



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication: **13.04.2011** **Bulletin 2011/15** (51) Int Cl.: **F21V 7/00** (2006.01) **F21K 99/00** (2010.01)

(21) Application number: **10179653.0**

(22) Date of filing: **24.09.2010**

(84) Designated Contracting States: AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO SE SI SK SM TR Designated Extension States: BA ME RS (30) Priority: 06.10.2009 IT TV20090194	(71) Applicant: Combustion and Energy S.r.l. 23848 Oggiono - Lecco (LC) (IT) (72) Inventor: Di Giovine, Vincenzo 22040, Lecco (LC) (IT) (74) Representative: Gallo, Luca Gallo & Partners S.r.l. Via Trieste 49 35121 Padova (IT)
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(54) **Lighting device**

(57) Lighting device (1), comprising: a first reflector (4) that is fixed to a support structure (2), extends in a longitudinal direction (X) symmetrically with respect to a middle plane (α) parallel to the longitudinal direction (X), and is equipped with at least two first concave surfaces (5) extending symmetrically from the middle plane (α) from a common ridge (6) positioned at the middle plane (α); a plurality of LEDs (3) fixed to the support structure (2), positioned aligned with one in front of the ridge (6) of the first reflector (4), emitting first beams of light rays onto the first concave surfaces (5), which reflect them with second beams of light rays propagating symmetri-

cally away from the middle plane (α) prevalently along light propagation directions (Y) perpendicular to the middle plane (α); Moreover, the lighting device (1) comprises two second reflectors (7) mechanically connected to the support structure (2), and each positioned outside of the respective first concave surface (5) of the first reflector (4) away from the middle plane (α) along the light propagation directions (Y).

Each of the second reflectors (7) extends with longitudinal extension parallel to the longitudinal direction (X) and is equipped with at least one second concave surface (8) arranged to intercept the second beams of light rays, which reflects with third beams of light rays.

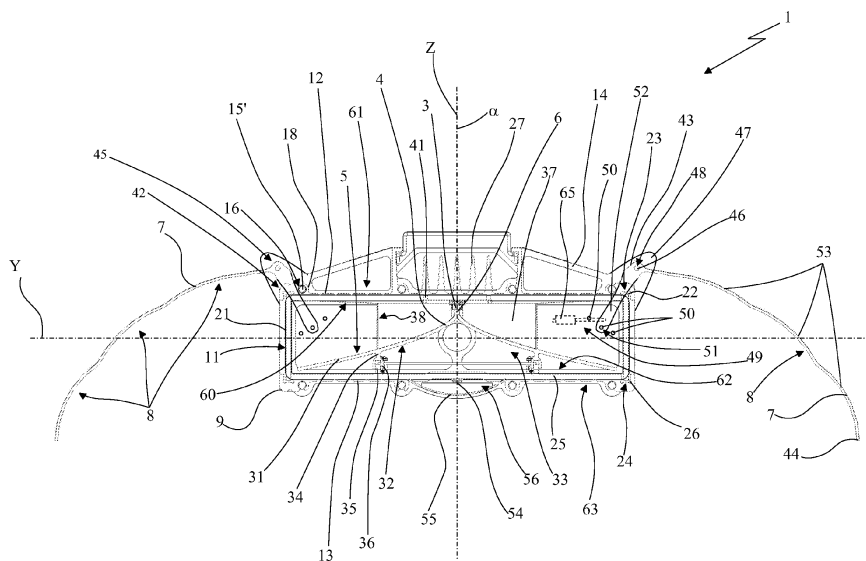


Fig. 4

Description

DESCRIPTION

Field of application

[0001] The present invention refers to a lighting device according to the preamble of the independent claim.

[0002] The lighting device concerned is intended to be advantageously used to light indoor locations like for example houses, offices, sheds, cinemas, theatres, etc., and outdoor locations such as streets, town squares, parking lots, parks, stadia, etc.

[0003] More specifically, the invention is in the industrial sector of the production of lighting apparatuses and systems equipped with LED light sources and it can advantageously be used for designs in the lighting-technical field.

State of the art

[0004] Lighting devices equipped with LED light sources are increasingly common on the market, since they demonstrate higher light efficiency with respect to most conventional light sources (like for example incandescent lamps, fluorescent lamps, discharge lamps).

[0005] For example, patent EP 1628070 describes a lighting device comprising a containment body having an elongated shape closed at the top by a first reflector with a concave section facing downwards, which supports a row of LEDs inside the containment body, said LEDs being arranged above a second reflector having an elongated shape and equipped with two longitudinal concave surfaces facing upwards and facing the first reflector. Such concave surfaces are suitable for reflecting the light emitted by the LEDs towards the first reflector, which in turn reflects it downwards, collimating it into beams of light rays that are parallel to one another and perpendicular to the ground. The beams of light rays generated by the first reflector come out from the lighting device through two openings formed on the bottom of the containment body at the sides of the first reflector, to light the floor of a room or of a corridor.

[0006] A first drawback of the lighting device briefly described above is the fact that it does not allow the floor to be lit uniformly, since the collimated beams of light rays generated by the first reflector are not able to reach the area of the floor located under the first reflector with a consequent formation of a dark zone on the floor.

[0007] A further drawback of the lighting device described in EP 1628070 is the fact that it does not allow the extension of the surface to be lit on the floor to be adjusted, since the first and the second reflector are mounted in a fixed manner with respect to the LEDs.

[0008] A further drawback of the lighting device described in EP 1628070 is due to the fact that it does not foresee means for suitably dissipating the heat emitted by the LEDs while they operate. Such heat result in a

substantial increase in temperature of the LEDs causing a substantial drop in efficiency of the LEDs themselves and a significant reduction in average lifetime.

[0009] A further drawback of the lighting device described in EP 1628070 is the fact that it is not suitable for being installed outdoors, since it necessarily foresees two openings to let the light out from the containment body, which allow atmospheric agents (like for example rain, humidity, etc.) to come into direct contact with the LEDs causing them to rapidly deteriorate.

Presentation of the invention

[0010] In this situation, the essential purpose of the present finding is therefore to avoid the drawbacks of the known solutions quoted above, by providing a lighting device capable of uniformly lighting an area, in particular without the formation of dark zones within the lit surface.

[0011] A further purpose of the present invention is to provide a lighting device that allows the extension of the surface to be lit to be varied.

[0012] A further purpose of the present invention is to provide a lighting device capable of operating totally efficiently in any location, in particular outdoors.

[0013] A further purpose of the present invention is to provide a lighting device capable of ensuring high lighting efficiency and long lifetime of the light sources.

[0014] A further purpose of the present invention is to provide a lighting device that is constructively simple and cost-effective to produce.

Brief description of the drawings

[0015] The technical characteristics of the finding, according to the aforementioned purposes, can be clearly seen from the content of the claims given below and its advantages will become clearer from the following detailed description, made with reference to the attached drawings, which represent a purely exemplificative and not limiting embodiment, in which:

- figure 1 shows a perspective view from above of the lighting device object of the present invention;
- figure 2 shows a perspective view from below of the lighting device object of the present invention;
- figure 3 shows a plan view from above of the lighting device object of the present invention;
- figure 4 shows a section view of the lighting device illustrated in figure 1 according to the line IV-IV of the same figure 1.

Detailed description of a preferred embodiment

[0016] With reference to the attached drawings the lighting device object of the present invention has been wholly indicated with 1, said device being intended to be mounted on a support structure (not illustrated), like for example a lamp post, or a ceiling, or a frame intended to

carry many lighting devices simultaneously, etc. In accordance with the attached figures, the lighting device 1 comprises a support structure 2 to which a plurality of LEDs 3 and a first reflector 4 are fixed.

[0017] In particular, the first reflector 4 extends in a longitudinal direction X symmetrically with respect to a middle plane α parallel to such a longitudinal direction X, and it is equipped with two first concave surfaces 5 extending symmetrically from the middle plane α from a common ridge positioned substantially at such a middle plane α .

[0018] The LEDs are positioned aligned with one another at the middle plane α , and in front of the ridge 6 of the first reflector 4, and they emit first beams of light rays onto the first concave surfaces 5, which reflect them with second beams of light rays propagating symmetrically away from the middle plane α prevalently along light propagation directions Y perpendicular to the middle plane α .

[0019] In accordance with the idea forming the basis of the present invention, the lighting device 1 also comprises two second reflectors 7 mechanically connected to the support structure 2, positioned along opposite sides of the lighting device 1 with respect to the middle plane α , and positioned outside of the respective first concave surface 5 of the first reflector 4 going away from the middle plane α along the light propagation directions Y of the second beams of light rays coming from such a respective surface.

[0020] Each second reflector 7 extends with longitudinal extension X parallel to the longitudinal direction X and is equipped with at least one second concave surface 8 arranged to intercept the second beams of light rays coming from the respective first concave surface 5 of the first reflector 4.

[0021] Moreover, the second concave surfaces 8 of the second reflectors 7 reflect the second beams of light rays coming from the respective first concave surfaces 5 with third beams of light rays preferably having greater divergence than that of the second beams of light rays.

[0022] Advantageously, the support structure 2 of the lighting device 1 comprises a containment body 9 inside which the LEDs and the first reflector 4 are housed.

[0023] Moreover, the containment body 9 is equipped with two side openings 11 that extend parallel to the longitudinal direction X, which are passed through going out by the second beams of light rays coming from the first concave surfaces 5 of the first reflector 4, and which face at least one portion of the second concave surfaces 8.

[0024] In greater detail, the two side openings 11 are formed on the containment body 9 in a symmetrical position with respect to the middle plane α and are arranged substantially facing it. Each side opening 11 is arranged between the corresponding first concave surface 5 of the first reflector 4 and the corresponding second reflector 7 to allow the second beams of light rays coming from the first reflector 4 to reach the second concave surface 8 of the second reflector 7.

[0025] In accordance with the embodiment illustrated in the attached figures, the containment body 9 is substantially box-shaped extending prevalently according to the longitudinal direction X of the first reflector 4, with its two longitudinal sides provided with the aforementioned side openings 11.

[0026] Advantageously, the containment body comprises a first wall 12 (upper) carrying the LEDs 3 fixed to it, and a second wall 13 (lower) facing the first 12 carrying the first reflector 4 fixed to it, and two third walls 14 (front), of which one is front and one is back, suitable for closing the containment body 9 at the ends. The first reflector 4 is arranged between the first 12 and the second 13 wall with its two first concave surfaces 5 substantially facing towards the first wall 12.

[0027] In greater detail, the first wall 12 is equipped with a first inner face 60, on which the LEDs 3 are arranged, and with a first outer face 61 on which metal fins 27 are fixed to dissipate the heat generated by the operation of the LEDs 3 as specified more clearly hereafter.

[0028] The second wall 13 is in turn equipped with a second inner face 62, on which the first reflector 4 rests, and an outer face facing in particular towards the ground to be lit, in the case in which the lighting device 1 is hung from the ceiling of a building.

[0029] In greater detail, the first wall 12 is equipped with two or more plate-shaped portions 19 extending to project like a step from its first outer face 61, in particular parallel to the longitudinal direction X, and intended to be connected, for example through one or more connection brackets 20, to the support structure of the lighting device 1.

[0030] The first and second wall 12, 13 are connected to one another by the two third (front) walls 14 that are parallel and face one another and are perpendicular to the longitudinal direction X, which are positioned at the ends 10 of the containment body 9 to close it.

[0031] In greater detail, the first and second wall 12, 13 extend prevalently according to the longitudinal direction X perpendicular to the middle plane α and symmetrically with respect to the latter.

[0032] In accordance with the embodiment illustrated in the attached figures, the lighting device 1 is arranged with the first and second wall 12, 13 positioned horizontally, in particular to close the containment body 9 at the top and bottom respectively. In this embodiment, the light emitted by the device 1 to light up the area is thus obtained with third beams of light rays substantially facing downwards.

[0033] The first and second walls 12, 13 of the containment body 9 are preferably made from metal, for example aluminium, obtained through extrusion.

[0034] The two third walls 14 are fixed to the first 12 and to the second 13 wall through first attachment means 15, comprising for example first screws 15', which are inserted into first longitudinal perforations 16 formed on the first and second wall 12, 13 and aligned with corresponding first holes 17 formed on the third walls 14, and

act upon the latter to hold them fixedly connected to the first and second wall 12, 13 themselves.

[0035] In greater detail, with reference to figure 4, the first longitudinal perforations 16 are formed in ribs 18 extending from the first and from the second wall 12, 13 and obtained in a single piece with the corresponding walls 12, 13 through an extrusion process. In accordance with the example embodiment illustrated in the figures, the ribs 18 extend from the outer faces 61, 62 of the corresponding walls 12, 13.

[0036] Advantageously, each longitudinal window 11, through which the second beams of light rays coming from the first reflector 4 come out from the containment body 9, is closed by a refraction plate 21 fixed to the containment body 9 and positioned between the first wall 12 and the second wall 13.

[0037] In greater detail, the refraction plates 21 are arranged in a symmetrical position with respect to the middle plane α , preferably parallel to the latter.

[0038] With reference to the embodiment illustrated in figure 3, each refraction plate 21 is arranged with its own longitudinal profiles 22 inserted into first and second longitudinal grooves 23, 24 respectively formed on the first inner face 60 of the first wall 12 and on the second inner face 62 of the second wall 13.

[0039] Each refraction plate 21 is made from substantially transparent material to allow the second beams of light rays to come out from the containment body 9.

[0040] By the term "substantially transparent" we mean that the refraction plate 21 can be made from perfectly transparent material, translucent material, or material equipped with pigments that allow just certain wavelengths of light corresponding to certain colours to pass.

[0041] Preferably, the refraction plates 21 are made from an optically homogeneous material, like for example glass or else a plastic material, in particular an acrylic polymer like for example PMMA.

[0042] The first and second wall 12, 13 and the refraction plates 21, at each end 10 of the containment body 9, define a front edge sealed closed by the corresponding third wall 14 with the interposition of a first gasket 25 between such an edge and the wall 14 itself.

[0043] Moreover, there are second gaskets 26 arranged along the longitudinal profiles 22 of the refraction plates 21 to keep the latter in a sealed relationship with the first and with the second wall 12, 13. In particular, such second gaskets 26 are inserted inside the first and second longitudinal grooves 23, 24, respectively, of the first and second wall 12, 13 and are U-shaped to house the longitudinal profiles 22 of the refraction plates 21 inside them.

[0044] Such first and second gaskets 25, 26 have the function of making the inside of the containment body 9, in which the LEDs 3 are arranged, fluid-tight, in particular preventing water and humidity from infiltrating and therefore making the lighting device 1 particularly suitable for operating outdoors and in any atmospheric condition.

[0045] Advantageously, the lighting device 1 object of

the present invention comprises a plurality of metal fins 27 extending from the first wall 12 outside of the containment body 9 to disperse the heat generated by these while they operate.

[0046] In greater detail, the metal fins 27 extend comb-like from the first outer face 61 of the first wall 12 parallel to the longitudinal direction X and they are arranged substantially at the LEDs 3 fixed onto the first inner face 60 of the first wall 12. Preferably, such metal fins 27 are also made in a single piece with the first wall 12 of the containment body 9 through an extrusion process.

[0047] With reference to the embodiment illustrated in figure 4, the LEDs 3 aligned in front of the ridge 6 of the first reflector 4 are divided into many groups 28 each comprising many LEDs 3 (for example eight) and fixed onto a first inner face 60 of the first wall 12 of the containment body 9.

[0048] Preferably, the LEDs 3 of each group 28 are mounted onto a printed circuit fixed onto a support plate 30, which is in turn fixed to the first wall 12 of the containment body 9 through, for example, second screws screwed into corresponding second threaded holes formed on the inner face 60 of the first wall 12 itself.

[0049] In greater detail, each support plate 30 is made from aluminium to efficiently transfer the heat generated by the LEDs 3 of the corresponding group 28 by conduction to the first wall 12 and then to the metal fins 27 suitable for dissipating the heat outside of the containment body 9.

[0050] With reference to the embodiment illustrated in figure 4, the LEDs 3 are aligned in front of the ridge 6 of the first reflector 4 and are each equipped with its own emission axis Z of the beam of light rays, said axis Z being perpendicular to the first wall 12 on which the LEDs 3 are mounted and lying on the middle plane α intersecting the ridge 6 of the first reflector 4 itself.

[0051] Advantageously, the first beam of light rays emitted by the LEDs 3 has a divergence angle centred on the axis Z of between 80 and 140 degrees.

[0052] In accordance with the embodiment illustrated in figure 4, the first beams of light rays propagate from the LEDs 3 symmetrically with respect to the middle plane α (for example with an angle of about 60° from each side of the middle plane α) therefore being distributed substantially equally shared over two first concave surfaces 5 of the first reflector 4.

[0053] In accordance with the embodiment illustrated in figure 3 and 4, the first reflector 4, preferably made from metal, in particular aluminium, comprises two arched portions 31, each of which defines one of the two first concave surfaces 5 on one side and a corresponding convex surface 32 facing towards the second inner face 62 of the second lower wall 13 on the other side.

[0054] In greater detail, each arched portion 31 of the first reflector 4 extends in the longitudinal direction X from a generatrix section having a substantially cone-section shape, and in particular a parabola-section shape. Otherwise, in accordance with a particular solution that has

not been illustrated of the present finding, the generatrix section of the arched portions 31 has a linear progression in sections that approximates the shape of a cone, in particular a parabola.

[0055] In accordance with the attached figures, the first reflector 4 comprises at least two first shaped holding portions 34 extending from its convex surfaces 32 and mechanically connected in shape relationship to corresponding second holding portions 35 extending from the second inner face 62 of the second wall 13.

[0056] In greater detail, the first holding portions 34 are shaped like an inverted U with their arms 36 internally serrated. The second holding portions 35 consist of elongated ribs with the edges serrated so as to insert in an anchoring relationship between the serrated arms 36 of the first holding bodies 35.

[0057] Advantageously, the lighting device 1 object of the present invention comprises a plurality of dividing reflector walls 37, which rise up parallel to one another from the first concave surfaces 5 of the first reflector 4 perpendicular to the longitudinal direction X separating the plurality of LEDs 3 into the groups 28 (described earlier) to reflect their first beams of light rays towards the side openings 11 of the containment body 9.

[0058] The aforementioned dividing reflector walls 37 are preferably made from plastic and are shaped with decreasing thickness going from the middle plane α towards the side ends 38.

[0059] With reference to the embodiment illustrated in figure 4, the dividing walls 37 extend vertically between the first reflector 4 and the first wall 12 of the containment body 9.

[0060] Each dividing wall 37 is provided at the bottom with a substantially inverted V-shaped recess, inside which the ridge 6 of the first reflector 4 is inserted, and it is equipped on the top with attachment teeth 41 inserted into corresponding third holes formed on the first wall 12.

[0061] Functionally, such dividing walls 37 reflect the first beams of light rays emitted by the LEDs 3 and the second beams of light rays coming from the first reflector 4 limiting their divergence in the longitudinal direction X and contributing to the orientation of such beams towards the refraction plates 21 prevalently along the first direction of propagation Y.

[0062] Moreover, the dividing walls 37 prevent the first beams of light rays emitted by the LEDs 3 from directly reaching an observer causing him to be dazzled.

[0063] As already stated earlier, the first concave surfaces 5 of the first reflector 4 reflect the first beams of light rays emitted by the LEDs 3 with the second beams of light rays propagating symmetrically away from the middle plane α towards the second concave surfaces 8 of the second reflectors 7.

[0064] The second beams of light rays coming from the first reflector 4 are reflected by the second surfaces 8 of the second reflectors 7 with the third beams of light rays facing towards the location to be lit.

[0065] Advantageously, the second beams of light

rays coming from the concave surfaces 5 of the first reflector 4 have lower divergence than that of the first beams of light rays emitted by the LEDs 3. Preferably, such second beams have a divergence of less than about 30°.

[0066] In this way, the light rays of the second beams strike the refraction plates 21 of the side openings 11 with a relatively small angle of incidence, allowing the containment body 9 of the lighting device 1 to be made with particularly small dimensions and allowing the second reflectors 7 to precisely direct the light towards the location to be lit.

[0067] As stated earlier, the second reflectors 7 are positioned outside of the first concave surfaces 5 of the first reflector 4, so that the latter does not block the propagation of the third beams of light rays below the device 1.

[0068] By the term "outside" we mean that the projection of the two second reflectors 7 on a plane perpendicular to the middle plane α and parallel to the longitudinal direction X does not intersect the projection of the first reflector 4 on the same plane.

[0069] Advantageously, the third beams of light rays are able to project towards the middle plane α below the first reflector 4.

[0070] In particular, the third beams of light rays generated by each second concave surface 8 of the second reflectors 7 have a divergence able to allow the rays to uniformly light up the area located under the containment body 9 of the lighting device 1 even when the lighting device 1 is positioned a relatively short distance from the ground.

[0071] With reference to the embodiment illustrated in the attached figures, the two second reflectors 7 are mechanically connected to the containment body 9 at two respective side corners 42 of the first wall 12.

[0072] In particular, each second reflector 7 is made with an arched foil, preferably made from metal, for example aluminium, obtained through an extrusion process. Each second reflector 7 is also equipped with a first longitudinal edge 43, at which it is fixedly connected to the support structure 2, and with a second longitudinal edge 44 that is free and parallel to the first 43.

[0073] Advantageously, each second reflector 7 is mechanically connected in a mobile manner to the support structure 2 through hinge connection means 45 having a rotation axis R parallel to the longitudinal direction X, and it can be adjusted between many reflection positions having different inclinations with respect to the middle plane α . Moreover, the lighting device 1 comprises adjustment means 49 acting on the second reflectors 7 to stop the latter selectively in the aforementioned reflection positions.

[0074] In greater detail, the hinge connection means 45 comprise at least one pin 46 aligned with the rotation axis R and fixed to the containment body 9 at the longitudinal edges 42 of the first wall 12. Moreover, the pin 46 is inserted into a second longitudinal perforation 48 formed on the relative second reflector 7 at its first lon-

gitudinal edge 43, so that such a second reflector 7 can rotate around the rotation axis R between the aforementioned reflection positions.

[0075] In particular, each pin 46 of the hinge connection means 45 is fixed between the two third walls 14 of the containment body 9, preferably at projecting portions 47 thereof extending outside the containment body 9 beyond the first outer surface 61 of the first wall 12.

[0076] In accordance with the particular embodiment illustrated in the attached figures, the positioning means 49 comprise, for each second reflector 7, many pins 50 fixed to the third walls 14 of the containment body 9 and extending parallel to the longitudinal direction X to interfere with the rotation movement of the corresponding second reflector 7 to keep it fixed in the desired reflection position. In greater detail, each pin 50 is fixed to the third wall 14 of the containment body in a corresponding interference position, which defines the corresponding reflection portion of the second reflector 7 on which the pin 50 itself acts.

[0077] In accordance with the embodiment illustrated in figures 3 and 4, each pin 50 extends projecting from the relative third wall 14 inside the containment body 9 and able to be inserted into a fourth hole 51 formed on an extension 52 of the second reflector 7, which extends inside the containment body 9 from the first longitudinal edge 43 of the second reflector 7 itself. According to such an embodiment, the pins 50 are arranged on an arc of circumference with centre on the rotation axis Z of the corresponding second reflector 7.

[0078] In accordance with the different embodiment that is not illustrated, the second reflector 7 will be locked in the desired reflection position going with the protuberance 52 in abutment on the pin 50 corresponding to such a reflection position.

[0079] Of course, in a totally equivalent manner, it is possible to foresee a pin 50 on the extension 52 and a plurality of holes 51 on the third wall 14.

[0080] In accordance with a further embodiment that is not illustrated, the adjustment means 49 comprise motorised actuators, able to be actuated to make the second reflectors 7 rotate automatically. In accordance with a particular embodiment, the adjustment means 49 comprise, for each second reflector 7, an actuator 65 (indicated with a broken line in figure 4) mounted inside the containment body 9 and acting on the corresponding second reflector 7 to make the latter rotate around the rotation axis R. Advantageously, the actuator 65 is hinged to the third wall 14 of the containment body 9, and it actuates an extensible arm hinged to the extension 52 of the corresponding second reflector 7.

[0081] Of course, each second reflector 7 can be positioned in the same reflection position as the other second reflector 7, or else it can also be positioned in different reflection positions to the other second reflector 7, according to the shape and size of the area that it is wished to light up.

[0082] Advantageously, each second reflector 7 is

equipped with at least two contiguous second concave surfaces 8 extending parallel along the longitudinal direction X. In greater detail, each second reflector 7 is shaped with many longitudinal lobes 53 (for example three), each of which defines a corresponding second concave surface 8.

[0083] Advantageously, the portion of the second reflector 7 facing the side opening 11 to receive the second beams of light rays coming from the first reflector 4 substantially corresponds to one of the second concave surfaces 8 with the second reflector 7 stopped in a corresponding reflection position. Basically, each reflection portion of the second reflector 7 corresponds to a respective second concave surface 8 that intercepts the second beams of light rays coming from the first reflector 4.

[0084] In accordance with the embodiment illustrated in the attached figures, each second reflector 7 is equipped with three concave surfaces 8, each of which corresponding to one of the reflection positions of the second reflector 7. For example, there is a first reflection position, in which the second reflector 7 has a first inclination of about 20° and intercepts the second beams of light rays with the second concave surface 8 closest to its first longitudinal edge 43, a second reflection position, in which the second reflector 7 has a second inclination of about 50° and intercepts the second beams of light rays with the second concave surface 8 arranged in an intermediate position between its longitudinal edges 43, 44, and a third reflection position, in which the second reflector 7 has a third inclination of about 70° and intercepts the second beams of light rays with the second concave surface 8 closest to its second longitudinal edge 44. Advantageously, the lighting device comprises a plurality of auxiliary light sources 54 fixed onto the second outer face 63 of the second wall 13 of the containment body 9 and suitable for emitting fourth beams of light rays towards the ground.

[0085] In greater detail, the auxiliary light sources 54 are arranged aligned with one another parallel to the longitudinal direction X preferably at the middle plane α and they preferably consist of light emitting diodes, intended to be used for example to generate courtesy lights.

[0086] Preferably, the lighting device 1 comprises an substantially transparent elongated foil 55, having an arched shape and fixed onto the second wall 13 in front of the auxiliary light sources 54 with a third concavity thereof facing towards the latter, so as to define, together with the second wall 13, a first seat 56 in which the auxiliary light sources 54 are housed to insulate them from the external environment.

[0087] Advantageously, the lighting device 1 comprises an electronic control unit 57 of the LEDs 3 housed inside the containment body 9 and fixed to the second wall 13 through second attachment means 58, comprising for example second screws 58'. In accordance with the embodiment illustrated in figure 3 and 4, the electronic control unit 57 comprises a printed circuit board 59, for example having a quadrangular shape, which is fixed to

the second wall 13 of the containment body 9 through the second screws 58' inserted into fifth holes formed on the board 59 and screwed into third threaded longitudinal grooves 64 formed on the second inner face 62 of the second wall 13.

[0088] In accordance with the embodiment illustrated in figures 3 and 4, the electronic control unit 57 is positioned inside the containment body 9 at the side of the first reflector 4 between the latter and one of the third walls 14 of the containment body 9 itself.

[0089] In accordance with a different embodiment that has not been illustrated, the electronic control unit 57 is positioned in a second seat 33 defined inside the containment body 9 between the convex surfaces 32 of the first reflector 4 and the second inner face 63 of the second wall 13.

[0090] The electronic control unit 57 is electrically connected to the LEDs 3 to control their actuation according to different operating modes, and it is connected, through electrical cables that are not illustrated since they are of the known type, to an electrical energy source. Moreover, the electronic control unit 57 is electrically connected to the auxiliary light sources 54 to also control their operation.

[0091] The finding thus conceived therefore achieves the predetermined purposes.

[0092] Of course, it can, in its practical embodiment, also take up different shapes and configurations from the one illustrated above, without for this reason departing from the present scope of protection. Moreover, all of the details can be replaced by technically equivalent elements and the shapes, sizes and materials used can be whatever according to requirements.

Claims

1. Lighting device (1), comprising:

- a support structure (2);
- at least one first reflector (4) that is fixed to said support structure (2), extends in a longitudinal direction (X) symmetrically with respect to a middle plane (α) parallel to said longitudinal direction (X), and is equipped with at least two first concave surfaces (5) extending symmetrically from said middle plane (α) from a common ridge (6) substantially positioned at said middle plane (α);
- a plurality of LEDs (3) fixed to said support structure (2), positioned aligned with one another at said middle plane (α), and in front of the ridge (6) of said first reflector (4), emitting first beams of light rays onto said first concave surfaces (5), which reflect them with second beams of light rays propagating symmetrically away from said middle plane (α) substantially prevalently along light propagation directions (Y) per-

pendicular to said middle plane (α);

said lighting device (1) being **characterised in that** it also comprises at least two second reflectors (7) mechanically connected to said support structure (2), and each positioned outside of a respective said first concave surfaces (5) of said first reflector (4) away from said middle plane (α) along said light propagation directions (Y) perpendicular to said middle plane (α);

each of said second reflectors (7) extending with longitudinal extension parallel to said longitudinal direction (X) and being equipped with at least one second concave surface (8) arranged to intercept said second beams of light rays, which reflects with third beams of light rays.

2. Lighting device (1) according to claim 1, **characterised in that** said third beams of light rays are able to project towards said middle plane (α) below said first reflector (4).
3. Lighting device (1) according to claim 1, **characterised in that** said support structure (2) comprises a containment body (9) inside which said plurality of LEDs (3) and said first reflector (4) are housed; said containment body (9) being equipped with at least two side openings (11) that extend parallel to said longitudinal direction (X), which are crossed going out by said second beams of light rays coming from said first concave surfaces (5), and which face at least one portion of said second concave surfaces (8).
4. Lighting device (1) according to claim 3, **characterised in that** said containment body (9) comprises a first wall (12) having said LEDs (3) fixed, and a second wall (13) facing the first wall (12) having said first reflector (4) fixed, which is arranged between said first (12) and second (13) wall with its first concave surfaces (5) substantially facing towards said first wall (12).
5. Lighting device (1) according to claim 4, **characterised in that** said first (12) and second (13) wall are connected together through two third walls (14) parallel and facing one another and perpendicular to said longitudinal direction (X), fixed to said first (12) and second (13) wall through first attachment means (15).
6. Lighting device (1) according to claim 3, **characterised in that** each of said longitudinal windows (11) is closed by at least one refraction plate (21).
7. Lighting device (1) according to claim 4, **characterised in that** it comprises a plurality of metal fins (27) extending from said first wall (12) outside of said con-

tainment body (9) to disperse the heat generated by said plurality of LEDs (3) during their operation.

substantially corresponds to one of said second concave surfaces with said second reflector (7) stopped in a corresponding reflection position.

8. Lighting device (1) according to claim 3, **characterised in that** it comprises a plurality of dividing reflection walls (37) that rise up parallel to one another from said first concave surfaces (5) of said first reflector (4) perpendicular to said longitudinal direction (X) separating said plurality of LEDs (3) into groups (28) to reflect said first beams of light rays towards the side openings (11) of said containment body (9). 5
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9. Lighting device (1) according to claim 1, **characterised in that** each said second reflector (7) is mechanically connected to said support structure (2) through hinge connection means (45) having rotation axis (R) parallel to said longitudinal direction (X), and is adjustable between many reflection positions having different inclinations with respect to the middle plane (α), adjustment means (49) acting on said second reflectors (7) being foreseen to stop said second reflectors (7) selectively in said reflection positions. 15
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10. Lighting device (1) according to claim 1, **characterised in that** each said second reflector is equipped with at least two contiguous second concave surfaces (8) extending parallel along said longitudinal direction (X). 25
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11. Lighting device (1) according to claim 4, **characterised in that** it comprises a plurality of auxiliary light sources (54) fixed to said second wall (13) outside of said containment body (9) to emit fourth beams of light rays. 35
12. Lighting device (1) according to claim 4, **characterised in that** it comprises an electronic control unit (57) of said LEDs (3) housed inside said containment body (9) and in particular fixed to said second wall (13) through second attachment means (58). 40
13. Lighting device (1) according to claim 1, **characterised in that** the first concave surfaces (5) of said first reflector (4) reflect said first beams of light rays with said second beams of light rays having less divergence than that of said first beams of light rays. 45
14. Lighting device (1) according to claim 1, **characterised in that** said at least one second concave surface (8) of said second reflectors (7) reflects said second beams of light rays with said third beams of light rays having greater divergence than that of said second beams of light rays. 50
55
15. Lighting device (1) according to claims 3, 9 and 10, **characterised in that** the reflection portion of said second reflector (7) facing said side opening (11)

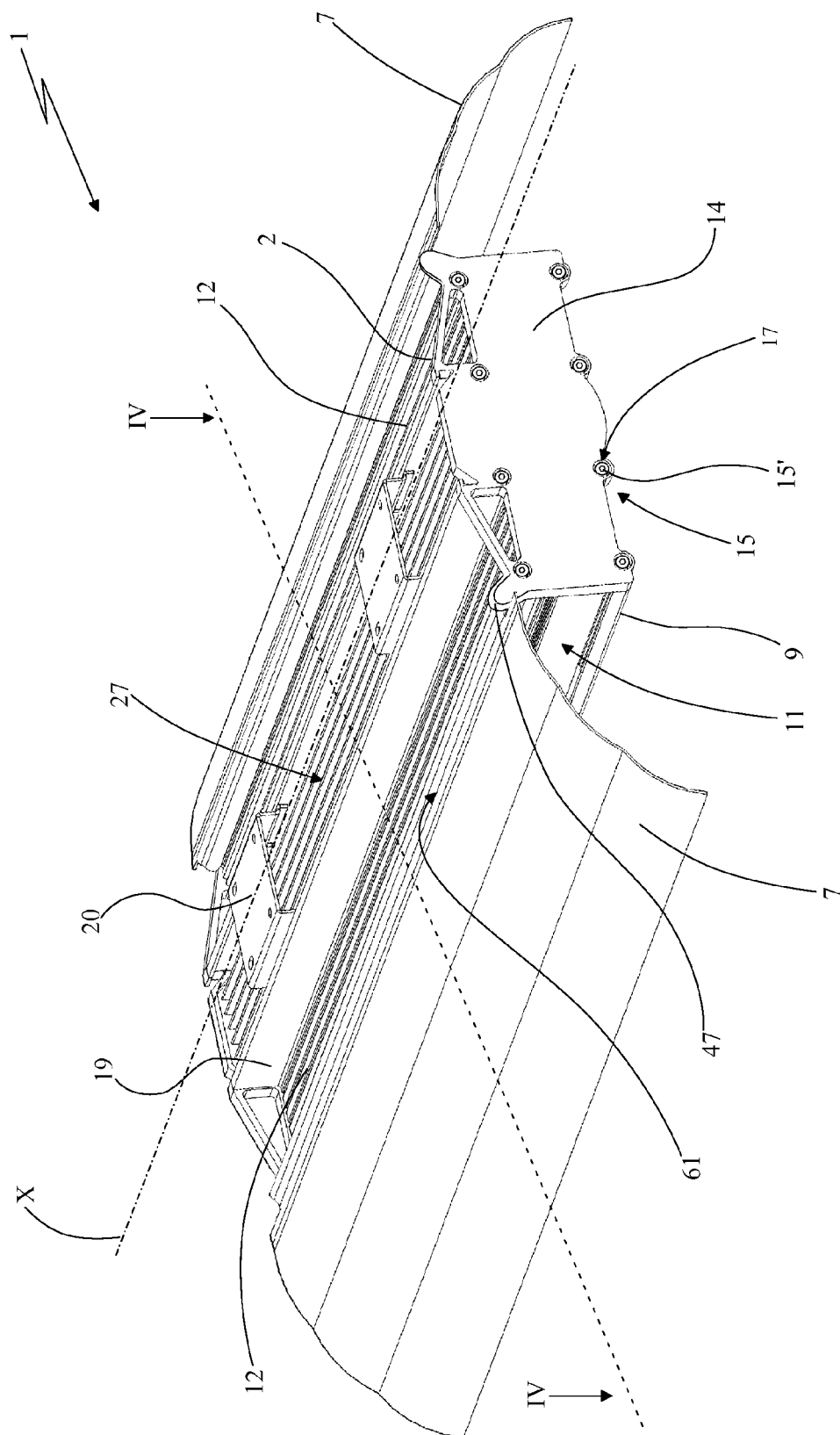


Fig. 1

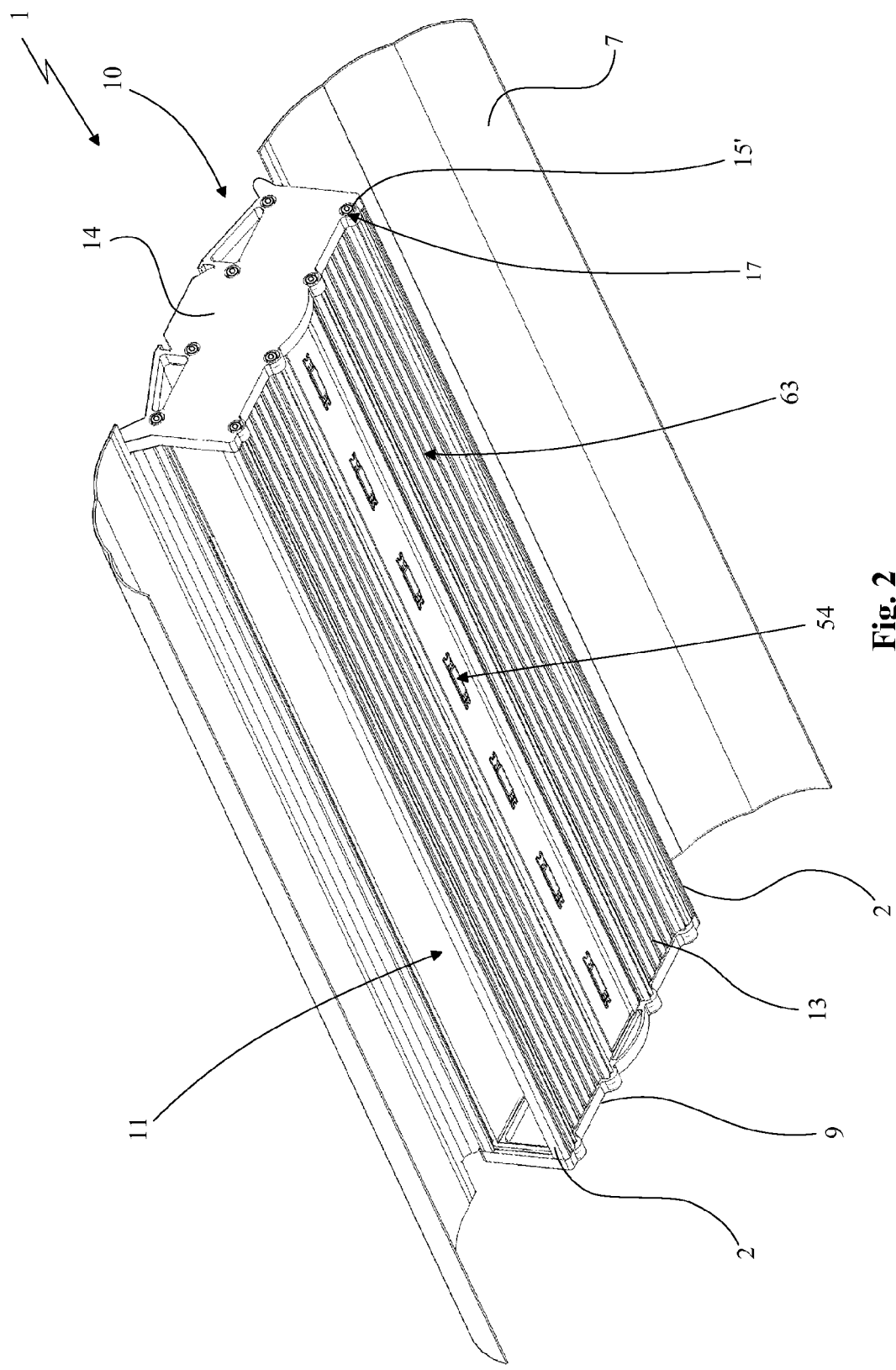


Fig. 2

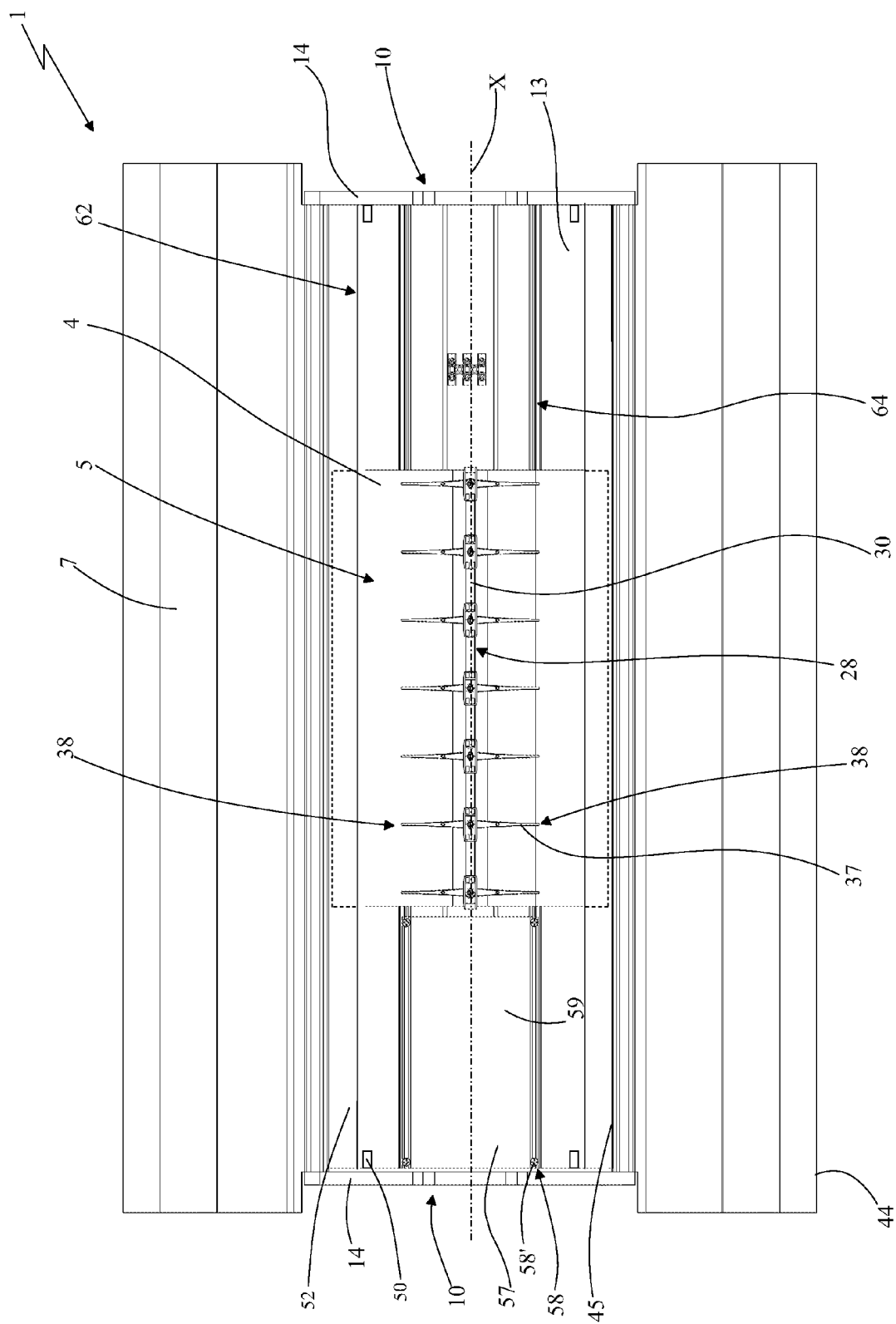


Fig. 3

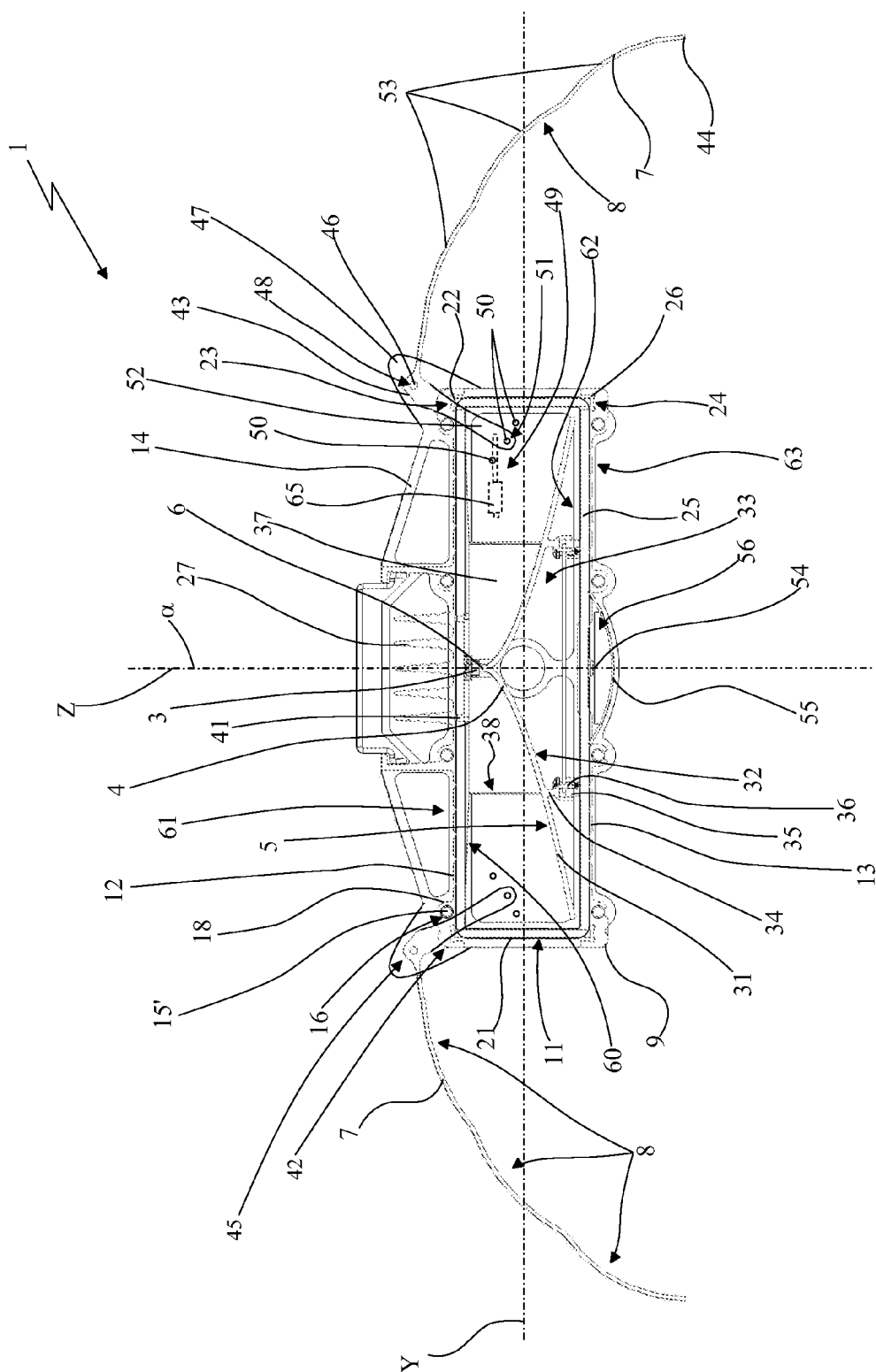


Fig. 4



EUROPEAN SEARCH REPORT

 Application Number
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Place of search		Date of completion of the search	Examiner
The Hague		16 February 2011	Lange, Christian
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