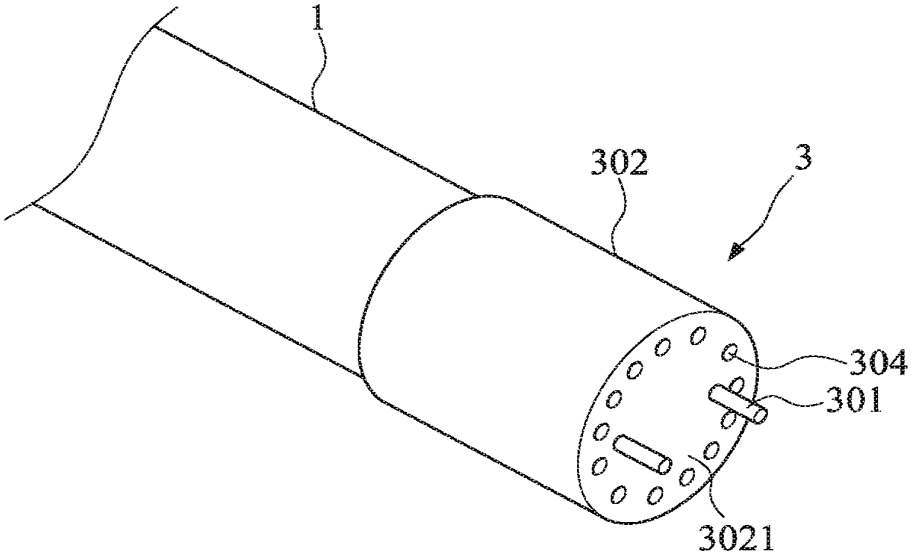


FIG.5

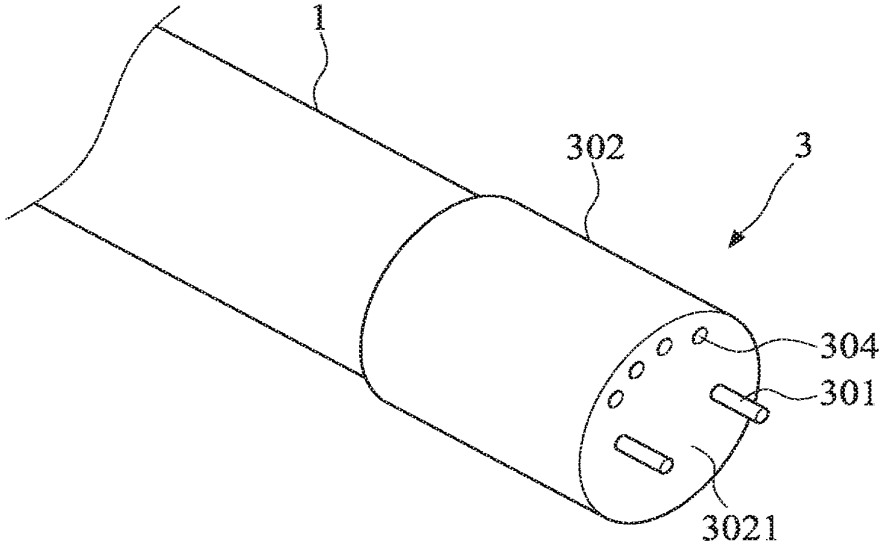


FIG.6

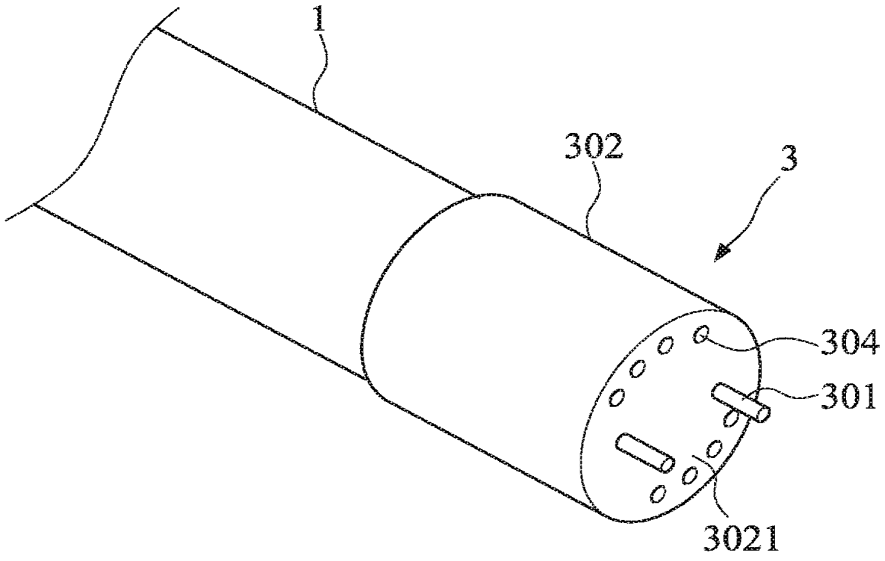


FIG.7

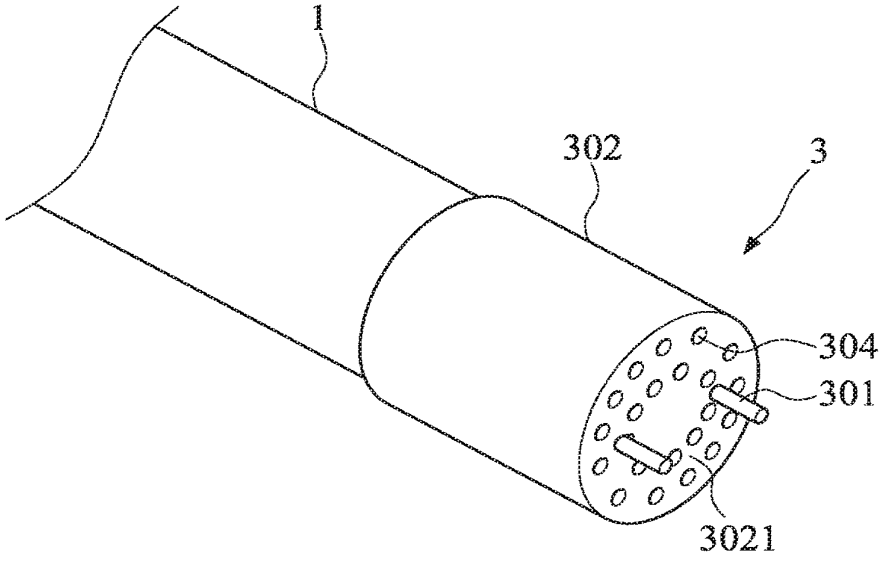


FIG.8

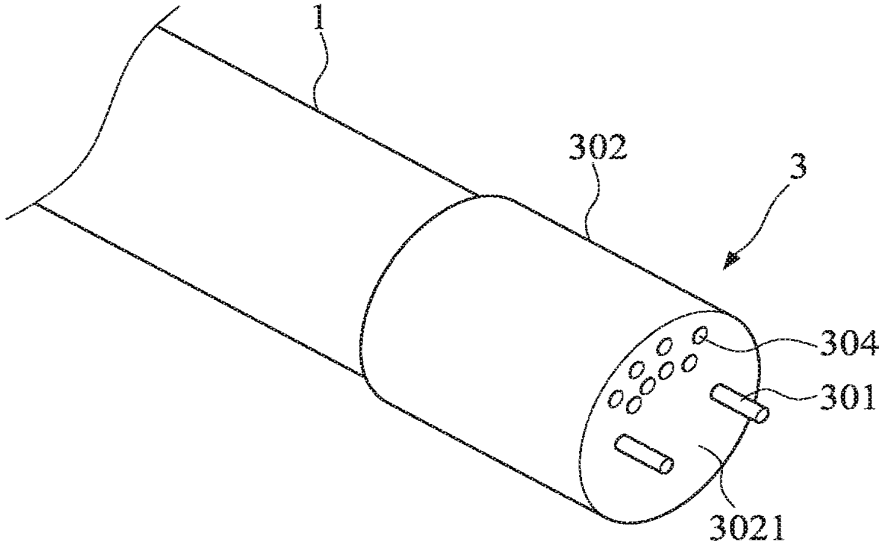


FIG.9

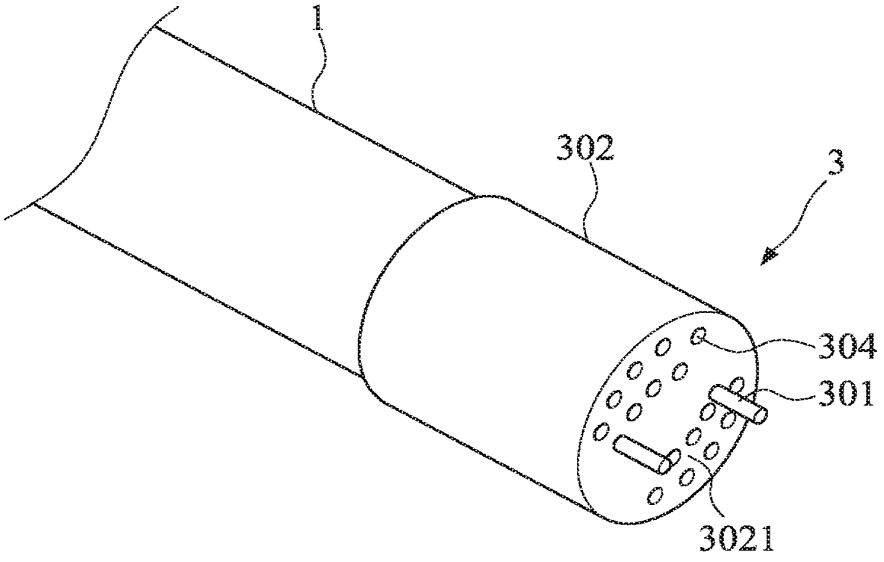


FIG.10

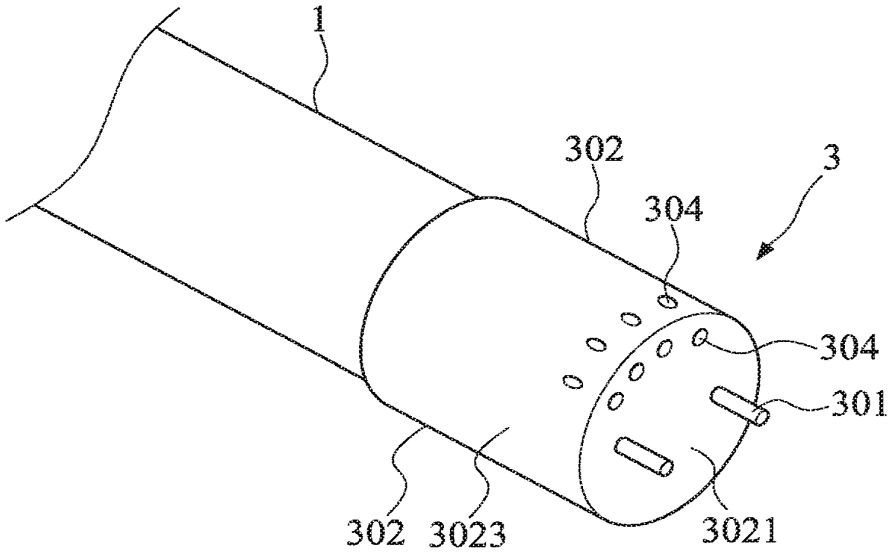


FIG.11

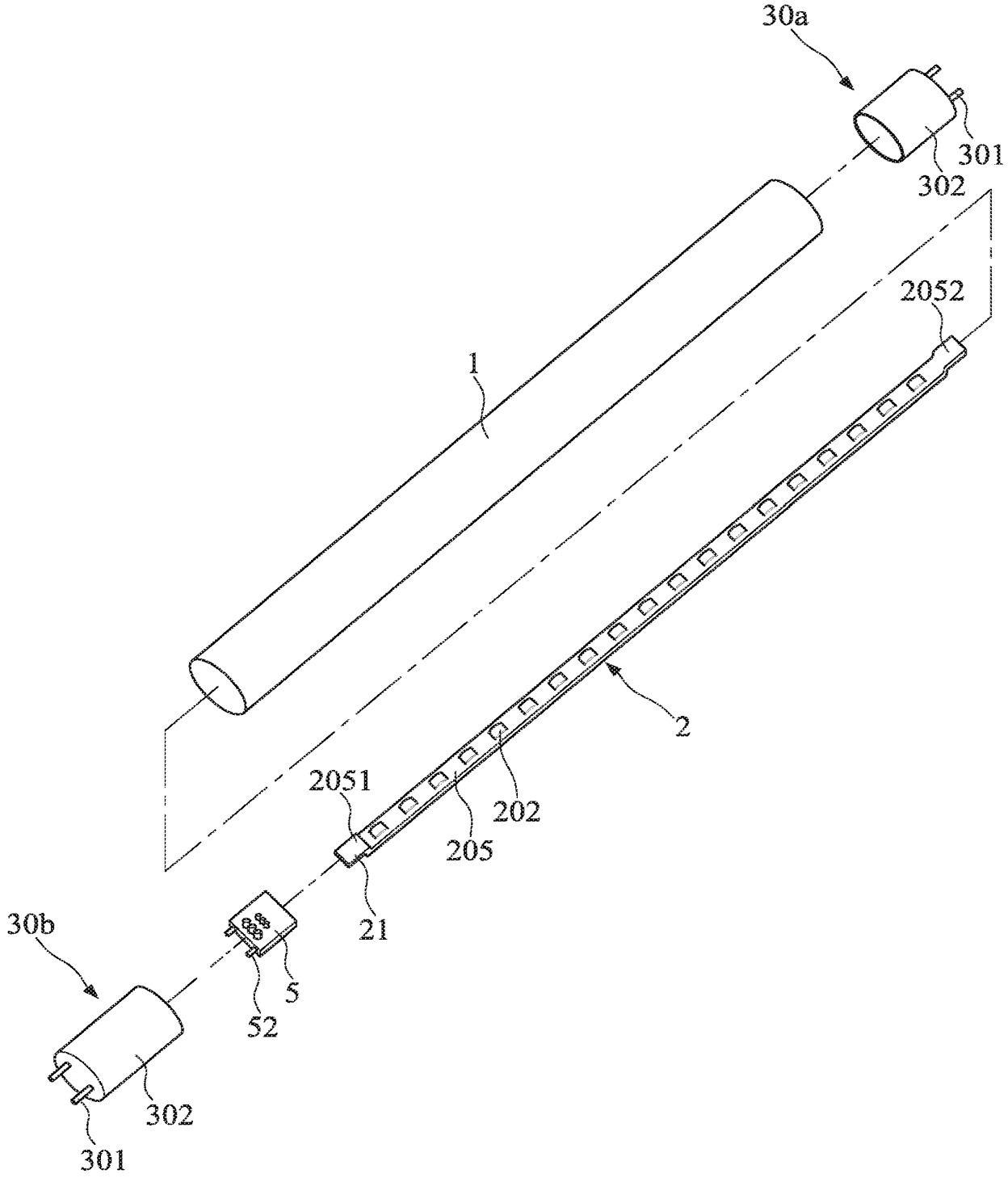


FIG.12

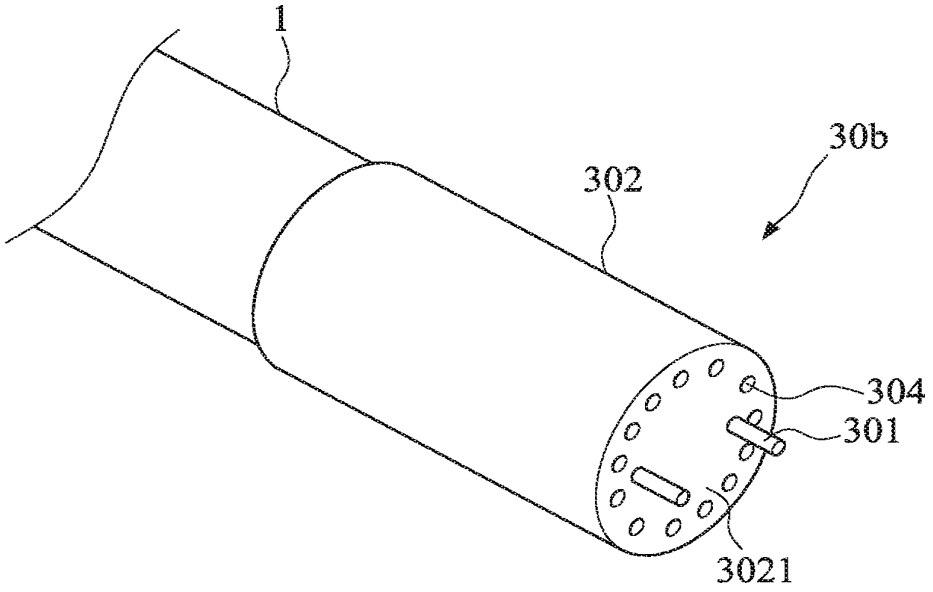


FIG.13

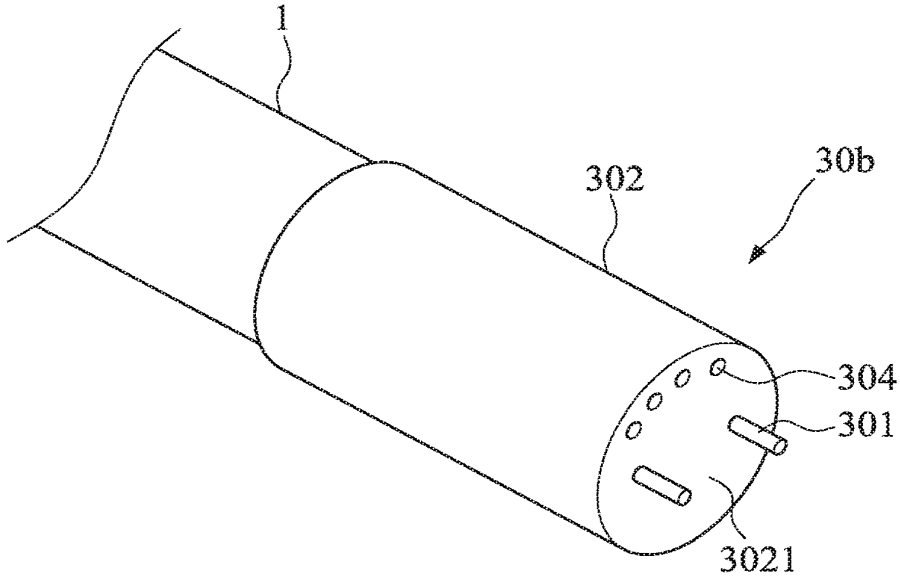


FIG.14

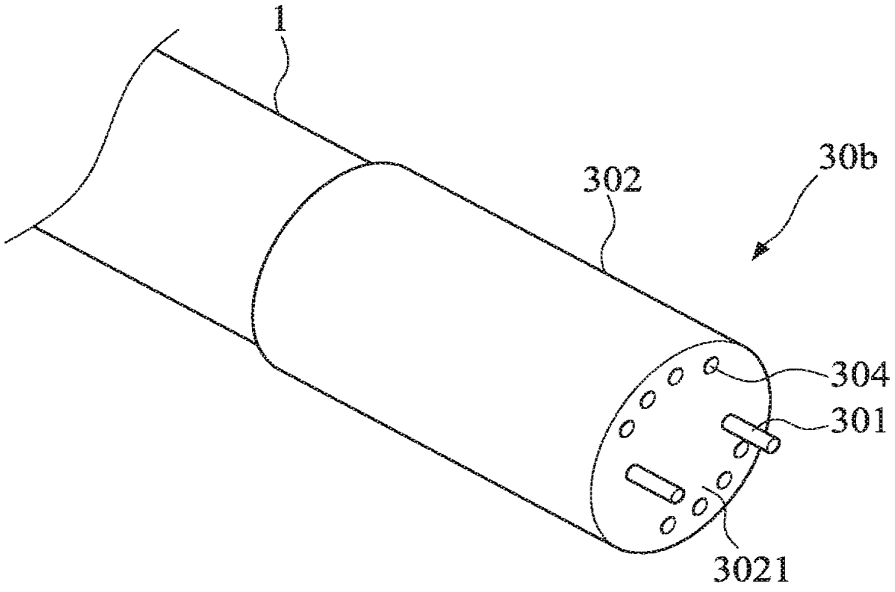


FIG.15

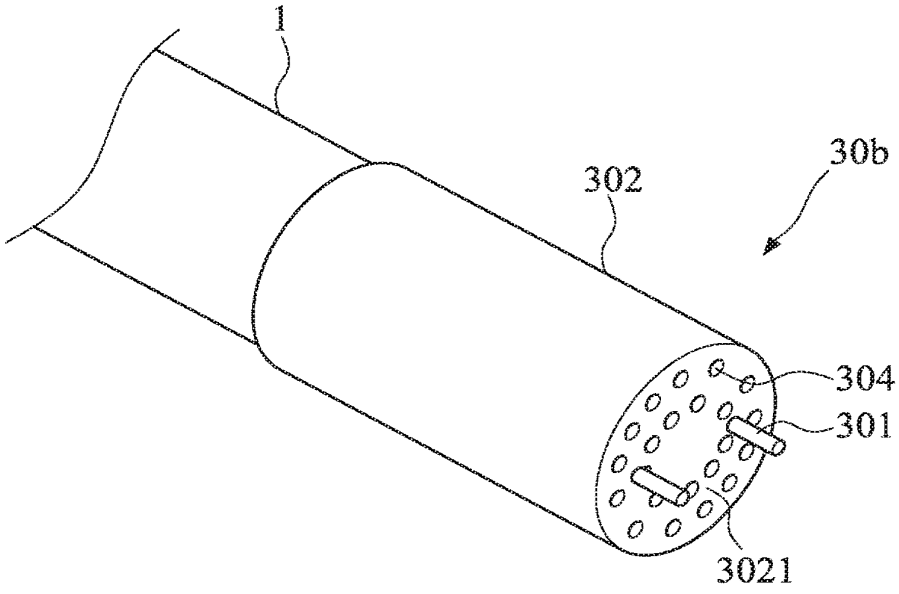


FIG.16

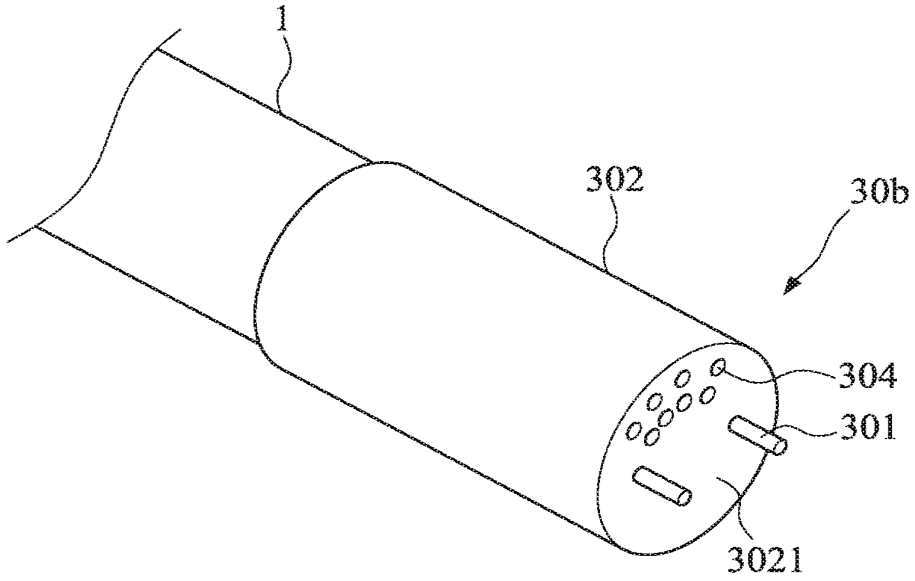


FIG.17

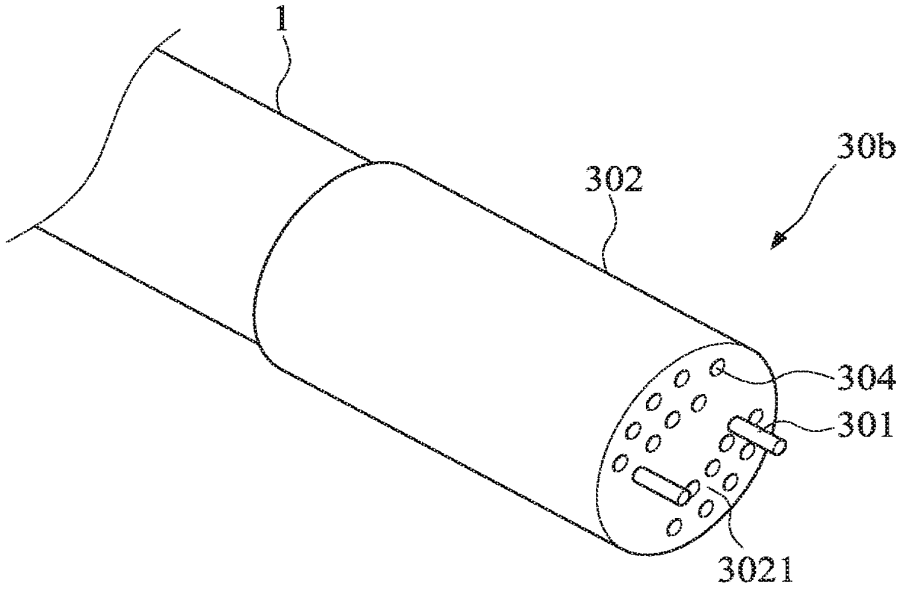


FIG.18

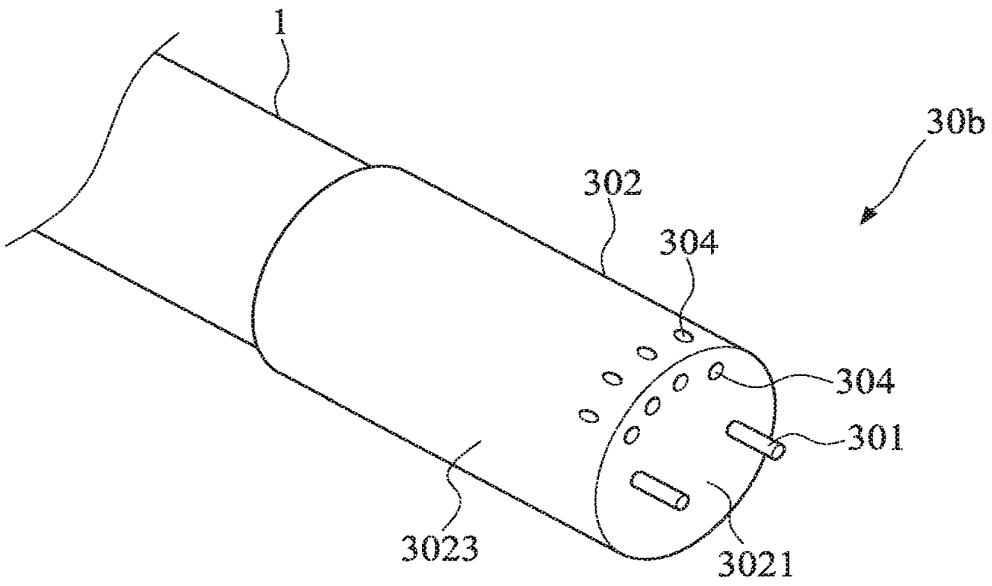


FIG.19

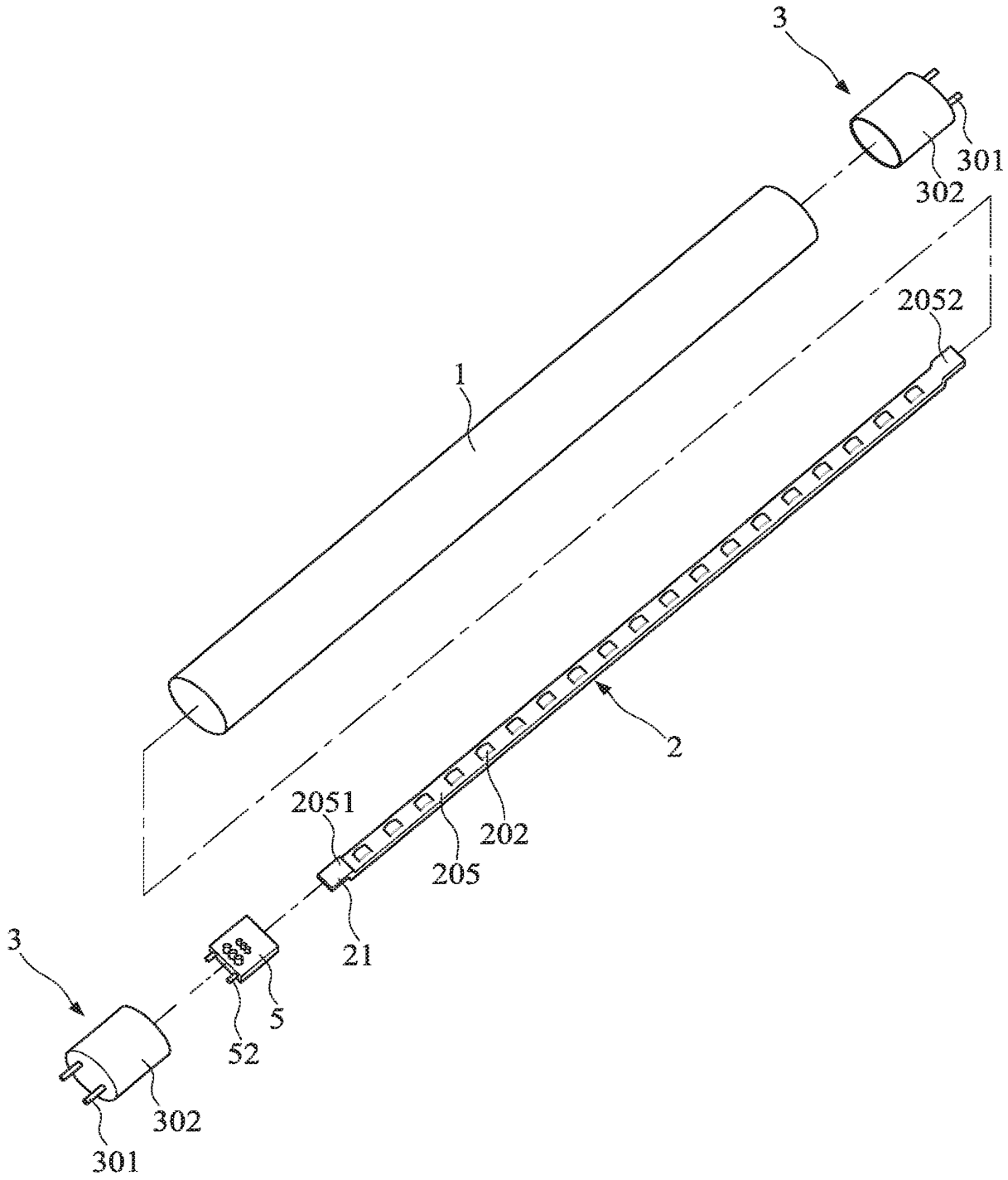


FIG.20

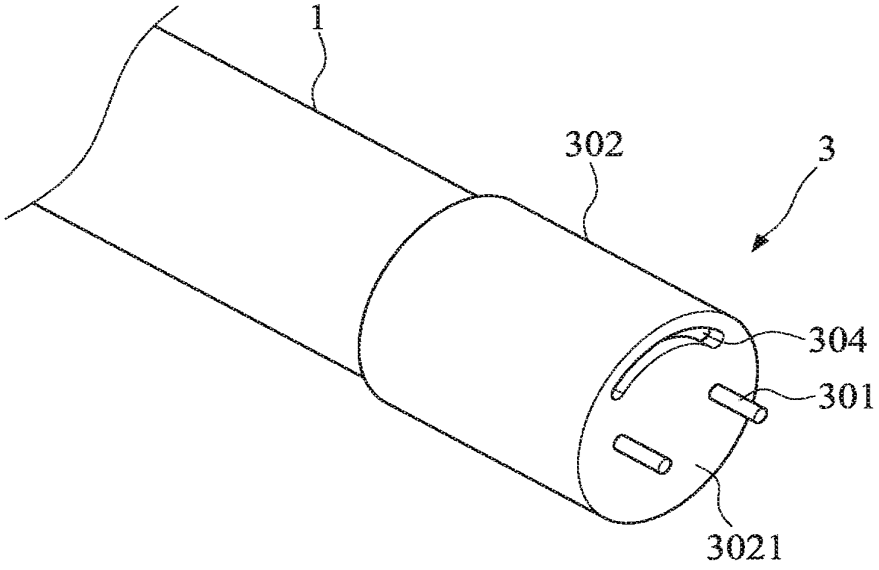


FIG.21

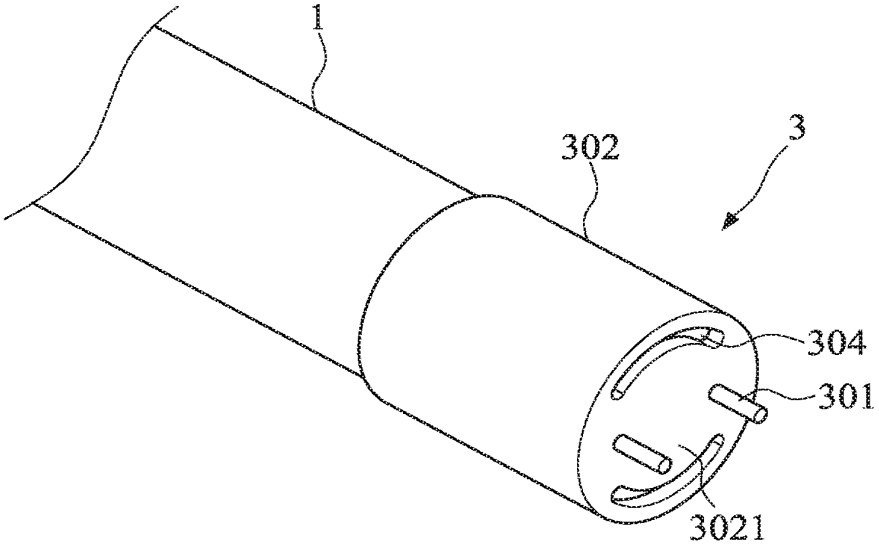


FIG.22

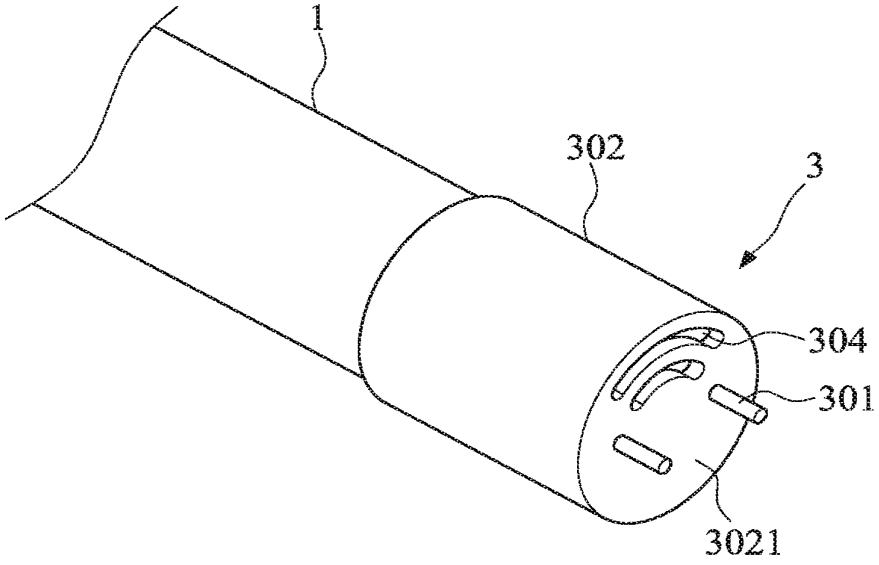


FIG.23

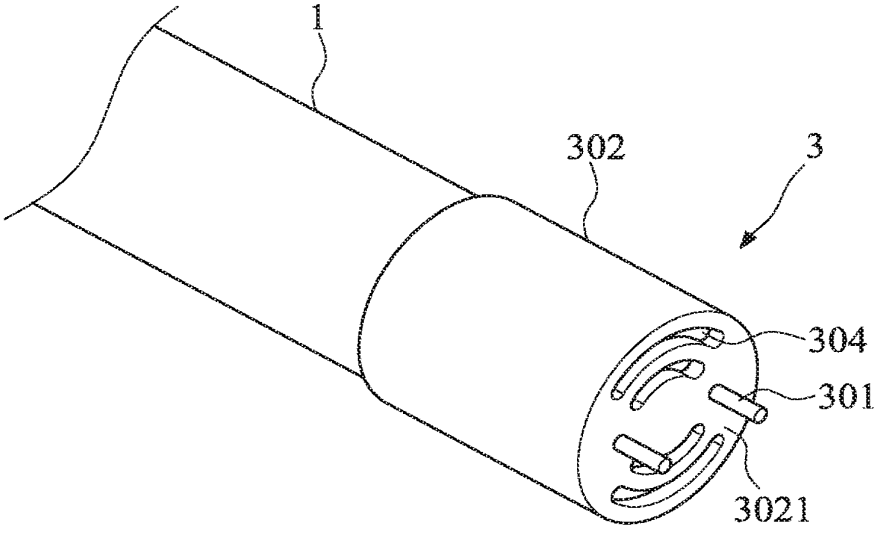


FIG.24

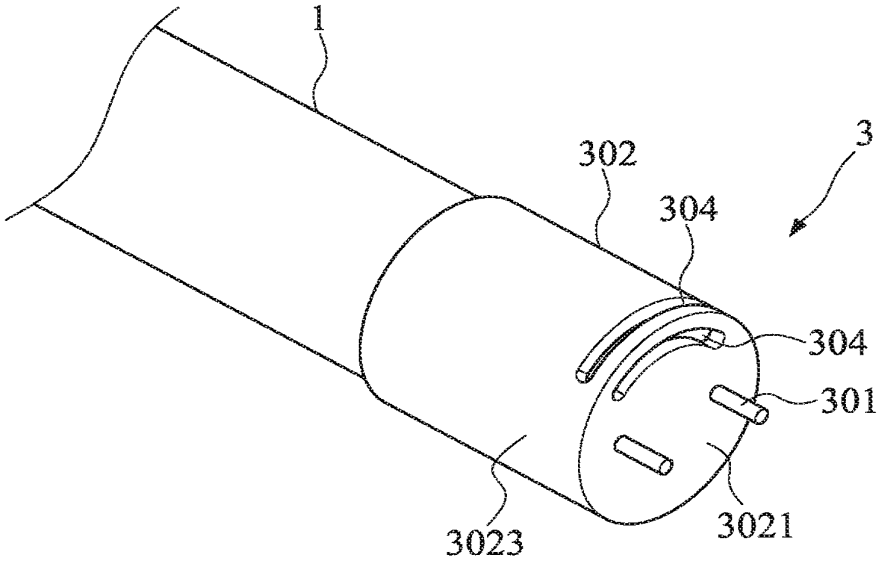


FIG.25

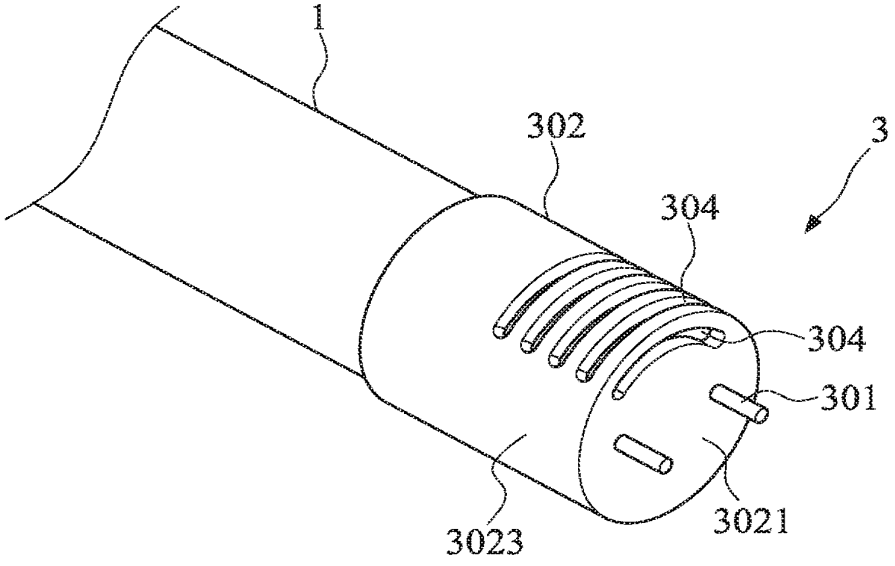


FIG.26

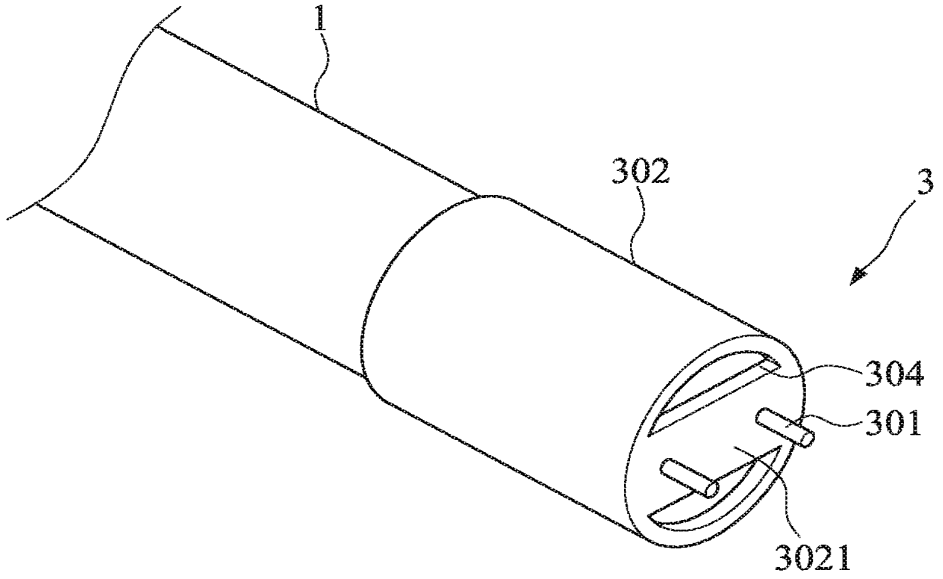


FIG.27

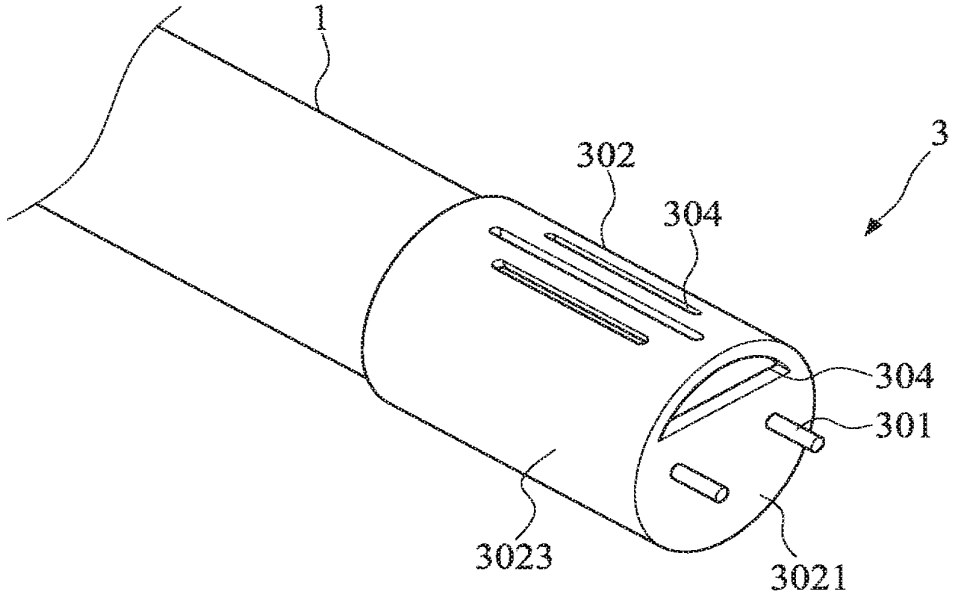


FIG.28

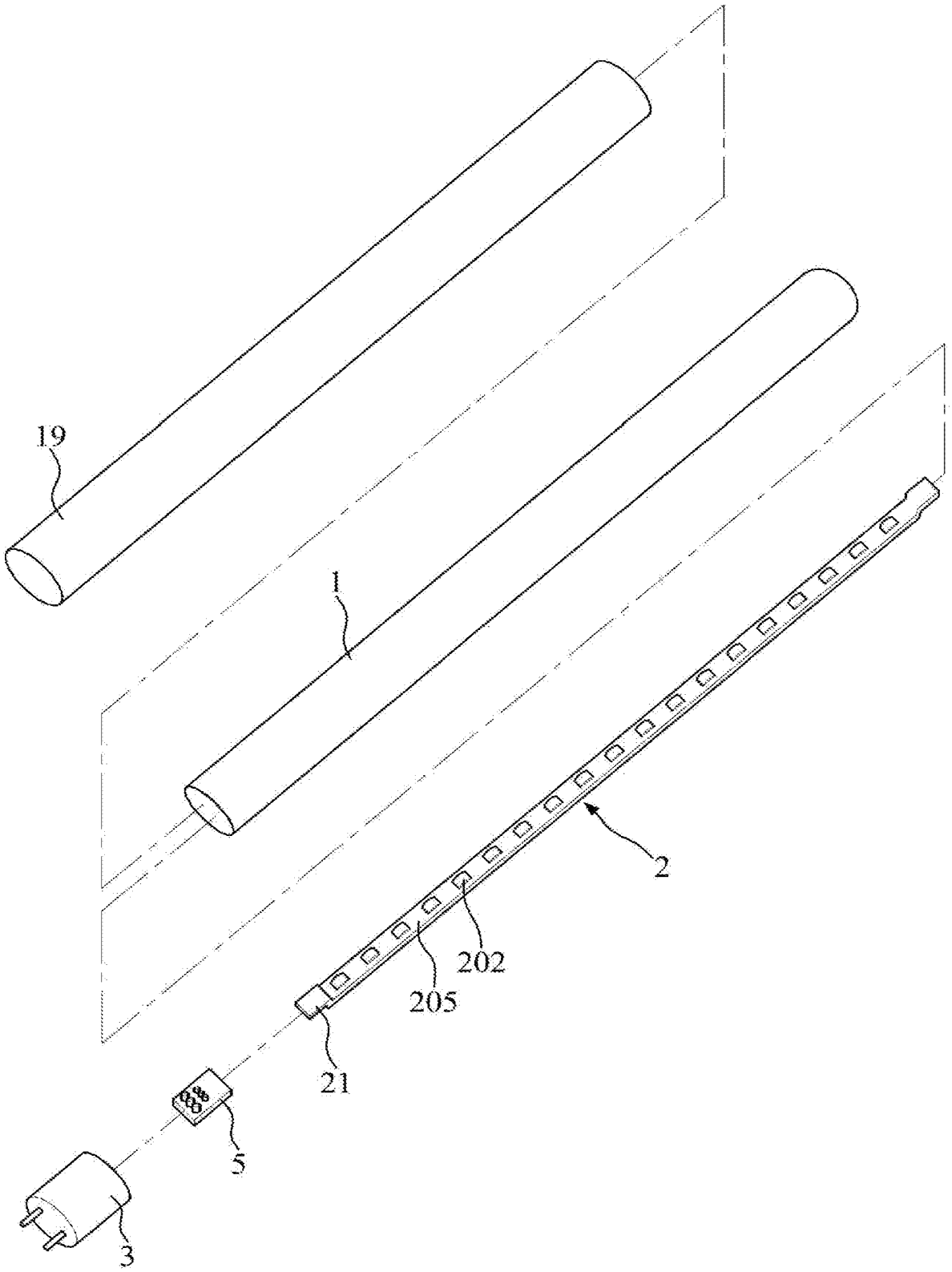


FIG.29A

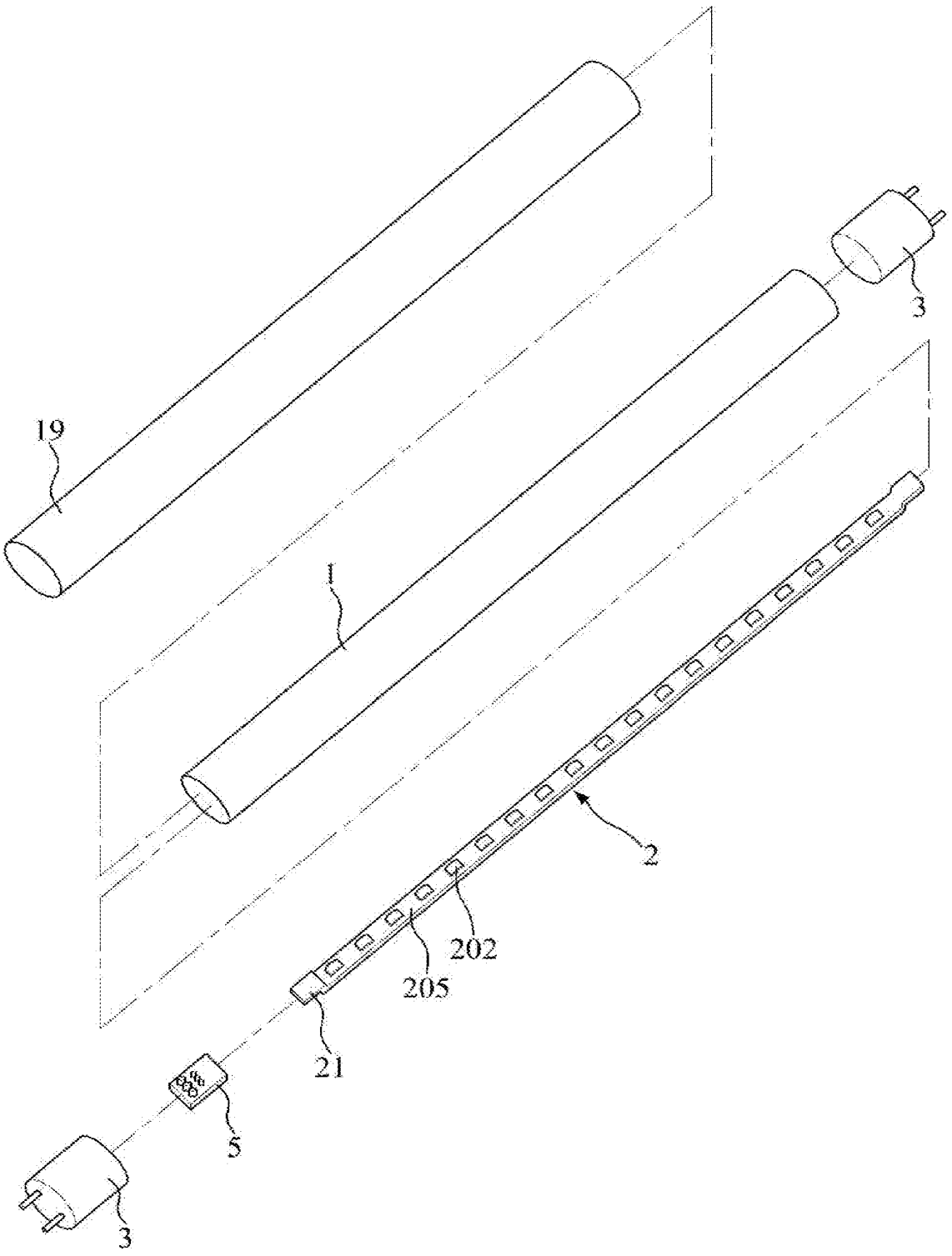


FIG.29B

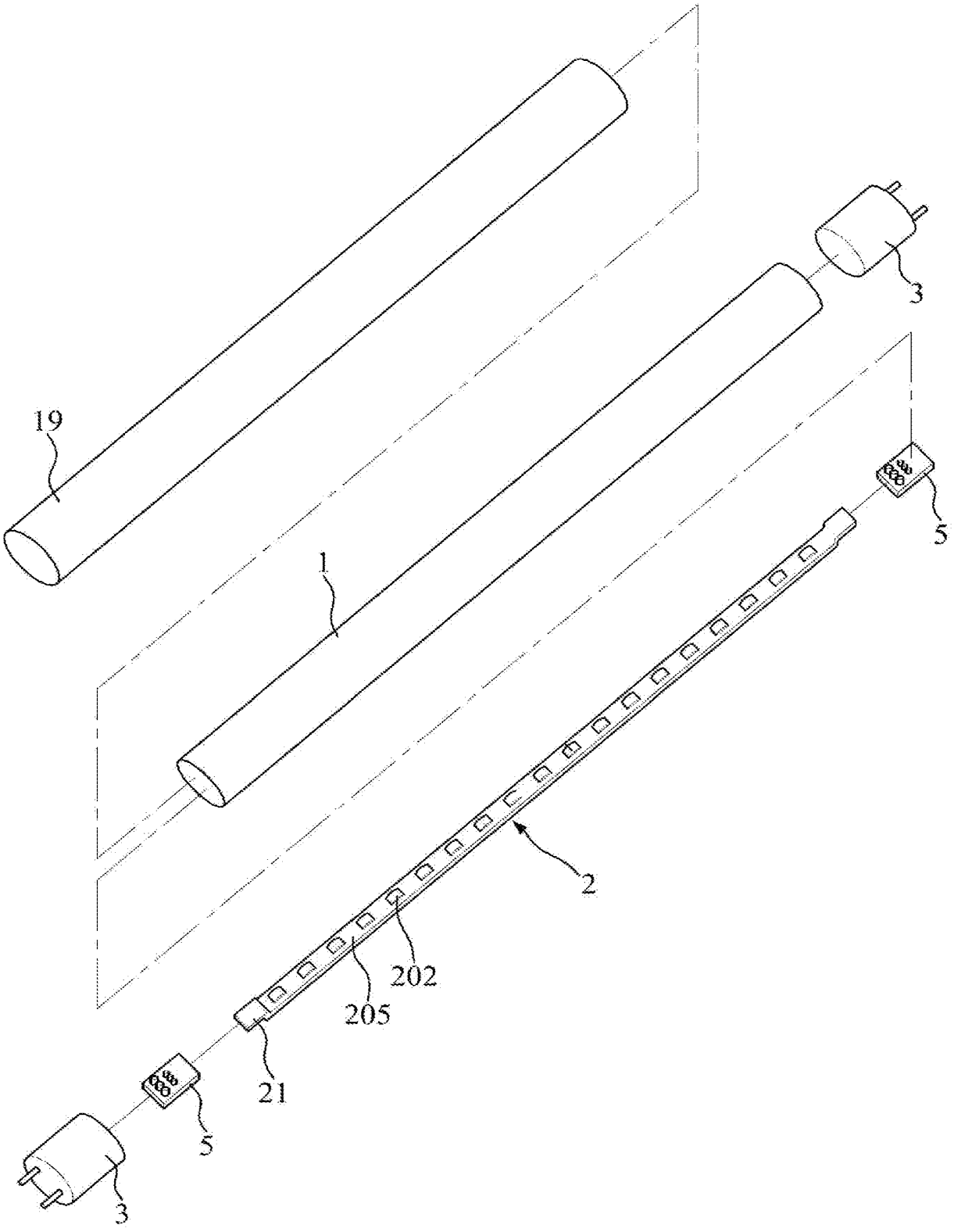


FIG.29C

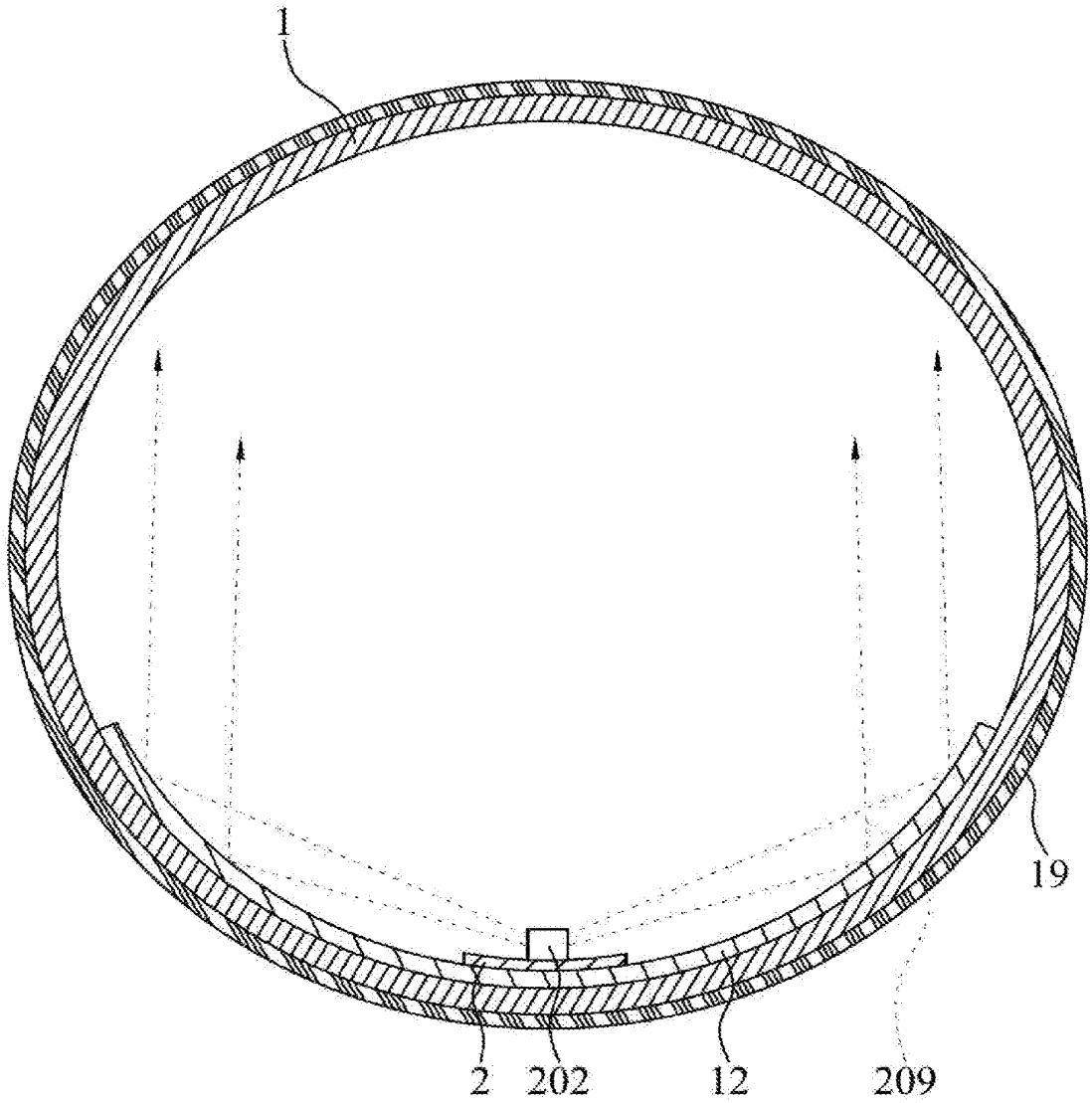


FIG.30

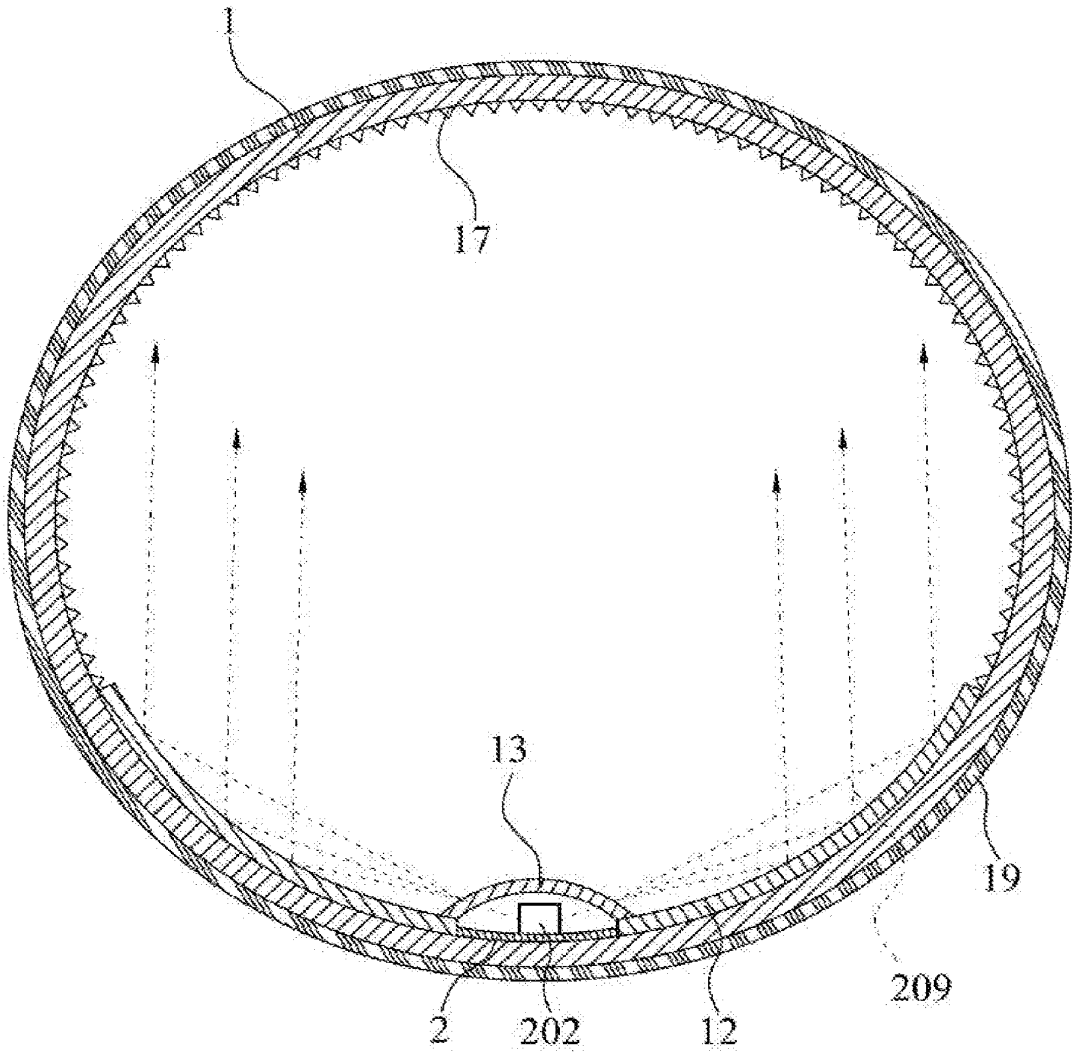


FIG.31

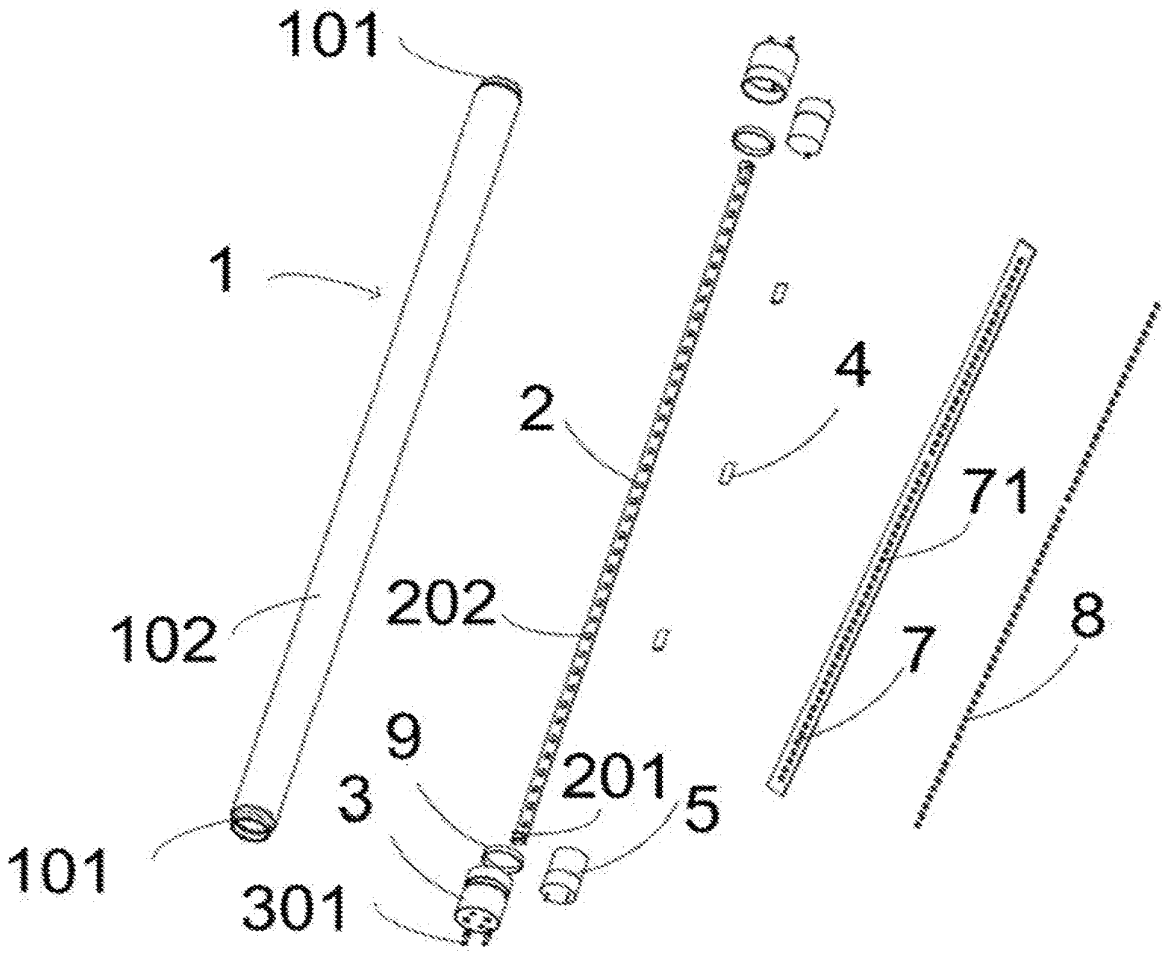


FIG. 32

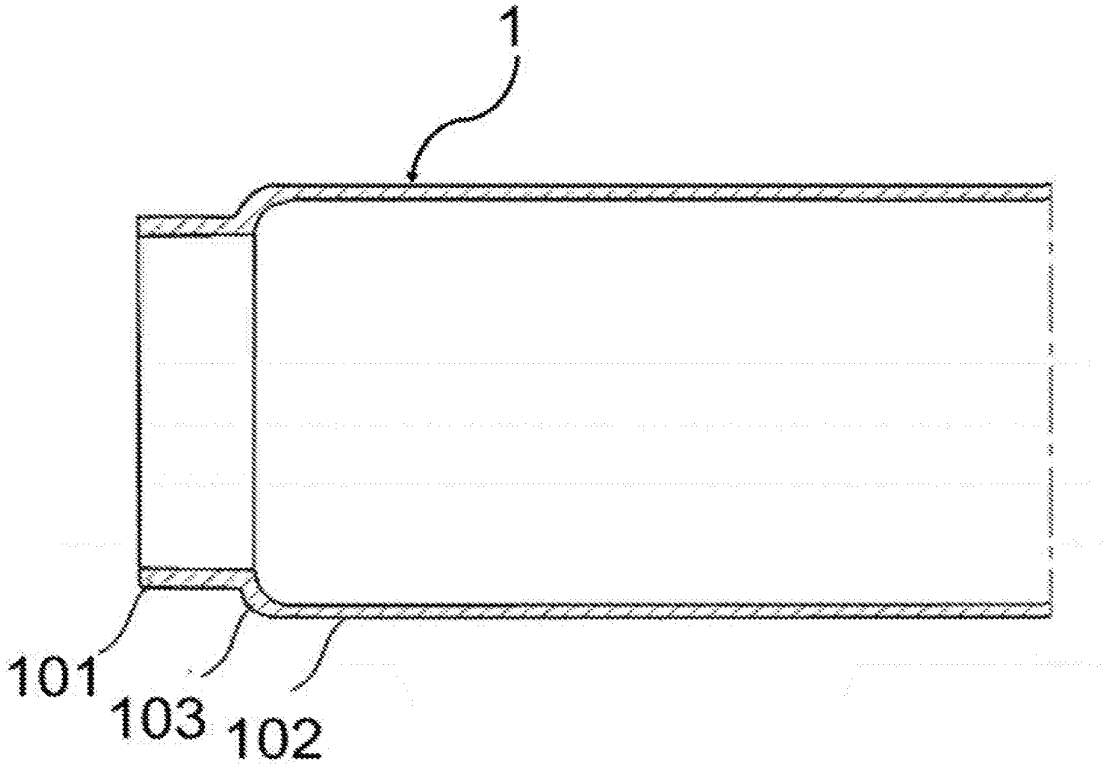


FIG. 33

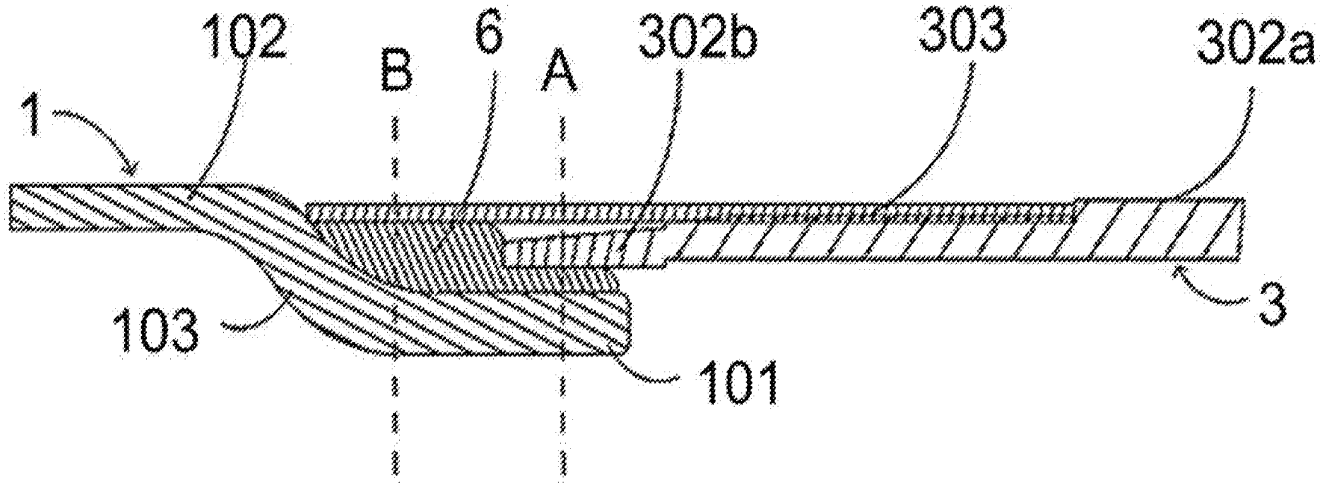


FIG. 34

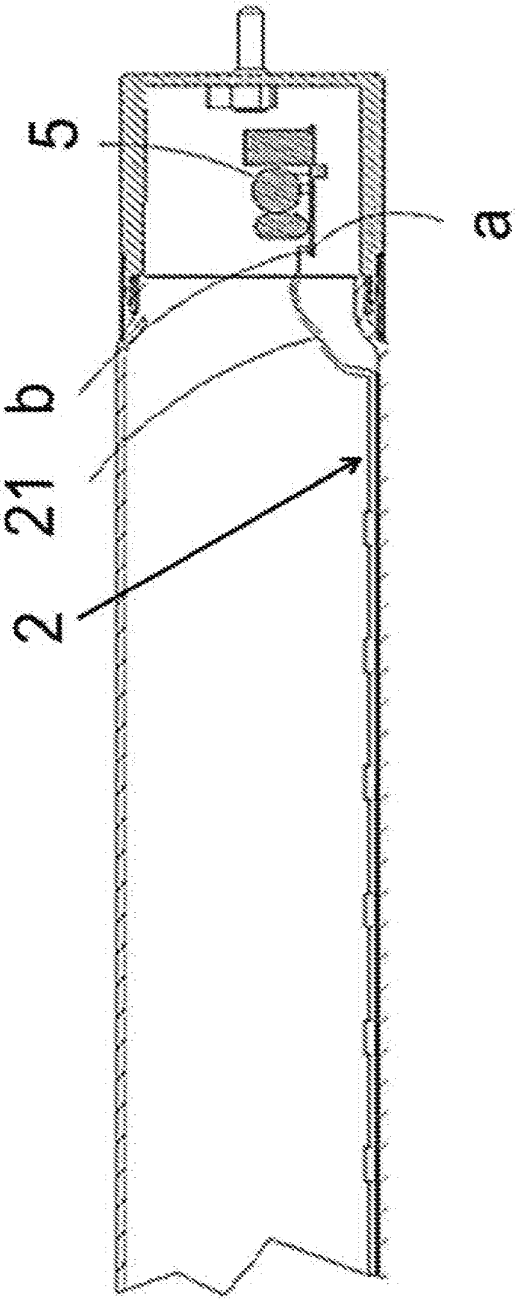


FIG. 35

Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	LED TUBE LAMP
First Named Inventor/Applicant Name:	Tao JIANG
Filer:	Simon Kuang Lu/Jin Huang
Attorney Docket Number:	S19141USUC01T

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
UTILITY APPLICATION FILING	1011	1	300	300
UTILITY SEARCH FEE	1111	1	660	660
UTILITY EXAMINATION FEE	1311	1	760	760
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**1720**

Electronic Acknowledgement Receipt

EFS ID:	38079526
Application Number:	16719861
International Application Number:	
Confirmation Number:	5387
Title of Invention:	LED TUBE LAMP
First Named Inventor/Applicant Name:	Tao JIANG
Customer Number:	147274
Filer:	Simon Kuang Lu/Jin Huang
Filer Authorized By:	Simon Kuang Lu
Attorney Docket Number:	S19141USUC01T
Receipt Date:	18-DEC-2019
Filing Date:	
Time Stamp:	20:23:56
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$1720
RAM confirmation Number	E2019BHK24558415
Deposit Account	
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Application Data Sheet	20191218_aia0014_ADSforS19141USUC01T.pdf	1257452 da8b920b241f639ca9280e7aeaf13b463156539b	no	10
Warnings:					
Information:					
2	Transmittal of New Application	20191218_aia0015_utility_transmittalforS19141USUC01T.pdf	392393 296fbcb178d62495cd029890708d02d92e8e2a61	no	2
Warnings:					
Information:					
3	Power of Attorney	20191218_aia0082_transmittal_S19141USUC01T.pdf	1551244 6c557c0e761b9f35d5b53a9b1e15b4922655a989	no	3
Warnings:					
Information:					
4	Fee Worksheet (SB06)	20191218_sb06_FeeforS19141USUC01T.pdf	608818 2eaa47dcf2b6b487e217a1baec24bbd544076ee7	no	2
Warnings:					
Information:					
5	Transmittal Letter	20191218_FOREIGN_PRIORITY_STATEMENT_S19141USUC01T_F.pdf	57726 895284e62cc087577049ea4ee0e9575e731da15c	no	1
Warnings:					
Information:					
6	Oath or Declaration filed	S18016USUP01T_DeclarationAssignment_F.pdf	762060 c230b4667384151f31f445d4ca21b2fd0dacd5d3	no	3
Warnings:					
Information:					

7		S19141USUC01T_Spec_F.pdf	616741 c26d688db83f8e04b912c2985f4617f326993250	yes	35

Multipart Description/PDF files in .zip description		
Document Description	**Start**	**End**
Abstract	35	35
Claims	30	34
Specification	1	29

Warnings:

Information:

8	Drawings-only black and white line drawings	S19141USUC01T_FIGS_F.pdf	1225055 3cd95d6b5df5961b023938c836901d1497a3a508	no	27

Warnings:

Information:

9	Fee Worksheet (SB06)	fee-info.pdf	34713 9158c29f2a6902536f652531e60813d41726d890	no	2

Warnings:

Information:

Total Files Size (in bytes):	6506202

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New Applications Under 35 U.S.C. 111

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

National Stage of an International Application under 35 U.S.C. 371

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

New International Application Filed with the USPTO as a Receiving Office

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

PTO/AIA/14 (02-18)
Approved for use through 11/30/2020. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	S19141USUC01T
	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.

Secrecy Order 37 CFR 5.2:

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

Inventor Information:

Inventor 1 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Tao		Jiang	

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

City	Jiaxing	Country of Residence	CN

Mailing Address of Inventor:

Address 1	No.1288 Jiachuang Rd. Xiuzhou Area
Address 2	Jiaxing City, Zhejiang, China
City	Jiaxing City
State/Province	
Postal Code	
Country	CN

Inventor 2 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Li-Qin		Li	

Residence Information (Select One) ● US Residency ○ Non US Residency Active US Military Service

City		State/Province		Country of Residence	

Mailing Address of Inventor:

Address 1	No.1288 Jiachuang Rd. Xiuzhou Area
Address 2	Jiaxing City, Zhejiang, China
City	Jiaxing City
State/Province	
Postal Code	
Country	CN

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

Correspondence Information:

PTO/AIA/14 (02-18)
Approved for use through 11/30/2020. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	S19141USUC01T
	Application Number	
Title of Invention	LED TUBE LAMP	

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

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

Customer Number	147274		
Email Address		Add Email	Remove Email

Application Information:

Title of the Invention	LED TUBE LAMP		
Attorney Docket Number	S19141USUC01T	**Small Entity Status Claimed**	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	27	**Suggested Figure for Publication (if any)**	31

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

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

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

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

Representative Information:

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

Please Select One:	● Customer Number	US Patent Practitioner	○ Limited Recognition (37 CFR 11.9)
Customer Number	147274		

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	S19141USUC01T
	Application Number	
Title of Invention	LED TUBE LAMP	

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.
When referring to the current application, please leave the "Application Number" field blank.

Prior Application Status	Pending	Remove

Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
	Continuation of	16051826	2018-08-01

Prior Application Status	Patented	Remove

Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
16051826	Continuation in part of	15437084	2017-02-20	10352540	2019-07-16

Prior Application Status	Patented	Remove

Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
15437084	Continuation of	15056106	2016-02-29	9903537	2018-02-07

Prior Application Status		Remove

Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
15056106	Continuation in part of	PCT/CN2015/096502	2015-12-05

Prior Application Status	Patented	Remove

Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
16051826	Continuation in part of	15087092	2016-03-31	10082250	2018-09-25

Prior Application Status		Remove

Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
15087092	Continuation in part of	PCT/CN2015/096502	2015-12-05

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	S19141USUC01T
	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).

Remove

Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)
201410734425.5	CN	2014-12-05	

Remove

Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)
201510075925.7	CN	2015-02-12	

Remove

Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)
201510136796.8	CN	2015-03-27	1FC7

Remove

Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)
201510259151.3	CN	2015-05-19	207D

Remove

Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)
201510324394.0	CN	2015-06-12	1F77

Remove

Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)
201510338027.6	CN	2015-06-17	206C

Remove

Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)
201510373492.3	CN	2015-06-26	1FB4

Remove

Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)
201510448220.5	CN	2015-07-27	1DDF

Remove

Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)
201510482944.1	CN	2015-08-07	1FC6

Remove

Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)
201510483475.5	CN	2015-08-08	206F

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	S19141USUC01T
	Application Number	
Title of Invention	LED TUBE LAMP	

Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)
201510499512.1	CN	2015-08-14	1E49
201510555543.4	CN	2015-09-02	1FC2
201510557717.0	CN	2015-09-06	1E4A
201510595173.7	CN	2015-09-18	1E4D
201510645134.3	CN	2015-10-08	1E59
201510716899.1	CN	2015-10-29	1FD9
201510726365.7	CN	2015-10-30	1DF0
201510868263.9	CN	2015-12-02	1FD6

Remove

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	S19141USUC01T
	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	S19141USUC01T
	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		
Address 2	Jiaxing City, Zhejiang, China		
City	Jiaxing	**State/Province**	
Country	CN	Postal Code	314031
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	S19141USUC01T
	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:

Remove

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	/SIMON KUANG LU/			Date (YYYY-MM-DD)	2019-12-18
First Name	SIMON KUANG	Last Name	LU	Registration Number	51,974

Additional Signature may be generated within this form by selecting the Add button. Add

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	S19141USUC01T
	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 CooperationTreaty.

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.

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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

Application Number	16719861
Filing Date	2019-12-18
First Named Inventor	JIANG, Tao
Art Unit	2875
Examiner Name	
Attorney Docket Number	S19141USUC01T

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	10288272	B2	2019-05-14	ZHEJIANG SUPER LIGHTING ELECTRIC APPLIANCE CO LTD	
	2	9989200	B2	2018-06-05	Zhang Yingchun	
	3	7611260	B1	2009-11-03	Kuo-Len LIN et al.	
	4	7815338	B2	2010-10-19	Dennis Siemiet et al.	
	5	9864438	B2	2018-01-09	SEO JOON KYU et al.	
	6	8360599	B2	2013-01-29	Illumisys, Inc.	
	7	9625137	B2	2017-04-18	Li-Qin, Li et al.	
	8	7067032	B1	2006-06-27	A RAYMOND & CIE	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16719861
	Filing Date	2019-12-18
	First Named Inventor	JIANG, Tao
	Art Unit	2875
	Examiner Name	
	Attorney Docket Number	S19141USUC01T

	9	9448660	B2	2016-09-20	SEO JOON KYU et al.	
	10	9228727	B2	2016-01-05	MAY, MICHAEL, W.	
	11	9322531	B2	2016-04-26	Chun-wei Liang et al.	
	12	1088142	A	1914-02-24	GARDNER JESSE O	
	13	8456075	B2	2013-06-04	AURALIGHT INTERNATIONAL AB	
	14	7594738	B1	2009-09-29	KITAGAWA HOLDINGS, LLC	
	15	9016890	B2	2015-04-28	KIM KYUNG RYE et al.	
	16	9488767	B2	2016-11-08	Dante P. Nava et al.	
	17	8240875	B2	2012-08-14	Cree, Inc.	
	18	10021742	B2	2018-07-10	Tao JIANG	
	19	5964518	A	1999-10-12	YA-KUANG SHEN	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16719861
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	First Named Inventor	JIANG, Tao
	Art Unit	2875
	Examiner Name	
	Attorney Docket Number	S19141USUC01T

	20	9810384	B2	2017-11-07	Zhang Yingchun	
	21	6246167	B1	2001-06-12	SICA, MICHAEL F.	
	22	10161569	B2	2018-12-25	XU HONG et al.	
	23	9000668	B2	2015-04-07	Fujun Qiu	
	24	6118072	A	2000-09-12	TELEDYNE TECHNOLOGIES INCORP	
	25	9885449	B2	2018-02-06	JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO LTD	

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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	20130050998	A1	2013-02-28	GT BIOMESCILT LIGHT	
	2	20110305021	A1	2011-12-15	Shao-Han Chang	
	3	20140331532	A1	2014-11-13	ALMAX MFG CORP	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	Filing Date	2019-12-18
	First Named Inventor	JIANG, Tao
	Art Unit	2875
	Examiner Name	
	Attorney Docket Number	S19141USUC01T

	4	20130021809	A1	2013-01-24	OSRAM GMBH	
	5	20130033888	A1	2013-02-07	KONINKLIJKE PHILIPS ELECTRONICS N V	
	6	20140009923	A1	2014-01-09	FIN-CORE CORPORATION & TONG HONG INVESTMENT CO., L	
	7	20130250565	A1	2013-09-26	DELTA ELECTRONICS, INC	
	8	20100066230	A1	2010-03-18	Kuo-Len LIN et al.	
	9	20110084608	A1	2011-04-14	I/O CONTROLS CORPORATION	
	10	20100220469	A1	2010-09-02	ILUMISYS, INC.	
	11	20100201269	A1	2010-08-12	LEXTAR ELECTRONICS CORP.	
	12	20130182425	A1	2013-07-18	PANASONIC INTELLECTUAL PROPERTY MANAGEMENT CO., LT	
	13	20080055894	A1	2008-03-06	DENG JIA H. et al.	
	14	20120069556	A1	2012-03-22	OSRAM GMBH	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	First Named Inventor	JIANG, Tao
	Art Unit	2875
	Examiner Name	
	Attorney Docket Number	S19141USUC01T

	15	20160178137	A1	2016-06-23	JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.,LT	
	16	20150176770	A1	2015-06-25	Cree, Inc.	
	17	20040189218	A1	2004-09-30	LEONG SUSAN J., et al	
	18	20110279063	A1	2011-11-17	ORION ENERGY SYSTEMS, INC.	
	19	20130235570	A1	2013-09-12	HOOD, WILLIAM et al.	
	20	20140306599	A1	2014-10-16	EDWARDS CHARLES et al.	
	21	20050162850	A1	2005-07-28	LUK JOHN F. & ALTMAN ROBERT M.	
	22	20160081147	A1	2016-03-17	GUANG LUO HUA	
	23	20140225519	A1	2014-08-14	POESEN ELECTRONIC CO., LTD.	
	24	20120146503	A1	2012-06-14	CREE Inc.,	
	25	20130301255	A1	2013-11-14	Lumirich Co., Ltd.	

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	Filing Date	2019-12-18
	First Named Inventor	JIANG, Tao
	Art Unit	2875
	Examiner Name	
	Attorney Docket Number	S19141USUC01T

	26	20050281030	A1	2005-12-22	LEONG SUSAN J	
	27	20100253226	A1	2010-10-07	OKI ISAMU	
	28	20110149563	A1	2011-06-23	LIGHTEL TECHNOLOGIES INC.	
	29	20150345755	A1	2015-12-03	PURDY STEVEN	
	30	20140203717	A1	2014-07-24	CREE, INC.	
	31	20140192526	A1	2014-07-10	NINGBO FUTAI ELECTRIC LIMITED	
	32	20090159919	A1	2009-06-25	ALTAIR ENGINEERING, INC.	
	33	20030189829	A1	2003-10-09	Matsushita Electric Industrial Co., Ltd	
	34	20130223053	A1	2013-08-29	VERTICIL ELECTRONICS CORPORATION	
	35	20160084455	A1	2016-03-24	HUNG-CHANG CHEN	
	36	20080192476	A1	2008-08-14	KABUSHIKIKAISHA MIRAI	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	Filing Date	2019-12-18
	First Named Inventor	JIANG, Tao
	Art Unit	2875
	Examiner Name	
	Attorney Docket Number	S19141USUC01T

	37	20170211753	A1	2017-07-27	JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.,LT	
	38	20180335200	A1	2018-11-22	JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.,LT	
	39	20130051008	A1	2013-02-28	SHEW LARRY N	
	40	20110084554	A1	2011-04-14	TIAN FENG	
	41	20130135857	A1	2013-05-30	CHEN, CHIA-CHIN et al.	
	42	20130256704	A1	2013-10-03	TANG GUOFU & HSIAO YUCHUN	
	43	20170318678	A1	2017-11-02	Chris Wh MIAO et al.	
	44	20130229104	A1	2013-09-05	GREEN, ADAM et al.	
	45	20080290814	A1	2008-11-27	Susan J. Leong & John Kit	
	46	20160091147	A1	2016-03-31	JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO., LTD	
	47	20120049684	A1	2012-03-01	AVANTIS LTD.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	Filing Date	2019-12-18
	First Named Inventor	JIANG, Tao
	Art Unit	2875
	Examiner Name	
	Attorney Docket Number	S19141USUC01T

	48	20170089530	A1	2017-03-30	JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.,LT	
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16719861
	Filing Date	2019-12-18
	First Named Inventor	JIANG, Tao
	Art Unit	2875
	Examiner Name	
	Attorney Docket Number	S19141USUC01T

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16719861
	Filing Date	2019-12-18
	First Named Inventor	JIANG, Tao
	Art Unit	2875
	Examiner Name	
	Attorney Docket Number	S19141USUC01T

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	1	203202740	CN	U	2013-09-18	FUZHOU SUNLIGHT LIGHTING ELECTRICAL APPLIANCE CO L		☒
	2	2014045523	WO	A1	2014-03-27	PANASONIC CORP		☒

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16719861
	Filing Date	2019-12-18
	First Named Inventor	JIANG, Tao
	Art Unit	2875
	Examiner Name	
	Attorney Docket Number	S19141USUC01T

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	4	2014154479	JP	A	2014-08-25	EREBAMU KK		☒
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	Art Unit	2875
	Examiner Name	
	Attorney Docket Number	S19141USUC01T

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

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

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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	/Simon Kuang Lu/	Date (YYYY-MM-DD)	2019-12-24
Name/Print	Simon Kuang Lu	Registration Number	51,974

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(71) Applicant: **JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO., LTD** [CN/CN]; IP Dept. No.1288 Jiachuang Rd. Xiuzhou Area, Jiaxing, Zhejiang 314000 (CN).

(72) Inventor: **JIANG, Tao**; IP Dept. No.1288 Jiachuang Rd. Xiuzhou Area, Jiaxing, Zhejiang 314000 (CN).

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— *with international search report (Art. 21(3))*

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

(88) Date of publication of the international search report:
1 December 2016

(54) Title: LED TUBE LAMP

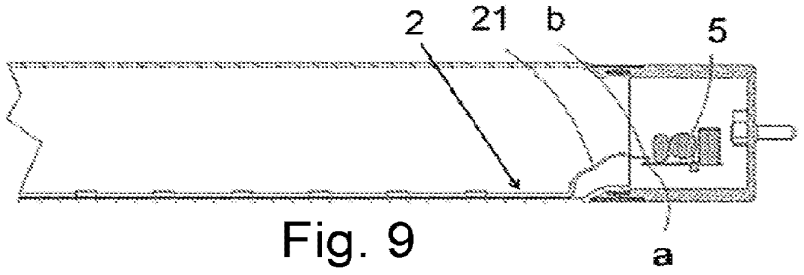


Fig. 9

(57) Abstract: An LED tube lamp includes a glass tube (1), an end cap (3) disposed at one end of the glass tube, a power supply (5) provided inside the end cap, an LED light strip (2) disposed inside the glass tube with a plurality of LED light sources (202) mounted on the LED light strip. The LED light strip has a bendable circuit sheet which is made of a metal layer structure (2a) only to electrically connect the LED light sources and the power supply. The glass tube and the end cap is secured by a highly thermal conductive silicone gel with its thermal conductivity not less than 0.7 w/m-k. The end cap includes a safety switch to prevent the risk of electrical shock during installation and improve the safety and adaption of LED tube lamp installation.

WO 2016/086901 A3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2015/096502

A. CLASSIFICATION OF SUBJECT MATTER

F21S 2/00(2016.01)i; F21V 19/00(2006.01)i; F21V 23/00(2015.01)i; F21V 25/12(2006.01)i; F21V 3/04(2006.01)i; F21Y 101/02(2006.01)n

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F21

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 104776332 A (JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO LTD) 15 July 2015 (2015-07-15) description, pages 3-15, and figures 1-15	1-20
PX	CN 104832813 A (JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO LTD) 12 August 2015 (2015-08-12) description, pages 3-16, and figures 1-23	1-20
PX	CN 204573639 U (JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO LTD) 19 August 2015 (2015-08-19) description, pages 3-14, and figures 1-15	1-20
PX	CN 204201535 U (ELEC-TECH INT CO LTD) 11 March 2015 (2015-03-11) description, pages 1-3, and figures 1-4	1, 17
Y	CN 203963553 U (HESHAN YINYU LIGHTING CO LTD) 26 November 2014 (2014-11-26) description, pages 2 and 3, and figures 1-10	1-20
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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2015/096502

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
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				JP	3199768	U	10 September 2015
				JP	3201340	U	03 December 2015
				GB	201515232	D0	14 October 2015
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				GB	201513501	D0	16 September 2015
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				CN	105042372	A	11 November 2015
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				JP	3199835	U	10 September 2015
CN	204573639	U	19 August 2015		None		
CN	204201535	U	11 March 2015		None		
CN	203963553	U	26 November 2014		None		
CN	201014273	Y	30 January 2008		None		
CN	202791824	U	13 March 2013	HK	1172494	A2	19 April 2013

Form PCT/ISA/210 (patent family annex) (July 2009)

Electronic Acknowledgement Receipt

EFS ID:	38131282
Application Number:	16719861
International Application Number:	
Confirmation Number:	5387
Title of Invention:	LED TUBE LAMP
First Named Inventor/Applicant Name:	Tao Jiang
Customer Number:	147274
Filer:	Simon Kuang Lu/Jin Huang
Filer Authorized By:	Simon Kuang Lu
Attorney Docket Number:	S19141USUC01T
Receipt Date:	24-DEC-2019
Filing Date:	
Time Stamp:	06:42:46
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	20191224_1stIDS_Transmittal_S19141USUC01T_F.pdf	158133 1abc9e8f350fe323d5a40141d1c8fa546b460b0b	no	2

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Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	20191224_1stIDS_1forS19141USUC01T.pdf	620135 2f32aaacb679a3405a2d96f1b8cc9757324a144d	no	17
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3	Foreign Reference	CN2498692Y.pdf	231205 e0483f3af6b782bfa6aa4554d5427234cfeddd2e	no	6
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4	Foreign Reference	CN2911390Y.pdf	411547 8c7095cd6d2f2dfaf2b75e9da25de844c9c9b113	no	10
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13	Foreign Reference	CN103270618A.pdf	2811244 9ee0f8bd74df28cca6e47fc2affc8fefec586945	no	26
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		Total Files Size (in bytes):	60321032		

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of JIANG et al.

Attorney Docket: S19141USUC01T

Serial Number: 16/719,861

Group Art Unit: 2875

Filed: December 18, 2019

Examiner: Unassigned

Confirmation Number: 5387

Title: LED TUBE LAMP

INFORMATION DISCLOSURE STATEMENT UNDER 37 C.F.R. 1.97

Pursuant to 37 C.F.R. l .56 and l .97(b), Applicant brings to the attention of the Examiner the listed documents on the attached SB/08 Form. **This Information Disclosure Statement is being filed before a first office action on the merits of this application.**

Applicant respectfully requests that the Examiner consider the listed documents and indicate that they were considered by making appropriate notations on the attached form.

This submission does not represent that a search has been made or that no better art exists and does **not constitute an admission that each or all of the listed documents are material or constitute "prior art." If the Examiner applies any of the documents a**s prior art against any claim in the application and **Applicant determines that the cited documents do not constitute "prior art" under United States law,** Applicant reserves the right to present to the U.S. Patent and Trademark Office the relevant facts and law regarding the appropriate status of such documents.

Applicant further reserves the right to take appropriate action to establish the patentability of the disclosed invention over the listed documents, should one or more of the documents be applied against the claims of the present application.

If any fees required in connection with this paper, please charge the Deposit Account No. 602062.

Date: December 24, 2019

Respectfully submitted,

By: /Simon Kuang Lu/

Simon Kuang Lu

Registration No. 51,974

1380 Charles Willard St.,

Carson, CA 90746

(650) 315-4468

PTO/SB/08a (01-10)
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	16719861
Filing Date	2019-12-18
First Named Inventor	JIANG, Tao
Art Unit	2875
Examiner Name	
Attorney Docket Number	S19141USUC01T

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	10288272	B2	2019-05-14	ZHEJIANG SUPER LIGHTING ELECTRIC APPLIANCE CO LTD	

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	1	3147313	JP	U	2008-12-25	Kuo-Len LIN et.al		☒
	2	2519258	GB	A	2015-04-15	UNITY OPTO TECHNOLOGY CO. LTD		☐
	3	2013243132	JP	A	2013-12-05	OKI ISAMU		☒

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16719861
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	First Named Inventor	JIANG, Tao
	Art Unit	2875
	Examiner Name	
	Attorney Docket Number	S19141USUC01T

	4	203549435	CN	U	2014-04-16	HU FEILIN		☒
	5	H01204982	JP	A	1989-08-17	Kanbayashi Tomio et al.		☒
	6	203848055	CN	U	2014-09-24	CHEN JINZHANG		☒
	7	200980183	CN	Y	2007-11-21	WANG GUOZHONG		☒
	8	204042527	CN	U	2014-12-24	JIANGSU INKIN OPTOELECTRIC TECHNOLOGY DEV CO LTD		☒
	9	205877791	CN	U	2017-01-11	JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO LTD		☒
	10	103851547	CN	A	2014-06-11	OSRAM GMBH		☒
	11	2012155880	JP	A	2012-08-16	SEKI KATSUSH et al.		☒
	12	203771102	CN	U	2014-08-13	SUZHOU ARES INTERNAT CO LTD		☒
	13	202216003	CN	U	2012-05-09	BEIJING TONGFANG LANSEN LIGHTING TECHNOLOGY CO LTD		☒
	14	203240337	CN	U	2013-10-16	ZHEJIANG SUPER LIGHTING ELECTRIC APPLIANCE CO LTD		☒

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	First Named Inventor	JIANG, Tao
	Art Unit	2875
	Examiner Name	
	Attorney Docket Number	S19141USUC01T

	15	103943752	CN	A	2014-07-23	LEXTAR ELECTRONICS CORP		☒
	16	104832813	CN	A	2015-08-12	JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO LTD		☒
	17	201954169	CN	U	2011-08-31	HUANSONG XU; QUEMING WANG		☒
	18	1914458	CN	A	2007-02-14	KONINKL PHILIPS ELECTRONICS NV		☒
	19	203686635	CN	U	2014-07-02	JIANGSU TIWIN OPTOELECTRONIC TECHNOLOGY CO LTD		☒
	20	2005122906	JP	A	2005-05-12	HITACHI LIGHTING LTD		☒
	21	203162856	CN	U	2013-08-28	RONG SHENG		☒
	22	2554899	EP	A2	2013-02-06	QBAS TECH CO LTD		☐
	23	1292930	CN	A	2001-04-25	KONINKL PHILIPS ELECTRONICS NV		☒
	24	2531425	GB	A	2016-04-20	JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO LTD		☐
	25	204083927	CN	U	2015-01-07	LU YING et al.		☒

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	Filing Date	2019-12-18
	First Named Inventor	JIANG, Tao
	Art Unit	2875
	Examiner Name	
	Attorney Docket Number	S19141USUC01T

	26	101228393	CN	A	2008-07-23	LEMNIS LIGHTING IP GMBH		☒
	27	203927469	CN	U	2014-11-05	SUZHOU LINKE LIGHTING TECHNOLOGY CO LTD		☒
	28	202852551	CN	U	2013-04-03	YANTAI GELINRUIDE OPTOELECTRONIC ENGINEERING CO LT		☒
	29	204300737	CN	U	2015-04-29	LIU MEICHAN		☒
	30	101182919	CN	A	2008-05-21	ZHENHANG YANG		☒
	31	3146803	EP	A1	2017-03-29	JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO LTD		☐
	32	104595765	CN	A	2015-05-06	WUXI HYPERION ENERGY CONSERVATIONS CO LTD		☒
	33	103742875	CN	A	2014-04-23	KUANG ZHENGFANG		☒
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	35	101806444	CN	A	2010-08-18	OCEANS KING LIGHTING SCIENCE		☒
	36	104033772	CN	B	2016-06-08	NINGBO LIAN ELECTRONIC CO LTD		☒

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	Attorney Docket Number	S19141USUC01T

	37	20090118147	KR	A	2009-11-18	NAM KI HO et al,		☒
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	40	201866575	CN	U	2011-06-15	SHENZHEN XINRUI OPTOELECTRONICS CO LTD		☒
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	42	201555053	CN	U	2010-08-18	PEILING LIAO		☒
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	45	2016086900	WO	A2	2016-06-09	HONG XU et al.		☐

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	First Named Inventor	JIANG, Tao
	Art Unit	2875
	Examiner Name	
	Attorney Docket Number	S19141USUC01T

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	Filing Date	2019-12-18
	First Named Inventor	JIANG, Tao
	Art Unit	2875
	Examiner Name	
	Attorney Docket Number	S19141USUC01T

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	/Simon Kuang Lu/	Date (YYYY-MM-DD)	2019-12-24
Name/Print	Simon Kuang Lu	Registration Number	51,974

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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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.

Electronic Acknowledgement Receipt

EFS ID:	38131307
Application Number:	16719861
International Application Number:	
Confirmation Number:	5387
Title of Invention:	LED TUBE LAMP
First Named Inventor/Applicant Name:	Tao Jiang
Customer Number:	147274
Filer:	Simon Kuang Lu/Jin Huang
Filer Authorized By:	Simon Kuang Lu
Attorney Docket Number:	S19141USUC01T
Receipt Date:	24-DEC-2019
Filing Date:	
Time Stamp:	07:05:15
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	20191224_1stIDS_Transmittal_S19141USUC01T_F.pdf	158133 1abc9e8f350fe323d5a40141d1c8fa546b460b0b	no	2

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2	Foreign Reference	CN1292930A.pdf	583106 4781291b702912364fd0343bfc69c52418d3f0de	no	13
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3	Foreign Reference	CN1914458A.pdf	632132 a75f1799e40979ca5afa3cca83e32078ecedbdab	no	11
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4	Foreign Reference	CN101182919A.pdf	435604 435fd3bf2386fbfe49472495c30ef7a5f639b1d4	no	10
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34	Foreign Reference	CN204300737U.pdf	526244 fd69c0e34c4e18772ead0bd02b481aec018cc757	no	9
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40	Foreign Reference	JP3147313U.pdf	2965588 886af9066eb6a0cb099fc7899a67b76e8b91ac92	no	10
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46	Foreign Reference	WO2016086900A2.pdf	448938 be5e66b945c7fb434c9d3a13edab679638150e01	no	63
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47	Information Disclosure Statement (IDS) Form (SB08)	20191224_1stIDS_2forS19141USUC01T.pdf	616824 8eed752fb501975525dd9f33eedb7e6622dfbb49	no	8
Warnings:					
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		Total Files Size (in bytes):	42995868		

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<u>New Applications Under 35 U.S.C. 111</u>
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.
<u>National Stage of an International Application under 35 U.S.C. 371</u>
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.
<u>New International Application Filed with the USPTO as a Receiving Office</u>
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of JIANG et al.

Attorney Docket: S19141USUC01T

Serial Number: 16/719,861

Group Art Unit: 2875

Filed: December 18, 2019

Examiner: Unassigned

Confirmation Number: 5387

Title: LED TUBE LAMP

INFORMATION DISCLOSURE STATEMENT UNDER 37 C.F.R. 1.97

Pursuant to 37 C.F.R. l .56 and l .97(b), Applicant brings to the attention of the Examiner the listed documents on the attached SB/08 Form. **This Information Disclosure Statement is being filed before a first office action on the merits of this application.**

Applicant respectfully requests that the Examiner consider the listed documents and indicate that they were considered by making appropriate notations on the attached form.

This submission does not represent that a search has been made or that no better art exists and does **not constitute an admission that each or all of the listed documents are material or constitute "prior art." If the Examiner applies any of the documents a**s prior art against any claim in the application and **Applicant determines that the cited documents do not constitute "prior art" under United States law,** Applicant reserves the right to present to the U.S. Patent and Trademark Office the relevant facts and law regarding the appropriate status of such documents.

Applicant further reserves the right to take appropriate action to establish the patentability of the disclosed invention over the listed documents, should one or more of the documents be applied against the claims of the present application.

If any fees required in connection with this paper, please charge the Deposit Account No. 602062.

Date: December 24, 2019

Respectfully submitted,

By: /Simon Kuang Lu/

Simon Kuang Lu

Registration No. 51,974

1380 Charles Willard St.,

Carson, CA 90746

(650) 315-4468

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	16719861
Filing Date	2019-12-18
First Named Inventor	JIANG, Tao
Art Unit	2875
Examiner Name	
Attorney Docket Number	S19141USUC01T

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
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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	20130050998	A1	2013-02-28	GT BIOMESCILT LIGHT	

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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	101787273	CN	A	2010-07-28	ANHUI ZERUN OPTOELECTRONIC CO		☓
	2	102738355	CN	A	2012-10-17	SILICONWARE PREC IND CO LTD		☒
	3	102121690	CN	A	2011-07-13	NANJING ZHONGYA OPTO ELECTRICAL SCIENCE AND TECHNO		☒

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16719861
	Filing Date	2019-12-18
	First Named Inventor	JIANG, Tao
	Art Unit	2875
	Examiner Name	
	Attorney Docket Number	S19141USUC01T

	4	203240362	CN	U	2013-10-16	SUZHOU MONT LIGHTING CO LTD		☒
	5	102016661	CN	A	2011-04-13	NITTA CORP		☒
	6	204573700	CN	U	2015-08-19	FUJIAN QUANZHOU SIGOLED LIGHTING TECHN CO LTD		☒
	7	202100985	CN	U	2012-01-04	YUNJIE XU		☒
	8	1460165	CN	A	2003-12-03	KONINKL PHILIPS ELECTRONICS NV		☒
	9	20120055349	KR	A	2012-05-31	AMOLUXE CO LTD		☒
	10	2523275	GB	A	2015-08-19	The Wand Lite Company Limited		☐
	11	102518972	CN	A	2012-06-27	SEEWILL OPTOELECTRONICS TECHNOLOGY CO LTD		☒
	12	203517629	CN	U	2014-04-02	ZHANG JING		☒
	13	2012129301	WO	A1	2012-09-27	ELECTRALED INC.		☐
	14	201437921	CN	U	2010-04-14	SHENZHEN SEVEN COLOR STAR OPTOELECTRONICS TECHNOLO		☒

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16719861
	Filing Date	2019-12-18
	First Named Inventor	JIANG, Tao
	Art Unit	2875
	Examiner Name	
	Attorney Docket Number	S19141USUC01T

	15	202012011550	DE	U1	2013-06-27	BERNDT BENJAMIN		☒
	16	204573682	CN	U	2015-08-19	JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO LTD		☒
	17	202281101	CN	U	2012-06-20	LIXIA LIU		☒
	18	102720901	CN	A	2012-10-10	MENG YANG		☒
	19	2014117435	WO	A1	2014-08-07	CHEN YUAN HSING YEH CO LTD		☒
	20	2013254667	JP	A	2013-12-19	MITSUBISHI ELEC LIGHTING CORP		☒
	21	2009111098	WO	A2	2009-09-11	ALTAIR ENG INC		☒
	22	103822121	CN	A	2014-05-28	LEXTAR ELECTRONICS CORP; LEXTAR ELECTRONICS SUZHOU		☒
	23	204573684	CN	U	2015-08-19	JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO LTD		☒
	24	101092545	CN	A	2007-12-26	HONG BAI		☒
	25	201255393	CN	Y	2009-06-10	ZHONG YING		☒

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16719861
	Filing Date	2019-12-18
	First Named Inventor	JIANG, Tao
	Art Unit	2875
	Examiner Name	
	Attorney Docket Number	S19141USUC01T

	26	103968272	CN	A	2014-08-06	WU RONGFENG		☒
	27	202302841	CN	U	2012-07-04	NINGBO RUIKANG PHOTOELECTRIC CO LTD & SHENZHEN REF		☒
	28	102889446	CN	A	2013-01-23	LI WENZHONG		☒
	29	203131520	CN	U	2013-08-14	JIANGSU DONGLIN ELECTRONICS CO LTD		☒
	30	103411140	CN	A	2013-11-27	DALIAN THERMALWAY HEAT TRANSFER TECHNOLOGY CO LTD		☒
	31	203464014	CN	U	2014-03-05	ZHANG WEI et al.		☒

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16719861
	Filing Date	2019-12-18
	First Named Inventor	JIANG, Tao
	Art Unit	2875
	Examiner Name	
	Attorney Docket Number	S19141USUC01T

[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	16719861
	Filing Date	2019-12-18
	First Named Inventor	JIANG, Tao
	Art Unit	2875
	Examiner Name	
	Attorney Docket Number	S19141USUC01T

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	/Simon Kuang Lu/	Date (YYYY-MM-DD)	2019-12-24
Name/Print	Simon Kuang Lu	Registration Number	51,974

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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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)).

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Bibliographic data: WO2014117435 (A1) — 2014-08-07

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Inventor(s): LIN CHENG-WEN [CN]; LIANG CHE-PENG [CN] +

Applicant(s): CHEN YUAN HSING YEH CO LTD [CN] +

Classification:

- international: F21S2/00; F21V17/10; F21V23/06; F21Y101/02

- cooperative:

F21K9/272; F21V19/003; F21V19/0075; F21V23/06; F21Y2103/10; F21Y2115/10

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CN203176791 (U) US2015219322 (A1)

Abstract of WO2014117435 (A1)

First page clipping of WO2014117435 (A1)

A light emitting diode lamp tube, comprising a tube body (10), a light source module (20), and two snap-on caps (30); the corresponding two ends of the tube body (10) are respectively provided with an opening (101); a first coupler (102) is arranged adjacent to each opening (101); the light source module (20) passes through the tube body (10) and comprises a control circuit board (201), at least one terminal member (202), and a plurality of light emitting diodes (203); the light emitting diodes (203) are coupled to the control circuit board (201); the terminal member (202) is coupled to one end of the control circuit board (201); the snap-on caps (30) respectively cover the two ends of the tube body (10); each snap-on cap (30) is provided with a second coupler (301), and the second coupler (301) engages with the first coupler (102) of the tube body opening; the snap-on cap (30) adjacent to the terminal member (202) is provided with two conductive pins (302); and the conductive pins (302) are electrically connected to the terminal member (202). The lamp tube has not only fewer components, lower cost, and fewer processing steps, but also improved yield of automated production and increased productivity.

(12) 按照专利合作条约所公布的国际申请

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(26) 公布语言: 中文

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(81) 指定国 (除另有指明，要求每一种可提供的国家保护): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW。

(84) 指定国 (除另有指明，要求每一种可提供的地区保护): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), 欧亚 (AM, AZ, BY, KG, KZ, RU, TJ, TM), 欧洲 (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO,

[见续页]

(54) **Title**: LIGHT EMITTING DIODE LAMP TUBE

(54) **发明名称** : 发光二极管灯管

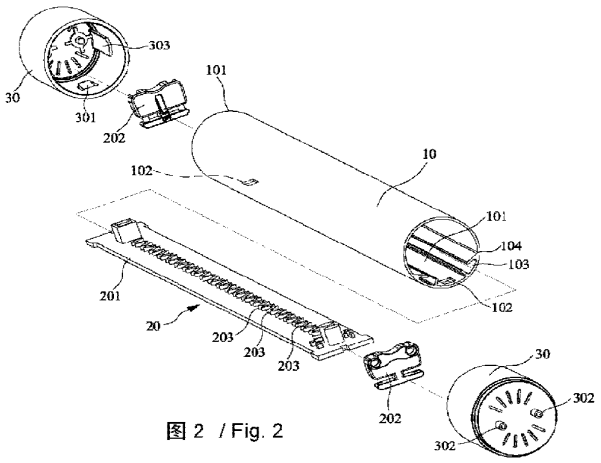


图 2 / Fig. 2

(57) **Abstract**: A light emitting diode lamp tube, comprising a tube body (10), a light source module (20), and two snap-on caps (30); the corresponding two ends of the tube body (10) are respectively provided with an opening (101); a first coupler (102) is arranged adjacent to each opening (101); the light source module (20) passes through the tube body (10) and comprises a control circuit board (201), at least one terminal member (202), and a plurality of light emitting diodes (203); the light emitting diodes (203) are coupled to the control circuit board (201); the terminal member (202) is coupled to one end of the control circuit board (201); the snap-on caps (30) respectively cover the two ends of the tube body (10); each snap-on cap (30) is provided with a second coupler (301), and the second coupler (301) engages with the first coupler (102) of the tube body opening; the snap-on cap (30) adjacent to the terminal member (202) is provided with two conductive pins (302); and the conductive pins (302) are electrically connected to the terminal member (202). The lamp tube has not only fewer components, lower cost, and fewer processing steps, but also improved yield of automated production and increased productivity.

(57) **摘要**:

[见续页]

WO 2014/117435 A1

RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)。

本国际公布:

— 包括国际检索报告(条约第 21 条(3))。

一种发光二极管灯管，包括一管体（10）、一光源模块（20）以及两个扣合盖（30）。管体（10）相对应的两端各具有一开口（101），且邻近开口（101）分别设有一第一结合部（102）。光源模块（20）穿设于管体（10）内部，并包含一控制电路板（201）与至少一端子件（202）以及复数个发光二极管（203），其中发光二极管（203）与控制电路板（201）耦接，端子件（202）耦接于控制电路板（201）的一端。扣合盖（30）分别遮盖于管体（10）的两端。每一扣合盖（30）各具有一第二结合部（301），且与管体开口的第一结合部（102）结合。相近于端子件（202）的扣合盖（30）设有两个导电接脚（302），导电接脚（302）与端子件（202）电性连接。灯管具有减少组件、降低成本、减少工序、提高自动化生产良率以及增加产能的特性。

发光二极管灯管

技术领域

本发明是有关于一种发光二极管灯管，特别是指一种组装式的发光二极管灯管。

背景技术

传统发光二极管灯管于组装时，常须运用到螺丝结合、上胶以及打高周波等工序，该些工序无法有效导入自动化生产产线中，导致制备工艺中不断发生异常而造成设备损坏，亦或是发光二极管灯管的毁损，此为成本无法降低的其一原因。传统发光二极管灯管组件多，而该发光二极管灯管于生产组装时，工序多且复杂，为了能够提高生产时的良率及增加产能，乃不断投入更多人力资源与时间成本，于此之下，造成成本无法有效降低，抑制了公司的发展。为改善发光二极管灯管，使其能够减少组件、降低成本、减少工序以及提升生产时的良率与增加产能，实有改善的必要。

发明内容

本发明的目的在于提供一种发光二极管灯管，以改进公知技术中存在的缺陷。

为实现上述目的，本发明提供的发光二极管灯管，其包括有：

一管体，相对应两端各具有一开口，且邻近开口分别设有一第一结合部；

一光源模块，穿设于管体内部，该光源模块包含一控制电路板与至少一端子件以及复数个发光二极管，其中该些发光二极管与该控制电路板耦接，而该端子件耦接于该控制电路板的一端；以及

二扣合盖，分别遮盖于该管体的二端，而每一扣合盖各具有一第二结合部，且与该管体开口的第一结合部结合，其中相近于该端子件的扣合盖设有二导电接脚，且该些导电接脚与该端子件电性连结。

所述的灯管结构，其中该管体内部相对应的两侧各具有一控制电路板导槽。

所述的灯管结构，其中该第一结合部为孔，而该第二结合部为插销。

所述的灯管结构，其中管体内部设有至少一第一定位部，而每一扣合盖设有相对应于第一定位部的第二定位部，且与第一定位部相互结合。

本发明提供的组装式发光二极管灯管，具有减少组件、降低成本、减少工序、提高自动化生产良率以及增加产能的特性，进而增加其实用性、进步性以及安全性。

附图说明

图 1 为本发明发光二极管灯管的立体外观图。

图 2 为本发明发光二极管灯管的组件分解图。

图 3 为本发明发光二极管灯管的剖视图。

附图中主要组件符号说明：

10 管体，101 开口，102 第一结合部，103 控制电路板导槽，104 第一定位部；

20 光源模块，201 控制电路板，202 端子件，203 发光二极管；

30 扣合盖，301 第二结合部，302 导电接脚，303 第二定位部。

具体实施方式

本发明的发光二极管灯包括一管体、一光源模块以及二扣合盖。该管体相对应两端各具有一开口，且邻近开口分别设有一第一结合部；该光源模块穿设于管体内部，该光源模块包含一控制电路板与至少一端子件以及复数个发光二极管，其中该些发光二极管与该控制电路板耦接，而该端子件耦接于该控制电路板的一端；二扣合盖，分别遮盖于该管体的二端，而每一扣合盖各具有一第二结合部，且与该管体开口的第一结合部结合，其中相近于该端子件的扣合盖设有二导电接脚，且该些导电接脚与该一端子件电性连结；由此，使具有使具有减少组件、降低成本、减少工序、提高自动化生产良率以及增加产能的特性。

为了能够更进一步了解本发明的特征、特点和技术内容，请参阅以下有关本发明的详细说明与附图，惟附图仅提供参考与说明用，非用以限制本发明。

请参阅图 1-图 3 所示，为本发明的发光二极管灯管，其包括有：

一管体 10，相对应两端各具有一开口 101，而邻近于开口 101 分别设有一第一结合部 102（实际使用时，该第一结合部 102 设为孔），该管体 10 内部相对应的两侧各具有一控制电路板导槽 103，且该管体 10 内部还设有至少一第一定位部 104；一光源模块 20，穿设于管体 10 内部，该光源模块 20 包含一控制电路板 201 与至少一端子件 202 以及复数个发光二极管 203，其中该些发光二极管 203 与该控制电路板 201 耦接，而该端子件 202 耦接于该控制电路板 201 的一端；二扣合盖 30，分别遮盖于该管体 10 的二端，而每一扣合盖 30 各具有一第二结合部 301（实际使用时，该第二结合部 301 设为插销），且与该管体 10 开口 101 的第一结合部 102 结合，其中相近于该端子件 202 的扣合盖 30 设有二导电接脚 302，且该些导电接脚 302 与该端子件 202 电性连结，每一扣合盖 30 进一步设有相对应于第一定位部 104 的第二定位部 303，且与第一定位部 104 相互结合。

请参阅图 1-图 3 所示，为本发明的发光二极管灯管，该发光二极体灯管于实际运用时，该些发光二极管 203 耦接于控制电路板 201，将控制电路板 201 沿管体 10 内部的控制电路板导槽 103 放入，再将端子件 202 耦接于控制电路板 201 的两端，最后在将扣合盖 30 扣合于管体 10 的两端，当扣合盖 30 扣合于管体 10 的两端时，该扣合盖 30 的第二结合部 301 与该管体 10 的第一结合部 102 相互扣合，而该扣合盖的第二定位部 303（请同时参阅图 3 所示）与该管体 10 内部的第一定位部 104 相互连接（用以稳固定位），且该扣合盖 30 的该些导电接脚 302 会与该端子件 202 耦接。由此，使能组装快速、稳固定位、更不需要锁螺丝、不上胶、不打高周波及不焊接，达到无工具的快速组装。

以上所述，仅为本发明的较佳实施例而已，当不能以此限定本发明实施的范围；故，凡依本发明申请专利范围及说明书内容所作的简单的等效变化与修饰，皆应仍属本发明专利涵盖的范围内。

权 利 要 求

1、一种发光二极管灯管，其特征是，包括有：

一管体，相对应两端各具有一开口，且邻近开口分别设有一第一结合部；

一光源模块，穿设于管体内部，该光源模块包含一控制电路板与至少一端子件以及复数个发光二极管，其中该些发光二极管与该控制电路板耦接，而该端子件耦接于该控制电路板的一端；以及

二扣合盖，分别遮盖于该管体的二端，而每一扣合盖各具有一第二结合部，且与该管体开口的第一结合部结合，其中相近于该端子件的扣合盖设有二导电接脚，且该些导电接脚与该端子件电性连结。

2、根据权利要求 1 所述的灯管结构，其特征是，其中该管体内部相对应的两侧各具有一控制电路板导槽。

3、根据权利要求 1 所述的灯管结构，其特征是，其中该第一结合部为孔，而该第二结合部为插销。

4、根据权利要求 1 所述的灯管结构，其特征是，其中管体内部设有至少一第一定位部，而每一扣合盖设有相对应于第一定位部的第二定位部，且与第一定位部相互结合。

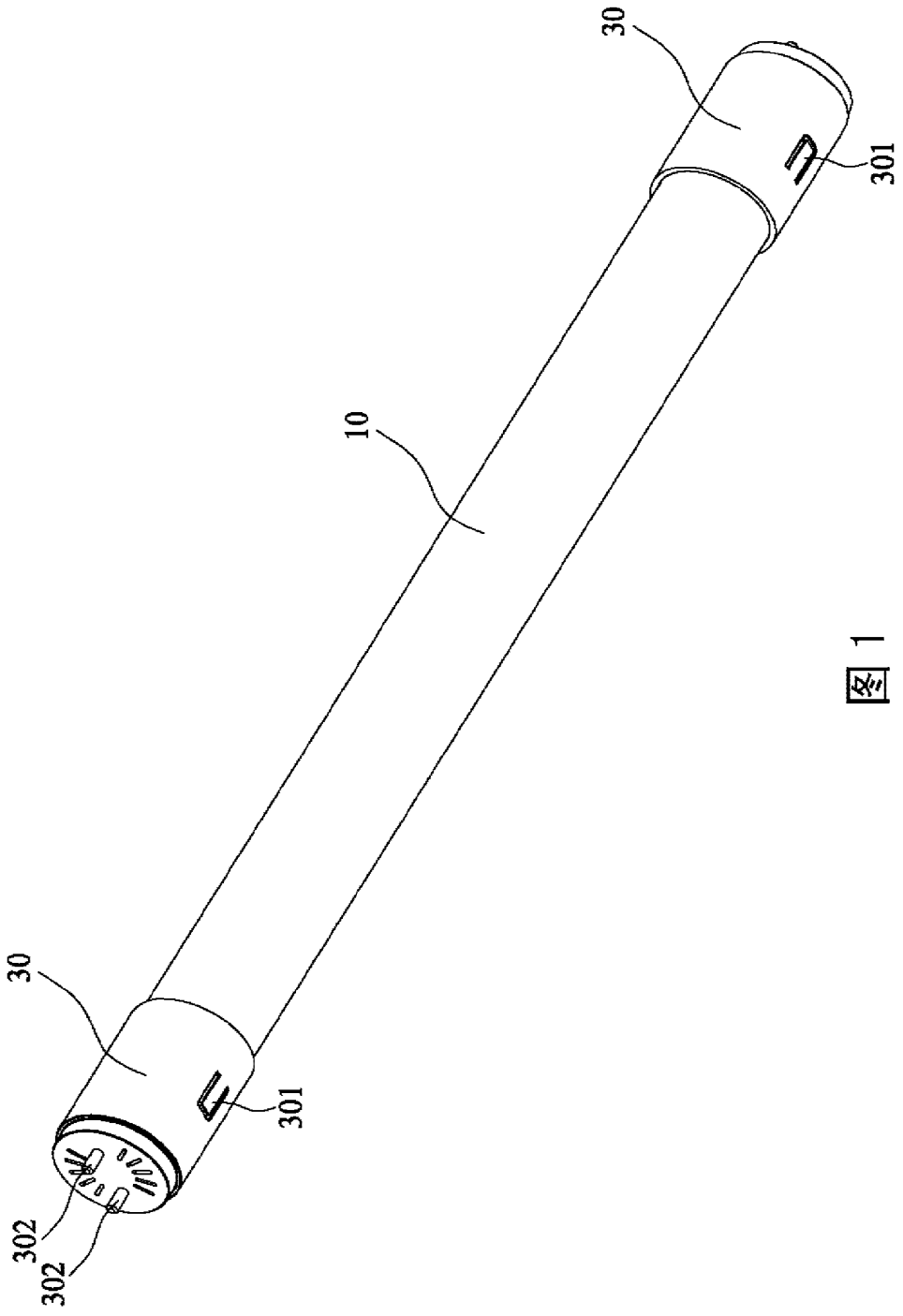


图 1

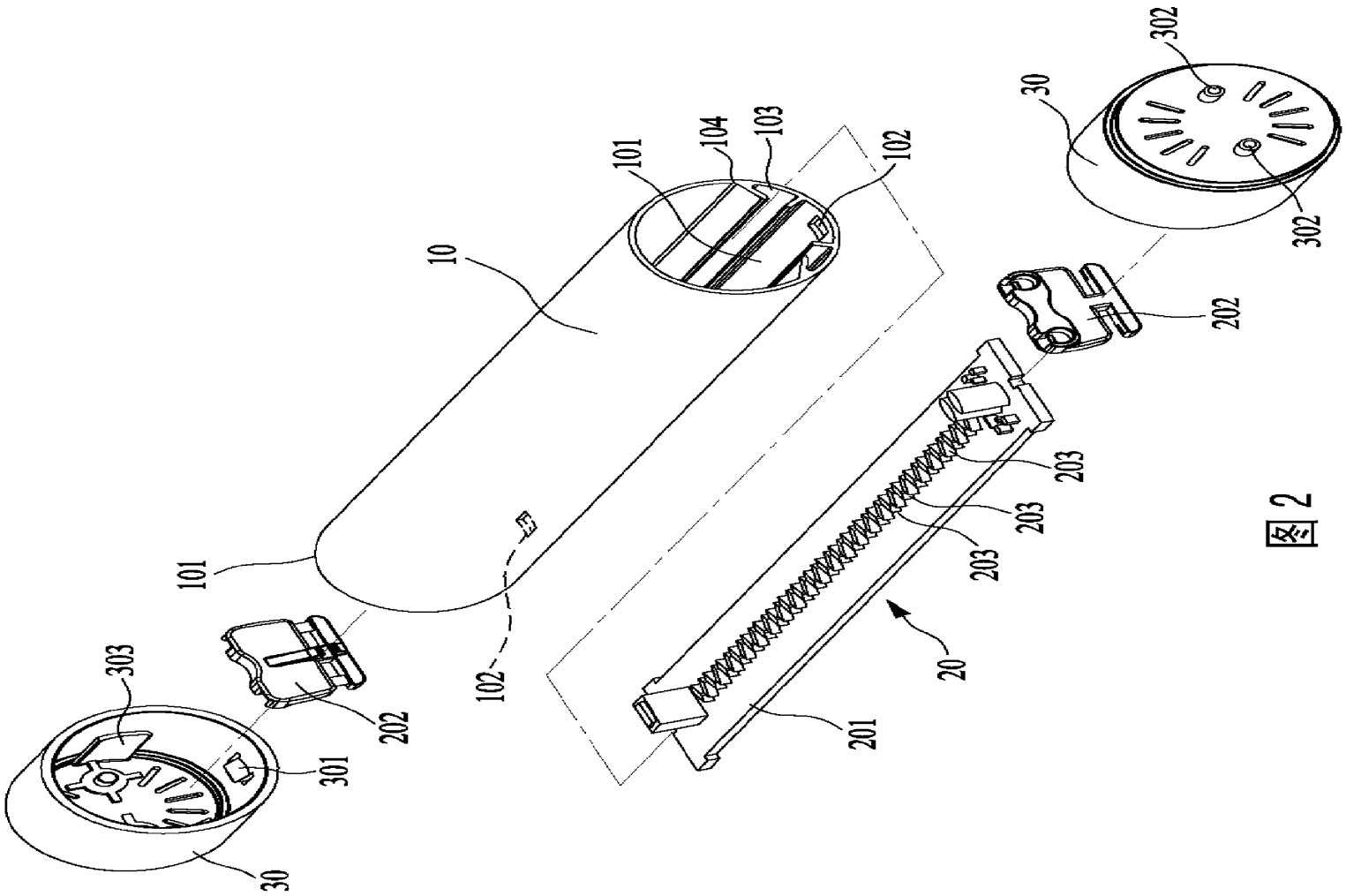

303
301
202
30
101
102
10
101
104
103
102
30
302
302
202
203
203
203
20
201

图 2

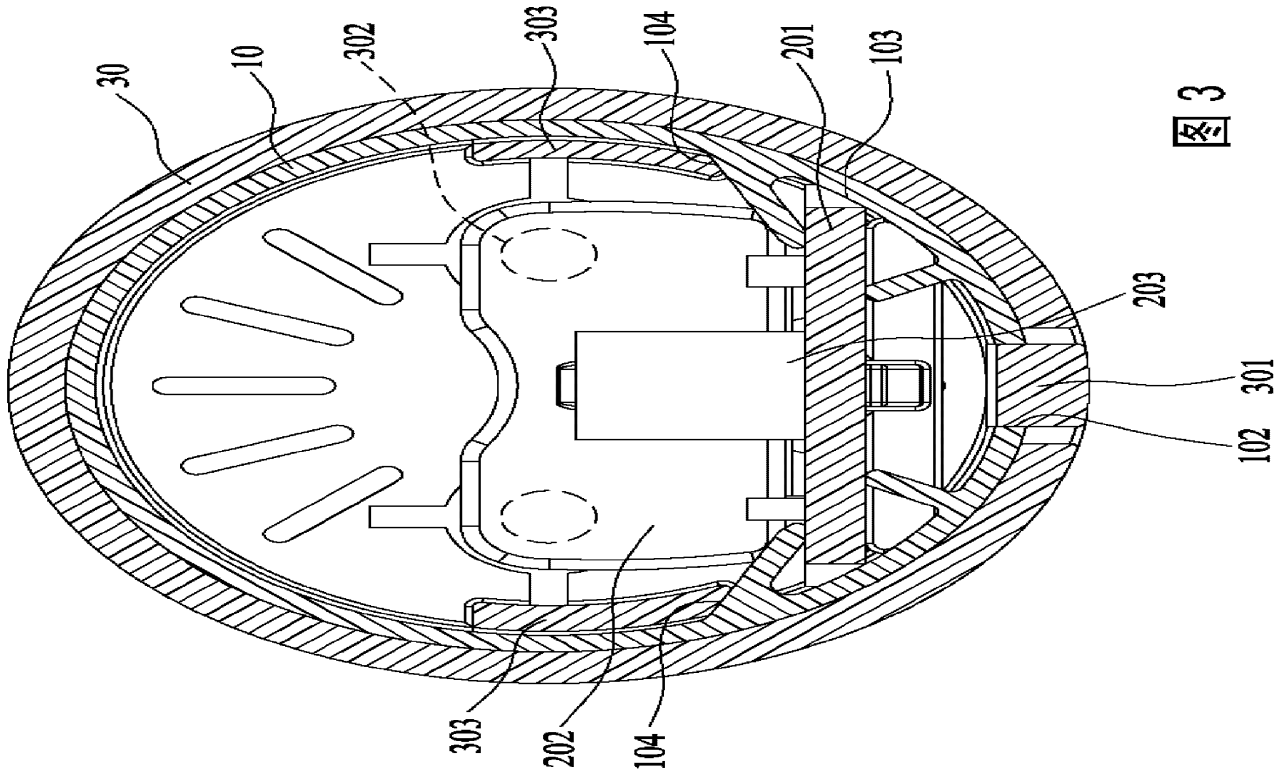


图 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2013/073861

A. CLASSIFICATION OF SUBJECT MATTER

See the extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: F21S; F21V

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNABS, TWABS, VEN: LED, diode, tube, end, join, side cover, end cover, lamp holder, snap-cover

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 202274298 U (LIU, Huozhong) 13 June 2012 (13.06.2012) description, paragraphs [0044] to [0046] and figures 1 to 9	1-4
X	CN 202580799 U (JUSTING TECHNOLOGY PTE LTD) 05 December 2012 (05.12.2012) description, paragraphs [0046] to [0050] and figures 2 and 3	1-4
X	CN 201251033 Y (GOLDEN SUN NEWS TECHNIQUES CO LTD et al.) 03 June 2009 (03.06.2009) description, pages 3 and 4 and figures 2 to 4	1-4
A	CN 202452392 U (UNITY OPTO TECHNOLOGY CO LTD) 26 September 2012 (26.09.2012) the whole document	1-4
A	CN 202032481 U (DONGGUAN KEEN PHOTOELECTRIC LTD) 09 November 2011 (09.11.2011) the whole document	1-4

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
23 October 2013 (23.10.2013)	31 October 2013 (31.10.2013)
Name and mailing address of the ISA State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No. (86-10) 62019451	Authorized officer LI, Jie Telephone No. (86-10) 62085764

Form PCT/ISA /210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2013/073861

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 202274298 U	13.06.2012	None	
CN 202580799 U	05.12.2012	TWM 420641 U	11.01.2012
		WO 2013009263 A	17.01.2013
		AU 2012281196 A	09.05.2013
CN 201251033 Y	03.06.2009	None	
CN 202452392 U	26.09.2012	TWM 418223 U	11.12.2011
CN 202032481 U	09.11.2011	None	

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2013/073861

A. CLASSIFICATION OF SUBJECT MATTER

F21S 2/00 (2006.01) i

F21V 17/10 (2006.01) i

F21V 23/06 (2006.01) i

F21Y 101/02 (2006.01) n

国际检索报告

国际申请号
PCT/CN2013/073861

A. 主题的分类

参加附加页

按照国际专利分类(IPC)或者同时按照国家分类和 IPC 两种分类

B. 检索领域

检索的最低限度文献(标明分类系统和分类号)

IPC: F21S, F21V

包含在检索领域中的除最低限度文献以外的检索文献

在国际检索时查阅的电子数据库(数据库的名称，和使用的检索词（如使用）)

CNABS, TWABS, VEN: 发光二极管，灯管，接头，侧盖，端盖，端头，灯头，扣合盖，LED, diode, tube, end

C. 相关文件

类　型*	引用文件，必要时，指明相关段落	相关的权利要求
X	CN 202274298 U (刘火中) 13.6 月 2012 (13.06.2012) 说明书[0044]-[0046]段、附图 1-9	1-4
X	CN 202580799 U (佳骅科技股份有限公司) 05.12 月 2012 (05.12.2012) 说明书[0046]-[0050]段、附图 2 和 3	1-4
X	CN 201251033 Y (鈤新科技股份有限公司 等) 03.6 月 2009 (03.06.2009) 说明书第 3 和 4 页、附图 2-4	1-4
A	CN 202452392 U (东贝光电科技股份有限公司) 26.9 月 2012 (26.09.2012) 全文	1-4
A	CN 202032481 U (东莞市科恩光电有限公司) 09.11 月 2011 (09.11.2011) 全文	1-4

☐ 其余文件在 C 栏的续页中列出。　　☒ 见同族专利附件。

* 引用文件的具体类型：

"A" 认为不特别相关的表示了现有技术一般状态的文件

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"&" 同族专利的文件

国际检索实际完成的日期	国际检索报告邮寄日期
23.10 月 2013 (23.10.2013)	**31.10 月 2013 (31.10.2013)**
ISA/CN 的名称和邮寄地址： 中华人民共和国国家知识产权局 中国北京市海淀区蓟门桥西土城路 6 号 100088 传真号：　(86-10)62019451	受权官员 李洁 电话号码：(86-10) **62085764**

国际检索报告
关于同族专利的信息

国际申请号
PCT/CN2013/073861

检索报告中引用的专利文件	公布日期	同族专利	公布日期
CN 202274298 U	13.06.2012	无	
CN 202580799 U	05.12.2012	TWM 420641 U	11.01.2012
		WO 2013009263 A	17.01.2013
		AU 2012281196 A	09.05.2013
CN 201251033 Y	03.06.2009	无	
CN 202452392 U	26.09.2012	TWM 418223 U	11.12.2011
CN 202032481 U	09.11.2011	无	

A. 主题的分类

F21S 2/00 (2006.01) i

F21V 17/10 (2006.01) i

F21V 23/06 (2006.01) i

F21Y 101/02 (2006.01) n

Electronic Acknowledgement Receipt

EFS ID:	38131314
Application Number:	16719861
International Application Number:	
Confirmation Number:	5387
Title of Invention:	LED TUBE LAMP
First Named Inventor/Applicant Name:	Tao Jiang
Customer Number:	147274
Filer:	Simon Kuang Lu/Jin Huang
Filer Authorized By:	Simon Kuang Lu
Attorney Docket Number:	S19141USUC01T
Receipt Date:	24-DEC-2019
Filing Date:	
Time Stamp:	07:17:39
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	20191224_1stIDS_Transmittal_S19141USUC01T_F.pdf	158133 1abc9e8f350fe323d5a40141d1c8fa546b460b0b	no	2

Warnings:

Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	20191224_1stIDS_3forS19141USUC01T.pdf	616345 b58846e5449b6c09d3cec9ed8f2658e30f1a1cdb	no	7
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Information:					
3	Foreign Reference	CN1460165A.pdf	537567 d7f9c31077f38f66a74b26339269c333a26882de	no	10
Warnings:					
Information:					
4	Foreign Reference	CN101092545A.pdf	447529 721fd3beced3bf07cfb97991d54e4e4ee2e7d818	no	8
Warnings:					
Information:					
5	Foreign Reference	CN101787273A.pdf	408992 b1e483ab9089e68a78a473570f8dde1a2483118a	no	6
Warnings:					
Information:					
6	Foreign Reference	CN102016661A.pdf	643384 b27336bc2967a5624f119f98838aaa0702cd7419	no	14
Warnings:					
Information:					
7	Foreign Reference	CN102121690A.pdf	356740 1474a876ecf40cb67d7069fdb97607a3b9c2cf44	no	8
Warnings:					
Information:					
8	Foreign Reference	CN102518972A.pdf	281086 230707bb3a27760427da6f39119d2d961cf5a052	no	7
Warnings:					
Information:					

9	Foreign Reference	CN102720901A.pdf	394781 b447660a8101b2e4906bb0d47d00a0aac41f606a	no	10
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10	Foreign Reference	CN102738355A.pdf	656282 e92aba69efa8558639d94e33a8cbba02303eee87	no	14
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11	Foreign Reference	CN102889446A.pdf	780796 5c74c26d1882830d0ec9bc62145c89b30abbc0ec	no	8
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12	Foreign Reference	CN103411140A.pdf	1329090 b6f8c3fbca7b910aa245af98ec33d5dda0ab23af	no	23
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13	Foreign Reference	CN103822121A.pdf	1008824 4886cd4ed902b3c7a68291f2d511fa8a1341a072	no	13
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14	Foreign Reference	CN103968272A.pdf	655276 60fc0a93da71cf2a02fe8c10ad30c05d39bbf8ae	no	11
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15	Foreign Reference	CN201255393Y.pdf	608889 c70748e098c5305a05edc23540ecfb0411befa9c	no	8
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16	Foreign Reference	CN201437921U.pdf	509757 7fb97e9999675e06ef7e9a45c4a3f5a56b8050c5	no	8
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17	Foreign Reference	CN202100985U.pdf	500911 5e04aadb20fee4e2bd3dab9bd3eab699fb4561ba	no	12
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18	Foreign Reference	CN202281101U.pdf	396223 468634d525dc5627d85e9c33264e789385e62db7	no	7
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19	Foreign Reference	CN202302841U.pdf	333421 6e1374d7ab56a3d8b7dbfd2b8479ee573a5e4788	no	9
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Information:					
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21	Foreign Reference	CN203240362U.pdf	314571 8bdaf44ec283454673c97d2766115582518 3d54a	no	7
Warnings:					
Information:					
22	Foreign Reference	CN203464014U.pdf	330163 5e94dbe9612a9abf422d130ac24a96c1936b0fb1	no	6
Warnings:					
Information:					

23	Foreign Reference	CN203517629U.pdf	341607 a906e2f970e12ba0dcb85a4fac1acfc896f004bf	no	8
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24	Foreign Reference	CN204573682U.pdf	2539432 168cc61f79da1e31c45a147d7c1f94668b513706	no	33
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25	Foreign Reference	CN204573684U.pdf	2517988 e1031aab4c68ae401f0cf5b0f365ecaf4cee1861	no	34
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26	Foreign Reference	CN204573700U.pdf	1032117 fdcacd24abdcc9b2365799c63580c4039e755854	no	8
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27	Foreign Reference	DE202012011550U1.pdf	385176 da6facf46264c70af72650153fb13da0b9cf5a45	no	7
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28	Foreign Reference	GB2523275A.pdf	1059823 3d7c759886fdd12c9c3e577d74310f1f70ac13da	no	27
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29	Foreign Reference	JP2013254667A.pdf	5147489 ae44413dbeca10c2899a4a43a0670a9b27ec8411	no	20
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30	Foreign Reference	KR20120055349A.pdf	779482 cf5b1ed8ca7dc856b75037155b9bf05f93dd1a2e	no	17
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31	Foreign Reference	WO2009111098A2.pdf	1603662 621d73391872297b13d4c1e32b53a07cce1a5565	no	16
Warnings:					
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32	Foreign Reference	WO2012129301A1.pdf	2163236 bc39943a56460b2af30c87a44fff1888c6e836a4	no	26
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33	Foreign Reference	WO2014117435A1.pdf	516532 ca6501cc77ccb623e9f88dfec8b18efb85592a54	no	16
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Information:					
		Total Files Size (in bytes):	29807761		

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

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

New International Application Filed with the USPTO as a Receiving Office

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of JIANG et al.

Attorney Docket: S19141USUC01T

Serial Number: 16/719,861

Group Art Unit: 2875

Filed: December 18, 2019

Examiner: Unassigned

Confirmation Number: 5387

Title: LED TUBE LAMP

INFORMATION DISCLOSURE STATEMENT UNDER 37 C.F.R. 1.97

Pursuant to 37 C.F.R. l .56 and l .97(b), Applicant brings to the attention of the Examiner the listed documents on the attached SB/08 Form. **This Information Disclosure Statement is being filed before a first office action on the merits of this application.**

Applicant respectfully requests that the Examiner consider the listed documents and indicate that they were considered by making appropriate notations on the attached form.

This submission does not represent that a search has been made or that no better art exists and does **not constitute an admission that each or all of the listed documents are material or constitute "prior art." If the Examiner applies any of the documents a**s prior art against any claim in the application and **Applicant determines that the cited documents do not constitute "prior art" under United States law,** Applicant reserves the right to present to the U.S. Patent and Trademark Office the relevant facts and law regarding the appropriate status of such documents.

Applicant further reserves the right to take appropriate action to establish the patentability of the disclosed invention over the listed documents, should one or more of the documents be applied against the claims of the present application.

If any fees required in connection with this paper, please charge the Deposit Account No. 602062.

Date: December 24, 2019

Respectfully submitted,

By: /Simon Kuang Lu/

Simon Kuang Lu

Registration No. 51,974

1380 Charles Willard St.,

Carson, CA 90746

(650) 315-4468

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 16/719,861

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	300
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	660
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	760
TOTAL CLAIMS (37 CFR 1.16(i))	19 minus 20 =	*			OR	x 100 =	0.00
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3 minus 3 =	*				x 460 =	0.00
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						0.00
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	1720

APPLICATION AS AMENDED - PART II

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT A	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE($)	ADDITIONAL FEE($)		RATE($)	ADDITIONAL FEE($)
AMENDMENT B	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
16/719,861	12/18/2019	2875	1720	S19141USUC01T	19	3

CONFIRMATION NO. 5387

FILING RECEIPT



147274
Jiaxing Super Lighting Electric Appliance Co., Ltd
IP Department
No. 1288 Jiachuang Road, Xiuzhou Area
Jiaxing, Zhejiang
Jiaxing City, 314031
CHINA

Date Mailed: 01/14/2020

Receipt is acknowledged of this non-provisional utility patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF FIRST INVENTOR, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection.

Please verify the accuracy of the data presented on this receipt. If an error is noted on this Filing Receipt, please submit a written request for a corrected Filing Receipt, including a properly marked-up ADS showing the changes with strike-through for deletions and underlining for additions. If you received a "Notice to File Missing Parts" or other Notice requiring a response for this application, please submit any request for correction to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections provided that the request is grantable.

Inventor(s)

Tao Jiang, Jiaxing, CHINA;
Li-Qin Li, Jiaxing City, CHINA;

Applicant(s)

JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO., LTD, Jiaxing, CHINA;

Power of Attorney: The patent practitioners associated with Customer Number 147274

Domestic Priority data as claimed by applicant

This application is a CON of 16/051,826 08/01/2018 PAT 10514134
which is a CIP of 15/437,084 02/20/2017 PAT 10352540
which is a CON of 15/056,106 02/29/2016 PAT 9903537
which is a CIP of PCT/CN2015/096502 12/05/2015
and said 16/051,826 08/01/2018
is a CIP of 15/087,092 03/31/2016 PAT 10082250
which is a CIP of PCT/CN2015/096502 12/05/2015

Foreign Applications (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.)
CHINA 201410734425.5 12/05/2014 No Access Code Provided
CHINA 201510075925.7 02/12/2015 No Access Code Provided
CHINA 201510136796.8 03/27/2015 Access Code Provided
CHINA 201510259151.3 05/19/2015 Access Code Provided
CHINA 201510324394.0 06/12/2015 Access Code Provided

CHINA 201510338027.6 06/17/2015 Access Code Provided
CHINA 201510373492.3 06/26/2015 Access Code Provided
CHINA 201510448220.5 07/27/2015 Access Code Provided
CHINA 201510482944.1 08/07/2015 Access Code Provided
CHINA 201510483475.5 08/08/2015 Access Code Provided
CHINA 201510499512.1 08/14/2015 Access Code Provided
CHINA 201510555543.4 09/02/2015 Access Code Provided
CHINA 201510557717.0 09/06/2015 Access Code Provided
CHINA 201510595173.7 09/18/2015 Access Code Provided
CHINA 201510645134.3 10/08/2015 Access Code Provided
CHINA 201510716899.1 10/29/2015 Access Code Provided
CHINA 201510726365.7 10/30/2015 Access Code Provided
CHINA 201510868263.9 12/02/2015 Access Code Provided

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The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/719,861**

Projected Publication Date: 04/23/2020

Non-Publication Request: No

Early Publication Request: No

Title

LED TUBE LAMP

Preliminary Class

362

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

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证　明

本证明之附件是向本局提交的下列专利申请文件副本。

申　　请　　号：201510557717.0

申　请　类　型：发明专利

发明 创造 名称：LED 直管灯

申　　请　　日：2015 年 09 月 06 日

申　　请　　人：嘉兴山蒲照明电器有限公司

发明人或设计人：江涛

局长

申长雨

2016 年 03 月 09 日

2015105577170

权 利 要 求 书

1. 一种 LED 直管灯，包括：一灯管和一设于所述灯管一端的灯头；一电源，设于所述灯头内；一灯板，设于所述灯管内，所述灯板上设有一光源；所述光源和所述电源之间通过所述灯板电气连通；其特征在于，所述电源包含一第一电路板及一电源组件，所述灯板包含一第二电路板，所述第二电路板的长度大于所述第一电路板的长度，所述第一电路板及所述第二电路板彼此贴合构成一长短电路板的组合件。

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说 明 书

LED 直管灯

技术领域

本发明涉及照明器具领域，具体涉及一种 LED 直管灯与其光源设计、电子组件以及灯头结构。

背景技术

LED 直管灯一般包括灯管、设于灯管内且带有光源的灯板，以及设于灯管两端的灯头，灯头内设有电源，光源与电源之间通过灯板进行电气连接。

现有的 LED 直管灯容易出现以下几类质量问题：

第一，灯板一般为刚性板，当灯管破裂后，尤其在局部破裂的时候，整根 LED 日光灯仍旧处于直管的状态，使用者会误认为灯管还能使用，从而去自行安装，容易导致发生漏电而触电事故。

第二，现有 LED 直管灯中，刚性灯板与灯头之间一般采用金属导线透过打线的方式实现电气连接，在制造、运输和使用过程中，金属导线打线的方式偶然会发现由于搬动而断裂，形成质量上的问题。

第三，现有 LED 直管灯中，灯头与灯管之间粘接时通常使用热熔胶或者硅胶，当其直接套接灯头后，不易控制粘胶溢出的状况，如果不去除多余的粘胶，则影响美观、造成遮光问题；如果要去除多余的粘胶，则需要动用大量的人工在制造过程的后期进行擦拭，影响产量。此外，灯头内的电源组件的散热不良容易导致灯头内形成高温环境，进而减少热熔胶的使用寿命同时降低灯管与灯头间的粘接性，导致 LED 直管灯的可靠度下降。

第四，现有技术的灯管一般为均匀的圆柱体，灯头套设在灯管外并与灯管之间通过粘胶粘接，因此，灯头的外径要大于灯管的外径。包装时，由于包装承托物一般也是呈均匀柱状的盒体，从而只能与灯头接触，使得灯头成为唯一受力点，造成在运输过程中，灯头与灯管的连接部位容易破裂。针对此部分，申请号为 US20100103673A 的美国专利申请公开了一种 LED 直管灯，其灯管为玻璃灯管，并将灯头塞入玻璃灯管内，使得玻璃灯管的两端承受一个由内而外的力。但是相对于由外而内的方向来说，玻璃灯管能够承受的由内而外的力较小，因此在相同的施力条件下，这种 LED 直管灯较容易破裂。

第五，现有的 LED 直管灯中，光源为多个排布于灯板上的 LED 晶粒，对于每颗晶粒来说，因为其点光源的特性，未经过适宜的光学处理，整个灯管中的光照不均匀，因此当用户从外部观察灯管时，具有颗粒感，影响视觉的舒适度；并且无法从其他角度看到光源所发出的光线，具有视角上的缺陷。

针对该问题，申请号为 CN201320748271.6 的专利申请中，引入了扩散管并将其放置于玻璃管之中，以期降低视觉上的颗粒感。但是扩散管的设置使得在光的传播路径中增加了一个接口，这将增加光在传播时发生全反射的机率，使得光的输出效率降低。此外，由于扩散管的吸旋光性，也将导致光的输出效率降低。

发明内容

本发明提供一种新的 LED 直管灯，以解决上述问题。

本发明提供一种 LED 直管灯，包括一灯管和一套设于所述灯管的灯头，所述灯头包括一绝缘管，以及固设于所述绝缘管外周面上的一导热部；所述导热部和所述灯管之间通过粘接固定。

本发明另提供一种 LED 直管灯，包括一灯管和设于所述灯管两端部外的两个灯头，所述两个灯头的尺寸大小可以为相同或不相同。当两个灯头的尺寸大小为不相同时，可选的，所述较小灯头的尺寸为较大灯头尺寸的 30%至 80%。

可选的，所述灯管包括一主体部和一位于所述主体部两端的端部，所述端部的外径小于所述主体部的外径，所述灯头套设于所述端部外，对应端部的灯头外径与所述主体部的外径相等。

可选的，对应端部的外径与所述主体部外径的差值范围为 1mm 至 10mm。

可选的，对应端部的外径与所述主体部外径的差值范围为 2mm 至 7mm。

可选的，所述端部与所述主体部之间具有一过渡部。

可选的，所述过渡部的两端皆为弧形且在过渡部靠近主体部的外表面为受拉力的状态，内表面为受压力的状态；过渡部靠近端部的外表面为受压力的状态，内表面为受拉力的状态。所述过渡部与主体部相接的弧线的法线为朝向灯管外，过渡部与端部相接的弧线的法线为朝向灯管内。

可选的，所述过渡部与主体部相接的弧形的曲率半径 R1 小于所述过渡部与端部相接的弧型的曲率半径 R2，所述 R1 与 R2 的比例范围 R1:R2 为 1:1.5 至 1:10。

可选的，所述主体部与所述灯头之间并无缝隙。

可选的，所述过渡部的外表面与所述主体部的外表面之间具有一弧面，所述弧面的夹角大于九十度，而所述端部的外表面为一连续面且与主体部的外表面维持平行。

可选的，所述过渡部的长度为 1mm 至 4mm。

可选的，所述灯管为玻璃灯管或塑料灯管。

可选的，沿轴向朝向所述灯管的方向，所述绝缘管包括沿轴向相接的一第一管和一第二管，所述第二管的外径小于所述第一管的外径。可选的，所述第一管和第二管的外径差值范围为 0.15mm 至 0.3mm。

可选的，所述导热部设于所述第二管的外周面上，所述导热部的外表面与所述第一管的外周面平齐。

可选的，所述第二管至少部分套设于所述灯管外，所述导热部和所述灯管之间通过热熔胶粘接。

可选的，所述第二管远离所述第一管的一端开设有一个或多个缺口，所述多个缺口沿周向排列。

可选的，所述导热部沿所述灯头轴向方向的长度与所述绝缘管的轴向长度比为 1:2.5 至 1:5 之间。

可选的，所述灯管伸入所述灯头的长度为所述导热部轴向长度的三分之一到三分之二。

可选的，所述导热部为金属片。

可选的，所述导热部呈管状。

可选的，所述绝缘管为塑料管。

本发明另提供一种 LED 直管灯，包括一灯管和一套设于所述灯管的灯头，所述灯头包括一绝缘管，所述绝缘管包括沿轴向相接的一第一管和一第二管，以及固设于所述绝缘管外周面上的一导热部，所述第二管、所述导热部内表面、所述端部外表面以及所述过渡部外表面形成一容置空间。

可选的，所述热熔胶位于所述的容置空间中。

可选的，所述热熔胶未完全填满所述容置空间。

可选的，部分热熔胶位于所述第二管内表面和端部外表面之间的空间。

可选的，所述热熔胶填充于所述容置空间的位置借由一与灯管轴向垂直的

第一虚拟平面通过，沿径向方向，所述第一虚拟平面依次通过所述导热部、所述热熔胶及所述灯管的外周面。

可选的，所述热熔胶填充于所述容置空间的位置借由一与灯管轴向垂直的第二虚拟平面通过，沿径向方向，所述第二虚拟平面依次通过所述导热部、所述第二管、所述热熔胶及所述端部。

可选的，所述热熔胶填充于所述容置空间的位置借由一与灯管轴向垂直的第一虚拟平面通过，沿径向方向，所述第一虚拟平面依次通过所述导热部、所述热熔胶及所述灯管的外周面；所述热熔胶填充于所述容置空间的位置还借由一与灯管轴向垂直的第二虚拟平面通过，沿径向方向，所述第二虚拟平面依次通过所述导热部、所述第二管、所述热熔胶及所述端部。

可选的，所述热熔胶，其主要的组成物包括：酚醛树脂 2127#、虫胶、松香、方解石粉、氧化锌、乙醇，所述热熔胶在摄氏 200-250 度的温度时，体积相较在室温时膨胀 1 至 1.3 倍。

本发明另提供一种 LED 直管灯，包括一灯管和一设于所述灯管端部外的灯头，所述灯头包括：一绝缘管，用于套设在所述灯管端部外；一导磁金属件，固设在所述绝缘管的内周面上；所述导磁金属件至少部分位于所述绝缘管的内周面和所述灯管端部之间。

可选的，所述导磁金属件和所述灯管端部通过粘接固定。

可选的，所述导磁金属件和所述灯管端部通过热熔胶粘接固定。

可选的，所述导磁金属件全部位于所述绝缘管内，所述热熔胶覆盖所述导磁金属件的整个内表面。

可选的，所述绝缘管内周面上还包括一沿径向向内突伸的支撑部，所述导磁金属件沿轴向顶靠在所述支撑部上。可选的，所述支撑部沿径向方向的厚度为 1mm 至 2mm。

可选的，所述绝缘管的内周面上还包括一沿径向向内突伸的凸出部，所述凸出部位于所述导磁金属件的外周面和所述绝缘管的内周面之间，以在所述导磁金属件的外周面和所述绝缘管的内周面之间形成间隙；所述凸出部的厚度小于所述支撑部。可选的，所述凸出部的厚度为 0.2mm 至 1mm。

可选的，所述凸出部呈沿所述绝缘管周向延伸的环形；或者，所述凸出部包括多个凸块，多个凸块围绕所述绝缘管的内周面排列。

可选的，所述多个凸块沿周向绕着所述绝缘管的内周面等距离间隔排列。

可选的，所述多个凸块沿周向绕着所述绝缘管的内周面不等距离间隔排列。

可选的，所述导磁金属件的内径大于灯管端部的外径。

本发明另提供一种用于 LED 直管灯的灯头，所述灯头包括：一绝缘管，用于套设在一灯管的端部；一导磁金属件，固设在所述绝缘管的内周面上；一热熔胶覆盖所述导磁金属件面的内周面上。

可选的，所述热熔胶完全覆盖所述导磁金属件面的内周面。

可选的，所述导磁金属件为环状。

可选的，所述导磁金属件具有至少一空孔结构。

可选的，所述空孔结构面积占所述导磁金属件表面积的 10%至 50%。

可选的，所述空孔结构为复数个，沿所述灯头的周向等距离间隔排列或不等距离间隔排列。

可选的，所述空孔结构为复数个，沿所述灯头的周向不等距离间隔排列。

可选的，所述导磁金属件面向所述绝缘管的表面具有压痕结构。

可选的，所述压痕结构由导磁金属件内表面向外表面浮凸。

可选的，所述压痕结构由导磁金属件外表面向内表面浮凸。

可选的，所述导磁金属件呈与所述绝缘管同轴的管状。

可选的，所述导磁金属件为圆形环或非圆形环。

可选的，所述导磁金属件为椭圆形环。

可选的，在热熔胶中直接参杂预定比例的高导磁性材质粉末，藉由一外部加热设备通电后，使得均匀分布在热熔胶中的高导磁性材质粉末带电，进而使得热熔胶发热，热熔胶吸收热量后膨胀并流动，随后冷却固化，以实现将灯头固定于灯管的目的。

可选的，所述高导磁性材质粉末的相对导磁系数介于至 10^2 至 10^6。

可选的，所述高导磁性材质粉末其材质系选自铁、镍、钴及其合金所组成的混合物族群中的一种。

可选的，所述高导磁性材质粉末占所述热熔胶的重量百分比为 10%至 50%。

可选的，所述高导磁性材质粉末平均粒径为 1 微米到 30 微米。

可选的，所述热熔胶中所述高导磁性材质粉在一电磁场范围内形成一闭合电路。

可选的，所述热熔胶中所述高导磁性材质粉末的单个颗粒在一电磁场范围内带有电场。

可选的，所述热熔胶在摄氏 200 至 250 的温度时具有一流动性。

可选的，所述热熔胶被加热至摄氏 200 至 250 的温度后，经冷却后固化。

可选的，所述热熔胶被加热至摄氏 200 至 250 的温度后，随即固化。

可选的，所述外部加热设备为一感应线圈，所述感应线圈连接一电源，通电后形成电磁场，当所述灯头内的所述导磁金属件进入所述电磁场后，将感应生电产生电流，使得导磁金属件发热，并将热量传导至热熔胶。

可选的，所述电源为交流电，提供电功率为 15kW 至 25kW，频率为 25kHz 至 35kHz。

可选的，所述电源在流入感应线圈前会先经一功率放大单元，所述功率放大单元将交流电电功率放大 1 至 2 倍。

可选的，所述感应线圈自所述电源所获电流大小为 25A 至 35A，所述感应线圈的持续通电时间为 2 秒至 10 秒。

可选的，所述感应线圈由宽度 5mm 至 6mm 的金属导线所卷曲成环状线圈结构，所述环状线圈结构直径约 30mm 至 35mm。

可选的，所述感应线圈材质主要为紫铜。

可选的，所属导磁金属件的发热温度可以达到摄氏 250 至 300 度。

可选的，所述热熔胶的加热温度可以达到摄氏 200 至 250 度。

可选的，所述感应线圈摆放在固定位置不动,所述灯头被移动并进入所述感应线圈中，所述热熔胶受热后膨胀并流动，接著所述灯头被抽离感应线圈，随后所述热熔胶冷却固化。

可选的，所述感应线圈摆放在固定位置不动，所述灯头被移动并进入所述感应线圈中，所述热熔胶受热固化，接著所述灯头被抽离感应线圈。

可选的，所述灯头摆放在固定位置不动，所述感应线圈被移动并包围所述灯头，所述热熔胶受热后固化，接著所述感应线圈被移动而离开所述灯头。

可选的，所述灯头摆放在固定位置不动，所述感应线圈被移动并包围所述灯头，所述热熔胶受热后膨胀并流动，接著所述感应线圈被移动而离开所述灯头，随后所述热熔胶冷却固化。

可选的，所述灯头和所述灯管端部通过所述热熔胶粘接固定后，可以通过

1.5 至 5 牛顿-米(Nt-m)的扭矩测试。

可选的，所述灯头和所述灯管端部通过所述热熔胶粘接固定后，可以通过 5 至 10 牛顿-米(Nt-m)的弯矩测试。

可选的，所述灯头中包含有一用于安装电源的电源插槽。

可选的，还包括一电源，所述电源一端具有一金属插针，灯头上设有用于连接所述电源的空心导电针。

可选的，所述灯头上设有用于散热的孔洞。

可选的，所述灯头上用于散热的孔洞为弧形。

可选的，所述灯头上用于散热的孔洞为三条大小不一的弧线。

可选的，所述灯头上用于散热的孔洞为由小到大逐渐变化的三条弧线。

可选的，所述灯管还包括一扩散层，所述光源产生的光线通过所述扩散层后穿出所述灯管。

可选的，所述灯管内周面上还设有一反射膜，且沿周向占用所述灯管的部分内周面。

可选的，所述反射膜沿所述灯管周向延伸的长度与所述灯管内周面的周长之间的比例范围为 0.3 至 0.5。

可选的，所述扩散层为扩散涂层，覆盖于所述灯管的内周面或外周面。

可选的，所述扩散层为扩散涂层，覆盖于所述光源表面。

可选的，所述扩散层的厚度范围为 20μm 至 30μm。

可选的，所述扩散层为扩散膜片且罩设于光源外，与光源不接触。

可选的，所述扩散层具有 85%以上的透光率。

可选的，所述扩散层的透光率为 92%至 94%且厚度范围为 200μm 至 300μm。

本发明另提供一种 LED 直管灯，包括：一灯管和一设于所述灯管一端的灯头；一电源，设于所述灯头内；一灯板，设于所述灯管内，所述灯板上设有一光源；所述光源和所述电源之间通过所述灯板电气连通；所述灯板为一可挠式电路板。

可选的，所述可挠式电路板为一层线路层(具导电效果)，所述光源设于所述线路层上，所述光源通过所述线路层与所述电源电气连通。

可选的，所述可挠式电路板还包括一层介电层，与所述线路层迭置；所述介电层设于所述线路层与光源相背的一侧，并固定于所述灯管的内周面。

可选的，所述可挠式电路板沿所述灯管周向延伸的长度与所述灯管内周面的周长之间的比例范围为 0.3 至 0.5。

可选的，所述可挠式电路板表面还包括一层电路保护层。

可选的，所述可挠式电路板与所述电源之间通过导线打线连接。

可选的，所述可挠式电路板设于所述反射膜上。

可选的，沿所述灯管的周向方向，所述可挠式电路板位于所述反射膜的一侧。

可选的，所述反射膜设于所述灯板两侧且沿所述灯管周向延伸。

可选的，所述灯管内周面或外周面上可覆盖有粘接膜，用于在灯管破裂后对灯管的外部和内部进行隔离。

可选的，所述可挠式电路板爬过所述过渡部和所述电源电气连通，

可选的，所述可挠式电路板包括多层线路层与多层介电层，所述介电层与所述线路层依序交错迭置，所述光源设于所述多层线路层的最上一层，并通过所述多层线路层的最上一层与所述电源电气连通。

可选的，所述可挠式电路板沿灯管轴向的两端不固定在灯管的内周面上。

可选的，所述可挠式电路板沿灯管轴向的两端分别形成一自由部，自由部向灯管内部弯曲变形。

可选的，所述电源可以为单个体（即所有电源组件都集成在一个部件中），并设于灯管一端的灯头中；或者电源也可以分为两部分，称为双个体（即所有电源组件分别设置在两个部件中），并将两部分分别设于灯管两端的灯头中。

可选的，所述可挠式电路板直接与所述电源焊接。

可选的，所述电源透过一长短电路板的组合件与所述灯板电气连通。长短电路板的组合件具有一长电路板和一短电路板，长电路板和短电路板彼此贴合透过粘黏接方式固定，短电路板位于长电路板周缘附近。短电路板上具有电源组件，整体构成电源。所述短电路板材质较所述长电路板硬，以达到支撑电源组件的作用。

可选的，短电路板的长度约为 15 毫米至 40 毫米，较佳为 19 毫米至 36 毫米，长电路板的长度可为 800 毫米至 2800 毫米，较佳为 1200 毫米至 2400 毫米。短电路板和长电路板的比例可以为 1:20 至 1:200。

可选的，电源组件和长电路板皆位于短电路板的同一侧，电源组件直接与

长电路板电气连接。

可选的，电源组件和长电路板系分别位于短电路板的两侧，电源组件透过短电路板和可挠式电路板的线路层电气连接。

可选的，所述电源采用垂直的方式焊接固定在短电路板端部上方。

本发明另提供一种 LED 光源，所述光源包括一具有凹槽的支架，LED 晶粒设于所述凹槽中，所述支架具有第一侧壁以及第二侧壁，所述第一侧壁低于所述第二侧壁。

可选的，所述第一侧壁的内表面为斜面，所述斜面面向所述凹槽的外部。

可选的，所述斜面为平面。

可选的，所述平面与所述凹槽底壁之间的夹角范围为 105 度至 165 度。

可选的，所述平面与所述凹槽底壁之间的夹角范围为 120 度至 150 度。

可选的，所述斜面为弧面。

本发明另提供一种 LED 直管灯，包括一 LED 光源以及一用于容纳所述光源的灯管，所述光源包括一具有凹槽的支架以及一设于所述凹槽中的 LED 晶粒；至少一个光源的所述支架具有沿所述灯管长度方向排布的第一侧壁，以及沿所述灯管宽度方向排布的第二侧壁，所述第一侧壁低于所述第二侧壁。

本发明另提供一种 LED 直管灯，包括一 LED 光源以及一用于容纳所述光源的灯管，所述光源包括一具有凹槽的支架以及一设于所述凹槽中的 LED 晶粒；至少一个光源的所述支架具有沿所述灯管长度方向延伸的第二侧壁，以及沿所述灯管宽度方向延伸的第一侧壁，所述第一侧壁低于所述第二侧壁。

可选的，所述光源具有多个，多个光源排布成一列或多列，每列光源沿所述灯管的长度方向排布。

可选的，所述多个光源的支架中，沿所述灯管宽度方向位于同一侧的所有第二侧壁在同一条直线上。

可选的，对于沿所述灯管宽度方向位于最外侧的两列光源，每列的多个光源的支架中，沿所述灯管宽度方向位于同一侧的所有第二侧壁在同一条直线上。

与现有技术相比，本发明的技术方案具有以下优点：

进一步地，在灯头上设置一导热部，在灯头与灯管连接时，可以通过热传导实现热熔胶的固化，粘接方便，效率高。

进一步地，在灯头上设置一导磁金属片，在灯管与灯头粘接时，通过电磁

感应技术实现粘胶的固化，粘接方便，效率高。

进一步地，长短灯头的设计，可以增加产品设计与制造的弹性。

进一步地，灯头中电源插槽的设计，可以提高电源安装的效率与方便性。

进一步地，透过灯头针脚的设计，可以增加产品设计与制造的弹性。

进一步地，透过灯头散热孔的设计，可以解决电源散热问题并提升产品的外观美感。

进一步地，灯管的一端或两端通过缩口形成一外径小于主体部的端部，并使得灯头外周面与主体部外周面平齐，使得包装承托物能够同时接触灯管和灯头，整个 LED 直管灯受力均匀，防止运输过程中破裂。另外，将灯头在过渡部与灯管粘接，由于灯管端部与主体部之间具有高度差，从而避免粘胶溢出至主体部上，省去人工修饰处理的麻烦，提高产量。

进一步地，灯管内设有一扩散层，当光线透过扩散层时能够发生漫射，可修正光线成均匀面光源以达到光学扩散的效果最终使得从灯管的亮度均匀分布。通过在灯管内壁设置一扩散层的形式，可以减小用户观察时的颗粒感，提升视觉舒适度；且扩散层的厚度可以非常小，从而在最大限度上保证光的输出效率。

进一步地，在灯管内设一反射膜，一方面，当从侧面看灯管时，由于有反射膜阻挡，可以让使用者从其他角度看到光源所发出的光线；另一方面，光源发出的光经过反射膜的反射作用，可以控制灯管的发散角，使得光线更多地朝向未涂有反射膜的方向照射，使得 LED 直管灯以更低的功率获得相同的照射效果，提高节能性。

进一步地，透过光源直接于灯管内周面进行贴合，可以增加发管角度并提升散热效率。

进一步地，在灯管内周面或外周面上覆盖粘接膜，可帮助在灯管破裂后对灯管的外部和内部进行隔离而提高安全性。

灯板采用一可挠式电路板，使得灯管在破裂后，例如断裂呈两截时不能保持直管状态，使得使用者不会认为灯管还能使用而去自行安装，从而避免触电事故。

进一步地，可挠式电路板直接焊接在灯头的电源输出端，在搬动过程中不容易发生断裂。

进一步地，可挠式电路板沿灯管轴向的两端分别形成一自由部，自由部向灯管内部弯曲变形，如此一来可以以提升组装制造的方便性。

进一步地，电源透过一长短电路板的组合件与灯板电气连通，可以强化其结构而不容易发生断裂。

进一步地，光源包括具有一凹槽的支架，支架具有第一侧壁以及第二侧壁，LED 晶粒设于凹槽中，通过在支架中设置沿所述灯管长度方向排布的第二侧壁，使得用户从侧面观察灯管时，LED 晶粒能够被第二侧壁遮挡，减少颗粒感，提高视觉的舒适度；设置支架的第一侧壁低于第二侧壁，使得 LED 晶粒发出的光线能够越过第一侧壁而照射出去，增加光照强度，提高节能效果。

进一步地，每列的多个光源的支架中，第二侧壁沿灯管的长度方向延伸且沿灯管宽度方向位于同一侧的所有第二侧壁在同一条直线上，可以降低光线在沿灯管长度方向照射时的损耗，同时第二侧壁排列形成一面墙，能够更好地阻挡用户的视线看到光源。

进一步地，透过优化热熔胶的设计与使用以及热熔胶的加热方式，可以更好地执行灯管与灯头之间的结合固定，避免灯管与灯头间的热熔胶黏接因灯头内部环境的高温所导致的可靠度下降。此外，利用热熔胶作为灯管与灯头间实现绝缘作用的物体，亦可避免灯管破损时可能发生的触电情况。

进一步地，透过不同的电源组件设计，可以增加产品设计与制造的弹性。

附图说明

图 1 是本发明一实施例的 LED 直管灯的立体图；

图 1A 是本发明另一实施例的 LED 直管灯的立体图，示出了灯管两端灯头具有不同尺寸；

图 2 是本发明一实施例的 LED 直管灯的立体分解图；

图 3 示出了本发明一实施例的 LED 直管灯的灯头的外部结构；

图 4 示出了本发明一实施例的 LED 直管灯的灯头的内部结构；

图 5 是本发明一实施例的 LED 直管灯的部分剖面图，示出了灯头和灯管的连接位置的结构；

图 6 是本发明另一实施例的 LED 直管灯的灯头的立体剖视图，示出了灯头为全塑料灯头（内有导磁金属件与热熔胶）；

图 7 是一示意图，示出了本发明另一实施例的 LED 直管灯，其全塑料灯头

（内有导磁金属件和热熔胶）和灯管透过感应线圈加热固化；

图 8 是本发明另一实施例的 LED 直管灯，其全塑料灯头的绝缘管的内周面上具有一支撑部及一凸出部的立体结构图；

图 9 是图 8 中的全塑料灯头沿 X-X 方向的剖视图；

图 10 是沿径向方向看，导磁金属件具有至少一空孔结构的示意图；

图 11 是沿径向方向看，导磁金属件具有至少一压痕结构的示意图；

图 12 是图 8 的灯头的绝缘管和灯管结合后，沿灯管轴向方向的剖视图，其中导磁金属件为圆形环结构；

图 13 是沿灯管轴向方向的剖视图，示出了灯头的导磁金属件为一椭圆形环结构；

图 14 示出了本发明又一实施例 LED 直管灯中的灯头结构；

图 15 示出了本发明各实施例 LED 直管灯中灯管的端部结构；

图 16 是一剖视图，示出了图 15 中灯管的过渡部的结构；

图 17 是本发明实施例 LED 直管灯中的灯管沿轴向方向的剖视图，示出了反射膜在灯板两侧沿灯管周向延伸；

图 18 示出了图 17 的 LED 直管灯的第一个变形例沿轴向方向的剖视图，其中反射膜仅在灯板一侧沿灯管周向延伸；

图 19 示出了图 17 的 LED 直管灯的第二个变形例沿轴向方向的剖视图，其中灯板在反射膜上且反射膜在灯板两侧沿灯管周向延伸；

图 20 示出了图 17 的 LED 直管灯的第三个变形例沿轴向方向的剖视图，其中灯板在反射膜上且反射膜仅在灯板一侧沿灯管周向延伸；

图 21 示出了图 17 的 LED 直管灯的第四个变形例沿轴向方向的剖视图，其中灯板的两侧具反射膜；

图 22 示出了本发明各实施例 LED 直管灯中，灯板为可挠式电路板且爬过强化部处与电源输出端焊接连接的结构；

图 23 示出了本发明各实施例 LED 直管灯中，灯板为双层可挠式电路板的层结构；

图 24 示出了本发明一实施例 LED 直管灯中，灯板为可挠式电路板且与电源的印刷电路板焊接的立体结构；

图 25 示出了本发明一实施例 LED 直管灯的灯板为可挠式电路板的焊盘结

构；

图 26 示出了本发明一实施例 LED 直管灯的灯板为可挠式电路板且具有 3 个呈一列并排焊垫的焊盘结构；

图 27 示出了本发明一实施例 LED 直管灯的灯板为可挠式电路板且具有 3 个呈两列并排焊垫的焊盘结构；

图 28 示出了本发明实施例 LED 直管灯的灯板为可挠式电路板且具有 4 个呈一列并排焊垫的焊盘结构；

图 29 示出了本发明实施例 LED 直管灯的灯板为可挠式电路板且具有 4 个呈两列并排焊垫的焊盘结构；

图 30 示出了本发明实施例 LED 直管灯的灯板为可挠式电路板且焊垫具有孔洞的焊盘结构；

图 31 是图 30 的可挠式电路板与电源的印刷电路板焊接的侧面剖视局部放大图；

图 32 是图 30 的可挠式电路板的焊垫孔洞位置靠近边缘时，与电源的印刷电路板焊接的侧面剖视局部放大图；

图 33 示出了本发明实施例 LED 直管灯的灯板为可挠式电路板且其焊垫具有缺口的焊盘结构；

图 34 是沿图 33 中 A-A'线的侧面剖视局部放大图；

图 35 示出了本发明另一实施例 LED 直管灯中，灯板为可挠式电路板且与电源的印刷电路板结合的立体结构；

图 36 是图 35 的一变化例的结构图；

图 37 示出了本发明一实施例 LED 直管灯中的光源中支架的立体结构；

图 38 示出了本发明一实施例 LED 直管灯中的电源结构；

图 39 示出了本发明另一实施例 LED 直管灯中，硬式铝基板与电源的印刷电路板结合的立体结构；

图 40 是本发明一实施例中，用来焊接可挠式电路板与电源的印刷电路板所使用的压焊头结构图；

图 41 示出了本发明实施例中，可挠式电路板与电源的印刷电路板焊接前的焊垫上的预留锡厚度差异状态；

图 42 示出了本发明实施例中，可挠式电路板与电源的印刷电路板焊接的焊

接载具装置；

图 43 示出了图 41 中可挠式电路板与电源的印刷电路板焊接时，焊接载具装置上的灯板载具转动状态；

图 44 示出了本发明另一实施例中，藉以提供热熔胶热量的一外部加热设备；图 45 示出了本发明一实施例中，掺杂有均匀分布的小粒径高导磁性材质粉末的热熔胶体；

图 46 示出了本发明一实施例中，掺杂有不均匀分布的小粒径高导磁性材质粉末形成一闭合电路的热熔胶体；

图 47 示出了本发明另一实施例中，掺杂有不均匀分布的大粒径高导磁性材质粉末形成一闭合电路的热熔胶体；

图 48 示出了本发明一实施例中，灯板具双层线路层的可挠式电路板。

图 49A 为根据本发明第一较佳实施例的 LED 日光灯的电源组件的应用电路方块示意图。

图 49B 为根据本发明第二较佳实施例的 LED 日光灯的电源组件的应用电路方块示意图。图 49C 为根据本发明第一较佳实施例的 LED 灯的电路方块示意图。

图 49D 为根据本发明第三较佳实施例的 LED 日光灯的电源组件的应用电路方块示意图。

图 49E 为根据本发明第二较佳实施例的 LED 灯的电路方块示意图。

图 50A 为根据本发明第一较佳实施例的整流电路的电路示意图。

图 50B 为根据本发明第二较佳实施例的整流电路的电路示意图。

图 50C 为根据本发明第三较佳实施例的整流电路的电路示意图。

图 50D 为根据本发明第四较佳实施例的整流电路的电路示意图。

图 51A 为根据本发明第一较佳实施例的端点转换电路的电路示意图。

图 51B 为根据本发明第二较佳实施例的端点转换电路的电路示意图。

图 51C 为根据本发明第三较佳实施例的端点转换电路的电路示意图。

图 51D 为根据本发明第四较佳实施例的端点转换电路的电路示意图。

图 52A 为根据本发明第一较佳实施例的滤波电路的电路方块示意图。

图 52B 为根据本发明第一较佳实施例的滤波单元的电路示意图。

图 52C 为根据本发明第二较佳实施例的滤波单元的电路示意图。

图 52D 为根据本发明第三较佳实施例的滤波单元的电路示意图。

图 52E 为根据本发明第二较佳实施例的滤波单元的电路方块示意图。

图 53A 为根据本发明第一较佳实施例的 LED 模块的电路示意图。

图 53B 为根据本发明第二较佳实施例的 LED 模块的电路示意图。

图 53C 为根据本发明第一较佳实施例的 LED 模块的走线示意图。

图 53D 为根据本发明第二较佳实施例的 LED 模块的走线示意图。

图 53E 为根据本发明第三较佳实施例的 LED 模块的走线示意图。

图 54A 为根据本发明第三较佳实施例的 LED 灯的电源组件的应用电路方块示意图。

图 54B 为根据本发明第一较佳实施例的驱动电路的电路方块示意图。

图 54C 为根据本发明第一较佳实施例的驱动电路的电路示意图。

图 54D 为根据本发明第二较佳实施例的驱动电路的电路示意图。

图 54E 为根据本发明第三较佳实施例的驱动电路的电路示意图。

图 54F 为根据本发明第四较佳实施例的驱动电路的电路示意图。

图 54G 为根据本发明第二较佳实施例的驱动电路的电路方块示意图。

图 54H 为根据本发明一较佳实施例的电压 Vin 与电流 Iout 之区线关系示意图。

图 55A 为根据本发明第四较佳实施例的 LED 灯的电源组件的应用电路方块示意图。

图 55B 为根据本发明一较佳实施例的防闪烁电路的电路示意图。

图 56A 为根据本发明第五较佳实施例的 LED 灯的电源组件的应用电路方块示意图。

图 56B 为根据本发明一较佳实施例的保护电路的电路示意图。

图 57A 为根据本发明第六较佳实施例的 LED 灯的电源组件的应用电路方块示意图。

图 57B 为根据本发明第一较佳实施例的模式切换电路的电路示意图。

图 57C 为根据本发明第二较佳实施例的模式切换电路的电路示意图。

图 57D 为根据本发明第三较佳实施例的模式切换电路的电路示意图。

图 57E 为根据本发明第四较佳实施例的模式切换电路的电路示意图。

图 57F 为根据本发明第五较佳实施例的模式切换电路的电路示意图。

图 57G 为根据本发明第六较佳实施例的模式切换电路的电路示意图。

图 57H 为根据本发明第七较佳实施例的模式切换电路的电路示意图。

图 57I 为根据本发明第八较佳实施例的模式切换电路的电路示意图。

图 58A 为根据本发明第七较佳实施例的 LED 灯的电源组件的应用电路方块示意图。

图 58B 为根据本发明第八较佳实施例的 LED 灯的电源组件的应用电路方块示意图。

图 58C 为根据本发明较佳实施例的镇流兼容电路的电路配置示意图。

图 58D 为根据本发明第九较佳实施例的 LED 灯的电源组件的应用电路方块示意图。

图 58E 为根据本发明第十较佳实施例的 LED 灯的电源组件的应用电路方块示意图。

图 58F 为根据本发明第一较佳实施例的镇流兼容电路的电路示意图。

图 58G 为根据本发明第十一较佳实施例的 LED 日光灯的电源组件的应用电路方块示意图。

图 58H 为根据本发明第二较佳实施例的镇流兼容电路的电路示意图。

图 58I 为根据本发明第三较佳实施例的镇流兼容电路的电路示意图。

图 59A 为根据本发明第十二较佳实施例的 LED 日光灯的电源组件的应用电路方块示意图。

图 59B 为根据本发明第十三较佳实施例的 LED 日光灯的电源组件的应用电路方块示意图。

图 59C 为根据本发明第十四较佳实施例的 LED 日光灯的电源组件的应用电路方块示意图。

图 59D 为根据本发明第三较佳实施例的镇流兼容电路的电路示意图。

图 60A 为根据本发明第十五较佳实施例的 LED 日光灯的电源组件的应用电路方块示意图。

图 60B 为根据本发明第一较佳实施例的灯丝仿真电路的电路示意图。

图 60C 为根据本发明第二较佳实施例的灯丝仿真电路的电路示意图。

图 60D 为根据本发明第三较佳实施例的灯丝仿真电路的电路示意图。

图 60E 为根据本发明第四较佳实施例的灯丝仿真电路的电路示意图。

图 60F 为根据本发明第五较佳实施例的灯丝仿真电路的电路示意图。

图 61A 为根据本发明第十六较佳实施例的 LED 日光灯的电源组件的应用电路方块示意图。

图 61B 为根据本发明较佳实施例的过压保护电路的电路示意图。

图 62A 为根据本发明第十七较佳实施例的 LED 日光灯的电源组件的应用电路方块示意图。

图 62B 为根据本发明第十八较佳实施例的 LED 日光灯的电源组件的应用电路方块示意图。

图 62C 为根据本发明较佳实施例的镇流侦测电路的电路方块示意图。

图 62D 为根据本发明第一较佳实施例的镇流侦测电路的电路示意图。

图 62E 为根据本发明第二较佳实施例的镇流侦测电路的电路示意图。

图 63A 为根据本发明第十九较佳实施例的 LED 日光灯的电源组件的应用电路方块示意图。

图 63B 为根据本发明第二十较佳实施例的 LED 日光灯的电源组件的应用电路方块示意图。

图 63C 为根据本发明较佳实施例的辅助电源模块的电路示意图。

图 64 为根据本发明第二十一较佳实施例的 LED 日光灯的电源组件的应用电路方块示意图。

具体实施方式

本发明的发明人在玻璃灯管的基础上，提出了一种新的 LED 直管灯，以解决背景技术中提到的问题以及上述问题。

为使本发明的上述目的、特征和优点能够更为明显易懂，下面结合附图对本发明的具体实施例做详细的说明。

请参照图 1 与图 2，本发明各实施例中，提供一种 LED 直管灯，其包括：一灯管 1、一设于灯管 1 内的灯板 2，以及分别设于灯管 1 两端的两个灯头 3。其中灯管 1 可以采用塑料灯管或者玻璃灯管，一实施例中,所述灯头的尺寸大小为相同，且 LED 直管灯采用具强化部的玻璃灯管，以避免传统玻璃灯管易破裂以及破裂因漏电而引发的触电事故，以及塑料灯管容易老化的问题。请参照图 1A，在其他实施例中，所述灯头的尺寸大小可以为不相同，优选地，所述较小灯头的尺寸为较大灯头尺寸的 30%至 80%。

说 明 书

本发明各实施例中，所提出的 LED 直管灯的玻璃灯管强化的方式可以使用化学方式或是物理方式对玻璃做二次加工强化。

使用化学方式对玻璃做强化的基本原理是用改变玻璃表面的组成来提高玻璃的强度，其方法是用其它的碱金属离子与玻璃表层的 Na 离子或 K 离子发生交换，表面形成离子交换层，当冷却到常温后，玻璃处于内层受拉，外层受压缩的状态，从而达到增加强度的目的，包括但不限于高温型离子交换法、低温型离子交换法、脱碱法、表面结晶法、硅酸钠强化法等，进一步说明如下。

1、高温型离子交换法

在玻璃的软化点与转变点之间的温度区域内，把含 Na_2O 或 K_2O 的玻璃侵入锂的熔盐中，使玻璃中的 Na 离子或与它们半径小的熔盐中的 Li 离子相交换，然后冷却至室温，由于含 Li 离子的表层与含 Na 离子或 K 离子内层膨胀系数不同，表面产生残余压力而强化，同时；玻璃中和含有 Al_2O_3、TiO_2 等成分时，通过离子交换，能产生膨胀系数极低的结晶，冷却后的玻璃表面将产生很大的压力，可得到强度高达 700MPa 的玻璃。

2、低温型离子交换法

低温离子交换法在比玻璃应变点低的温度区，用比表层碱离子（如 Na 离子）还大一些离子半径的一价阳离子（如 K 离子）与 Na 离子做离子交换，使 K 离子进入表层的方法。例如 $Na_2O+CaO+SiO_2$ 系统玻璃，在四百多度的熔融盐中可以浸渍十几小时。低温型离子交换法可以容易的得到高强度，具有处理方法简单、不损坏玻璃表面透明性、不变形等特点。

3、脱碱法

脱碱法是在含亚硫酸气体与水分的高温气氛中，利用 Pt 催化剂处理玻璃，使 Na+离子从玻璃表层渗出与亚硫酸反应，从而表面层成为富 SiO_2 层，其结果由于表层成为低膨胀性玻璃，冷却时产生压应力。

4、表面结晶法

表面结晶法与高温型离子交换不同的，但仅通过热处理在表层形成低膨胀系数的微晶体，从而使之强化的方法。

5、硅酸钠强化法

硅酸钠强化法是将硅酸钠（水玻璃）的水溶液中在摄氏 100 度以上数个大气压下处理，从而得到难以划伤表层的高强度玻璃。

说 明 书

使用物理方式对玻璃做强化的方式，可以包括但不限于，使用涂层的方式或是改变物品的结构。涂层根据需要喷涂的基质决定涂料的种类和状态，可以是瓷砖强化涂层、压克力涂层或是玻璃涂层等，在涂布时可以为液态或是气态涂布。改变物品的结构，例如在易破裂之处做结构性强化设计。

以上不论是化学方式或是物理方式不限于单一方式实施，可以混合物理方式中或化学方式中的任一种做任意搭配组合。

请参照图 2 与图 15，一实施例中本发明所提出的 LED 直管灯的玻璃灯管具有结构强化端部，说明如下。灯管 1 包括主体部 102 和分别位于主体部 102 两端的端部 101，灯头 3 套设于端部 101 外。其中，至少一个端部 101 的外径小于主体部 102 的外径。本实施例中，设置两个端部 101 的外径均小于主体部 102 的外径，端部 101 的剖面为一平面且与主体部 102 平行。具体地，灯管 1 的两端通过强化部处理，端部 101 形成强化部结构，灯头 3 套在强化后的端部 101 上，这样可以使得灯头 3 外径与灯管主体部 102 外径的差值变小，甚至完全相平，即灯头 3 外径与主体部 102 外径相等并使得灯头 3 与主体部 102 之间不会有缝隙产生。这样设置的好处在于，在运输过程中，包装承托物不会只接触灯头 3，其能够同时接触灯头 3 和灯管 1，使得整支 LED 直管灯受力均匀，而不会使得灯头 3 成为唯一受力点，避免灯头 3 与灯管端部 101 连接的部位由于受力集中发生破裂，提高产品的质量，并兼具美观的作用。

本实施例中，灯头 3 外径与主体部 102 外径基本相等，公差为在正负 0.2mm（毫米）内，最多不超过正负 1mm。

为了达到灯头 3 外径与主体部 102 外径基本相等的目的，根据不同的灯头 3 的厚度，强化后的端部 101 与主体部 102 外径的差值范围可以为 1mm 至 10mm；或者更优选的，强化后的端部 101 与主体部 102 外径的差值范围可以放宽至 2mm 至 7mm。

本实施例中，参照图 15，灯管 1 的端部 101 与主体部 102 之间平滑过渡，形成一个过渡部 103，过渡部 103 的两端皆呈弧面，即过渡部 103 的两端沿轴向的剖面呈弧线状。进一步地，弧面介于过渡部 103 的外表面与主体部 102 的外表面之间，弧面的弧角大于九十度，且端部 101 的外表面为一连续面且与主体部 102 的外表面仍维持平行。

过渡部 103 的长度为 1mm 至 4mm，如果小于 1mm，则过渡部的强度不够；

如果大于 4mm，则会减小主体部 102 的长度，减小发光面，同时需要灯头 3 的长度相应增加以与主体部 102 配合，造成灯头 3 的材料增加。在其他实施例中，则过渡部 103 也可以不为弧形。请参照图 5 与图 16，图 5 示出了本发明实施例灯头 3 和灯管 1 的连接时的结构示意图，图 16 示出了图 5 中灯管 1 的过渡部 103 的结构示意图。如图 5 与图 16 所示，在本实施例中，灯管 1 系采用玻璃灯管，介于主体部 102 与端部 101 之间的过渡部 103，会略呈由连续二个具有曲率半径 R1、R2 的弧面所构成的倒 S 形曲面，一般而言，二个弧面的曲率半径 R1 与 R2 之间的关系为 R1<R2，R1 与 R2 的比例范围 R1:R2 为 1:1.5 至 1:10，较佳的范围为 1:2.5 至 1:5，最佳的范围为 1:3 至 1:4，本实施例采用 R1:R2 约为 1:3，如此一来，靠近端部 101 的过渡部 103(即图 16 所示弧面凹向上的过渡部 103)，经过强化处理后，使得玻璃处于内层受拉，外层受压的状态，从而达到增加玻璃灯管 1 的过渡部 103 强度的目的。而靠近主体部 102 的过渡部 103(即图 16 所示弧面凹向下的过渡部 103)，经过强化处理后，使得玻璃处于内层受压，外层受拉的状态，从而达到增加玻璃灯管 1 的过渡部 103 强度的目的。

以 T8 的标准灯管为例，强化后的端部 101 的外径范围为 20.9mm 至 23mm，如果小于 20.9mm，则端部 101 的内径过小，导致电源部件无法插入灯管 1 中。主体部 102 的外径范围为 25mm 至 28mm，如果小于 25mm，则以现有的工艺条件，不方便对其两端作强化部处理，如果大于 28mm，将不符合行业标准。

请参照图 3 与图 4，本发明一实施例中，LED 直管灯的灯头 3 包括一绝缘管 302，一固设于绝缘管 302 外周面上的导热部 303，以及设于绝缘管 302 上的两支空心导电针 301。

请参照图 5，本实施例中，导热部 303 的一端伸出绝缘管 302 面向灯管的一端，导热部 303 的伸出部分（伸出绝缘管的部分）和灯管 1 之间通过一热熔胶 6 粘接。进一步地，灯头 3 通过导热部 303 延伸至过渡部 103，藉由导热部 303 与过渡部 103 紧密的接触，使得导热部 303 和灯管 1 通过热熔胶 6 粘接时，不会有热熔胶 6 溢出灯头 3 而残留至灯管 1 的主体主体部 102。此外，绝缘管 302 面向灯管 1 的一端未延伸至过渡部 103，即绝缘管 302 面向灯管的一端与过渡部 103 之间保持一定间隔。本实施例中，绝缘管 302 的材质并不限定使用塑料、陶瓷等材质， 主要是在一般状态下不是电的良导体即可。再者， 热熔胶 6 是一种组成物， 包含一种为焊泥粉的材料，成份较佳的为：酚醛树脂 2127#、虫胶、

松香、方解石粉、氧化锌、乙醇等。本实施例中，松香为一种增黏剂，具有溶于乙醇，但不溶于水的特性。 这种热熔胶 6 能够在高温加热的条件下，改变其物理状态发生大幅膨胀，达到固化的效果，加上本身材料的黏性，从而可以使灯头 3 与灯管 1 紧密接触，便于 LED 直管灯实现自动化生产。于本实施例中，热熔胶 6 在高温加热后会呈现膨胀并流动，随后冷却即会达到固化的效果，当热熔胶 6 从室温加热到摄氏 200 至 250 度的温度时，热熔胶的体积将膨胀至原来的 1 至 1.3 倍。当然，本发明热熔胶成份的选用并不限定于此，亦可选用高温加热至预定温度后而固化的成份。由于本发明热熔胶 6 不会由于电源组件等发热元器件发热形成高温环境而导致可靠性下降，可以防止 LED 直管灯使用过程中灯管 1 与灯头 3 的粘接性能降低，提高长期可靠性。

具体地，在导热部 303 伸出部分的内周面与灯管 1 的外周面之间形成有一容置空间，热熔胶 6 填充于该容置空间中（图 5 中虚线 B 所示位置）。换言之，热熔胶 6 填充的位置借由与灯管 1 轴向垂直的第一虚拟平面（如图 5 中虚线 B 所画过的平面）通过：沿径向向内的方向，在第一虚拟平面的位置，依序排列为导热部 303、热熔胶 6 和灯管 1 的外周面。热熔胶 6 涂覆厚度可以为 0.2mm 至 0.5mm，热熔胶 6 会膨胀后固化，从而与灯管 1 接触并将灯头 3 固定于灯管 1。并由于端部 101 和主体部 102 两者的外周面之间具有高度差，因此可以避免热熔胶溢出到灯管的主体部 102 部分上，免去后续的人工擦拭过程，提高 LED 直管灯的产量。

加工时，通过外部加热设备将热量传导至导热部 303，然后再传导至热熔胶 6、使热熔胶 6 膨胀后冷却固化，从而将灯头 3 固定粘接在灯管 1 上。

本实施例中，如图 5 所示，绝缘管 302 包括沿轴向相接的第一管 302a 和第二管 302b，第二管 302b 的外径小于第一管 302a 的外径，两个管的外径差值范围为 0.15mm 至 0.3mm。导热部 303 设于第二管 302b 的外周面上，导热部 303 的外表面与第一管 302a 的外周面平齐，使得灯头 3 的外表面平整光滑，保证整个 LED 直管灯在包装、运输过程中受力均匀。其中，导热部 303 沿灯头轴向方向的长度与绝缘管 302 的轴向长度比为 1:2.5 至 1:5，即导热部长度：绝缘管长度为 1:2.5 至 1:5。

在本实施例中，为了确保粘接的牢固性，本实施例设置第二管 302b 至少部分套设于灯管 1 外，容置空间还包括第二管 302b 的内表面和灯管的端部 101 外

表面之间的空间。热熔胶 6 有部分填充于相互重迭（图 5 中虚线 A 所示位置）的第二管 302b 和灯管 1 之间，即部分热熔胶 6 位于第二管 302b 的内表面和端部 101 的外表面之间。换言之，热熔胶 6 填充于所述容置空间的位置借由一与灯管轴向垂直的第二虚拟平面（如图 5 中虚线 A 所画过的平面）通过：沿径向向内的方向，在第二虚拟平面的位置，依序排列为导热部 303、第二管 302b、热熔胶 6 及端部 101。特予说明的是，于本实施例中，热熔胶 6 并不需要完全填满上述的容置空间（如图中容置空间还可以包括导热部 303 与第二管 302b 之间的空间）。制造时，当在导热部 303 和端部 101 之间涂覆热熔胶 6 时，可以适当增加热熔胶的量，使得在后续加热的过程中，热熔胶能够由于膨胀而流动至第二管 302b 和端部 101 之间，冷却固化后进而将两者粘合连接。

其中，灯管 1 的端部 101 插设于灯头 3 后，灯管 1 的端部 101 插入灯头 3 部分的轴向长度占导热部 303 轴向长度的三分之一到三分之二之间，这样的好处是：一方面，保证空心导电针 301 与导热部 303 具有足够的爬电距离，通电时两者不易短接使人触电而引发危险；另一方面，由于绝缘管 302 的绝缘作用，使得空心导电针 301 与导热部 303 之间的爬电距离加大，更容易通过高电压时使人触电而引发危险的测试。

进一步地，对于第二管 302b 内表面的热熔胶 6 来说，第二管 302b 隔在热熔胶 6 与导热部 303 之间，因此热量从导热部 303 传导至热熔胶 6 的效果会打折扣。因此，参照图 4，本实施例在第二管 302b 面向灯管 1 的一端（即远离第一管 302a 的一端）设置多个沿周向排列的缺口 302c，增加导热部 303 与热熔胶 6 的接触面积，以利于热量快速从导热部 303 传导至热熔胶 6 上，加速热熔胶 6 的固化过程。同时，当用户触及导热部 303 时，由于导热部 303 和灯管 1 之间热熔胶 6 的绝缘作用，不会因为灯管 1 有破损而触电。

其中，导热部 303 可以为各种容易传导热量的材料，本实施例中为金属片，并兼具美观的考虑，例如铝合金。导热部 303 呈管状（或称环状），套设在第二管 302b 外。绝缘管 302 可以为各种绝缘材料，但以不容易导热为佳，避免热量传导至灯头 3 内部的电源组件上、影响电源组件的性能，本实施例中的绝缘管 302 为塑料管。

在其他实施例中，导热部 303 还可以由多个沿第二管 302b 周向间隔或者不间隔排列的金属片组成。

本发明 LED 直管灯的灯头，在其他实施例中，还可以设置成其他形式或者包含其他元件，说明如下。

请参照图 6，在本发明另一实施例中，灯头 3 除包括绝缘管 302 外，还包括一导磁金属件 9，但不包含前述的导热部。导磁金属件 9 固设在绝缘管 302 的内周面上，且至少部分位于绝缘管 302 的内周面和灯管端部之间、与灯管 1 沿径向具有重迭部分。

本实施例中，整个导磁金属件 9 都位于绝缘管 302 内，热熔胶 6 涂覆于导磁金属件 9 的内表面上（导磁金属件 9 面向灯管 1 的表面），并与灯管 1 的外周面粘接。其中，为了增加粘接面积、提高粘接稳定性，热熔胶 6 较佳覆盖导磁金属件 9 的整个内表面。

请参照图 7，本实施例的 LED 直管灯于制造时，系将灯头 3 的绝缘管 302 插设于一外部加热设备中，此一外部加热设备较佳为一感应线圈 11，使得感应线圈 11 位于导磁金属件 9 的上方而与导磁金属件 9 沿绝缘管 302 的径向相对。加工时，将感应线圈 11 通电，感应线圈 11 通电后形成电磁场，电磁场经过导磁金属件 9 后转换为电流，使得导磁金属件 9 发热，即运用电磁感应技术使得导磁金属件 9 发热，并热量传导至热熔胶 6，热熔胶 6 吸收热量后膨胀并流动，经冷却后使得热熔胶 6 固化，以实现将灯头 3 固定于灯管 1 的目的。本实施例中，感应线圈 11 系由主要材质为紫铜且宽度 5mm 至 6mm 的金属导线所卷曲成的一环状线圈，环状线圈的直径约 30mm 至 35mm，环状线圈直径下限稍大于灯头 3 的外径。在灯头 3 的外径相同于灯管 1 的外径的前提下，灯头 3 的外径将随著不同的灯管 1 而有不同的外径，因而不同型号的灯管可以使用不同直径的感应线圈 11。例如，T12 灯管的直径为 38.1mm，T10 灯管的直径为 31.8mm，T8 灯管的直径为 25.4mm，T5 灯管的直径为 16mm，T4 灯管的直径为 12.7mm，T2 灯管的直径为 6.4 mm。

此外，感应线圈 11 被供应交流电，电功率为 15kW 至 25kW，频率为 25 kHz 至 35kHz 的电流。优选地，电功率为 20kW，频率为 30kHz。进一步地，感应线圈 11 还可与一功率放大单元搭配使用，藉以将交流电店功率放大 1 至 2 倍。感应线圈 11 所获电流大小为 25A 至 35A，最佳为 32.5A，感应线圈 11 的持续通电时间为 2 秒至 10 秒，最佳为 5 秒。感应线圈 11 尽量与绝缘管 302 同轴，使得能量传递较为均匀。本实施例中，感应线圈 11 与绝缘管 302 中轴线之间的偏差

不超过 0.05mm。当粘接完成后，将灯管 1 连同灯头 3 抽离感应线圈 11。本实施例中，热熔胶 6 在吸收热量后会呈现膨胀并流动，随后冷却即会达到固化的效果。本实施例中，导磁金属件 9 的发热温度可以达到摄氏 250 至 300 度，而热熔胶 6 的加热温度可以达到摄氏 200 至 250 度。当然，本发明热熔胶成份的选用并不限定于此，亦可选用吸收热量后随即固化的成份。

本实施例中，上述的灯管 1 制造流程完成后，系采取感应线圈 11 不动，再将灯管 1 连同灯头 3 抽离感应线圈 11 的方式。然而，在其他实施例中，也可以是灯管 1 不动，再将感应线圈 11 脱离灯管的来完成。于此实施例中，导磁金属件 9 的加热设备可以采用具有复数个感应线圈 11 的装置，也就是说，当欲将复数个灯管 1 的灯头 3 加热时，仅需将复数个灯管 1 摆放在默认位置，接着，加热设备即会移动对应的感应线圈 11 至欲加热灯管 1 的灯头位置加热，加热完成后，即会将复数个感应线圈 11 抽离对应的灯管 1 而完成导磁金属件 9 的加热。然而， 在这些实施方式中，感应线圈 11 及灯头 3 之间的相对移动，无论是感应线圈 11 摆放在固定位置不动，灯头 3 被移动并插设于感应线圈 11 中，或是灯头 3 摆放在固定位置不动，感应线圈 11 被移动并让灯头 3 插设于感应线圈 11 中，均属于前后方向的相对移动。由于灯管 1 的长度远大于灯头 3 的长度，甚或在一些特殊用途中灯管 1 的长度可达 240cm 以上，因此在灯管 1 及灯头 3 连动的情况下，感应线圈 11 和灯头 3 彼此在相对抽入或抽离时，很可能会因为位置的误差而损害灯头 3 与灯管 1 的连接固定。

请继续参照图 44，本实施例中所述的感应线圈 11 也可以采用多数个上、下二半圆状的夹具 11a 所构成的一外部加热设备 110，来达到相同于前述感应线圈的效果，同时降低前述前后方向的相对移动所带来因位置误差而造成灯头 3 与灯管 1 连接固定的损害可能性。上、下二半圆状的夹具 11a 内分别具有上述宽度 5mm 至 6mm 的金属导线所卷曲成的半圆状线圈，当上、下半圆状的夹具接触后将形成一直径约 30mm 至 35mm 的中空环状，且内部形成一闭合的电路而形成前述的感应线圈 11。本实施例中，使用上、下二半圆状的夹具 11a 形成中空环状，灯管 1 的灯头 3 不是以前后移动的方式进入中空环状中，而是用滚动的方式进入下半圆状的夹具缺口中，可以避免感应线圈 11 和灯头 3 彼此在抽入或抽离时产生因位置精度控制不良而造成损害的问题。详言之，灯管 1 在一滚动的生产线上，灯管 1 的灯头 3 经滚动而置放在下半圆状的夹具缺口上，接著

上半圆状的夹具和下半圆的夹具接触形成一闭合的电路，待加热完成后，再将上半圆状的夹具分离，如此可以降低对于位置精度控制的要求，以减少制造上的良率问题。

请参照图 6，为了较好地支撑导磁金属件 9，绝缘管 302 的内周面用于支撑导磁金属件 9 的部位 302d 的内径要大于其余部分 302e 的内径，并于 302d 及 302e 交接处形成一个台阶，导磁金属件 9 的轴向一端顶靠在台阶上，并且使得设置导磁金属件 9 后，整个灯头的内表面平齐。另外，导磁金属件 9 可以是各种形状，例如呈周向排列的片状或管状等，此处设置导磁金属件 9 呈与绝缘管 302 同轴的管状。

请参照图 8、图 9，在其他实施例中，绝缘管 302 的内周面用于支撑导磁金属件 9 的部位还可以为如下形式：绝缘管 302 的内周面上具有朝向绝缘管 302 内部突伸的支撑部 313，并且，绝缘管 302 的内周面上、在支撑部 313 面向灯管主体部一侧还设置有凸出部 310，所述凸出部 310 的径向厚度小于所述支撑部 313 的径向厚度。如图 9 所示，凸出部 310 与支撑部 313 沿轴向相连，导磁金属件 9 在轴向上顶靠在支撑部 313 的上缘（即支撑部面向凸出部一侧的端面），在周向上顶靠在凸出部 310 的径向内侧。也就是说，至少一部分凸出部 310 位于导磁金属件 9 和绝缘管 302 的内周面之间。凸出部 310 可以是沿绝缘管 302 周向延伸的环形、或者是绕着绝缘管 302 的内周面沿周向间隔排列的多个凸块，此外，凸块的排列可以呈周向等距离间隔排列或是不等距离间隔排列，只要能够使导磁金属件 9 的外表面和绝缘管 302 的内周面的接触面积减少，但又能具有固持热熔胶 6 的功能。

优选地，支撑部 313 由绝缘管 302 的内周面向内侧凸起的厚度为 1mm 至 2mm，凸出部 310 的厚度小于支撑部 313 厚度，凸出部 310 的厚度为 0.2mm 至 1mm。

在其他实施例中，灯头 3 还可以作成全金属的，此时需要在空心导电针的下部增设一绝缘体，以耐高电压。

请参照图 10，在其他实施例中，导磁金属件 9 面向绝缘管 302 的表面具有至少一空孔结构 91，空孔结构 91 的形状为圆形，但不限于圆形，可以例如为椭圆形、方形、星形等，只要能够减少导磁金属件 9 和绝缘管 302 的内周面的接触面积，但又能具有热固化即加热热熔胶 6 的功能。优选地，空孔结构 91 面积

占导磁金属件 9 面积的 10%至 50%。空孔结构 91 的排列可以呈周向等距离间隔排列或是不等距离间隔排列等。

请参照图 11，在其他实施例中，导磁金属件 9 面向绝缘管 302 的表面具有一压痕结构 93，压痕结构 93 可以为从导磁金属件 9 的内表面向外表面浮凸的结构，但也可以为从导磁金属件 9 的外表面向内表面浮凸的结构，其目的是为了在导磁金属件 9 的外表面形成凸起或凹陷，以达到减小使导磁金属件 9 的外表面和绝缘管 302 的内周面的接触面积的目的。也就是说，导磁金属件 9 的表面形状可选自空孔结构、浮凸结构及凹陷结构所组成的群组中的一种结构形状，以达到减小使导磁金属件 9 的外表面和绝缘管 302 的内周面的接触面积的目的。但需要注意的是，同时应当保证导磁金属件 9 与灯管稳定粘接，实现热固化热熔胶 6 的功能。

请参照图 12，本实施例中，导磁金属件 9 为一圆形环。请参照图 13，在其他实施例中，导磁金属件 9 为一非圆形环，例如但不限于椭圆形环，当灯管 1 和灯头 3 为椭圆形时，椭圆形环的短轴略大于灯管端部外径，以减小导磁金属件 9 的外表面和绝缘管 302 的内周面的接触面积，但又能实现热固化热熔胶 6 的功能。换言之，绝缘管 302 的内周面上具有支撑部 313，非圆形环的导磁金属件 9 设于支撑部 313 上，因此，可以使导磁金属件 9 和绝缘管 302 的内周面的接触面积减少，并又能实现固化热熔胶 6 的功能。需说明的是，在其他实施例中，也可将导磁金属件 9 设至于灯头 3 的外部，取代如图 5 中所示的导热部 303，藉由电磁感应原理，亦可实现固化热溶胶 6 的功能。

请参照图 45 至 47，于其他实施例中，不需要在灯头 3 额外设置导磁金属件 9，仅需在前述所提热熔胶 6 中直接参杂预定比例的高导磁性材质粉末 65，其材质系选自铁、镍、钴及其合金所组成的混合物族群中的一种，高导磁性材质粉末 65 占热熔胶 6 的重量百分比为 10%至 50%，高导磁性材质粉末 65 的平均粒径为 1 微米到 30 微米。于这些实施例中，高导磁性材质粉末 65 的相对导磁系数介于 10^2 至 10^6，或是以高导磁性材质粉末 65 取代部份方解石粉的添加量，也就是说，高导磁性材质粉末 65 与方解石粉的占有体积比例大约为 1:3~1:1，因此，使得灯头 3 与灯管 1 藉由热熔胶 6 黏合后，可通过灯头的破坏性试验，即可同时符合灯头的弯矩测试标准及灯头的扭矩测试标准，一般而言，直管灯的灯头弯矩测试标准需大于 5 牛顿-米(Nt-m)，直管灯的灯头扭矩测试标准需大于 1.5

牛顿-米(Nt-m)，本实施例依据不同的高导磁性材质粉末 65 掺杂至热熔胶 6 的比例以及施予灯头不同的磁通量可通过 5 至 10 牛顿-米(Nt-m)的弯矩测试及 1.5 至 5 牛顿-米(Nt-m)的扭矩测试。加工时，将前述的感应线圈 11 通电，感应线圈 11 通电后，使得均匀分布在热熔胶 6 中的高导磁性材质粉末 65 带电，进而使得热熔胶 6 发热，热熔胶 6 吸收热量后膨胀并流动，经冷却后固化，以实现将灯头 3 固定于灯管 1 的目的。

如图 45 至图 47 所示，为不同的高导磁性材质粉末 65 在热熔胶 6 内的分布状态。如图 45 所示，高导磁性材质粉末 65 平均粒径为 1 微米到 5 微米之间，且在热熔胶 6 内均匀分布，当热熔胶 6 涂覆于灯头 3 的内表面，高导磁性材质粉末 65 在热熔胶 6 内的均匀分布虽无法形成一闭合的电路，但在一电磁场范围内，高导磁性材质粉末 65 的单个颗粒仍会因为磁滞效应发热，藉以加热热熔胶 6。如图 46 所示，高导磁性材质粉末 65 平均粒径为 1 微米到 5 微米之间，且在热熔胶 6 内不均匀分布，当热熔胶 6 涂覆于灯头 3 的内表面，高导磁性材质粉末 65 颗粒间彼此连接形成一闭合的电路，在一电磁场范围内，高导磁性材质粉末 65 单个颗粒会因为磁滞效应发热，也会因为闭合电路的电荷流动而产生热量。如图 47 所示，高导磁性材质粉末 65 平均粒径为 5 微米到 30 微米之间，且在热熔胶 6 内不均匀分布，当热熔胶 6 涂覆于灯头 3 的内表面，高导磁性材质粉末 65 颗粒间彼此连接形成一闭合的电路，在一电磁场范围内，高导磁性材质粉末 65 单个颗粒会因为磁滞效应发热，也会因为闭合电路的电荷流动而产生热量。因此，藉由调整高导磁性材质粉末 65 的粒径大小、分布密度、分布形貌、以及施予灯头 3 的磁通量，可以对热熔胶 6 的加热温度做不同的控制。一实施方式中，当热熔胶 6 被加热至摄氏 200 至 250 度的温度时可具有流动性，经冷却后固化。在另一实施方式中，当热熔胶 6 被加热至摄氏 200 至 250 度的温度后随即固化。

在其他实施例中，灯头中包含有一用于安装电源组件的电源插槽(图未示)。

为了方便灯头 3 与灯管 1 的连接固定，本实施例针对灯头 3 做了改进。

请参照图 3-5 并结合图 6-9，灯头 3 套设于灯管 1 外时，灯头 3 套设于灯管 1 的端部 101 外，并延伸至过渡部 103，与过渡部 103 部分重迭。于本实施例中，灯头 3 包含有两根空心导电针 301。

请参照图 14 及图 39，于另一实施例中，灯头 3'的端部设有一凸柱 312，凸柱 312 的顶端开设有孔洞，其外缘设有一深度为 0.1mm 的凹槽 313 可供导电引

脚 53 定位。导电引脚 53 在穿出灯头 3’端部凸柱 312 的孔洞之后，可弯折置于凹槽 313 之上，然后再以一导电金属帽 311 覆盖住凸柱 312，如此，则可将导电引脚 53 固定在凸柱 312 与导电金属帽 311 之间，于本实施例中，导电金属帽 311 的内径例如为 7.56mm，而凸柱 312 的外径例如为 7.23mm，且导电引脚 53 外径例如为 0.5mm，因此导电金属帽 311 可直接紧密覆盖住凸柱 312 而不需要再额外涂覆黏胶，如此便可完成电源 5 与导电金属帽 311 的电气连接。

请参照图 2、3、12、13，在其他实施例中，本发明所提供的灯头上设有用于散热的孔洞 304。藉此，让位于灯头内部的电源组件产生的热能够散去而不会造成灯头内部处于高温状态，以避免灯头内部元件的可靠度下降。

进一步地，灯头上用于散热的孔洞为弧形。

进一步地，灯头上用于散热的孔洞为三条大小不一的弧线。

进一步地，灯头上用于散热的孔洞为由小到大逐渐变化的三条弧线。

进一步地，灯头上用于散热的孔洞可以为上述弧形，弧线的任意搭配所构成。

参照图 17，本实施例的灯管 1 内除了紧贴于灯管 1 的灯板 2（或可挠式电路板）外，还包括扩散层 13，光源 202 产生的光线通过扩散层 13 后穿出灯管 1。

扩散层 13 对光源 202 发出的光起到扩散的作用，因此，只要能使得光线透过扩散层 13 后再穿出灯管 1，扩散层 13 的布置可以有多种形式，例如：扩散层 13 可以涂覆或覆盖于灯管 1 的内周面上，或者涂覆或覆盖于光源 202 表面上的扩散涂层（图中未示出），或者作为一个外罩而罩（或遮盖）在光源 202 外的扩散膜片。

请再次参照图 17，当扩散层 13 为扩散膜片时，其可罩在光源 202 外，且与光源 202 不接触。扩散膜片的一般用语是光学扩散片或光学扩散板，通常用 PS 聚苯乙烯、PMMA 聚甲基丙烯酸甲酯、PET （聚对苯二甲酸乙二酯）、PC （聚碳酸酯）中的一种或几种的组合来搭配扩散粒子，所形成的一种复合材料，当光线透过该复合材料时能够发生漫射现象，可修正光线成均匀面光源以达到光学扩散的效果最终使得从灯管的亮度均匀分布。

当扩散层 13 为扩散涂层时，其主要成分可以是碳酸钙、卤磷酸钙以及氧化铝其中的任一种，或其中任二种的组合，或三种的组合。当利用碳酸钙为主要材料搭配适当的溶液所形成的扩散涂层，将具有绝佳的扩散和透光（有机会达

到 90%以上）的效果。另外也发现，结合强化部玻璃的灯头有时候会有质量问题，有些许比例会容易脱落，而只要将该扩散涂层也涂到灯管的端部 101 的外表面上，扩散涂层和热熔胶 6 间会增加灯头和灯管间的摩擦力，使得扩散涂层和热熔胶 6 间的摩擦力大于未涂上扩散涂层时灯管的端部 101 的端面和热熔胶间的摩擦力，因此灯头 3 透过扩散涂层和热熔胶 6 间的摩擦力，灯头 3 脱落的问题便能大幅度的解决。

本实施例中，在调配时，扩散涂层的组成成分包括碳酸钙、磷酸锶（例如 CMS-5000，白色粉末）、增稠剂，以及陶瓷活性炭（例如陶瓷活性碳 SW-C，无色液体）。

具体地，当扩散涂层以碳酸钙为主材料，搭配增稠剂，陶瓷活性碳以及去离子水，混合后涂覆于玻璃灯管的内周面上，涂覆的平均厚度落在 20 至 30μm 之间，最后去离子水将挥发掉，只剩下碳酸钙、增稠剂与陶瓷活性碳三种物质。采用这种材料形成的扩散层 13，可以具有约 90%的透光率，一般而言，透光率的范围约为 85%至 96%。另外，这种扩散层 13 在除了具有扩散光的效果之外，还能起到电隔离的作用，从而使得当玻璃灯管破裂时，降低用户触电的风险；同时，这种扩散层 13 可以使得光源 202 在发光时，让光产生漫射，往四面八方射出，从而能够照到光源 202 的后方，即靠近可挠式电路板的一侧，避免在灯管 1 中形成暗区，提升空间的照明舒适感。此外，当选择不同材料成分的扩散涂层时，有另一种可能的实施方式，可以采用扩散层厚度范围为 200μm 至 300μm，且透光率控制在 92%至 94%之间，也会有另一番效果。

在其他实施例中，扩散涂层也可以碳酸钙为主材料，搭配少量的反射材(如磷酸锶或硫酸钡)、增稠剂，陶瓷活性碳以及去离子水，混合后涂覆于玻璃灯管的内周面上，涂覆的平均厚度落在 20 至 30μm 之间，最后去离子水将挥发掉，只剩下碳酸钙、反射材、增稠剂与陶瓷活性碳四种物质。由于扩散层的目的是让光产生漫射，漫射现象在微观而言，是光线经颗粒的反射作用，磷酸锶或硫酸钡等反射材的颗粒粒径大小会远大于碳酸钙的粒径，因此，选择在扩散涂层中加入少量的反射材，可有效地增加光线的漫射效果。当然，其他实施例中，也可以选用卤磷酸钙或氧化铝为扩散涂层的主要材料，碳酸钙的颗粒的粒径大约落在 2 至 4μm 之间，而卤磷酸钙和氧化铝的颗粒的粒径大约分别落在 4 至 6μm 之间与 1 至 2μm 之间，以碳酸钙为例，当透光率的要求范围落在 85%至

92%时，整体以碳酸钙为主要材料的扩散涂层需涂覆的平均厚度约在 20 至 30μm，在相同的透光率要求范围(85%至 92%)下，卤磷酸钙为主要材料的扩散涂层需涂覆的平均厚度会落在 25 至 35μm，氧化铝为主要材料的扩散涂层需涂覆的平均厚度会落在 10 至 15μm。若透光率需求更高时，例如 92%以上，则以碳酸钙、卤磷酸钙或氧化铝为主要材料的扩散涂层厚度则需更薄，以碳酸钙为主要材料的扩散涂层为例，其涂覆的平均厚度落在 10 至 15μm 之间。

也就是说，依灯管 1 的使用场合，而选择不同的透光率需求，即可选择所欲涂覆扩散涂层的主要材料、对应的形成厚度等等。需补充说明的是，扩散层的透光率越高，使用者看到光源的颗粒感会越显着。于本实施例中，形成扩散涂层主要有二种方式，一、压涂法:先将整支灯管直立后，于扩散涂层设备中利用压力施压，使得扩散涂层溶液灌满整支灯管后，接着移除压力，因扩散涂层溶液中含有增稠剂可增加碳酸钙等扩散涂层材料贴附于灯管内周面时的黏稠度，当扩散涂层溶液回流至扩散涂层设备后，再利用风干方式，使得扩散涂层均匀地形成于灯管的内周面；二、喷涂法:先将整支灯管直立后，利用扩散液喷涂设备将整支灯管内周面喷涂扩散涂层溶液，灯管可藉由倾斜摆设或旋转灯管等方式，以增加扩散涂层溶液贴附于灯管内周面时的均匀度，最后，再利用风干方式，使得扩散涂层均匀地形成于灯管的内周面。

继续参照图 17，进一步地，灯管 1 的内周面上还设有反射膜 12，反射膜 12 设于具有光源 202 的灯板 2 周围，且沿周向占用灯管 1 的部分内周面。如图 17 所示，反射膜 12 在灯板 2 两侧沿灯管周向延伸，灯板 2 基本位于反射膜 12 沿周向的中间位置。反射膜 12 的设置具有两方面的效果，一方面，当从侧面（图中 X 方向）看灯管 1 时，由于有反射膜 12 阻挡，不会直接看到光源 202，从而减少颗粒感造成的视觉上的不适；另一方面，光源 202 发出的光经过反射膜 12 的反射作用，可以控制灯管的发散角，使得光线更多地朝向未涂有反射膜的方向照射，使得 LED 直管灯以更低的功率获得相同的照射效果，提高节能性。

具体地，反射膜 12 贴设于灯管 1 的内周面上，并在反射膜 12 上开设与灯板 2 对应的开孔 12a，开孔 12a 的尺寸应当与灯板 2 一致或者略大于灯板 2，用于容纳具有光源 202 的灯板 2。装配时，先将带有光源 202 的灯板 2（或可挠式电路板）设置于灯管 1 的内周面上，再将反射膜 12 贴设在灯管内周面，其中反射膜 12 的开孔 12a 与灯板 2 一一对应，以将灯板 2 暴露在反射膜 12 之外。

说 明 书

本实施例中，反射膜 12 的反射率至少要大于 85%，反射效果较好，一般在 90%以上时，最好能达到 95%以上，以获得更为理想的反射效果。反射膜 12 沿灯管 1 周向延伸的长度占据整个灯管 1 圆周的 30%至 50%，也就是说，沿灯管 1 的周向方向，反射膜 12 的周向长度与灯管 1 内周面的周长之间的比例范围为 0.3~0.5。特予说明的是，本发明仅以灯板 2 设置在反射膜 12 沿周向的中部位置为例，也就是说，灯板 2 两侧反射膜 12 具有实质上相同的面积，如图 17 所示。反射膜的材料可以是 PET、磷酸锶以及硫酸钡其中任一种，或者其中任二种的组合，或者三种的组合，反射效果更好，厚度在 140μm 至 350μm 之间，一般在 150μm 至 220μm 之间，效果更佳。

在其他实施例中，反射膜 12 也可以采用其他形式来设置，例如，沿灯管 1 的周向方向，反射膜 12 可以设于灯板 2 的一侧或两侧，即反射膜 12 和灯板 2 周向一侧或两侧接触，其周向单侧占据灯管 1 圆周的比例与本实施例相同，如图 18 示出了反射膜 12 仅与灯板 2 一侧接触的结构。或者，如图 19、图 20，反射膜 12 可以不开设开孔，装配时直接将反射膜 12 贴设在灯管 1 的内周面上，然后再将带有光源 202 的灯板 2 固定在反射膜 12 上，此处反射膜 12 也可以在灯板 2 的两侧分别沿灯管周向延伸，如图 19，或者只在灯板 2 的一侧沿灯管周向延伸，如图 20。

在上述实施例中所述的各种类型反射膜 12 与各种类型扩散层 13 可以任意搭配，而能实现单独反射，单独扩散或同时实现反射及扩散的光学效果。例如，可以只设置反射膜 12，不设置扩散层 13，如图 19、图 20 以及图 21 所示。

在其他实施例中，可挠式电路板的宽度可以加宽，由于电路板表面包括油墨材料的电路保护层，而油墨材料具有反射光线的作用，因此在加宽的部位，电路板本身便可以起到如反射膜 12 功能的效果。优选地，可挠式电路板沿灯管 2 周向延伸的长度与所述灯管 2 内周面的周长之间的比例范围为 0.3 至 0.5。可挠式电路板外可包覆一电路保护层，电路保护层可以是一种油墨材料，具有增加反射的功能，加宽的可挠式电路板以光源为起点向周向延伸，光源的光线会藉由加宽的部位使光线更加集中。

在其他的实施例中，玻璃管的内周面上，可全部都涂上扩散涂层，或者是部分涂上扩散涂层（有反射膜 12 之处不涂），但无论是哪一种方式，扩散涂层最好都要涂到灯管 1 的端部的外表面上，以使得灯头 3 与灯管 1 之间的黏接更

牢固。

需补充的是，于本发明上述实施例中，皆可选用由扩散涂层、扩散膜片、反射膜以及粘接膜所组成的群组中的一种，应用于本发明光源所发出光线的光学处理。

请继续参照图 2，本发明一实施例中，LED 直管灯还包括粘接剂片 4、灯板绝缘胶片 7 和光源胶片 8。灯板 2 通过粘接剂片 4 粘贴于灯管 1 的内周面上。图中所示，粘接剂片 4 可以为硅胶，其形式不限，可以是图中所示的几段，或者呈长条状的一段。各种形式的粘接剂片 4、各种形式的灯板绝缘胶片 7 和各种形式的光源胶片 8 可互为组合而构成本发明的不同实施例。

灯板绝缘胶片 7 涂于灯板 2 面向光源 202 的表面上，使得灯板 2 不外露，从而起到将灯板 2 与外界隔离的绝缘作用。涂胶时预留出与光源 202 对应的通孔 71，光源 202 设于通孔 71 中。灯板绝缘胶片 7 的组成成分包括乙烯基聚硅氧烷、氢基聚硅氧烷和氧化铝。灯板绝缘胶片 7 的厚度范围为 100μm 至 140μm（微米）。如果小于 100μm，则起不到足够的绝缘作用，如果大于 140μm，则会造成材料的浪费。

光源胶片 8 涂于光源 202 的表面。光源胶片 8 的颜色为透明色，以保证透光率。涂覆至光源 202 表面后，光源胶片 8 的形状可以为颗粒状、条状或片状。其中，光源胶片 8 的参数有折射率、厚度等。光源胶片 8 的折射率允许的范围为 1.22~1.6，如果光源胶片 8 的折射率为光源 202 壳体折射率的开根号，或者光源胶片 8 的折射率为光源 202 壳体折射率的开根号的正负 15%，则透光率较好。这里的光源壳体是指容纳 LED 晶粒（或芯片）的壳体。本实施例中，光源胶片 8 的折射率范围为 1.225 至 1.253。光源胶片 8 允许的厚度范围为 1.1mm 至 1.3mm，如果小于 1.1mm，将会盖不住光源 202，效果不佳，如果大于 1.3mm，则会降低透光率，同时还会增加材料成本。

装配时，先将光源胶片 8 涂于光源 202 的表面；然后将灯板绝缘胶片 7 涂于灯板 2 上的一侧表面上；再把光源 202 固定于灯板 2 上；接着将灯板 2 与光源 202 相背的一侧表面通过粘接剂片 4 粘贴固定于灯管 1 的内周面；最后再将灯头 3 固定于灯管 1 的端部，同时将光源 202 与电源 5 电连接。或者是如图 22 所示，利用可挠式电路板 2 爬过过渡部 103 和电源 5 焊接（即穿过过渡部 103 与电源 5 焊接），或者采取传统导线打线的方式让灯板 2 与电源 5 电性相连，最

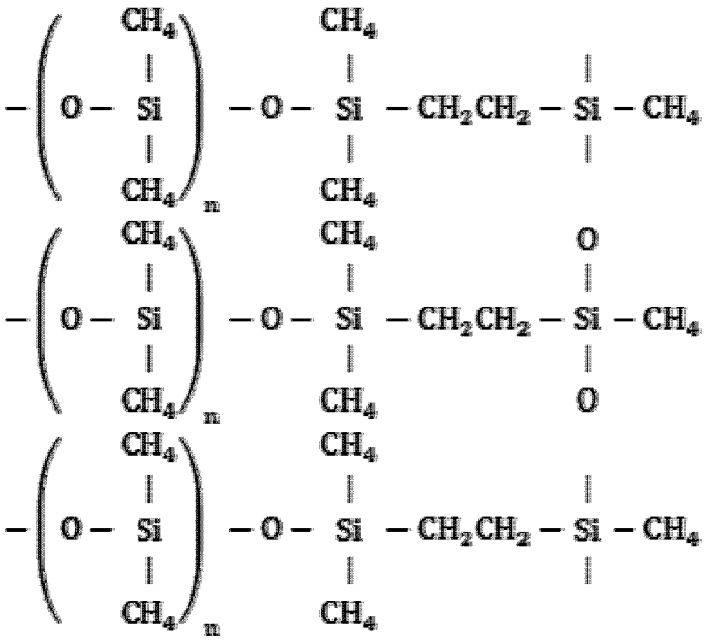
后灯头 3 通过图 5（用图 3-图 4 的结构）或图 7（用图 6 的结构）的方式接在强化处理的过渡部 103，形成一个完整的 LED 直管灯。

本实施例中，灯板 2 通过粘接剂片 4 固定在灯管 1 的内周面，使得灯板 2 贴设在灯管 1 的内周面上，这样可以增大整支 LED 直管灯的发光角度，扩大可视角，这样设置一般可以使得可视角可以超过 330 度。通过在灯板 2 涂灯板绝缘胶片 7，在光源 202 上涂绝缘的光源胶片 8，实现对整个灯板 2 的绝缘处理，这样，即使灯管 1 破裂，也不会发生触电事故，提高安全性。

进一步地，于其他实施例中，灯管 1 内周面或外周面上可覆盖有粘接膜（未图示），用于在灯管 1 破裂后对灯管 1 的外部和内部进行隔离。本实施例将粘接膜涂在灯管 1 的内周面上。

粘接膜的组成成分包括端乙烯基硅油、含氢硅油、二甲苯和碳酸钙。其中端乙烯基硅油的化学式为：$(C_2H_8OSi)_n \cdot C_2H_3$，含氢硅油的化学式为：$C_3H_9OSi \cdot (CH_4OSi)_n \cdot C_3H_9Si$。

其生成产物为聚二甲基硅氧烷（有机硅弹性体），化学式为：



其中二甲苯为辅助性材料，当粘接膜涂覆在灯管 1 内周面并固化后，二甲苯会挥发掉，其作用主要是调节粘度，进而来调节粘接膜的厚度。

本实施例中，粘接膜的厚度范围为 100μm 至 140μm。如果粘接膜厚度小于 100μm 则防爆性能不够，玻璃破碎时，整根灯管会裂开，大于 140μm 则会

降低透光率，且增加材料成本。如果防爆性能和透光率要求较宽松，则粘接膜的厚度范围也可以放宽至 10μm 至 800μm。

本实施例中，由于灯管内部涂有粘接膜，在玻璃灯管破碎后，粘接膜会将碎片粘连一起，并且不会形成贯通灯管内部和外部的通孔，从而防止用户接触到灯管 1 内部的带电体，以避免发生触电事故，同时采用上述配比的粘接膜还具有扩散光、透光的作用，提高整支 LED 直管灯的发光均匀度和透光率。本实施例的粘接膜可以与前述的粘接剂片 4、灯板绝缘胶片 7 和光源胶片 8 搭配使用，而构成本发明的各种不同实施例。

需要注意的是，由于本实施例中的灯板 2 为可挠式电路板，因此也可以不设置粘接膜。

进一步地，灯板 2 可以是条状铝基板、FR4 板或者可挠式电路板中的任意一种。由于本实施例的灯管 1 为玻璃灯管，如果灯板 2 采用刚性的条状铝基板或者 FR4 板，那么当灯管破裂，例如断成两截后，整个灯管仍旧能够保持为直管的状态，这时使用者有可能会认为 LED 直管灯还可以使用、并去自行安装，容易导致触电事故。由于可挠式电路板具有较强的可挠性与易弯曲的特性，解决刚性条状铝基板、FR4 板可挠性与弯曲性不足的情况，因此本实施例的灯板 2 采用可挠式电路板，这样当灯管 1 破裂后，即无法支撑破裂的灯管 1 继续保持为直管状态，以告知使用者 LED 直管灯已经不能使用，避免触电事故的发生。因此，当采用可挠式电路板后，可以在一定程度上缓解由于玻璃管破碎而造成的触电问题。以下实施例即以可挠式电路板作为灯板 2 来做说明。

请参照图 23，作为灯板 2 的可挠式电路板包括一层具有导电效果的线路层 2a，光源 202 设于线路层 2a 上，通过线路层 2a 与电源电气连通。参照图 23，本实施例中，可挠式电路板还可以包括一层介电层 2b，与线路层 2a 迭置，介电层 2b 与线路层 2a 的面积相等，线路层 2a 在与介电层 2b 相背的表面用于设置光源 202，介电层 2b 在与线路层 2a 相背的表面则通过粘接剂片 4 粘接于灯管 1 的内周面上。其中，线路层 2a 可以是金属层，或者布有导线（例如铜线）的电源层。

在其他实施例中，线路层 2a 和介电层 2b 的外表面可以包覆一电路保护层，所述电路保护层可以是一种油墨材料，具有阻焊和增加反射的功能。或者，可挠式电路板可以是一层结构，即只由一层线路层 2a 组成，然后在线路层 2a 的表

面包覆一层上述油墨材料的电路保护层。不论是一层线路层 2a 结构或二层结构（一层线路层 2a 和一层介电层 2b）都可以搭配电路保护层。电路保护层也可以在可挠式电路板的一侧表面设置，例如仅在具有光源 202 的一侧设置电路保护层。需要注意的是，可挠式电路板为一层线路层结构 2a 或为二层结构（一层线路层 2a 和一层介电层 2b），明显比一般的三层柔性基板(二层线路层中夹一层介电层)更具可挠性与易弯曲性，因此，可与具有特殊造型的灯管 1 搭配（例如：非直管灯），而将可挠式电路板紧贴于灯管 1 管壁上。此外，可挠式电路板紧贴于灯管管壁为较佳的配置，且可挠式电路板的层数越少，则散热效果越好，并且材料成本越低，更环保，柔韧效果也有机会提升。

当然，本发明的可挠式电路板并不仅限于一层或二层电路板，在其他实施例中，可挠式电路板包括多层线路层 2a 与多层介电层 2b，介电层 2b 与线路层 2a 会依序交错迭置且设于线路层 2a 与光源 202 相背的一侧，光源 202 设于多层线路层 2a 的最上一层，通过线路层 2a 的最上一层与电源电气连通。在其他实施例中，作为灯板 2 的可挠式电路板的长度大于灯管的长度。

请参见图 48，在一变化例中，作为灯板 2 的可挠式电路板由上而下依序包括一第一线路层 2a，一介电层 2b 及一第二线路层 2c，第二线路层 2c 的厚度大于第一线路层 2a 的厚度，灯板 2 的长度大于灯管 1 的长度，其中在灯板 2 未设有光源 202 且突出于灯管 1 的末端区域上，第一线路层 2a 及第二线路层 2c 分别透过二个贯穿孔 203 及 204 电气连通，但贯穿孔 203 及 204 彼此不连通以避免短路。

藉此方式，由于第二线路层 2c 厚度较大，可起到支撑第一线路层 2a 及介电层 2b 的效果，同时让灯板 2 贴附于灯管 1 的内管壁上时不易产生偏移或变形，以提升制造良率。此外，第一线路层 2a 及第二线路层 2c 电气相连通，使得第一线路层 2a 上的电路布局可以延伸至第二线路层 2c，让灯板 2 上的电路布局更为多元。再者，原本的电路布局走线从单层变成双层，灯板 2 上的线路层单层面积，亦即宽度方向上的尺寸，可以进一步减缩，让批次进行固晶的灯板数量可以增加，提升生产率。

进一步地，灯板 2 上未设有光源 202 且突出于灯管 1 的末端区域上的第一线路层 2a 及第二线路层 2c，亦可直接被利用来实现电源组件的电路布局，而让电源组件直接配置在可挠式电路板上得以实现。

请继续参照图 2，灯板 2 上设有若干光源 202，灯头 3 内设有电源 5，光源 202 与电源 5 之间通过灯板 2 电气连通。本发明各实施例中，电源 5 可以为单个体（即所有电源组件都集成在一个部件中），并设于灯管 1 一端的灯头 3 中；或者电源 5 也可以分为两部分，称为双个体（即所有电源组件分别设置在两个部件中），并将两部分分别设于灯管两端的灯头 3 中。如果灯管 1 仅有一端作强化部处理时，电源优先选择为单个体，并设于强化后的端部 101 所对应的灯头 3 中。

不管是单个体还是双个体，电源的形成方式都可以有多重选择，例如，电源可以为一种灌封成型后的模块，具体地，使用一种高导热的硅胶（导热系数≥0.7w/m·k），通过模具对电源组件进行灌封成型，得到电源，这种方式得到的电源具有高绝缘、高散热、外形更规则的优点，且能够方便地与其他结构件配合。或者，电源也可以为不作灌封胶成型，直接将裸露的电源组件置入灯头内部，或者将裸露的电源组件用传统热缩管包住后，再置入灯头 3 内部。

换言之，本发明各实施例中，电源 5 可为如图 23 所示以单片印刷电路板搭载电源组件的形式出现，亦可为如图 38 所示以单个体模块的形式出现。

请参照图 2 并结合图 38，于一实施例中，电源 5 的一端具有公插 51，另一端具有金属插针 52，灯板 2 的端部设有母插 201，灯头 3 上设有用于连接外部电源的空心导电针 301。电源 5 的公插 51 插设于灯板 2 的母插 201 内，金属插针 52 插设于灯头 3 的空心导电针 301 内。此时公插 51 和母插 201 相当于转接头，用于将电源 5 和灯板 2 电连接。当金属插针 52 插入空心导电针 301 内后，经过外部冲压工具冲击空心导电针 301，使得空心导电针 301 发生轻微的变形，从而固定住电源 5 上的金属插针 52，并实现电气连接。

通电时，电流依次通过空心导电针 301、金属插针 52、公插 51 以及母插 201 到达灯板 2，并通过灯板 2 到达光源 202。在其他实施例中，可以不采用公插 51、母插 201 的连接方式，而可以用传统导线打线方式取代，即采用一根传统的金属导线，将金属导线的一端与电源电连接，另一端与灯板 2 电连接，但导线打线连接的方式有可能在运输过程中会有断裂的问题，质量上稍差。在其他实施例中，也可将电源 5 配置于印刷电路板上，再用公插 51、母插 201 的连接方式或用导线打线方式与灯板 2 电性连接，电源 5 的结构则不限于图 38 所示模块化的样态。

说 明 书

本实施例中，电源 5 的输入端具有金属插针 52 连接灯头，另一边输出端可依与灯板 2 的连接模式设置公插、电性金属连接孔或是焊盘。分开来的灯板 2 与电源 5 的输出端之间可以透过公插 51 与母插 201 连接，或者通过导线打线连接，导线的外层可以包裹绝缘套管做为电性绝缘保护。此外，灯板 2 与电源 5 的输出端亦可通过铆钉钉接、锡膏黏接、焊接或是以导线捆绑的方式来直接连接在一起。与前述灯板 2 的固定方式一致，可挠式电路板的一侧表面通过粘接剂片 4 粘接固定于灯管 1 的内周面，而可挠式电路板的两端可以选择固定或者不固定在灯管 1 的内周面上。

如果灯板 2 沿灯管 1 轴向的两端不固定在灯管 1 的内周面上，如果采用导线连接，在后续搬动过程中，由于两端自由，在后续的搬动过程中容易发生晃动，因而有可能使得导线发生断裂。因此灯板 2 与电源 5 的连接方式优先选择为焊接，具体地，参照图 22，可以直接将灯板 2 爬过强化部结构的过渡部 103 后焊接于电源 5 的输出端上，免去导线的使用，提高产品质量的稳定性。此时灯板 2 不需要设置母插 201，电源 5 的输出端也不需要设置公插 51，具体作法可以是如图 24 所示，将电源 5 的输出端留出电源焊盘 a，并在电源焊盘 a 上留锡、以使得焊盘上的锡的厚度增加，方便焊接，相应的，在灯板 2 的端部上也留出光源焊盘 b，并将电源 5 输出端的电源焊盘 a 与灯板 2 的光源焊盘 b 焊接在一起。将焊盘所在的平面定义为正面，则灯板 2 与电源 5 的连接方式以两者正面的焊盘对接最为稳固，但是在焊接时焊接压头必须压在灯板 2 的背面，隔着灯板 2 来对焊锡加热，比较容易出现可靠度的问题。如果如图 25 所示，将灯板 2 正面的光源焊盘 b 中间开出孔洞，再将其正面朝上迭加在电源 5 正面的电源焊盘 a 上来焊接，则焊接压头可以直接对焊锡加热熔解，对实务操作上较为容易实现。

如果可挠式电路板的两端固定在灯管 1 的内周面上，则优先考虑在可挠式电路板上设置母插 201，然后将电源 5 的公插 51 插入母插 201 实现电气连接。

如图 24 所示，上述实施例中，作为灯板 2 的可挠式电路板大部分固定在灯管 1 的内周面上，只有在两端是不固定在灯管 1 的内周面上，不固定在灯管 1 内周面上的灯板 2 形成一自由部 21，在装配时，自由部 21 和电源 5 焊接的一端会带动自由部 21 向灯管 1 内部收缩，灯板 2 的自由部 21 会因收缩而变形，使用上述的具有穿孔焊垫的灯板 2，灯板 2 具有光源的一侧和电源 5 焊接的电源焊

盘 a 是朝向同一侧的，灯板 2 的自由部 21 因收缩而变形时，灯板 2 和电源 5 焊接的一端对电源 5 是有一个侧向的拉力，相较于灯板 2 具有光源 202 的一侧和电源 5 焊接的电源焊盘 a 是朝向不同一侧的焊接法，灯板 2 和电源 5 焊接的一端对电源 5 还有一个向下的拉力，使用上述的具有穿孔焊垫的灯板 2，形成结构性的电连接固定增强具有更佳的效果。在本实施例中，灯板 2 的光源焊盘 b 位于灯板 2 具有光源的另一侧，灯板 2 的光源焊盘 b 和电源 5 焊接的电源焊盘 a 相对应焊接固定。在装配时，灯板 2 的自由部 21 朝向灯管 1 的内部收缩而变形，受力变形的自由部 21 位于灯板 2 具有光源的相同侧。值得注意的是，当前述提及作为灯板 2 的可挠式电路板具有二层线路层夹一介电层的结构时，前述灯板 2 未设有光源 202 且突出于灯管 1 的末端区域可作为自由部 21，而让自由部 21 实现二层线路层的连通及电源组件的电路布局。

如图 25 所示，灯板 2 的光源焊盘 b 为两个不连接的焊垫，分别和光源 202 正负极电连接，焊垫的大小约为 3.5×2 mm^2，电源 5 的印刷电路板上也有与其相对应的焊垫，焊垫的上方为便于焊接机台自动焊接而有预留锡，锡的厚度可为 0.1 至 0.7 mm，较佳值为 0.3 至 0.5 mm 较为恰当，以 0.4 mm 为最佳。在两个焊垫之间可设置一绝缘孔洞 c，避免两个焊垫在焊接的过程中因焊锡熔接在一起而造成电性短路，此外在绝缘孔洞 c 的后方还可设置定位孔 d，用来让自动焊接机台可正确判断出光源焊盘 b 的正确位置。

灯板的光源焊盘 b 具有至少一个焊垫，分别和光源 202 正负极电连接。在其他实施例中，为了能达到兼容性及后续使用上的扩充性，光源焊盘 b 的数量可以具有一个以上的焊垫，例如 1 个、2 个、3 个、4 个或是 4 个以上。当焊垫为 1 个时，灯板对应二端都会分别与电源电连接，以形成一回路，此时可利用电子组件取代的方式，例如:以电感取代电容当作稳流组件。如图 26 至 28 所示，当焊垫为 3 个时，第 3 个焊垫可以用作接地使用，当焊垫为 4 个时，第 4 个焊垫可以用来作讯号输入端。相应的，电源焊盘 a 亦留有和光源焊盘 b 数量相同的焊垫。当焊垫为 3 个以上时，焊垫间的排列可以为一列并排或是排成两列，依实际使用时的容置面积大小配置在适当的位置，只要彼此不电连接造成短路即可。在其他实施例中，若是将部份电路制作在可挠式电路板上，光源焊盘 b 可以只具有单独一个焊垫，焊垫数量愈少，在工艺上愈节省流程；焊垫数量愈多，可挠式电路板和电源输出端的电连接固定愈增强。

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如图 30 所示，在其他实施例中，光源焊盘 b 的焊垫内部可以具有焊接穿孔 e 的结构，焊接穿孔 e 的直径可为 1 至 2 mm，较佳为 1.2 至 1.8 mm，最佳为 1.5 mm，太小则焊接用的锡不易穿越。当电源 5 的电源焊盘 a 与灯板 2 的光源焊盘 b 焊接在一起时，焊接用的锡可以穿过所述的焊接穿孔 e，然后堆积在焊接穿孔 e 上方冷却凝结，形成具有大于焊接穿孔 e 直径的焊球结构 g，这个焊球结构 g 会起到像是钉子的功能，除了透过电源焊盘 a 和光源焊盘 b 之间的锡固定外，更可以因为焊球结构 g 的作用而增强电性连接的稳固定。

如图 31 至图 32 所示，在其他实施例中，当光源焊盘 b 的焊接穿孔 e 距离灯板 2 的边缘≦1 mm 时，焊接用的锡会穿过所述的孔洞 e 而堆积在孔洞上方边缘，过多的锡也会从灯板 2 的边缘往下方回流，然后与电源焊盘 a 上的锡凝结在一起，其结构就像是一个铆钉将灯板 2 牢牢的钉在电源 5 的电路板上，具有可靠的电性连接功能。此外，焊接穿孔 e 的直径太小会阻碍锡穿过所述的孔洞，因此也可以将光源焊盘 b 的焊接穿孔 e 直接改为如图 33 及图 34 所是的焊接缺口 f，焊接用的锡透过所述的焊接缺口 f 把电源焊盘 a 和光源焊盘 b 电连接固定，锡更容易爬上光源焊盘 b 而堆积在焊接缺口 f 周围，当冷却凝结后会有更多的锡形成具有大于焊接缺口 f 直径的焊球，这个焊球结构会让电性连接结构的固定能力增强。

在其他实施例中，焊垫的焊接穿孔是在边缘，也就是焊垫具有一焊接缺口，焊接用的锡透过所述的焊接缺口把电源焊盘 a 和光源焊盘 b 电连接固定，锡会堆积在焊接穿孔周围，当冷却后，会形成具有大于焊接穿孔直径的焊球，这个焊球结构会形成结构性的电连接固定增强，本实施例中，因为焊接缺口的设计，焊接用的锡起到像是 C 形钉子的功能。

焊垫的焊接穿孔不论是先形成好，或是在焊接的过程中直接用焊接压头打穿，都可以达到本实施例所述的结构。所述的焊接压头其与焊锡接触的表面可以为平面或是具有凹部和凸出部的表面，凸出部可以为长条状或是网格状，所述的凸出部不完全将穿孔覆盖，确保焊锡能从穿孔穿出，当焊锡穿出焊接穿孔堆积在焊接穿孔周围时，凹部能提供焊球的容置位置。在其他实施例中，作为灯板 2 的可挠式电路板具有一定位孔，在焊接时可以透过定位孔将电源焊盘 a 和光源焊盘 b 的焊垫精准的定位。

请参照图 40，于上述实施例中，灯板 2 的光源焊盘 b 和电源 5 的电源焊盘

a 可透过焊接方式固定，焊垫的穿孔不论是先形成好，或是在焊接的过程中系直接用焊接压头 41 打穿。如图 40 所示，所述的焊接压头 41 大致可分成四个区域：压焊面 411、导流槽 412、锡成形槽 413 以及压制面 414, 压焊面 411 为与焊锡实际接触的表面，提供焊接时的压力与加热源，其形状可以为平面或是具有凹部和凸出部的表面，凸出部可以为长条状或是网格状，所述的凸出部不会完全将焊盘上的孔洞覆盖，在焊接压头 41 中间压焊面 411 下缘的部分有复数个圆弧形下凹的导流槽 412，其主要功能即是确保经过压焊面 411 加热熔解的焊锡能从下凹的导流空间流入穿过焊盘的孔洞或缺口，故，导流槽 412 具有导流和止挡(stopper)的功能，当焊锡穿出孔洞或缺口堆积在其表面周围时，位于导流槽 412 下方比导流槽 412 更下凹的锡成形槽 413 即为提供焊锡凝结成焊球的容置位置。另外在成形槽 413 周边比压焊面 411 略为低一点的平面则是压制面 414，其与压焊面 411 的高低厚度差别即为灯板 2 的厚度，主要功能就是在焊接的过程中能够确实将灯板 2 压制固定在电源 5 的印刷电路板上。

请参照图 41、图 25 及图 40，灯板 2 与电源 5 的印刷电路板上也有与其相对应的焊垫，焊垫的上方为便于焊接机台自动焊接而有预留锡，一般而言锡的厚度较佳值为 0.3 至 0.5 mm 则可以将灯板 2 稳固地焊接在电源 5 的印刷电路板上。若发生如图 41 中所示，二个焊垫上预留锡的厚度相差太大时，焊接压头 41 在焊压过程中，就会发生一个焊垫已经先接触预留锡而加热熔化，另一个预留锡要等前述预留锡熔化至相同高度而被焊接压头 41 接触后才会开始熔化，如此，预留锡厚度较低的那一个焊垫，常会发生焊接不牢靠的状况，进而影响到灯板 2 与电源 5 的印刷电路板电性连接。因此，本实施例应用动平衡的原理解决此一状况。于本实施例中，可在焊接压头 41 的设备上设置一连动机构，始动焊接压头 41 为一可转动的机构，当焊接压头 41 接触并侦测到二个焊垫上预留锡的压力值相同时，再施予和压过程，即可解决上述的状况。

上述实施例中，是以灯板 2 与电源 5 的印刷电路板不动，而转动焊接机台的焊接压头 41 的动平衡原理来达成焊压过程，在其他实施例中，如图 42 所示，则是以焊接压头 41 不动，而转动灯板 2 的动平衡原理来达成焊压过程。首先，先将灯板 2 与电源 5 的印刷电路板放置于一载具装置 60 中，载具装置 60 包括一灯板载具 61 用以承载灯板 2 与电源 5 的印刷电路板，以及一载具支架 62 用以承载灯板载具 61。灯板载具 61 包括一转动轴 63 以及二弹性组件 64 分别设于

转动轴二侧用以当灯板载具 61 空载时保持灯板载具 61 呈水平状态。于本实施例中，弹性组件 64 为弹簧，且弹簧的一端分别设置于载具支架 62 上作为支点，当图 42 中所示具二边厚度不一的预留锡的灯板 2 放置在灯板载具 61 上时，灯板载具 61 会受转动轴 63 驱动而转动，直至焊接压头 41 侦测到二边预留锡的压力相等时，才会开始执行焊压过程，如图 43 所示，此时转动轴二侧的弹性组件 64 分别后一拉力与一压力，当焊压过程完成后，转动轴 63 的驱动力即会移除，且藉由转动轴 63 二侧的弹性组件 64 的回复力而使得灯板载具 61 回复到原始的水平状态。当然，本实施例的灯板载具 61 也可以其他方式的机构来达成，而并非必需要转动轴 63 与弹性组件 64，例如于灯板载具 61 内建驱动马达、主动式转动机构等，此时载具支架 62(固设弹性组件 64 的作用)也非必要组件，凡利用动平衡的原理而带动灯板 2 转动的方式达成焊压过程的变化例，均不脱离本发明的范畴，以下则不再赘述。

请参照图 35 和图 36，在其它的实施方式中，上述透过焊接方式固定的灯板 2 和电源 5 可以用搭载有电源组件 250 的长短电路板的组合件 25 取代。长短电路板的组合件 25 具有一长电路板 251 和一短电路板 253，长电路板 251 和短电路板 253 彼此贴合透过黏接方式固定，短电路板 253 位于长电路板 251 周缘附近。短电路板 253 上具有电源组件 25,整体构成电源。长电路板 251 可以为上述作为灯板 2 的可挠式电路板或柔性基板，短电路板 253 材质较长电路板 251 硬，以达到支撑电源组件 250 的作用。短电路板 253 的长度约为 15 毫米至 40 毫米，较佳为 19 毫米至 36 毫米，长电路板 251 的长度可为 800 毫米至 2800 毫米，较佳为 1200 毫米至 2400 毫米。短电路板 253 和长电路板 251 的比例可以为 1:20 至 1:200。

灯板 2 的线路层 2a 和电源组件 250 电连接的方式可依实际使用情况有不同的电连接方式。如图 35 所示，电源组件 250 和长电路板 251(即灯板 2 的线路层 2a)皆位于短电路板 253 的同一侧，电源组件 250 直接与长电路板 251 电气连接。如图 36 所示，电源组件 250 和长电路板 251(即灯板 2 的线路层 2a)系分别位于短电路板 253 的两侧，电源组件 250 穿透过短电路板 253 和灯板 2 的线路层 2a 电气连接。特予说明的是，本实施例的长短电路板的组合件 25 省略了前述实施例中灯板 2 和电源 5 要用焊接的方式固定的情况，而是先将长电路板 251 和短电路板 253 黏接固定，再将电源组件 250 和灯板 2 的线路层 2a 电气连接。此外，

灯板 2 如上述并不仅限于一层或二层电路板，光源 202 设于线路层 2a，通过线路层 2a 与电源 5 电气连通。

此外，在另一实施例中，长短电路板的组合件 25 具有一长电路板 251 和一短电路板 253，长电路板 251 可以为上述灯板 2 的可挠式电路板或柔性基板，灯板 2 包括一线路层 2a 与一介电层 2b，先将介电层 2b 和短电路板 253 以拼接方式固接，之后，再将线路层 2a 贴附在介电层 2b 上并延伸至短电路板 253 上，也不脱离本发明长短电路板的组合件 25 的应用范围。

此外，在前述的实施例中，当灯板 2 和电源 5 系透过焊接方式固定时，灯板 2 的端部并不固定在灯管 1 的内周面上，无法安全的固定支撑住电源 5，在其他实施例中，若电源 5 必须另行固定在灯管 1 端部的灯头内，则灯头会相对较长而压缩了灯管 1 有效的发光面积。请进一步参考图 39 为本发明的另一实施例的结构图。在本实施例中，所使用的灯板为硬式铝基板 22，因其端部可相对的固定在灯管 1 的端部，而电源 5 则采用垂直于铝基板 22 的方式焊接固定在铝基板 22 端部上方，一来便于焊接工艺的实施，二来灯头 3 不需要具有足以承载电源 5 的总长度的空间而可以缩短长度，如此可增加灯管有效的发光面积。此外，在前述的实施例中，电源 5 上除了装设有电源组件之外，还需要另行焊接金属导线与灯头 3 的空心导电针 301 形成电气连接。在本实施例中，可以直接使用于电源 5 上，做为电源组件的导电引脚 53 与灯头 3 电气连接，不需额外再焊接其它导线，更有利于制程的简化。

接下来说明电源组件 250 的电路设计及应用。

请参见图 49A，为根据本发明第一较佳实施例的 LED 日光灯的电源组件的应用电路方块示意图。交流电源 508 系用以提供交流电源讯号。交流电源 508 可以为市电，电压范围 100-277V，频率为 50 或 60Hz。灯管驱动电路 505 接收交流电源 508 的交流电源讯号，并转换成交流驱动讯号以做为外部驱动讯号。灯管驱动电路 505 可以为电子镇流器，用以将市电的讯号转换而成高频、高压的交流驱动讯号。常见电子镇流器的种类，例如：瞬时启动型(Instant Start)电子镇流器、预热型启动型(Program Start)电子镇流器、快速型启动型(Rapid Start) 电子镇流器等，本发明的 LED 日光灯均适用。交流驱动讯号的电压大于 300V，较佳电压范围为 400-700V；频率大于 10kHz，较佳频率范围为 20k-50kHz。LED

日光灯 500 接收外部驱动讯号，在本实施例中，外部驱动讯号为灯管驱动电路 505 的交流驱动讯号，而被驱动发光。在本实施例中，LED 日光灯 500 为单端电源的驱动架构，灯管的一端灯头具有两个接脚 501、502，接脚 501、502 耦接(即，电性连接、或直接或间接连接)至灯管驱动电路 505 以接收交流驱动讯号。

值得注意的是，灯管驱动电路 505 为可省略的电路，故在图式中以虚线标示出。当灯管驱动电路 505 省略时，交流电源 508 与接脚 501、502 耦接。此时，接脚 501、502 接收交流电源 508 所提供的交流电源讯号，以做为外部驱动讯号。

除了上述的单端电源的应用外，本发明的 LED 日光灯 500 也可以应用至双端单接脚的电路结构。请参见图 49B，为根据本发明第二较佳实施例的 LED 日光灯的电源组件的应用电路方块示意图。相较于图 49A 所示，接脚 501、502 分别置于 LED 日光灯 500 的灯管的双端灯头以形成双端各单接脚，其余的电路连接及功能则与图 49A 所示电路相同。

接着，请参见图 49C，为根据本发明第一较佳实施例的 LED 灯的电路方块示意图。LED 灯的电源组件主要包含整流电路 510、滤波电路 520 以及 LED 驱动模块 530。整流电路 510 耦接接脚 501、502，以接收外部驱动讯号，并对外部驱动讯号进行整流后由整流输出端 511、512 输出整流后讯号。在此的外部驱动讯号可以是图 49A 及图 49B 中的交流驱动讯号或交流电源讯号，甚至也可以为直流讯号而不影响 LED 灯的操作。滤波电路 520 耦接整流输出端 511、512 以接收整流后讯号，并对整流后讯号进行滤波，然后由滤波后输出端 521、522 输出滤波后讯号。LED 驱动模块 530 耦接滤波后输出端 521、522 以接收滤波后讯号，然后驱动 LED 驱动模块 530 内的 LED 单元(未绘出)发光。此部分请详见之后实施例的说明。

值得注意的是，在本实施例中，整流输出端 511、512 及滤波后输出端 521、522 的数量均为二，而实际应用时则根据整流电路 510、滤波电路 520 以及 LED 驱动模块 530 各电路间讯号传递的需求增加或减少，即各电路间耦接端点可以为一个或以上。

再者，图 49C 所示的 LED 灯的电源组件以及以下 LED 灯的电源组件的各实施例，除适用于图 49A 及图 49B 所示的 LED 日光灯外，对于包含两接脚用以传递电力的发光电路架构，例如：球泡灯、PAL 灯等均适用。

请参见图 49D，为根据本发明第三较佳实施例的 LED 日光灯的电源组件的应用电路方块示意图。交流电源 508 系用以提供交流电源讯号。灯管驱动电路 505 接收交流电源 508 的交流电源讯号，并转换成交流驱动讯号。LED 日光灯 500 接收灯管驱动电路 505 的交流驱动讯号，而被驱动发光。在本实施例中，LED 日光灯 500 为双端(各双接脚)电源，灯管的一端灯头具有接脚 501、502，另一端灯头具有接脚 503、504。接脚 501、502、503 及 504 耦接至灯管驱动电路 505 以接收交流驱动讯号，以驱动 LED 日光灯 500 内的 LED 单元(未绘出)发光。交流电源 508 可以为市电，而灯管驱动电路 505 可以是安定器或电子镇流器。

请参见图 49E，为根据本发明第二较佳实施例的 LED 灯的电路方块示意图。LED 灯的电源组件主要包含整流电路 510、滤波电路 520、LED 驱动模块 530 以及整流电路 540。整流电路 510 耦接接脚 501、502，用以接收并整流接脚 501、502 所传递的外部驱动讯号；整流电路 540 耦接接脚 503、504，用以接收并整流接脚 503、504 所传递的外部驱动讯号。整流电路 510、540 共同于整流输出端 511、512 输出整流后讯号。滤波电路 520 耦接整流输出端 511、512 以接收整流后讯号，并对整流后讯号进行滤波，然后由滤波后输出端 521、522 输出滤波后讯号。LED 驱动模块 530 耦接滤波后输出端 521、522 以接收滤波后讯号，然后驱动 LED 驱动模块 530 内的 LED 单元(未绘出)发光。

本实施例的 LED 灯的电源组件可以应用至图 49D 的双端电源架构。值得注意的是，由于本实施例的 LED 灯的电源组件同时具有整流电路 510、540，也可以应用至图 49A、B 的单端电源架构，来接收外部驱动讯号(包含前述实施例中的交流电源讯号、交流驱动讯号等)。当然，除本实施例外，其余各实施例的的 LED 灯的电源组件也可以应用至直流讯号的驱动架构。

请参见图 50A，为根据本发明第一较佳实施例的整流电路的电路示意图。整流电路 610 包含整流二极管 611、612、613 及 614，用以对所接收的讯号进行全波整流。整流二极管 611 的正极耦接整流输出端 512，负极耦接接脚 502。整流二极管 612 的正极耦接整流输出端 512，负极耦接接脚 501。整流二极管 613 的正极耦接接脚 502，负极耦接整流输出端 511。整流二极管 614 的正极耦接接脚 501，负极耦接整流输出端 511。

当接脚 501、502 接收的讯号为交流讯号时，整流电路 610 的操作描述如下。当交流讯号处于正半波时，交流讯号依序经接脚 501、整流二极管 614 和整流输

出端 511 后流入，并依序经整流输出端 512、整流二极管 611 和接脚 502 后流出。当交流讯号处于负半波时，交流讯号依序经接脚 502、整流二极管 613 和整流输出端 511 后流入，并依序经整流输出端 512、整流二极管 612 和接脚 501 后流出。因此，不论交流讯号处于正半波或负半波，整流电路 610 的整流后讯号的正极均位于整流输出端 511，负极均位于整流输出端 512。依据上述操作说明，整流电路 610 输出的整流后讯号为全波整流讯号。

当接脚 501、502 耦接直流电源而接收直流讯号时，整流电路 610 的操作描述如下。当接脚 501 耦接直流电源的正端而接脚 502 耦接直流电源的负端时，直流讯号依序经接脚 501、整流二极管 614 和整流输出端 511 后流入，并依序经整流输出端 512、整流二极管 611 和接脚 502 后流出。当接脚 501 耦接直流电源的负端而接脚 502 耦接直流电源的正端时，交流讯号依序经接脚 502、整流二极管 613 和整流输出端 511 后流入，并依序经整流输出端 512、整流二极管 612 和接脚 501 后流出。同样地，不论直流讯号如何透过接脚 501、502 输入，整流电路 610 的整流后讯号的正极均位于整流输出端 511，负极均位于整流输出端 512。

因此，在本实施例的整流电路 610 不论所接收的讯号为交流讯号或直流讯号，均可正确输出整流后讯号。

请参见图 50B，为根据本发明第二较佳实施例的整流电路的电路示意图。整流电路 710 包含整流二极管 711 及 712，用以对所接收的讯号进行半波整流。整流二极管 711 的正端耦接接脚 502，负端耦接整流输出端 511。整流二极管 712 的正端耦接整流输出端 511，负端耦接接脚 501。整流输出端 512 视实际应用而可以省略或者接地。

接着说明整流电路 710 的操作如下。

当交流讯号处于正半波时，交流讯号在接脚 501 输入的讯号准位高于在接脚 502 输入的讯号准位。此时，整流二极管 711 及 712 均处于逆偏的截止状态，整流电路 710 停止输出整流后讯号。当交流讯号处于负半波时，交流讯号在接脚 501 输入的讯号准位低于在接脚 502 输入的讯号准位。此时，整流二极管 711 及 712 均处于顺偏的导通状态，交流讯号经由整流二极管 711、整流输出端 511 而流入，并由整流输出端 512 或 LED 灯的另一电路或接地端流出。依据上述操作说明，整流电路 710 输出的整流后讯号为半波整流讯号。

请参见图 50C，为根据本发明第三较佳实施例的整流电路的电路示意图。整

流电路 810 包含整流单元 815 和端点转换电路 541，以进行半波整流。在本实施例中，整流单元 815 为半波整流电路，包含整流二极管 811 及 812，用以进行半波整流。整流二极管 811 的正端耦接整流输出端 512，负端耦接半波连接点 819。整流二极管 812 的正端耦接半波连接点 819，负端耦接整流输出端 511。端点转换电路 541 耦接半波连接点 819，以及接脚 501 及 502，用以将接脚 501 及 502 所接收的讯号传递至半波连接点 819。藉由端点转换电路 541 的端点转换功能，整流电路 810 可以提供两个输入端(耦接接脚 501 及 502 的端点)及两个输出端(整流输出端 511 及 512)。

接着说明整流电路 810 的操作如下。

当交流讯号处于正半波时，交流讯号依序经接脚 501(或者接脚 502)、端点转换电路 541、半波连接点 819、整流二极管 812 和整流输出端 511 后流入，并由 LED 灯的另一电路流出。当交流讯号处于负半波时，交流讯号并由 LED 灯的另一电路流入，然后经整流输出端 512、整流二极管 811、半波连接点 819、端点转换电路 541 和接脚 501(或者接脚 502) 后流出。

值得注意的是，端点转换电路 541 可以包含电阻、电容、电感或其组合，来同时具有限流/限压、保护、电流/电压调节等功能。这些功能的说明请参见于后说明。

实际应用上，整流单元 815 和端点转换电路 541 可以调换而不影响半波整流功能。请参见图 50D，为根据本发明第四较佳实施例的整流电路的电路示意图。整流二极管 811 的正端耦接接脚 502，整流二极管 812 的负端耦接接脚 501，而整流二极管 811 的负端及整流二极管 812 的正端同时耦接半波连接点 819。端点转换电路 541 耦接半波连接点 819，以及整流输出端 511 及 512。当交流讯号处于正半波时，交流讯号并由 LED 灯的另一电路流入，然后经整流输出端 512(或者整流输出端 511)、端点转换电路 541 半波连接点 819、整流二极管 812、和接脚 501 后流出。当交流讯号处于负半波时，交流讯号依序经接脚 502、整流二极管 811、半波连接点 819、端点转换电路 541 和整流输出端 511(或整流输出端 512)后流入，并由 LED 灯的另一电路流出。

值得说明的是，图 50C 和图 50D 所示的实施例中的和端点转换电路 541 可以被省略，故以虚线来表示。图 50C 省略端点转换电路 541 后，接脚 501 及 502 耦接至半波连接点 819。图 50D 省略端点转换电路 541 后，整流输出端 511 及

512 耦接至半波连接点 819。

图 50A 到图 50D 所示的整流电路的接脚 501 及 502 变更为接脚 503 及 504 时，即可作为图 49E 所示的整流电路 540。

接着搭配图 49C、图 49E 来说明整流电路 510、540 的选用及组合。

图 49C 所示实施例的整流电路 510 可以使用图 50A 所示的整流电路 610。

图 49E 所示实施例的整流电路 510、540 则可以使用图 50A 至图 50D 中的任一整流电路，而图 50C 和图 50D 所示的整流电路也可以省略端点转换电路 541 而不影响 LED 日光灯操作所需的整流功能。当整流电路 510、540 选用图 50B 至图 50D 的半波整流的整流电路时，随着交流讯号处于正半波或负半波，整流电路 510 及 540 其中之一负责流入，另一负责流出。再者，整流电路 510、540 若同时选用图 50C 或图 50D，或者图 50C 和图 50D 各一，则其中之一的端点转换电路 541 即可具有限流/限压、保护、电流/电压调节的功能，另一端点转换电路 541 可以省略。

请参见图 51A，为根据本发明第一较佳实施例的端点转换电路的电路示意图。端点转换电路 641 包含电容 642，电容 642 的一端同时耦接接脚 501 及 502，另一端耦接半波连接点 819。电容 642 对交流讯号具有等效阻抗值。交流讯号的频率越低，电容 642 的等效阻抗值越大；交流讯号的频率越高，电容 642 的等效阻抗值越小。因此，本实施例的端点转换电路 641 中的电容 642 具有高通滤波作用。再者，端点转换电路 641 与 LED 灯中的 LED 单元为串联，并具有等效阻抗下，对 LED 单元具有限流、限压的作用，可以避免 LED 单元的电流及跨压过高而损害 LED 单元。另外，藉由配合交流讯号的频率选择电容 642 的容值，更可对 LED 单元具有电流、电压调节的作用。

值得注意的是，端点转换电路 641 可以额外包含电容 645 或/及电容 646。电容 645 一端耦接半波连接点 819，另一端耦接接脚 503。电容 646 一端耦接半波连接点 819，另一端耦接接脚 504。这样的电路架构下，接脚 501 及 502 其中之一与接脚 503 之间有串联的电容 642 及 645，或者接脚 501 及 502 其中之一与接脚 504 之间有串联的电容 642 及 646。藉由串联的电容的等效阻抗值，交流讯号被分压。请同时参见图 49E，根据串联的电容的等效阻抗值的比例，可以控制整流电路 510 中的电容 642 的跨压以及滤波电路 520 及 LED 驱动模块 530 上的跨压，避免过高电压毁损滤波电路 520 及 LED 驱动模块 530 而达到保护滤波电

路 520 及 LED 驱动模块 530 的作用。

请参见图 51B，为根据本发明第二较佳实施例的端点转换电路的电路示意图。端点转换电路 741 包含电容 743 及 744。电容 743 的一端耦接接脚 501，另一端耦接半波连接点 819。电容 744 的一端耦接接脚 502，另一端耦接半波连接点 819。相较于图 51A 所示的端点转换电路 641，端点转换电路 741 主要系将电容 642 改为两个电容 743 及 744。电容 743 及 744 的电容值可以相同，也可以视接脚 501 及 502 所接收的讯号大小而为不同。

同样地，端点转换电路 741 可以额外包含电容 745 或/及电容 746，分别耦接至接脚 503 及 504。如此，接脚 501 及 502 中任一与接脚 503 及 504 中任一均有串联的电容而达到分压作用以及保护的功能。

请参见图 51C，为根据本发明第三较佳实施例的端点转换电路的电路示意图。端点转换电路 841 包含电容 842、843 及 844。电容 842 及 843 串联于接脚 501 及半波连接点 819 之间。电容 842 及 844 串联于接脚 502 及半波连接点 819 之间。在这样的电路架构下，电容 842、843 及 844 之间任一短路，接脚 501 及半波连接点 819 接脚之间以及 502 及半波连接点 819 之间均仍存在电容而仍有限流的作用。因此，对于使用者误触 LED 灯而发生触电时，可以避免过高电流流经人体而造成使用者触电伤害。

同样地，端点转换电路 841 可以额外包含电容 845 或/及电容 846，分别耦接至接脚 503 及 504。如此，接脚 501 及 502 中任一与接脚 503 及 504 中任一均有串联的电容而达到分压作用以及保护的功能。

请参见图 51D，为根据本发明第四较佳实施例的端点转换电路的电路示意图。端点转换电路 941 包含保险丝 947、948。保险丝 947 一端耦接接脚 501，另一端耦接半波连接点 819。保险丝 948 一端耦接接脚 502，另一端耦接半波连接点 819。藉此，当接脚 501 及 502 任一流经的电流高于保险丝 947 及 948 的额定电流时，保险丝 947 及 948 就会对应地熔断而开路，藉此达到过流保护的功能。

当然，上述端点转换电路的实施例中的接脚 501 及 502 改为接脚 503 及 504(以及接脚 503 及 504 改为接脚 501 及 502)，即可转用至整流电路 540。

上述端点转换电路实施例中的电容的电容值较佳为落在 100pF ~ 100nF 之间。另外，电容可以并联或串联的二个或以上的电容来等效取代。例如：电容

642、842 可以用两个电容串联来代替。2 个电容其中之一的容值可自 1.0nF~2.5 nF 的范围内选取，较佳的选取 1.5nF；另一个选自 1.5nF~3.0 nF 的范围，较佳的选取 2.2nF。

请参见图 52A，为根据本发明第一较佳实施例的滤波电路的电路方块示意图。滤波电路 520 包含滤波单元 523，耦接整流输出端 511 及 512，以接收整流电路所输出的整流后讯号，并滤除整流后讯号中的纹波后输出滤波后讯号。因此，滤波后讯号的波形较整流后讯号的波形更平滑。滤波电路 520 也可更包含另一滤波单元 524，用以滤除电磁干扰(EMI)。滤波单元 524 也耦接整流输出端 511 及 512，而与滤波单元 523 并联，而使滤波电路的滤波能力更为加强。由于滤波单元 524 可视实际应用情况增加或省略，故图中以虚线表示之。

请参见图 52B，为根据本发明第一较佳实施例的滤波单元的电路示意图。滤波单元 623 包含一电容 625。电容 625 的一端耦接整流输出端 511 及滤波输出端 521，另一端耦接整流输出端 512 及滤波输出端 522，以对由整流输出端 511 及 512 输出的整流后讯号进行低通滤波，以滤除整流后讯号中的高频成分而形成滤波后讯号，然后由滤波输出端 521 及 522 输出。

请参见图 52C，为根据本发明第二较佳实施例的滤波单元的电路示意图。滤波单元 723 为 π 型滤波电路，包含电容 725、电感 726 以及电容 727。电容 725 的一端耦接整流输出端 511 并同时经过电感 726 耦接滤波输出端 521，另一端耦接整流输出端 512 及滤波输出端 522。电感 726 耦接于整流输出端 511 及滤波输出端 521 之间。电容 727 的一端经过电感 726 耦接整流输出端 511 并同时耦接滤波输出端 521，另一端耦接整流输出端 512 及滤波输出端 522。

等效上来看，滤波单元 723 较图 52B 所示的滤波单元 623 多了电感 726 及电容 727。而且电感 726 与电容 727 也同电容 725，具有低通滤波作用。故，本实施例的滤波单元 723 相较于图 52B 所示的滤波单元 623，具有更佳的高频滤除能力，所输出的滤波后讯号的波形更为平滑。

上述实施例中的电感 726 的感值较佳为选自 10nH~10mH 的范围。电容 625、725、727 的容值较佳为选自 100pF ~ 1uF 的范围。

请参见图 52D，为根据本发明第三较佳实施例的滤波单元的电路示意图。滤波单元 823 包含电容 825 及电感 828。电容 825 的一端耦接整流输出端 511 及滤波输出端 521，另一端耦接整流输出端 512 及滤波输出端 522，以对由整流输

出端 511 及 512 输出的整流后讯号进行低通滤波，以滤除整流后讯号中的高频成分。电感 828 的一端耦接整流输出端 511 及滤波输出端 521，另一端耦接整流输出端 512 及滤波输出端 522，以对由整流输出端 511 及 512 输出的整流后讯号进行高通滤波，以滤除整流后讯号中的低频成分。因此，电容 825 及电感 828 的结合可对整流后讯号对特定频率呈现高阻抗。

经由适当地选取电容 825 的容值以及电感 828 的感值，可使高阻抗的中心频率位于特定频率上，中心频率为 $f=\frac{1}{2\pi\sqrt{LC}}$，其中 L 为电感 828 的感值，C 为电容 825 的容值。例如：较佳的中心频率为 25kHz，具有滤波单元 823 的 LED 灯可符合 UL 认证的安规要求。

值得注意的是，滤波单元 823 可包含电阻 829。电阻 829 耦接于整流输出端 511 及滤波输出端 521 之间。因此，电阻 829 与并联的电容 825、电感 828 串联。电阻 829 用以调整电容 825 及电感 828 所构成的 LC 电路的 Q 值，以更适应于不同 Q 值要求的应用环境。由于电阻 829 为非必要组件，故在本实施例中以虚线表示。

电容 824 的容值较佳为在 10nF~ 2uF 的范围内。电感 828 的感值较佳为小于 2mH，更佳为小于 1mH。电阻 829 较佳为大于 50 奥姆，更佳为大于 500 奥姆。

除了上述的实施例所示的滤波电路外，传统的低通或带通滤波器均可以作为本发明的滤波单元而使用于滤波电路内。

请参见图 52E，为根据本发明第二较佳实施例的滤波单元的电路方块示意图。在本实施例中，滤波单元 924 设计于图 50A 所示的整流电路 610 之内，一端耦接整流二极管 611 及 612 的正端并同时耦接整流输出端 511，另一端耦接整流二极管 613 及 614 的负端并同时耦接整流输出端 512，用以滤除电磁干扰 (EMI)。滤波单元 924 可以是图 52B 至图 52D 的任一滤波单元。

请参见图 53A，为根据本发明第一较佳实施例的 LED 模块的电路示意图。LED 模块 630 的正端耦接滤波输出端 521，负端耦接输出端 522。LED 模块 630 包含至少一个 LED 单元 632。LED 单元 632 为两个以上时彼此并联。每一个 LED 单元的正端耦接 LED 模块 630 的正端，以耦接滤波输出端 521；每一个 LED 单元的负端耦接 LED 模块 630 的负端，以耦接滤波输出端 522。LED 单元 632 包含至少一个 LED 组件 631。当 LED 组件 631 为复数时，LED 组件 631 串联成一

串，第一个 LED 组件 631 的正端耦接所属 LED 单元 632 的正端，第一个 LED 组件 631 的负端耦接下一个(第二个)LED 组件 631。而最后一个 LED 组件 631 的正端耦接前一个 LED 组件 631 的负端，最后一个 LED 组件 631 的负端耦接所属 LED 单元 632 的负端。

值得注意的是，LED 模块 630 可产生电流侦测讯号 S531，代表 LED 模块 630 的流经电流大小，以作为侦测、控制 LED 模块 630 之用。

请参见图 53B，为根据本发明第二较佳实施例的 LED 模块的电路示意图。LED 模块 630 的正端耦接滤波输出端 521，负端耦接输出端 522。LED 模块 630 包含至少二个 LED 单元 732，而且每一个 LED 单元 732 的正端耦接 LED 模块 630 的正端，以及负端耦接 LED 模块 630 的负端。LED 单元 732 包含至少二个 LED 组件 731，在所属的 LED 单元 732 内的 LED 组件 731 的连接方式如同图 53A 所描述般，LED 组件 731 的负极与下一个 LED 组件 731 的正极耦接，而第一个 LED 组件 731 的正极耦接所属 LED 单元 732 的正极，以及最后一个 LED 组件 731 的负极耦接所属 LED 单元 732 的负极。再者，本实施例中的 LED 单元 732 之间也彼此连接。每一个 LED 单元 732 的第 n 个 LED 组件 731 的正极彼此连接，负极也彼此连接。因此，本实施例的 LED 模块 630 的 LED 组件间的连接为网状连接。

相较于图 54A 至图 54G 的实施例，上述实施例的 LED 驱动模块 530 包含 LED 模块 630 但未包含驱动电路。

同样地，本实施例的 LED 模块 630 可产生电流侦测讯号 S531，代表 LED 模块 630 的流经电流大小，以作为侦测、控制 LED 模块 630 之用。

另外，实际应用上，LED 单元 732 所包含的 LED 组件 731 的数量较佳为 15-25 个，更佳为 18-22 个。

请参见图 53C，为根据本发明第一较佳实施例的 LED 模块的走线示意图。本实施例的 LED 组件 831 的连接关系同图 53B 所示，在此以三个 LED 单元为例进行说明。正极导线 834 与负极导线 835 接收驱动讯号，以提供电力至各 LED 组件 831，举例来说：正极导线 834 耦接前述滤波电路 520 的滤波输出端 521，负极导线 835 耦接前述滤波电路 520 的滤波输出端 522，以接收滤波后讯号。为方便说明，图中将每一个 LED 单元中的第 n 个划分成同一 LED 组 833。

正极导线 834 连接最左侧三个 LED 单元中的第一个 LED 组件 831，即如图所示最左侧 LED 组 833 中的三个 LED 组件的(左侧)正极，而负极导线 835 连接三个 LED 单元中的最后一个 LED 组件 831，即如图所示最右侧 LED 组 833 中的三个 LED 组件的(右侧)负极。每一个 LED 单元的第一个 LED 组件 831 的负极，最后一个 LED 组件 831 的正极以及其他 LED 组件 831 的正极及负极则透过连接导线 839 连接。

换句话说，最左侧 LED 组 833 的三个 LED 组件 831 的正极透过正极导线 834 彼此连接，其负极透过最左侧连接导线 839 彼此连接。左二 LED 组 833 的三个 LED 组件 831 的正极透过最左侧连接导线 839 彼此连接，其负极透过左二的连接导线 839 彼此连接。由于最左侧 LED 组 833 的三个 LED 组件 831 的负极及左二 LED 组 833 的三个 LED 组件 831 的正极均透过最左侧连接导线 839 彼此连接，故每一个 LED 单元的第一个 LED 组件的负极与第二个 LED 组件的正极彼此连接。依此类推从而形成如图 53B 所示的网状连接。

值得注意的是，连接导线 839 中与 LED 组件 831 的正极连接部分的宽度 836 小于与 LED 组件 831 的负极连接部分的宽度 837。使负极连接部分的面积大于正极连接部分的面积。另外，宽度 837 小于连接导线 839 中同时连接邻近两个 LED 组件 831 中其中之一的正极及另一的负极的部分的宽度 838，使同时与正极与负极部分的面积大于仅与负极连接部分的面积及正极连接部分的面积。因此，这样的走线架构有助于 LED 组件的散热。

另外，正极导线 834 还包含有正极引线 834a，负极导线 835 还包含有负极引线 835a，使 LED 模块的两侧均具有正极及负极连接点。这样的走线架构可使 LED 灯的电源组件的其他电路，例如：滤波电路 520、整流电路 510 及 540 由任一侧或同时两侧的正极及负极连接点耦接到 LED 模块，增加实际电路的配置安排的弹性。

请参见图 53D，为根据本发明第二较佳实施例的 LED 模块的走线示意图。本实施例的 LED 组件 931 的连接关系同图 53A 所示，在此以三个 LED 单元且每个 LED 单元包含 7 个 LED 组件为例进行说明。正极导线 934 与负极导线 935 接收驱动讯号，以提供电力至各 LED 组件 931，举例来说：正极导线 934 耦接前述滤波电路 520 的滤波输出端 521，负极导线 935 耦接前述滤波电路 520 的滤

波输出端 522，以接收滤波后讯号。为方便说明，图中将每一个 LED 单元中七个 LED 组件划分成同一 LED 组 932。

正极导线 934 连接每一 LED 组 932 中第一个(最左侧)LED 组件 931 的(左侧)正极。负极导线 935 连接每一 LED 组 932 中最后一个(最右侧)LED 组件 931 的(右侧)负极。在每一 LED 组 932 中，邻近两个 LED 组件 931 中左方的 LED 组件 931 的负极透过连接导线 939 连接右方 LED 组件 931 的正极。藉此，LED 组 932 的 LED 组件串联成一串。

值得注意的是，连接导线 939 用以连接相邻两个 LED 组件 931 的其中之一的负极及另一的正极。负极导线 935 用以连接各 LED 组的最后一个(最右侧)的 LED 组件 931 的负极。正极导线 934 用以连接各 LED 组的第一个(最左侧)的 LED 组件 931 的正极。因此，其宽度及供 LED 组件的散热面积依上述顺序由大至小。也就是说，连接导线 939 的宽度 938 最大，负极导线 935 连接 LED 组件 931 负极的宽度 937 次之，而正极导线 934 连接 LED 组件 931 正极的宽度 936 最小。因此，这样的走线架构有助于 LED 组件的散热。

另外，正极导线 934 还包含有正极引线 934a，负极导线 935 还包含有负极引线 935a，使 LED 模块的两侧均具有正极及负极连接点。这样的走线架构可使 LED 灯的电源组件的其他电路，例如：滤波电路 520、整流电路 510 及 540 由任一侧或同时两侧的正极及负极连接点耦接到 LED 模块，增加实际电路的配置安排的弹性。

再者，图 53C 及 48D 中所示的走线可以可挠式电路板来实现。举例来说，可挠式电路板具有单层线路层，以蚀刻方式形成图 53C 中的正极导线 834、正极引线 834a、负极导线 835、负极引线 835a 及连接导线 839，以及图 53D 中的正极导线 934、正极引线 934a、负极导线 935、负极引线 935a 及连接导线 939。

请参见图 53E，为根据本发明第三较佳实施例的 LED 模块的走线示意图。本实施例系将图 53C 的 LED 模块的走线由单层线路层改为双层线路层，主要是将正极引线 834a 及负极引线 835a 改至第二层金属层。说明如下。

请同时参见图 48，可挠式电路板具有双层线路层，包括一第一线路层 2a，介电层 2b 及第二线路层 2c。第一线路层 2a 及第二线路层 2c 间以介电层 2b 进行电性隔离。可挠式电路板的第一线路层 2a 以蚀刻方式形成图 53E 中的正极导

线 834、负极导线 835 及连接导线 839，第二线路层 2c 以蚀刻方式正极引线 834a、负极引线 835a。而且在可挠式电路板的第一线路层 2a 的正极导线 834、负极导线 835 具有层连接点 834b 及 835b。第二线路层 2 的正极引线 834a、负极引线 835a 具有层连接点 834c 及 835c。层连接点 834b 及 835b 与层连接点 834c 及 835c 位置相对，用以电性连接正极导线 834 及正极引线 834a，以及负极导线 835 及负极引线 835a。较佳的做法系将第一层金属层的层连接点 834b 及 835b 的位置同下方个藉电层形成开口至裸露出层连接点 834c 及 835c，然后用焊锡焊接，使正极导线 834 及正极引线 834a，以及负极导线 835 及负极引线 835a 彼此电性连接。

同样地，图 53D 所示的 LED 模块的走线也可以将正极引线 934a 及负极引线 935a 改至第二层金属层，而形成双层金属层的走线结构。

值得注意的是，具有双层导电层的可挠式电路板的第二线路层的厚度较佳为相较于第一线路层的厚度厚，藉此可以降低在正极引线及负极引线上的线损(压降)。再者，具有双层导电层的可挠式电路板相较于单层金属层的可挠式电路板，由于将两侧的正极引线、负极引线移至第二层，可以缩小可挠式电路板的宽度。在相同的治具上，较窄的基板的排放数量多于较宽的基板，因此可以提高 LED 模块的生产效率。而且具有双层导电层的可挠式电路板相对上也较容易维持形状，以增加生产的可靠性，例如：LED 组件的焊接时焊接位置的准确性。

作为上述方案的变形，本发明还提供一种 LED 日光灯，该 LED 日光灯的点灯电路模块的至少部分电子组件设置在灯板上：即利用 PEC（印刷电子电路，PEC：Printed Electronic Circuits），技术将至少部分电子组件印刷或嵌入在灯板上。

本发明的一个实施例中，将点灯电路模块的电子组件全部设置在灯板上。其制作过程如下：基板准备（可挠性印刷电路板准备）→喷印金属纳米油墨→喷印无源组件/有源器件（点灯电路模块）→烘干/烧结→喷印层间连接凸块→喷涂绝缘油墨→喷印金属纳米油墨→喷印无源组件及有源器件（依次类推形成所需要的多层板）→喷涂表面焊接盘→喷涂阻焊剂焊接 LED 组件。

上述的本实施例中，若将点灯电路模块的电子组件全部设置在灯板上时，只需在灯板的两侧通过焊接导线连接 LED 日光灯的接脚，实现接脚与灯板的电气连接。这样就无需再为点灯电路模块设置基板，进而可进一步的优化灯头的

设计。较佳的，点灯电路模块设置在灯板的两侧，这样尽量减少其工作产生的热对 LED 组件的影响。本实施例因减少焊接，提高点灯电路模块的整体信赖性。

若将部分电子组件印刷在灯板上（如电阻，电容）时，而将大的器件如：电感，电解电容等电子组件设置在灯头内。灯板的制作过程同上。这样通过将部分电子组件，设置在灯板上，合理的布局点灯电路模块，来优化灯头的设计。

作为上述的方案变形，也可通过嵌入的方式来实现将点灯电路模块的电子组件设置在灯板上。即：以嵌入的方式在可挠性灯板上嵌入电子组件。较佳的，可采用含电阻型/电容型的覆铜箔板(CCL)或丝网印刷相关的油墨等方法实现；或采用喷墨打印技术实现嵌入无源组件的方法，即以喷墨打印机直接把作为无源组件的导电油墨及相关功能油墨喷印到灯板内设定的位置上。作为上述方案的变形，无源组件也可以喷墨打印机直接把作为无源组件的导电油墨及相关功能油墨喷印到灯板上）。然后，经过 UV 光处理或烘干/烧结处理，形成埋嵌无源组件的灯板。嵌入在灯板上电子组件包括电阻、电容和电感；在其它的实施例中，有源组件也适用。通过这样的设计来合理的布局点灯电路模块进而达到优化灯头的设计（由于部分采用嵌入式电阻和电容，本实施例节约了宝贵的印刷电路板表面空间，缩小了印刷电路板的尺寸并减少了其重量和厚度。同时由于消除了这些电阻和电容的焊接点(焊接点是印刷电路板上最容易引入故障的部分)，点灯电路模块的可靠性也得到了提高。同时将减短印刷电路板上导线的长度并且允许更紧凑的器件布局，因而提高电气性能）。

以下说明嵌入式电容、电阻的制造方法。

通常使用嵌入式电容的方法，采用一种叫做分布式电容或平面电容的概念。在铜层的基础上压上非常薄的绝缘层。一般以电源层/地层的形式成对出现。非常薄的绝缘层使电源层与地层之间的距离非常小。这样的电容量也可以通过传统的金属化孔实现。基本上来说，这样的方法在电路板上建立了一个大的平行的板极电容。

一些高电容量的产品，有些是分布式电容型的，另外一些是分立嵌入式的。通过在绝缘层中填充钛酸钡(一种具有高介电常数的材料)来获得更高的电容量。

通常制造嵌入式电阻的方法是使用电阻粘剂。它是掺杂有传导性碳或石墨的树脂，以此为填充剂，丝网印刷至指定处，然后经过处理后层压入电路板内部。电阻由金属化孔或微过孔连接至电路板上的其他电子组件。另一种方法为

Ohmega-Ply 法：它是双金属层结构——铜层与一个薄的镍合金层构成了电阻器元素，它们形成层状的相对于底层的电阻器。然后通过对铜层和镍合金层的蚀刻，形成具有铜端子的各种镍电阻。这些电阻器被层压至电路板的内层中。

在本发明的一个实施例中，将导线直接印刷在玻璃管的内壁（设置成线状），LED 组件直接贴该内壁，以经过这些导线彼此电性连接。较佳的，采用 LED 组件的芯片形式直接贴在该内壁的导线上（在导线的两端设置连接点，通过连接点 LED 组件与点灯电路模块连接），贴附后，在该芯片上点滴荧光粉（使 LED 日光灯工作时产生白光，也可是其它颜色的光）。

请参见图 54A，为根据本发明第三较佳实施例的 LED 灯的电源组件的应用电路方块示意图。相较于图 49E 所示，本实施例的 LED 灯的电源组件包含整流电路 510 及 540、滤波电路 520、LED 驱动模块 530，且 LED 驱动模块 530 更包含驱动电路 1530 及 LED 模块 630。驱动电路 1530 耦接滤波输出端 521 及 522，以接收滤波后讯号，并进行电力转换以将滤波后讯号转换成驱动讯号而于驱动输出端 1521 及 1522 输出。LED 模块 630 耦接驱动输出端 1521 及 1522，以接收驱动讯号而操作。LED 模块 630 可参见图 53A 至图 53D 的说明。

值得注意的是，整流电路 540 为非必要组件而可省略，故在图中以虚线表示。也就是说，图 49A 及图 49C 所示的实施例中的 LED 驱动模块 530 可如同图 49E 的实施例，更包含驱动电路 1530 及 LED 模块 630。因此，本实施例的 LED 灯的电源组件亦可应用至单端电源、双端电源的应用环境，例如：球泡灯、PAL 灯等均适用。

请参见图 54B，为根据本发明第一较佳实施例的驱动电路的电路方块示意图。驱动电路包含控制器 1531 及转换电路 1532，以电流源的模式进行电力转换，以驱动 LED 模块发光。转换电路 1532 包含开关电路 1535 以及储能电路 1538。转换电路 1532 耦接滤波输出端 521 及 522，接收滤波后讯号，并根据控制器 1531 的控制，转换成驱动讯号而由驱动输出端 1521 及 1522 输出，以驱动 LED 模块。在控制器 1531 的控制下，转换电路 1532 所输出的驱动讯号为稳定电流，而使 LED 模块稳定发光。

请参见图 54C，为根据本发明第一较佳实施例的驱动电路的电路示意图。在本实施例，驱动电路 1630 为降压直流转直流转换电路，包含控制器 1631 及转换电路，而转换电路包含电感 1632、续流二极管 1633、电容 1634 以及切换开

关 1635。驱动电路 1630 耦接滤波输出端 521 及 522，以将接收的滤波后讯号转换成驱动讯号，以驱动耦接在驱动输出端 1521 及 1522 之间的 LED 模块。

在本实施例中，切换开关 1635 为金氧半场效晶体管，具有控制端、第一端及第二端。切换开关 1635 的第一端耦接续流二极管 1633 的正极，第二端耦接滤波输出端 522，控制端耦接控制器 1631 以接受控制器 1631 的控制使第一端及第二端之间为导通或截止。驱动输出端 1521 耦接滤波输出端 521，驱动输出端 1522 耦接电感 1632 的一端，而电感 1632 的另一端耦接切换开关 1635 的第一端。电容 1634 的耦接于驱动输出端 1521 及 1522 之间，以稳定驱动输出端 1521 及 1522 之间的电压差。续流二极管 1633 的负端耦接驱动输出端 1521。

接下来说明驱动电路 1630 的运作。

控制器 1631 根据电流侦测讯号 S535 或/及 S531 决定切换开关 1635 的导通及截止时间，也就是控制切换开关 1635 的占空比(Duty Cycle)来调节驱动讯号的大小。电流侦测讯号 S535 系代表流经切换开关 1635 的电流大小。电流侦测讯号 S535 系代表流经耦接于驱动输出端 1521 及 1522 之间的 LED 模块的电流大小。根据电流侦测讯号 S531 及 S535 的任一，控制器 1631 可以得到转换电路所转换的电力大小的信息。当切换开关 1635 导通时，滤波后讯号的电流由滤波输出端 521 流入，并经过电容 1634 及驱动输出端 1521 到 LED 模块、电感 1632、切换开关 1635 后由滤波输出端 522 流出。此时，电容 1634 及电感 1632 进行储能。当切换开关 1635 截止时，电感 1632 及电容 1634 释放所储存的能量，电流经续流二极管 1633 续流到驱动输出端 1521 使 LED 模块仍持续发光。

值得注意的是，电容 1634 非必要组件而可以省略，故在图中以虚线表示。在一些应用环境，可以藉由电感会阻抗电流的改变的特性来达到稳定 LED 模块电流的效果而省略电容 1634。

请参见图 54D，为根据本发明第二较佳实施例的驱动电路的电路示意图。在本实施例，驱动电路 1730 为升压直流转直流转换电路，包含控制器 1731 及转换电路，而转换电路包含电感 1732、续流二极管 1733、电容 1734 以及切换开关 1735。驱动电路 1730 将由滤波输出端 521 及 522 所接收的滤波后讯号转换成驱动讯号，以驱动耦接在驱动输出端 1521 及 1522 之间的 LED 模块。

电感 1732 的一端耦接滤波输出端 521，另一端耦接滤流二极管 1733 的正极及切换开关 1735 的第一端。切换开关 1735 的第二端耦接滤波输出端 522 及驱

动输出端 1522。续流二极管 1733 的负极耦接驱动输出端 1521。电容 1734 耦接于驱动输出端 1521 及 1522 之间。

控制器 1731 耦接切换开关 1735 的控制端，根据电流侦测讯号 S531 或/及电流侦测讯号 S535 来控制切换开关 1735 的导通与截止。当切换开关 1735 导通时，电流由滤波输出端 521 流入，并流经电感 1732、切换开关 1735 后由滤波输出端 522 流出。此时，流经电感 1732 的电流随时间增加，电感 1732 处于储能状态。同时，电容 1734 处于释能状态，以持续驱动 LED 模块发光。当切换开关 1735 截止时，电感 1732 处于释能状态，电感 1732 的电流随时间减少。电感 1732 的电流经续流二极管 1733 续流流向电容 1734 以及 LED 模块。此时，电容 1734 处于储能状态。

值得注意的是，电容 1734 为可省略的组件，以虚线表示。在电容 1734 省略的情况，切换开关 1735 导通时，电感 1732 的电流不流经 LED 模块而使 LED 模块不发光；切换开关 1735 截止时，电感 1732 的电流经续流二极管 1733 流经 LED 模块而使 LED 模块发光。藉由控制 LED 模块的发光时间及流经的电流大小，可以达到 LED 模块的平均亮度稳定于预定值上，而达到相同的稳定发光的作用。

请参见图 54E，为根据本发明第三较佳实施例的驱动电路的电路示意图。在本实施例，驱动电路 1830 为降压直流转直流转换电路，包含控制器 1831 及转换电路，而转换电路包含电感 1832、续流二极管 1833、电容 1834 以及切换开关 1835。驱动电路 1830 耦接滤波输出端 521 及 522，以将接收的滤波后讯号转换成驱动讯号，以驱动耦接在驱动输出端 1521 及 1522 之间的 LED 模块。

切换开关 1835 的第一端耦接滤波输出端 521，第二端耦接续流二极管 1833 的负极，而控制端耦接控制器 1831 以接收控制器 1831 的控制讯号而使第一端与第二端之间的状态为导通或截止。续流二极管 1833 的正极耦接滤波输出端 522。电感 1832 的一端与切换开关 1835 的第二端耦接，另一端耦接驱动输出端 1521。驱动输出端 1522 耦接续流二极管 1833 的正极。电容 1834 耦接于驱动输出端 1521 及 1522 之间，以稳定驱动输出端 1521 及 1522 之间的电压。

控制器 1831 根据电流侦测讯号 S531 或/及电流侦测讯号 S535 来控制切换开关 1835 的导通与截止。当切换开关 1835 导通时，电流由滤波输出端 521 流入，并流经切换开关 1835、电感 1832、驱动输出端 1521 及 1522 后由滤波输出端 522 流出。此时，流经电感 1832 的电流以及电容 1834 的电压随时间增加，电感 1832

及电容 1834 处于储能状态。当切换开关 1835 截止时，电感 1832 处于释能状态，电感 1832 的电流随时间减少。此时，电感 1832 的电流经驱动输出端 1521 及 1522、续流二极管 1833 再回到电感 1832 而形成续流。

值得注意的是，电容 1834 为可省略组件，图式中以虚线表示。当电容 1834 省略时，不论切换开关 1835 为导通或截止，电感 1832 的电流均可以流过驱动输出端 1521 及 1522 以驱动 LED 模块持续发光。

请参见图 54F，为根据本发明第四较佳实施例的驱动电路的电路示意图。在本实施例，驱动电路 1930 为降压直流转直流转换电路，包含控制器 1931 及转换电路，而转换电路包含电感 1932、续流二极管 1933、电容 1934 以及切换开关 1935。驱动电路 1930 耦接滤波输出端 521 及 522，以将接收的滤波后讯号转换成驱动讯号，以驱动耦接在驱动输出端 1521 及 1522 之间的 LED 模块。

电感 1932 的一端耦接滤波输出端 521 及驱动输出端 1522，另一端耦接切换开关 1935 的第一端。切换开关 1935 的第二端耦接滤波输出端 522，而控制端耦接控制器 1931 以根据控制器 1931 的控制讯号而为导通或截止。续流二极管 1933 的正极耦接电感 1932 与切换开关 1935 的连接点，负极耦接驱动输出端 1521。电容 1934 耦接驱动输出端 1521 及 1522，以稳定耦接于驱动输出端 1521 及 1522 之间的 LED 模块的驱动。

控制器 1931 根据电流侦测讯号 S531 或/及电流侦测讯号 S535 来控制切换开关 1935 的导通与截止。当切换开关 1935 导通时，电流由滤波输出端 521 流入，并流经电感 1932、切换开关 1935 后由滤波输出端 522 流出。此时，流经电感 1932 的电流随时间增加，电感 1932 处于储能状态；电容 1934 的电压随时间减少，电容 1934 处于释能状态，以维持 LED 模块发光。当切换开关 1935 截止时，电感 1932 处于释能状态，电感 1932 的电流随时间减少。此时，电感 1932 的电流经续流二极管 1933、驱动输出端 1521 及 1522 再回到电感 1932 而形成续流。此时，电容 1934 处于储能状态，电容 1934 的电压随时间增加。

值得注意的是，电容 1934 为可省略组件，图式中以虚线表示。当电容 1934 省略时，切换开关 1935 导通时，电感 1932 的电流并未流经驱动输出端 1521 及 1522 而使 LED 模块不发光。切换开关 1935 截止时，电感 1932 的电流经续流二极管 1933 而流经 LED 模块而使 LED 模块发光。藉由控制 LED 模块的发光时间及流经的电流大小，可以达到 LED 模块的平均亮度稳定于预定值上，而达到相

同的稳定发光的作用。

请参见图 54G，为根据本发明第二较佳实施例的驱动电路的电路方块示意图。驱动电路包含控制器 2631 及转换电路 2632，以可调电流源的模式进行电力转换，以驱动 LED 模块发光。转换电路 2632 包含开关电路 2635 以及储能电路 2638。转换电路 2632 耦接滤波输出端 521 及 522，接收滤波后讯号，并根据控制器 2631 的控制，转换成驱动讯号而由驱动输出端 1521 及 1522 输出，以驱动 LED 模块。控制器 2631 接收电流侦测讯号 S535 或/及 S539，控制转换电路 2632 输出的驱动讯号稳定于设定电流值上。其中，电流侦测讯号 S535 代表开关电路 2635 的电流大小；电流侦测讯号 S539 代表储能电路 2638 的电流大小，例如：储能电路 2638 中的电感电流，驱动输出端 1521 所输出的电流等。电流侦测讯号 S535 及 S539 的任一均可以代表驱动电路由驱动输出端 1521 及 1522 提供给 LED 模块的电流 Iout 的大小。控制器 2631 更耦接滤波输出端 521，以根据滤波输出端 521 的电压 Vin 决定设定电流值的大小。因此，驱动电路的电流 Iout 会根据滤波电路所输出的滤波后讯号的电压 Vin 的大小调整。

值得注意的是，上述电流侦测讯号 S535 及 S539 的产生可以是利用电阻或电感的方式量测。举例来说，根据电流流经电阻而于电阻两端产生的压差，或者利用互感电感与储能电路 2638 中的电感互感等均可以用以侦测电流。

上述的电路架构，尤其适用于灯管驱动电路为电子镇流器的应用环境。电子镇流器等效上为电流源，其输出功率并非为定值。而如图 54C 到图 54F 所示般的驱动电路，其消耗功率与 LED 模块的 LED 组件数量有关，可视为定值。当电子镇流器的输出功率高于驱动电路所驱动的 LED 模块的消耗功率时，电子镇流器的输出电压会不断提高，也就是 LED 灯的电源组件所接收的交流驱动讯号的准位会不断上升而导致有超过电子镇流器或/及 LED 灯的电源组件的组件耐压而毁损的风险。当电子镇流器的输出功率低于驱动电路所驱动的 LED 模块的消耗功率时，电子镇流器的输出电压会不断降低，也就是交流驱动讯号的准位会不断下降而导致电路无法正常操作。

值得注意的是，LED 灯照明所需的功率已经小于日光灯等荧光灯照明所需的功率。若使用以往背光模块等控制 LED 亮度的控制机制，应用于电子镇流器等传统的驱动系统，必然会遭遇到驱动系统的功率与 LED 灯的所需功率不同造成的不兼容问题。甚至导致驱动系统或/及 LED 灯毁损的问题。例用上述的功率

调整，使得 LED 灯更为兼容于传统的荧光灯照明系统。

请参见图 54H，为根据本发明一较佳实施例的电压 Vin 与电流 Iout 的区线关系示意图。其中，横轴为电压 Vin，纵轴为电流 Iout。在一实施例中，当滤波后讯号的电压 Vin 在电压上限值 VH 和电压下限值 VL 之间时，电流 Iout 维持在预设电流值。当滤波后讯号的电压 Vin 高于电压上限值 VH 时，电流 Iout 随电压 Vin 的增加而提高。电压上限值 VH 高于电压下限值 VL。较佳为曲线的斜率随电压 Vin 上升而变大。当滤波后讯号的电压 Vin 低于电压下限值 VL 时，电流 Iout 随电压 Vin 的减少而降低。较佳为曲线的斜率随电压 Vin 减少而变小。也就是，当电压 Vin 高于电压上限值 VH 或低于电压下限值 VL 时，电流 Iout 较佳为电压 Vin 的二次方或以上的函数关系，而使得消耗功率的增加率(减少率)高于输出功率的增加率(减少率)。

在另一实施例中，当滤波后讯号的电压 Vin 在电压上限值 VH 和电压下限值 VL 之间时，LED 灯的电流 Iout 会随电压 Vin 增加或减少而线性增加会减少。当电压 Vin 在电压上限值 VH 时，电流 Iout 在上电流值 IH；当电压 Vin 在电压下限值 VL 时，电流 Iout 在下电流值 IL。其中，上电流值 IH 高于下电流值 IL。也就是，当电压 Vin 在电压上限值 VH 和电压下限值 VL 之间，电流 Iout 为电压 Vin 的一次方的函数关系。

藉由上述的设计，当电子镇流器的输出功率高于驱动电路所驱动的 LED 模块的消耗功率时，电压 Vin 会随时间提高并超过电压上限值 VH。当电压 Vin 高于电压上限值 VH 时，LED 模块的消耗功率的增加率高于电子镇流器的输出功率的增加率，并于电压 Vin 为高平衡电压 VH+以及电流 Iout 为高平衡电流 IH+时，输出功率等于消耗功率而平衡。此时，高平衡电压 VH+高于电压上限值 VH，而高平衡电流 IH+高于上电流值。反之，当电压 Vin 低于电压下限值 VL 时，LED 模块的消耗功率的减少率高于电子镇流器的输出功率的减少率，并于电压 Vin 为低平衡电压 VL-以及电流 Iout 为低平衡电流 IL-时，输出功率等于消耗功率而平衡。此时，低平衡电压 VL-低于电压下限值 VL，而低平衡电流 IL-低于下电流值 IL。

在一较佳实施例中，电压下限值 VL 定义为电子镇流器的最低输出电压的 90%，电压上限值 VH 定义为最高输出电压的 110%。以全电压 100-277V AC/60HZ 为例，电压下限值 VL 设置为 90V (100V *90%)，电压上限值 VH 设置为

305V(277V *110%)。

配合图 35 及图 36，短电路板 253 被区分成与长电路板 251 两端连接的第一短电路板及第二短电路板，而且电源组件中的电子组件被分别设置于的短电路板 253 的第一短电路板及第二短电路板上。第一短电路板及第二短电路板的长度尺寸可以约略一致，也可以不一致。。一般，第一短电路板(图 35e 短电路板 253 的右侧部分及图 36 的短电路板 253 的左侧)的长度尺寸为第二短电路板的长度尺寸的 30%～80%。更佳的第一短电路板的长度尺寸为第二短电路板的长度尺寸的 1/3～2/3。在本实施中，第一短电路板的长度尺寸大致为第二短电路板的尺寸的一半。第二短电路板的尺寸介于 15mm～65mm（具体视应用场合而定）。

举例来说，驱动电路的电容例如：图 54C 至图 54F 中的电容 1634、1734、1834、1934)实际应用上可以是两个或以上的电容并联而成。电源组件中驱动电路的电容至少部分或全部设置于短电路板 253 设置于长电路板 251 上。即，整流电路、滤波电路、驱动电路的电感、控制器、切换开关、二极管等均设置于长电路板 251 上。而电感、控制器、切换开关等为电子组件中温度较高的组件，与部分或全部电容设置于不同的电路板上，可使电容(尤其是电解电容)避免因温度较高的组件对电容的寿命造成影响，提高电容信赖性。进一步，还可因电容与整流电路及滤波电路在空间上分离，解决 EMI 问题。

请参见图 55A，为根据本发明第四较佳实施例的 LED 灯的电源组件的应用电路方块示意图。相较于图 49E 所示实施例，本实施例包含整流电路 510 及 540、滤波电路 520、LED 驱动模块 530，且更增加防闪烁电路 550。防闪烁电路 550 耦接于滤波电路 520 与 LED 驱动模块 530 之间。其中，整流电路 540 为可省略的电路，在图式中以虚线表示。

防闪烁电路 550 耦接滤波输出端 521 及 522，以接收滤波后讯号，并于至少于特定情况时，消耗滤波后讯号的部分能量，以抑制滤波后讯号的纹波造成 LED 驱动模块 530 的发光间断的情况发生。一般而言，滤波电路 520 具有电容或电感等滤波组件，或者电路上会有寄生的电容及电感，而形成谐振电路。谐振电路在交流电源讯号停止提供时，例：使用者关闭 LED 灯的电源之后，其谐振讯号的振幅会随时间递减。然而，LED 灯的 LED 模块为单向导通组件且具有最低导通电压。当谐振讯号的波谷值低于 LED 模块最低导通电压，而波峰值仍高于 LED 模块最低导通电压时，LED 模块的发光会出现闪烁现象。防闪烁电路在此

时会消耗滤波后讯号的部分能量，此部分能量高于谐振讯号于波峰值与波谷值之间的能量差，而抑制 LED 模块的发光的闪烁现象。较佳为在滤波后讯号接近 LED 模块的最低导通电压时，防闪烁电路所消耗滤波后讯号的部分能量高于谐振讯号于波峰值与波谷值之间的能量差。

值得注意的是，防闪烁电路 550 更适用于 LED 驱动模块 530 未包含驱动电路 1530 的实施情况。也就是说，当 LED 驱动模块 530 包含 LED 模块 630，而 LED 模块 630 由滤波电路的滤波后讯号直接驱动发光时的应用情况。LED 模块 630 的发光将直接反映滤波后讯号的纹波而变化。防闪烁电路 550 的设置，将抑制在关闭 LED 灯的电源后 LED 灯所出现的闪烁现象。

请参见图 55B，为根据本发明一较佳实施例的防闪烁电路的电路示意图。防闪烁电路 650 包含至少一电阻，例如：串联的两个电阻，串联于滤波输出端 521 及 522 之间。在本实施例中，防闪烁电路 650 持续消耗滤波后讯号的部分能量。在正常操作时，此部分能量远小于 LED 驱动模块 530 所消耗的能量。然，当电源关闭后，滤波后讯号的准位下降至 LED 模块 630 的最低导通电压附近时，防闪烁电路 650 仍消耗滤波后讯号的部分能量而使 LED 模块 630 减少间断发光的情况。在一较佳实施例中，防闪烁电路 650 可设定为在 LED 模块 630 的最低导通电压时，流经大于或等于一防闪烁电流，并据此可决定防闪烁电路 650 的等效防闪烁电阻值。

参见图 56A，为根据本发明第五较佳实施例的 LED 灯的电源组件的应用电路方块示意图。相较于图 55A 所示实施例，本实施例包含整流电路 510 及 540、滤波电路 520、LED 驱动模块 530 及防闪烁电路 550，且更增加保护电路 560。保护电路 560 滤波输出端 521 及 522，侦测滤波后讯号以决定是否进入保护状态。当决定进入保护状态时，保护电路 560 箝制滤波后讯号的准位大小，以避免 LED 驱动模块 530 中的组件发生损坏。其中，整流电路 540 及防闪烁电路 550 为可省略的电路，在图式中以虚线表示。

参见图 56B，为根据本发明一较佳实施例的保护电路的电路示意图。保护电路 660 包含双向可控硅 661、双向触发二极管 662、电容 663 及 670、双载子接面晶体管 667 及 668、电阻 664、665、666、669 及 671 以及二极管 672，于 LED 模块的电流或/及电压过高时进入保护状态，而避免 LED 模块的损坏。

双向可控硅 661 的第一端耦接滤波输出端 521，第二端耦接滤波输出端 522，

而控制端耦接双向触发二极管 662 的第一端。双向触发二极管 662 的第二端耦接电容 663 的一端，电容 663 的另一端耦接滤波输出端 522。电阻 664 的一端耦接双向触发二极管 662 的第二端，另一端耦接滤波输出端 522，而与电容 663 并联。电阻 665 的一端耦接双向触发二极管 662 的第二端，另一端耦接双载子接面晶体管 667 的集极。双载子接面晶体管 667 的射极耦接滤波输出端 522。电阻 666 的一端耦接双向触发二极管 662 的第二端，另一端耦接双载子接面晶体管 668 的集极以及双载子接面晶体管 667 的基极。双载子接面晶体管 668 的射极耦接滤波输出端 522。电阻 669 的一端耦接双载子接面晶体管 668 的基极，另一端耦接电容 670 的一端。电容 670 的另一端耦接输出端 522。电阻 671 的一端耦接双向触发二极管 662 的第二端，另一端耦接二极管 672 的负极。二极管 672 的正极耦接滤波输出端 521。

值得注意的是，电阻 665 的阻值小于电阻 666 的阻值。

以下先说明保护电路 660 的过流保护的操作。

电阻 669 和电容 670 的连接点接收电流侦测讯号 S531，其中电流侦测讯号 S531 代表 LED 模块流经的电流大小。电阻 671 的另一端耦接电压端 521'。在此实施例中，电压端 521'可以耦接一偏压源或者如图式般，透过二极管 672 耦接到滤波输出端 521 以滤波后讯号作为偏压源。当电压端 521'耦接额外的偏压源时，二极管 672 可以省滤，在图式中，二极管 672 以虚线表示。电阻 669 和电容 670 的组合可以滤除电流侦测讯号 S531 的高频成分，并将滤除后电流侦测讯号 S531 输入双载子接面晶体管 668 的基极以控制双载子接面晶体管 668 的导通与截止。藉由电阻 669 和电容 670 的滤波作用，可以避免因噪声所造成的双载子接面晶体管 668 的误动作。在实际应用上，电阻 669 和电容 670 可以省略(故电阻 669 和电容 670 于图中以虚线表示)，而将电流侦测讯号 S531 直接输入双载子接面晶体管 668 的基极。

当 LED 灯正常操作而 LED 模块的电流在正常范围内时，双载子接面晶体管 668 为截止。此时，电阻 666 将双载子接面晶体管 667 的基极电压拉高而使得双载子接面晶体管 667 导通。此时，双向触发二极管 662 的第二端的电位根据电源端 521'的偏压源的电压，以及电阻 671 及并联的电阻 664 与 665 的分压比例而决定。由于电阻 665 的阻值较小，分压比例较低因而双向触发二极管 662 的第二端的电位较低。此时，双向可控硅 661 的控制端电位也被双向触发二极管

662 拉低，双向可控硅 661 为截止而使保护电路 660 处于未保护状态。

当 LED 模块的电流超过电流保护值时，此时电流侦测讯号 S531 的准位会过高而使双载子接面晶体管 668 导通。双载子接面晶体管 668 会拉低双载子接面晶体管 667 的基极而使得双载子接面晶体管 667 为截止。此时，双向触发二极管 662 的第二端的电位根据电源端 521'的偏压源的电压，以及电阻 671 及并联的电阻 664 与 666 的分压比例而决定。由于电阻 666 的阻值较大，分压比例较高因而双向触发二极管 662 的第二端的电位较高。此时，双向可控硅 661 的控制端电位也被双向触发二极管 662 拉高，双向可控硅 661 为导通以箝制滤波输出端 521 及 522 之间的电压差而使保护电路 660 处于保护状态。

在本实施例中，偏压源的电压系根据双向可控硅 661 的触发电压、电阻 671 及并联的电阻 664 与 665 的分压比例以及电阻 671 及并联的电阻 664 与 666 的分压比例来决定。藉此，偏压源的电压在前者的分压比例分压后低于双向可控硅 661 的触发电压，而在后者的分压比例分压后高于双向可控硅 661 的触发电压。

接着说明保护电路 660 的过压保护的操作。

电阻 669 和电容 670 的连接点接收电流侦测讯号 S531，其中电流侦测讯号 S531 代表 LED 模块流经的电流大小。因此，此时保护电路 660 仍具有电流保护的功能。电阻 671 的另一端耦接电压端 521'，在此实施例中，电压端 521'耦接 LED 模块的正端以侦测 LED 模块的电压。以上述的实施例为例，在图 53A 及图 53B 的实施例等 LED 驱动电路 530 未包含驱动电路 1530 的实施例中，电压端 521'耦接滤波输出端 521；在图 54A 至图 54G 等 LED 驱动电路 530 包含驱动电路 1530 的实施例中，电压端 521'耦接驱动输出端 1521。在本实施例中，电阻 671 及并联的电阻 664 与 665 的分压比例以及电阻 671 及并联的电阻 664 与 666 的分压比例将视电压端 521'的电压，即驱动输出端 1521 或滤波输出端 521 的电压来调整。因此，保护电路 660 的过流保护仍可正常操作。

当 LED 模块正常操作时，双向触发二极管 662 的第二端的电位(由电阻 671 与并联的电阻 665 与 664 的分压比例与电压端 521'的电压决定)不足以触发双向可控硅 661。此时，触发双向可控硅 661 为截止，保护电路 660 处于未保护状态。当 LED 模块操作异常而造成 LED 模块的正端的电压超过电压保护值。此时，双向触发二极管 662 的第二端的电位较高而使双向触发二极管 662 的第一端超过

触发双向可控硅 661 的触发电压。此时，触发双向可控硅 661 为导通，保护电路 660 处于保护状态并箝制滤波后讯号的准位。

如上所述，保护控制电路 660 可以具有过流保护功能，或者可以同时具有过流及过压保护的功能。

另外，保护电路 660 可在电阻 664 的两端并联齐纳二极管，以箝制两端的电压。齐纳二极管的崩溃电压较佳为 25-50V，更佳为 36V。

再者，双向可控硅 661 可用硅控整流器(Silicon Controlled Rectifier，SCR)来代替，而不影响保护电路的保护功能。尤其，通过采用硅控整流器管可降低导通时的压降。

在一实施例中，保护电路 660 的组件参数可如下设定。电阻 669 的阻值较佳为 10 奥姆。电容 670 的容值较佳为 1nf。电容 633 的容值较佳为 10nf。双向触发二极管 662 的电压范围 26-36V。电阻 671 的阻值较佳为 300K-600K 奥姆，更佳为 540K 奥姆。电阻 666 的阻值较佳为 100K-300K 奥姆，更佳为 220K 奥姆。电阻 665 的阻值较佳为 30K-100K 奥姆，更佳为 40K 奥姆。电阻 664 的阻值较佳为 100K-300K 奥姆，更佳为 220K 奥姆。

参见图 57A，为根据本发明第六较佳实施例的 LED 灯的电源组件的应用电路方块示意图。相较于图 54A 所示实施例，本实施例包含整流电路 510 及 540、滤波电路 520、包含驱动电路 1530 及 LED 模块 630 的 LED 驱动模块 530，且更增加模式切换电路 580。模式电路 580 耦接滤波输出端 521 及 522 至少其中之一以及驱动输出端 1521 及 1522 至少其中之一，用以决定进行第一驱动模式或第二驱动模式。其中，第一驱动模式系将滤波后讯号输入驱动电路 1530，第二驱动模式系至少旁通驱动电路 1530 的部份组件，使驱动电路 1530 停止操作并将滤波后讯号直接驱动 LED 模块 630。被旁通的驱动电路 1530 的部份组件包含电感或切换开关，使驱动电路 1530 无法进行电力转换而停止操作。当然，驱动电路 1530 的电容若存在而未省略，依然可以用以滤除滤波后讯号的纹波而达到稳定 LED 模块两端的电压的作用。当模式电路 580 决定第一驱动模式而将滤波后讯号输入驱动电路 1530 时，驱动电路 1530 将滤波后讯号转换成驱动讯号以驱动 LED 模块 630 发光。当模式电路 580 决定第二驱动模式而将滤波后讯号直接输至 LED 模块 630 而旁通驱动电路 1530 时，等效上滤波电路 520 为 LED 模块 630 的驱动电路，滤波电路 520 提供滤波后讯号为 LED 模块的驱动讯号，以驱

动 LED 模块发光。

值得注意的是，模块切换电路 580 可以根据用户的命令或侦测 LED 灯所接受的经由接脚 501、502、503 及 504 所接收的讯号来判断，而决定第一驱动模式或第二驱动模式。藉由模式切换电路，LED 灯的电源组件可以对应不同的应用环境或驱动系统，而调整适当的驱动模式，因而提高了 LED 灯的兼容性。另外，整流电路 540 为可省略电路，以虚线表示。

参见图 57B，为根据本发明第一较佳实施例的模式切换电路的电路示意图。模式切换电路 680 包含模式切换开关 681，适用于图 54C 所示的驱动电路 1630。请同时参见图 57B 及图 54C，模式切换开关 681 具有三个端点 683、684、685，端点 683 耦接驱动输出端 1522，端点 684 耦接滤波输出端 522 以及端点 685 耦接驱动电路 1630 的电感 1632。

当模式切换电路 680 决定第一模式时，模式切换开关 681 导通端点 683 及 685 的第一电流路径而截止端点 683 及 684 的第二电流路径。此时，驱动输出端 1522 与电感 1632 耦接。因此，驱动电路 1630 正常运作，将由滤波输出端 521 及 522 接收滤波后讯号并转换成驱动讯号由驱动输出端 1521 及 1522 驱动 LED 模块。

当模式切换电路 680 决定第二模式时，模式切换开关 681 导通端点 683 及 684 的第二电流路径而截止端点 683 及 685 的第一电流路径。此时，滤波输出端 522 与驱动输出端 1522 耦接。因此，驱动电路 1630 停止运作。滤波后讯号由滤波输出端 521 及 522 输入直接由驱动输出端 1521 及 1522 驱动 LED 模块，而旁通驱动电路 1630 的电感 1632 及切换开关 1635。

参见图 57C，为根据本发明第二较佳实施例的模式切换电路的电路示意图。模式切换电路 780 包含模式切换开关 781，适用于图 54C 所示的驱动电路 1630。请同时参见图 57C 及图 54C，模式切换开关 781 具有三个端 783、784、785，端点 783 耦接滤波输出端 522，端点 784 耦接驱动输出端 1522 以及端点 785 耦接驱动电路 1630 的切换开关 1635。

当模式切换电路 780 决定第一模式时，模式切换开关 781 导通端点 783 及 785 的第一电流路径而截止端点 783 及 784 的第二电流路径。此时，滤波输出端 522 与切换开关 1635 耦接。因此，驱动电路 1630 正常运作，将由滤波输出端 521 及 522 接收滤波后讯号并转换成驱动讯号由驱动输出端 1521 及 1522 驱动

LED 模块。

当模式切换电路 780 决定第二模式时，模式切换开关 781 导通端点 783 及 784 的第二电流路径而截止端点 783 及 785 的第一电流路径。此时，滤波输出端 522 与驱动输出端 1522 耦接。因此，驱动电路 1630 停止运作。滤波后讯号由滤波输出端 521 及 522 输入直接由驱动输出端 1521 及 1522 驱动 LED 模块，而旁通驱动电路 1630 的电感 1632 及切换开关 1635。

参见图 57D，为根据本发明第三较佳实施例的模式切换电路的电路示意图。模式切换电路 880 包含模式切换开关 881，适用于图 54D 所示的驱动电路 1730。请同时参见图 57D 及图 54D，模式切换开关 881 具有三个端点 883、884、885，端点 883 耦接滤波输出端 521，端点 884 耦接驱动输出端 1521 以及端点 885 耦接驱动电路 1730 的电感 1732。

当模式切换电路 880 决定第一模式时，模式切换开关 881 导通端点 883 及 885 的第一电流路径而截止端点 883 及 884 的第二电流路径。此时，滤波输出端 521 与电感 1732 耦接。因此，驱动电路 1730 正常运作，将由滤波输出端 521 及 522 接收滤波后讯号并转换成驱动讯号由驱动输出端 1521 及 1522 驱动 LED 模块。

当模式切换电路 880 决定第二模式时，模式切换开关 881 导通端点 883 及 884 的第二电流路径而截止端点 883 及 885 的第一电流路径。此时，滤波输出端 521 与驱动输出端 1521 耦接。因此，驱动电路 1730 停止运作。滤波后讯号由滤波输出端 521 及 522 输入直接由驱动输出端 1521 及 1522 驱动 LED 模块，而旁通驱动电路 1730 的电感 1732 及续流二极管 1733。

参见图 57E，为根据本发明第四较佳实施例的模式切换电路的电路示意图。模式切换电路 980 包含模式切换开关 981，适用于图 54D 所示的驱动电路 1730。请同时参见图 57E 及图 54D，模式切换开关 981 具有三个端点 983、984、985，端点 983 耦接驱动输出端 1521，端点 984 耦接滤波输出端 521 以及端点 985 耦接驱动电路 1730 的续流二极管 1733 的负极。

当模式切换电路 980 决定第一模式时，模式切换开关 981 导通端点 983 及 985 的第一电流路径而截止端点 983 及 984 的第二电流路径。此时，续流二极管 1733 的负极与滤波输出端 521 耦接。因此，驱动电路 1730 正常运作，将由滤波输出端 521 及 522 接收滤波后讯号并转换成驱动讯号由驱动输出端 1521 及 1522

驱动 LED 模块。

当模式切换电路 980 决定第二模式时，模式切换开关 981 导通端点 983 及 984 的第二电流路径而截止端点 983 及 985 的第一电流路径。此时，滤波输出端 521 与驱动输出端 1521 耦接。因此，驱动电路 1730 停止运作。滤波后讯号由滤波输出端 521 及 522 输入直接由驱动输出端 1521 及 1522 驱动 LED 模块，而旁通驱动电路 1730 的电感 1732 及续流二极管 1733。

参见图 57F，为根据本发明第五较佳实施例的模式切换电路的电路示意图。模式切换电路 1680 包含模式切换开关 1681，适用于图 54E 所示的驱动电路 1830。请同时参见图 57F 及图 54E，模式切换开关 1681 具有三个端点 1683、1684、1685，端点 1683 耦接滤波输出端 521，端点 1684 耦接驱动输出端 1521 以及端点 1685 耦接驱动电路 1830 的切换开关 1835。

当模式切换电路 1680 决定第一模式时，模式切换开关 1681 导通端点 1683 及 1685 的第一电流路径而截止端点 1683 及 1684 的第二电流路径。此时，滤波输出端 521 与切换开关 1835 耦接。因此，驱动电路 1830 正常运作，将由滤波输出端 521 及 522 接收滤波后讯号并转换成驱动讯号由驱动输出端 1521 及 1522 驱动 LED 模块。

当模式切换电路 1680 决定第二模式时，模式切换开关 1681 导通端点 1683 及 1684 的第二电流路径而截止端点 1683 及 1685 的第一电流路径。此时，滤波输出端 521 与驱动输出端 1521 耦接。因此，驱动电路 1830 停止运作。滤波后讯号由滤波输出端 521 及 522 输入直接由驱动输出端 1521 及 1522 驱动 LED 模块，而旁通驱动电路 1830 的电感 1832 及切换开关 1835。

参见图 57G，为根据本发明第六较佳实施例的模式切换电路的电路示意图。模式切换电路 1780 包含模式切换开关 1781，适用于图 54E 所示的驱动电路 1830。请同时参见图 57G 及图 54E，模式切换开关 1781 具有三个端点 1783、1784、1785，端点 1783 耦接滤波输出端 521，端点 1784 耦接驱动输出端 1521 以及端点 1785 耦接驱动电路 1830 的电感 1832。

当模式切换电路 1780 决定第一模式时，模式切换开关 1781 导通端点 1783 及 1785 的第一电流路径而截止端点 1783 及 1784 的第二电流路径。此时，滤波输出端 521 与电感 1832 耦接。因此，驱动电路 1830 正常运作，将由滤波输出端 521 及 522 接收滤波后讯号并转换成驱动讯号由驱动输出端 1521 及 1522 驱

动 LED 模块。

当模式切换电路 1780 决定第二模式时，模式切换开关 1781 导通端点 1783 及 1784 的第二电流路径而截止端点 1783 及 1785 的第一电流路径。此时，滤波输出端 521 与驱动输出端 1521 耦接。因此，驱动电路 1830 停止运作。滤波后讯号由滤波输出端 521 及 522 输入直接由驱动输出端 1521 及 1522 驱动 LED 模块，而旁通驱动电路 1830 的电感 1832 及切换开关 1835。

参见图 57H，为根据本发明第七较佳实施例的模式切换电路的电路示意图。模式切换电路 1880 包含模式切换开关 1881 及 1882，适用于图 54F 所示的驱动电路 1930。请同时参见图 57H 及图 54F，模式切换开关 1881 具有三个端点 1883、1884、1885，端点 1883 耦接驱动输出端 1521，端点 1884 耦接滤波输出端 521 以及端点 1885 耦接驱动电路 1930 的续流二极管 1933。模式切换开关 1882 具有三个端点 1886、1887、1888，端点 1886 耦接驱动输出端 1522，端点 1887 耦接滤波输出端 522 以及端点 1888 耦接滤波输出端 521。

当模式切换电路 1880 决定第一模式时，模式切换开关 1881 导通端点 1883 及 1885 的第一电流路径而截止端点 1883 及 1884 的第二电流路径，以及模式切换开关 1882 导通端点 1886 及 1888 的第三电流路径而截止端点 1886 及 1887 的第四电流路径。此时，驱动输出端 1521 与续流二极管 1933 耦接，且滤波输出端 521 与驱动输出端 1522 耦接。因此，驱动电路 1930 正常运作，将由滤波输出端 521 及 522 接收滤波后讯号并转换成驱动讯号由驱动输出端 1521 及 1522 驱动 LED 模块。

当模式切换电路 1880 决定第二模式时，模式切换开关 1881 导通端点 1883 及 1884 的第二电流路径而截止端点 1883 及 1885 的第一电流路径，以及模式切换开关 1882 导通端点 1886 及 1887 的第四电流路径而截止端点 1886 及 1888 的第三电流路径。此时，滤波输出端 521 与驱动输出端 1521 耦接，而且滤波输出端 522 与驱动输出端 1522 耦接。因此，驱动电路 1930 停止运作。滤波后讯号由滤波输出端 521 及 522 输入直接由驱动输出端 1521 及 1522 驱动 LED 模块，而旁通驱动电路 1930 的续流二极管 1933 及切换开关 1935。

参见图 57I，为根据本发明第八较佳实施例的模式切换电路的电路示意图。模式切换电路 1980 包含模式切换开关 1981 及 1982，适用于图 54F 所示的驱动电路 1930。请同时参见图 57I 及图 54F，模式切换开关 1981 具有三个端点 1983、

1984、1985，端点 1983 耦接滤波输出端 522，端点 1984 耦接驱动输出端 1522 以及端点 1985 耦接驱动电路 1930 的切换开关 1935。模式切换开关 1982 具有三个端点 1986、1987、1988，端点 1986 耦接滤波输出端 521，端点 1987 耦接驱动输出端 1521 以及端点 1988 耦接驱动输出端 1522。

当模式切换电路 1980 决定第一模式时，模式切换开关 1981 导通端点 1983 及 1985 的第一电流路径而截止端点 1983 及 1984 的第二电流路径，以及模式切换开关 1982 导通端点 1986 及 1988 的第三电流路径而截止端点 1986 及 1987 的第四电流路径。此时，滤波输出端 522 与切换开关 1935 耦接，且滤波输出端 521 与驱动输出端 1522 耦接。因此，驱动电路 1930 正常运作，将由滤波输出端 521 及 522 接收滤波后讯号并转换成驱动讯号由驱动输出端 1521 及 1522 驱动 LED 模块。

当模式切换电路 1980 决定第二模式时，模式切换开关 1981 导通端点 1983 及 1984 的第二电流路径而截止端点 1983 及 1985 的第一电流路径，以及模式切换开关 1982 导通端点 1986 及 1987 的第四电流路径而截止端点 1986 及 1988 的第三电流路径。此时，滤波输出端 521 与驱动输出端 1521 耦接，而且滤波输出端 522 与驱动输出端 1522 耦接。因此，驱动电路 1930 停止运作。滤波后讯号由滤波输出端 521 及 522 输入直接由驱动输出端 1521 及 1522 驱动 LED 模块，而旁通驱动电路 1930 的续流二极管 1933 及切换开关 1935。

值得注意的是，上述实施例中的模式切换开关可以是单刀双掷开关，或两个半导体开关(例如：金氧半场效晶体管)，用来切换两个电流路径之一为导通，另一为截止。电流路径系用以提供滤波后讯号的导通路径，使滤波后讯号的电流流经其中之一来达到模式选择的功能。举例来说，请同时参见图 49A、图 49B 及图 49D，当灯管驱动电路 505 不存在而由交流电源 508 直接供电给 LED 日光灯 500 时，模式切换电路可以决定第一模式，由驱动电路将滤波后讯号转换成驱动讯号，使驱动讯号的准位可以匹配 LED 模块发光所需的准位，而得以正确驱动 LED 模块发光。当灯管驱动电路 505 存在时，模式切换电路可以决定第二模式，由滤波后讯号直接驱动 LED 模块发光；或者也可以决定第一模式，仍由驱动电路将滤波后讯号转换成驱动讯号以驱动 LED 模块发光。

参见图 58A，为根据本发明第七较佳实施例的 LED 灯的电源组件的应用电路方块示意图。相较于图 49E 所示实施例，本实施例的日光灯包含整流电路 510

及 540、滤波电路 520 及 LED 驱动模块 530，且更增加镇流兼容电路 1510。镇流兼容电路 1510 可耦接于接脚 501 或/及接脚 502 以及整流电路 510 之间。在本实施例，以镇流兼容电路 1510 耦接于接脚 501 及整流电路之间为例说明。请同时参见图 49A、图 49B 及图 49D，灯管驱动电路 505 为电子镇流器，提供交流驱动讯号以驱动本实施例的 LED 灯。

由于灯管驱动电路 505 的驱动系统启动之初，输出能力尚未完全提升至正常状态。然而，在启动之初 LED 灯的电源组件立即导通并接收灯管驱动电路 505 所提供的交流驱动讯号。这会造成启动之初，灯管驱动电路 505 立即有负载而无法顺利启动。举例来说，灯管驱动电路 505 的内部组件自其转换的输出取电而维持启动后的操作，输出电压无法正常上升而导致启动失败，或灯管驱动电路 505 的谐振电路的 Q 值因 LED 灯的负载的加入而改变而无法顺利启动等。

本实施例的镇流兼容电路 1510 在启动之初，将呈现开路状态，使交流驱动讯号的能量无法输入至 LED 模块，并经预定的延迟时间后才进入导通状态，使交流驱动讯号的能量开始输入至 LED 灯模块。藉由上述的镇流兼容电路 1510 的导通延迟，LED 灯的操作模拟了荧光灯的启动特性—驱动电源启动后一段延迟时间后内部气体才放电而发光。因此，镇流兼容电路 1510 进一步改善了对电子镇流器等灯管驱动电路 505 的兼容性。

在本实施例中，整流电路 540 为可省略的电路，以虚线表示。

参见图 58B，为根据本发明第八较佳实施例的 LED 灯的电源组件的应用电路方块示意图。相较于图 58A 所示实施例，本实施例的镇流兼容电路 1510 可耦接于接脚 503 或/及接脚 504 以及整流电路 540 之间。如图 58A 中镇流兼容电路 1510 的说明，镇流兼容电路 1510 具有延迟起动的作用，使交流驱动讯号的输入延迟了预定的时间，避免电子镇流器等灯管驱动电路 505 启动失败的问题。

镇流兼容电路 1510 除了如上述实施例般置于接脚与整流电路之间外，也可以对应不同的整流电路的架构而改置于整流电路之内。请参见图 58C，为根据本发明较佳实施例的镇流兼容电路的电路配置示意图。在本实施例中，整流电路系采用图 50C 所示的整流电路 810 的电路架构。整流电路 810 包含整流单元 815 和端点转换电路 541。整流单元 815 耦接接脚 501 及 502，端点转换电路 541 耦接整流输出端 511 及 512，而镇流兼容电路 1510 耦接于整流单元 815 及端点转换电路 541 之间。于启动之初，交流驱动讯号仅能经过整流单元 815，而无法经

过端点转换电路 541 以及内部的滤波电路及 LED 驱动模块等，且整流单元 815 内的整流二极管 811 及 812 的寄生电容相当小可忽略。因此，LED 灯的电源组件的等效电容或电感于启动之初并未耦接灯管驱动电路 505，因而不影响灯管驱动电路 505 的 Q 值而可使灯管驱动电路 505 顺启动。

值得注意的是，在端点转换电路 541 不包含电容或电感等组件的前提下，整流单元 815 和端点转换电路 541 的交换(即，整流单元 815 耦接整流输出端 511 及 512，端点转换电路 541 耦接接脚 501 及 502)并不影响镇流兼容电路 1510 的功能。

再者，如图 50A 到图 50D 的说明，整流电路的接脚 501 及 502 变更为接脚 503 及 504 时，即可作为整流电路 540。即，上述的镇流兼容电路 1510 的电路配置也可以改至整流电路 540 内而不影响镇流兼容电路 1510 的功能。

另外，如前述般端点转换电路 541 不包含电容或电感等组件，或者整流电路 510 或 540 采用如图 50A 所示的整流电路 610 时，整流电路 510 或 540 的寄生电容相当小，也不会影响灯管驱动电路 505 的 Q 值。

参见图 58D，为根据本发明第九较佳实施例的 LED 灯的电源组件的应用电路方块示意图。相较于图 58A 所示实施例，本实施例的镇流兼容电路 1510 耦接于整流电路 540 与滤波电路 520 之间。如上说明，本实施例中的整流电路 540 不包含电容或电感等组件，因此不影响镇流兼容电路 1510 的功能。

参见图 58E，为根据本发明第十较佳实施例的 LED 灯的电源组件的应用电路方块示意图。相较于图 58A 所示实施例，本实施例的镇流兼容电路 1510 耦接于整流电路 510 与滤波电路 520 之间。同样地，本实施例中的整流电路 510 不包含电容或电感等组件，因此不影响镇流兼容电路 1510 的功能。

参见图 58F，为根据本发明第一较佳实施例的镇流兼容电路的电路示意图。镇流兼容电路 1610 中的初始状态为镇流兼容输入端 1611 及镇流兼容输出端 1621 之间等效上为开路。镇流兼容电路 1610 于镇流兼容输入端 1611 接收讯号后，经预定时间才导通镇流兼容输入端 1611 及镇流相容输出端 1621，使镇流兼容输入端 1611 所接收的讯号传送到镇流兼容输出端 1621。

镇流兼容电路 1610 包含二极管 1612、电阻 1613、1615、1618、1620 及 1622、双向可控硅 1614、双向触发二极管 1617、电容 1619、镇流兼容输入端 1611 及镇流兼容输出端 1621。其中，电阻 1613 的阻值相当大，因此在双向可控硅 1614

截止时，镇流兼容输入端 1611 及镇流兼容输出端 1621 之间等效上为开路。

双向可控硅 1614 耦接于镇流兼容输入端 1611 及镇流兼容输出端 1621 之间，电阻 1613 也耦接于镇流兼容输入端 1611 及镇流兼容输出端 1621 之间而与双向可控硅 1614 并联。二极管 1612、电阻 1620、1622 及电容 1619 依序串联于镇流兼容输入端 1611 及镇流兼容输出端 1621 之间，而与双向可控硅 1614 并联。二极管 1612 的正极与双向可控硅 1614 连接，而负极连接到电阻 1620 的一端。双向可控硅 1614 的控制端与双向触发二极管 1617 的一端相连，双向触发二极管 1617 的另一端与电阻 1618 的一端相连，电阻 1618 的的另一端耦接电容 1619 及电阻 1622 的连接端。电阻 1615 耦接于双向可控硅 1614 的控制端及电阻 1613 与电容 1619 的连接端之间。

当交流驱动讯号(例如：电子镇流器所输出的高频、高压交流讯号)开始输入到镇流兼容输入端 1611 时，双向可控硅 1614 先处于开路状态，使交流驱动讯号无法输入而使 LED 灯也处于开路状态。交流驱动讯号经过二极管 1612、电阻 1620、1622 开始对电容 1619 充电，使电容 1619 的电压逐渐上升。持续充电一段时间后，电容 1619 的电压升高到超过双向触发二极管 1617 的阀值而使触发双向触发二极管 1617 导通。然后，导通的双向触发二极管 1617 触发双向可控硅 1614，使双向可控硅 1614 也导通。此时，导通的双向可控硅 1614 电性连接镇流兼容输入端 1611 及镇流兼容输出端 1621，使交流驱动讯号经由镇流兼容输入端 1611 及镇流兼容输出端 1621 输入，使 LED 灯的电源组件开始操作。另外，电容 1619 所储存的能量维持双向可控硅 1614 导通，以避免交流驱动讯号的交流变化造成双向可控硅 11614，即镇流兼容电路 1610 的再度截止，或者重复于导通与截止之间变化的问题。

一般电子镇流器等灯管驱动电路 505 启动后经几百毫秒，电子镇流器的输出电压可以提高到一定电压值之上而不至于受到 LED 灯的负载加入的影响。另外，电子镇流器等灯管驱动电路 505 会设有荧光灯是否点灯的侦测，若超过时间荧光灯未点灯则判断荧光灯异常而进入保护状态。因此，镇流兼容电路 1610 的延迟时间较佳为在 0.1 秒到 3 秒之间。

值得注意的是，电阻 1622 可以额外并联电容 1623。电容 1623 的作用在于反应镇流兼容输入端 1611 及镇流兼容输出端 1621 之间电压差的瞬间变化，且不影响镇流兼容电路 1610 的延迟导通的作用。

说 明 书

请参见图 58G，为根据本发明第十一较佳实施例的 LED 日光灯的电源组件的应用电路方块示意图。相较于图 49D 所示实施例，本实施例的灯管驱动电路 505 驱动多个串联的 LED 日光灯 500，且每个 LED 日光灯 500 内均装设有镇流兼容电路 1610。为方便说明，以下以两个串联的 LED 日光灯 500 为例说明。

因两个 LED 日光灯 500 内的镇流兼容电路 1610 的延迟时间因组件制程误差等因素的影响而具有不同的延迟时间，因此两个镇流兼容电路 1610 的导通时间并不一致。当灯管驱动电路 505 启动，灯管驱动电路 505 所提供的交流驱动讯号的电压大致由两个 LED 日光灯 500 所均分承受。而后当镇流兼容电路 1610 其中之一先导通时，灯管驱动电路 505 的交流驱动讯号的电压几乎落在尚未导通的另一只 LED 日光灯 500 上。这使得尚未导通的 LED 日光灯 500 的镇流兼容电路 1610 上的跨压突然增加一倍，即镇流兼容输入端 1611 及镇流兼容输出端 1621 之间电压差突然增加一倍。由于电容 1623 的存在，电容 1619 及 1623 的分压效果，会瞬间拉高电容 1619 的电压，使得双向触发二极管 1617 触及双向可控硅 1614 导通，而使两个 LED 日光灯 500 的镇流兼容电路 1610 几乎同时导通。藉由电容 1623 的加入，可避免串联的 LED 日光灯之间因镇流兼容电路 1610 的延迟时间不同，导致先导通的镇流兼容电路 1610 中的双向可控硅 1614 因维持导通的电流不足而再度截止的问题。因此，加入电容 1623 的镇流兼容电路 1610 可进一步改受串联的 LED 日光灯的兼容性。

在实际应用上，电容 1723 的建议容值为在 10pF~1nF 之间，较佳为 10pF~100PF，更佳为 47pF。

值得注意的是，二极管 1612 系用以对电容 1619 充电的讯号进行整流。因此，请参见图 58C、图 58D 及图 58E，在镇流兼容电路 1610 配置于整流单元或整流电路之后的应用情况，二极管 1612 可以省略。因此，在图 58F 中，二极管 1612 以虚线表示。

参见图 58H，为根据本发明第二较佳实施例的镇流兼容电路的电路示意图。镇流兼容电路 1710 中的初始状态为镇流兼容输入端 1711 及镇流兼容输出端 1721 之间为开路。镇流兼容电路 1710 于镇流兼容输入端 1711 接收讯号后，经预定时间才导通镇流兼容输入端 1711 及镇流相容输出端 1721，使镇流兼容输入端 1711 所接收的讯号传送到镇流兼容输出端 1721。

镇流兼容电路 1710 包含双向可控硅 1712、双向触发二极管 1713、电阻 1714、

1716 及 1717 及电容 1715。双向可控硅 1712 的第一端耦接镇流兼容输入端 1711，控制端耦接双向触发二极管 1713 的一端及电阻 1714 的一端，而第二端耦接电阻 1714 的另一端。电容 1715 的一端耦接双向触发二极管 1713 的另一端，另一端耦接双向可控硅 1712 的第二端。电阻 1717 与电容 1715 并联，因此也耦接双向触发二极管 1713 的另一端及双向可控硅 1712 的第二端。电阻 1716 的一端耦接双向触发二极管 1713 与电容 1715 的连接点，另一端耦接镇流兼容输出端 1721。

当交流驱动讯号(例如：电子镇流器所输出的高频、高压交流讯号)开始输入到镇流兼容输入端 1711 时，双向可控硅 1712 先处于开路状态，使交流驱动讯号无法输入而使 LED 灯也处于开路状态。交流驱动讯号的输入会在镇流兼容电路 1710 的镇流兼容输入端 1711 及镇流兼容输出端 1721 之间造成压差。当交流驱动讯号随时间变大并经过一段时间后达到足够的振幅时，镇流兼容输出端 1721 的准位经过电阻 1716、并联的电容 1715 及电阻 1717 以及电阻 1714 反应到双向可控硅 1712 的控制端而触发双向可控硅 1712 导通。此时，镇流兼容电路 1710 导通而使 LED 灯正常操作。在双向可控硅 1712 导通后，电阻 1716 流经电流，并对电容 1715 充电以储存一定的电压于电容 1715。电容 1715 所储存的能量维持双向可控硅 1712 导通，以避免交流驱动讯号的交流变化造成双向可控硅 1712，即镇流兼容电路 1710 的再度截止，或者重复于导通与截止之间变化的问题。

参见图 58I，为根据本发明第三较佳实施例的镇流兼容电路的电路示意图。镇流兼容电路 1810 包含外壳 1812、金属电极 1813、双金属片 1814 以及加热丝 1816。金属电极 1813 及加热丝 1816 由外壳 1812 穿出，因此部分在外壳 1812 内，部分在外壳 1812 之外，且并于外壳外的部分具有镇流兼容输入端 1811 及镇流兼容输出端 1821。外壳 1812 为密封状态，内充有惰性器体 1815，例如：氦气。双金属片 1814 位于外壳 1812 内，与加热丝 1816 在外壳 1812 内部的部分物理性及电性连接。双金属片 1814 与金属电极 1813 之间具有一定间隔，因此镇流兼容输入端 1811 及镇流兼容输出端 1821 在初始状态并位电性连接。

当交流驱动讯号(例如：电子镇流器所输出的高频、高压交流讯号)开始输入到镇流兼容输入端 1811 及镇流兼容输出端 1821 时，金属电极 1813 及加热丝 1816 之间会形成电位差。当电位差大到能击穿惰性气体 1815 发生弧光放电时，惰性

气体 1815 发热使双金属片 1814 往金属电极 1813 膨胀而靠近(参见图线箭头的方向)，并使双金属片 1814 与金属电极 1813 闭合而形成物理性及电性连接。此时，镇流兼容输入端 1811 及镇流兼容输出端 1821 彼此导通。然后，交流驱动讯号流过加热丝 1816，使加热丝 1816 发热，维持双金属片 1814 与金属电极 1813 的闭合状态。

因此，镇流兼容电路 1810 于镇流兼容输入端 1811 及镇流兼容输出端 1821 接收讯号后，经预定时间才导通镇流兼容输入端 1811 及镇流兼容输出端 1821。

请参见图 59A，为根据本发明第十二较佳实施例的 LED 日光灯的电源组件的应用电路方块示意图。相较于图 49E 所示实施例，本实施例的日光灯包含整流电路 510 及 540、滤波电路 520 及 LED 驱动模块 530，且更增加两镇流兼容电路 1540。两镇流兼容电路 1540 分别耦接于接脚 503 与整流输出端 511 之间以及接脚 504 与整流输出端 511 之间。请同时参见图 49A、图 49B 及图 49D，灯管驱动电路 505 为电子镇流器，提供交流驱动讯号以驱动本实施例的 LED 灯。

两镇流兼容电路 1540 的初始状态为导通，并经一段时间后截止。因此，在灯管驱动电路 505 启动之初，交流驱动讯号经接脚 503、对应的镇流兼容电路 1540 和整流输出端 511 及整流电路 510 或接脚 504、对应的镇流兼容电路 1540 和整流输出端 511 及整流电路 510 流过 LED 灯，并旁通了 LED 灯内部的滤波电路及 LED 驱动模块 530。藉此，LED 灯在灯管驱动电路 505 启动之初不影响灯管驱动电路 505 的 Q 值而使灯管驱动电路 505 可以顺利启动。两镇流兼容电路 1540 经一段时间后截止，此时灯管驱动电路 505 已顺利启动，并可以开始驱动 LED 灯。

请参见图 59B，为根据本发明第十三较佳实施例的 LED 日光灯的电源组件的应用电路方块示意图。相较于图 59A 所示实施例，本实施例的两镇流兼容电路 1540 的配置改为分别耦接于接脚 503 与整流输出端 512 之间以及接脚 504 与整流输出端 512 之间。同样地，两镇流兼容电路 1540 的初始状态为导通，并经一段时间后截止，使灯管驱动电路 505 顺利启动后才开始驱动 LED 灯发光。

值得注意的是，两镇流兼容电路 1540 的配置也可以改为分别耦接于接脚 501 与整流输出端 511 之间以及接脚 502 与整流输出端 511 之间，或者改为分别耦接于接脚 501 与整流输出端 512 之间以及接脚 502 与整流输出端 512 之间，依然可以使灯管驱动电路 505 顺利启动后才开始驱动 LED 灯发光。

请参见图 59C，为根据本发明第十四较佳实施例的 LED 日光灯的电源组件的应用电路方块示意图。相较于图 59A 及图 59B 所示的实施例，本实施例的整流电路 540 改采图 50C 所示的整流电路 810，其中整流单元 815 耦接接脚 503 及 504，端点转换电路 541 耦接整流输出端 511 及 512。两镇流兼容电路 1540 的配置也改为分别耦接于接脚 501 与半波连接点 819 之间以及接脚 502 与半波连接点 819 之间。

在灯管驱动电路 505 启动之初，两镇流兼容电路 1540 的初始状态为导通，交流驱动讯号经接脚 501、对应的镇流兼容电路 1540、半波连接点 819 及整流单元 815 或接脚 502、对应的镇流兼容电路 1540 和半波连接点 819 及整流单元 815 流过 LED 灯，并旁通了 LED 灯内部的端点转换电路 541、滤波电路及 LED 驱动模块 530。藉此，LED 灯在灯管驱动电路 505 启动之初不影响灯管驱动电路 505 的 Q 值而使灯管驱动电路 505 可以顺利启动。两镇流兼容电路 1540 经一段时间后截止，此时灯管驱动电路 505 已顺利启动，并可以开始驱动 LED 灯。

值得注意的是，图 59C 的实施例也可以改为整流电路 510 采用图 50C 所示的整流电路 810，其中整流单元 815 耦接接脚 501 及 502，端点转换电路 541 耦接整流输出端 511 及 512；两镇流兼容电路 1540 的配置也改为分别耦接于接脚 503 与半波连接点 819 之间以及接脚 503 与半波连接点 819 之间。如此，镇流兼容电路 1540 依然可以使灯管驱动电路 505 顺利启动后才开始驱动 LED 灯发光。

请参见图 59D，为根据本发明第三较佳实施例的镇流兼容电路的电路示意图，可以应用于图 59A 至图 59C 所示的实施例及对应说明所述的变形例。

镇流兼容电路 1640 包含电阻 1643、1645、1648 及 1650、电容 1644 及 1649；二极管 1647 及 1652、双载子接面晶体管 1646 及 1651、镇流兼容输入端 1641 及镇流兼容输出端 1642。电阻 1645 一端连接镇流相容输入端 1641，另一端耦接双载子接面晶体管 1646 的射极。双载子接面晶体管 1646 的集极耦接二极管 1647 的正极，而二极管 1647 的负极耦接镇流兼容输出端 1642。电阻 1643 及电容 1644 串联于双载子接面晶体管 1646 的射极与集极之间，且电阻 1643 及电容 1644 的连接点耦接双载子接面晶体管 1646 的基极。电阻 1650 一端连接镇流兼容输出端 1642，另一端耦接双载子接面晶体管 1651 的射极。双载子接面晶体管 1651 的集极耦接二极管 1652 的正极，而二极管 1652 的负极耦接镇流相容输入端 1641。电阻 1648 及电容 1649 串联于双载子接面晶体管 1651 的射极与集极之

间，且电阻 1648 及电容 1649 的连接点耦接双载子接面晶体管 1651 的基极。

当电子镇流器的灯管驱动电路 505 刚启动时，电容 1644 及 1649 的电压为 0，此时双载子接面晶体管 1646 及 1651 的基极流过一定电流而处于短路状态（即导通状态）。因此，在灯管驱动电路 505 激活之初，镇流兼容电路 1640 处于导通状态。交流驱动讯号经电阻 1643 及二极管 1647 对电容 1644 充电，同样地经电阻 1648 及二极管 1652 对电容 1649 充电。一定时间后电容 1644 及 1649 的电压升高到一定程度，使电阻 1643 及 1648 的电压降低而截止双载子接面晶体管 1646 及 1654（即截止状态），因此镇流兼容电路 1640 转为关断状态。这样电路运作设计可以避免于灯管驱动电路 505 因 LED 灯的电源组件内部的电容或电感影响灯管驱动电路 505 的 Q 值，确保灯管驱动电路 505 的顺利启动。因此，镇流兼容电路 1640 可以改善 LED 灯对电子镇流器的兼容性。

请参见图 60A，为根据本发明第十五较佳实施例的 LED 日光灯的电源组件的应用电路方块示意图。相较于图 49E 所示实施例，本实施例的 LED 日光灯包含整流电路 510 及 540、滤波电路 520 及 LED 驱动模块 530，且更增加两灯丝仿真电路 1560。两灯丝仿真电路 1560 分别耦接于接脚 501 及 502 之间以及耦接于接脚 503 及 504 之间，用以改善具有灯丝侦测的灯管驱动电路的兼容性，例如：具有预热功能电子镇流器。

具有灯丝侦测的灯管驱动电路于启动之初，会侦测灯管的灯丝是否正常而未发生短路或开路的异常情况。当判断灯丝发生异常时，灯管驱动电路会停止而进入保护状态。为避免灯管驱动电路判断 LED 灯异常，两灯丝仿真电路 1560 可以仿真正常的灯丝，而使灯管驱动电路正常启动驱动 LED 灯发光。

请参见图 60B，为根据本发明第一较佳实施例的灯丝仿真电路的电路示意图。灯丝仿真电路 1660 包含并联的电容 1663 及电阻 1665，而电容 1663 及电阻 1665 的各自两端分别耦接灯丝模拟端 1661 及 1662。请同时参见图 60A，两灯丝仿真电路 1660 的灯丝仿真端 1661 及 1662 耦接接脚 501 及 502 以及接脚 503 及 504。当灯管驱动电路输出侦测讯号以测试灯丝是否正常时，侦测讯号会经过并联的电容 1663 及电阻 1665 而使灯管驱动电路判断灯丝正常。

值得注意的是，电容 1663 的容值小。因此当灯管驱动电路正式驱动 LED 灯而输出的高频交流讯号时，电容 1663 的容抗(等效阻值)远小电阻 1665 的阻值。藉此，灯丝仿真电路 1660 在 LED 灯正常操作时，所消耗的功率相当小而几乎不

影响 LED 灯的发光效率。

请参见图 60C，为根据本发明第二较佳实施例的灯丝仿真电路的电路示意图。在本实施例中，整流电路 510 或/及 540 采用图 50C 所示的整流电路 810 但省略端点转换电路 541，而由灯丝仿真电路 1660 取代端点转换电路 541 的功能。即，本实施例的灯丝仿真电路 1660 同时具有灯丝仿真及端点转换功能。请同时参见图 60A，灯丝仿真电路 1660 的灯丝仿真端 1661 及 1662 耦接接脚 501 及 502 或/及接脚 503 及 504。整流电路 810 中的整流单元 815 的半波连接点 819 耦接灯丝模拟端 1662。

请参见图 60D，为根据本发明第三较佳实施例的灯丝仿真电路的电路示意图。相较于图 60C 所示的实施例，半波连接点 819 改为耦接灯丝模拟端 1661，而本实施例的灯丝仿真电路 1660 依然同时具有灯丝仿真及端点转换功能。

请参见图 60E，为根据本发明第四较佳实施例的灯丝仿真电路的电路示意图。灯丝仿真电路 1760 包含电容 1763 及 1764，以及电阻 1765 及 1766。电容 1763 及 1764 串联于灯丝模拟端 1661 及 1662 之间。电阻 1765 及 1766 也串联于灯丝模拟端 1661 及 1662 之间，且电阻 1765 及 1766 的连接点与电容 1763 及 1764 的连接点耦接。请同时参见图 60A，两灯丝仿真电路 1760 的灯丝仿真端 1661 及 1662 耦接接脚 501 及 502 以及接脚 503 及 504。当灯管驱动电路输出侦测讯号以测试灯丝是否正常时，侦测讯号会经过串联的电容 1763 及 1764 以及电阻 1765 及 1766 而使灯管驱动电路判断灯丝正常。

值得注意的是，电容 1763 及 1764 的容值小。因此当灯管驱动电路正式驱动 LED 灯而输出的高频交流讯号时，串联的电容 1763 及 1764 的容抗远小串联的电阻 1765 及 1766 的阻值。藉此，灯丝仿真电路 1760 在 LED 灯正常操作时，所消耗的功率相当小而几乎不影响 LED 灯的发光效率。再者，电容 1763 或电阻 1765 任一开路或短路，或者电容 1764 或电阻 1766 任一开路或短路，灯丝模拟端 1661 及 1662 之间仍可以流过灯管驱动电路所输出的侦测讯号。因此，电容 1763 或电阻 1765 任一开路或短路及/或电容 1764 或电阻 1766 任一开路或短路，灯丝仿真电路 1760 仍可正常运作而具有相当高的容错率。

请参见图 60F，为根据本发明第五较佳实施例的灯丝仿真电路的电路示意图。在本实施例中，整流电路 510 或/及 540 采用图 50C 所示的整流电路 810 但省略端点转换电路 541，而由灯丝仿真电路 1860 取代端点转换电路 541 的功能。

即，本实施例的灯丝仿真电路 1860 也同时具有灯丝仿真及端点转换功能。灯丝仿真电路 1860 具有负温度系数的阻值，在温度高时的阻值低于在温度低时的阻值。在本实施例中，灯丝仿真电路 1860 包含了两负温度系数电阻 1863 及 1864，串联于灯丝模拟端 1661 及 1662 之间。请同时参见图 60A，灯丝仿真电路 1860 的灯丝仿真端 1661 及 1662 耦接接脚 501 及 502 或/及接脚 503 及 504。整流电路 810 中的整流单元 815 的半波连接点 819 耦接负温度系数电阻 1863 及 1864 的连接点。

当灯管驱动电路输出侦测讯号以测试灯丝是否正常时，侦测讯号会经过负温度系数电阻 1863 及 1864 而使灯管驱动电路判断灯丝正常。而且负温度系数电阻 1863 及 1864 因测试讯号或预热程序，温度逐渐上升并降低阻值。当灯管驱动电路正式驱动 LED 灯发光时，负温度系数电阻 1863 及 1864 的阻值已降至相对低值，而减少功耗的损失。

负温度系数电阻 1863 及 1864 的阻值较佳为于室温时为 10 奥姆或以上并于 LED 灯稳定操作时，负温度系数电阻的阻值降至 2~10 奥姆；更佳的是，于 LED 灯稳定操作时负温度系数电阻 1863 及 1864 的阻值介于 3~6 奥姆之间。

请参见图 61A，为根据本发明第十六较佳实施例的 LED 日光灯的电源组件的应用电路方块示意图。相较于图 49E 所示实施例，本实施例的 LED 日光灯包含整流电路 510 及 540、滤波电路 520 及 LED 驱动模块 530，且更增加过压保护电路 1570。过压保护电路 1570 耦接滤波输出端 521 及 522，以侦测滤波后讯号，并于滤波后讯号的准位高于预定过压值时，箝制滤波后讯号的准位。因此，过压保护电路 1570 可以保护 LED 驱动模块 530 的组件不因过高压而毁损。整流电路 540 为可省略，故在图式中以虚线表示。

请参见图 61B，为根据本发明较佳实施例的过压保护电路的电路示意图。过压保护电路 1670 包含稳压二极管 1671，例如：齐纳二极管(Zener Diode)，耦接滤波输出端 521 及 522。稳压二极管 1671 于滤波输出端 521 及 522 的电压差(即，滤波后讯号的准位)达到崩溃电压时导通，使电压差箝制在崩溃电压上。崩溃电压较佳为在 40-100V 的范围内，更佳为 55-75V 的范围。

请参见图 62A，为根据本发明第十七较佳实施例的 LED 日光灯的电源组件的应用电路方块示意图。相较于图 60A 的实施例，本实施例的 LED 灯包含整流电路 510 及 540、滤波电路 520、LED 驱动模块 530 及两灯丝仿真电路 1560，且

更增加镇流侦测电路 1590。镇流侦测电路 1590 可以耦接于接脚 501、502、503 及 504 的任一与整流电路 510 及 540 中对应的整流电路。在本实施例中，镇流侦测电路 1590 耦接于接脚 501 及整流电路 510 之间。

镇流侦测电路 1590 侦测交流驱动讯号或者经过接脚 501、502、503 及 504 输入的讯号，并根据侦测结果判断所输入的讯号是否为电子镇流器所提供。

请参见图 62B，为根据本发明第十八较佳实施例的 LED 日光灯的电源组件的应用电路方块示意图。相较于图 62A 的实施例，本实施例的整流电路 540 采用图 50C 所示的整流电路 810。镇流侦测电路 1590 耦接于整流单元 815 及端点转换电路 541 之间。整流单元 815 及端点转换电路 541 其中之一耦接接脚 503 及 504，另一耦接整流输出端 511 及 512。在本实施例，整流单元 815 耦接接脚 503 及 504，而端点转换电路 541 耦接整流输出端 511 及 512。同样地，镇流侦测电路 1590 侦测由接脚 503 或 504 所输入的讯号以判断是否为电子镇流器所提供。

再者，本实施例也可以改由整流电路 510 采用图 50C 所示的整流电路 810，并将镇流侦测电路 1590 耦接于整流单元 815 及端点转换电路 541 之间。

请参见图 62C，为根据本发明较佳实施例的镇流侦测电路的电路方块示意图。镇流侦测电路 1590 包含侦测电路 1590a 以及切换电路 1590b。切换电路 1590b 耦接切换端 1591 及 1592。侦测电路 1590a 耦接侦测端 1593 及 1594 以侦测流经侦测端 1593 及 1594 的讯号。或者，也可以省略侦测端 1593 及 1594 而共同耦接到切换端 1591 及 1592 以侦测流经切换端 1591 及 1592 的讯号。因此，图式中侦测端 1593 及 1594 以虚线表示。

请参见图 62D，为根据本发明第一较佳实施例的镇流侦测电路的电路示意图。镇流侦测电路 1690 包含侦测电路 1690a 以及切换电路 1690b，耦接于切换端 1591 及 1592 之间。侦测电路 1690a 包含双向触发二极管 1691、电阻 1692 及 1696 以及电容 1693、1697 及 1698。切换电路 1690b 包含双向可控硅 1699 及电感 1694。

电容 1698 耦接于切换端 1591 及 1592 之间，用以反应流经切换端 1591 及 1592 的讯号而产生侦测电压。当讯号为高频讯号时，电容 1698 的容抗相当低，而产生的侦测电压相当小。当讯号为低频讯号或直流讯号时，电容 1698 的容抗相当高，而产生的侦测电压相当高。电阻 1692 及电容 1693 串联于电容 1698 的

两端，对电容 1698 所产的侦测电压进行滤波并于电阻 1692 及电容 1693 的连接点产生滤波后侦测电压。电阻 1692 及电容 1693 的滤波作用系用以滤除侦测电压的高频噪声，以避免高频噪声造成的误动作。电阻 1696 及电容 1697 串联于电容 1693 的两端，用以将滤波后侦测电压传递至双向触发二极管 1691 的一端。电阻 1696 及电容 1697 同时对滤波后侦测电压进行第二次滤波，使侦测电路 1690a 的滤波效果更佳化。根据不同的应用及噪声滤波需求，电容 1697 可以选择省略而双向触发二极管 1691 的一端经过电阻 1696 耦接至电阻 1692 及电容 1693 的连接点；或者，电阻 1696 及电容 1697 同时省略而双向触发二极管 1691 的一端直接耦接至电阻 1692 及电容 1693 的连接点。故，在图式中电阻 1696 及电容 1697 以虚线表示。双向触发二极管 1691 的另一端耦接至切换电路 1690b 的双向可控硅 1699 的控制端。双向触发二极管 1691 根据所接受到的讯号准位大小，以决定是否产生控制讯号 1695 来触发双向可控硅 1699 导通。双向可控硅 1699 的第一端耦接切换端 1591，另一端经过电感 1694 耦接切换端 1592。电感 1694 的作用在于保护双向可控硅 1699 不因流经切换端 1591 及 1592 的讯号超过最大切换电压上升率、截止状态下反复电压峰值及最大的切换电流变化率而毁损。

当切换端 1591 及 1592 接收的讯号为低频交流讯号或直流讯号时，电容 1698 的侦测电压将足够高而使双向触发二极管 1691 产生控制讯号 1695 来触发双向可控硅 1699。此时，切换端 1591 及 1592 之间为短路，而旁通了切换电路 1690b 所并联的电路，例如：连接于切换端 1591 及 1592 之间的电路、侦测电路 1690a、电容 1698 等。

当切换端 1591 及 1592 接收的讯号为高频交流讯号时，电容 1698 的侦测电压并不足以使双向触发二极管 1691 产生控制讯号 1695 来触发双向可控硅 1699。此时，双向可控硅 1699 为截止，低频交流讯号或直流讯号主要经由外部电路或侦测电路 1690a 传递。

因此，镇流侦测电路 1690 可以判断输入的讯号是否为电子镇流器所提供的高频交流讯号，若是则使高频交流讯号流经外部电路或侦测电路 1690a；若否则旁通外部电路或侦测电路 1690a。

值得注意的是，电容 1698 可以外部电路中的电容来取代，例如：图 51A 至图 51C 所示端点转换电路实施例的至少一电容，而侦测电路 1690a 则省略电容

1698，故图式中以虚线表示。

请参见图 62E，为根据本发明第二较佳实施例的镇流侦测电路的电路示意图。镇流侦测电路 1790 包含侦测电路 1790a 以及切换电路 1790b。切换电路 1790b 耦接于切换端 1591 及 1592 之间。侦测电路 1790a 耦接于侦测端 1593 及 1594 之间。侦测电路 1790a 包含互感的电感 1791 及 1792、电容 1793 及 1796、电阻 1794 以及二极管 1797。切换电路 1790b 包含切换开关 1799。在本实施例，切换开关 1799 为 P 型空乏式金氧半场效晶体管(P-type Depletion Mode MOSFET)，当其闸极电压高于一临界电压时为截止，低于该临界电压时为导通。

电感 1792 耦接于侦测端 1593 及 1594 之间，以根据流经侦测端 1593 及 1594 的讯号互感至电感 1791，使电感 1791 产生侦测电压。

当讯号为高频讯号时，电感 1792 的感抗相当高，互感至电感 1791 而产生相当高的侦测电压。当讯号为低频讯号或直流讯号时，电感 1792 的感抗相当低，互感至电感 1791 而产生相当低的侦测电压。电感 1791 的一端接地。串联的电容 1793 及电阻 1794 与电感 1791 并联，以接收电感 1791 所产生侦测电压，并进行高频滤波后产生滤波后侦测电压。滤波后侦测电压经二极管 1797 后对电容 1796 充电以产生控制讯号 1795。由于二极管 1797 提供电容 1796 单向充电，故控制讯号 1795 的准位为电感 1791 的侦测电压的最大值。电容 1796 耦接切换开关 1799 的控制端。切换开关 1799 的第一端与第二端分别耦接切换端 1591 及 1592。

当切换端 1591 及 1592 接收的讯号为低频交流讯号或直流讯号时，电容 1796 所产生的控制讯号 1795 低于切换开关 1799 的临界电压而使切换开关 1799 导通。此时，切换端 1591 及 1592 之间为短路，而旁通了切换电路 1790b 所并联的外部电路，例如：图 51A 至图 51C 所示端点转换电路实施例中的至少一电容等。

当切换端 1591 及 1592 接收的讯号为高频交流讯号时，电容 1796 所产生的控制讯号 1795 高于切换开关 1799 的临界电压而使切换开关 1799 截止。此时，高频交流讯号主要经由外部电路传递。

因此，镇流侦测电路 1790 可以判断输入的讯号是否为电子镇流器所提供的高频交流讯号，若是则使高频交流讯号流经外部电路；若否则旁通外部电路。

接下来说明 LED 灯中加入镇流侦测电路，其切换电路的导通(旁通)与截止(不旁通)的操作。举例来说，切换端 1591 及 1592 耦接与 LED 灯串联的电容，

即，驱动 LED 日光灯的讯号也会流经此电容。此电容可以设置在 LED 日光灯的内部与内部电路串联或者串联在 LED 日光灯外部。请同时参见图 49A、图 49B 或图 49D，当灯管驱动电路 505 不存在时，交流电源 508 提供低压、低频交流驱动讯号做为外部驱动讯号以驱动 LED 日光灯 500。此时，镇流侦测电路的切换电路导通，使交流电源 508 的交流驱动讯号直接驱动与 LED 日光灯的内部电路。灯管驱动电路 505 存在时，灯管驱动电路 505 产生高压、高频交流讯号以驱动 LED 日光灯 500。此时，镇流侦测电路的切换电路截止，此电容与 LED 日光灯内部的等效电容串联，因而达到电容分压的效果。藉此，可以使施加在 LED 日光灯内部电路的电压较低(例如：落在 100-277V 的范围内)以避免内部电路因高压而毁损。或者，切换端 1591 及 1592 耦接图 51A 至图 51C 所示端点转换电路实施例中的电容，使流经半波连接点 819 的讯号也同时流经此电容，举例来说，图 51A 的电容 642、图 51C 的电容 842。当灯管驱动电路 505 产生高压、高频交流讯号输入时，切换电路截止，使电容可以达到分压效果；当市电的低频交流讯号或电池的直流讯号输入时，切换电路导通以旁通电容。

值得注意的是，切换电路可以包含多个切换组件，以提供两个以上的切换端来并联连接多个并联的电容(例如：图 51A 的电容 645 及 646、图 51A 的电容 643、645 及 646、图 51B 的 743 与 744 或/及 745 与 746、图 51C 的电容 843 及 844、图 51C 的电容 845 及 846、图 51C 的电容 842、843 及 844、图 51C 的电容 842、845 及 846、图 51C 的电容 842、843、844、845 及 846)，来确实达到将等效与 LED 日光灯串联的多个电容旁通知效果。

另外，在此也说明本发明的镇流侦测电路如何与图 57A 至图 57I 所示的模式切换电路结合使用。镇流侦测电路中的切换电路以模式切换电路来取代。镇流侦测电路中的侦测电路耦接于输入接脚 501、502、503 及 504 其中之一，以侦测 LED 灯所接受的经由接脚 501、502、503 及 504 所接收的讯号。侦测电路根据讯号为高频、低频或直流讯号来产生控制讯号，以控制模式切换电路为第一模式或第二模式。

举例来说，当讯号为高频讯号时，例如：由灯管驱动电路 505 所提供的高频讯号，侦测电路的控制讯号将使模式切换电路为第二模式；当讯号为低频或直流讯号时，例如：市电或电池所提供的低频或直流讯号，侦测电路的控制讯号将使模式切换电路为第一模式。

请参见图 63A，为根据本发明第十九较佳实施例的 LED 日光灯的电源组件的应用电路方块示意图。相较于图 60A 所示实施例，本实施例的 LED 日光灯包含整流电路 510 及 540、滤波电路 520、 LED 驱动模块 530 及两灯丝仿真电路 1560，且更增加辅助电源模块 2510。辅助电源模块 2510 耦接于滤波输出端 521 与 522 之间。辅助电源模块 2510 侦测滤波输出端 521 与 522 上的滤波后讯号，并根据侦测结果决定是否提供辅助电力到滤波输出端 521 与 522。当滤波后讯号停止提供或交流准位不足时，辅助电源模块 2510 提供辅助电力，使 LED 驱动模块 530 可以持续发光。整流电路 540 及两灯丝仿真电路 1560 为可以省略，在图式中以虚线表示。

请参见图 63B，为根据本发明第二十较佳实施例的 LED 日光灯的电源组件的应用电路方块示意图。相较于图 63A 所示实施例，本实施例的 LED 日光灯包含整流电路 510 及 540、滤波电路 520、 LED 驱动模块 530、两灯丝仿真电路 1560 及辅助电源模块 2510，且 LED 驱动模块 530 更包含驱动电路 1530 及 LED 模块 630。辅助电源模块 2510 耦接驱动输出端 1521 及 1522 之间。辅助电源模块 2510 侦测驱动输出端 1521 及 1522 的驱动讯号，并根据侦测结果决定是否提供辅助电力到驱动输出端 1521 及 1522。当驱动讯号停止提供或交流准位不足时，辅助电源模块 2510 提供辅助电力，使 LED 模块 630 可以持续发光。整流电路 540 及两灯丝仿真电路 1560 为可以省略，在图式中以虚线表示。

请参见图 63C，为根据本发明较佳实施例的辅助电源模块的电路示意图。辅助电源模块 2610 包含储能单元 2613 以及电压侦测电路 2614。辅助电源模块 2610 并具有辅助电源正端 2611 及辅助电源负端 2612 以分别耦接滤波输出端 521 与 522 或驱动输出端 1521 及 1522。电压侦测电路 2614 侦测辅助电源正端 2611 及辅助电源负端 2612 上讯号的准位，以决定是否将储能单元 2613 的电力透过辅助电源正端 2611 及辅助电源负端 2612 向外释放。

在本实施例中，储能单元 2613 为电池或超级电容。电压侦测电路 2614 更于辅助电源正端 2611 及辅助电源负端 2612 的讯号的准位高于储能单元 2613 的电压时，以辅助电源正端 2611 及辅助电源负端 2612 上的讯号对储能单元 2613 充电。当辅助电源正端 2611 及辅助电源负端 2612 的讯号之准位低于储能单元 2613 的电压时，储能单元 2613 经辅助电源正端 2611 及辅助电源负端 2612 对外部放电。

电压侦测电路 2614 包含二极管 2615、双载子接面晶体管 2616 及电阻 2617。二极管 2615 的正极耦接储能单元 2613 的正极，负极耦接辅助电源正端 2611。储能单元 2613 的负极耦接辅助电源负端 2612。双载子接面晶体管 2616 的集极耦接辅助电源正端 2611，射极耦接储能单元 2613 的正极。电阻 2617 一端耦接辅助电源正端 2611，另一端耦接双载子接面晶体管 2616 的基极。电阻 2617 于双载子接面晶体管 2616 的集极高于射极一个导通电压时，使双载子接面晶体管 2616 导通。当驱动 LED 日光灯的电源正常时，滤波后讯号经滤波输出端 521 与 522 及导通的双载子接面晶体管 2616 对储能单元 2613 充电，或驱动讯号经驱动输出端 1521 与 1522 及导通的双载子接面晶体管 2616 对储能单元 2613 充电，直至双载子接面晶体管 2616 的集极-射击的差等于或小于导通电压为止。当滤波后讯号或驱动讯号停止提供或准位突然下降时，储能单元 2613 通过二极管 2615 提供电力至 LED 驱动模块 530 或 LED 模块 630 以维持发光。

值得注意的是，储能单元 2613 充电时所储存的最高电压将至少低于施加于辅助电源正端 2611 与辅助电源负端 2612 的电压一个双载子接面晶体管 2616 的导通电压。储能单元 2613 放电时由辅助电源正端 2611 与辅助电源负端 2612 输出的电压低于储能单元 2613 的电压一个二极管 2615 的阈值电压。因此，当辅助电源模块开始供电时，所提供的电压将较低(约等于二极管 2615 的阈值电压与双载子接面晶体管 2616 的导通电压之和)。在图 63B 所示的实施例中，辅助电源模块供电时电压降低会使 LED 模块 630 的亮度明显下降。如此，当辅助电源模块应用于紧急照明系统或常亮照明系统时，用户可以知道主照明电源，例如：市电，异常，而可以进行必要的防范措施。

请参见图 64，为根据本发明第二十一较佳实施例的 LED 日光灯的电源组件的应用电路方块示意图。相较于前述的 LED 日光灯的实施例，本实施例的 LED 日光灯的驱动电路外置。即，LED 日光灯 3500 由外置驱动电源 3530 透过外部驱动端 3501 及 3502 而驱动发光。LED 日光灯 3500 内仅包含 LED 模块 630 及电流控制电路 3510，而不包含整流电路、滤波电路及驱动电路。在此实施例中的外部驱动端 3501 及 3502 作用同图 49A 及图 49B 所示的接脚 501 及 502。

外置驱动电源 3530 可直接连接市电或电子镇流器，以接收电力并转换成外部驱动讯号并经外部驱动端 3501 及 3502 输入 LED 日光灯 3500。外部驱动讯号为直流讯号，更佳为稳定的直流电流讯号。在正常工作情况时，电流控制电路

3510 处于导通状态，使 LED 模块 630 流经电流而发光。电流控制电路 3510 还可以侦测 LED 模块 630 的电流以进行稳压及/或稳流控制，而具有线性纹波去除功能。在异常工作情况时，电流控制电路 3510 截止以停止提供外置驱动电源 3530 的电力至 LED 模块 630，以进入保护状态。

当电流控制电路 3510 判断 LED 模块 630 的电流低于预设电流值或预定范围的下限时，电流控制电路 3510 处于完全导通状态。当电流控制电路 3510 判断 LED 模块 630 的电流高于预设电流值或预定范围的上限（较佳为超过 LED 模块 630 额定电流的 30%）时，电流控制电路 3510 处于截止状态，截止外置驱动电源 3530 的电力输入 LED 日光灯 3500。根据这样的设计，不仅在外置驱动电源 3530 的驱动能力降低时，电流控制电路 3510 可以尽量维持 LED 灯的亮度。在外置驱动电源 3530 的驱动能力异常提高时，电流控制电路 3510 还可以避免 LED 模块 630 因过流而毁损，因而达到过流保护的功能。

值得注意的是，外置驱动电源 3530 也可以是稳定的直流电压讯号。在正常工作情况时，电流控制电路 3510 稳定 LED 模块 630 的电流或处于线性工作状态(即，LED 模块 630 的电流随电压线性变化)。为了维持 LED 模块 630 的电流稳定或处于线性工作状态，外置驱动电源 3530 所提供的直流电压讯号越高，电流控制电路 3510 上的跨压越高而使得电流控制电路 3510 的功耗也会越高。电流控制电路 3510 可以设有温度传感器。当外置驱动电源 3530 所提供的直流电压讯号过高时，电流控制电路 3510 进入过温保护，截止外置驱动电源 3530 的电力输入 LED 日光灯 3500。例如：当温度传感器检测出电流控制电路 3510 的温度超过 120° 时，电流控制电路 3510 进入过温保护。根据这样的设计，电流控制电路 3510 可以同时具有过温或过压保护的功能。

因采用外置驱动电源的结构，缩短了灯头的长度尺寸。为保证 LED 灯的整体长度符合规定,其灯头短缩的长度由延长灯管的长度来补足。因灯管的长度有延长，相应地延长贴在灯管内的灯板的长度。同等照明条件下，贴在灯管内壁的灯板上的 LED 组件间的间隔可相应的加大，由于 LED 组件间的间隔增大，这样可提高散热效率、降低 LED 组件操作时的温度，而可延长 LED 组件的寿命。

请参照图 37，在本发明各实施例中，光源 202 可以进一步改良为包括具有凹槽 202a 的支架 202b，以及设于凹槽 202a 中的 LED 晶粒(或芯片)18。凹槽 202a 内填充有荧光粉，荧光粉覆盖 LED 晶粒(或芯片)18，以起到光色转换的作用。

特予说明的是，相较于传统 LED 晶粒(或芯片)的长度与宽度的比例约略为 1:1 的正方形形状,本发明各实施例中所采用的 LED 晶粒(或芯片)18 的长度与宽度的比例范围可为 2:1 至 10:1，本发明各实施例中采用的 LED 晶粒(或芯片)18 的长度与宽度的比例范围以 2.5:1 至 5:1 为较佳，最佳范围为 3:1 至 4.5:1，如此一来，将 LED 晶粒(或芯片)18 的长度方向沿着灯管 1 的长度方向排列，改善了 LED 晶粒(或芯片)18 的平均电流密度以及灯管 1 整体的出光光形等问题。

本发明各实施例中，一根灯管 1 中的光源 202 具有多个，多个光源 202 可以排布成一列或多列，每列光源 202 均沿灯管 1 的轴向（Y 方向）排布。当排布成一列或多列的各个光源 202 系采用前述包括具有凹槽 202a 的支架 202b 时，每个支架 202b 中的凹槽 202a 可以为一个或者多个。其中，至少一个光源 202 的支架 202b 具有沿灯管长度方向排布且沿灯管宽度方向延伸的第一侧壁 15，以及沿灯管宽度方向排布且沿灯管长度方向延伸的第二侧壁 16，第一侧壁 15 低于第二侧壁 16。此处的第一侧壁、第二侧壁指的是用以围成凹槽 202a 的侧壁。本发明各实施例中，一列光源中亦允许其中有一个或多个光源的支架的侧壁采用其他的排布或延伸方式。

优选地，每个支架 202b 具有一个凹槽 202a，对应的，每个支架 202b 具有两个第一侧壁 15、两个第二侧壁 16。其中，两个第一侧壁 15 沿灯管 1 长度方向（Y 方向）排布且沿灯管 1 的宽度方向（X 方向）延伸，两个第二侧壁 16 沿灯管 1 宽度方向（X 方向）排布且沿灯管 1 的长度方向（Y 方向）延伸。第一侧壁 15 和第二侧壁 16 围成凹槽 202a。

当用户从灯管的侧面，例如沿 X 方向观察灯管时，第二侧壁 16 可以阻挡用户的视线直接看到光源 202，以降低颗粒的不舒适感。其中，第一侧壁 15“沿灯管 1 的宽度方向”延伸，只要满足延伸趋势与灯管 1 的宽度方向基本相同即可，不要求严格与灯管 1 的宽度方向平行，例如，第一侧壁 15 可以与灯管 1 的宽度方向有些许角度差，或者，第一侧壁 15 也可以为折线形、弧形、波浪形等各种形状；第二侧壁 16“沿灯管 1 的长度方向”延伸，只要满足延伸趋势与灯管 1 的长度方向基本相同即可，不要求严格与灯管 1 的长度方向平行，例如，第二侧壁 16 可以与灯管 1 的长度方向有些许角度差，或者，第二侧壁 16 也可以为折线形、弧形、波浪形等各种形状。

本发明各实施例中，第一侧壁 15 低于第二侧壁 16，可以使得光线能够容易

越过支架 202b 发散出去，透过疏密适中的间距设计，在 Y 方向可以不产生颗粒的不舒适感，在本发明各实施例中，若第一侧壁不低于第二侧壁，则每列光源 202 之间要排列地更紧密，才能降低颗粒感，提高效能。

本发明各实施例中，第一侧壁 15 的内表面 15a 可设置为坡面，相对于将内表面 15a 设置为垂直于底壁的形式来说，坡面的设置使得光线更容易穿过坡面发散出去。坡面可以包括平面或弧面，或者，坡面可以是平面和弧面的结合体。当采用平面时，该平面的坡度约在 30 度至 60 度之间。也就是说，平面形式的坡面与凹槽 202a 的底壁之间的夹角范围为 120 度至 150 度之间。优选地，平面的坡度约在 15 度至 75 度之间，也就是说，平面形式的坡面与凹槽 202a 的底壁之间的夹角范围为 105 度至 165 度之间。

在本发明各实施例中，若光源 202 为多列，且沿灯管 1 的轴向方向（Y 方向）排布，仅要最外侧二列的光源 202（即邻近灯管管壁的两列光源 202）的支架 202b 具有沿灯管 1 长度方向（Y 方向）排布的两个第一侧壁 15 以及沿灯管 1 宽度方向（X 方向）排布的两个第二侧壁 16，也就是说，最外侧二列的光源 202 的支架 202b 具有沿灯管 1 的宽度方向（X 方向）延伸的第一侧壁 15，以及沿灯管 1 的长度方向（Y 方向）延伸的第二侧壁 16 即可，于此二列光源 202 之间的其他列的光源 202 的支架 202b 排列方向则不限定，例如，中间列（第三列）光源 202 的支架 202b，每个支架 202b 可具有沿灯管 1 长度方向（Y 方向）排布的两个第一侧壁 15 以及沿灯管 1 宽度方向（X 方向）排布的两个第二侧壁 16、或每个支架 202b 可具有沿灯管 1 宽度方向（X 方向）排布的两个第一侧壁 15 以及沿灯管 1 长度方向（Y 方向）排布的两个第二侧壁 16、或交错排列等等，只要当用户从灯管的侧面，例如沿 X 方向观察灯管时，最外侧二列光源 202 中支架 202b 的第二侧壁 16 可以阻挡用户的视线直接看到光源 202，即可降低颗粒的不舒适感。对于最外侧的两列光源，亦允许其中有一个或多个光源的支架的侧壁采用其他的排布或延伸方式。

由此可见，当多个光源 202 排布成沿灯管长度方向的一列时，多个光源 202 的支架 202b 中，沿灯管宽度方向位于同一侧的所有第二侧壁 16 在同一条直线上，即同侧的第二侧壁 16 形成类似于一面墙的结构，以阻挡用户的视线直接看到光源 202。

当多个光源 202 排布成沿灯管长度方向的多列时，多列光源 202 沿灯管的

宽度方向分布，且针对位于沿灯管宽度方向最外侧的两列光源，每列的多个光源 202 的支架 202b 中，沿灯管宽度方向位于同一侧的所有第二侧壁 16 在同一条直线上。如此一来，用户沿灯管宽度方向从侧面观察灯管时，只要最外侧的两列光源 202 中支架 202b 的第二侧壁 16 能够阻挡用户视线直接看到光源 202，则就能够达到降低颗粒的不是舒适感的目的。而对于中间的一列或几列光源 202，其侧壁的排布、延伸方式不作要求，可以与最外侧的两列光源 202 相同，也可以采用其他排布方式。

需要提醒注意的是，在其他实施例中，对于同一根 LED 直管灯而言，在“灯管具有强化部结构”、“灯板采用可挠式电路板”、“灯管内周面涂有粘接膜”、“灯管内周面涂有扩散层”、“光源外罩有扩散膜片”、“灯管内壁涂有反射膜”、“灯头为包括导热部的灯头”、“灯头为包括导磁金属片的灯头”、“光源具有支架” 、“电源具有长短电路板的组合件”等特征中，可以只包括其中的一个或多个技术特征，其中关于“灯管具有强化部结构”的内容系可选自于包含有实施例中其相关技术特征的其中之一或其组合，其中关于“灯板采用可挠式电路板”的内容系可选自于包含有实施例中其相关技术特征的其中之一或其组合，其中关于“灯管内周面涂有粘接膜”的内容系可选自于包含有实施例中其相关技术特征的其中之一或其组合，其中关于“灯管内周面涂有扩散层”的内容系可选自于包含有实施例中其相关技术特征的其中之一或其组合，其中关于“光源外罩有扩散膜片”的内容系可选自于包含有实施例中其相关技术特征的其中之一或其组合，其中关于“灯管内壁涂有反射膜”的内容系可选自于包含有实施例中其相关技术特征的其中之一或其组合，其中关于“灯头为包括导热部的灯头”的内容系可选自于包含有实施例中其相关技术特征的其中之一或其组合，其中关于“灯头为包括导磁金属片的灯头”的内容系可选自于包含有实施例中其相关技术特征的其中之一或其组合，其中关于“光源具有支架”的内容系可选自于包含有实施例中其相关技术特征的其中之一或其组合。

在灯管具有强化部结构中，所述灯管包括主体部和分别位于所述主体部两端的端部，所述端部与所述主体部之间具有一过渡部，所述过渡部的两端皆为弧形，所述端部各套设于一灯头，至少一个所述端部的外径小于所述主体部的外径，且对应所述外径小于所述主体部外径端部的灯头，其外径与所述主体部的外径相等。

说 明 书

在灯板采用可挠式电路板中，所述可挠式电路板与所述电源的输出端之间通过导线打线连接或所述可挠式电路板与所述电源的输出端之间焊接。此外，所述可挠式电路板包括一介电层与一线路层的堆栈；可挠式电路板可以在表面涂覆油墨材料的电路保护层，并通过增加沿周向的宽度来实现反射膜的功能。

在灯管内周面涂有扩散层中，所述扩散涂层的组成成分包括碳酸钙、卤磷酸钙以及氧化铝中的至少一种，以及增稠剂和陶瓷活性炭。此外，所述扩散层亦可为扩散膜片且罩在光源外。

在灯管内壁涂有反射膜中，所述光源可设置于反射膜上、设置于所述反射膜开孔中、或在所述反射膜的侧边。

在灯头设计中，灯头可以包括绝缘管与导热部，其中热熔胶可以填充容置空间的一部分或者填充满容置空间。或者，灯头包括绝缘管与导磁金属件，其中，导磁金属件可以是圆形或者非圆形，并可以通过设置空孔结构或压痕结构来减小与绝缘管的接触面积。另外，绝缘管内也可以通过设置支撑部、凸出部来加强对导磁金属件的支撑并减小导磁金属件与绝缘管的接触面积。

在光源设计中，所述光源包括具有凹槽的支架，以及设于所述凹槽中的 LED 晶粒；所述支架具有沿所述灯管长度方向排布的第一侧壁，以及沿所述灯管宽度方向排布的第二侧壁，所述第一侧壁低于所述第二侧壁。

在电源设计中，长短电路板的组合件具有一长电路板和一短电路板，长电路板和短电路板彼此贴合透过黏接方式固定，短电路板位于长电路板周缘附近。短电路板上具有电源组件,整体构成电源。

在电源组件设计中，所述的外部驱动讯号可以是低频交流讯号(例如：市电所提供)、高频交流讯号(例如：电子镇流器所提供)、或直流讯号(例如：电池所提供或外置驱动电源)，且均可以单端电源的驱动架构或双端电源的驱动架构来输入 LED 日光灯。在双端电源的驱动架构，可以支持仅使用其中一端以做为单端电源的方式来接收外部驱动讯号。

在直流讯号做为外部驱动讯号时，LED 日光灯的电源组件可以省略整流电路。

在电源组件的整流电路设计中，可以是具有单一整流电路，或双整流电路。双整流电路中的第一整流电路与第二整流电路分别与配置在 LED 日光灯的两端

灯头的接脚耦接。在单一整流电路可适用于单端电源的驱动架构，而双整流电路适用于单端电源及双端电源的驱动架构。而且配置有至少一整流电路时，可以适用于低频交流讯号、高频交流讯号、或直流讯号的驱动环境。

单一整流电路可以是半桥整流电路或全桥整流电路。双整流电路可以是双半桥整流电路、双全桥整流电路或半桥整流电路及全桥整流电路各一之组合。

在 LED 日光灯的接脚设计中，可以是单端双接脚(共两个接脚，另一端无接脚)、双端各单接脚(共两个接脚)、双端各双接脚(共四个接脚)的架构。在单端双接脚及双端各单接脚的架构下，可适用于单一整流电路的整流电路设计。在双端各双接脚的架构下，可适用于双整流电路的整流电路设计，且使用双端各任一接脚或任一单端的双接脚来接收外部驱动讯号。

在电源组件的滤波电路设计中，可以具有单一电容、π 型滤波电路或 LC 滤波电路。在直流讯号做为外部驱动讯号时，LED 日光灯的电源组件可以省略滤波电路。

在电源组件的 LED 驱动模块设计中，可以仅包含 LED 模块或者包含 LED 模块及驱动电路。也可以将稳压电路与 LED 驱动模块并联，以确保 LED 驱动模块上的电压不至发生过压。稳压电路可以是钳压电路，例如：齐纳二极管、双向稳压管等。在整流电路包含电容电路时，可以在双端的各端的一接脚与另一端的一接脚两两连接一电容于之间，以与电容电路进行分压作用而做为稳压电路。

在仅包含 LED 模块的设计中，于高频交流讯号做为外部驱动讯号时，至少一整流电路包含电容电路(即，包含一个以上的电容)，与整流电路内的全桥或半桥整流电路串联，使电容电路在高频交流讯号下等效为阻抗以做为电流调节电路并调节 LED 模块的电流。藉此，不同的电子镇流器所提供不同电压的高频交流讯号时，LED 模块的电流可以被调节在预设电流范围内而不至发生过流的情况。另外，可以额外增加释能电路，与 LED 模块并联，于外部驱动讯号停止提供之后，辅助将滤波电路进行释能，以降低滤波电路或其他电路所造成的谐振造成 LED 模块闪烁发光之情况。在包含 LED 模块及驱动电路中，驱动电路可以是直流转直流升压转换电路、直流转直流降压转换电路或直流转直流升降压转换电路。驱动电路系用以将 LED 模块的电流稳定在设定电流值，也可以根据外部驱动讯号的高或低来对应调高或调低设定电流值。另外，可以额外增加模式

切换开关于 LED 模块与驱动电路之间，使电流由滤波电路直接输入 LED 模块或经过驱动电路后输入 LED 模块。

另外，可以额外增加保护电路来保护 LED 模块。保护电路可以侦测 LED 模块的电流或/及电压来对应启动对应的过流或过压保护。

在电源组件的镇流侦测电路设计中，镇流侦测电路与等效上与 LED 驱动模块串联的电容并联，并根据外部驱动讯号的频率来决定外部驱动讯号流经电容或流经镇流侦测电路(即旁通电容)。上述的电容可以是整流电路的电容电路。

在电源组件的灯丝仿真电路设计中，可以是单一并联电容及电阻或双并联电容及电阻或负温度系数电路。灯丝仿真电路适用于程序预热型启动型电子镇流器，可以避免程序预热型启动型电子镇流器判断灯丝异常的问题，改善对程序预热型启动型电子镇流器的兼容性。而且灯丝仿真电路几乎不影响瞬时启动型(Instant Start)电子镇流器、快速型启动型(Rapid Start) 电子镇流器等其他电子镇流器的兼容性。

在电源组件的镇流兼容电路设计中，可以与整流电路串联或与滤波电路及 LED 驱动模块并联。在与整流电路串联的设计中，镇流兼容电路的初始状态为截止，并经过预定延迟时间后导通。在与滤波电路及 LED 驱动模块并联的设计中，镇流兼容电路的初始状态为导通，并经过预定延迟时间后截止。镇流兼容电路可以在启动初期使瞬时启动型电子镇流器能顺利启动，而改善对瞬时启动型电子镇流器的兼容性。而且镇流兼容电路几乎不影响预热型启动型电子镇流器、快速型启动型电子镇流器等其他电子镇流器的兼容性。

在电源组件的辅助电源模块设计中，储能单元可以是电池或超级电容，与 LED 模块并联。辅助电源模块适用于包含驱动电路的 LED 驱动模块设计中。

在电源组件的 LED 模块设计中，LED 模块可以包含彼此并联的多串 LED 组件(即，单一 LED 芯片，或多个不同颜色 LED 芯片组成的 LED 组)串，各 LED 组件串中的 LED 组件可以彼此连接而形成网状连接。

也就是说，可以将上述特征作任意的排列组合，并用于 LED 直管灯的改进。

应当理解的是，以上仅为本发明的优选实施方式，不能因此限制本发明的专利范围。凡是利用本发明说明书及附图内容所作的等效结构或等效流程变换，或直接或间接运用在其他相关的技术领域，均同理包括在本发明的专利保护范围内。

说 明 书 附 图

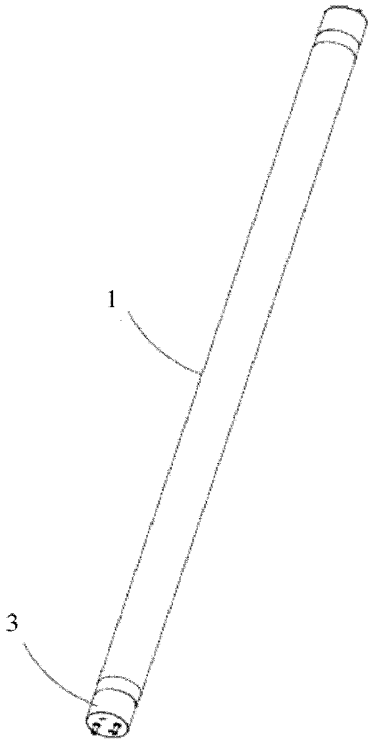


图 1

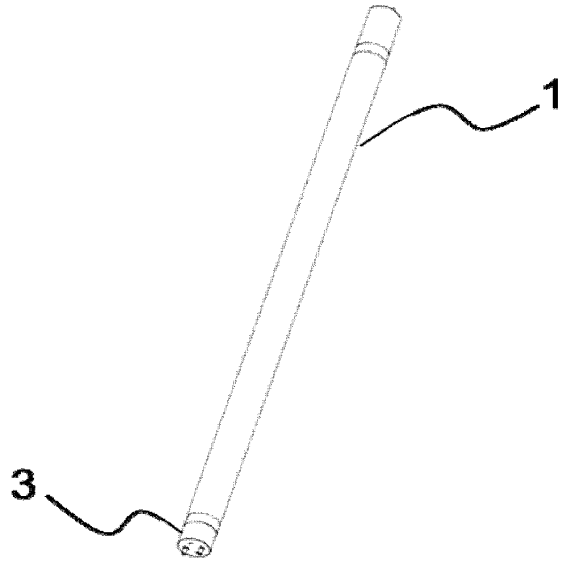


图 1A

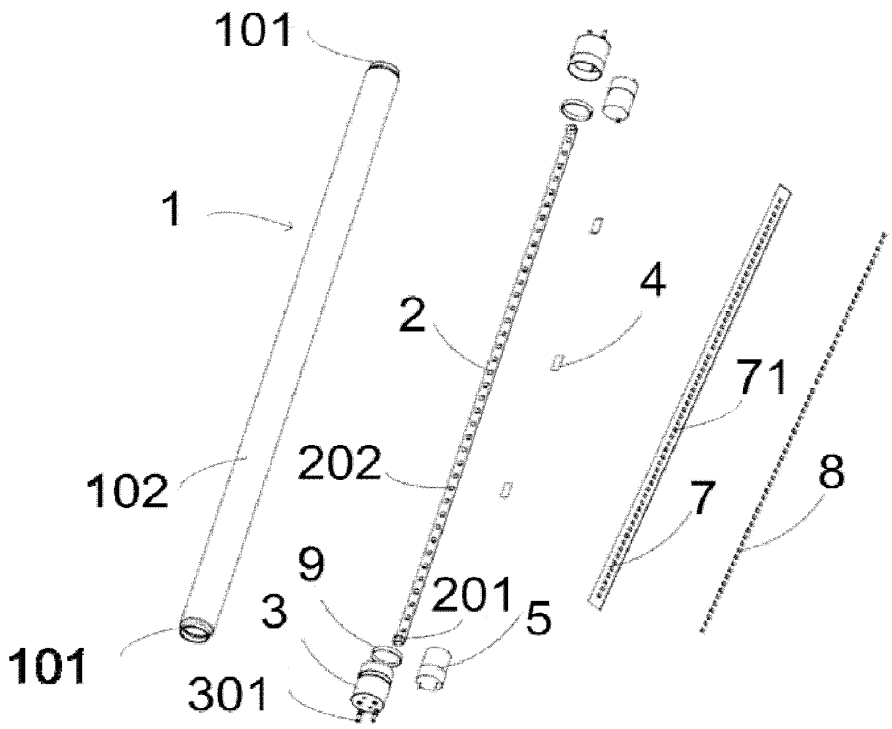


图 2

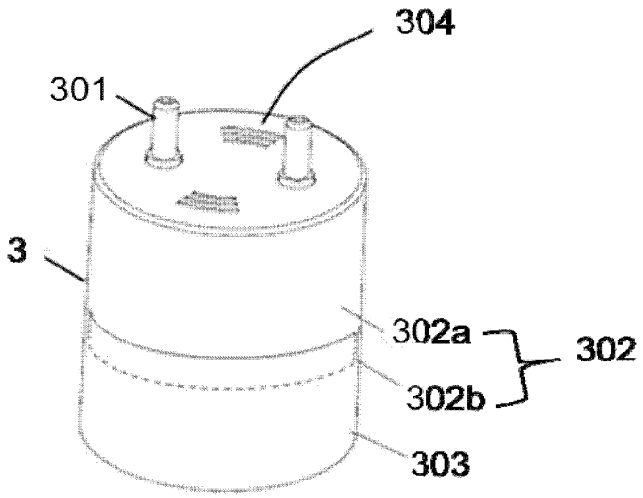

304
301
3
302a
302
302b
303

图 3

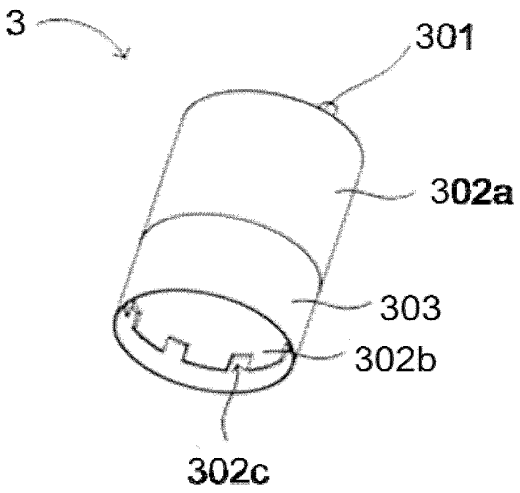

3
301
302a
303
302b
302c

图 4

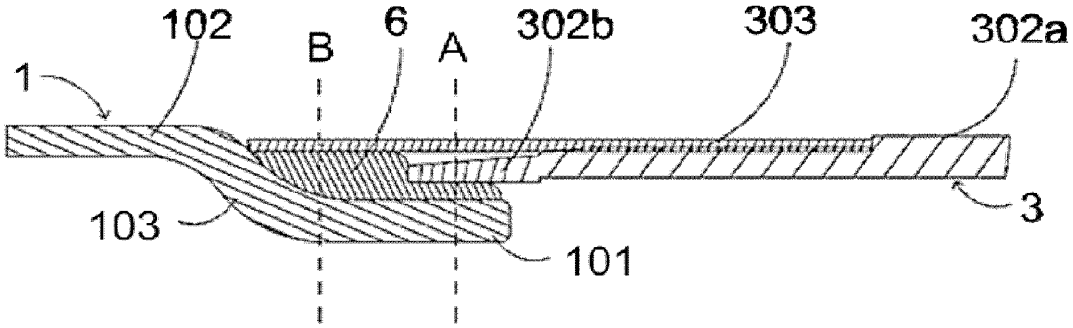

102
B
6
A
302b
303
302a
1
3
103
101

图 5

说 明 书 附 图

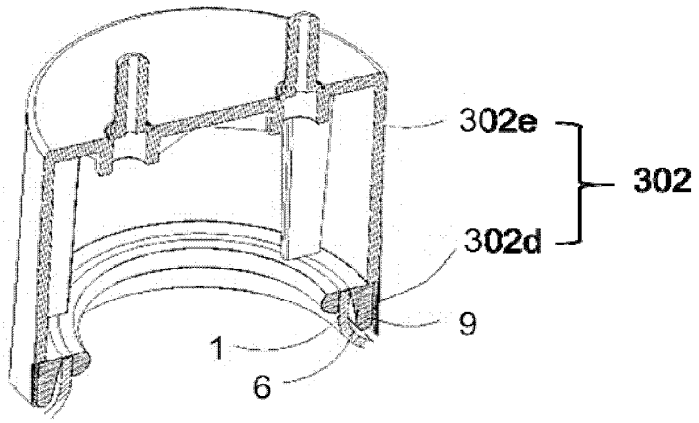


图 6

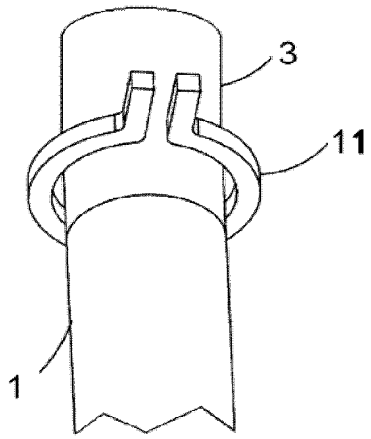


图 7

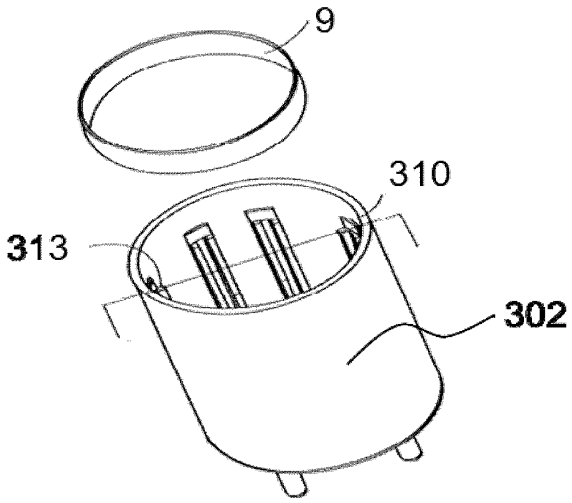


图 8

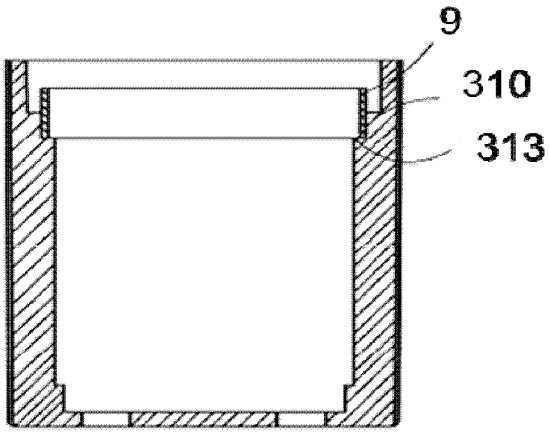


图 9

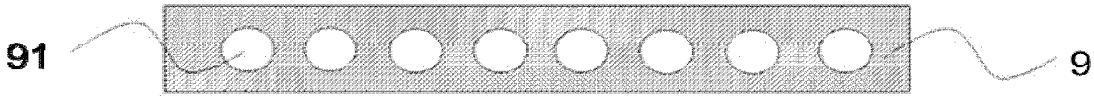


图 10

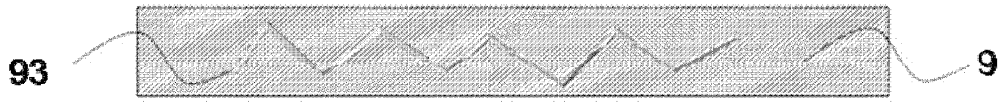


图 11

说 明 书 附 图

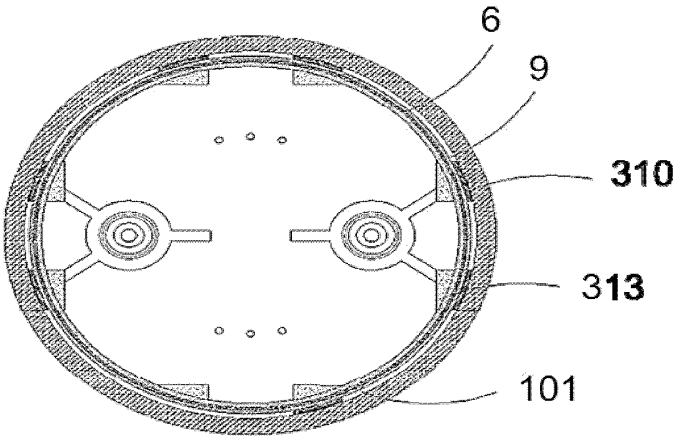


图 12

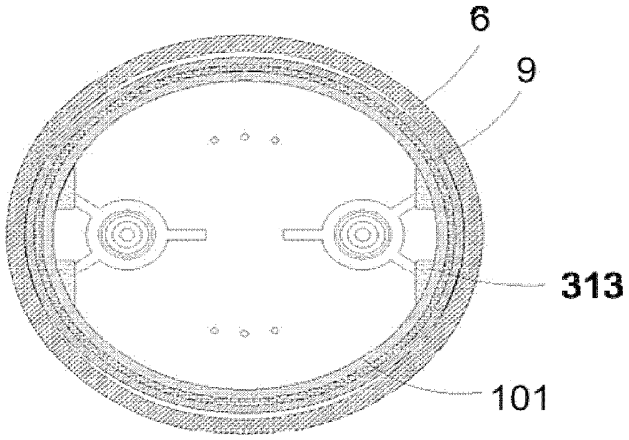


图 13

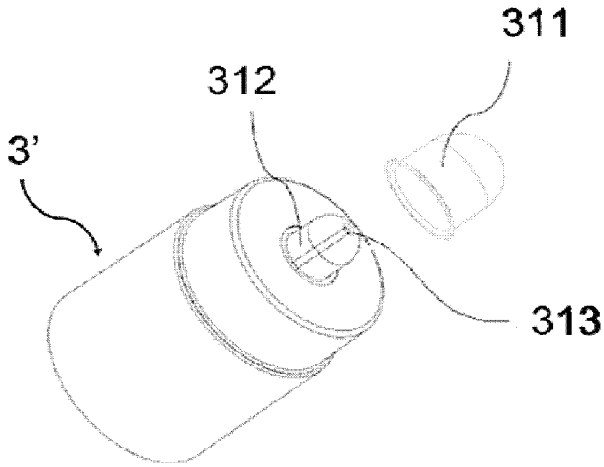


图 14

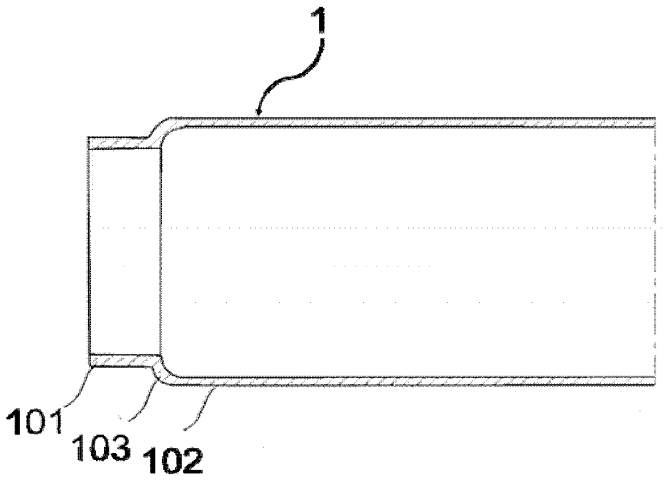


图 15

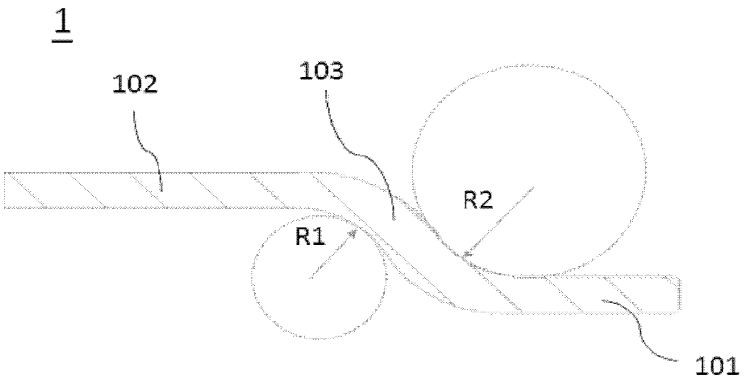


图 16

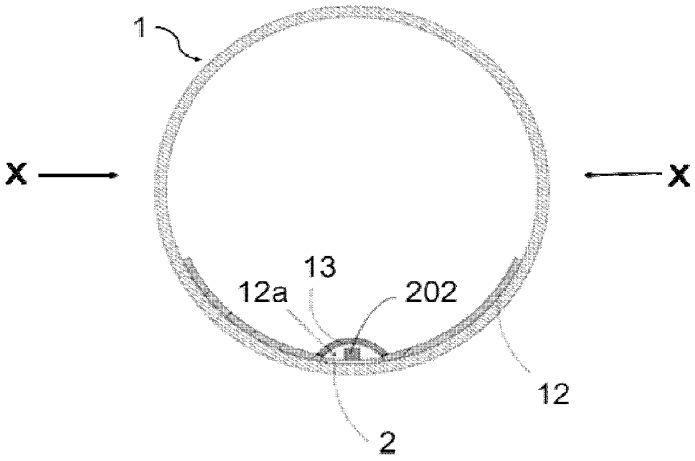


图 17

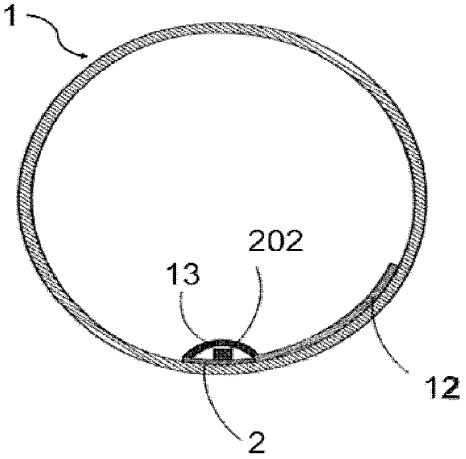


图 18

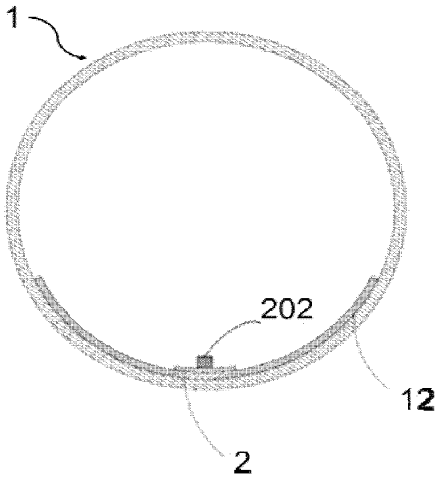


图 19

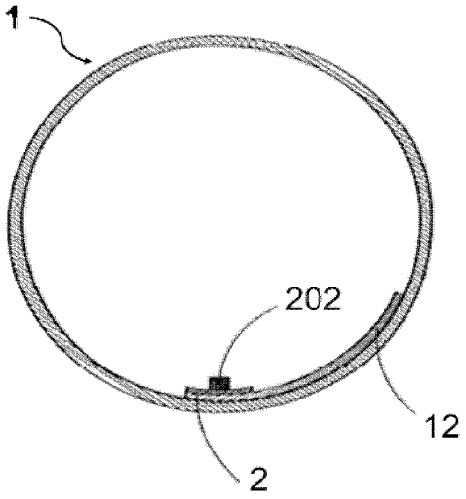


图 20

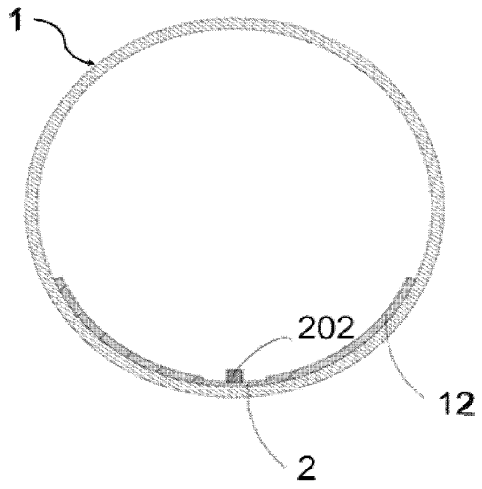


图 21

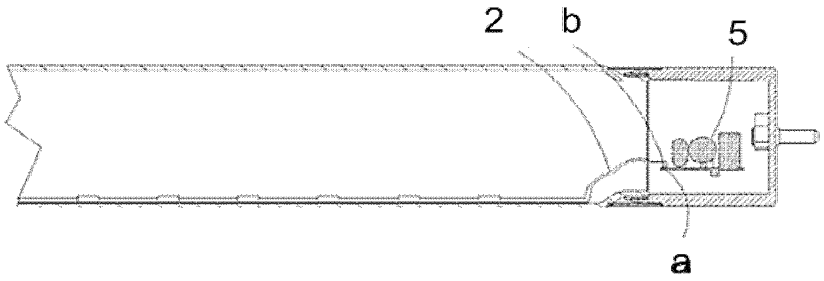


图 22

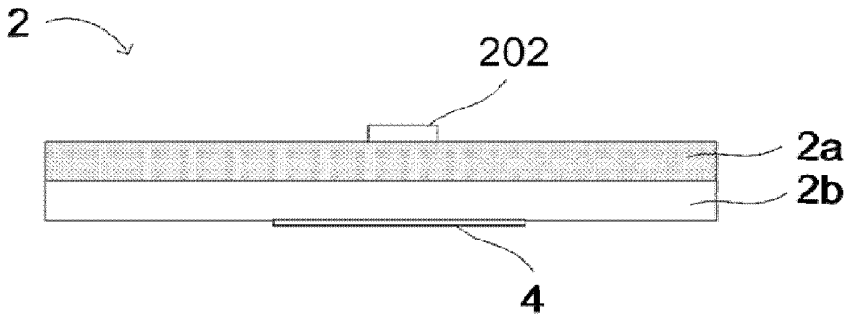


图 23

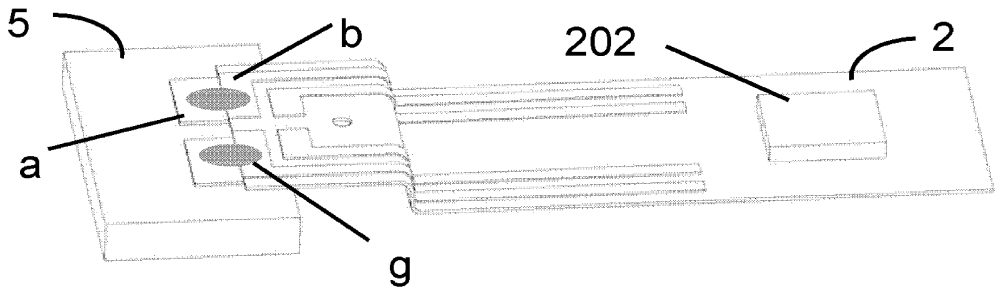


图 24

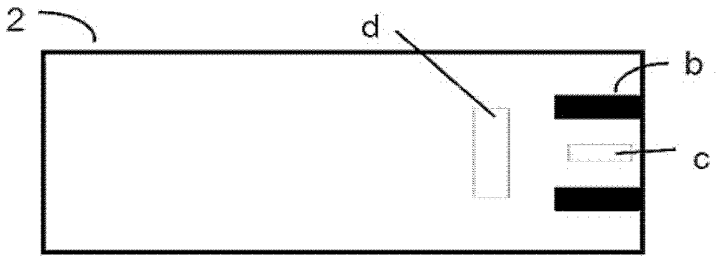


图 25

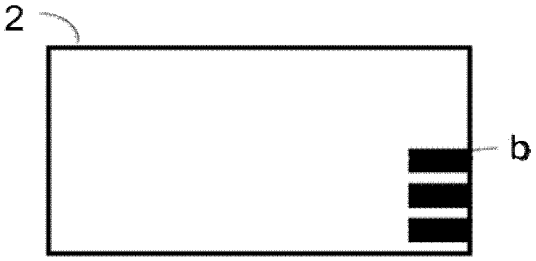


图 26

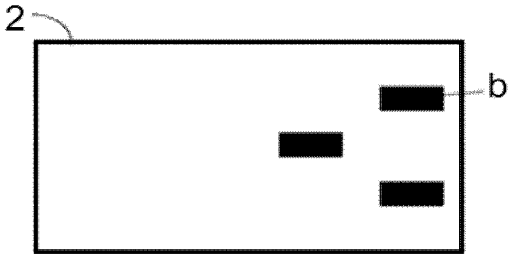


图 27

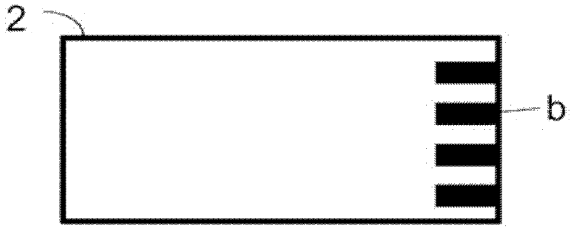


图 28

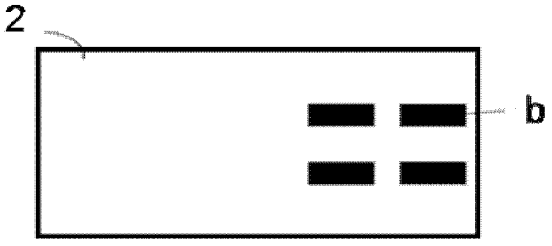


图 29

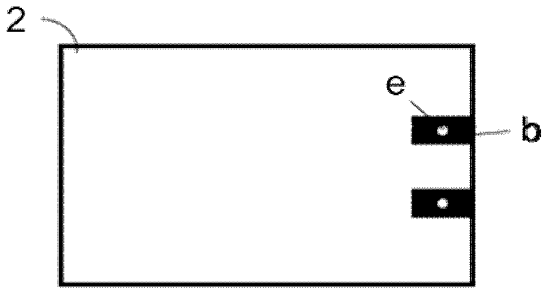


图 30

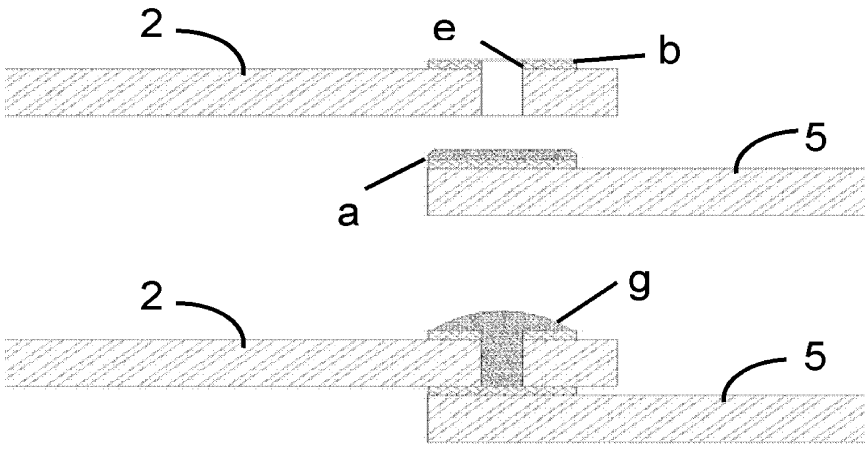


图 31

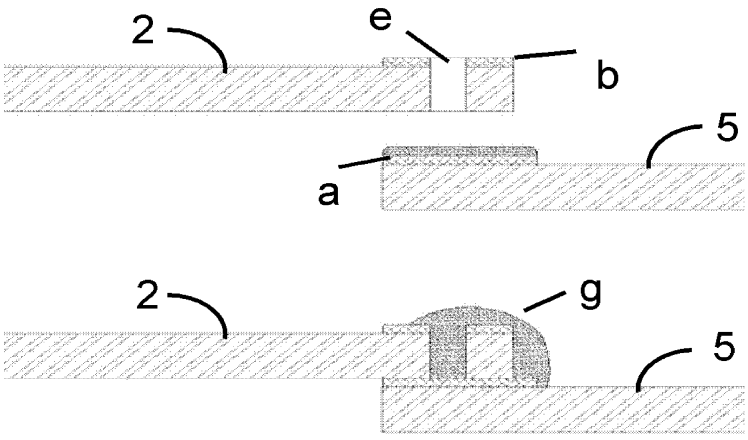


图 32



图 33

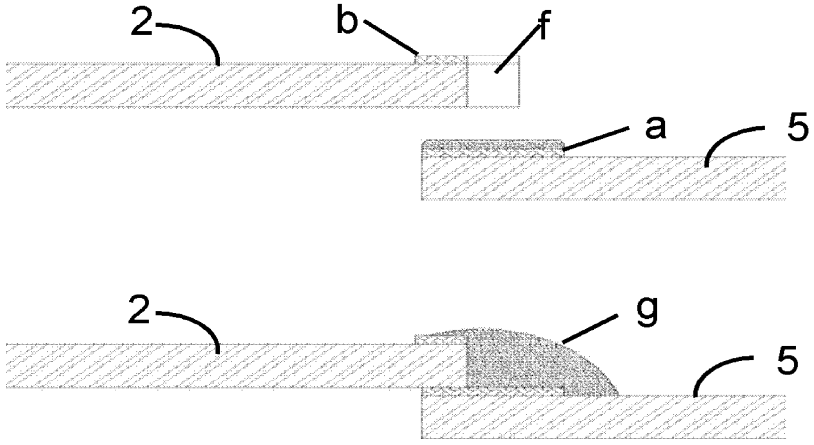


图 34

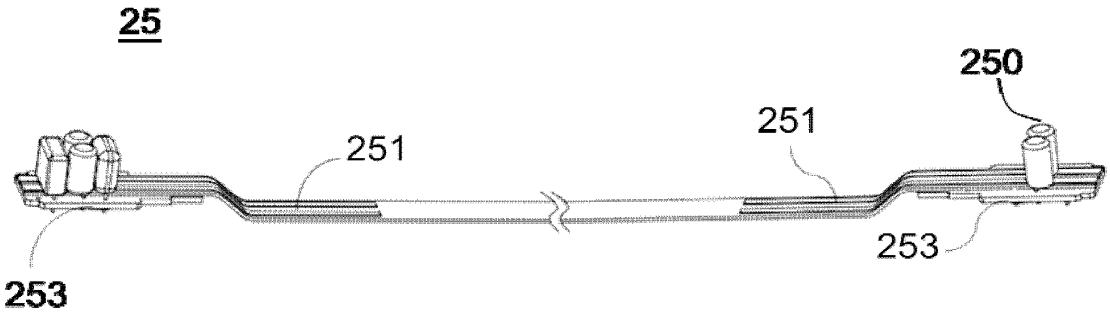


图 35

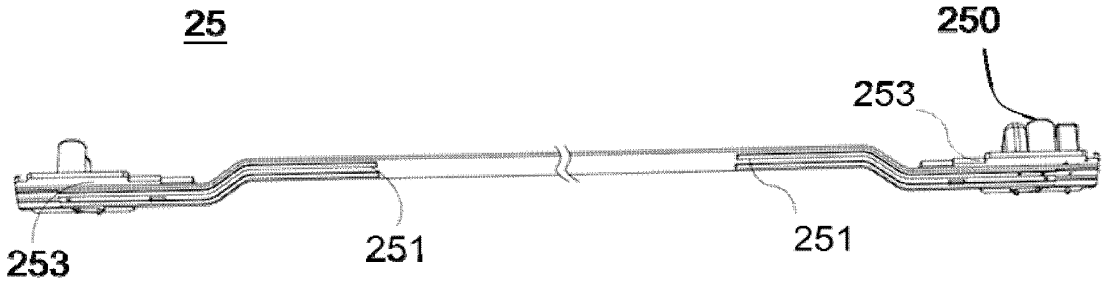


图 36

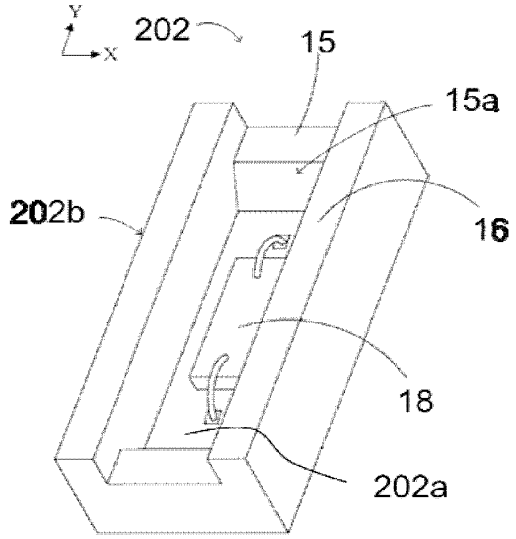


图 37

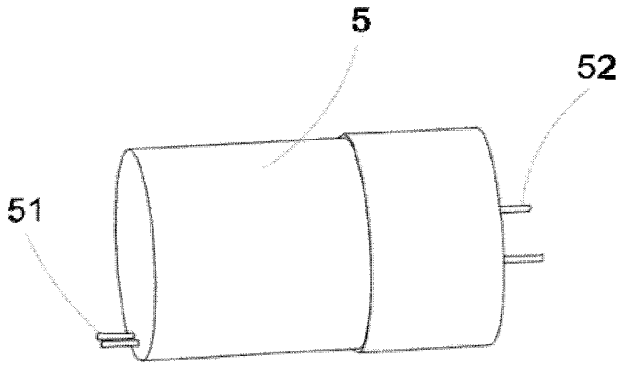


图 38

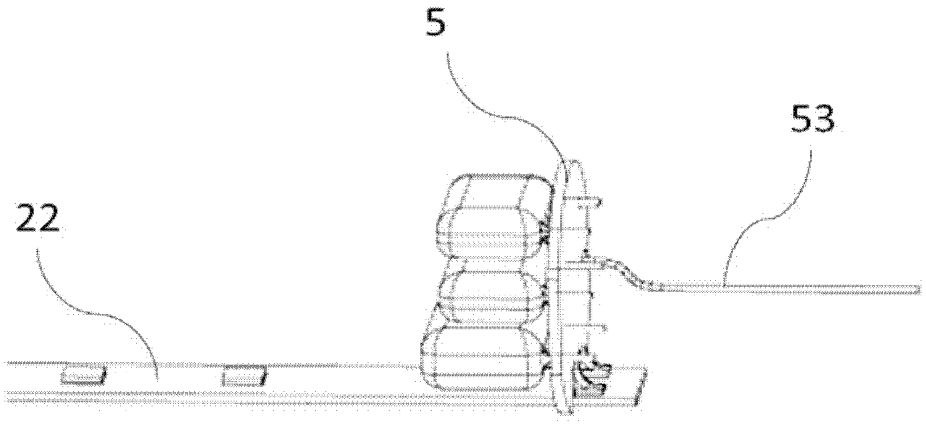


图 39

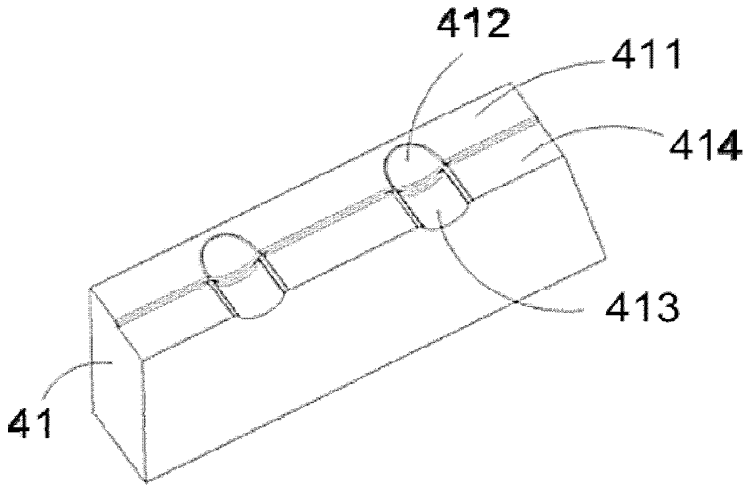


图 40

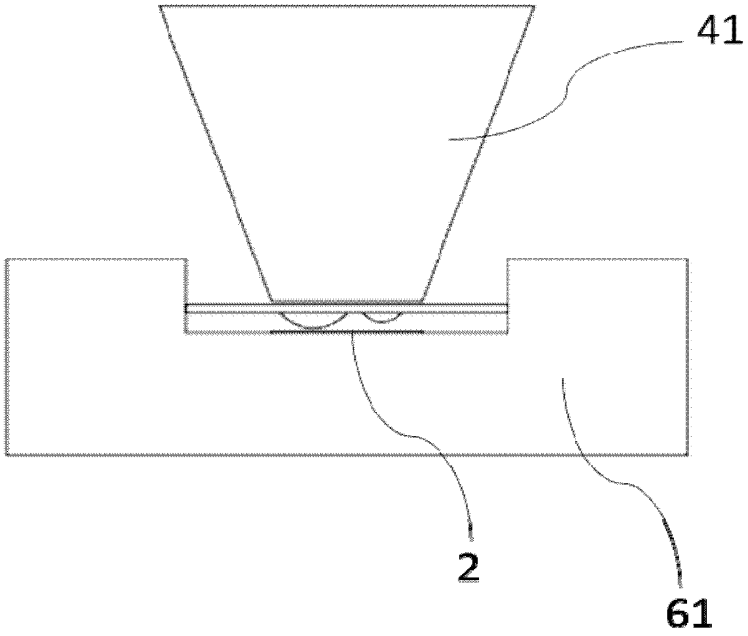


图 41

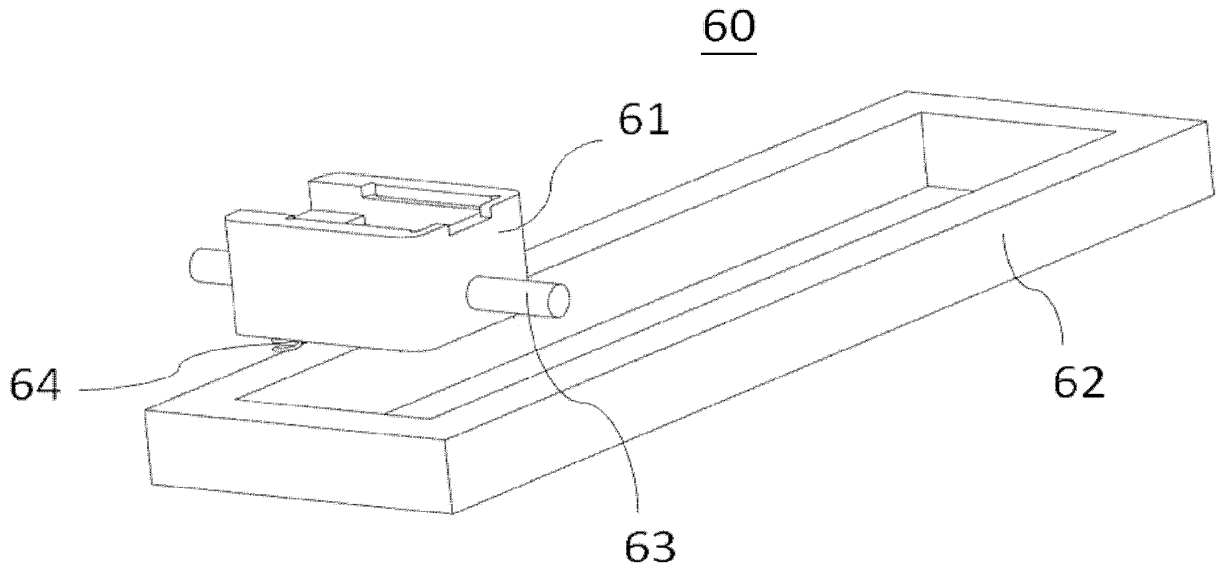


图 42

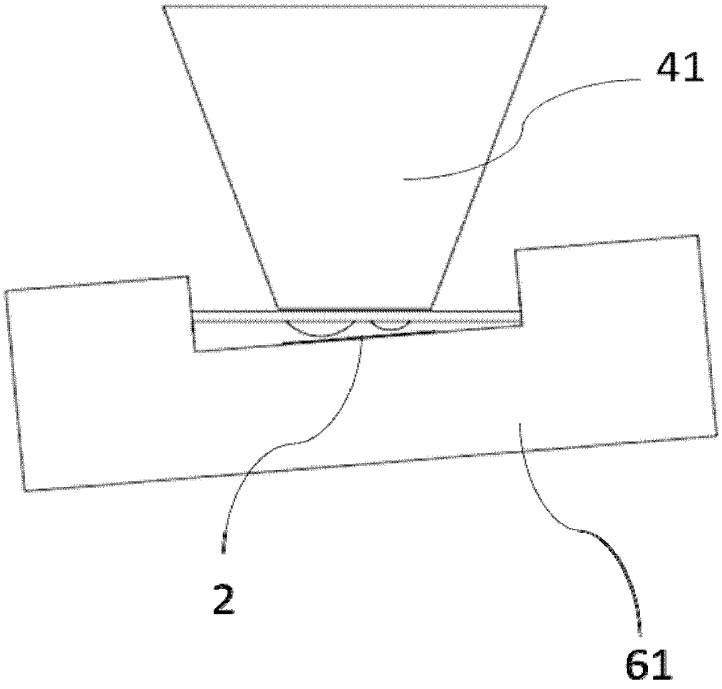


图 43

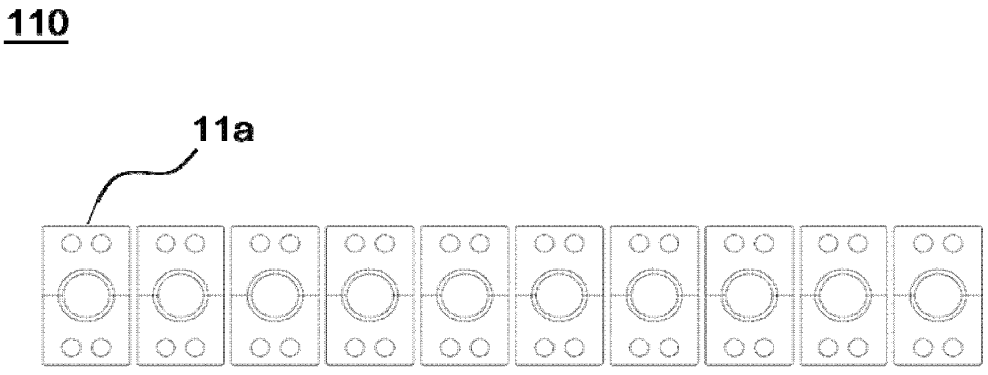


图 44

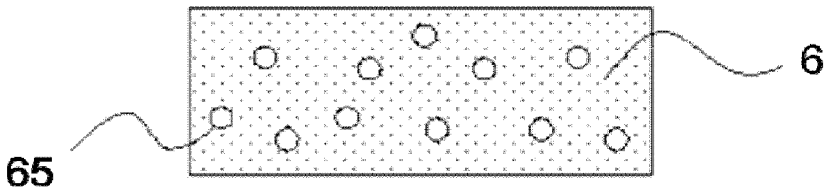


图 45

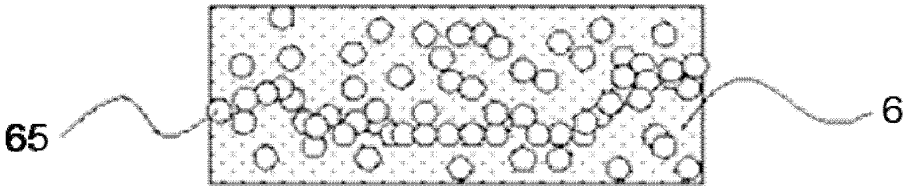


图 46

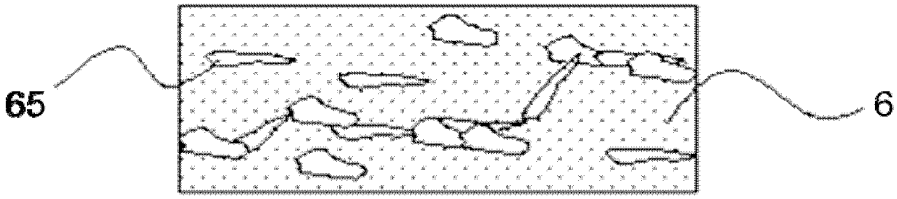


图 47

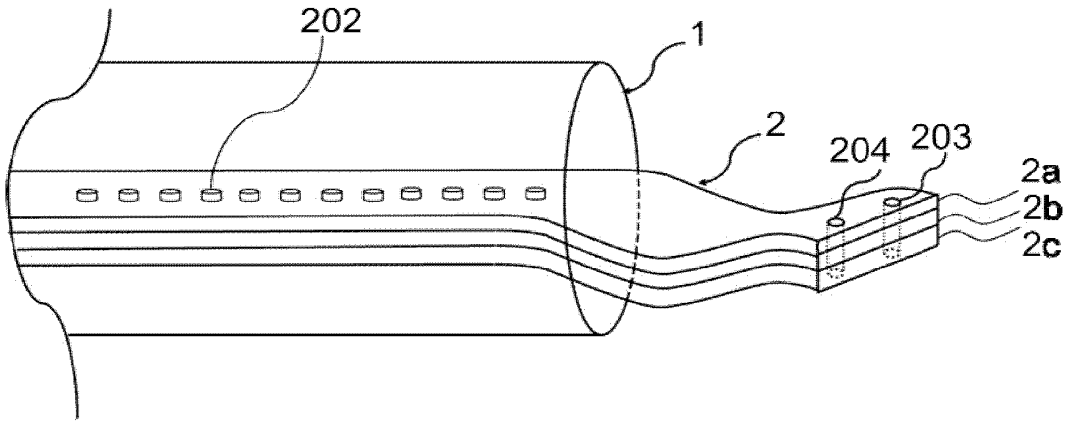


图 48

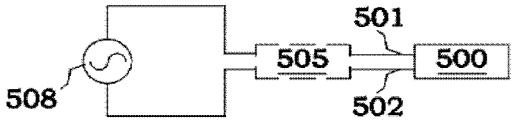


图49A

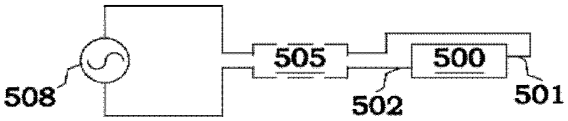


图49B

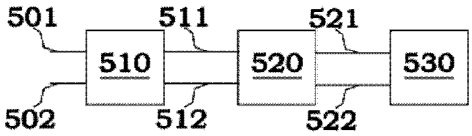


图49C

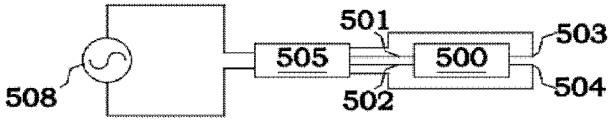


图49D

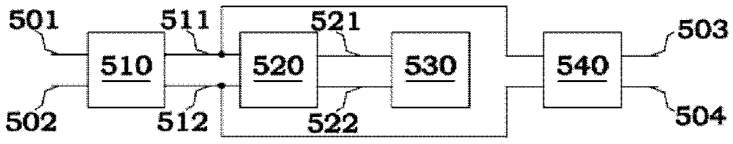


图49E

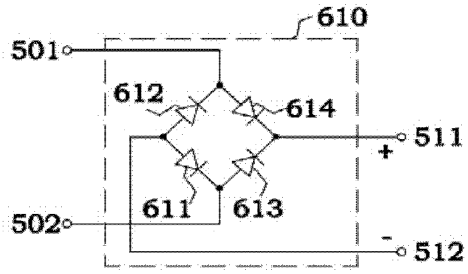


图50A

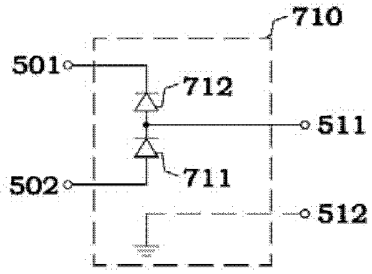


图50B

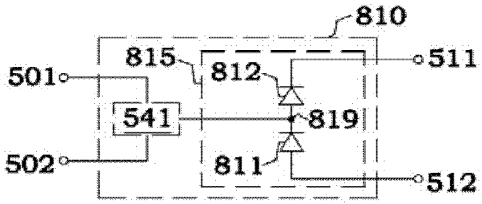


图50C

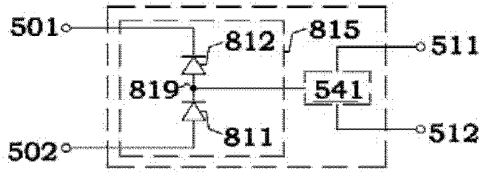


图50D

说 明 书 附 图

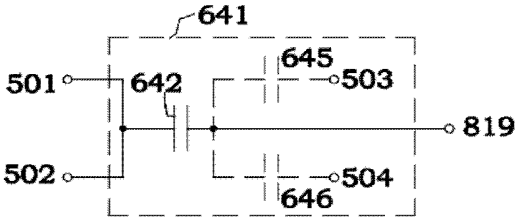


图51A

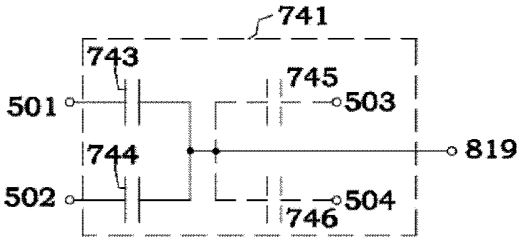


图51B

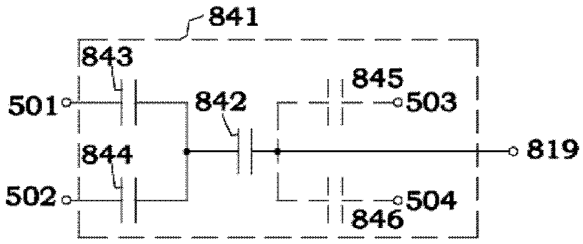


图51C

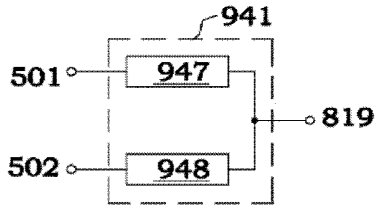


图51D

说 明 书 附 图

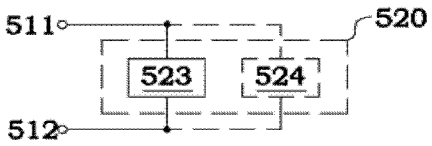


图52A

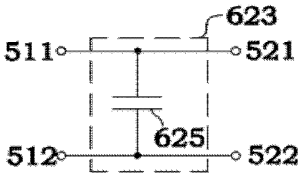


图52B

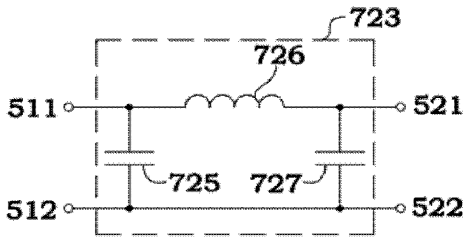


图52C

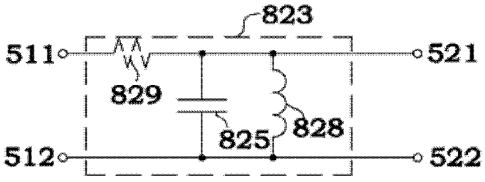


图52D

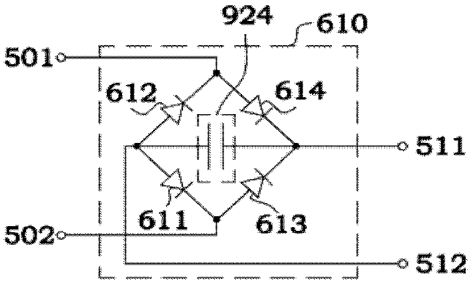


图52E

说 明 书 附 图

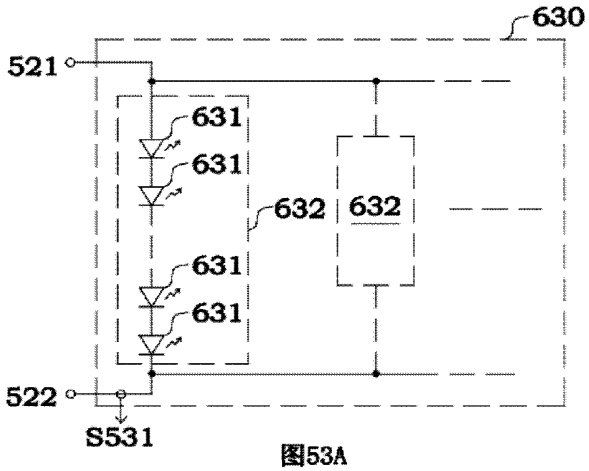


图53A

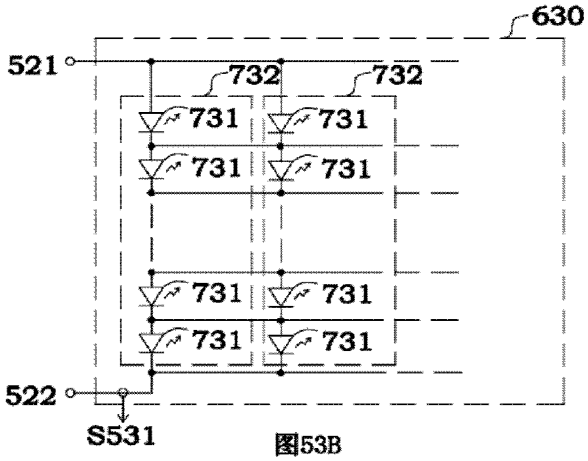


图53B

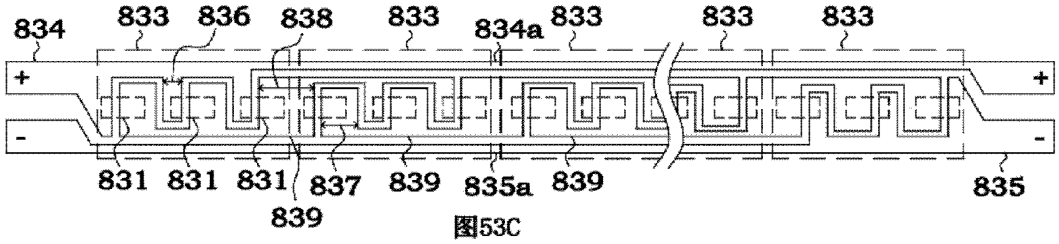


图53C

说 明 书 附 图

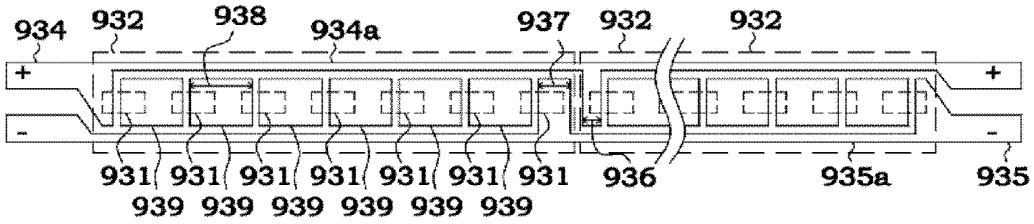


图53D

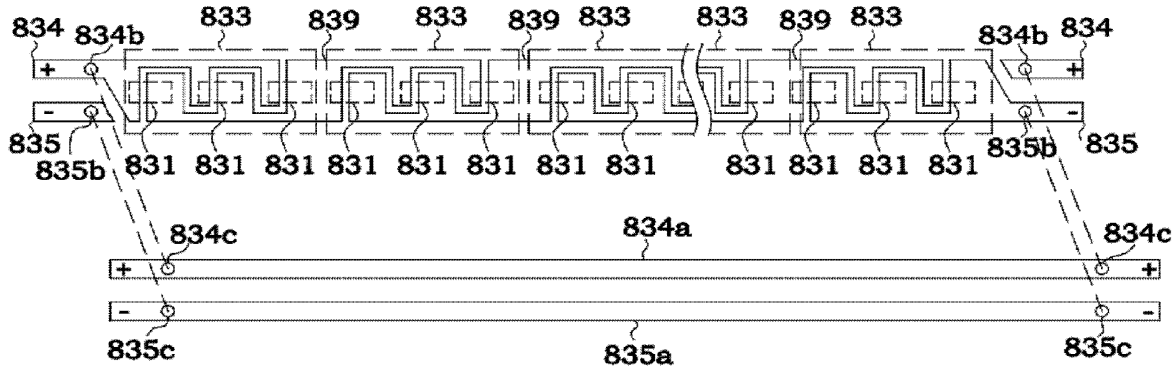


图53E

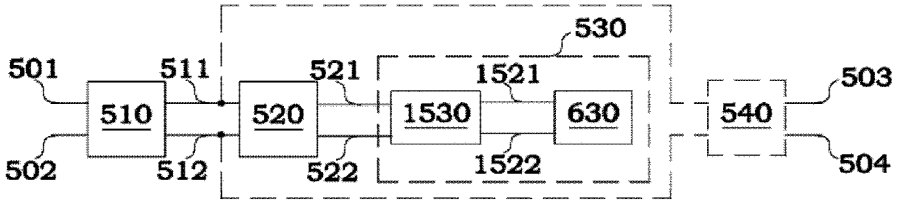


图54A

说 明 书 附 图

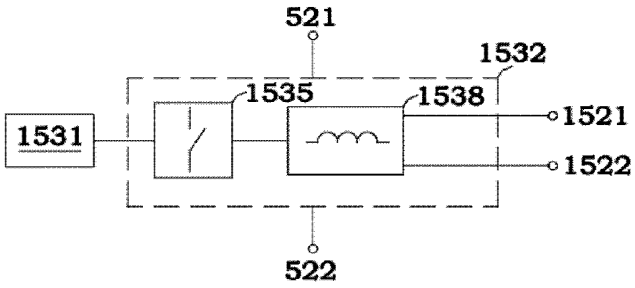


图54B

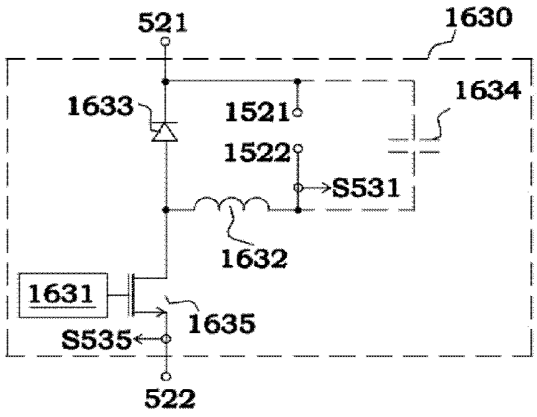


图54C

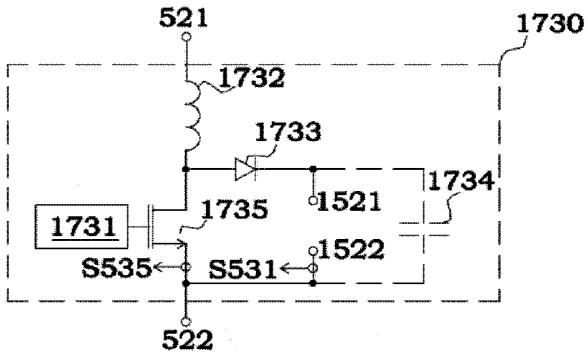


图54D

说 明 书 附 图

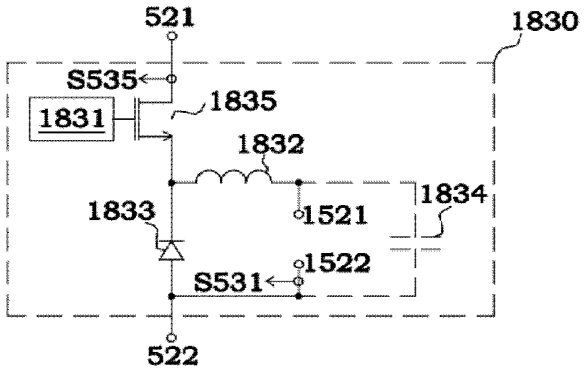


图54E

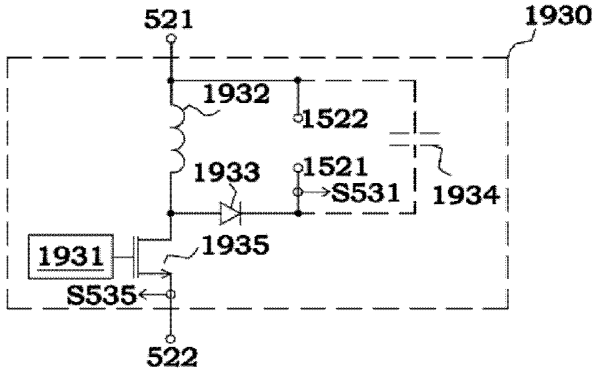


图54F

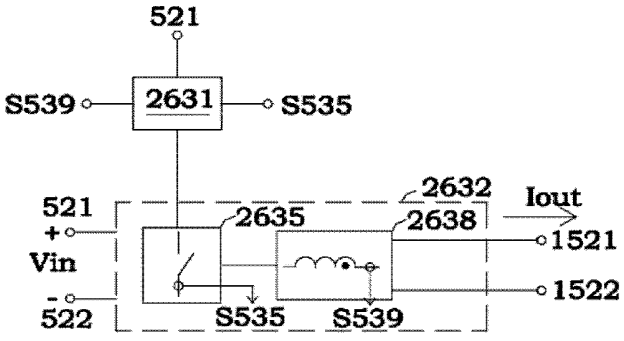


图54G

说 明 书 附 图

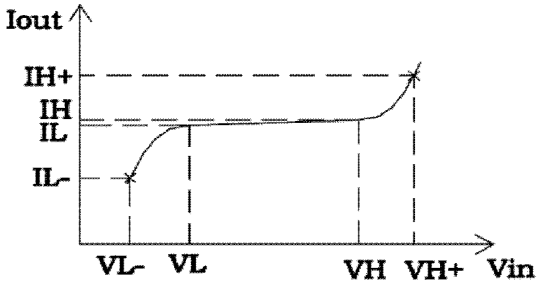


图54H

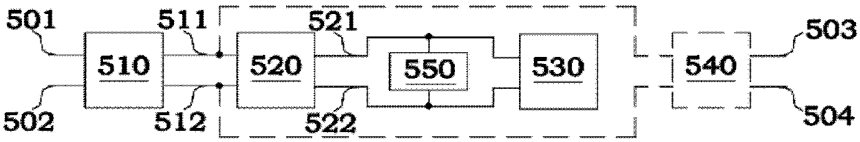


图55A

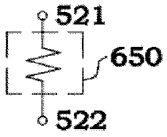


图55B

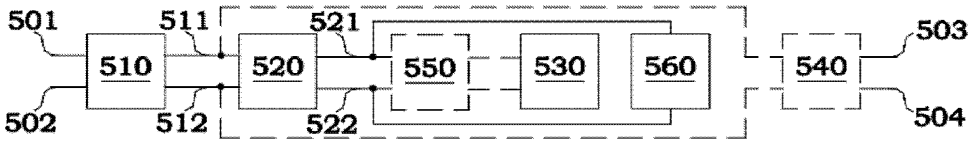


图56A

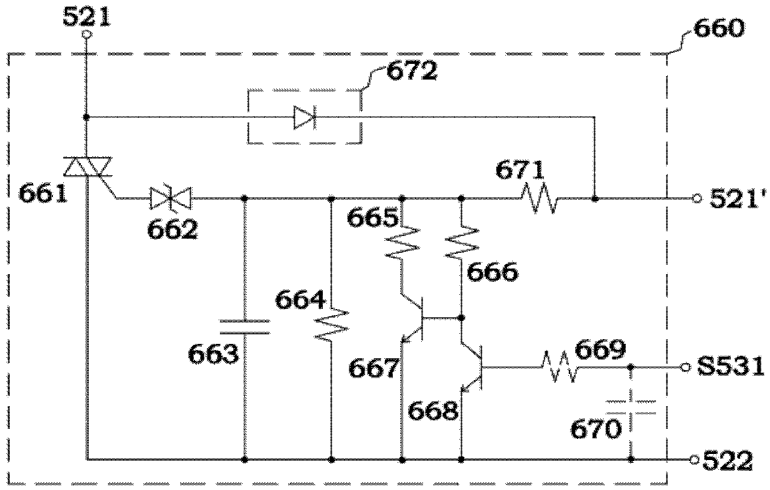

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图56B

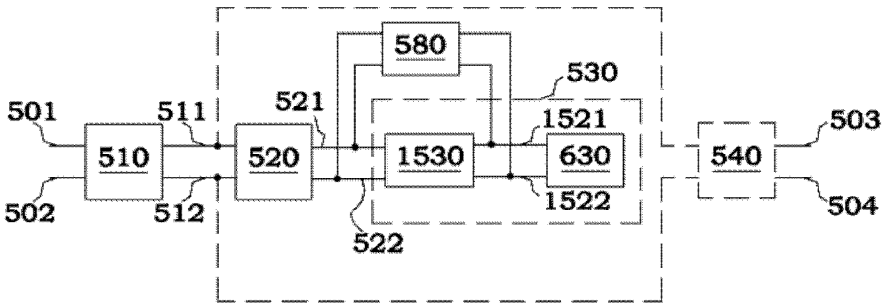

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图57A

说 明 书 附 图

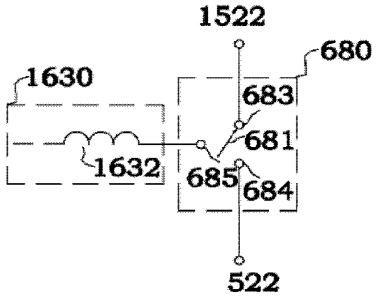


图57B

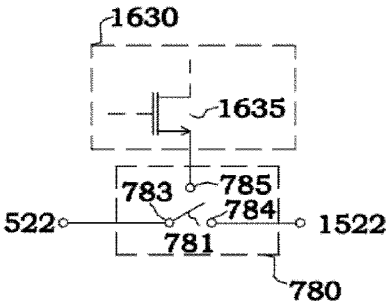


图57C

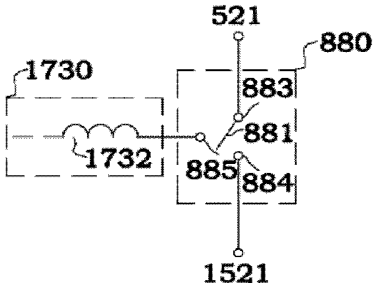


图57D

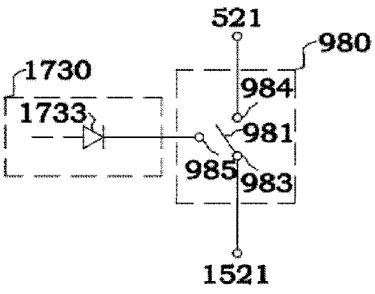


图57E

说 明 书 附 图

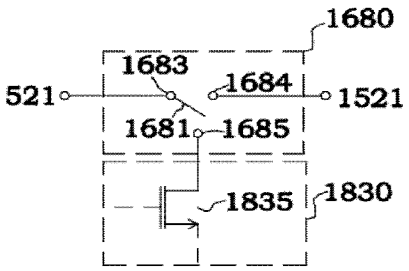


图57F

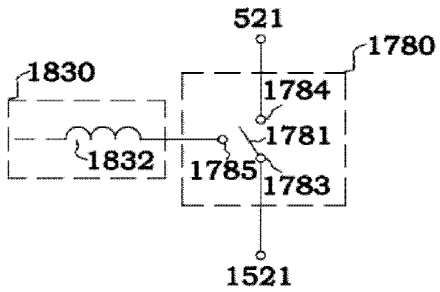


图57G

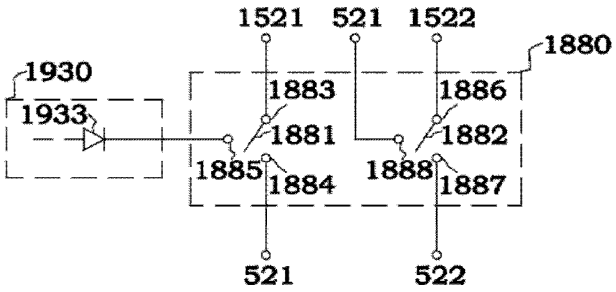


图57H

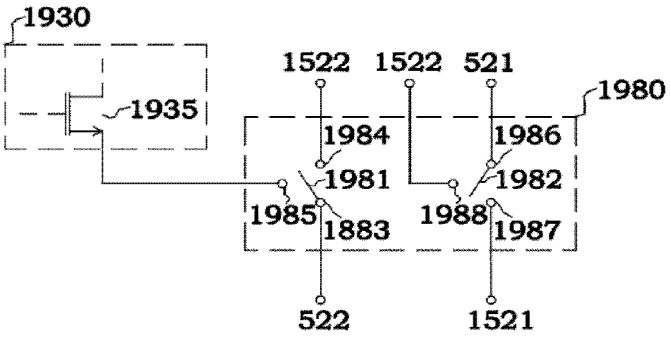


图57I

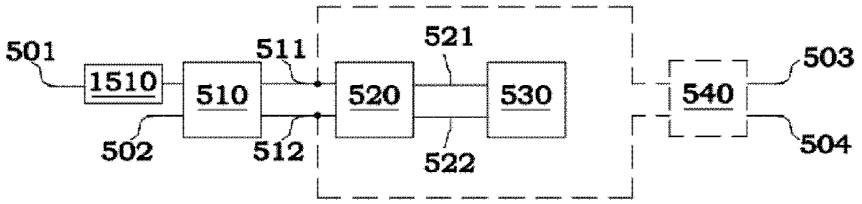


图58A

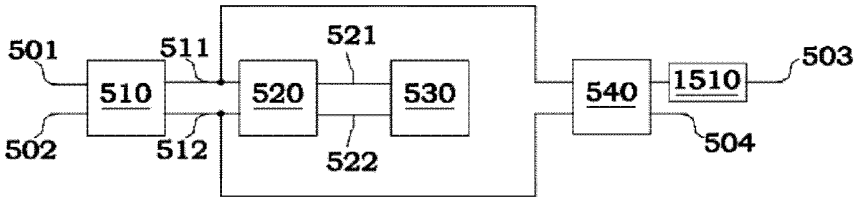


图58B

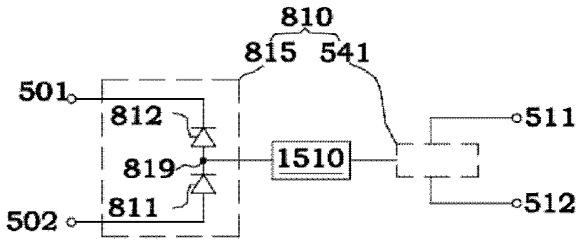


图58C

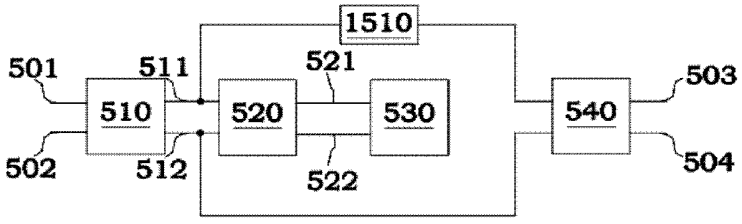


图58D

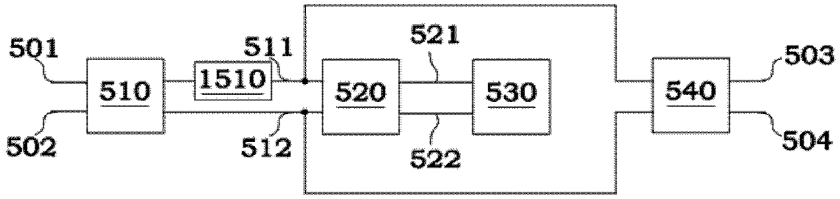


图58E

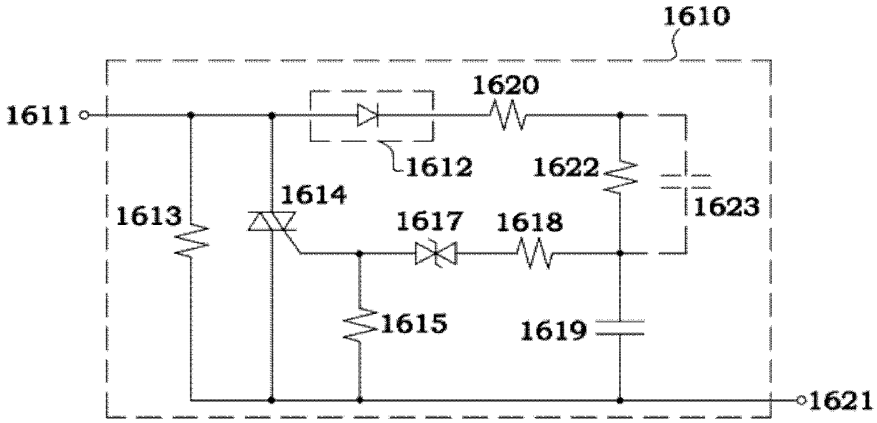


图58F

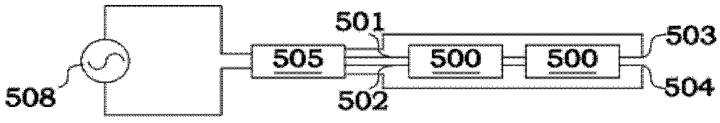


图58G

说 明 书 附 图

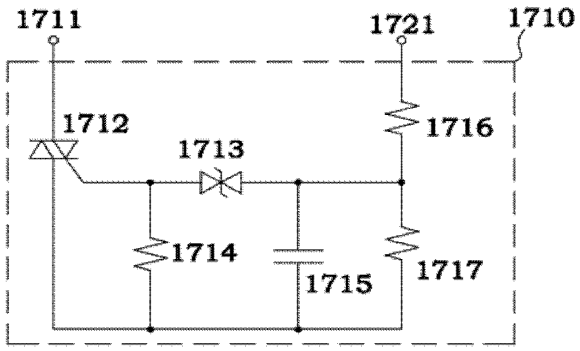


图58H

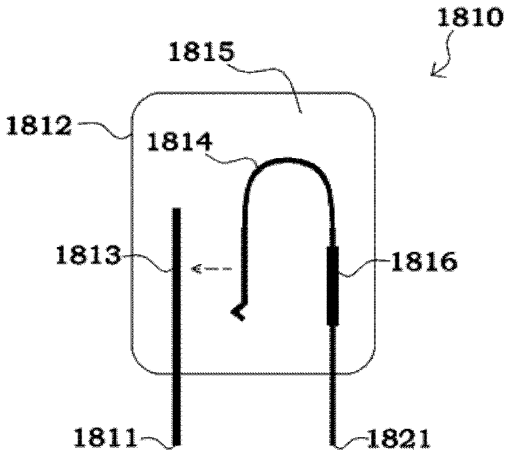


图58I

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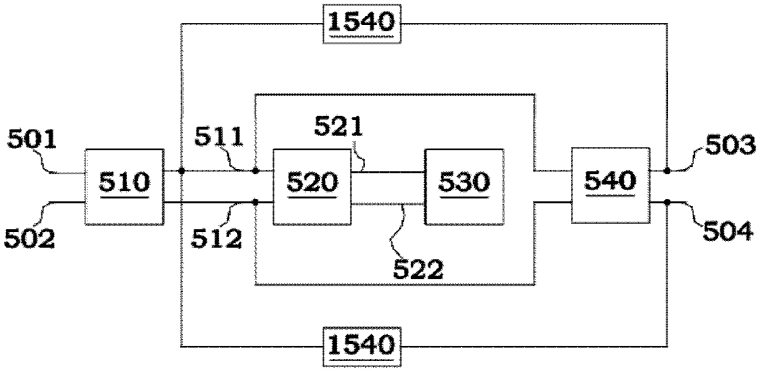


图59A

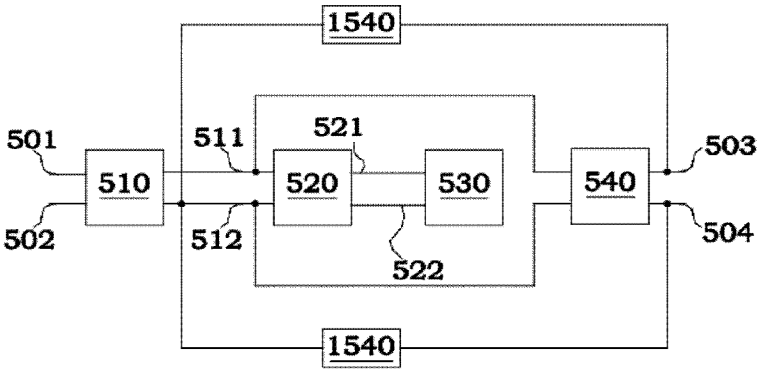


图59B

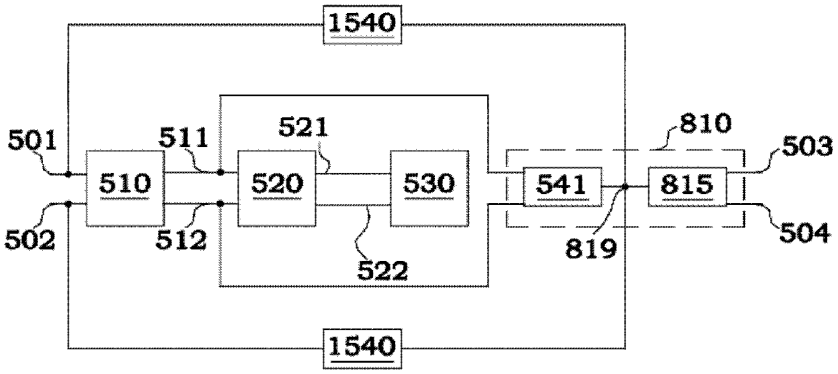


图59C

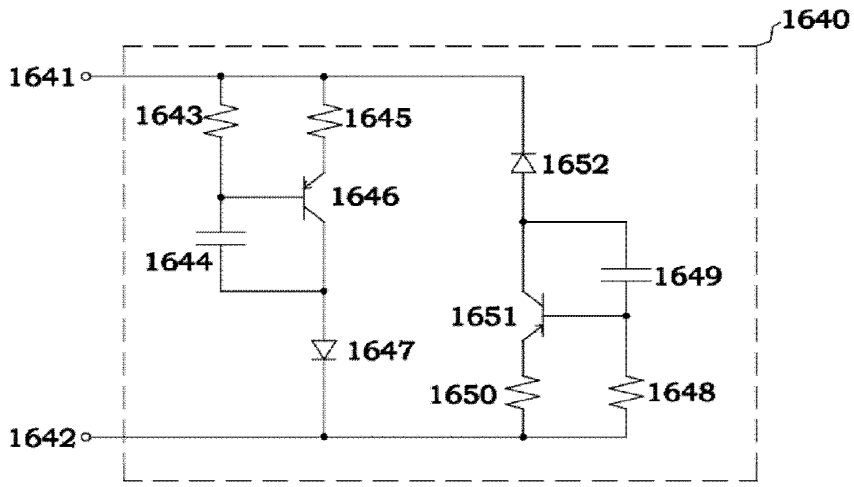


图59D

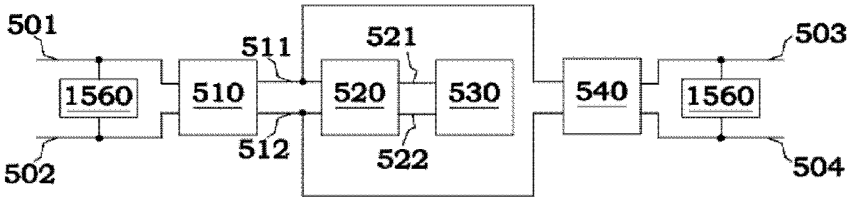


图60A

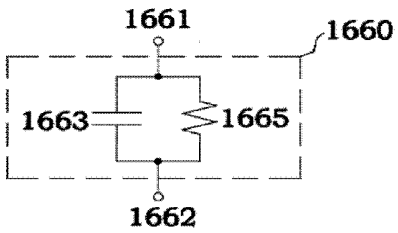


图60B

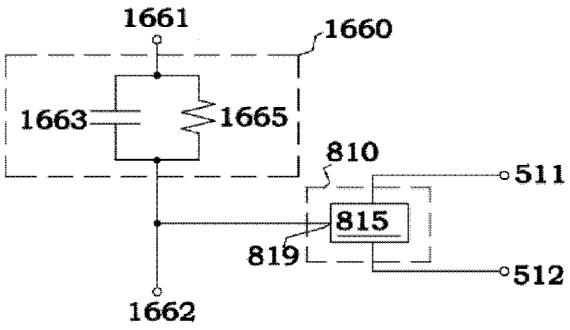


图60C

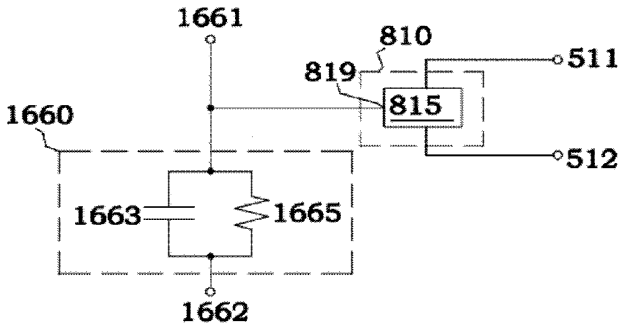


图60D

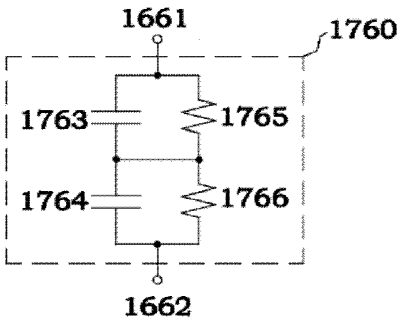


图60E

说 明 书 附 图

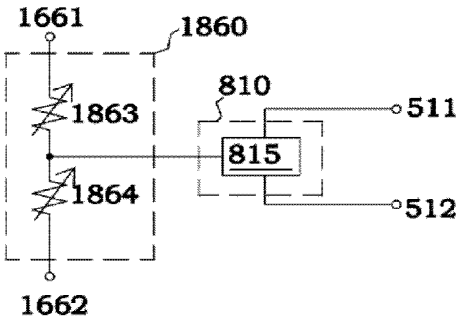


图60F

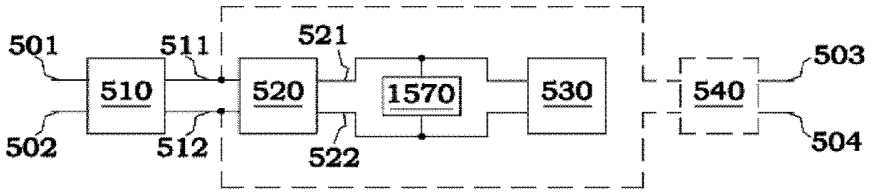


图61A

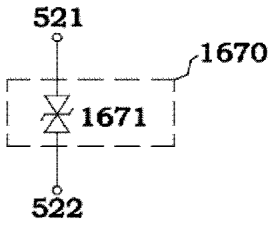


图61B

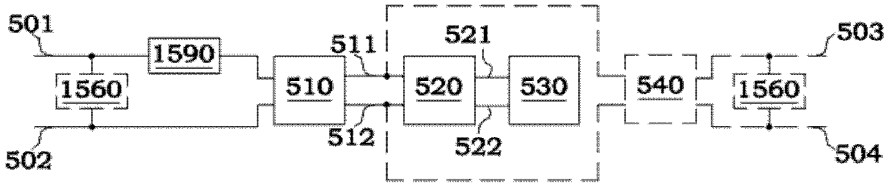


图62A

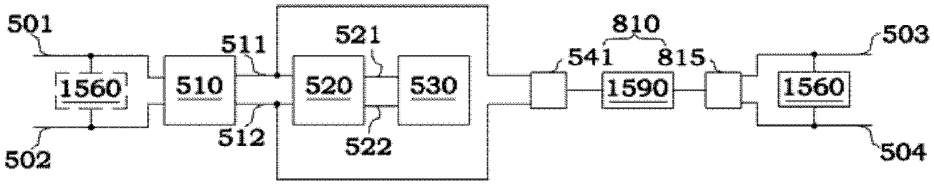


图62B

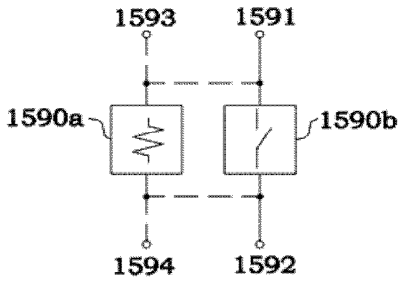


图62C

说 明 书 附 图

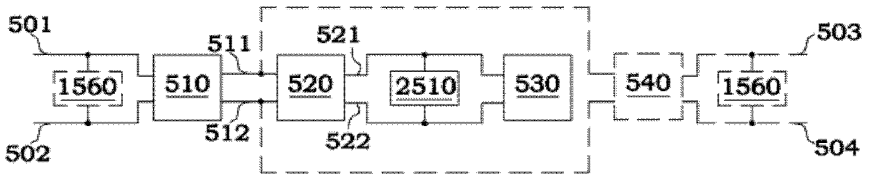


图63A

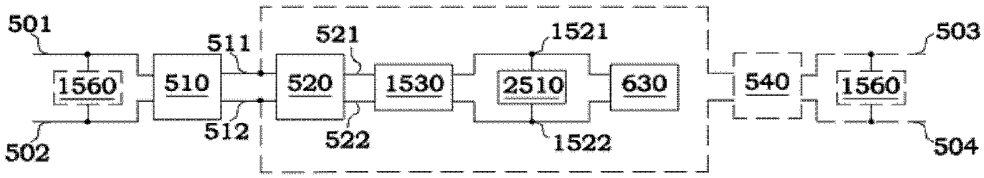


图63B

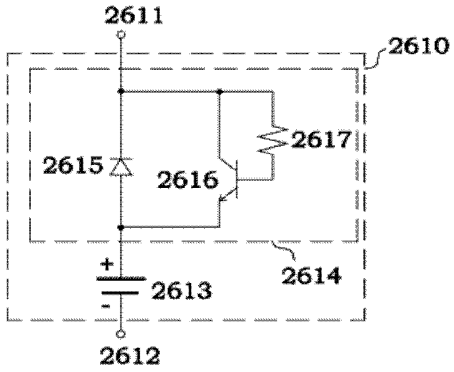


图63C

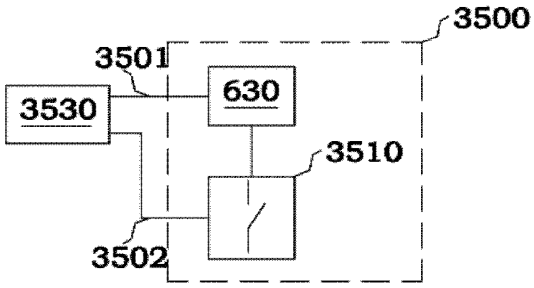


图64

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/719,861	12/18/2019	Tao Jiang	S19141USUC01T

CONFIRMATION NO. 5387

147274
Jiaxing Super Lighting Electric Appliance Co., Ltd
IP Department
No. 1288 Jiachuang Road, Xiuzhou Area
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Jiaxing City, 314031
CHINA

PUBLICATION NOTICE



Title:LED TUBE LAMP

Publication No.US-2020-0124236-A1
Publication Date:04/23/2020

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Application Number	16719861
Filing Date	2019-12-18
First Named Inventor	JIANG, Tao
Art Unit	2875
Examiner Name	ALAVI, ALI
Attorney Docket Number	S19141USUC01T

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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	10161569	B2	2020-12-25	Xu et al.	
	2	8360599	B2	2013-01-29	Lvey et al.	
	3	10560989	B2	2020-02-11	Tao Jiang et al.	
	4	9777891	B2	2017-10-03	Yusaku Kawabata et al.	
	5	9574717	B2	2017-02-21	James R. Scapa et al.	
	6	8791650	B2	2014-07-29	XinXin Shan	
	7	8931918	B2	2015-01-13	Chun-Chen Liu et al.	
	8	9883555	B2	2018-01-30	Jinsheng Deng et al.	

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	First Named Inventor	JIANG, Tao
	Art Unit	2875
	Examiner Name	ALAVI, ALI
	Attorney Docket Number	S19141USUC01T

	9	9338853	B2	2016-05-10	Luo Hua Guang	
	10	8304993	B2	2012-11-06	Hua-Lung Tzou et al.	

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	1	20160341414	A1	2016-11-24	Tao Jiang	
	2	20090159919	A1	2009-06-25	John Ivey et al.	
	3	20150198291	A1	2015-07-16	Ching-Feng Lin et al.	
	4	20100201269	A1	2010-08-12	TZOU, HUA-LUNG et al.	
	5	20150049473	A1	2015-02-19	Pan et al.	
	6	20090045715	A1	2009-02-19	Totada R. Shantha et al.	
	7	20130215609	A1	2013-08-22	LIU, CHUN-CHEN et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	Filing Date	2019-12-18
	First Named Inventor	JIANG, Tao
	Art Unit	2875
	Examiner Name	ALAVI, ALI
	Attorney Docket Number	S19141USUC01T

	8	20060146527	A1	2006-07-06	Carl R. VanderSchuit		
	9	20150077001	A1	2015-03-19	TAKAHASHI et al.		
	10	20140084800	A1	2014-07-29	Bong Jin LEE		
	11	20150173138	A1	2015-06-18	Bruce Richard Roberts		

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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	2014068335	WO	A1	2014-05-08	EVITT, Jonathan		
	2	2012114096	WO	A1	2012-08-30	WADE, Scott et al.		
	3	202660350	CN	U	2013-01-09	CHENYI ZHEJIANG ELECTRONIC IND CO LTD		☒
	4	202100985	CN	U	2012-01-04	YUNJIE XU		☒
	5	203628340	CN	U	2014-06-04	LIU TIANMING et al.		☒

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16719861
	Filing Date	2019-12-18
	First Named Inventor	JIANG, Tao
	Art Unit	2875
	Examiner Name	ALAVI, ALI
	Attorney Docket Number	S19141USUC01T

	6	104633491	CN	A	2015-05-20	HOU LIQUN		☒
	7	201851921	CN	U	2011-06-01	WANG LIAN et al.		☒
	8	2014118754	WO	A1	2014-08-07	DEN BOER REINIER IMRE ANTON et al.		☐
	9	204437746	CN	U	2015-07-01	ZHANG, SHUHUA et al.		☒
	10	2015110306	WO	A1	2015-07-30	YUAN et al.		☐
	11	2608761	DE	A1	1977-09-08	MUTZHAS MAXIMILIAN FRIEDRICH D		☒
	12	201739830	CN	U	2011-02-09	GEM SUN TECHNOLOGIES CO LTD		☒
	13	204442771	CN	U	2015-07-01	Qiangfei Duan		☒
	14	203322772	CN	U	2013-12-04	QIAN, FENGTAO et al.		☒
	15	204005873	CN	U	2014-12-10	HANGZHOU SANGDI LIGHTING ELECTRIC APPLIANCE CO LT		☒
	16	2009129689	WO	A1	2009-10-29	Chen Zhonglie		☒

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16719861
	Filing Date	2019-12-18
	First Named Inventor	JIANG, Tao
	Art Unit	2875
	Examiner Name	ALAVI, ALI
	Attorney Docket Number	S19141USUC01T

	17	203162690	CN	U	2013-08-28	LIANG YOUQING et al.		☒
	18	101922640	CN	A	2010-12-22	FUJIAN XIANGYUN PHOTOELECTRIC TECHNOLOGY CO LTD		☒
	19	104990041	CN	A	2015-10-21	ZHAO XING; LU LIBING		☒
	20	203500909	CN	U	2014-03-26	WANG JUN		☒

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Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T5
	1	Lenk, R. et al., Practical Lighting Design with LEDs, IEEE Press, A John Wiley & Sons, Inc., 2011, pp. 103-106	
	2	Declaration of Regan Zane, Ph.D., November 18, 2019	
	3	CV of Dr. Regan Zane, November 18, 2019	
	4	Petition for Inter Parte Review of U.S. Patent No. 9,897,265 Under 35 U.S.C.311-319 and 37 C.F.R. 42.1-080, 42.100-.123.	
	5	DEFENDANT MAXLITE, INC.'S PRELIMINARY NONINFRINGEMENT AND INVALIDITY CONTENTIONS PURSUANT TO COURT'S ORDER, May 19, 2020	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16719861
	Filing Date	2019-12-18
	First Named Inventor	JIANG, Tao
	Art Unit	2875
	Examiner Name	ALAVI, ALI
	Attorney Docket Number	S19141USUC01T

	6	Philips InstantFit LED T8 Lamps data sheet, May 19, 2020
	7	Keystone KT-LED18T8-48G-850-D T8 LED LAMP Data Sheet, May 19, 2020
	8	MaxLite LED T8 - LINEAR REPLACEMENT LAMP DirectFit G SERIES Data Sheet, May 19, 2020

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*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	16719861
	Filing Date	2019-12-18
	First Named Inventor	JIANG, Tao
	Art Unit	2875
	Examiner Name	ALAVI, ALI
	Attorney Docket Number	S19141USUC01T

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	/Simon Kuang Lu/	Date (YYYY-MM-DD)	2020-07-22
Name/Print	Simon Kuang Lu	Registration Number	51974

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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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:

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Electronic Acknowledgement Receipt

EFS ID:	40068997
Application Number:	16719861
International Application Number:	
Confirmation Number:	5387
Title of Invention:	LED TUBE LAMP
First Named Inventor/Applicant Name:	Tao Jiang
Customer Number:	147274
Filer:	Simon Kuang Lu/Jin Huang
Filer Authorized By:	Simon Kuang Lu
Attorney Docket Number:	S19141USUC01T
Receipt Date:	22-JUL-2020
Filing Date:	18-DEC-2019
Time Stamp:	09:00:38
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	20200722_2ndIDS_S19141USUC01T.pdf	617194 87d5b62c34a933c3645cea1e172a1ecd1dfdc1a4	no	8

Warnings:

Information:					
2	Foreign Reference	CN101922640A.pdf	633000 fa53627d2eae97dbc589590b30aa7ad186fa32dd	no	8
Warnings:					
Information:					
3	Foreign Reference	CN104633491A.pdf	799067 a5698090b5b1da505505b7b9875814f7c20551a5	no	11
Warnings:					
Information:					
4	Foreign Reference	CN104990041A.pdf	443411 68087bd7f6f72eed6a2b2d252aa096b00ecd2f31	no	8
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5	Foreign Reference	CN201739830U.pdf	530806 47d6bc40d4f95e141ac25769057b97d1c76c0a3a	no	10
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6	Foreign Reference	CN201851921U.pdf	582890 6068d06f91915d813bca2902e1a41c3ce4745c7e	no	7
Warnings:					
Information:					
7	Foreign Reference	CN202100985U.pdf	500911 5e04aadb20fee4e2bd3dab9bd3eab699fb4561ba	no	12
Warnings:					
Information:					
8	Foreign Reference	CN202660350U.pdf	261644 0555c037dfb2d396eaa220e43e0b334ca0dc1ed9	no	6
Warnings:					
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9	Foreign Reference	CN203162690U.pdf	370211 f6b0e8251acb38aec2c4b2270b3e0432e0ef8cec	no	9
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10	Foreign Reference	CN203322772U.pdf	384708 10371fbd18527911bd381fd396194f24049ccd35	no	6
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11	Foreign Reference	CN203500909U.pdf	991464 bcdd9df841f3c1a3609a79a2b688cd7c80259194	no	16
Warnings:					
Information:					
12	Foreign Reference	CN203628340U.pdf	295910 78f290bc23dbd37cdb8672a8bd9cce5f8ec8b241	no	8
Warnings:					
Information:					
13	Foreign Reference	CN204005873U.pdf	544417 b9b02903118b23c03d2d72c4e90bede4a4cbaf66	no	10
Warnings:					
Information:					
14	Foreign Reference	CN204437746U.pdf	991843 0dea867a1533eb8de992d1d70fc3f17412791b56	no	11
Warnings:					
Information:					
15	Foreign Reference	DE2608761A1.pdf	1112058 d02154c8c029201de7f1d3ce356d2f54a3f5f36b	no	15
Warnings:					
Information:					

16	Foreign Reference	WO2009129689A1.pdf	1280535 9bb2ed064177428386a4d357ba1da1e46239a33e	no	35
Warnings:					
Information:					
17	Foreign Reference	WO2012114096A1.pdf	535090 f8652b55e009493f26e5a798a8468ee108050137	no	33
Warnings:					
Information:					
18	Foreign Reference	WO2014068335A1.pdf	407443 cca02de77c942edb969a6690a0799ecf966bad00	no	30
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Information:					
19	Foreign Reference	WO2014118754A1.pdf	374654 9f088269a5d2948f0fe06fd49373ab14284f1024	no	34
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Information:					
20	Foreign Reference	WO2015110306A1.pdf	310575 2f3a073badcedf8db2fb69e9b458cb0876d74a7a	no	33
Warnings:					
Information:					
21	Foreign Reference	CN204442771U.pdf	3912380 09f73271ea81c05c51c9077e73b32921f2aa59a3	no	65
Warnings:					
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22	Other Reference-Patent/App/Search documents	IPR2020_00162_1008_CurriculumVitaeofReganZanePhD.pdf	1043622 cf6065ba804daf7458206ffe404d111abce4b70a	no	28
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23	Other Reference-Patent/App/Search documents	MAXLITE-SL_0000723.pdf	2004993 ce907d021e8bfb0c1fc81ba055e9056082c57133	no	4
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24	Other Reference-Patent/App/Search documents	MAXLITE-SL_0001099.pdf	1180393 6a6a4ca0737802a820eb5572ff65c6d51d82026e	no	2
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25	Other Reference-Patent/App/Search documents	MAXLITE-SL_0001101.PDF	1282848 dde0b7b4aae2fb333d6f3f5185064e1341ff10ff	no	3
Warnings:					
Information:					
26	Other Reference-Patent/App/Search documents	20200519MaxLiteNoninfringementANDInvalidityContentionsDisclosures.pdf	5964212 dc3f4a6e923629168b891a5ddaf91fb3b4406005	no	67
Warnings:					
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27	Non Patent Literature	IPR2020_00162_1012_LenkANDLenk_PracticalLightingDesignwithLEDs_IEEE.pdf	1408563 13c174c58e2899807efe60c3c2586196373b57dd	no	7
Warnings:					
Information:					
28	Other Reference-Patent/App/Search documents	IPR2020-00162_1003_DeclarationofReganZane_PhD.pdf	24645950 775a79418bf03011890cf123e6dccff215d3d9c1	no	100
Warnings:					
Information:					
29	Other Reference-Patent/App/Search documents	PTAB_IPR2020_00162_1.pdf	23895963 c94f29b40964c4eae4157737385443e9ba99de8f	no	101
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If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

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

New International Application Filed with the USPTO as a Receiving Office

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NOTICE OF ALLOWANCE AND FEE(S) DUE

147274 7590 08/19/2020

Jiaxing Super Lighting Electric Appliance Co., Ltd
IP Department
No. 1288 Jiachuang Road, Xiuzhou Area
Jiaxing, Zhejiang
Jiaxing City, 314031
CHINA

EXAMINER
ALAVI, ALI

ART UNIT	PAPER NUMBER
2875	

DATE MAILED: 08/19/2020

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/719,861	12/18/2019	Tao Jiang	S19141USUC01T	5387

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	$1000	$0.00	$0.00	$1000	11/19/2020

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.

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P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (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)

147274 7590 08/19/2020

Jiaxing Super Lighting Electric Appliance Co., Ltd
IP Department
No. 1288 Jiachuang Road, Xiuzhou Area
Jiaxing, Zhejiang
Jiaxing City, 314031
CHINA

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.

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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 transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/719,861	12/18/2019	Tao Jiang	S19141USUC01T	5387

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	$1000	$0.00	$0.00	$1000	11/19/2020

EXAMINER	ART UNIT	CLASS-SUBCLASS
ALAVI, ALI	2875	362-222000

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 03-09 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,
(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.

1 _____
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 must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). 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. Fees submitted: ❑ Issue Fee ❑ Publication Fee (if required) ❑ Advance Order - # of Copies _____

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❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

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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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/719,861	12/18/2019	Tao Jiang	S19141USUC01T	5387

147274 7590 08/19/2020

Jiaxing Super Lighting Electric Appliance Co., Ltd
IP Department
No. 1288 Jiachuang Road, Xiuzhou Area
Jiaxing, Zhejiang
Jiaxing City, 314031
CHINA

EXAMINER	
ALAVI, ALI	

ART UNIT	PAPER NUMBER
2875	

DATE MAILED: 08/19/2020

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.

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 30 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 enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No. 16/719,861	Applicant(s) Jiang et al.	
	Examiner ALI ALAVI	Art Unit 2875	AIA (FITF) 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 application filed on 12/18/19.
   ☐ 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 1-19 . 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 7/22/20.
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 _____.

/Ali Alavi/
Primary Examiner, Art Unit 2875

Notice of Pre-AIA or AIA Status

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

Priority

Receipt is acknowledged of certified copies of papers required by 37 CFR 1.55.

Information Disclosure Statement

The information disclosure statement (IDS) submitted on 12/24/19. The submission is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

Allowable Subject Matter

Claims 1-19are allowed.

The following is an examiner's statement of reasons for allowance:

Claim 1 is allowed because the prior art of record failed to teach all the features of the claimed invention which includes an LED tube lamp, comprising: a glass lamp tube, wherein at least a portion of an inner surface of the glass lamp tube is covered by a rough surface and the roughness of the rough surface is higher than that of the outer surface of the glass lamp tube, two end caps, each of the two end caps coupled to a respective end of the glass lamp tube, an LED light strip disposed on an inner surface of the glass lamp tube with a plurality of LED light sources mounted on the LED light strip, a power supply disposed at one end or two ends of the glass lamp tube, the power supply electrically connected to the plurality of LED light sources; and a reflective film disposed on a portion of the inner surface of the glass lamp tube, wherein the glass lamp tube comprises a main body region and two rear end regions, each of the two rear end regions coupled to a respective end of the main body region and

each of the two end caps coupled to a respective rear end region, and further wherein a length of the light strip is longer than a length of the main body region of the glass lamp tube.

Claims 2-7 are allowed because being depended on base claim 1.

Claim 8 is allowed because the prior art of record failed to teach all the features of the claimed invention which includes an LED tube lamp, comprising: a glass lamp tube, a diffusion film coated on an inner surface of the glass lamp tube, an LED light strip disposed on the inner surface of the glass lamp tube with a plurality of LED light sources mounted on the LED light strip, a reflective film disposed on the inner surface of the glass lamp tube, two end caps, each of the two end caps coupled to a respective end of the glass lamp tube; and a power supply disposed at one end or two ends of the glass lamp tube, the power supply electrically connected to the plurality of LED light sources, wherein the diffusion film has a rough surface, the roughness of the rough surface is higher than that of an outer surface of the glass lamp tube, and wherein a portion of the inner surface of the glass lamp tube is covered by the rough surface and a portion of the inner surface of the glass lamp tube is covered by the reflective film, wherein the glass lamp tube comprises a main body region and two rear end regions, each of the two rear end regions coupled to a respective end of the main body region and each of the two end caps coupled to a respective rear end region, and further wherein a length of the light strip is longer than a length of the main body region of the glass lamp tube.

Claims 9-13 are allowed because being depended on base claim 8.

Claim 14 is allowed because the prior art of record failed to teach all the features of the claimed invention which includes an LED tube lamp, comprising: a glass lamp tube having an inner surface, an LED light strip disposed on the inner surface of the glass lamp tube with a plurality of LED light sources mounted on the LED light strip, two end caps, each of the two end caps coupled to a respective end of the glass lamp tube; and a power supply disposed at one end or two ends of the glass lamp tube, the power supply electrically connected to the plurality of LED light sources, wherein the inner surface of

the glass lamp tube is covered by a reflective layer and a rough layer, the roughness of the rough layer is higher than that of an outer surface of the glass lamp tube, wherein the glass lamp tube comprises a main body region and two rear end regions, each of the two rear end regions coupled to a respective end of the main body region and each of the two end caps coupled to a respective rear end region, and further wherein a length of the light strip is longer than a length of the main body region of the glass lamp tube.

Claims 15-19 are allowed because being depended on claim 14.

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."

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ALI ALAVI whose telephone number is (571)272-2365. The examiner can normally be reached on M-F 8:00 am- 8:00 pm Flex.

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, Diane Lee can be reached on 571-272-2399. 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 https://ppair-my.uspto.gov/pair/PrivatePair. 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.

/Ali Alavi/
Primary Examiner, Art Unit 2875

Notice of References Cited	Application/Control No. 16/719,861	Applicant(s)/Patent Under Reexamination Jiang et al.	
	Examiner ALI ALAVI	Art Unit 2875	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-9618168-B1	04-2017	Jiang; Tao	B23K3/08	1/1
*	B	US-9897265-B2	02-2018	Xiong; Aiming	F21V3/062	1/1
	C					
	D					
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	I					
	J					
	K					
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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.

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/719,861	Jiang et al.
	Examiner	Art Unit
	ALI ALAVI	2875

CPC - Searched*		
Symbol	**Date**	**Examiner**
F21K 9/272, 275, 276, 278, 27 AND 68	08/12/2020	AA
F21V 3/06, 10	08/12/2020	AA
F21V 23/00, 02, 04	08/12/2020	AA
F21V 29/83	08/12/2020	AA
F21Y 2103/10	08/12/2020	AA
F21Y 2115/10	08/12/2020	AA
F21V 7/00	08/12/2020	AA

CPC Combination Sets - Searched*		
Symbol	**Date**	**Examiner**

US Classification - Searched*			
Class	**Subclass**	**Date**	**Examiner**
362	222	08/12/2020	AA

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

/Ali Alavi/ Primary Examiner, Art Unit 2875	

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/719,861	Jiang et al.
	Examiner	Art Unit
	ALI ALAVI	2875

Search Notes		
Search Notes	**Date**	**Examiner**
F21K 9/272, 275, 276, 278, 27 AND 68	08/12/2020	AA
F21V 3/06, 10	08/12/2020	AA
F21V 23/00, 02, 04	08/12/2020	AA
F21V 29/83	08/12/2020	AA
F21Y 2103/10	08/12/2020	AA
F21Y 2115/10	08/12/2020	AA
F21V 7/00	08/12/2020	AA
362/222	08/12/2020	AA
Inventor name searched	08/12/2020	AA
IDS backward searched	08/12/2020	AA

Interference Search			
US Class/CPC Symbol	**US Subclass/CPC Group**	**Date**	**Examiner**
All	Above PGPUB searched	08/12/2020	AA

/Ali Alavi/ Primary Examiner, Art Unit 2875	

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/719,861	Jiang et al.
	Examiner	Art Unit
	ALI ALAVI	2875

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

CLAIMS

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	08/12/2020								
	1	=								
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	18	=								
	19	=								

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/719,861	Jiang et al.
	Examiner	**Art Unit**
	ALI ALAVI	2875

CPC						
Symbol					**Type**	**Version**
F21K	/	9	/	272	F	2016-08-01
F21V	/	29	/	83	I	2013-01-01
F21K	/	9	/	68	I	2016-08-01
F21K	/	9	/	275	I	2016-08-01
F21K	/	9	/	278	I	2016-08-01
F21K	/	9	/	27	I	2016-08-01
F21V	/	3	/	0615	I	2018-02-01
F21V	/	3	/	061	I	2018-02-01
F21V	/	3	/	02	I	2013-01-01
F21V	/	7	/	005	I	2013-01-01
F21V	/	15	/	015	I	2013-01-01
F21V	/	17	/	101	I	2013-01-01
F21V	/	19	/	009	I	2013-01-01
F21V	/	23	/	00	I	2013-01-01
F21V	/	23	/	02	I	2013-01-01
F21V	/	23	/	023	I	2013-01-01
F21V	/	25	/	04	I	2013-01-01
F21V	/	31	/	005	I	2013-01-01
F21Y	/	2103	/	10	A	2016-08-01
F21Y	/	2115	/	10	A	2016-08-01
F21V	/	3	/	10	A	2018-02-01
F21V	/	7	/	00	A	2013-01-01

CPC Combination Sets							
Symbol					**Type**	**Set**	**Ranking**	**Version**
	/		/					

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	19	
/Ali Alavi/ Primary Examiner, Art Unit 2875	12 August 2020	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

U.S. Patent and Trademark Office

Part of Paper No.: 20200812

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/719,861	Jiang et al.
	Examiner	**Art Unit**
	ALI ALAVI	2875

INTERNATIONAL CLASSIFICATION				
CLAIMED				
F21V	/	23	/	02

NON-CLAIMED				
	/		/	

US ORIGINAL CLASSIFICATION	
CLASS	**SUBCLASS**
362	222

CROSS REFERENCES(S)						
CLASS	**SUBCLASS (ONE SUBCLASS PER BLOCK)**					

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	19	
/Ali Alavi/ Primary Examiner, Art Unit 2875	12 August 2020	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

U.S. Patent and Trademark Office

Part of Paper No.: 20200812

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CLAIMS

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
	1		10		19										
	2		11												
	3		12												
	4		13												
	5		14												
	6		15												
	7		16												
	8		17												
	9		18												

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	19	
/Ali Alavi/ Primary Examiner, Art Unit 2875	12 August 2020	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

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

Application Number	16719861
Filing Date	2019-12-18
First Named Inventor	JIANG, Tao
Art Unit	2875
Examiner Name	ALAVI, ALI
Attorney Docket Number	S19141USUC01T

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	10161569	B2	2020-12-25	Xu et al.	
	2	8360599	B2	2013-01-29	Lvey et al.	
	3	10560989	B2	2020-02-11	Tao Jiang et al.	
	4	9777891	B2	2017-10-03	Yusaku Kawabata et al.	
	5	9574717	B2	2017-02-21	James R. Scapa et al.	
	6	8791650	B2	2014-07-29	XinXin Shan	
	7	8931918	B2	2015-01-13	Chun-Chen Liu et al.	
	8	9883555	B2	2018-01-30	Jinsheng Deng et al.	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /AA/

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	Examiner Name	ALAVI, ALI
	Attorney Docket Number	S19141USUC01T

	9	9338853	B2	2016-05-10	Luo Hua Guang	
	10	8304993	B2	2012-11-06	Hua-Lung Tzou 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	20160341414	A1	2016-11-24	Tao Jiang	
	2	20090159919	A1	2009-06-25	John Ivey et al.	
	3	20150198291	A1	2015-07-16	Ching-Feng Lin et al.	
	4	20100201269	A1	2010-08-12	TZOU, HUA-LUNG et al.	
	5	20150049473	A1	2015-02-19	Pan et al.	
	6	20090045715	A1	2009-02-19	Totada R. Shantha et al.	
	7	20130215609	A1	2013-08-22	LIU, CHUN-CHEN et al.	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /AA/

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	Attorney Docket Number	S19141USUC01T

	8	20060146527	A1	2006-07-06	Carl R. VanderSchuit	
	9	20150077001	A1	2015-03-19	TAKAHASHI et al.	
	10	20140084800	A1	2014-07-29	Bong Jin LEE	
	11	20150173138	A1	2015-06-18	Bruce Richard Roberts	

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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	2014068335	WO	A1	2014-05-08	EVITT, Jonathan		
	2	2012114096	WO	A1	2012-08-30	WADE, Scott et al.		
	3	202660350	CN	U	2013-01-09	CHENYI ZHEJIANG ELECTRONIC IND CO LTD		☒
	4	202100985	CN	U	2012-01-04	YUNJIE XU		☒
	5	203628340	CN	U	2014-06-04	LIU TIANMING et al.		☒

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /AA/

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Attorney Docket Number	S19141USUC01T

	6	104633491	CN	A	2015-05-20	HOU LIQUN		☒
	7	201851921	CN	U	2011-06-01	WANG LIAN et al.		☒
	8	2014118754	WO	A1	2014-08-07	DEN BOER REINIER IMRE ANTON et al.		☐
	9	204437746	CN	U	2015-07-01	ZHANG, SHUHUA et al.		☒
	10	2015110306	WO	A1	2015-07-30	YUAN et al.		☐
	11	2608761	DE	A1	1977-09-08	MUTZHAS MAXIMILIAN FRIEDRICH D		☒
	12	201739830	CN	U	2011-02-09	GEM SUN TECHNOLOGIES CO LTD		☒
	13	204442771	CN	U	2015-07-01	Qiangfei Duan		☒
	14	203322772	CN	U	2013-12-04	QIAN, FENGTAO et al.		☒
	15	204005873	CN	U	2014-12-10	HANGZHOU SANGDI LIGHTING ELECTRIC APPLIANCE CO LT		☒
	16	2009129689	WO	A1	2009-10-29	Chen Zhonglie		☒

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /AA/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16719861
	Filing Date	2019-12-18
	First Named Inventor	JIANG, Tao
	Art Unit	2875
	Examiner Name	ALAVI, ALI
	Attorney Docket Number	S19141USUC01T

	17	203162690	CN	U	2013-08-28	LIANG YOUQING et al.		☒
	18	101922640	CN	A	2010-12-22	FUJIAN XIANGYUN PHOTOELECTRIC TECHNOLOGY CO LTD		☒
	19	104990041	CN	A	2015-10-21	ZHAO XING; LU LIBING		☒
	20	203500909	CN	U	2014-03-26	WANG JUN		☒

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NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T5
	1	Lenk, R. et al., Practical Lighting Design with LEDs, IEEE Press, A John Wiley & Sons, Inc., 2011, pp. 103-106	
	2	Declaration of Regan Zane, Ph.D., November 18, 2019	
	3	CV of Dr. Regan Zane, November 18, 2019	
	4	Petition for Inter Parte Review of U.S. Patent No. 9,897,265 Under 35 U.S.C.311-319 and 37 C.F.R. 42.1-080, 42.100-.123.	
	5	DEFENDANT MAXLITE, INC.'S PRELIMINARY NONINFRINGEMENT AND INVALIDITY CONTENTIONS PURSUANT TO COURT'S ORDER, May 19, 2020	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /AA/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16719861
	Filing Date	2019-12-18
	First Named Inventor	JIANG, Tao
	Art Unit	2875
	Examiner Name	ALAVI, ALI
	Attorney Docket Number	S19141USUC01T

	6	Philips InstantFit LED T8 Lamps data sheet, May 19, 2020
	7	Keystone KT-LED18T8-48G-850-D T8 LED LAMP Data Sheet, May 19, 2020
	8	MaxLite LED T8 - LINEAR REPLACEMENT LAMP DirectFit G SERIES Data Sheet, May 19, 2020

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature	/Ali Alavi/ (08/12/2020)	Date Considered	

*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.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /AA/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	16719861
Filing Date	2019-12-18
First Named Inventor	JIANG, Tao
Art Unit	2875
Examiner Name	ALAVI, ALI
Attorney Docket Number	S19141USUC01T

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	/Simon Kuang Lu/	Date (YYYY-MM-DD)	2020-07-22
Name/Print	Simon Kuang Lu	Registration Number	51974

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.**

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /AA/

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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:

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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.

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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.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /AA/

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	141	("20030231485" | "20060028837" | "20080192476" | "20120106157" | "20120146503" | "20130170245" | "20130256704" | "20170038013" | "20170038014" | "3294518" | "4647399" | "6796680" | "7033239" | "20050168123" | "20100085772" | "20110084608" | "20110309745" | "20120212951" | "20130293098" | "20170159894A1" | "20100066230" | "20130135857" | "9288867" | "20070001709" | "20090159919" | "20110057572" | "20140226320" | "20150009688" | "20160091179" | "20160178138" | "20160341414" | "20170038012" | "6118072" | "6127783" | "8456075" | "8579463" | "20090140271" | "20170130911A1" | "20170167664A1" | "6043600" | "20050162101" | "20100253226" | "20070274084" | "20080278941" | "20080290814" | "20090161359" | "20120153873" | "20130250565" | "20160091156" | "20160290569" | "5575459" | "7594738" | "20050185396" | "20100177532" | "20110084627" | "20130258650" | "6860628" | "8360599" | "20050213321" | "20100253226" | "20120169968" | "20120319150" | "20130050998" | "20160178137" | "20160215936" | "20160290568" | "6211262" | "7067032" | "20100220469" | "20110084554" | "20140192526" | "9618168" | "20120026761" | "20130033888" | "20150070885" | "9000668" | "20040095078" | "20040189218" | "20050207166" | "20070145915" | "20110038146" | "20110216538" | "20120069556" | "20130021809" | "20130033888" | "20130182425" | "8360599" | "20080302476" | "20110279063" | "20130223053" | "20150176770" | "20120106144" | "20090161359" | "20110149563" | "20120212951" | "7611260" | "20020044456" | "20070210687" |	US-PGPUB; USPAT; USOCR	OR	OFF	2020/08/12 12:13

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L3	21	2 and reflect$3 near2 (film layer element)	US-PGPUB; USPAT; USOCR	OR	OFF	2020/08/12 12:14
L4	20	3 and power near supply	US-PGPUB; USPAT; USOCR	OR	OFF	2020/08/12 12:15
L5	20	4 and end near caps	US-PGPUB; USPAT; USOCR	OR	OFF	2020/08/12 12:15
L6	9	5 and led near2 strip	US-PGPUB; USPAT; USOCR	OR	OFF	2020/08/12 12:16
L7	0	(led near tube near lamp and glass near lamp and led near strip and power near	US-PGPUB;	OR	OFF	2020/08/12 12:25

		supply and reflective near layer and end near caps).clm.	USPAT; USOCR			
L8	0	(led near tube and glass near lamp and led near strip and power near supply and reflective near layer and end near caps).clm.	US-PGPUB; USPAT; USOCR	OR	OFF	2020/08/12 12:26
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L12	6	("20160081147" | "20140226320" | "20090290334" | "20100103673" | "20050162850" | "20130313983").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2020/08/12 12:42
L13	401	((("Jiang") near3 ("Tao"))).INV.	US-PGPUB	OR	OFF	2020/08/12 12:50

L14	15	((("Li") near3 ("Li-Qin"))).INV.	US-PGPUB	OR	OFF	2020/08/12 12:51
L15	22,255	F21K9/272 F21K9/275 F21K9/278 F21K9/27 F21V3/06 F21V3/06 F21V3/02 F21V7/00 F21V15/015 F21V17/10 F21V19/00 F21V23/00 F21V23/02 F21V23/02 F21V25/04 F21V31/00 F21V29/83 F21K9/68 F21Y103/10 F21Y115/10 F21V3/10 F21V7/00	US-PGPUB; USPAT; USOCR	OR	OFF	2020/08/12 12:52
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L17	146	16 and reflect$3 near2 (film layer element)	US-PGPUB; USPAT; USOCR	OR	OFF	2020/08/12 12:52
L18	131	17 and power near supply	US-PGPUB; USPAT; USOCR	OR	OFF	2020/08/12 12:53
L19	106	18 and end near caps	US-PGPUB; USPAT; USOCR	OR	OFF	2020/08/12 12:53
L20	89	19 and led near2 strip	US-PGPUB; USPAT; USOCR	OR	OFF	2020/08/12 12:53
L21	18	20 and rough near surface	US-PGPUB; USPAT; USOCR	OR	OFF	2020/08/12 12:54

8/12/2020 12:56:19 PM
C:\Users\aalavi1\Documents\EAST\Workspaces\15638963.wsp

Bibliographic Data

Application No: 16/719,861

Foreign Priority claimed: (●) Yes ( ) No

35 USC 119 (a-d) conditions met: ☐ Yes ☑ No ☐ Met After Allowance

Verified and Acknowledged: /Ali Alavi/ Examiner's Signature | Initials

Title: LED TUBE LAMP

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
12/18/2019	362	2875	S19141USUC01T
RULE			

APPLICANTS

JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO., LTD, Jiaxing, CHINA

INVENTORS

Tao Jiang, Jiaxing, CHINA

Li-Qin Li, Jiaxing City, CHINA

CONTINUING DATA

This application is a CON of 16051826 08/01/2018 PAT 10514134

16051826 is a CIP of 15437084 02/20/2017 PAT 10352540

16051826 is a CIP of 15087092 03/31/2016 PAT 10082250

15437084 is a CON of 15056106 02/29/2016 PAT 9903537

15056106 is a CIP of PCT/CN2015/096502 12/05/2015

15087092 is a CIP of PCT/CN2015/096502 12/05/2015

FOREIGN APPLICATIONS

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CHINA CN201510259151.3 05/19/2015

CHINA CN201510324394.0 06/12/2015

CHINA CN201510338027.6 06/17/2015

CHINA CN201510373492.3 06/26/2015

CHINA CN201510448220.5 07/27/2015

CHINA CN201510482944.1 08/07/2015

CHINA CN201510483475.5 08/08/2015

CHINA CN201510499512.1 08/14/2015

CHINA CN201510555543.4 09/02/2015

CHINA CN201510557717.0 09/06/2015

CHINA CN201510595173.7 09/18/2015

CHINA CN201510645134.3 10/08/2015

CHINA CN201510716899.1 10/29/2015

CHINA CN201510726365.7 10/30/2015

CHINA CN201510868263.9 12/02/2015

IF REQUIRED, FOREIGN LICENSE GRANTED**

01/09/2020

STATE OR COUNTRY

CHINA

ADDRESS

Jiaxing Super Lighting Electric Appliance Co., Ltd
IP Department
No. 1288 Jiachuang Road, Xiuzhou Area
Jiaxing, Zhejiang
Jiaxing City, 314031
CHINA

FILING FEE RECEIVED

$1,720

Document Description: Issue Fee Payment (PTO-85B)

Issue Fee Transmittal Form

Application Number	Filing Date	First Named Inventor	Atty. Docket No.	Confirmation No.
16719861	18-Dec-2019	Tao Jiang	S19141USUC01T	5387

TITLE OF INVENTION :

LED TUBE LAMP

Entity Status	Application Type	Art Unit	Class - Subclass	EXAMINER
Regular Undiscounted	Utility under 35 USC 111(a)	2875	222000	ALI ALAVI

Issue Fee Due	Publication Due	Total Fee(s) Due	Date Due	Prev. Paid Fee
$1000	$0	$1000	19-Nov-2020	$0

1.Change of Correspondence Address and/or Indication Of Fee Address (37 CFR 1.33 & 1.363)

Current Correspondence Address:	Current Indicated Fee Address :
147274 Jiaxing Super Lighting Electric Appliance Co., Ltd IP Department No. 1288 Jiachuang Road, Xiuzhou Area Jiaxing, Zhejiang Jiaxing City 314031 CHINA (650) 315-4468 jin@atipm.com	
☐ Change of correspondence address requested, system generated AIA/122-EFS form attached	☐ Fee Address indication requested, system generated SB/47-EFS form attached

2.Entity Status

Change in Entity Status

○ Applicant certifying micro entity status; system generated Micro Entity certification form attached. See 37 CFR 1.29.
Note: Absent a valid certification of micro entity status, issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment. If this box is checked, you will be prompted to choose a micro entity status on the gross income basis (37 CFR 1.29(a)) or the institution of higher education basis (37 CFR 1.29(d)), and make the applicable certification online.

○ Applicant asserting small entity status. See 37 CFR 1.27.
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.

◉ Applicant changing to regular undiscounted fee status.
Note: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

Document Description: Issue Fee Payment (PTO-85B)

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☒ Issue Fee	☐ I authorize USPTO to apply my previously paid issue fee to the current fees due
☐ Publication Fee	☐ The Director is hereby authorized to apply my previously paid issue fee to the current fee due and to charge deficient fees to Deposit Account Number _____
☐ Advance Order - # of copies _____	☐ If **in addition to** the payment of the issue fee amount submitted with this form, there are any discrepancies in any amount(s) due, the Director is authorized to charge any deficiency, or credit any overpayment, to Deposit Account Number _____ . The **issue fee must be submitted** with this form. **If payment of the issue fee does not accompany this form, checking this box and providing a deposit account number will NOT be effective to satisfy full payment of the fee(s) due.**

4.Firm and/or Attorney Names To Be Printed

NOTE: If no name is listed, no name will be printed
For printing on the patent front page, list to be displayed as entered

1. Simon Kuang Lu
2.
3.

5.Assignee Name(s) and Residence Data To Be Printed

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Name	City	State	Country	Category
JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO., LTD	JIAXING		china	corporation

6.Signature

I certify, in accordance with 37 CFR 1.4(d)(4) that I am an attorney or agent registered to practice before the Patent and Trademark Office who has filed and has been granted power of attorney in this application. I also certify that this Fee(s) Transmittal form is being transmitted to the USPTO via EFS-WEB on the date indicated below.

Signature	/Simon Kuang Lu/	**Date**	09-28-2020
Name	Simon Kuang Lu	**Registration Number**	51974

Electronic Patent Application Fee Transmittal

Application Number:	16719861
Filing Date:	18-Dec-2019
Title of Invention:	LED TUBE LAMP
First Named Inventor/Applicant Name:	Tao Jiang
Filer:	Simon Kuang Lu/Jin Huang
Attorney Docket Number:	S19141USUC01T

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
UTILITY APPL ISSUE FEE	1501	1	1000	1000
PUBL. FEE- EARLY, VOLUNTARY, OR NORMAL	1504	1	0	0
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**1000**

Electronic Acknowledgement Receipt

EFS ID:	40686602
Application Number:	16719861
International Application Number:	
Confirmation Number:	5387
Title of Invention:	LED TUBE LAMP
First Named Inventor/Applicant Name:	Tao Jiang
Customer Number:	147274
Filer:	Simon Kuang Lu/Jin Huang
Filer Authorized By:	Simon Kuang Lu
Attorney Docket Number:	S19141USUC01T
Receipt Date:	28-SEP-2020
Filing Date:	18-DEC-2019
Time Stamp:	13:46:19
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$1000
RAM confirmation Number	E20209RD46165726
Deposit Account	
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	Web85b.pdf	46003 a1afeee686e4f405e518cf87051c9eda826396b4	no	2
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	31781 5d703c0c86e42919a5ba26640792d34c8daec3e6	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	77784		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

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

National Stage of an International Application under 35 U.S.C. 371

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

New International Application Filed with the USPTO as a Receiving Office

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

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

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/719,861	12/18/2019	Tao Jiang	S19141USUC01T	5387

147274 7590 10/09/2020

Jiaxing Super Lighting Electric Appliance Co., Ltd
IP Department
No. 1288 Jiachuang Road, Xiuzhou Area
Jiaxing, Zhejiang
Jiaxing City, 314031
CHINA

EXAMINER	
ALAVI, ALI	

ART UNIT	PAPER NUMBER
2875	

NOTIFICATION DATE	DELIVERY MODE
10/09/2020	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):

jin@atipm.com
sl-ip@super-lamps.com

Supplemental ***Notice of Allowability***	**Application No.** 16/719,861	**Applicant(s)** Jiang et al.	
	Examiner ALI ALAVI	**Art Unit** 2875	**AIA (FITF) 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 See Continuation Sheet.
   ☐ 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 1-19 . 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)12/24/19.
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 _____.

/Ali Alavi/
Primary Examiner, Art Unit 2875

Continuation of 1. This communication is responsive to: IDS filed on 12/24/19

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	16719861
Filing Date	2019-12-18
First Named Inventor	JIANG, Tao
Art Unit	2875
Examiner Name	
Attorney Docket Number	S19141USUC01T

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
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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	20130050998	A1	2013-02-28	GT BIOMESCILT LIGHT	

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FOREIGN PATENT DOCUMENTS Remove

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	101787273	CN	A	2010-07-28	ANHUI ZERUN OPTOELECTRONIC CO		☒
	2	102738355	CN	A	2012-10-17	SILICONWARE PREC IND CO LTD		☒
	3	102121690	CN	A	2011-07-13	NANJING ZHONGYA OPTO ELECTRICAL SCIENCE AND TECHNO		☒

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /AA/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT
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Filing Date	2019-12-18
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Art Unit	2875
Examiner Name	
Attorney Docket Number	S19141USUC01T

	4	203240362	CN	U	2013-10-16	SUZHOU MONT LIGHTING CO LTD		☒
	5	102016661	CN	A	2011-04-13	NITTA CORP		☒
	6	204573700	CN	U	2015-08-19	FUJIAN QUANZHOU SIGOLED LIGHTING TECHN CO LTD		☒
	7	202100985	CN	U	2012-01-04	YUNJIE XU		☒
	8	1460165	CN	A	2003-12-03	KONINKL PHILIPS ELECTRONICS NV		☒
	9	20120055349	KR	A	2012-05-31	AMOLUXE CO LTD		☒
	10	2523275	GB	A	2015-08-19	The Wand Lite Company Limited		☐
	11	102518972	CN	A	2012-06-27	SEEWILL OPTOELECTRONICS TECHNOLOGY CO LTD		☒
	12	203517629	CN	U	2014-04-02	ZHANG JING		☒
	13	2012129301	WO	A1	2012-09-27	ELECTRALED INC.		☐
	14	201437921	CN	U	2010-04-14	SHENZHEN SEVEN COLOR STAR OPTOELECTRONICS TECHNOLO		☒

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /AA/

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Examiner Name	
Attorney Docket Number	S19141USUC01T

	15	202012011550	DE	U1	2013-06-27	BERNDT BENJAMIN		☒
	16	204573682	CN	U	2015-08-19	JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO LTD		☒
	17	202281101	CN	U	2012-06-20	LIXIA LIU		☒
	18	102720901	CN	A	2012-10-10	MENG YANG		☒
	19	2014117435	WO	A1	2014-08-07	CHEN YUAN HSING YEH CO LTD		☒
	20	2013254667	JP	A	2013-12-19	MITSUBISHI ELEC LIGHTING CORP		☒
	21	2009111098	WO	A2	2009-09-11	ALTAIR ENG INC		☒
	22	103822121	CN	A	2014-05-28	LEXTAR ELECTRONICS CORP; LEXTAR ELECTRONICS SUZHOU		☒
	23	204573684	CN	U	2015-08-19	JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO LTD		☒
	24	101092545	CN	A	2007-12-26	HONG BAI		☒
	25	201255393	CN	Y	2009-06-10	ZHONG YING		☒

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Art Unit	2875
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Attorney Docket Number	S19141USUC01T

	26	103968272	CN	A	2014-08-06	WU RONGFENG		☒
	27	202302841	CN	U	2012-07-04	NINGBO RUIKANG PHOTOELECTRIC CO LTD & SHENZHEN REF		☒
	28	102889446	CN	A	2013-01-23	LI WENZHONG		☒
	29	203131520	CN	U	2013-08-14	JIANGSU DONGLIN ELECTRONICS CO LTD		☒
	30	103411140	CN	A	2013-11-27	DALIAN THERMALWAY HEAT TRANSFER TECHNOLOGY CO LTD		☒
	31	203464014	CN	U	2014-03-05	ZHANG WEI et al.		☒

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NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T5
	1		

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EXAMINER SIGNATURE

Examiner Signature	/Ali Alavi/ (10/05/2020)	Date Considered	02/05/2020

*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.

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Art Unit	2875
Examiner Name	
Attorney Docket Number	S19141USUC01T

[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.

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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First Named Inventor	JIANG, Tao
Art Unit	2875
Examiner Name	
Attorney Docket Number	S19141USUC01T

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	/Simon Kuang Lu/	Date (YYYY-MM-DD)	2019-12-24
Name/Print	Simon Kuang Lu	Registration Number	51,974

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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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 record s.

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.

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Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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First Named Inventor	JIANG, Tao
Art Unit	2875
Examiner Name	
Attorney Docket Number	S19141USUC01T

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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	10288272	B2	2019-05-14	ZHEJIANG SUPER LIGHTING ELECTRIC APPLIANCE CO LTD	

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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
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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	3147313	JP	U	2008-12-25	Kuo-Len LIN et.al		☒
	2	2519258	GB	A	2015-04-15	UNITY OPTO TECHNOLOGY CO. LTD		☐
	3	2013243132	JP	A	2013-12-05	OKI ISAMU		☒

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /AA/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT
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First Named Inventor	JIANG, Tao
Art Unit	2875
Examiner Name	
Attorney Docket Number	S19141USUC01T

	4	203549435	CN	U	2014-04-16	HU FEILIN		☒
	5	H01204982	JP	A	1989-08-17	Kanbayashi Tomio et al.		☒
	6	203848055	CN	U	2014-09-24	CHEN JINZHANG		☒
	7	200980183	CN	Y	2007-11-21	WANG GUOZHONG		☒
	8	204042527	CN	U	2014-12-24	JIANGSU INKIN OPTOELECTRIC TECHNOLOGY DEV CO LTD		☒
	9	205877791	CN	U	2017-01-11	JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO LTD		☒
	10	103851547	CN	A	2014-06-11	OSRAM GMBH		☒
	11	2012155880	JP	A	2012-08-16	SEKI KATSUSH et al.		☒
	12	203771102	CN	U	2014-08-13	SUZHOU ARES INTERNAT CO LTD		☒
	13	202216003	CN	U	2012-05-09	BEIJING TONGFANG LANSEN LIGHTING TECHNOLOGY CO LTD		☒
	14	203240337	CN	U	2013-10-16	ZHEJIANG SUPER LIGHTING ELECTRIC APPLIANCE CO LTD		☒

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Art Unit	2875
Examiner Name	
Attorney Docket Number	S19141USUC01T

	15	103943752	CN	A	2014-07-23	LEXTAR ELECTRONICS CORP		☒
	16	104832813	CN	A	2015-08-12	JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO LTD		☒
	17	201954169	CN	U	2011-08-31	HUANSONG XU; QUEMING WANG		☒
	18	1914458	CN	A	2007-02-14	KONINKL PHILIPS ELECTRONICS NV		☒
	19	203686635	CN	U	2014-07-02	JIANGSU TIWIN OPTOELECTRONIC TECHNOLOGY CO LTD		☒
	20	2005122906	JP	A	2005-05-12	HITACHI LIGHTING LTD		☒
	21	203162856	CN	U	2013-08-28	RONG SHENG		☒
	22	2554899	EP	A2	2013-02-06	QBAS TECH CO LTD		☐
	23	1292930	CN	A	2001-04-25	KONINKL PHILIPS ELECTRONICS NV		☒
	24	2531425	GB	A	2016-04-20	JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO LTD		☐
	25	204083927	CN	U	2015-01-07	LU YING et al.		☒

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Attorney Docket Number	S19141USUC01T

	26	101228393	CN	A	2008-07-23	LEMNIS LIGHTING IP GMBH		☒
	27	203927469	CN	U	2014-11-05	SUZHOU LINKE LIGHTING TECHNOLOGY CO LTD		☒
	28	202852551	CN	U	2013-04-03	YANTAI GELINRUIDE OPTOELECTRONIC ENGINEERING CO LT		☒
	29	204300737	CN	U	2015-04-29	LIU MEICHAN		☒
	30	101182919	CN	A	2008-05-21	ZHENHANG YANG		☒
	31	3146803	EP	A1	2017-03-29	JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO LTD		☐
	32	104595765	CN	A	2015-05-06	WUXI HYPERION ENERGY CONSERVATIONS CO LTD		☒
	33	103742875	CN	A	2014-04-23	KUANG ZHENGFANG		☒
	34	102226504	CN	A	2011-10-26	SHANGHAI XINKAIYUAN LIGHTING TECHNOLOGY CO LTD		☒
	35	101806444	CN	A	2010-08-18	OCEANS KING LIGHTING SCIENCE		☒
	36	104033772	CN	B	2016-06-08	NINGBO LIAN ELECTRONIC CO LTD		☒

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /AA/

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Attorney Docket Number	S19141USUC01T

	37	20090118147	KR	A	2009-11-18	NAM KI HO et al,		☒
	38	203615157	CN	U	2014-05-28	PANASONIC CORP		☒
	39	203068187	CN	U	2013-07-17	HUANG YINGFENG		☒
	40	201866575	CN	U	2011-06-15	SHENZHEN XINRUI OPTOELECTRONICS CO LTD		☒
	41	202120982	CN	U	2012-01-18	SHENZHEN JUFEI OPTOELECTRONIC CO LTD		☒
	42	201555053	CN	U	2010-08-18	PEILING LIAO		☒
	43	201363601	CN	Y	2009-12-16	YINGCHENG RUILU TECHNOLOGY CO		☒
	44	202392485	CN	U	2012-08-22	KANG WANG		☒
	45	2016086900	WO	A2	2016-06-09	HONG XU et al.		☐

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Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T5

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16719861
	Filing Date	2019-12-18
	First Named Inventor	JIANG, Tao
	Art Unit	2875
	Examiner Name	
	Attorney Docket Number	S19141USUC01T

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Examiner Signature	/Ali Alavi/ (10/05/2020)	Date Considered	02/05/2020

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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.

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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	/Simon Kuang Lu/	Date (YYYY-MM-DD)	2019-12-24
Name/Print	Simon Kuang Lu	Registration Number	51,974

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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Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

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Art Unit	2875
Examiner Name	
Attorney Docket Number	S19141USUC01T

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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	10288272	B2	2019-05-14	ZHEJIANG SUPER LIGHTING ELECTRIC APPLIANCE CO LTD	
	2	9989200	B2	2018-06-05	Zhang Yingchun	
	3	7611260	B1	2009-11-03	Kuo-Len LIN et al.	
	4	7815338	B2	2010-10-19	Dennis Siemiet et al.	
	5	9864438	B2	2018-01-09	SEO JOON KYU et al.	
	6	8360599	B2	2013-01-29	Ilumisys, Inc.	
	7	9625137	B2	2017-04-18	Li-Qin, Li et al.	
	8	7067032	B1	2006-06-27	A RAYMOND & CIE	

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	9	9448660	B2	2016-09-20	SEO JOON KYU et al.	
	10	9228727	B2	2016-01-05	MAY, MICHAEL, W.	
	11	9322531	B2	2016-04-26	Chun-wei Liang et al.	
	12	1088142	A	1914-02-24	GARDNER JESSE O	
	13	8456075	B2	2013-06-04	AURALIGHT INTERNATIONAL AB	
	14	7594738	B1	2009-09-29	KITAGAWA HOLDINGS, LLC	
	15	9016890	B2	2015-04-28	KIM KYUNG RYE et al.	
	16	9488767	B2	2016-11-08	Dante P. Nava et al.	
	17	8240875	B2	2012-08-14	Cree, Inc.	
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	21	6246167	B1	2001-06-12	SICA, MICHAEL F.	
	22	10161569	B2	2018-12-25	XU HONG et al.	
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	3	20140331532	A1	2014-11-13	ALMAX MFG CORP	

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	4	20130021809	A1	2013-01-24	OSRAM GMBH	
	5	20130033888	A1	2013-02-07	KONINKLIJKE PHILIPS ELECTRONICS N V	
	6	20140009923	A1	2014-01-09	FIN-CORE CORPORATION & TONG HONG INVESTMENT CO., L	
	7	20130250565	A1	2013-09-26	DELTA ELECTRONICS, INC	
	8	20100066230	A1	2010-03-18	Kuo-Len LIN et al.	
	9	20110084608	A1	2011-04-14	I/O CONTROLS CORPORATION	
	10	20100220469	A1	2010-09-02	ILUMISYS, INC.	
	11	20100201269	A1	2010-08-12	LEXTAR ELECTRONICS CORP.	
	12	20130182425	A1	2013-07-18	PANASONIC INTELLECTUAL PROPERTY MANAGEMENT CO., LT	
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	22	20160081147	A1	2016-03-17	GUANG LUO HUA	
	23	20140225519	A1	2014-08-14	POESEN ELECTRONIC CO., LTD.	
	24	20120146503	A1	2012-06-14	CREE Inc.,	
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	27	20100253226	A1	2010-10-07	OKI ISAMU	
	28	20110149563	A1	2011-06-23	LIGHTEL TECHNOLOGIES INC.	
	29	20150345755	A1	2015-12-03	PURDY STEVEN	
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	50	20100124054	A1	2010-05-20	TAIWAN RODAN CO., LTD.	
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	61	20130069538	A1	2013-03-21	YU-SHENG SO	
	62	20130258650	A1	2013-10-03	SHARRAH RAYMOND L.	
	63	20130141890	A1	2013-06-06	STEVEN W. CARLIN et al.	
	64	20050185396	A1	2005-08-25	KUTLER MURRAY	
	65	20170290119	A1	2017-10-05	XIONG AIMING et al.	
	66	20130135852	A1	2013-05-30	HONG KONG PATENT EXCHANGE LIMITED	
	67	20150070885	A1	2015-03-12	PETRO, ALFRED et al.	
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	71	20130230995	A1	2013-09-05	ILUMISYS, INC.	
	72	20110038146	A1	2011-02-17	Yancheng Haomai Lighting Science&Technology Co.Ltd	
	73	20170059096	A1	2017-03-02	HONG XU et al.	
	74	20130215609	A1	2013-08-22	VERTICIL ELECTRONICS CORPORATION	
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	1	203202740	CN	U	2013-09-18	FUZHOU SUNLIGHT LIGHTING ELECTRICAL APPLIANCE CO L		☒
	2	2014045523	WO	A1	2014-03-27	PANASONIC CORP		☒

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	3	204879985	CN	U	2015-12-16	PANASONIC IP MAN CO LTD		☒
	4	2014154479	JP	A	2014-08-25	EREBAMU KK		☒
	5	204693095	CN	U	2015-10-07	JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO LTD		☒
	6	104633491	CN	A	2015-05-20	LIQUN HOU		☒
	7	205447315	CN	U	2016-08-10	JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.,LTD		☒
	8	201954350	CN	U	2011-08-31	YUANGUI LIU		☒
	9	101787255	CN	A	2010-07-28	JIANGSU WENRUN PHOTOELECTRIC C		☒
	10	102359697	CN	A	2012-02-22	HUAHUI CONSTRUCTION GROUP CO LTD		☒
	11	2008117666	JP	A	2008-05-22	SHARP CORP.		☒
	12	2016086901	WO	A3	2016-06-09	Jiaxing Super Lighting Electric Appliance Co., Ltd		☐
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	14	201661897	CN	U	2010-12-01	JIAHAO ZHANG		☒
	15	202884614	CN	U	2013-04-17	HE ZHONGLIANG		☒
	16	2013125803	WO	A1	2013-08-29	RYU, Dae Young		☒
	17	104776332	CN	A	2015-07-15	JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO LTD		☒
	18	2014118754	WO	A1	2014-08-07	KONINKLIJKE PHILIPS N.V.		☐
	19	203036285	CN	U	2013-07-03	SHENZHEN UNIBOND ELECTRICAL AND LIGHTING CO LTD		☒
	20	203202766	CN	U	2013-09-18	ZHOU SHUNLONG		☒
	21	202546288	CN	U	2012-11-21	BO ZHAN		☒
	22	202132647	CN	U	2012-02-01	MENG YANG		☒
	23	2498692	CN	Y	2002-07-03	LIYADE ELECTRONICS SCIENCE & T		☒
	24	104515014	CN	A	2015-04-15	JIANGMEN POTOP OPTO ELECTRONIC TECHNOLOGY CO LTD		☒

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	25	201796567	CN	U	2011-04-13	SHENZHEN LIANTRONICS CO LTD		☒
	26	204573639	CN	U	2015-08-19	JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO LTD		☒
	27	202546330	CN	U	2012-11-21	OPTO TECH CORP		☒
	28	203857296	CN	U	2014-10-01	SHENZHEN GUANGJU LIGHTING CO LTD		☒
	29	104565931	CN	A	2015-04-29	JIANGXI OUTRACE TECHNOLOGY CO LTD		☒
	30	2014103000	JP	A	2014-06-05	ONO TETSUYA		☒
	31	2011061056	JP	A	2011-03-24	STANLEY ELECTRIC CO. LTD.		☒
	32	102159867	CN	A	2011-08-17	EMABOND SOLUTIONS LLC		☒
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	35	103411140	CN	B	2015-05-20	DALIAN THERMALWAY HEAT TRANSFER TECHNOLOGY CO LTD;		☒

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

Application Number	16719861
Filing Date	2019-12-18
First Named Inventor	JIANG, Tao
Art Unit	2875
Examiner Name	
Attorney Docket Number	S19141USUC01T

	36	204268162	CN	U	2015-04-15	SI WENYUN		☒
	37	2911390	CN	Y	2007-06-13	SUN PINGRU		☒
	38	201014273	CN	Y	2008-01-30	GUOZHONG WANG		☒
	39	102777788	CN	A	2012-11-14	SUZHOU VELARIUM LANDSCAPE DECO		☒
	40	203963553	CN	U	2014-11-26	HESHAN NEO NEON LIGHTING CO LTD		☒
	41	103016984	CN	A	2013-04-03	ZHANG JING		☒
	42	102376843	CN	A	2012-03-14	WENBIN CHEN		☒
	43	104033772	CN	A	2014-09-10	NINGBO LAE ELECTRONIC CO LTD		☒
	44	204534210	CN	U	2015-08-05	ELEC TECH INT CO LTD		☒
	45	102116460	CN	A	2011-07-06	GANQIANG CAI		☒
	46	202125774	CN	U	2012-01-25	GUANGZHOU THERMOKING TECHNOLOGY INTERNAT CO LTD		☒

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /AA/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Application Number	16719861
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First Named Inventor	JIANG, Tao
Art Unit	2875
Examiner Name	
Attorney Docket Number	S19141USUC01T

	47	204420636	CN	U	2015-06-24	SHENHZEN BOSHIN LED LIGHTING CO LTD		☒

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NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
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EXAMINER SIGNATURE

Examiner Signature	/Ali Alavi/ (10/05/2020)	Date Considered	02/05/2020

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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.

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Attorney Docket Number	S19141USUC01T

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	/Simon Kuang Lu/	Date (YYYY-MM-DD)	2019-12-24
Name/Print	Simon Kuang Lu	Registration Number	51,974

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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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 record s.

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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.

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PATENT ASSIGNMENT COVER SHEET

Electronic Version v1.1
Stylesheet Version v1.2

EPAS ID: PAT6355358

SUBMISSION TYPE:	NEW ASSIGNMENT
NATURE OF CONVEYANCE:	ASSIGNMENT

CONVEYING PARTY DATA

Name	Execution Date
JIANG TAO	07/27/2018
LI-QIN LI	07/30/2018

RECEIVING PARTY DATA

Name:	JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO., LTD
Street Address:	NO. 1288 JIACHUANG RD., XIUZHOU AREA, ZHEJIANG
City:	JIAXING
State/Country:	CHINA
Postal Code:	314031

PROPERTY NUMBERS Total: 1

Property Type	Number
Application Number:	16719861

CORRESPONDENCE DATA

Fax Number:

Correspondence will be sent to the e-mail address first; if that is unsuccessful, it will be sent using a fax number, if provided; if that is unsuccessful, it will be sent via US Mail.

Phone: 6503154468
Email: jin@atipm.com
Correspondent Name: SIMON KUANG LU
Address Line 1: 1380 CHARLES WILLARD ST.
Address Line 4: CARSON, CALIFORNIA 90746

ATTORNEY DOCKET NUMBER:	S19141USUC01T
NAME OF SUBMITTER:	SIMON KUANG LU
SIGNATURE:	/Simon Kuang Lu/
DATE SIGNED:	10/19/2020
	This document serves as an Oath/Declaration (37 CFR 1.63).

Total Attachments: 3
source=S18016USUP01T_DeclarationAssignment_F#page1.tif
source=S18016USUP01T_DeclarationAssignment_F#page2.tif
source=S18016USUP01T_DeclarationAssignment_F#page3.tif

COMBINED DECLARATION AND ASSIGNMENT

Title of Invention: **LED TUBE LAMP**

As a below named inventor, I hereby declare that:

This declaration is directed to:
☒ The attached application; or
☐ United States application number or PCT international application number _____, filed on _____.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

WHEREAS, JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO., LTD. of No.1288 Jiachuang Rd. Xiuzhou Area, Jiaxing, Zhejiang, China, its heirs, successors, legal representatives and assigns (hereinafter designated as the Assignee) is desirous of acquiring the entire right, title and interest in and to said invention and in and to any Letters Patent(s) that may be granted therefor in the United States of America and ☐ in any foreign countries.

NOW, THEREFORE, in consideration of the sum of Ten Dollars ($10.00) to the undersigned in hand paid, the receipt of which is hereby acknowledged, and other good and valuable consideration, the undersigned has (have) sold, assigned and transferred, and by these presents does sell, assign and transfer unto said Assignee the full and exclusive right to the said invention in the United States of America, its territories, dependencies and possessions and the entire right, title and interest in and to any and all Letters Patent(s) which may be granted therefor in the United States of America, its territories, dependencies and possessions, and if the box above is designated, in any and all foreign countries; and to any and all divisions, reissues,

continuations, conversions and extensions thereof for the full term or terms for which the same may be granted.

The undersigned agree(s) to execute all papers necessary in connection with this application and any continuing, divisional, conversion or reissue applications thereof and also to execute separate assignments in connection with such applications as the Assignee may deem necessary or expedient.

The undersigned agree(s) to execute all papers necessary in connection with any interference which may be declared concerning this application or continuation, division, conversion or reissue thereof or Letter Patent(s) or reissue patent issued thereon and to cooperate with the Assignee in every way possible in obtaining and producing evidence and proceeding with such interference.

The undersigned agree(s) to execute all papers and documents and to perform any act which may be necessary in connection with claims or provisions of the International Convention for the Protection of Industrial Property or similar agreements.

The undersigned agree(s) to perform all affirmative acts which may be necessary to obtain a grant of a valid United States of America patent(s) or a grant of a valid United States of America and any foreign patent(s) to the Assignee and to vest all rights therein hereby conveyed to said Assignee as fully and entirely as the same would have been held by the undersigned if this Assignment and sale had not been made.

The undersigned hereby authorize(s) and request(s) the Patent and Trademark Office Officials in the United States of America and in any foreign countries to issue any and all Letters Patents resulting from said application or any continuing, divisional, conversion or reissue applications thereof to the said Assignee, as Assignee of the entire interest, and hereby covenants that he has (they have) the full right to convey the entire interest herein assigned, and that he has (they have) not executed, and will not execute, any agreement in conflict herewith.

The undersigned hereby covenant(s) that no assignment, sale, agreement or encumbrance has been or will be made or entered into which would conflict with this assignment.

In witness whereof, executed by the undersigned on the date(s) opposite the undersigned name(s).

LEGAL NAME OF FIRST OR SOLE INVENTOR:

JIANG, TAO

Signature: JIANG TAO Date: 7/27/2018

LEGAL NAME OF ADDITIONAL JOINT INVENTOR, IF ANY:

Li, Li-Qin
Signature: Li, Li-Qin Date: 7/30/2018

LEGAL NAME OF ADDITIONAL JOINT INVENTOR, IF ANY:

Signature: _____ Date: _____

LEGAL NAME OF ADDITIONAL JOINT INVENTOR, IF ANY:

Signature: _____ Date: _____

☐ Additional inventors are being named on separately numbered sheets attached hereto.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16719861
	Filing Date	2019-12-18
	First Named Inventor	JIANG, Tao
	Art Unit	2875
	Examiner Name	
	Attorney Docket Number	S19141USUC01T

	70	20120051039	A1	2012-03-01	CHANG SHAO HAN	
Change(s) applied to document, /M.H.E./ 10/14/2020	71	20130230995	A1	2013-09-05	ILUMISYS, INC.	Ivey et al.
	72	20110038146	A1	2011-02-17	Yancheng Haomai Lighting Science&Technology Co Ltd	Chen
	73	20170059096	A1	2017-03-02	HONG XU et al.	
	74	20130215609	A1	2013-08-22	VERTICIL ELECTRONICS CORPORATION	Liu et al.
	75	20050162101	A1	2005-07-28	LEONG SUSAN J. et al.	
	76	20100188001	A1	2010-07-29	BROITZMAN TROY RICHARD et al.	

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FOREIGN PATENT DOCUMENTS Remove

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	203202740	CN	U	2013-09-18	FUZHOU SUNLIGHT LIGHTING ELECTRICAL APPLIANCE CO L		X
	2	2014045523	WO	A1	2014-03-27	PANASONIC CORP		☒

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /AA/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Art Unit	2875
Examiner Name	
Attorney Docket Number	S19141USUC01T

Change(s) applied to document, /M.H.E./ 10/14/2020

	59	20110084627	A1	2011-04-14	THE SLOAN COMPANY, INC. DBA SLOANLED	Sloan et al.
	60	20110309745	A1	2011-12-22	LEDS AMERICA, INC.	Westermarck et al.
	61	20130069538	A1	2013-03-21	YU-SHENG SO	
	62	20130258650	A1	2013-10-03	SHARRAH RAYMOND L.	
	63	20130141890	A1	2013-06-06	STEVEN W. CARLIN et al.	
	64	20050185396	A1	2005-08-25	KUTLER MURRAY	
	65	20170290119	A1	2017-10-05	XIONG AIMING et al.	
	66	20130135852	A1	2013-05-30	HONG KONG PATENT EXCHANGE LIMITED	Chan et al.
	67	20150070885	A1	2015-03-12	PETRO, ALFRED et al.	
	68	20100277918	A1	2010-11-04	CHEN CHIEN-YUAN	
	69	20090219713	A1	2009-09-03	Dennis Siemiet et al.	

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Examiner Name	
Attorney Docket Number	S19141USUC01T

Change(s) applied to document, /M.H.E./ 10/14/2020

	48	20170089530	A1	2017-03-30	JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.,LT	Jiang
	49	20120212951	A1	2012-08-23	Chung-Ming, Lai et al.	
	50	20100124054	A1	2010-05-20	TAIWAN RODAN CO., LTD.	Chen et al.
	51	20040095078	A1	2004-05-20	LEONG SUSAN J	
	52	20070001709	A1	2007-01-04	SHEN YU-NUNG	
	53	20120319150	A1	2012-12-20	Kabushiki Kaisha Toshiba	Shimomura et al.
	54	20140153231	A1	2014-06-05	OSRAM GMBH	Bittmann
	55	20130293098	A1	2013-11-07	LI, YI-QUN et al.	
	56	20130033881	A1	2013-02-07	SHARP KABUSHIKI KAISHA	Terazawa et al.
	57	20090040415	A1	2009-02-12	SAMSUNG DISPLAY CO., LTD.	Kim
	58	20110175536	A1	2011-07-21	IRIS OHYAMA INC.	Fujita et al.

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Change(s) applied to document, /M.H.E./ 10/14/2020

	37	20170211753	A1	2017-07-27	~~JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.,LT~~	Jiang et al.
	38	20180335200	A1	2018-11-22	~~JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.,LT~~	Jiang et al.
	39	20130051008	A1	2013-02-28	SHEW LARRY N	
	40	20110084554	A1	2011-04-14	TIAN FENG	
	41	20130135857	A1	2013-05-30	CHEN, CHIA-CHIN et al.	
	42	20130256704	A1	2013-10-03	TANG GUOFU & HSIAO YUCHUN	
	43	20170318678	A1	2017-11-02	Chris Wh MIAO et al.	
	44	20130229104	A1	2013-09-05	GREEN, ADAM et al.	
	45	20080290814	A1	2008-11-27	Susan J. Leong & John Kit	
	46	20160091147	A1	2016-03-31	~~JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO., LTD~~	Jiang et al.
	47	20120049684	A1	2012-03-01	~~AVANTIS LTD.~~	Bodenstein et al.

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	26	20050281030	A1	2005-12-22	LEONG SUSAN J	
	27	20100253226	A1	2010-10-07	OKI ISAMU	
Change(s) applied to document, /M.HLE./ 10/14/2020	28	20110149563	A1	2011-06-23	LIGHTEL TECHNOLOGIES INC.	Hsia et al.
	29	20150345755	A1	2015-12-03	PURDY STEVEN	
	30	20140203717	A1	2014-07-24	CREE, INC	Zhang
	31	20140192526	A1	2014-07-10	NINGBO FUTAI ELECTRIC LIMITED	Qiu
	32	20090159919	A1	2009-06-25	ALTAIR ENGINEERING, INC.	Simon et al.
	33	20030189829	A1	2003-10-09	Matsushita Electric Industrial Co., Ltd	Shimizu et al.
	34	20130223053	A1	2013-08-29	VERTICIL ELECTRONICS CORPORATION	Liu et al.
	35	20160084455	A1	2016-03-24	HUNG-CHANG CHEN	
	36	20080192476	A1	2008-08-14	KABUSHIKIKAISHA MIRAI	Hiratsuka

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	Attorney Docket Number	S19141USUC01T

Change(s) applied to document, /M.H.E./ 10/14/2020	15	20160178137	A1	2016-06-23	JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO.,LT	Jiang
	16	20150176770	A1	2015-06-25	Cree, Inc.	Wilcox et al.
	17	20040189218	A1	2004-09-30	LEONG SUSAN J., et al	
	18	20110279063	A1	2011-11-17	ORION ENERGY SYSTEMS, INC.	Wang et al.
	19	20130235570	A1	2013-09-12	HOOD, WILLIAM et al.	
	20	20140306599	A1	2014-10-16	EDWARDS CHARLES et al.	
	21	20050162850	A1	2005-07-28	LUK JOHN F. & ALTMAN ROBERT M.	
	22	20160081147	A1	2016-03-17	GUANG LUO HUA	
	23	20140225519	A1	2014-08-14	POESEN ELECTRONIC CO., LTD.	Yu et al.
	24	20120146503	A1	2012-06-14	CREE Inc.,	Negley et al.
	25	20130301255	A1	2013-11-14	Lumirich Co., Ltd.	Kim et al.

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Attorney Docket Number	S19141USUC01T

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	4	20130021809	A1	2013-01-24	OSRAM GMBH	Dellian et al.
	5	20130033888	A1	2013-02-07	KONINKLIJKE PHILIPS ELECTRONICS N V	Van Der Wel et al.
	6	20140009923	A1	2014-01-09	FIN-CORE CORPORATION & TONG HONG INVESTMENT CO., L	Wu et al.
	7	20130250565	A1	2013-09-26	DELTA ELECTRONICS, INC	Chiang et al.
	8	20100066230	A1	2010-03-18	Kuo-Len LIN et al.	
	9	20110084608	A1	2011-04-14	VO CONTROLS CORPORATION	Lin et al.
	10	20100220469	A1	2010-09-02	ILUMISYS, INC.	Ivey et al.
	11	20100201269	A1	2010-08-12	LEXTAR ELECTRONICS CORP.	Tzou et al.
	12	20130182425	A1	2013-07-18	PANASONIC INTELLECTUAL PROPERTY MANAGEMENT CO., LT	Seki et al.
	13	20080055894	A1	2008-03-06	DENG JIA H. et al.	
	14	20120069556	A1	2012-03-22	OSRAM GMBH	Bertram et al.

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	20	9810384	B2	2017-11-07	Zhang Yingchun	
	21	6246167	B1	2001-06-12	SICA, MICHAEL F.	
	22	10161569	B2	2018-12-25	XU HONG et al.	
	23	9000668	B2	2015-04-07	Fujun Qiu	
Change(s) applied to document, /M.H.F./ 10/14/2020	24	6118072	A	2000-09-12	~~TELEDYNE TECHNOLOGIES INCORP~~	Scott
	25	9885449	B2	2018-02-06	~~JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO LTD~~	Jiang

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U.S.PATENT APPLICATION PUBLICATIONS Remove

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	20130050998	A1	2013-02-28	~~GT BIOMESCILT LIGHT~~	Chu et al.
	2	20110305021	A1	2011-12-15	~~Shao-Han Chang~~	Xin
	3	20140331532	A1	2014-11-13	~~ALMAX MFG CORP~~	Deppiesse

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(Not for submission under 37 CFR 1.99)

Application Number	16719861
Filing Date	2019-12-18
First Named Inventor	JIANG, Tao
Art Unit	2875
Examiner Name	
Attorney Docket Number	S19141USUC01T

	9	9448660	B2	2016-09-20	SEO JOON KYU et al.	
	10	9228727	B2	2016-01-05	MAY, MICHAEL, W.	
	11	9322531	B2	2016-04-26	Chun-wei Liang et al.	
	12	1088142	A	1914-02-24	GARDNER JESSE O	
Change(s) applied to document, /M.H.E./ 10/14/2020	13	8456075	B2	2013-06-04	~~AURALIGHT INTERNATIONAL AB~~	Axelsson
	14	7594738	B1	2009-09-29	~~KITAGAWA HOLDINGS, LLC~~	Lin et al.
	15	9016890	B2	2015-04-28	KIM KYUNG RYE et al.	
	16	9488767	B2	2016-11-08	Dante P. Nava et al.	
	17	8240875	B2	2012-08-14	~~Cree, Inc.~~	Roberts et al.
	18	10021742	B2	2018-07-10	Tao JIANG	
	19	5964518	A	1999-10-12	YA-KUANG SHEN	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /AA/

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
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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
Change(s) applied to document, /M.H.E./ 10/14/2020	1	10288272	B2	2019-05-14	ZHEJIANG SUPER LIGHTING ELECTRIC APPLIANCE CO LTD	Yao et al.
	2	9989200	B2	2018-06-05	Zhang Yingchun	
	3	7611260	B1	2009-11-03	Kuo-Len LIN et al.	
	4	7815338	B2	2010-10-19	Dennis Siemiet et al.	
	5	9864438	B2	2018-01-09	SEO JOON KYU et al.	
	6	8360599	B2	2013-01-29	Ilumisys, Inc.	Ivey et al.
	7	9625137	B2	2017-04-18	Li-Qin, Li et al.	
	8	7067032	B1	2006-06-27	A RAYMOND & CIE	Bremont et al.

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Change(s) applied to document, /M.H.E./ 10/14/2020

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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	10288272	B2	2019-05-14	ZHEJIANG SUPER LIGHTING ELECTRIC APPLIANCE CO LTD	Yao 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
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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	3147313	JP	U	2008-12-25	Kuo-Len LIN et.al		X
	2	2519258	GB	A	2015-04-15	UNITY OPTO TECHNOLOGY CO. LTD		☐
	3	2013243132	JP	A	2013-12-05	OKI ISAMU		☒

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Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

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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
Change(s) applied to document, /M.H/ 10/14/2020	1	20130050998	A1	2013-02-28	GT BIOMESCILT LIGHT Chu 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	101787273	CN	A	2010-07-28	ANHUI ZERUN OPTOELECTRONIC CO		☒
	2	102738355	CN	A	2012-10-17	SILICONWARE PREC IND CO LTD		☒
	3	102121690	CN	A	2011-07-13	NANJING ZHONGYA OPTO ELECTRICAL SCIENCE AND TECHNO		☒

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /AA/

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First Named Inventor	JIANG, Tao
Art Unit	2875
Examiner Name	ALAVI, ALI
Attorney Docket Number	S19141USUC01T

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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
Change(s) applied to document, /M.H.E./ 10/14/2020	1	10161569	B2	~~2020-12-25~~ 12/2018	Xu et al.	
	2	8360599	B2	2013-01-29	Lvey et al.	
	3	10560989	B2	2020-02-11	Tao Jiang et al.	
	4	9777891	B2	2017-10-03	Yusaku Kawabata et al.	
	5	9574717	B2	2017-02-21	James R. Scapa et al.	
	6	8791650	B2	2014-07-29	XinXin Shan	
	7	8931918	B2	2015-01-13	Chun-Chen Liu et al.	
	8	9883555	B2	2018-01-30	Jinsheng Deng et al.	

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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/719,861	11/10/2020	10830397	S19141USUC01T	5387

147274 7590 10/21/2020

Jiaxing Super Lighting Electric Appliance Co., Ltd
IP Department
No. 1288 Jiachuang Road, Xiuzhou Area
Jiaxing, Zhejiang
Jiaxing City, 314031
CHINA

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, Jiaxing, CHINA;
JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO., LTD, Jiaxing, CHINA;
Li-Qin Li, Jiaxing City, CHINA;

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AO 120 (Rev. 08/10)

TO:	REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK
Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court Western District of Texas on the following

☐ Trademarks or ☑ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
6:22-cv-00534	9/16/2022	Western District of Texas

PLAINTIFF	DEFENDANT
JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO., LTD. AND OBERT, INC.	CURRENT LIGHTING SOLUTIONS, LLC D/B/A GE CURRENT

	PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1	9,841,174	12/12/2017	Jiaxing Super Lighting Electric Appliance Co., Ltd.
2	9,939,140	4/10/2018	Jiaxing Super Lighting Electric Appliance Co., Ltd.
3	10,295,125	5/21/2019	Jiaxing Super Lighting Electric Appliance Co., Ltd.
4	11,112,068	9/7/2021	Jiaxing Super Lighting Electric Appliance Co., Ltd.
5			*See Attachment "A" for Additional Patents

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1		
2		
3		
4		
5		

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE

Copy 1—Upon initiation of action, mail this copy to Director Copy 3—Upon termination of action, mail this copy to Director
Copy 2—Upon filing document adding patent(s), mail this copy to Director Copy 4—Case file copy

ATTACHMENT A

AO 120 - Additional Patents for Reporting

Patent No.	Date of Patent	Holder of Patent
9,723,662	08/01/2017	Jiaxing Super Lighting Electric Appliance Co., Ltd.
9,945,520	04/17/2018	Jiaxing Super Lighting Electric Appliance Co., Ltd.
10,487,991	11/26/2019	Jiaxing Super Lighting Electric Appliance Co., Ltd.
10,560,989	02/11/2020	Jiaxing Super Lighting Electric Appliance Co., Ltd.
10,830,397	11/10/2020	Jiaxing Super Lighting Electric Appliance Co., Ltd.
10,897,801	01/19/2021	Jiaxing Super Lighting Electric Appliance Co., Ltd.
11,441,742	09/13/2022	Jiaxing Super Lighting Electric Appliance Co., Ltd.