

Lighting device

The invention relates to a lighting device having a three-way conductor strip which, in the axial direction, is electrically conductively connected to LED elements arranged one behind another in a row, each LED element being held by a plastic housing which also surrounds the conductor strip at the level of each LED element and is at least partly translucent.

DE 196 27 856 A1 shows a lighting strip having a lighting device of the generic type. The lighting strip has a multi-way conductor strip, which is fitted with LED elements arranged one behind another in a row, the conductor strip comprising a large number of conductor strip sections which are cut to length and lined up in a row in the axial direction, in each case between two axially adjacent conductor strip sections there being arranged a printed circuit board that is electrically conductively connected to the latter, and each printed circuit board being fitted with an LED element. In the case of the known lighting strip, it is further shown that the individual wires of the conductor strip are sheathed with insulation, that the insulation is removed at the end regions of each conductor strip section, and that the connection between the respective end of a conductor strip section and the respective printed circuit board is produced by electrically conductive contact elements, in each case a crimp connection being provided between the contact elements and the wires of the conductor strip section, and in each case a riveted connection being provided between the contact elements and the conductor tracks of the printed circuit board. The known illumination strip further shows that the end regions of the conductor strip sections, the contact elements, the printed circuit boards and the LED elements are in each case encapsulated in a plastic housing which is at least

partially translucent and formed by injection-moulding directly with a plastic material.

On the basis of a lighting device of the type mentioned at the beginning, the invention is based on the object of simplifying it significantly with respect to the indicated prior art, both in terms of configuration and in terms of manufacture.

According to the invention, this object is achieved by the features specified in Claim 1, while advantageous developments and expedient refinements of the invention are identified in the subclaims.

The two-shell design of the plastic housing permits the simple insertion of an LED element, an axial conductor strip area and electrical contact means in one of the half shells, the simple production of an electrical connection between the LED element and the respectively necessary conductors belonging to the conductor strip, and simple closure of the plastic housing by means of the top shell. Since the positive conductor and the negative conductor pass through and only the central conductor is designed to be interrupted, the result, as compared with the prior art, is a considerable saving in work, including that relating to the stripping operation.

The measure according to Claim 2, which is preferably provided, permits pure plug-in mounting of the individual parts which have to be electrically conductively connected to one another, and therefore constitutes a solution which can be brought about particularly simply and is particularly cost-effective, particularly since neither a stripping operation nor the insertion of printed circuit boards or the like is necessary for the production of the electrical connections.

The measure according to Claim 3 is provided for the cases in which particular requirements are to be placed on the quality and functional reliability.

Partial stripping is necessary if use is made of the measure according to Claim 4, but, as compared with the prior art, it offers the advantage of a direct electrical connection between the conductor strip and the LED elements, omitting the printed circuit boards previously required.

The measure according to Claim 5 means that the resistors still needed in the known lighting strip can be dispensed with, which contributes to simplifying and cheapening the lighting device according to the invention.

Further particularly expedient designs and configuration features of the invention are specified in Claims 6 to 13. Here, particular significance is attached to the measures according to Claims 11 and 12, since in this way the requirements of the IMO (International Maritime Organization, a daughter organization of UNO) for escape-route markings on passenger ships may be met in an optimal way; it should be noted that the subject of the invention according to Claim 11 or in particular 12 is also provided for this use.

Exemplary embodiments of the invention will be explained in more detail below using the drawings, in which:

Fig. 1 shows a circuit diagram and a segment fitted with eight LEG elements of the lighting device (cf. also Fig. 1a),

Fig. 2 shows a single two-shell plastic housing of a segment according to Figs 1 and 1a, with an LED

element and a conductor strip arranged in a housing shell,

Fig. 3 shows a two-shell plastic housing in an embodiment fitted with metallic contact elements, without a conductor strip,

Fig. 4 shows the plastic housing according to Fig. 3 with a conductor strip,

Fig. 5 shows the plastic housing according to Figs 3 and 4 with a conductor strip, which is led onward to an adjacent plastic housing held by a profiled strip, and

Fig. 6 shows a section V-V from Fig. 5.

Fig. 1 shows, in the manner of a circuit diagram, a segment 1 of a lighting device comprising a plurality of segments lined up in a row. The lighting device has a three-way conductor strip 2, which is conductively connected to LED elements 3 arranged one behind in another in a row, each LED element 3 being accommodated by a plastic housing 4 which also surrounds the conductor strip 2 at the level of each LED element and is preferably of glass-clear design (cf. also Fig. 1a).

The segment 1 according to Fig. 1 has eight LED elements 3 each arranged in a plastic housing 4 (it is also possible for more or fewer to be provided), and a conductor strip 2 with a continuous positive conductor 5, a continuous negative conductor 6 and a central conductor 7, lined up seven times in a row in the exemplary embodiment according to Fig. 1, as a resistance cable. In a trial arrangement, a central conductor 7 lined up seven times in a row and designed as a resistance cable with 90.3 ohms per segment 1 has proven to be particularly expedient.

As can be seen from Fig. 2, the plastic housing 4, or each plastic housing 4, has a two-shell design with a first shell 9 and a second shell 10. In the exemplary embodiment of Fig. 2, the first shell 9 forms the upper housing shell and the second shell 10 forms the lower housing shell. The shells 9 and 10, which can be fixed to each other by clip elements 8, have complementary holders 11 of half-round configuration to hold the continuous positive conductor 5, the continuous negative conductor 6 and the central conductor 9 interrupted in the area of each plastic housing 4, and also a circumferential holding groove for an adhesive (not shown) that also has sealing properties.

In a recess 13 in the first shell 9, which opens into a lens 14 shown, for example, in Fig. 5, there is situated an LED element 3 which is plugged into the said recess. In order to produce an electrical contact between the LED element 3, the positive conductor 5 (or the negative conductor 6) and the central conductor 7, use is made here of a means not shown here, preferably in the form of a contact adhesive, to accommodate which a connecting or distributing groove 15 is provided in the shell 9. The distributing groove 15 in each case ends at stripped regions of the conductors 5-7, exposing the respective core 16.

During the fabrication of a lighting device with plastic housings 4 and connecting means according to Fig. 2, the procedure may be approximately as follows: the upper shells (first shells 9) of two segments 1, if possible, are held by an elongate device table, not shown. The continuous positive conductors 5 and negative conductors 6 are stripped in the necessary areas and, continuously tensioned, are inserted into the holders 11 belonging to the first shells 9. The central conductor 7 is stripped to length and likewise inserted into the associated holders 11. The LED elements 3 are also inserted into the recesses 13. The

electrical connection is then carried out by applying a contact adhesive and by activating the contact adhesive, for example in a warming oven or by means of local heating devices. The lower shells (second shells 10) are put onto the upper shells and clipped to the latter. The lighting device, fabricated to this extent on the device table, can then be sealed off with a displaceable adhesive metering system, the sealing referring to the plastic housing 4 and to the sealing and permanent fixing of its shells 9 and 10 to each other. In order to supply the adhesive, the second shells 10 can be provided in each case with an adhesive feed opening (not shown) and, if necessary, in each case also with a venting opening (not shown).

In the exemplary embodiment according to Figs 3, 4 and 5, the first shell 9 forms the upper housing shell, which is designed with the lens 14, which is moulded on in one piece and from the same material, and the second shell 10 forms the lower housing shell. Provided in the shell 9 are holders 11 for the conductors 5-7, a recess 13 for an LED element 3, if necessary a circumferential accommodating groove for a sealing/adhesive means (not shown), and clearances for the arrangement of metallic contact elements 17, which are supplemented by corresponding holders and the like in the second shell 10.

The electrical contact elements 17 are formed, for example, from tinned copper sheet and are configured in such a way that they come into contact firstly in each case with an LED element 3 and secondly with the positive conductor 5 (or negative conductor 6) and the central conductor 7. The metallic contact elements 17 have material lugs 18 which are bent over upwards and have recesses 19 which are accessible from above, the edges of the recess being formed as cutters to cut through the insulation surrounding the core 16 of the positive conductor 5, the negative conductor 6 and the

central conductor 7. It goes without saying that the width of the opening of the recesses 19 has to be matched to the respective conductor diameter in such a way that reliable severing of and the reliable making of contact with the respective conductor core 16 is ensured.

During the fabrication of a lighting device with plastic housings 4 according to Figs 3 and 4, the procedure may be as follows: the contact elements 17 are clipped into the upper shells 9 and the LED placed on these and clamped, which results in a reliable electrical connection being established between the contact elements 17 and the contacts of the LED elements 3. Then, the upper shells (first shell 9) of two segments 1, if possible, are held by an elongated device table, not shown, and the positive conductor 5 and the negative conductor 6, continuously tensioned, are inserted into the said segments and pressed into the recesses 19 provided with cutters in the contact elements 17. Stripping the conductors 5-7 is neither envisaged nor necessary. The following mounting steps (clipping on the lower shell 10, sealing and adhesive bonding and, if necessary, functional optical testing) correspond to the explanation relating to Fig. 2.

Fig. 3 shows the two-shell plastic housing 4 without the conductors 5-7, while in Fig. 4 the plastic housing 4 has been fitted with the conductors 5-7. Fig. 5 reveals the arrangement of the new lighting device in the holder channel 20 in a profiled strip 21, which may be an escape-route marking, orientation, decorative or similar profiled strip 21.

A special feature of the novel lighting device which is of independent inventive significance is the design and configuration, shown on a substantially enlarged scale in Fig. 6, of the lens 14 which has already been mentioned. This has a flattened top surface 22, which

merges via a radius 23 into a cone 24, whose lower end coincides with the top surface of the shell 10 of the plastic housing 4. Above the LED element 3, the lens 14 has a cylindrical recess 25 with a rounded transition to the bottom of the recess. The cone angle is 30° , as referred to the vertical. The shaping of the lens 14 has been carried out by using the law of refraction and taking account of the material constant of the material used for the manufacture of the lens 14. Using this, as compared with a light distribution with a previously conventional emission angle of 120° , a light distribution with an emission angle of 180° could be achieved. The lines 26 indicate an emission angle of 120° , while the lines 27 indicate an emission angle of 180° , since the rays penetrating into the lens 14 experience an appropriate change in direction at the point 28.

While the lens 14 is shown in the drawings as an integrated constituent part of a housing shell, it is of course within the scope of the invention to provide a separately fabricated lens 14 for each LED element 3. It is also conceivable to use LED elements 3 which, from the start, have lenses 14 which are arranged on them and bridge the light-emitting diodes in the manner shown.

The invention is not restricted to the exemplary embodiments illustrated, but also comprises all the embodiments with the same effect in the sense of the invention. Furthermore, the invention is not restricted to the combination of features defined in Claim 1, but can also be defined by any other desired combination of specific features of all the individual features disclosed overall. This means that, in principle, each individual feature of Claim 1 can be left out or replaced by at least one individual feature disclosed at another point in the application documents. The present Claim 1 is therefore to be understood as a

first attempt at a formulation for the characterization
of the invention.



Patent Claims:

1. Lighting device having a three-way conductor strip (2), which, in the axial direction, is electrically conductively connected to LED elements (3) arranged one behind another in a row, each LED element (3) being held by a plastic housing (4) which also surrounds the conductor strip (2) at the level of each LED element (3) and is at least partly translucent, characterized in that the plastic housing (4) comprises two shells (9, 10), of which one is provided as a holding shell to hold an LED element (3), an axial conductor strip area and electrically conductive contact means, and the other shell is provided as a top shell, which is fixed to the first shell with the inclusion of sealing means, and in that the three-way conductor strip (2) comprises a continuous positive conductor (5), a continuous negative conductor (6) and an interrupted central conductor (7) that extends from LED element (3) to LED element (3).
2. Lighting device according to Claim 1, characterized in that the electrically conductive contact means provided between the conductor strips (2) and the LED elements (3) are metallic contact elements (17), via which electrical contact is made in each case, the metallic contact elements (17), which are connected to the LED elements (3) by means of simple plug-in mounting, having cutters which penetrate the conductor strip insulation and make contact with the respective conductor cores (16).
3. Lighting device according to Claim 1, characterized in that the electrically conductive contact means provided between the conductor strip (2) and the LED elements (3) is heat-activatable



solder pastes, contact adhesives or the like and metallic contact elements (17), via which electrical contact is made in each case, the metallic contact elements (17), which are connected to the LED elements (3) via the solder pastes, contact adhesives or the like, having cutters which penetrate the conductor strip insulation and make contact with the respective conductor cores (16).

4. Lighting device according to Claim 1, characterized in that the electrically conductive contact means provided between the conductor strip (2), which is partly stripped, and the LED elements (3) are heat-activatable solder pastes, contact adhesives or the like, via which electrical contact is made.
5. Lighting device according to at least one of the preceding claims, characterized in that the central conductor (7) is designed as a resistance conductor.
6. Lighting device according to at least one of the preceding claims, characterized in that the shells (9, 10) of the plastic housing (4) are fixed to one another via integrally moulded clip elements.
7. Lighting device according to at least one of the preceding claims, characterized in that the shells (9, 10) of the plastic housing (4) are in each case designed with complementary holders (11) for the individual conductors (5, 6, 7) of the conductor strip (2), an LED element (3), the metal contact elements (17), and sealing means provided for the sealing and permanent connection of the shells (9, 10).



8. Lighting device according to at least one of the preceding claims, characterized in that the shells (9, 10) of the plastic housing (4) are formed with holders for the solder paste and/or the contact adhesive.
9. Lighting device according to at least one of the preceding claims, characterized in that the shells (9, 10) of the plastic housing (4) are moulded in glass-clear fashion as injection-moulded parts made from PC (polycarbonate).
10. Lighting device according to at least one of the preceding claims, characterized in that one shell (9, 10) of the plastic housing (4) is designed with a lens (14) that bridges an LED element (3).
11. Lighting device according to Claim 10, characterized in that the lens (14) has a shape to distribute light with an emission angle greater than 120° .
12. Lighting device according to Claim 10 or 11, characterized in that the lens (14) has a shape to distribute light with an emission angle of 180° .
13. Lighting device according to at least one of the preceding claims, characterized in that the same is arranged in a holding channel (20) in an escape-route marking, orientation, decorative or similar profiled strip (21).