(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
12 December 2024 (12.12.2024)

WIPO | PCT

(10) International Publication Number
WO 2024/252373 A1

(51) International Patent Classification:
B29C 48/30 (2019.01) *B29C 33/36* (2006.01)
F21V 7/00 (2006.01) *B29C 43/22* (2006.01)
B29C 48/07 (2019.01)

(21) International Application Number:
PCT/IB2024/055658

(22) International Filing Date:
10 June 2024 (10.06.2024)

(25) Filing Language: Italian

(26) Publication Language: English

(30) Priority Data:
23178497.6 09 June 2023 (09.06.2023) EP

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CV, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IQ, IR, IS, IT, JM, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, MG, MK, MN, MU, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, CV, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SC, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, ME, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:
— *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))*

(54) Title: ELEMENT FOR LIGHTING DEVICES

(57) Abstract: Method and apparatus for producing an interface element for a lighting device comprising a plurality of light sources aligned in a shaped strip, wherein said shaped strip is obtained by a first step of extruding a thermoplastic material strip, a second step of compressing the strip between two male and female mould halves mounted on two carousels, wherein a shaped strip comprising a plurality of openings is obtained during the moulding step in which the two mould halves are coupled.

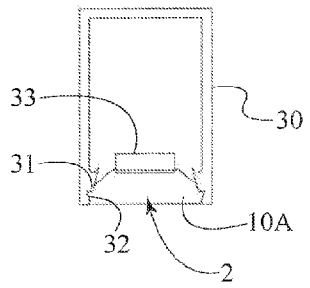

Fig. 2b

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ELEMENT FOR LIGHTING DEVICES

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[001] The present invention concerns an element for a lighting device, the device containing said element and a method for producing the said element.

[002] In particular, the invention concerns an element that constitutes a part of a lighting device, such as ceiling lights, wall lights, floor lighting devices, recessed lighting devices, lighting devices that can be constrained to plasterboard walls, lighting devices for furniture or vehicles, comprising a plurality of inline LED light sources.

[003] Applications of these lighting devices are, e.g., those in public buildings, e.g. in stations and airports, and generally where "strips" of light sources are required.

State of the art

[004] In the lighting field, in particular in the ceiling lighting field, devices are known that comprise a plurality of LED or OLED light sources arranged in one or more rows, or lines, generally mounted on or hanging from the ceiling. A problem of ceiling-type lighting devices with inline LED sources is to avoid that the exiting light beam can generate a glare effect for persons present in the environment and thus be inconvenient, e.g. disturbing the vision of monitors or information panels at a station or airport.

[005] Also, in order to avoid this problem, light sources are arranged in the inline devices on the rear of an element provided with a number of openings generally corresponding to the number of light sources (LEDs) and housed in turn in a housing frame which forms the outer body of the lighting device. This element then forms a type of interface between the LED light sources and the outside world. In a possible implementation, a lens is positioned at the opening on the inner side of the interface element.

[006] The openings, which allow the light beam to pass outwards, are positioned on the inner side of the interface element, at the base of a cavity portion generally shaped like a polyhedron or solid of revolution, e.g. a truncated-pyramid or truncated-cone shaped, widening toward the outer side of the device to transmit the beam toward the environment at a sufficiently wide angle, e.g. between 95 and 120 degrees. In other words, the dimensions of the opening on the inner side of the interface element are smaller than the dimensions of the corresponding opening on the outer side of said

element. As a result, the wall extending from the inner opening toward the outer surface of the interface element is angled with respect to the inner side of the element by an angle α that allows to avoid glare.

[007] The definition of inner and outer side of the interface element is made with reference to the position of the element in a lighting device; in any case, in the present description the inner side is intended to be the one on which the opening with smallest dimensions is found.

[008] The known interface elements are made by injection moulding. A problem with known interface elements is their cost, a cost which, moreover, increases with the length of the elements, i.e. with the number of openings and corresponding inline light sources present in the lighting device. The high cost may also be due to the need to make injection moulds, the time required for producing interface elements, as well as the time for assembling the final product.

[009] A further problem is the relatively short length of the known interface elements.

[010] Object of the present invention is to solve the problems described above and to provide an interface element for lighting devices with light sources aligned in strips that have low costs and are easily manufactured in a sustainable manner.

[011] This object is achieved by the present invention, which concerns a method for producing an interface element for a lighting device comprising a plurality of light sources aligned in a strip according to claim 1. The invention further concerns an interface element according to claim 13, an apparatus for producing said interface element according to claim 8 and a lighting device comprising said interface element according to claim 15.

[012] The production method of the invention provides for prearranging a plurality of male and female mould halves mounted on two carousels preferably vertical, however embodiments of horizontal carousels are not excluded. The two carousels translate the said mould halves along a path which provides a moulding length, in which the mould halves are closed to define a moulding cavity, an approach length for moving the said mould halves closer, upstream of the said moulding length and a length for separating the mould halves, downstream of the said moulding length, providing at least one extruder upstream of said carousel, said at least one extruder

being configured to feed a strip of at least one thermoplastic material; extruding or co-extruding said strip of thermoplastic material and feeding said strip to said carousel at said approach length of the moulds; compressing said strip between said moulds for shaping it; retrieving said shaped strip exiting the moulds in the said separation area of the mould halves.

[013] The thermoplastic material/s of the extruded strip fed to the carousel is in a plastic condition and adapted to be moulded, i.e. shaped, at the next step of the invention method. In an implementation of the invention, the extruded strip comprises two or more thermoplastic materials which are co-extruded to obtain a strip which may have different hardness and/or colours of the co-extruded materials, as needed. For example, the side edges of the extruded and moulded element may be stiffer than the element body to facilitate their assembly by interlocking into the frame.

[014] In the present description and claims, for the sake of descriptive simplicity, reference shall be made to the terms “extruded”, “extrusion” and “extrude” but these terms are also intended to cover the co-extrusion of two or more materials from two or more extruders. In particular, the present invention comprises the implementations in which materials with different physical characteristics (e.g. different compression or tensile stiffness) are co-extruded in the interface element.

[015] Advantageously, the extrusion speed is controlled so as to match the translation speed of the moulds on the double vertical carousel in the moulding length.

[016] Advantageously, the method is carried out continuously so as to achieve the invention interface element in the form of a continuous shaped strip of the desired length. In a preferred implementation, the strip material is a flexible material, such as e.g. a thermoplastic rubber like SBS, which may thereby be rolled up e.g. in reels.

[017] However, embodiments in which the material is stiff or is made with more than one thermoplastic material by co-extrusion are not excluded.

[018] In an implementation, at least one for each pair of mould halves is cooled in order to reduce the time in which the moulds are kept closed.

[019] Advantageously, multiple pairs of mould halves are present in the moulding length, which are arranged side-by-side without interruptions, so that together they form a single moulding template throughout the said carousel moulding length where

the mould halves are coupled to form shaping moulds. For this purpose, the template of at least one in each pair of mould halves has two carvings at the opposite transverse ends (with respect to the direction of movement of the mould halves) of the mould, which carvings form two corresponding openings transverse to the mould formed by the coupling of the mould halves at the sides which are arranged side-by-side in the carousel moulding length. This way, the transverse openings between two pairs of mould halves arranged side-by-side allow the continuous extruded strip to be shaped without having to interrupt it.

[020] A mould, as formed by the two corresponding mould halves, may comprise one or more templates, where a template comprises a cavity and the corresponding openings on the inner and outer sides of the element. In a preferred implementation, each mould comprises only one template.

[021] In an implementation, the volume of a shaped unit is lower than the volume of a corresponding unit of extruded strip; the volume of shaped unit means the volume defined between the two mould halves forming the moulding cavity. The volume of the corresponding extruded strip means the volume of the piece of strip inserted to be shaped between the two mould halves. Typically, the volume of strip material fed to the mould is from 5% to 10% or even 15% greater than the volume of cavity defined by the coupled mould halves.

[022] Advantageously, at least one of the mould halves is equipped with means to make the excess material come out during the moulding step; in fact, in this moulding step, the material in the plastic state is compressed between the two mould halves and fills the empty space (i.e. the cavity) between them. Generally, the pairs of mould halves comprise a male and a female mould half, the wall of the female mould half is provided with a venting hole to allow the excess material to come out during the moulding step. Since it is obtained by extrusion, the interface element according to the invention is free of injection points, as in the prior art.

Description of the figures

[023] The invention will now be depicted with reference to the figures enclosed by way of non-limiting example, wherein:

- Fig. 1 is a schematic side view of an apparatus according to the

invention;

- Fig. 2 is a perspective view of an interface element according to the invention;
- Figs. 2a, 2b are a perspective view and a sectional view of the interface element of figure 2 positioned in a frame;
- Fig. 3 is a cross-sectional view of the element of fig. 2;
- Fig. 4 is an enlarged schematic view of the mould halves in the approach area on the carousels;
- Fig. 5 is a side view from the left of fig. 4;
- Fig. 6 is a side view from the right of fig. 4;
- Fig. 7 is a sectional view of fig. 4; and
- Fig. 8 and fig. 9 are two perspective sectional views of the mould halves during the approaching step;
- Figs. 10A, 10B, 10C are a sectional view of the mould halves in which the male mould half is a movable element;
- - Figs. 11A and 11B are perspective views of a different embodiment, with different template, according to the invention;
- - Fig. 12 is a top view of the element of Fig. 11A;
- - Fig. 13 is a longitudinal sectional view of the element of Fig. 12;
- - Fig. 14 is a perspective view of a further embodiment of the element of the invention; and
- - Fig. 15 is a longitudinal sectional view of the element of Fig. 14.

[024] With reference to fig. 1, the invention apparatus is configured for the production of an interface element 2 for lighting devices, as exemplified in fig. 2 and fig. 3. This element 2 comprises a body 3 with a roughly trapezoidal section and provided with a plurality of openings 6 generally corresponding to the number of light sources (LEDs) schematically denoted in fig. 3 by the LED acronym and arranged on the inner side 7 of the interface element 2 in the lighting device. In the final device, the LEDs and the interface element 2 are housed e.g. in a housing frame (not shown) forming the outer body of the lighting device. The element 2 thus forms a type of interface between the LED light sources and the outside world. Typically, a lens is

positioned at the opening 5 on the inner side 7 of the interface element.

[025] The openings 5, which allow the light beam to pass outwards, are positioned on the inner side 7 of the interface element 2, at the base of a portion of cavity 6 generally shaped like a polyhedron or solid of revolution, e.g. a truncated-pyramid or truncated-cone shape. The cavity 6 is enlarged toward the outer side 8 of the device in order to transmit the light beam generated by the LED toward the environment at a sufficiently wide angle to avoid dazzling people in the room. In other words, the dimensions of the opening 5 on the inner side of the interface element 2 are smaller than the dimensions of the corresponding opening 4 on the outer side 8 of said element 2. As a result, the wall extending from the inner opening 5 toward the opening 4 on the outer surface 8 of the interface element is angled with respect to the inner side of the element by an angle α which allows to avoid glare.

[026] The apparatus 1 according to the invention comprises at least one extruder 9 known per se in the art and configured to extrude a thermoplastic material strip 10. The strip 10 is carried by conveyor means 1, e.g. with rollers or a conveyor belt, to a pair of carousels 12 and 13 on which a plurality of mould halves 14 and 15 are mounted, in particular a plurality of male mould halves 15 and female mould halves 14.

[027] The mould halves 14 and 15 are translated by the two vertical carousels 12 and 13 along a path that provides a moulding length 16, in which the mould halves are coupled to each other to define a moulding cavity, an approach length 17 of said mould halves, which is arranged on the side of the extruder 9, and a separation length 18 of the mould halves, which is arranged on the opposite side of the carousel with respect to the extruder 9. In other words, said approach length 17 and separation length 18 are arranged upstream and downstream, respectively, of the said moulding length 16 with respect to the direction of movement of said mould halves along the carousels.

[028] The apparatus 1 further comprises a control unit 19 configured for regulating the extruding speed of said extruder and the translation speed of the mould halves along at least the moulding length 16.

[029] At the opposite end of the carousels 12 and 13 with respect to the extruder 9, means 20 are provided for retrieving said continuous shaped strip 10A exiting said

separation area 18 of the mould halves.

[030] As shown in figures 4 – 9, in order to form the cavity 6 in the interface element 2, the male mould halves 15 have a protruding portion 21 which cooperates with a cavity 22 present in the female mould halves 14. In particular, the cylindrical end portion 23 of the male part 21 has such a diameter that it substantially abuts in a corresponding cylindrical part 24 of the cavity 22. When the mould closes, the opening 5 of the cavity 6 of the element 2 is formed by the interaction between the portions 23 and 24 of the mould halves.

[031] In an alternative embodiment, as shown in figure 10, in order to form the plurality of cavities 6 of the interface element 2, the male mould half 15 comprises a portion 15A which is movable by means known in the art inside the remaining mould half portion 15B in such a way as to form the cavities 6. In more detail, the male portion 15A including the cylindrical end portion 23 of the male mould half 15 is movable between a position (fig. 10A) retracted with respect to the cavity 22 formed by the two coupled mould halves 14 and 15, and a position extended in said cavity (fig. 10C) so as to make the cavity 6 in the moulded interface element. In the final moulding position (fig. 10C), the portion 15A is in the same condition and position as shown in figures 4 to 9 discussed above. In particular, the cylindrical part 23 is in contact with the sides of the corresponding cylindrical part 24 of the cavity 22 of the female mould half 14 to form the plurality of cavities 6 of the interface element 2.

[032] As shown in figures 1 and 4, the extruder produces a thermoplastic material strip 10 fed to the carousels to be engaged in the approach area 17 by the mould halves 15 and 14 that shape it to the required shape in the moulding length 16, i.e. in the length where the mould halves are coupled to each other to form the cavities 25.

[033] The amount of strip material to be fed to a mould formed by the mould halves 14 and 15 is greater than that necessary to fill the cavity 25 formed between the two mould halves; in particular, the amount of material is from 5% to 15%, preferably about 8% to 10% greater. This way, it is possible to ensure that the entire cavity 25 is filled during the compression and moulding step.

[034] The excess material is compressed by the portion 23 of the male part 21 into the cavity 24 of the female mould half 14 and is partially drained through the outlet,

i.e. venting, conduit 26 which extends from the cavity 24 to the outside of the mould half 14.

[035] The sides 27 of the mould halves, i.e. the sides transverse to the feeding direction of the strip, have two carvings, one on each of said sides; the carvings are made on at least one mould half, preferably on both mould halves. As shown in figs. 5 and 7, the carvings form an opening 28 which connects the moulds arranged side-by-side with each other in the moulding length 17, in such a way that the strip 10 may be shaped as a continuous shaped strip 10A which is collected by the means 20 as it exits the carousel. If it is wished to have strip portions instead of a continuous strip 10A, there will be a complete wall 27 for every n mould halves, where said complete wall defines the length of the strip which will be equal to that of n aligned mould halves.

[036] In a preferred implementation, at least one of the mould halves is provided with cooling means which are operated at least at the moulding length 17.

[037] The method according to the invention provides for extruding a strip 10 of at least one thermoplastic material from the extruder 9 and feeding it still in plastic condition to the carousels 12 and 13, at the length 17 where the male and female mould halves 15 and 14 are moved closer. As mentioned, the volume of the thermoplastic material in the strip 10, which is calculated for a corresponding portion of cavity 25 formed by a pair of coupled mould halves (as shown e.g. in fig. 8 and fig. 9), is greater than the volume of said cavity 25.

[038] Preferably, the volume of the strip portion Vs is greater than the volume of cavity Vc according to the formula Vs = x Vc, where x is in the range of 1.05 to 1.15, i.e. the amount of material intended for a cavity 25 is generally from 5% to 15% more than what would be needed.

[039] The strip is compressed and shaped, i.e. moulded, by the coupled mould halves in the length 17. As can be seen in this length, the pairs of mould halves are arranged side-by-side without interruptions so that their sides 27, i.e. the transverse sides, with respect to the feeding direction of the strip 10, are in contact with each other to form a cavity that extends throughout the moulding length 17 and is formed by the sum of the single cavities 25 of the pairs of mould halves coupled to each other.

[040] The shaped strip 10A exiting the moulds in said separation area of the mould halves is then retrieved by the means 20, e.g. by rolling it into reels or it may be cut to the desired length, according to means known in the art.

[041] According to a preferred aspect, the shaped strip 10A may have edges 32 as shown e.g. in figures 2a,2b. The edges 32 allow the shaped strip 10A and a light source 33, typically a LED, to be positioned in a frame 30 comprising recesses 31 which can be coupled to said protrusions 32. The frame 30 may be constrained to a wall or to any surface so that it can provide lighting at the place of interest.

[042] The edges 32 of the shaped strip 10A may be made of co-extruded materials such that they have such a stiffness to allow them to be suitably built in the recesses 31 of the guide element 2.

[043] A control unit 19 manages the speeds of the extruder and carousels, in particular the extrusion speed is preferably controlled to match the translation speed of the moulds on the double carousel, which is preferably vertical in the moulding length, and to avoid tearing or stressing the strip 10.

[044] The invention therefore has numerous advantages both in economic terms and in production efficiency terms. The invention has advantages in economic terms as it allows to decrease production costs, such as e.g. energy costs, and as it avoids the production of injection moulding moulds that have high production costs. The invention has advantages in production efficiency terms as the apparatus and method allow to produce interface elements of different geometries and dimension, without having to use different moulds. The invention further allows to obtain interface elements with long lengths. This allows to overcome the limitation in the known art whereby moulds may make interface elements with limitations in terms of length.

[045] The depicted implementation only represents a typical example of shape and geometry for the interface element of the invention, which has a truncated-cone-shaped cavity 6. However, the scope of the present invention also extends to interface elements in which the cavity shapes have different shape and geometry.

[046] Two examples of implementations with different geometries are illustrated in Figures 11A to 15. In these figures corresponding elements are identified with corresponding numerical references.

[047] In particular, the element 2 comprises a body 3 provided with a plurality of cavities 6 generally corresponding to the number of light sources (LEDs) that will be arranged on the inner side 7 of the interface element 2 in the lighting device. The element 2 thus forms a type of interface between the LED light sources and the outside world. Typically, a lens is positioned at the opening 5 on the inner side 7 of the interface element.

[048] The openings 5 allowing the passage of the light beam towards the outside are positioned on the inner side 7 of the interface element 2, at the base of a portion of the cavity 6, generally shaped like a polyhedron or a solid of revolution, e.g. a truncated-pyramid or truncated-cone shape. The dimensions of the opening 5 on the inner side of the interface element 2 are smaller than the dimensions of the corresponding opening 4 on the outer side 8 of said interface element 2 so that the cavity 6 extends towards the outer side 8 of the device in order to transmit the light beam generated by the LED towards the outside at a sufficiently wide angle to avoid dazzling the persons present in the environment. Accordingly, the wall extending from the inner opening 5 towards the opening 4 on the outer surface 8 of the interface element is angled with respect to the inner side of the element by an angle α to avoid glare effects.

[049] Following the same production methods detailed above in the present description, geometries may be made with particular, i.e. decorative, templates even devoid of inclined walls, except when necessary for the ejection of the shaped piece from the mould.

CLAIMS

1. Method for producing an interface element (2) for a lighting device comprising a plurality of light sources aligned in a strip (10A), comprising the following steps of:

- prearranging a plurality of male (15) and female (14) mould halves mounted on two carousels (12, 13) which translate the said mould halves along a path which provides for a moulding length (16), in which the mould halves (14,15) are coupled to define a moulding cavity (25), an approach length (17) of the said mould halves (14,15) and a separation length (18) of the mould halves (14,15), said approach length (17) and separation length (18) being arranged upstream and downstream, respectively, of the said moulding length (16) with respect to the movement of said mould halves (14,15),

- prearranging at least one extruder (9) upstream of said carousel (12,13), said extruder (9) being configured to feed a strip (10) of at least thermoplastic material;

- extruding or co-extruding said strip (10) of at least one thermoplastic material and feeding said strip (10) to said carousel (12,13) at said approach length (17) of the said mould halves (14, 15);

- compressing said strip (10) between said mould halves (14,15) in order to shape it;

- retrieving said strip (10A) shaped when exiting the moulds in the said separation area (18) of the mould halves (14,15).

2. Method according to claim 1, wherein the thermoplastic material of the extruded strip (10) fed to the carousel (12,13) is in a plastic condition and is adapted to be moulded and shaped by said mould halves (14,15).

3. Method according to claim 1 or 2, wherein the extrusion speed is controlled so as to match the translation speed of the moulds (14,15) on the double vertical carousel (12,13) in the moulding length (16).

4. Method according to one of the preceding claims, wherein said method is continuously carried out to produce said interface element (2) in the form of a continuous shaped strip (10A).

5. Method according to one of the preceding claims, wherein said material

of the strip (10) is a flexible material, preferably a thermoplastic rubber, said strip (10) is preferably rolled up, preferably in reels.

6. Method according to one of the preceding claims, wherein at least one for each pair of mould halves (14,15) is cooled at least during the time in which the moulds are kept closed.

7. Method according to one of the preceding claims, wherein throughout the said moulding length (16) of the carousel (12,13) where the mould halves (14,15) are coupled, said pairs of mould halves (14,15) are arranged side-by-side without interruptions to form a single moulding template of the said extruded strip (10).

8. Apparatus for producing interface elements (2) for lighting devices, comprising a plurality of light sources aligned in at least one strip (10A), characterised by comprising:

- a plurality of male (15) and female (14) mould halves mounted on two vertical carousels (12,13) which translate the said mould halves (14,15) along a path which provides for a moulding length (16) in which the mould halves (14,15) are closed to define a moulding cavity (25), an approach length (17) of the said mould halves (14,15) and a separation length (18) of the mould halves (14,15), said approach length (17) and separation length (18) being arranged upstream and downstream, respectively, of the said moulding length (16) with respect to the direction of movement of said mould halves (14,15),
- at least one extruder (9), said extruder being configured to feed a continuous strip (10) of thermoplastic material to the said approach length (17) of the said mould halves (14,15);
- a control unit (19) configured to regulate the extrusion speed of the said extruder (9) and the translation speed of the said mould halves (14,15) along at least said moulding length (16),
- means (20) for retrieving said continuous strip (10A) shaped when exiting said separation area (18) of the mould halves.

9. Apparatus according to claim 8, wherein at least one of said mould halves (14,15) in a pair of mould halves is provided with cooling means and preferably with a movable male portion (15A).

10. Apparatus according to claim 8 or 9, wherein the template of at least one in each pair of mould halves (14,15) has two carvings on each of the transverse walls (27), with respect to the direction of movement of the mould halves (14,15), of the said mould halves.

11. Apparatus according to claim 10, wherein in said moulding length (16) of the carousels (12,13), the moulds formed by coupling the mould halves (14,15) are arranged side-by-side without interruptions on the transverse sides (27) to form a moulding cavity (25) formed by a plurality of coupled mould halves (14,15) and which extends continuously throughout the said moulding length (16).

12. Apparatus according to one of claims 8 to 11, wherein said pairs of mould halves (14,15) comprise a male mould half (15) and a female mould half (14), the wall of said female mould half being provided with a venting hole (26) to allow the material to come out during the moulding step.

13. Interface element (2) for a lighting device comprising a plurality of light sources aligned in at least one strip (10A), as obtainable by extrusion and shaping according to the method of one of claims 1 to 7.

14. Element according to claim 13, characterised by being at least one continuous strip, preferably of a flexible material, said strip comprising a plurality of shapes aligned in a row, said shapes comprising a cavity (6) and two openings (4,5) on opposite sides of the said element, said shapes being preferably selected from polyhedra and solids of revolution.

15. Lighting device comprising a plurality of light sources aligned in at least one strip and arranged on the rear of an interface element (2) provided with a plurality of openings (4,5,6) for passing a light beam coming from said light sources, characterised in that said interface element (2) is an element according to claim 13 or 14.

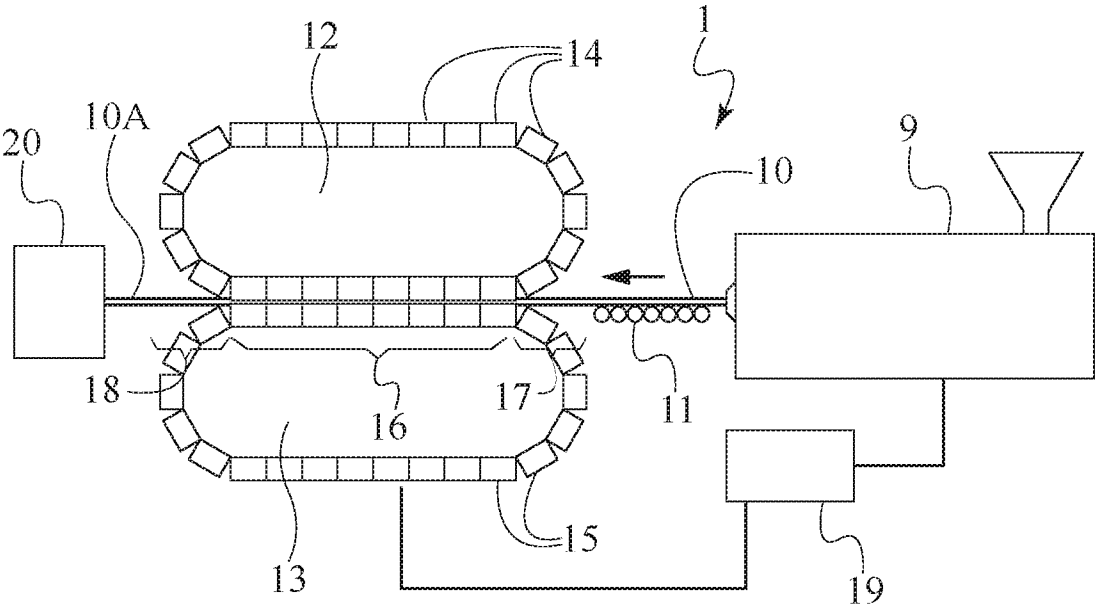

Fig. 1

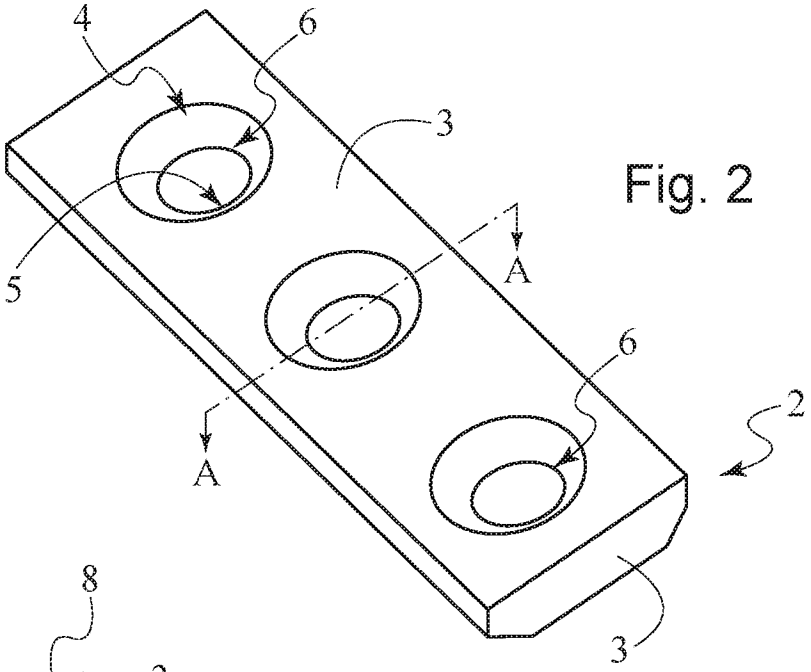

Fig. 2

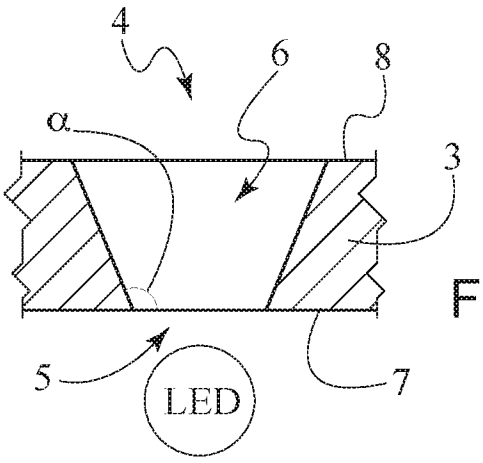

Fig. 3

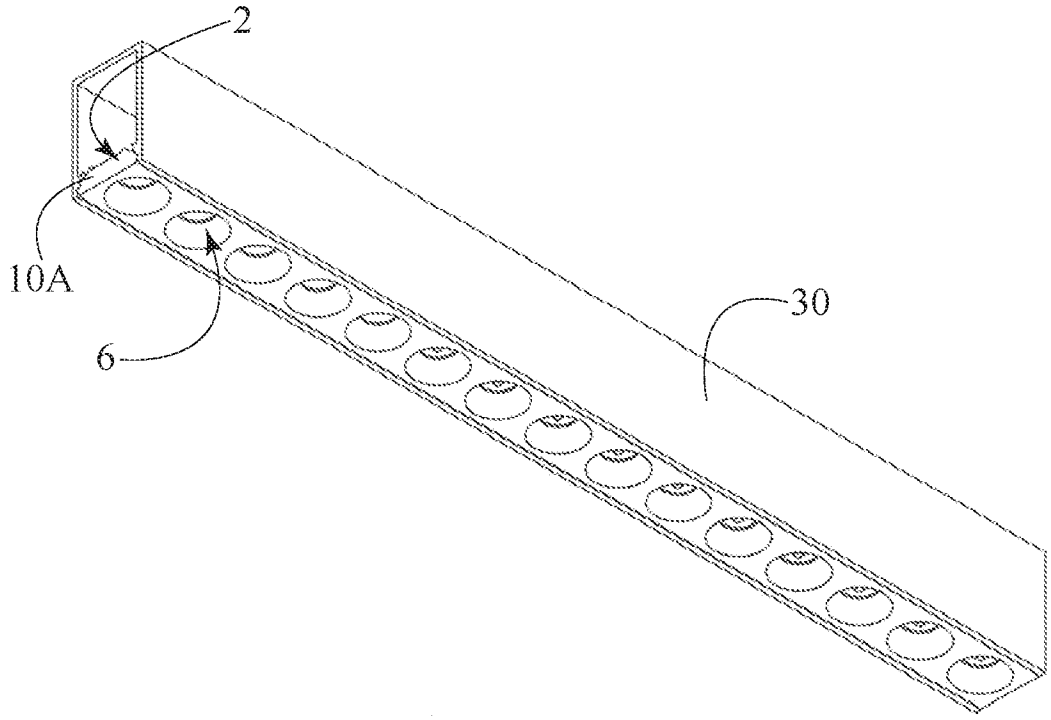

Fig. 2a

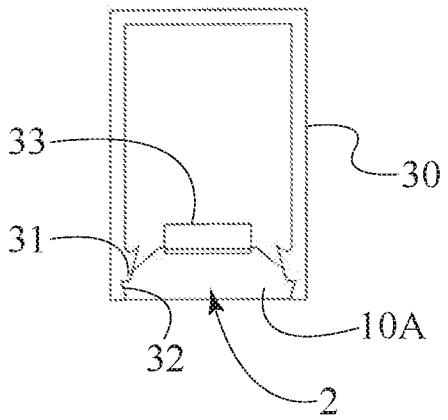

Fig. 2b

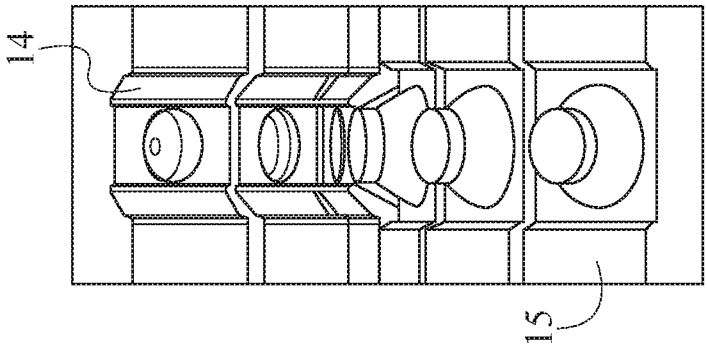

Fig. 6

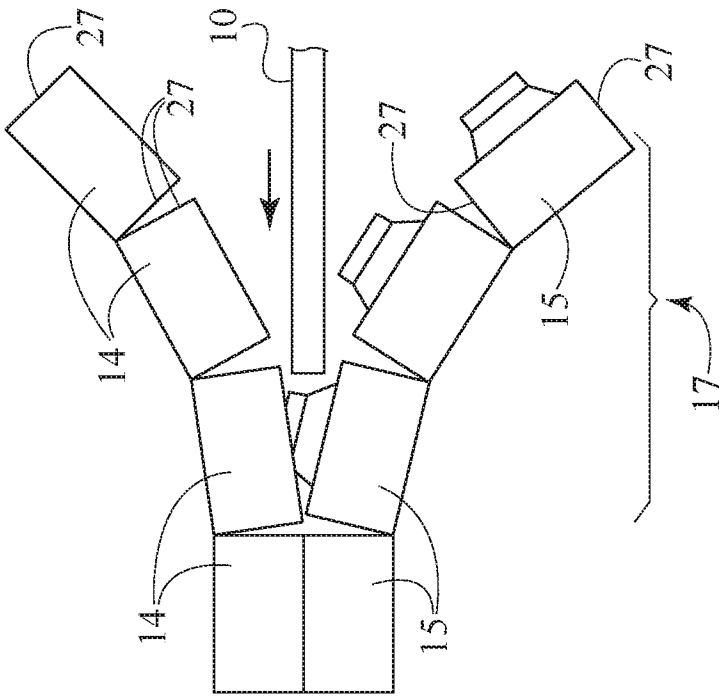

Fig. 4

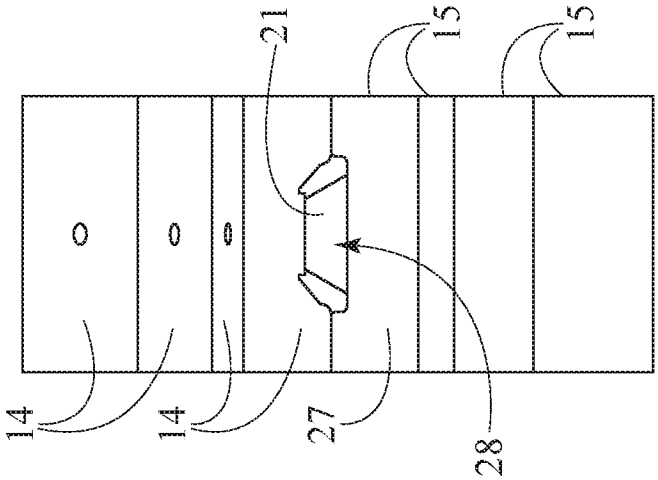

Fig. 5

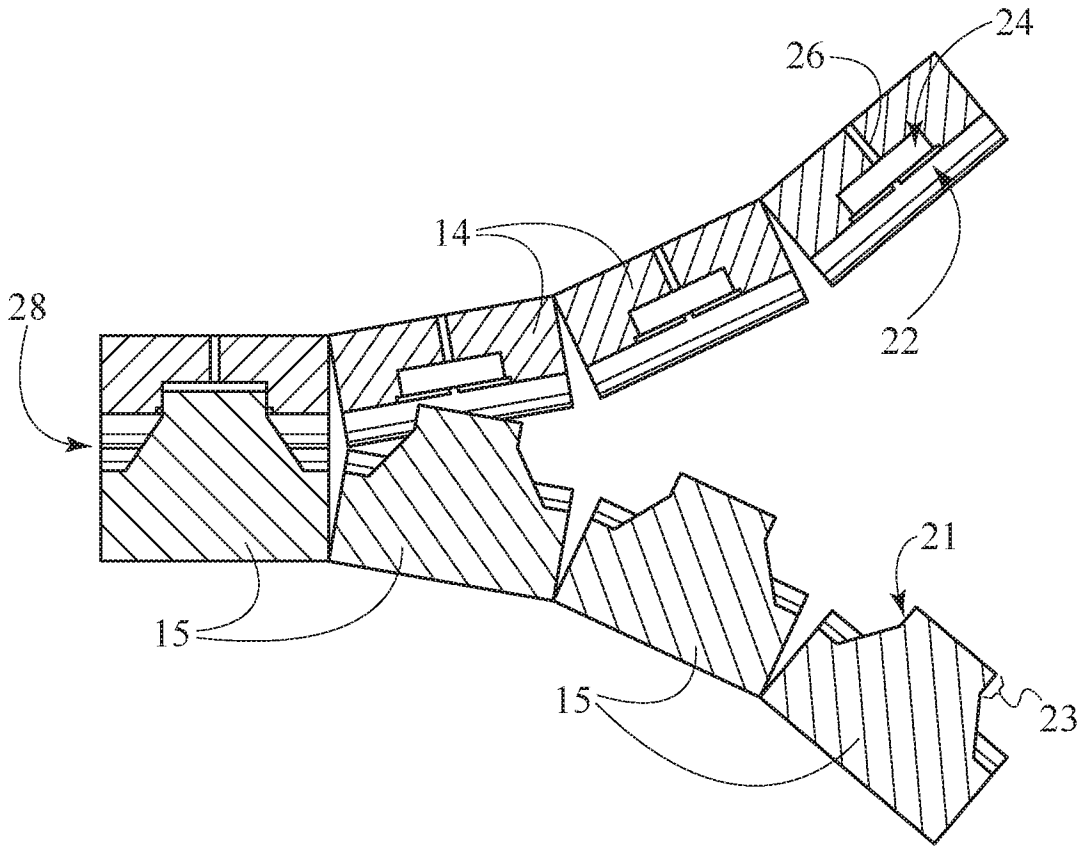

Fig. 7

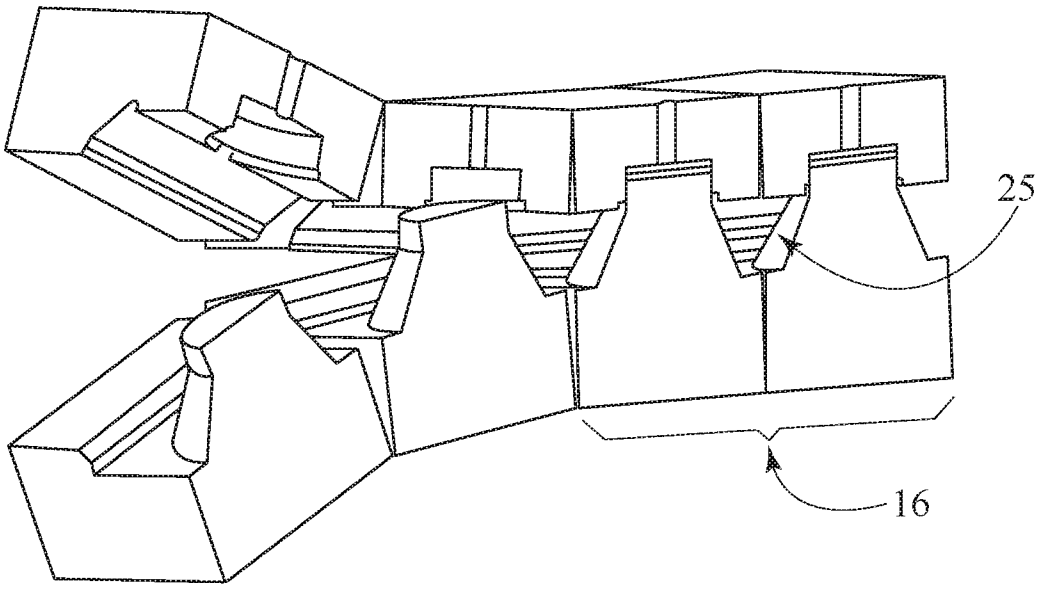

Fig. 8

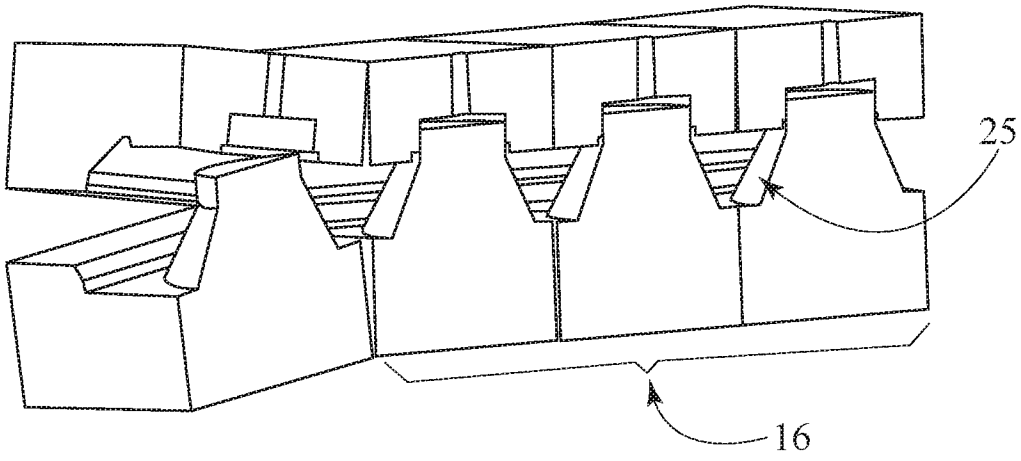

Fig. 9

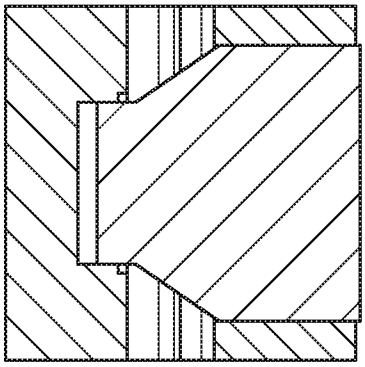

Fig. 10C

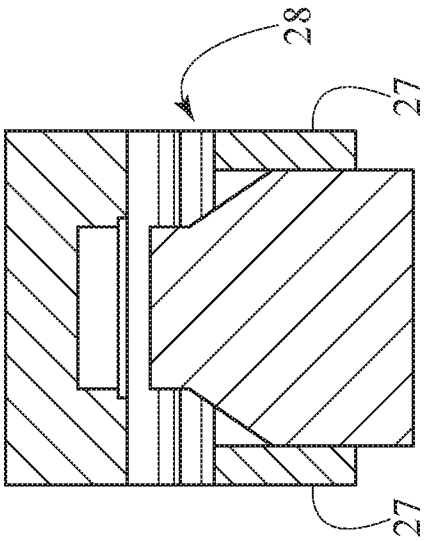

Fig. 10B

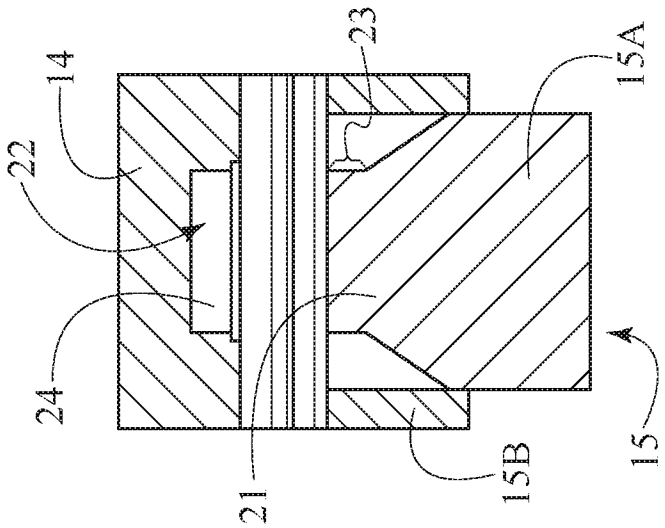

Fig. 10A

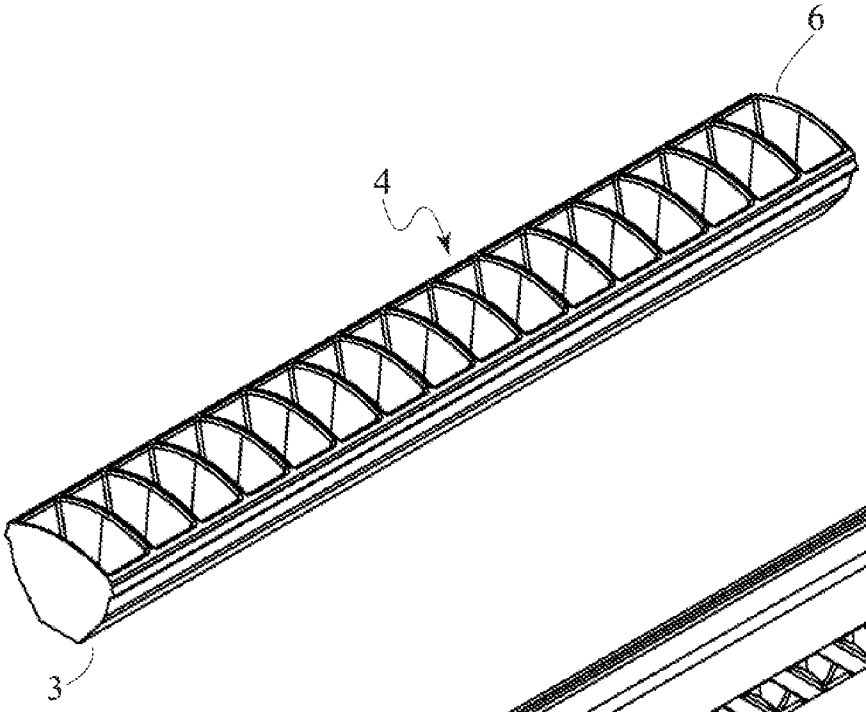

Fig. 11A

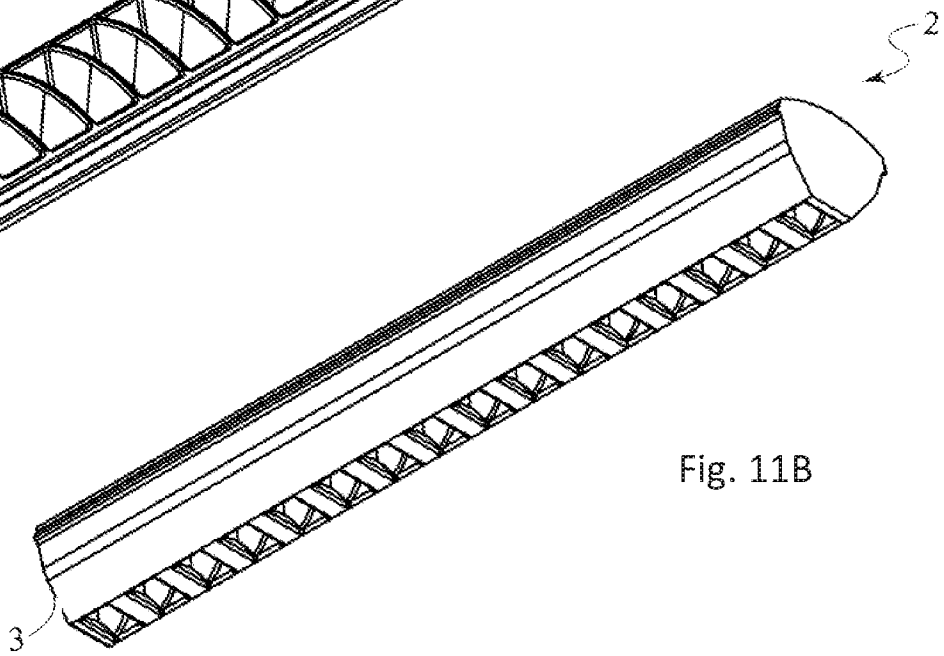

Fig. 11B

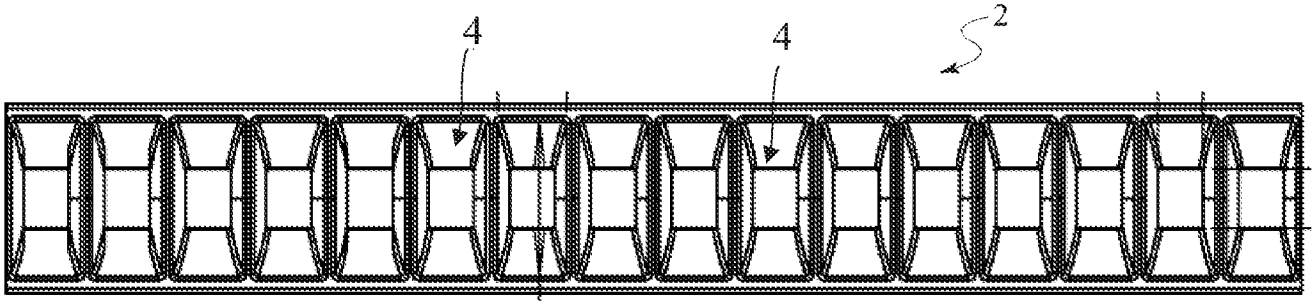

Fig. 12

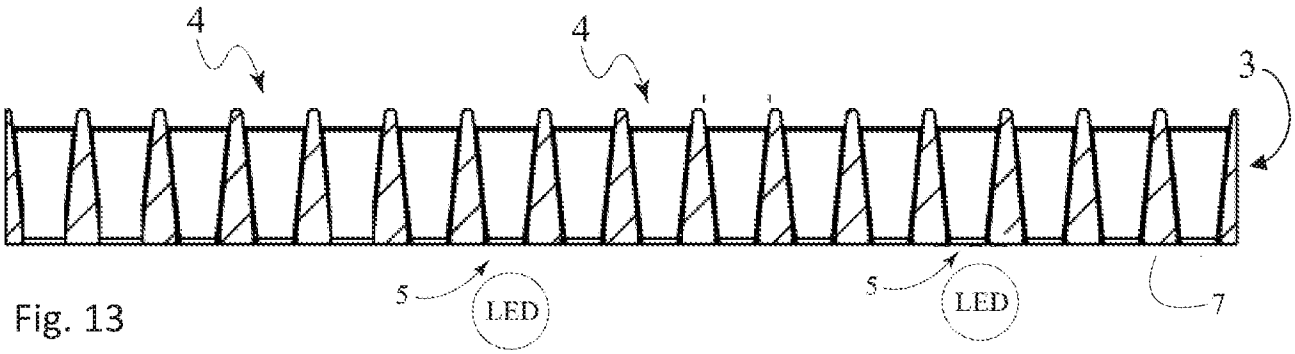

Fig. 13

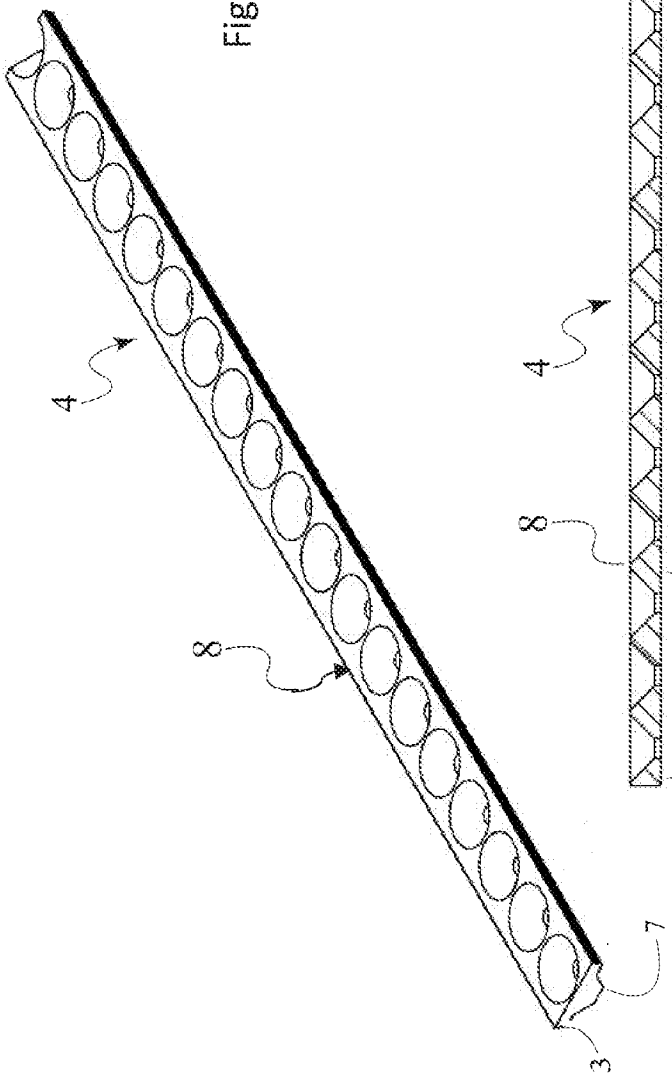

Fig. 14

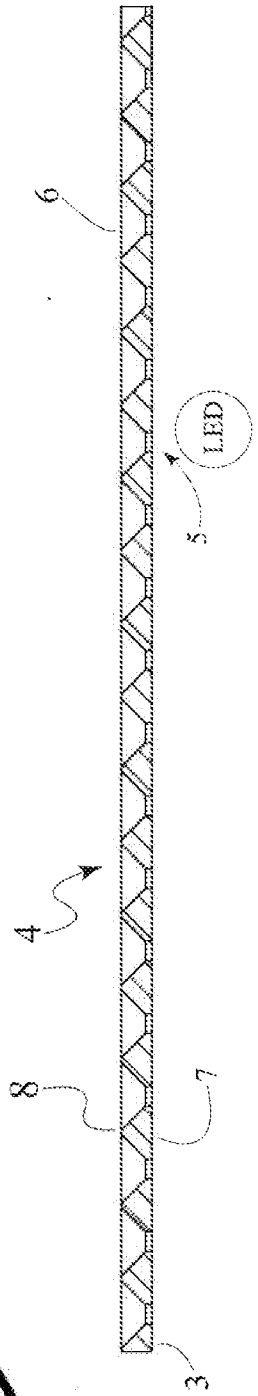

Fig. 15

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2024/055658

A. CLASSIFICATION OF SUBJECT MATTER

INV. B29C48/30 F21V7/00 B29C48/07 B29C33/36 B29C43/22
ADD.

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)

B29C F21V B29K B29L F21S

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)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2013/314796 A1 (HITOMI KAZUTOSHI [JP] ET AL) 28 November 2013 (2013-11-28)	13,15
A	abstract paragraph [0128] figures 1,2	1-12,14
A	US 4 226 580 A (LUPKE GERD P H ET AL) 7 October 1980 (1980-10-07) abstract figures 1,2,10	1-15
A	EP 3 109 535 A1 (USM HOLDING AG [CH]) 28 December 2016 (2016-12-28) abstract figure 3B	1-15

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[x] Further documents are listed in the continuation of Box C.

[x] See patent family annex.

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"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

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"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

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Date of the actual completion of the international search	Date of mailing of the international search report
11 October 2024	22/10/2024

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Koning, Erik

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Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2024/055658

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2014/138295 A2 (SLOAN CO INC DBA SLOANLED [US]) 12 September 2014 (2014-09-12) abstract paragraph [0084] figure 5	1-15

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Information on patent family members

International application No
PCT/IB2024/055658

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