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(54) **LIGHTING APPARATUS AND CORRESPONDING PRODUCTION METHOD**

(57) The present invention concerns a lighting apparatus (10) configured to be used, at most, in environments with an intermediate risk of explosion, comprising a containing body (11) of polymeric material, internally provided with a housing (12) in which a light source (16) is attached. The invention also concerns a method to produce the apparatus (10).

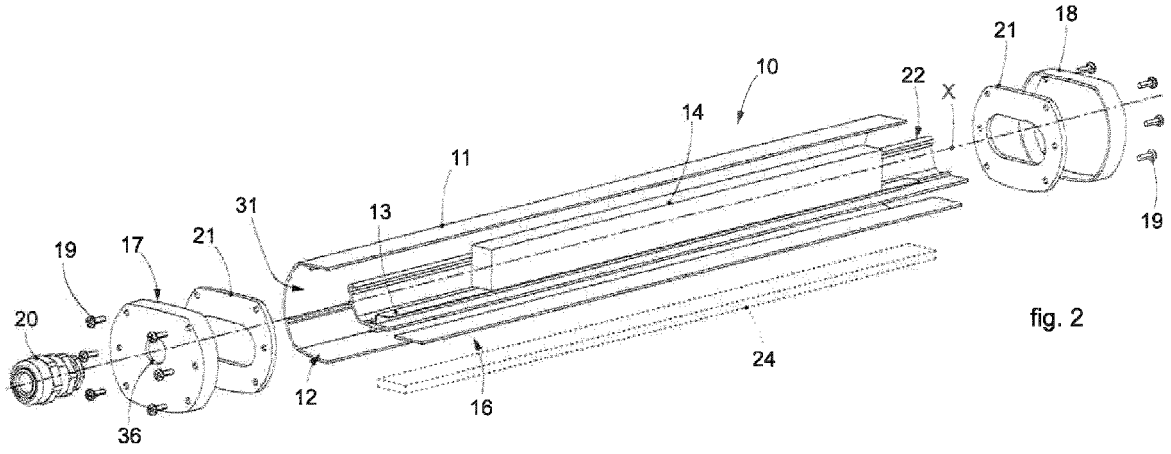

fig. 2

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Description

FIELD OF THE INVENTION

[0001] Embodiments described here concern a lighting apparatus used, preferably, but not exclusively, in areas and/or environments in which the formation of an explosive atmosphere, consisting of a mixture of air and flammable substances in the form of gas, vapors or mist, can occasionally occur during normal production activities.

[0002] The present invention concerns both the composition and the production method of said apparatus.

BACKGROUND OF THE INVENTION

[0003] Lighting apparatuses are known which comprise a containing body, provided with a housing, in which a light source is located and possibly a compartment in which a power supply and control unit is located.

[0004] The light source is suitable to generate a beam of light intended, for example, to illuminate an internal or external environment, or to provide an alarm signal associated with a malfunction of machinery inside a production plant.

[0005] Lighting apparatuses are known in which the containing body is made of metal material and, in addition to the mechanical function of accommodating the various electronic/mechanical components that make up the apparatus, it also performs a function of thermal dissipation of the heat generated by the light source and by the power supply and control unit.

[0006] In other known lighting apparatuses, the containing body is made in two or more pieces and of polymeric material. In this case, the heat dissipation function is performed by a dissipation support of the light source made of metal material and mounted in correspondence with the housing.

[0007] In particular, the category of such apparatuses includes, for example, spotlights, projectors, illuminated fixtures and ceiling lights.

[0008] Currently, in the construction of lighting apparatuses that can be used in zones classified according to the ATEX (ATmosphere EXplosive) standard, and defined as explosion-proof, LED light sources are used, the main advantage of which lies above all in the long duration which, in addition to being advantageous in economic terms, brings with it the need for a lower number of maintenance interventions.

[0009] Consequently, the exposure of operators to the risk of explosions and/or fires is significantly reduced, increasing the safety of use of the lighting apparatuses.

[0010] In known lighting apparatuses, in particular in those which use a LED light source, there is the primary need to prevent any dangerous substance, in terms of flammability or explosion, from coming into contact with the light source.

[0011] In some known lighting apparatuses, the light source is hermetically insulated from the external atmosphere, for example, it is completely covered, and then sealed, by means of a layer of transparent polymeric resin.

[0012] A first disadvantage of known explosion-proof lighting apparatuses whose components in contact with the external atmosphere are made of metal material is that it is not possible to install them in chemically aggressive environments against the metal material itself.

[0013] Another disadvantage of known explosion-proof lighting apparatuses is that the presence of the sealing polymeric resin, as described above, alters the light emission and the color rendering index of the light source, causing an absorption of the light radiation emitted.

[0014] Furthermore, the polymeric resin is subject to degradation due to aging and, since it cannot be replaced, as time passes, it reduces the luminous efficiency of the apparatus.

[0015] There is therefore a need to perfect a lighting apparatus that can be used, at most, in all environments with an intermediate risk of explosion (zone 1 according to ATEX standards) which can overcome at least one of the disadvantages of the state of the art.

[0016] A first purpose of the present invention is to provide an explosion-proof lighting apparatus that is suitable to be installed even in environments that are chemically aggressive toward metal materials exposed to the external environment.

[0017] Another purpose of the present invention is to not alter the light emission and the color rendering index of the light source.

[0018] Another purpose is that the luminous efficiency of the apparatus is high and constant throughout its entire usable life.

[0019] Another purpose is to perfect a method to produce a lighting apparatus that is simple, repeatable in series, efficient, rapid and with low implementation costs, which allows easier assembly operations, and which allows to obtain a long duration of the apparatus itself.

[0020] Consequently, a final purpose of the present invention is to provide a lighting apparatus which, even by increasing its performance in terms of luminous efficiency and duration over time, has production costs that are no higher, or possibly lower, than those of the apparatuses belonging to the state of the art.

[0021] The Applicant has devised, tested and embodied the present invention to overcome the shortcomings of the state of the art and to obtain these and other purposes and advantages.

SUMMARY OF THE INVENTION

[0022] The present invention is set forth and characterized in the independent claims. The dependent claims describe other characteristics of the present invention or variants to the main inventive idea.

[0023] In accordance with the above purposes, the present document discloses a lighting apparatus, indi-

cated hereafter as apparatus, which comprises a containing body, provided with two open ends, a dissipator support, which divides the containing body into a housing and a compartment, a light source attached to the dissipator support in correspondence with the housing, and two closing elements, both configured to close the open ends of the containing body.

[0024] The containing body is made in a single body and of polymeric material.

[0025] The housing and the compartment are hermetically sealed, with respect to the external environment, by means of the closing elements which are attached in correspondence with the open ends of the containing body.

[0026] According to some embodiments, the closing elements are made of polymeric material.

[0027] In this case, the housing and the compartment are hermetically sealed, with respect to the external environment, by means of the interposition of sealing elements made of a material with sealing properties between the open ends of the containing body and the closing elements.

[0028] The containing body comprises a containing portion and a diffusion portion, the latter being made of a transparent and/or translucent polymeric material.

[0029] According to some embodiments, the containing portion comprises inside it at least two upper protuberances and at least two lower protuberances.

[0030] Each upper protuberance faces the corresponding lower protuberance, so as to create a first cavity between them.

[0031] The first cavities are configured to accommodate and maintain in position the dissipator support.

[0032] According to some embodiments, the dissipator support comprises at least two first protuberances configured to be inserted inside the first cavities.

[0033] In accordance with other embodiments, a sheet of glass is positioned in the housing, attached to the dissipator support, defining with the latter a chamber separated from the external environment, in which the light source is disposed.

[0034] The chamber is hermetically sealed by means of the sealing elements and sealing material applied along the entire periphery of the sheet of glass.

[0035] According to some embodiments, the dissipator support comprises two second protuberances configured to support the sheet of glass and to delimit the chamber.

[0036] Each second protuberance delimits a second cavity configured to position and possibly additionally prevent the displacement of the sealing material.

[0037] According to other embodiments, the dissipator support is configured to rest on the at least two upper protuberances and comprises at least one end portion configured to attach the dissipator support to the containing body by means of attachment means of the closing elements.

[0038] In this way, a lighting apparatus is obtained that overcomes the limits of the state of the art and eliminates the defects present therein.

[0039] In particular, a simple and versatile apparatus is obtained that can be used in all environments that are chemically aggressive toward metal materials and that have at most an intermediate risk of explosion (zone 1 according to ATEX regulations).

[0040] The present invention also concerns a method to produce a lighting apparatus which comprises the following steps:

- producing, in a single body, a containing body provided with two open ends;
- producing a dissipator support;
- mounting a light source on the dissipator support;
- mounting the dissipator support inside the containing body, delimiting a housing containing the light source and a compartment;
- sealing the open ends of the containing body by assembling closing elements together with corresponding sealing elements, in order to obtain a hermetic closure of the housing and the entire apparatus.

[0041] According to some embodiments, the method to produce the lighting apparatus can also include the steps of:

- positioning a sheet of glass in contact with the dissipator support so as to delimit a chamber containing the light source;
- sealing the chamber by applying, along the entire periphery of the sheet of glass, sealing material and possible sealing elements.

[0042] In this way, a simple, repeatable and reliable method to produce a lighting apparatus is obtained, in which the production steps and the corresponding assembly times are optimized, minimizing the final production costs of the apparatus itself.

BRIEF DESCRIPTION OF THE DRAWINGS

[0043] These and other aspects, characteristics and advantages of the present invention will become apparent from the following description of some embodiments, given as a non-restrictive example with reference to the attached drawings wherein:

- fig. 1 is a perspective view of a lighting apparatus;
- fig. 2 is an exploded perspective view, in partial section, of the lighting apparatus of fig. 1;
- fig. 3 is a cross-section view along plane III-III of fig. 1, according to an embodiment of the present invention;
- fig. 3a shows detail A, indicated in fig. 3, enlarged;
- fig. 4 is a cross-section view along plane III-III of fig. 1, according to an alternative embodiment of the present invention;

- fig. 4a shows detail B, indicated in fig. 4, enlarged.

[0044] To facilitate comprehension, the same reference numbers have been used, where possible, to identify identical common elements in the drawings. It is understood that elements and characteristics of one embodiment can conveniently be incorporated into other embodiments without further clarifications.

DESCRIPTION OF SOME EMBODIMENTS

[0045] We will now refer in detail to the possible embodiments of the invention, of which one or more examples are shown in the attached drawings, by way of a non-limiting illustration. The phraseology and terminology used here is also for the purposes of providing non-limiting examples.

[0046] The attached drawings are used to describe some embodiments of a lighting apparatus 10, hereafter referred to as apparatus, and of a corresponding production method.

[0047] The present apparatus 10 comprises a containing body 11 provided with two open ends, a dissipator support 22, at least one light source 16 and two closing elements 17, 18.

[0048] The closing elements 17, 18 are configured to close the open ends of the containing body 11.

[0049] The closing elements 17, 18 can be configured to be applied to the respective opposite ends of the containing body 11 by means of suitable attachment means 19 such as, for example, self-tapping screws.

[0050] In accordance with a preferential embodiment, the containing body 11, as well as the closing elements 17, 18, can be made of polymeric material.

[0051] The polymeric material can be selected from polycarbonate, polyester resin, epoxy resin, polyester resin reinforced with glass fibers, or suchlike, or combinations thereof.

[0052] One advantage of using polymeric materials is that the apparatus 10 can be used in all environments that are chemically aggressive toward metal materials. For example, it can be used in environments where corrosive substances such as nitric acid or pentane, or suchlike, are present.

[0053] According to the present invention, as shown in the attached drawings, the containing body 11 is made in a single body.

[0054] Furthermore, the containing body 11 can have horizontal sections, according to a horizontal plane Y, having at least two parallel opposite sides, for example in the shape of a parallelogram, rectangular, square or trapezoidal. The containing body 11 also has a transverse section, according to a plane perpendicular to the horizontal plane Y, closed and empty inside, for example, shaped almost as an O, rectangular or square.

[0055] According to some embodiments, the containing body 11 is made by means of molding, extrusion or coextrusion, preferably by means of coextrusion, while the closing elements 17, 18 are made by means of molding.

[0056] According to some embodiments, the containing body 11 comprises a containing portion 11a and a diffusion portion 11b which are made in a single body, each made of polymeric material.

[0057] The diffusion portion 11b is disposed in the lower part of the containing body 11 facing the light source 16. The diffusion portion 11b is configured to suitably diffuse the beam of light generated by the light source 16. For example, the diffusion portion 11b can eliminate the risk of glare and therefore considerably increase visual comfort.

[0058] According to one possible embodiment, the diffusion portion 11b is made of a transparent and/or translucent polymeric material such as, for example, polycarbonate (figs. 3, 3a, 4 and 4a).

[0059] The containing portion 11a, on the other hand, can be made of an opaque polymeric material such as a polyester or epoxy resin, or a transparent and/or translucent material, such as polycarbonate.

[0060] According to some embodiments, the containing portion 11a and the diffusion portion 11b are each made of a transparent and/or translucent polymeric material, possibly of the same transparent and/or translucent polymeric material.

[0061] According to some embodiments, the external surface of the containing portion 11a and of the diffusion portion 11b can be smooth or rough to the touch, for example, it can be provided with grooves parallel to a longitudinal axis X of the apparatus 10.

[0062] The light source 16 can be any device whatsoever capable of converting the electrical power supplied by a power supply and control unit 14 into a beam of light such as, for example, incandescent, halogen, discharge, LED lights or suchlike.

[0063] According to some embodiments, as shown in figs. 3, 3a, 4, 4a, the containing body 11 can be configured to accommodate the dissipator support 22 on which, in correspondence with a rest surface 22a thereof facing the diffusion portion 11b, the light source 16 is attached.

[0064] According to some embodiments, the rest portion 22a is parallel to the horizontal plane Y and extends along the longitudinal axis X of the apparatus 10.

[0065] The dissipator support 22 is configured to optimally disperse the heat generated by the light source 16.

[0066] In this regard, the dissipator support 22 can be made of metal material, for example steel, aluminum or copper, preferably of aluminum alloy. Metal materials, in fact, have the advantage of having a good thermal conductivity, being able to dissipate the heat produced, for example, by the light source 16. Furthermore, the aluminum alloy is also a light and corrosion resistant material.

[0067] In accordance with possible embodiments, the dissipator support 22 can be made by means of molding, die casting or extrusion, preferably by means of extrusion.

[0068] According to some embodiments, with refer-

ence to figs. 3, 3a, 4 and 4a, the containing portion 11a of the containing body 11 can comprise inside it at least two upper protuberances 27a and at least two lower protuberances 27b. Each upper protuberance 27a faces the corresponding lower protuberance 27b, in such a way as to create a first cavity 27 between them.

[0069] According to the present invention, the first cavity 27 has a development parallel to the longitudinal axis X of the containing body 11.

[0070] According to some embodiments, the first cavity 27 is also configured to accommodate and maintain in position the dissipator support 22.

[0071] In this regard, the dissipator support 22 comprises at least two first protuberances 23.

[0072] In accordance with a first variant, the first protuberances 23 are configured to be inserted inside the respective first cavities 27.

[0073] In accordance with a second variant, the first protuberances 23 are configured to rest on the at least two upper protuberances 27a.

[0074] In the latter case, the dissipator support 22 can comprise at least one end portion 32 configured to attach the dissipator support 22 to the containing body 11 by means of attachment means 19 of the closing elements 17, 18.

[0075] The dissipator support 22, once mounted inside the containing body 11, divides the latter into a housing 12 and a compartment 31 which are disposed, respectively, in the upper part and in the lower part of the containing body 11.

[0076] The housing 12 can be configured to accommodate the light source 16 inside it.

[0077] According to a preferential embodiment, the dissipator support 22 is configured to position a dissipator element 16a of the light source 16 in contact with the rest surface 22a, capable of dissipating the heat produced by the light source 16.

[0078] According to some embodiments, in order to obtain a watertight insulation of the light source 16, sealing elements 21 are applied between the open ends of the containing body 11 and the closing elements 17, 18, the sealing elements 21 being made of a material with sealing properties and being configured to insulate the light source 16 from the external environment.

[0079] In this way, an apparatus 10 is obtained which can be used in all environments which have a risk of explosion that is, at most, low (zone 2 according to ATEX regulations). The apparatus 10 can also be used in environments with a lower risk than the low one, for example in environments in which there is no risk of explosion.

[0080] According to some embodiments, the dissipator support 22 can be configured to position a sheet of glass 24 in such a way that it is distanced from or, possibly, in contact with, the light source 16.

[0081] According to some embodiments, in order to obtain a watertight insulation of the light source 16, sealing material 25 and possible sealing elements 21 are applied along the entire periphery of the sheet of glass 24.

[0082] In this way, the apparatus 10 can be used, at most, in environments with an intermediate risk of explosion (zone 1 according to ATEX regulations).

[0083] The sealing material 25 can be a synthetic elastomer used to make packings (for example, silicone).

[0084] According to some embodiments, the sheet of glass 24, positioned on the dissipator support 22, delimits a chamber 26 separated from the external environment, comprising the light source 16 inside it.

[0085] According to one possible embodiment, the dissipator support 22 is equipped with two second protuberances 30 which extend outward and along its entire length. Each second protuberance 30 comprises a lower surface 30a configured to support the sheet of glass 24. These second protuberances 30 are also configured to obtain, during the assembly step, the centering of the light source 16 by means of the possible dissipator element 16a.

[0086] According to some embodiments, the lower surface 30a faces toward the external side.

[0087] The second protuberances 30 can also be configured to delimit the chamber 26.

[0088] Furthermore, at least each second protuberance 30 is disposed in such a way as to delimit a second cavity 28, placed laterally with respect to the rest zone of the light source 16. This second cavity 28 extends without a break in continuity between the two open ends of the containing body 11.

[0089] According to some embodiments, the dissipator support 22 comprises at least two third protuberances 33 disposed on the same side and outside the second protuberances 30, in such a way as to delimit the second cavity 28.

[0090] The second cavity 28 is configured to position and possibly additionally prevent the displacement of the sealing material 25.

[0091] According to a preferential embodiment, and with reference to figs. 3a and 4a, a wall 28a of each second cavity 28 which cooperates with the sealing material 25 has an inclination angle α, with respect to the vertical, facing toward the inside of the second cavity 28.

[0092] This solution has the advantage of preventing the sealing material 25, which fills each second cavity 28, from being displaced, for example, following impacts or due to aging. In this way, the sheet of glass 24, once positioned, remains fixed in any condition whatsoever.

[0093] According to a preferential embodiment, each third protuberance 33 can comprise at least one holding mean 34 which protrudes outward, laterally with respect to the second cavity 28.

[0094] The at least one holding mean 34 acts as a striker to correctly position and center the sheet of glass 24 during the assembly steps, delimiting the chamber 26 in which the light source 16 is disposed.

[0095] In particular, by also using a sheet of glass 24 with sealing material 25, an apparatus 10 is obtained which can be used, at most, even in environments with an intermediate risk of explosion (zone 1 according to

ATEX regulations).

[0096] Furthermore, the sheet of glass 24 is not subject to alteration of transparency characteristics with aging, throughout the entire operating life of the apparatus 10.

[0097] In order to reduce the number of items stored in the warehouse, the dissipator support 22 can always comprise at least two second protuberances 30 and at least two third protuberances 33 which delimit the two second cavities 28. In this way, two possible variants of the apparatus 10 can be provided with the same dissipator support 22 (without sheet of glass 24 and without sealing material 25; with sheet of glass 24 and with sealing material 25).

[0098] According to one possible variant, the dissipator support does not comprise any second 30 and third 33 protuberance whatsoever.

[0099] According to preferred embodiments, the containing body 11 acts as a casing for the other elements that make up the apparatus 10, and constitutes the bearing structure of the latter.

[0100] The compartment 31 of the containing body 11 can be configured to accommodate at least one support element 13.

[0101] The support element 13 is configured in such a way as to accommodate and attach on it the power supply and control unit 14, which comprises electronic elements configured to power and control the light source 16.

[0102] The at least one support element 13 can be made, in a single body, during the production of the containing body 11 or of the dissipator support 22, for example by means of extrusion.

[0103] This solution has the advantage of eliminating any mechanical work with stock removal and reducing assembly times for the production of the apparatus 10.

[0104] According to some embodiments, the containing body 11 can comprise, facing inward, first coupling elements 29.

[0105] Alternatively or in addition, the dissipator support 22 can comprise, on the opposite side of the rest surface 22a, second coupling elements 35.

[0106] The first 29 and second 35 coupling elements are configured to mount the support element 13 of the power supply and control unit 14, without the aid of additional attachment elements.

[0107] According to one possible embodiment, shown in figs. 1 and 2, one of the closing elements 17 comprises a hole 36 concentric, or not, with the longitudinal axis X, while the other closing element 18 is blind.

[0108] The hole 36 is configured to accommodate a watertight cable gland element 20.

[0109] The cable gland element 20 is configured to allow the passage of the electrical cables that connect to the power supply and control unit 14.

[0110] According to a preferential alternative embodiment, the closing elements 17, 18 are the same and both comprise a hole 36.

[0111] In this case, the cable gland element 20 is mounted on one of the closing elements 17, while a watertight cap is mounted on the other closing element 18, making it blind.

[0112] According to another embodiment, the closing elements 17, 18 can be made of a material with sealing properties, thus simultaneously achieving both the functions of the closing elements 17, 18 and of the sealing elements 21.

[0113] In accordance with some embodiments, a method to produce a lighting apparatus 10 is provided, which comprises the steps of:

- producing, in a single body, a containing body 11 provided with two open ends;
- producing a dissipator support 22;
- mounting a light source 16 on the dissipator support 22;
- mounting the dissipator support 22 inside the containing body 11, delimiting a housing 12 containing the light source 16 and a compartment 31;
- sealing the open ends of the containing body 11 by assembling closing elements 17, 18 together with possible corresponding sealing elements 21, in order to obtain a hermetic closure of the housing 12 and of the entire apparatus 10.

[0114] The mounting of the dissipator support 22 can occur without the aid of attachment elements, such as screws, bolts and suchlike, by inserting it, for example sliding or by applying pressure, in correspondence with two first cavities 27 made in the containing body 11 which are parallel to the longitudinal axis X.

[0115] In accordance with possible embodiments, the method to produce the apparatus 10, according to the present invention, can possibly also include the steps of:

- positioning a sheet of glass 24 in contact with the dissipator support 22 in such a way as to delimit a chamber 26 containing the light source 16;
- sealing the chamber 26 by applying, along the entire periphery of the sheet of glass 24, sealing material 25 and possible sealing elements 21.

[0116] It is clear that modifications and/or additions of parts or steps may be made to the lighting apparatus 10 and to the corresponding production method as described heretofore, without departing from the field and scope of the present invention as defined by the claims.

[0117] In the following claims, the sole purpose of the references in brackets is to facilitate reading: they must not be considered as restrictive factors with regard to the field of protection claimed in the specific claims.

Claims

1. Lighting apparatus (10) comprising a containing body (11) provided with two open ends and a dissipator support (22) which divides said containing

body (11) into a housing (12) and a compartment (31) as well as two closing elements (17, 18) and at least one light source (16), **characterized in that** said containing body (11) is made in a single body and of polymeric material **and in that** said housing (12) and compartment (31) are hermetically sealed by means of said closing elements (17, 18) which are attached in correspondence with the open ends of said containing body (11).

2. Apparatus (10) as in claim 1, **characterized in that** said closing elements (17, 18) are made of polymeric material **and in that** said housing (12) and said compartment (31) are hermetically sealed by means of the interposition of sealing elements (21) between the open ends of said containing body (11) and said closing elements (17, 18).

3. Apparatus (10) as in claims 1 or 2, **characterized in that** said containing body (11) comprises a containing portion (11a) and a diffusion portion (11b) which is made of a transparent and/or translucent polymeric material.

4. Apparatus (10) as in claim 3, **characterized in that** said containing portion (11a) comprises inside it at least two upper protuberances (27a) and at least two lower protuberances (27b), wherein each upper protuberance (27a) is facing the corresponding lower protuberance (27b) so as to create between them a first cavity (27) configured to accommodate and maintain in position said dissipator support (22).

5. Apparatus (10) as in claim 4, **characterized in that** said dissipator support (22) comprises at least two first protuberances (23) configured to be inserted inside said first cavities (27).

6. Apparatus (10) as in any claim hereinbefore, **characterized in that** said at least one light source (16) is attached to said dissipator support (22) in correspondence with said housing (12) **and in that** a sheet of glass (24) is positioned in said housing (12), attached to said dissipator support (22), delimiting with the latter a chamber (26) separated from the external environment and hermetically sealed by means of said sealing elements (21) and sealing material (25), in which said light source (16) is disposed.

7. Apparatus (10) as in claim 6, **characterized in that** said dissipator support (22) comprises two second protuberances (30) configured to support said sheet of glass (24) and to delimit said chamber (26), wherein at least each of said second protuberances (30) delimits a second cavity (28) configured to position and prevent the displacement of said sealing material (25).

8. Apparatus (10) as in any claim from 4 to 7, **characterized in that** said dissipator support (22) is configured to rest on the at least two said upper protuberances (27a) and comprises at least one end portion (32) configured to attach said dissipator support (22) to said containing body (11) by means of attachment means (19) of said closing elements (17, 18).

9. Method to produce a lighting apparatus (10), **characterized in that** it comprises the steps of:

- producing in a single body a containing body (11) provided with two open ends;
- producing a dissipator support (22);
- mounting a light source (16) on said dissipator support (22);
- mounting said dissipator support (22) inside said containing body (11), delimiting a housing (12) containing said light source (16) and a compartment (31);
- sealing the open ends of said containing body (11) by assembling closing elements (17, 18) together with corresponding sealing elements (21), in order to obtain a hermetic closure of said housing (12) and of the entire apparatus (10).

10. Method as in claim 9, **characterized in that** it comprises the steps of:

- positioning a sheet of glass (24) in contact with said dissipator support (22) so as to delimit a chamber (26) containing said light source (16);
- sealing said chamber (26) by applying, along the entire periphery of said sheet of glass (24), sealing material (25) and possible sealing elements (21).

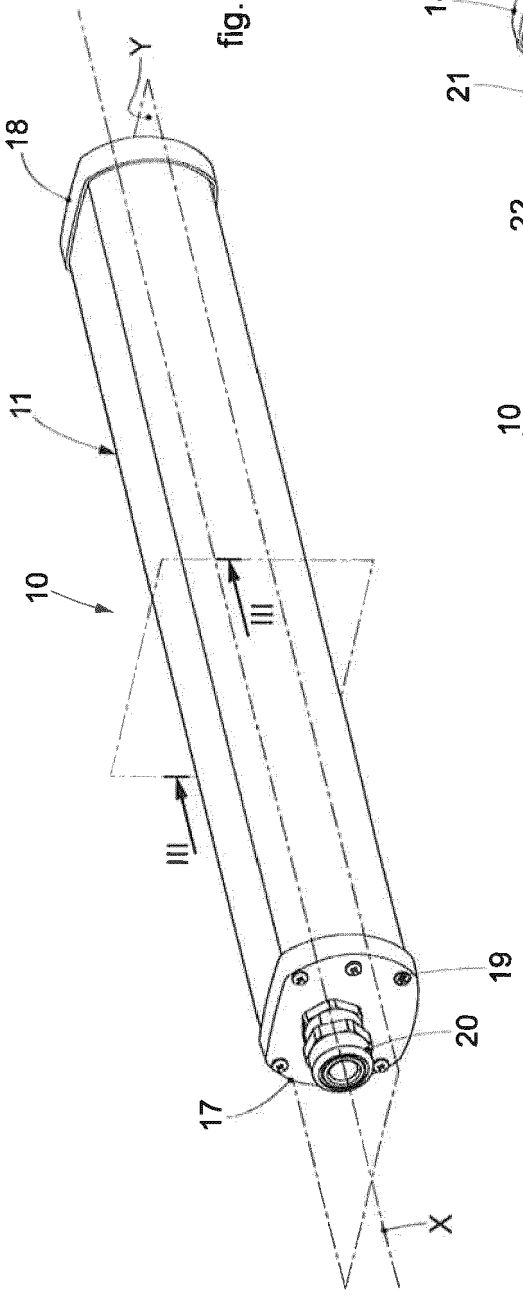
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fig. 1

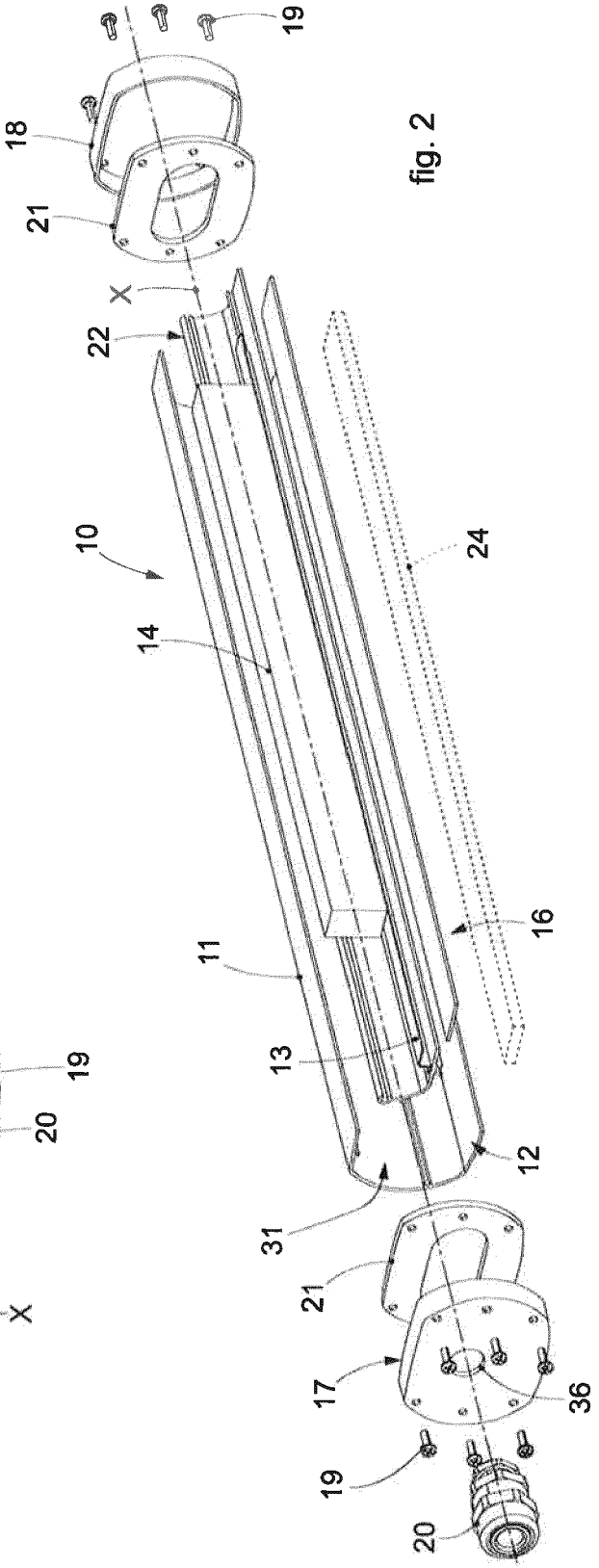
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fig. 2

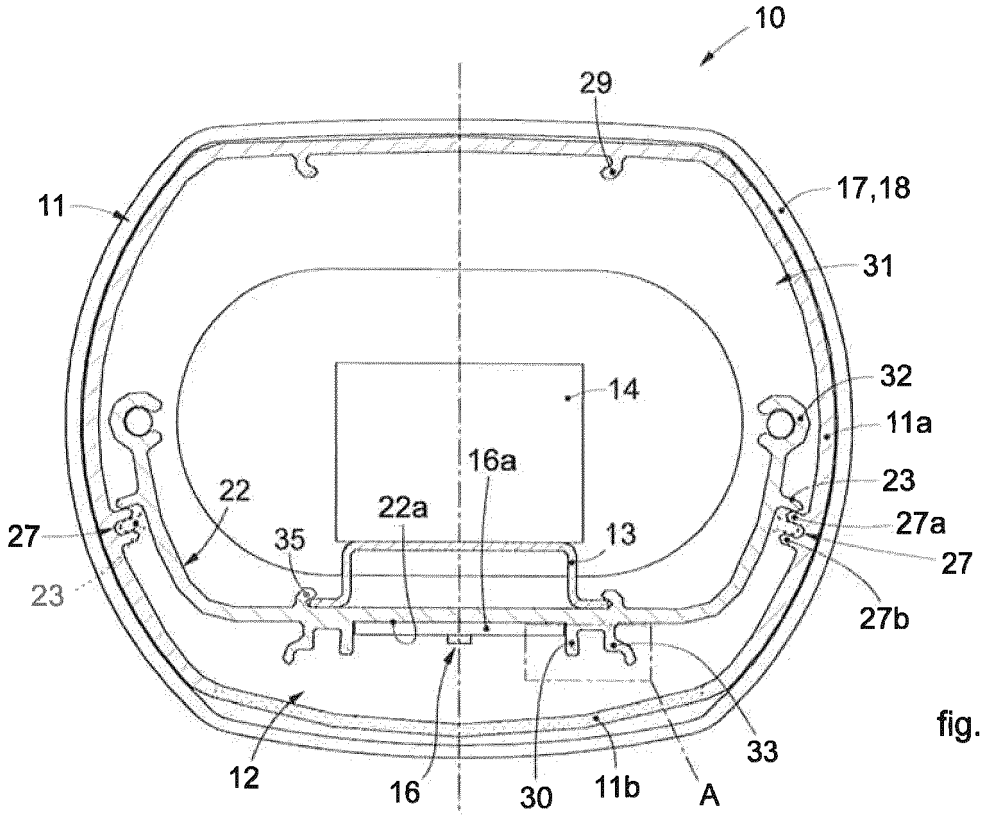
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fig. 3

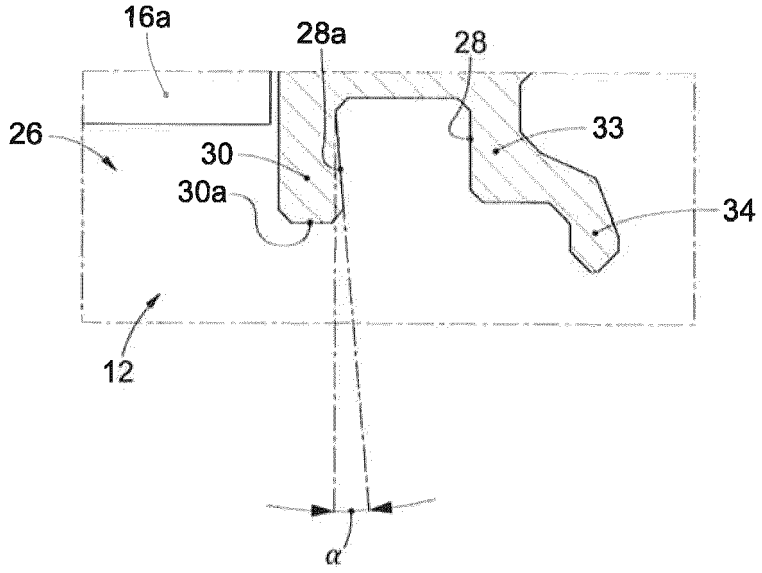
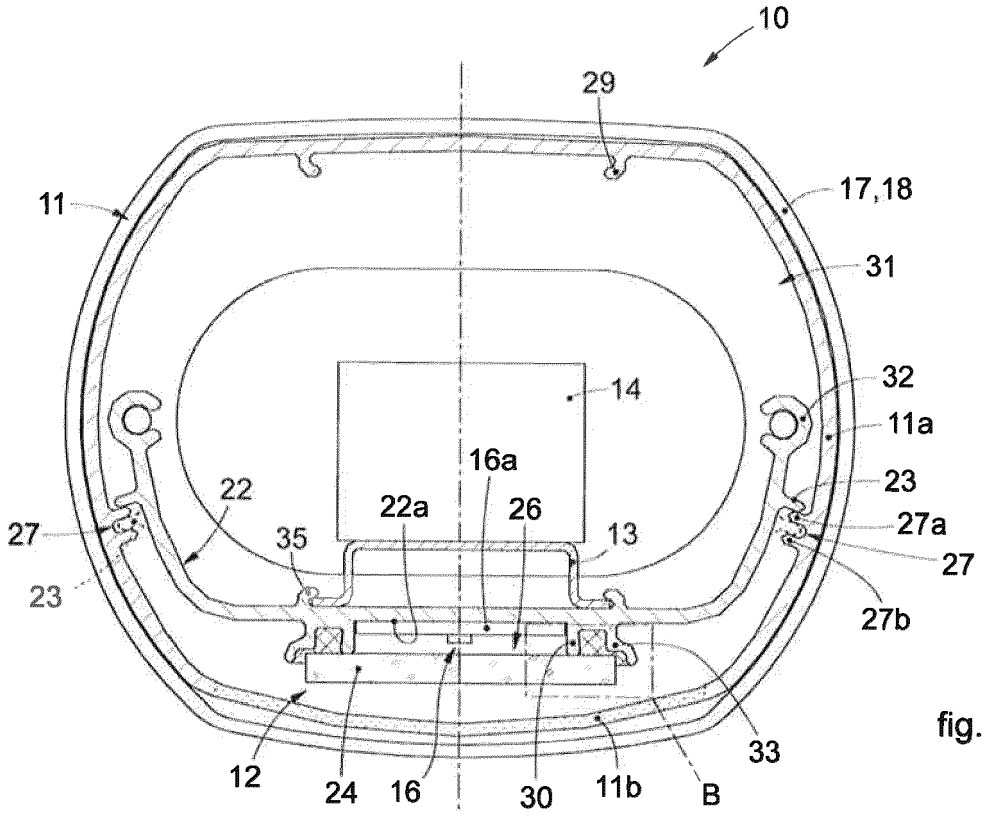

16a
28a
28
26
33
30
30a
34
12
α

fig. 3a


10
29
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17,18
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14
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11a
16a
22
22a
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27a
27
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13
27
23
27b
12
24
16
30
11b
B
33

fig. 4

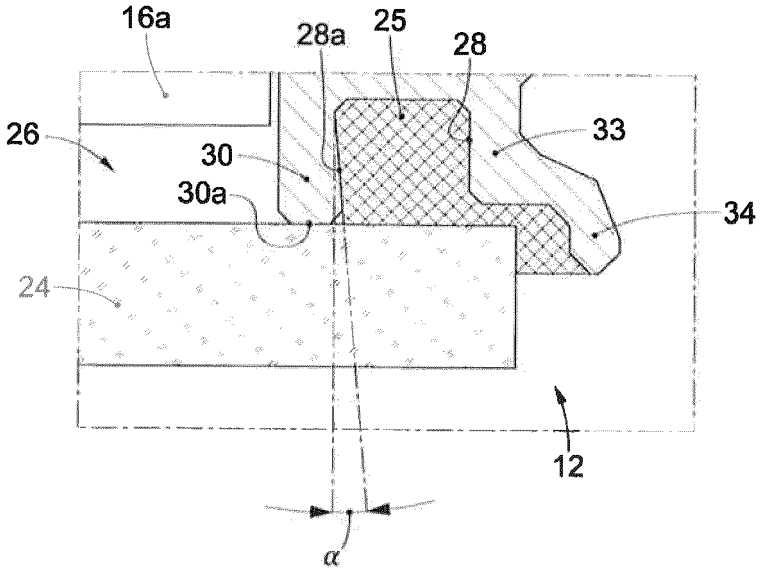
16a
28a
25
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fig. 4a

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EUROPEAN SEARCH REPORT

Application Number
EP 21 20 6586

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
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