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(54) **LED LIGHTING DEVICE**

(57) The present LED lighting device relates to the field of lighting technology and is intended for LED lighting equipment in indoor and outdoor lighting that can be easily adapted to different purposes. The technical result of the claimed invention is a standardized design for the housing of the modules of a light fitting, the possibility of modifying the lighting device when in service, an increase in the manufacturability of the design, and a decrease in production costs. The LED lighting device comprises two or more LED modules having a connecting member disposed therebetween. The housing of each of the modules is provided with a link of a one-degree of freedom sliding pair, the second link of which is situated on the connecting member. In order that modules can be connected to each other at an angle, a connecting member is configured in such a way that planes tangent to points on the outside surface of the connecting member form a dihedral angle A, the size of which is selected from the expression given in the description.

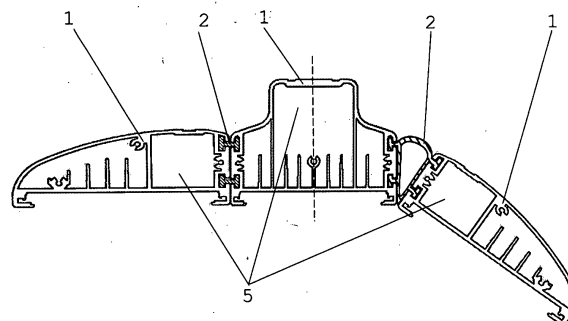


Fig. 2

Description

• Technical Field

[0001] The present LED lighting device relates to the field of lighting technology and is intended for LED lighting equipment in indoor and outdoor lighting that can be easily adapted to different purposes.

• Background Art

[0002] Designs are currently in use based on modular construction of lighting devices, containing the first lighting module equipped with emitter, the casing front edge of which contains the facilities for connection with the front edge of the second lighting module, which in turn contains the facilities for connection with the third module, designed for connection with the next module (patent US2006050505, published on March 09, 2010, IPC F21S4/00; patent EP1433997, published on June 30, 2004, IPC F21S4/00).

[0003] The LED modular lighting device is currently in use, containing the basic module attached on the mounting support and equipped with the facilities for connection with the additional module, while these modules are constituting the rotating pair relative the connection axis. The additional module in turn is equipped with the similar connecting facilities for connection with the next module (patent KR101027101, IPC F21V21/116, published on April 05, 2011).

[0004] The existing design makes it possible to adapt the mutual position of modules of the lighting device using the attachment facility combined with the facility designed for modules connection with each other. The connection facilities of modules are characterized by the complex attachment design containing multiple pieces used for modules positioning and fixing, which brings to the increased labor intensity and maintenance of the lighting device, increases the quantity of the component parts and eventually exerts an effect on the cost of the product.

[0005] Another design of the modular lighting device contains the attached basic and additional modules equipped with the emitters, in which the facilities for modules connection are designed as the sliding pair, the links of which are located on the casing of the basic and additional modules, while on the casing of the basic module the guiding link of the sliding pair is located. The end cover attached on the module casing is used as the facility preventing the self-movement of the sliding pair links (patent RU112340 U, IPC F21S4/00, published on January 10, 2012).

[0006] The parts of radiator of the LED lighting device described in the international application PCT/RU2012/000179 (international filing date: March 16, 2012) are equipped with links forming the slip joint, which makes it possible to assemble the casing of the lighting device from different segments.

[0007] The intent and design described in patent

RU112340 U are the nearest to those contained in the current application and it was accepted as the prototype.

[0008] The technical result of the current application is the design unification of the casing of the lighting device modules, possibility of modifying of the lighting device during operation, improvement of the design feasibility, lowering of the production cost.

• Detailed design description

[0009] The applied design may be characterized by the following substantial features in the aggregate: LED lighting device comprising at least a two LED modules, each of which equipped with a radiation source and the housing of each module is the first link sliding translational pair characterized in that has at least one connecting member disposed between the housings LED modules, and acts as a second link translational pairs for each of the housing of the LED modules, wherein the plane of the tangents to the point on the external surface of the connecting element form a dihedral the angle A whose magnitude is selected from mathematical expression:

$$0 < A < 90^{\circ},$$

where:

A - dihedral angle, plane of whose tangential to point on the external surface of the connecting element, the angular degree. The value of angle A is determined with precision subject to the permissible error of the measuring facilities.

[0010] Among the features, which are promoting and strengthening the technical result, it should be noted, that:

- the length of the connecting piece is equal to the module's length;
- the connecting piece may be hollow. Such design of the connecting piece makes it possible to decrease materials consumption;
- the important consequence of the dihedral angle value selection is the possibility of combining of LED modules in closed loop system;
- the facility for fixing of the relative links position within the sliding pair is fulfilled in the form of end cover attached on the module casing;

[0011] Usage of the connecting piece makes it possible to form the light flux direction in the course of operation without dismantling of the lighting device.

[0012] The link profile of the sliding pair may be produced in the course of extrusion of the casing and of the corresponding connecting piece.

[0013] The connection angle between modules is de-

terminated by the value of A angle.

• Brief description of the drawings

[0014] The design of the LED lighting device is illustrated by the following drawings:

Fig. 1 illustrates the cross section of the lighting device casing, in which three LED modules are combined by the connecting pieces (different designs are used for illustration). The left module is closed by the end cover;

Fig. 2 illustrates the cross section of the lighting device, composed of three modules. The right and left connecting pieces are characterized by different designs;

Fig. 3 illustrates the cross section of the third type of the lighting device, composed of five similar modules;

Fig. 4, Fig. 5, Fig. 6 and Fig 7 illustrate scaled-up profile for different variants of the connecting pieces, with ventilating duct in that number, which may be used for connection of LED modules of the lighting device;

Fig. 8 and Fig 9 illustrate the disassembled connected modules.

• Detailed device description

[0015] The LED lighting device contains modules 1, each equipped with the light source (not shown). The central supporting module is mounted on the supporting surface (not shown), which may be light tower, light post, building wall. Modules connection with each other is realized using connecting member 2 designed with projections 3, each being the first link of the sliding pair and the second link 4 of which is designed in the casing of the corresponding module. The holes 5 are designed for drivers attachment.

[0016] The links composing the sliding pair in simple case are the T-shaped groove in the module's casing and projection 3 of the corresponding profile on the connecting piece 2. The dihedral angle A value of the connecting piece in this case is near zero.

[0017] In case of the inclined modules connection the wedge-shaped connecting piece 2 (Figures 4 and 7) is used, in which the dihedral angle A is selected with accounting of the desired relative position of the lighting device's emitting surfaces.

[0018] In order to connect the lighting device's modules the projection 3 of the connecting member 2 is directed to the groove in the casing and the forward movement of the projection 3 in the groove 4 along the casing is realized till the final positioning of the connecting piece. Similarly the next module of the device is connected to the connecting member. In case of necessity disassembling of the modules is realized in reverse order.

[0019] The connection process of the lighting device

modules does not require the availability of any fastening elements and provides accuracy and reliability of their positioning. The fixing facility of the mutual position of links of the sliding pair is the end cover 6 (Fig. 1), which is attached on the module casing. The lighting device assembling is simple and processable. Changing of the lighting device configuration or modules upgrading may be realized in the course of operation. At the same time creation of the common flat light-emitting surface, or the one turned outside, or directed to restricted area may be easily provided.

• Possibility of the industrial application

[0020] The designs presented in this description are not exhaustive. The design solutions bringing to equivalent result may be realized in different ways and may be adapted for realization of the present application. The design parts are characterized by such technological forms, which may be realized using the existing automated control facilities.

Claims

1. LED lighting device comprising at least two LED modules, each of which equipped with a light source and the housing of each module is the first link sliding translational pair **characterized in that** has at least one connecting member disposed between the housings LED modules, and acts as a second link translational pairs for each the housing of the LED modules, wherein the plane of the tangents to the point on the external surface of the connecting element form a dihedral the angle A whose magnitude is selected from mathematical expression:

$$0 < A < 90^{\circ}, \text{ where:}$$

where:

A - dihedral angle, plane of whose tangential to point on the external surface of the connecting element, the angular degree.

2. LED lighting device, **characterized in that** the connecting member has a length equal to the length housing.
3. LED lighting device, **characterized in that** the connecting element is composed of two or more portions.
4. LED lighting device, **characterized in that** the connecting element is made hollow

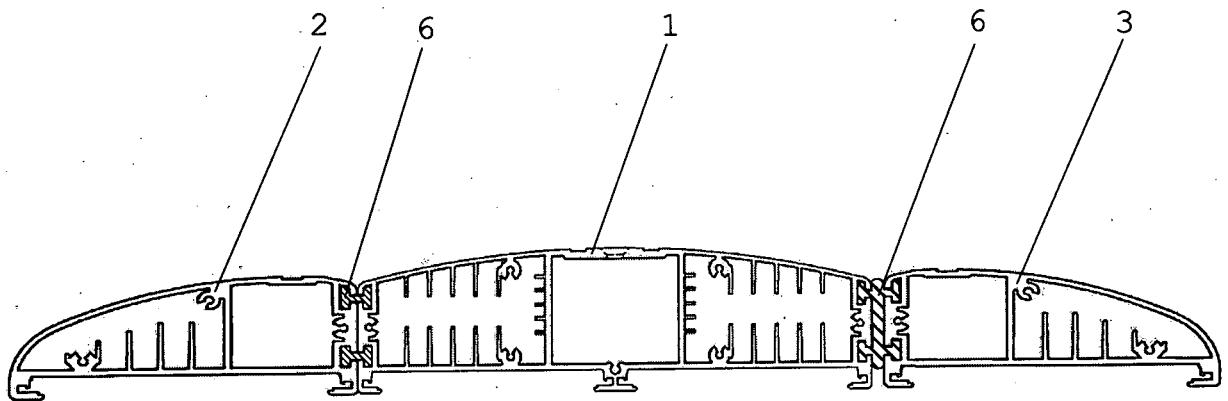


Fig. 1

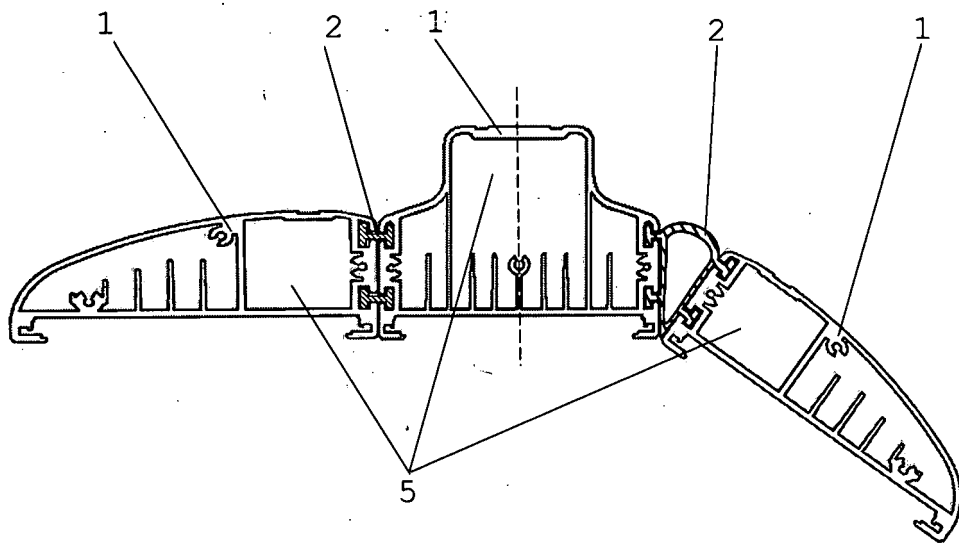


Fig. 2

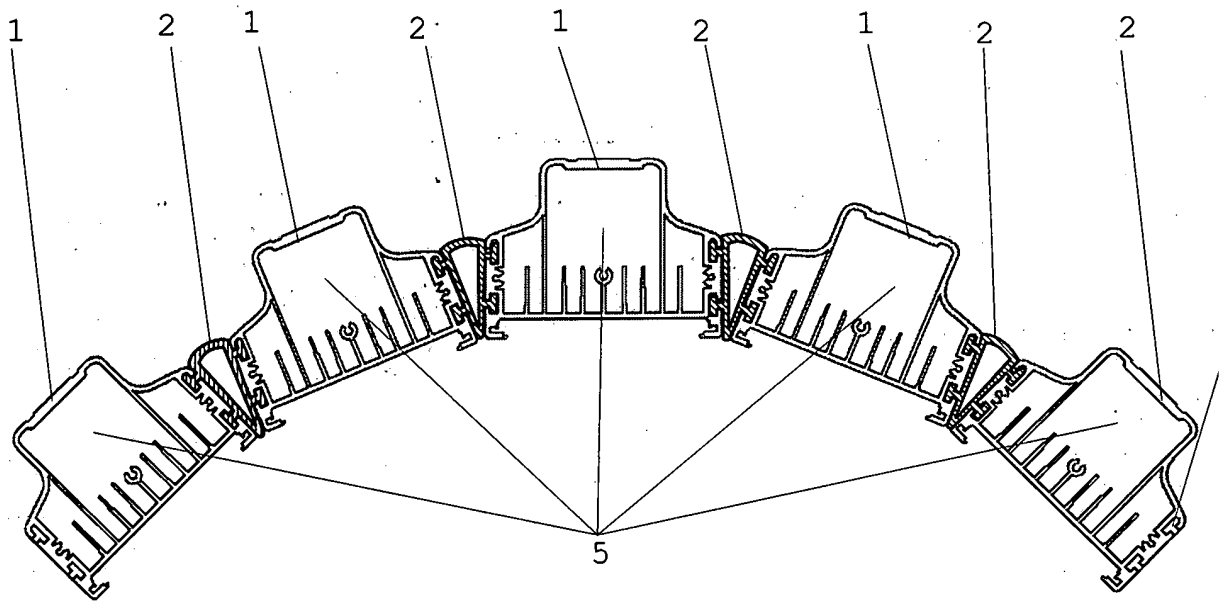


Fig. 3

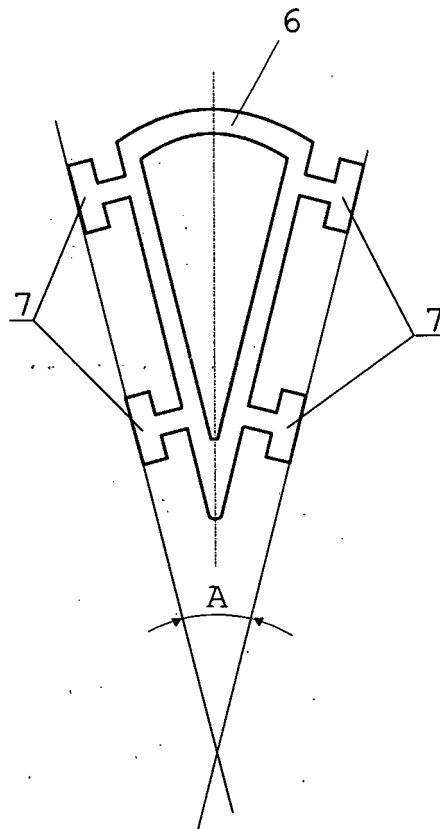


Fig. 4

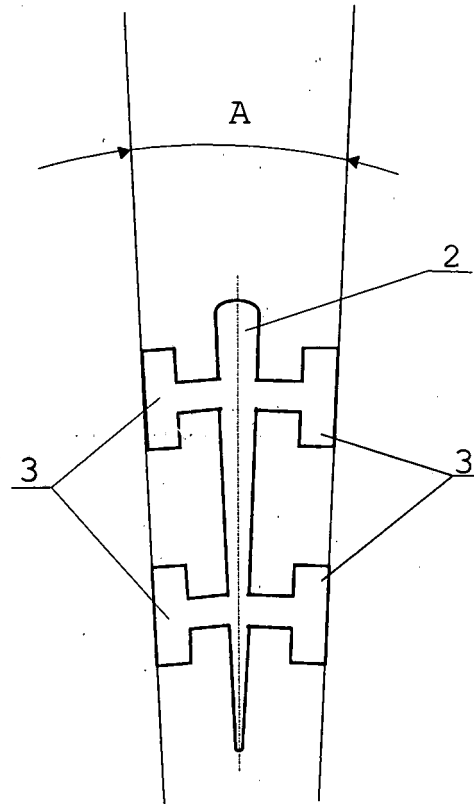


Fig. 5

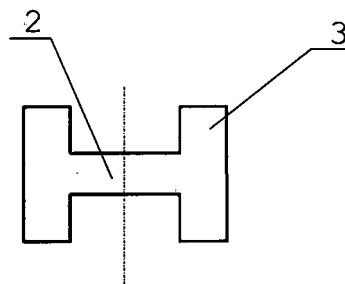


Fig. 6

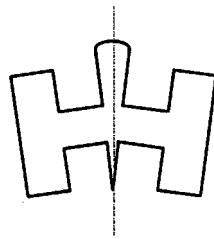


Fig. 7

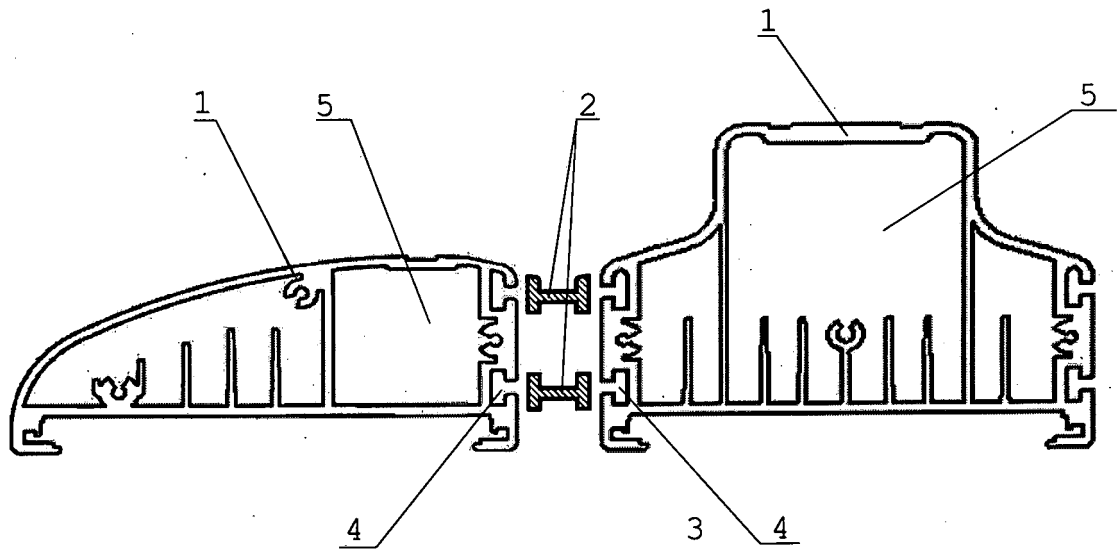


Fig. 8

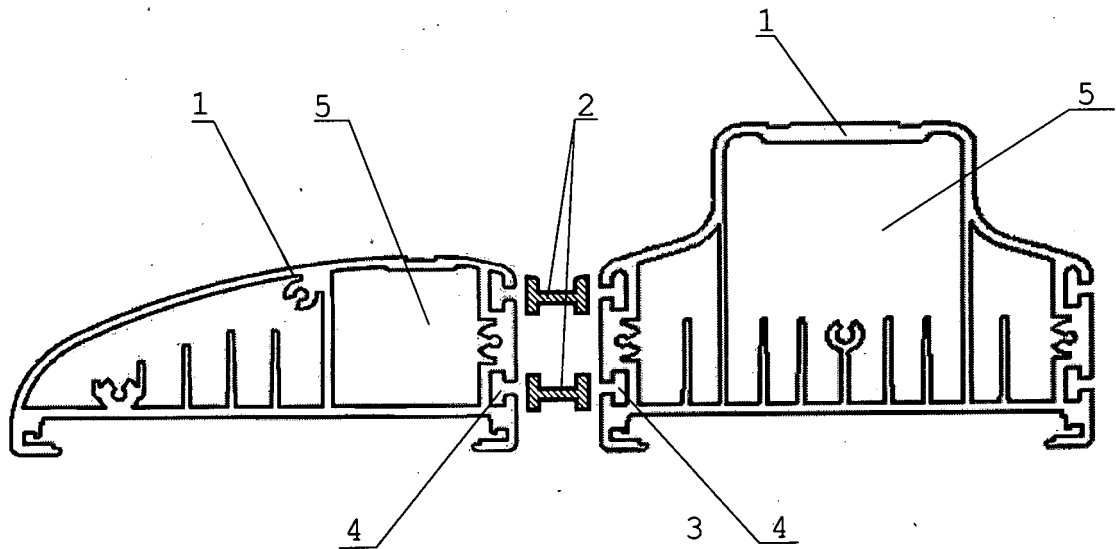


Fig. 9

INTERNATIONAL SEARCH REPORT

International application No.

PCT/RU 2014/000325

A. CLASSIFICATION OF SUBJECT MATTER <i>F21S 4/00 (2006.01)</i> 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) F21S 4/00, 8/00, F21V 15/02, 29/00, 5/04, F21Y 101/02 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) Wordwide, Espacenet, FIPS, PatSearch (RUPTO internal), Inpit, USPTO												
C. DOCUMENTS CONSIDERED TO BE RELEVANT												
<table border="1"> <thead> <tr> <th>Category*</th> <th>Citation of document, with indication, where appropriate, of the relevant passages</th> <th>Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>CN 102128427 A (SHENZHEN JBT ELECTRONICS TECHNOLOGY CO LTD) 20.07.2011</td> <td>1-4</td> </tr> <tr> <td>A</td> <td>CN 201606720 U (ZHOU F) 13.10.2010</td> <td>1-4</td> </tr> <tr> <td>A</td> <td>RU 112340 U1 (OBSCHESTVO S OGRANICHENNOI OTVETSTVENNOSTJU "DIS PLIUS") 10.01.2012</td> <td>1-4</td> </tr> </tbody> </table>	Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	A	CN 102128427 A (SHENZHEN JBT ELECTRONICS TECHNOLOGY CO LTD) 20.07.2011	1-4	A	CN 201606720 U (ZHOU F) 13.10.2010	1-4	A	RU 112340 U1 (OBSCHESTVO S OGRANICHENNOI OTVETSTVENNOSTJU "DIS PLIUS") 10.01.2012	1-4
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Date of the actual completion of the international search 05 September 2014 (05.09.2014)	Date of mailing of the international search report 18 September 2014 (18.09.2014)											
Name and mailing address of the ISA/ RU Facsimile No.	Authorized officer Telephone No.											

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REFERENCES CITED IN THE DESCRIPTION

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