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(54) **LED lighting device with tubular diffuser**

(57) An LED lighting device (1) comprises a box (20), a support body (72) contained in the box (20) and a plurality of transparent, colourless or coloured tubular diffusers (40) attached to the box. In addition, a lens (60) is applied to the head of the diffuser (40) and an LED light source is provided upstream of the lens (60).

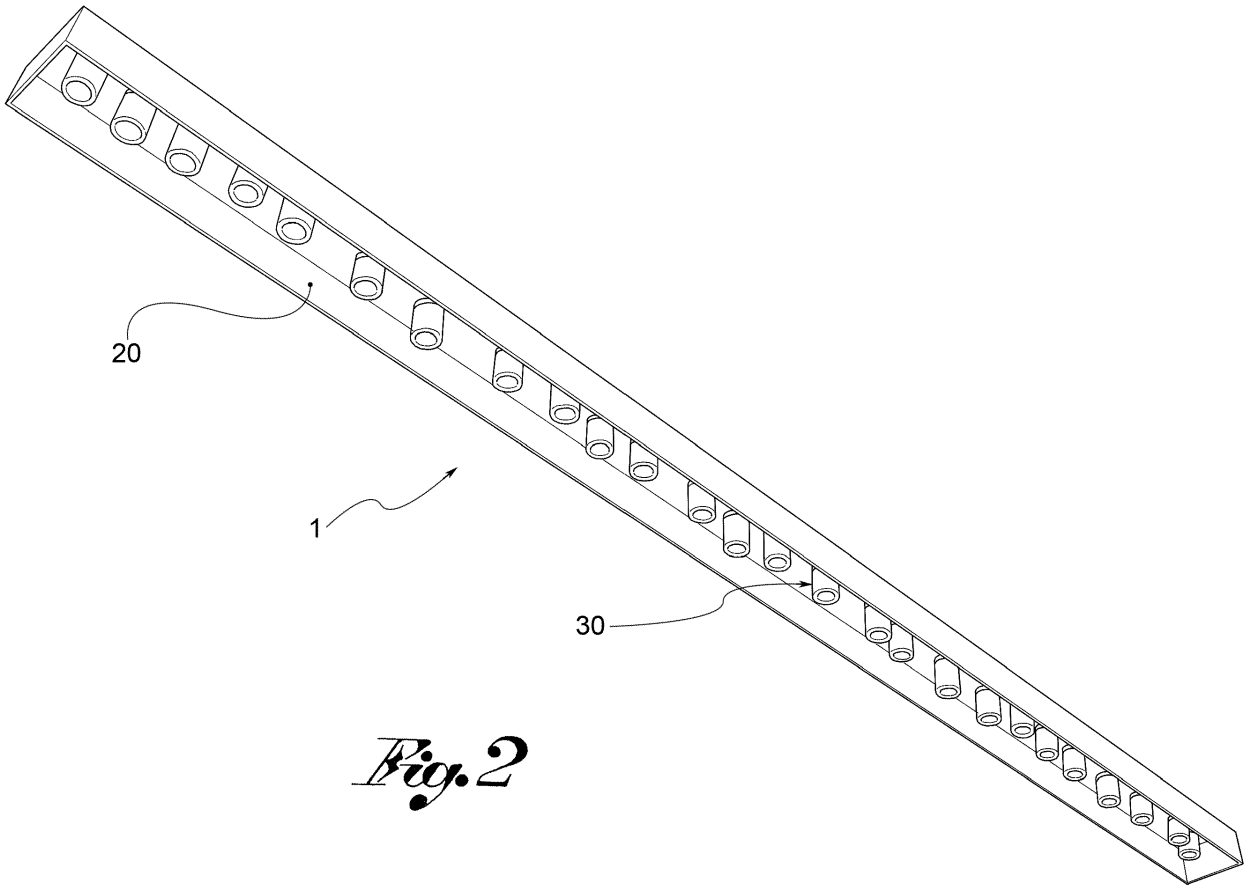

Fig. 2

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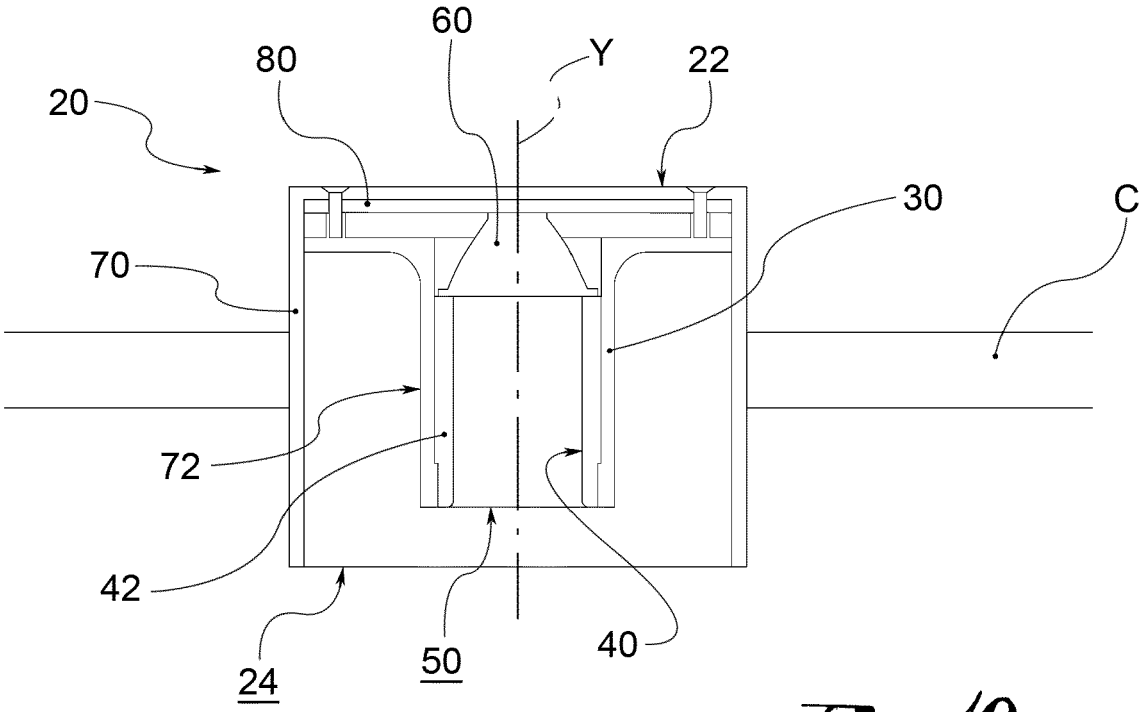


Fig.10

Description

[0001] The present invention relates to an LED lighting device of striking aesthetic impact.

[0002] The decorative lighting sector is characterised by great efforts to innovate, both from an aesthetic and functional point of view. Sometimes, functional innovations are dictated by the need to make specific aesthetic features usable, combining design aspects with industrialisation requirements.

[0003] Over recent years, LED lighting devices have become especially popular despite having imposed a reinterpretation of some technical aspects to overcome specific application issues.

[0004] In particular, LED light sources are characterised by a very intense emission of light near the source itself; such emission is uncomfortable for the user, who is almost blinded if directly exposed to the light coming from the source.

[0005] Such drawback also has repercussions on the aesthetic appeal of the lighting device. In fact, the high luminosity of the sources makes it practically impossible for the observer to appreciate the aesthetics of the device which is, instead, usually designed to make a particular impression with the light on.

[0006] The purpose of the present invention is to make an LED lighting device of striking aesthetic impact, which overcomes the drawbacks spoken of with reference to the prior art.

[0007] Such purpose is achieved by a lighting device according to claim 1.

[0008] The characteristics and advantages of the lighting device according to the present invention will be evident from the description below, made by way of a non-limiting example in accordance with the appended drawings wherein:

[0009] - figures 1 to 4 show a lighting device according to the present invention, according to various embodiments;

[0010] - figure 5 shows a modular lighting system comprising a plurality of devices according to the present invention;

[0011] - figures 6 to 11 show schematic cross-sections of embodiments of the device according to the present invention;

[0012] - figures 12 to 24 show examples of the shapes of the box and of the diffuser of the device according to the present invention;

[0013] - figures 25 to 30 show examples of the shapes of the box of the device according to the present invention;

[0014] - figures 31 to 35 show further embodiment variations of the device according to the present invention.

[0015] With reference to the appended drawings, reference numeral 1 globally denotes an LED lighting device, suitable for being attached to the ceiling or to the side walls, flush-mounted on the wall (figure 1) or on its surface (figure 2).

[0016] According to further embodiments, the device 1 is suitable for extending over a corner on two separate planes for example between a side wall and the adjacent ceiling (figure 3) or on a single plane, for example on the ceiling or on a single wall (figure 4).

[0017] A lighting assembly 10 comprises a plurality of devices 1, for example positioned adjacent to each other, identical to each other or different in shape, dimension or colour, repeated randomly or in a modular manner (figure 5).

[0018] For clarity of exposition, reference will be made below to the case of a lighting device 1 attached to the ceiling, the description in any case being understood to extend to the case of attachment to a side wall.

[0019] A wall of a room constitutes for example a ceiling C.

[0020] The device 1 is attachable to the wall C so as to be entirely flush mounted on the same (figure 6) or partially flush-mounted or partially projecting from the surface of the wall (figure 10) or completely projecting (figure 11).

[0021] The device 1 comprises an housing box 20, comprising a base 22 which defines it in height on one side, and open on the other side through a main aperture 24.

[0022] The box 20 further comprises a side wall 26, projecting from the base 22, preferably annularly closed, which defines an inner chamber 20a.

[0023] Preferably, the box 20 is made in plastic material, preferably opaque.

[0024] According to embodiment variations, the main aperture 24 of the box 20, which mainly defines the appearance of the device to the eyes of an observer, is a square, rectangular, circular or elliptical shape or the shape of a broken polygon or polygon mixed with straight and curved lines.

[0025] According to further embodiment variants, the main aperture 24 is in the shape of a crown, for example a square, rectangular, circular or elliptical crown, or a crown the shape of a broken polygon or polygon mixed with straight and curved lines.

[0026] Defined a median axis X of the box along the extension of the same, said median axis, according to embodiment variants of the box, is rectilinear, curvilinear or the shape of a broken polygon or polygon mixed with straight and curved lines.

[0027] According to a preferred embodiment, the box 20 comprises an annular protuberance 30, projecting from the bottom surface 22 inside the chamber 20a, which defines a coupling seat 32, having a main axis Y.

[0028] Preferably, the protuberance 30 is made in one piece with the bottom 22 of the box 20.

[0029] The device 1 further comprises a tube-shaped diffuser 40, made in colourless or coloured material transparent to the light, attachable in a releasable manner to the box 20.

[0030] For example, the diffuser 40 comprises an annular diffuser wall 42, preferably continuous around the

main axis Y, comprising a coupling foot 44, of lesser thickness, suitable for being inserted in the seat 32 defined by the protuberance 30.

[0031] According to an embodiment, the attachment of the tube to the box is by means of forced insertion in the seat; according to a further variant, the attachment is by means of a bayonet system; according to yet a further embodiment, the attachment is by means of a threaded system.

[0032] On the side opposite the portion connected to the box, the diffuser 40 is open by means of a diffuser aperture 50.

[0033] According to embodiment variations, the diffuser aperture 50 is a square, rectangular, circular or elliptical shape or the shape of a broken polygon or polygon mixed with straight and curved lines.

[0034] Give the thickness of the tube defining the diffuser 40, the diffuser aperture 50 is defined by an inner annular edge and by an outer annular edge which surrounds it.

[0035] According to embodiment variations, the inner and/or outer annular edge are closed lines, concentric or eccentric to each other, formed of one or more curved or rectilinear sections, of an identical shape or different to each other.

[0036] According to a preferred embodiment, the device 1 comprises a single diffuser 40.

[0037] According to a further embodiment, the device 1 comprises a plurality of diffusers 40, identical to each other or different from each other in shape, dimension or colour.

[0038] Preferably, the diffuser is completely contained in the box 20. According to one embodiment variation, the diffuser is partially projecting from the main aperture 24 of the box 20.

[0039] According to one embodiment of the present invention, the protuberance 30 extends along the height of the diffuser 40, surrounding it externally, only for a limited section, for example sufficient for the coupling of the diffuser (figure 6), preferably by less than half the total height of the diffuser.

[0040] According to a further embodiment of the present invention, the protuberance 30 extends along the diffuser 40, surrounding it externally, only partially, over half the total height of the diffuser (figure 7).

[0041] According to yet a further embodiment, the protuberance 30 extends all along the height of the diffuser 40, surrounding it externally (figure 8), forming a sort of opaque jacket surrounding the transparent diffuser.

[0042] In such variant, the diffuser in any case appears outwardly in the form of a transparent, colourless or coloured crown, which defines the diffuser aperture 50, flush with the aperture of the protuberance 30.

[0043] According to further embodiment variants (not shown), the protuberance projects in height beyond the diffuser.

[0044] The device 1 further comprises a lens 60 for the diffusion of the light emitted by the light source positioned on the head of the diffuser 40.

[0045] According to an embodiment, the lens 60 is positioned completely outside the diffuser 40.

[0046] According to an embodiment, the lens 60 is positioned externally to the box 20, in other words in the rear zone of the bottom 22 of said box (figure 6).

[0047] According to a further embodiment, the lens 60 is positioned at least partially in the protuberance 30; preferably, the lens 60 is completely housed in the protuberance 30 (figures 7 and 8).

[0048] Preferably, a direction of emission Z is defined which passes through the edge of the lens 60 and through the inner free edge of the diffuser (figure 6); said direction of emission Z forms an angle α with the main axis Y preferably of 45° or less.

[0049] According to further embodiment variants, said direction of emission Z is defined between the edge of the lens 60 and the inner free edge of the box (figure 34).

[0050] According to a preferred embodiment, the box 20 comprises a profile 70 and a body 72, inside the profile 70, which forms the bottom 22 and the protuberances 30, which the diffuser is housed in (figures 9, 10 and 11).

[0051] The device 1 further comprises electric apparatus 80 and LED light sources attached to it, for example housed between the base of the profile 70 and the bottom 22 of the body 72.

[0052] According to a further embodiment, the device 1 comprises an assembly plate 90, applicable to the wall, to which the profile 70 or the box 20 can be hooked, for the support of the device.

[0053] According to further embodiment variants, the box 20 comprises spring attachment means 100, projecting externally from the box, for the snap connection to a predefined seat flush-mounted in the wall.

[0054] Innovatively, the lighting device according to the present invention makes it possible to use LED light sources without their light emission disturbing the observer.

[0055] Advantageously, in addition, the device allows an appreciable aesthetic effect to be achieved, in that the colourless or coloured transparent diffuser, with the light on, forms a diffuser tube of the light emerging outwards through the crown of said diffuser.

[0056] It is clear that a person skilled in the art may make variations to the lighting device described above so as to satisfy contingent requirements, while remaining within the sphere of protection as defined by the following claims.

Claims

1. LED lighting device (1) comprising:

- a box (20) having a side wall (26) defined for a predetermined height and a main aperture (24) for access to the inner chamber (20a);
- a support body (72), at least partially contained

in the box (20), comprising a base (22) and at least one coupling seat (32) passing through the bottom;

- a diffuser (40) comprising an annular tubular wall (42) of a predefined height, at least partially transparent, colourless or coloured, applied to the coupling seat (32);
- a lens (60) applied to the head of the diffuser (40);
- an LED light source, upstream of the lens (60).

2. Device according to claim 1, wherein the body (72) comprises a protuberance (30), at least partially opaque, projecting from the bottom (22), which defines said seat (32), which the diffuser is at least partially housed in.

3. Device according to claim 2, wherein the transparent side wall (42) of the diffuser (40) projects in height from the protuberance (30).

4. Device according to claim 2, wherein the transparent side wall (42) of the diffuser (40) is contained in the protuberance (30).

5. Device according to claim 4, wherein the side wall (42) ends with a crown surface (46) flush with the crown end surface of the protuberance (30).

6. Device according to any of the previous claims, wherein the lens (60) is outside the diffuser (40).

7. Device according to any of the previous claims, wherein the lens (60) is positioned completely rearwards of the base (22).

8. Device according to any of the claims 1 to 6, wherein the lens (60) is at least partially or completely contained in the protuberance (30).

9. Device according to any of the previous claims, wherein the box (20) has a main aperture (24) of a square, rectangular, circular or elliptical shape or broken polygonal or polygonal mixed with straight and curved lines, or is in the shape of a crown such as a rectangular, circular, elliptical crown or broken polygonal, polygonal mixed with straight and curved lines crown.

10. Device according to any of the previous claims, wherein, defined a median axis (X) of the box along the extension of the same, said median axis is rectangular, curvilinear, broken polygonal or polygonal mixed with straight and curved lines.

11. Device according to any of the previous claims, wherein the diffuser(40) has a diffuser aperture (50) of a square, rectangular, circular or elliptical shape or broken polygonal or polygonal mixed with straight and curved lines.

12. Device according to any of the previous claims, wherein the diffuser (40) has a diffuser aperture (50) delimited by an inner annular edge and by an outer annular edge defined by closed lines, concentric or eccentric to each other, formed of one or more curved or rectilinear sections, of an identical shape or different to each other.

13. Device according to any of the previous claims, wherein the side wall of the box is made in at least partially opaque material.

14. Device according to any of the previous claims, comprising a single diffuser.

15. Device according to any of the claims from 1 to 13, comprising a plurality of diffusers.

16. Device according to any of the previous claims, suitable for being flush-mounted in the wall or for being mounted at least partially projecting from the wall.

17. Device according to any of the previous claims, wherein the diffuser is completely contained in the box (20) or is partially projecting from the main aperture (24) of the box (20).

18. Lighting assembly comprising a plurality of devices (1) made according to any of the previous claims.

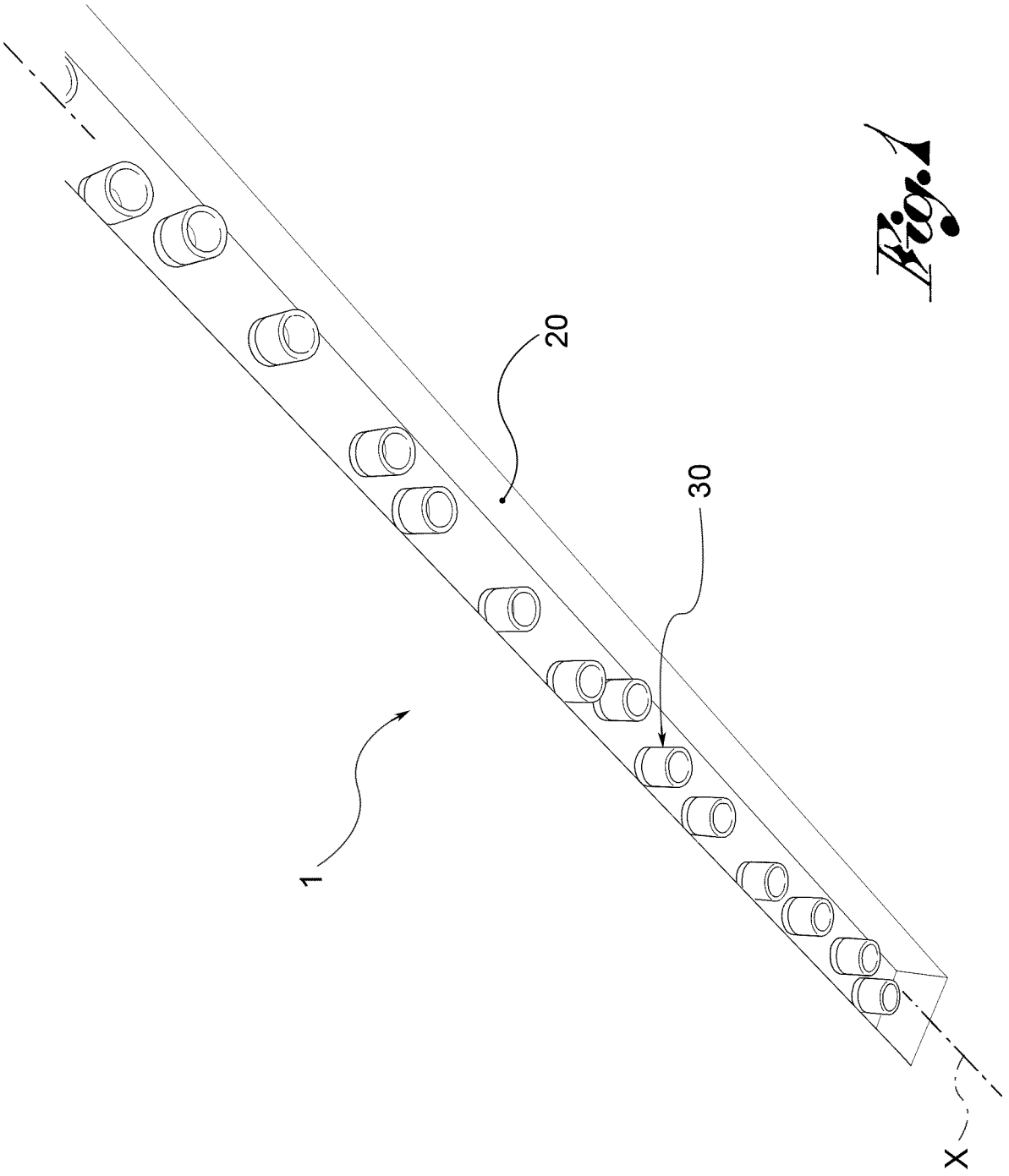


Fig. 1

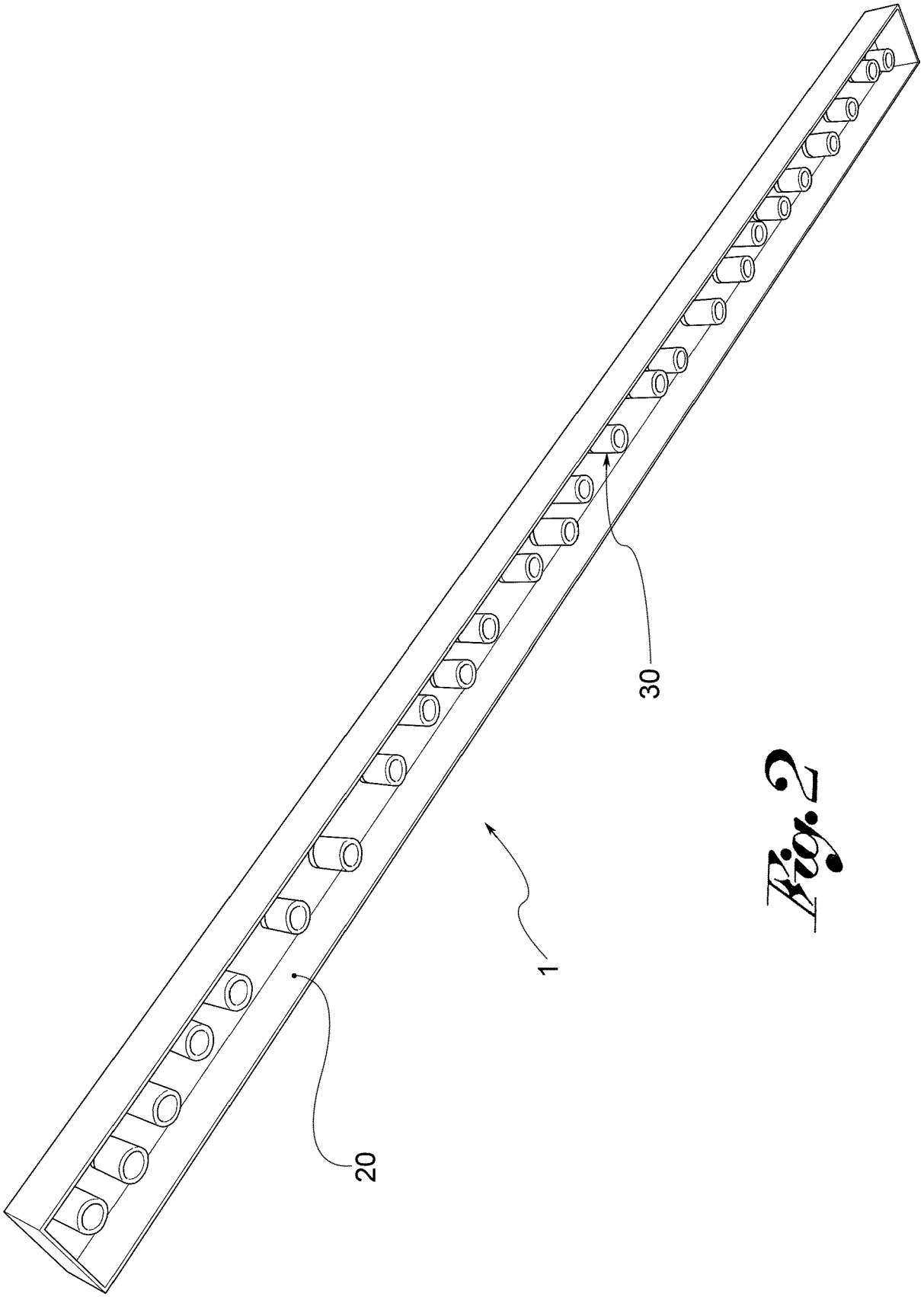


Fig. 2

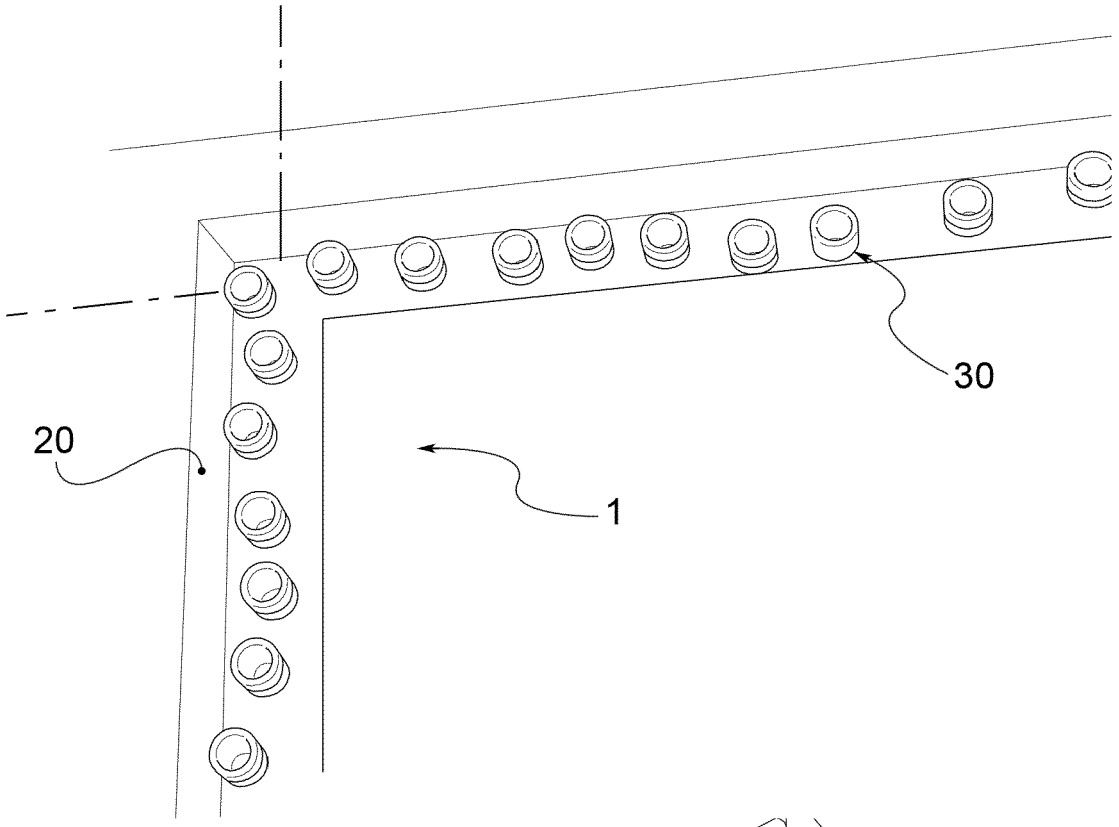


Fig. 4

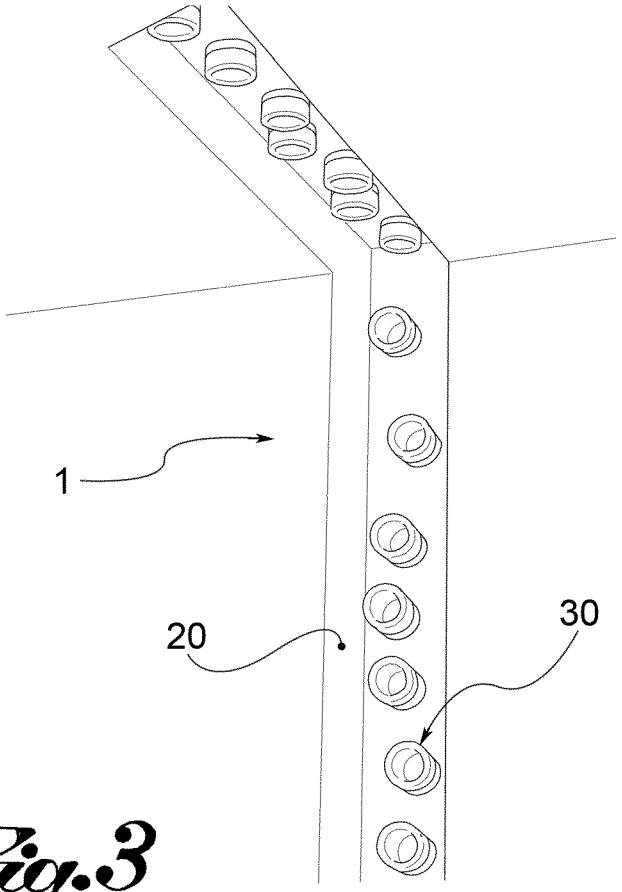


Fig. 3

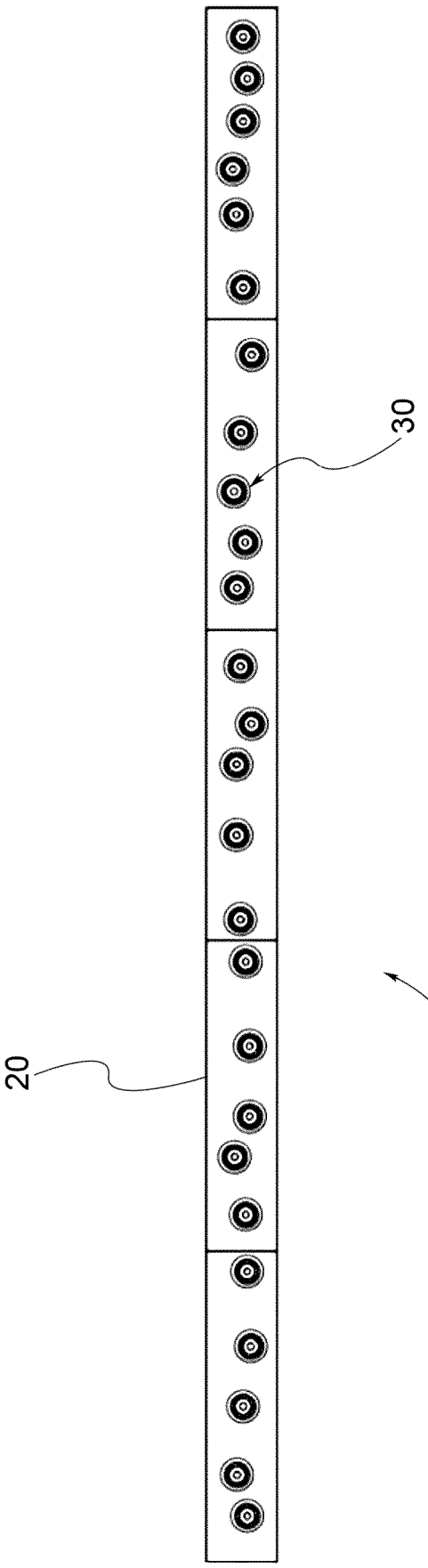


Fig.5

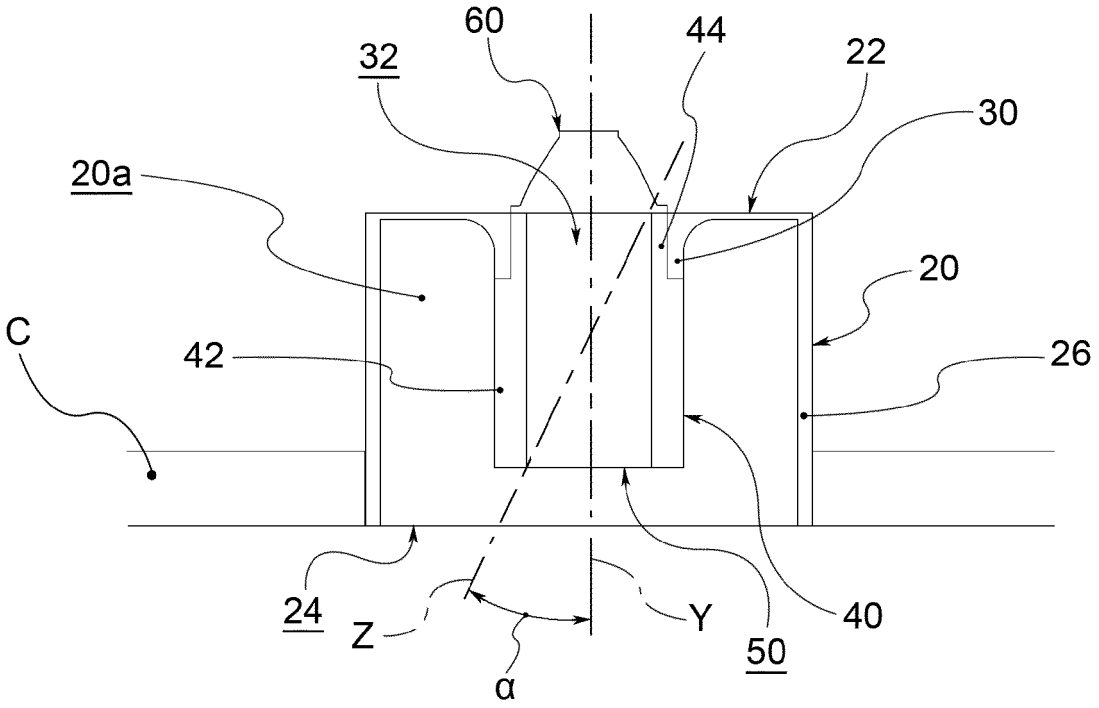

60
44
32
22
30
20a
20
C
42
26
24
Z
Y
40
50
α

Fig.6

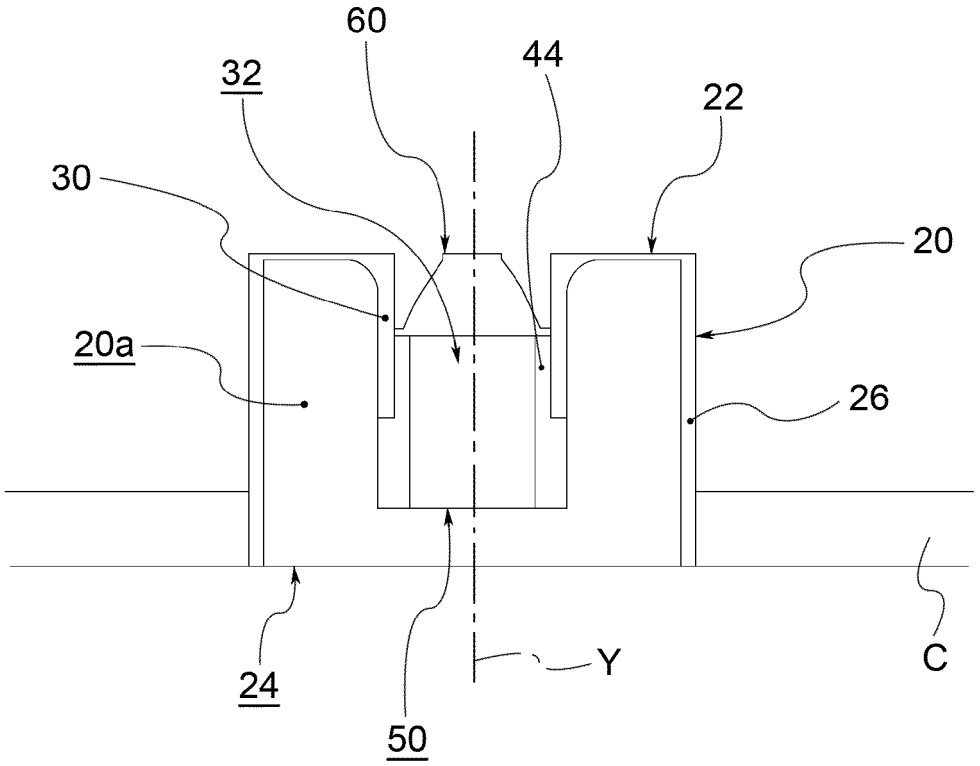

60
44
32
22
30
20
20a
26
24
Y
C
50

Fig.7

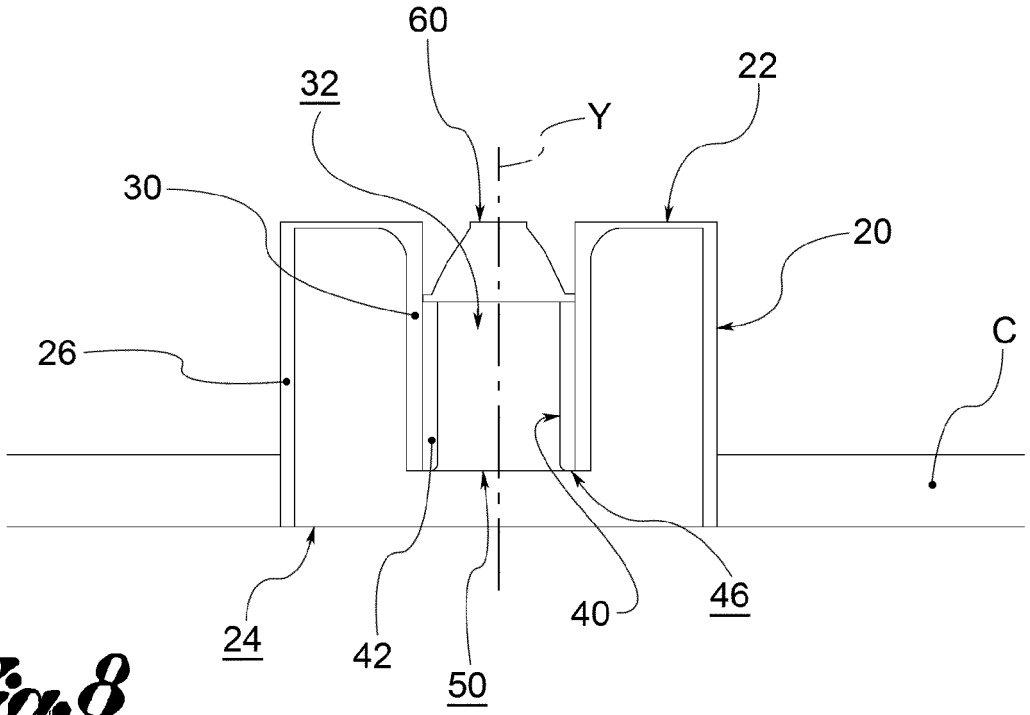


Fig.8

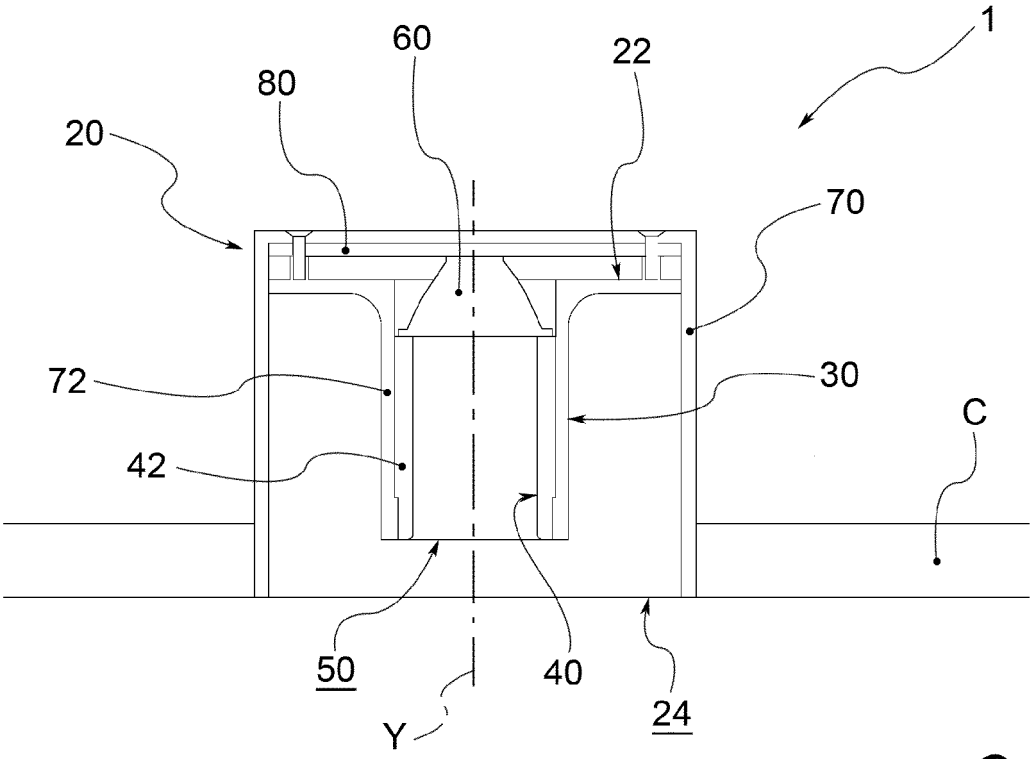


Fig.9

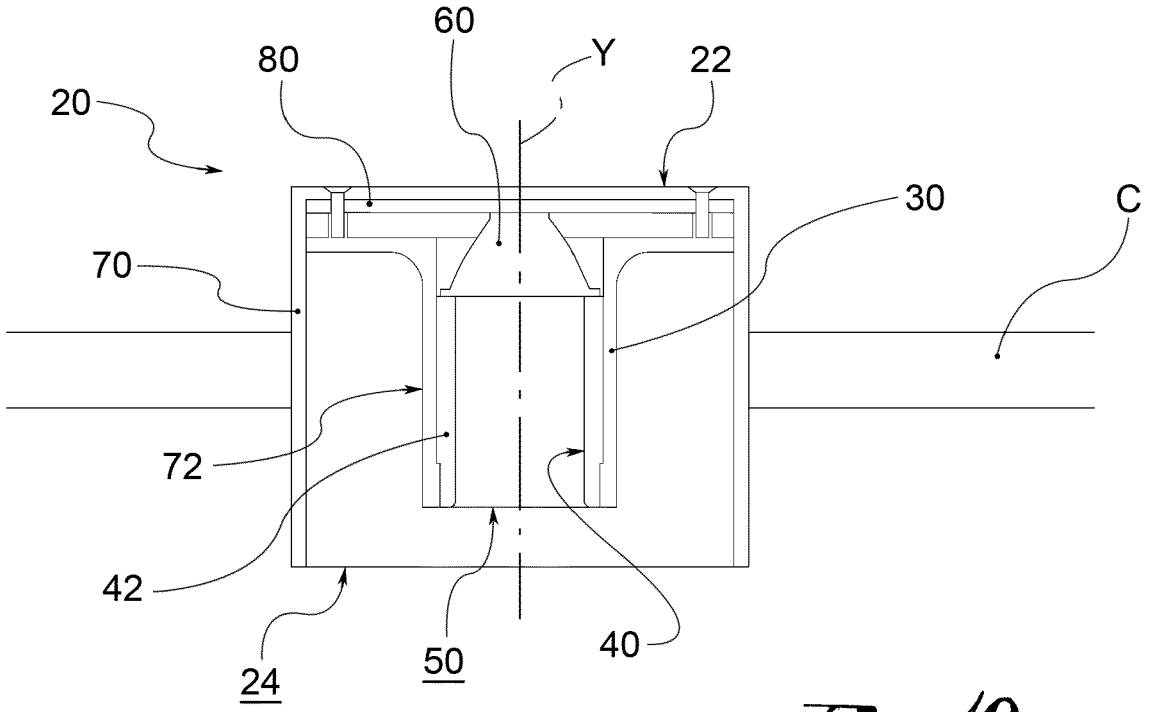


Fig.10

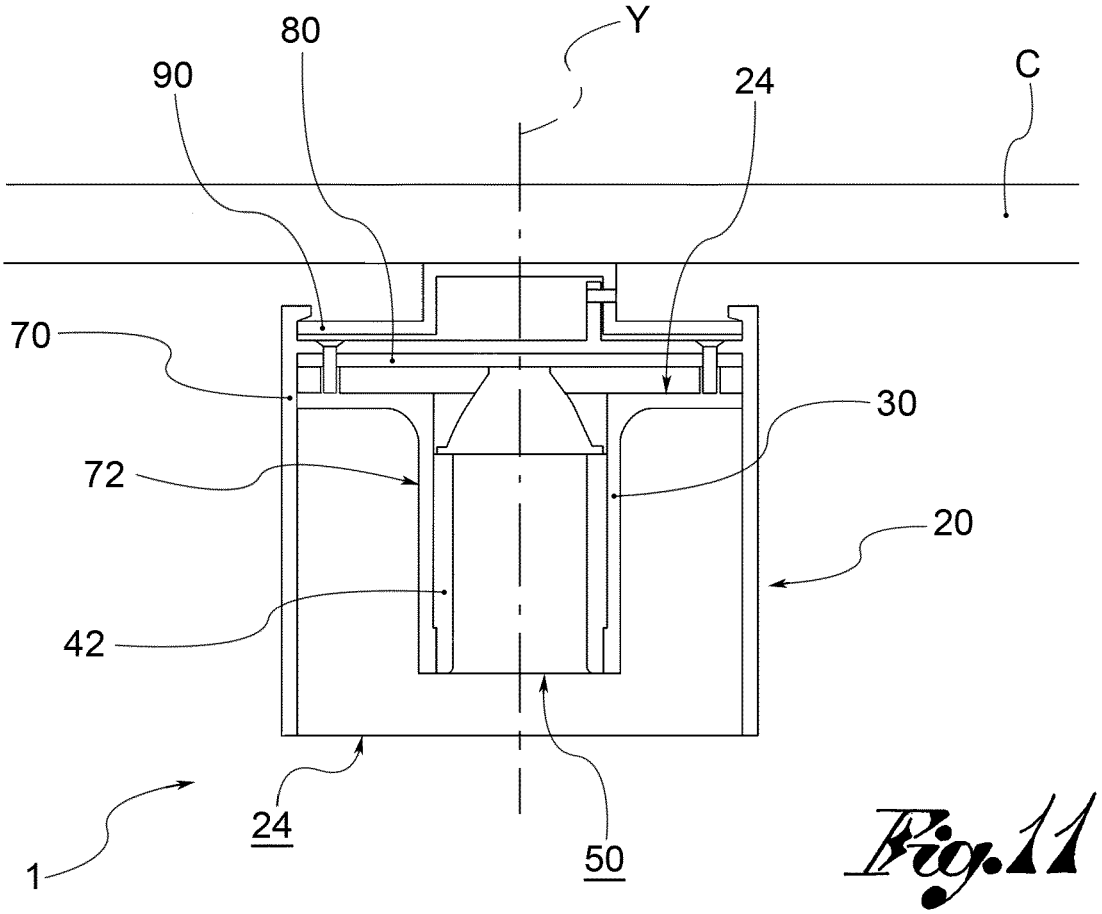


Fig.11

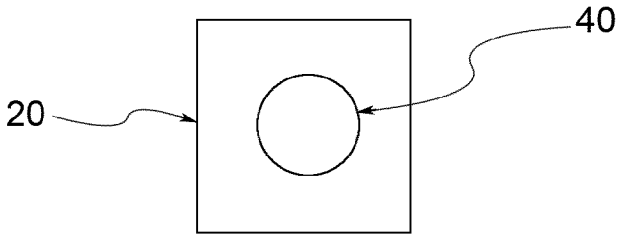


Fig.12

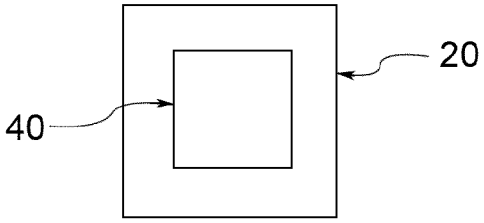


Fig.13

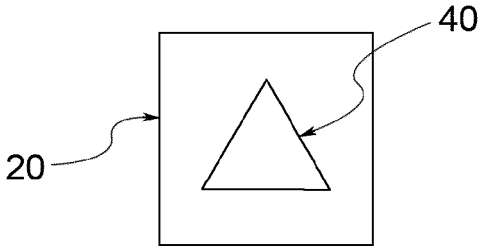


Fig.14

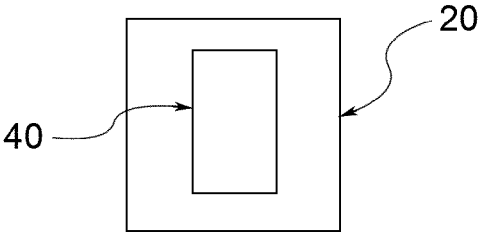
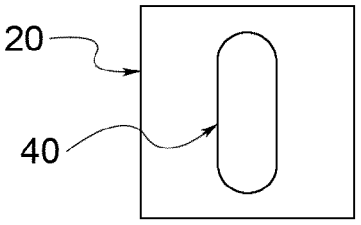


Fig.15



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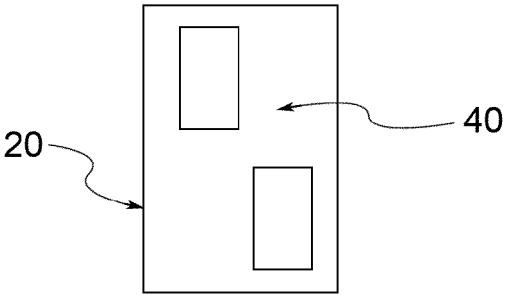
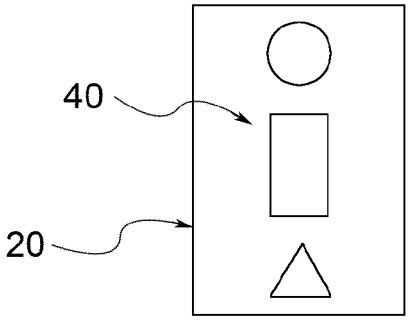


Fig.17



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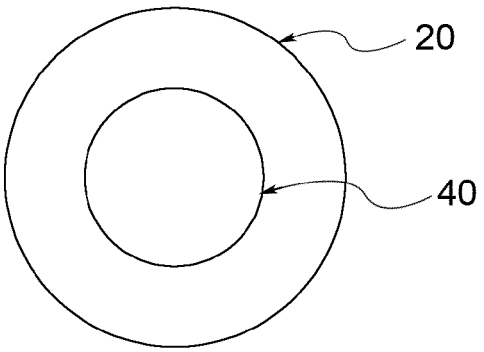

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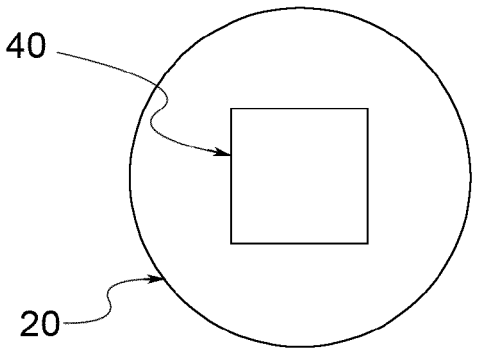

Fig.20

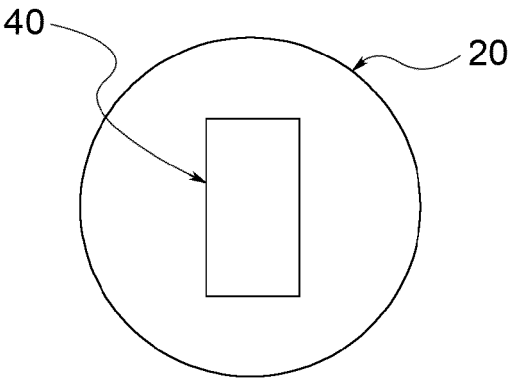

Fig.21

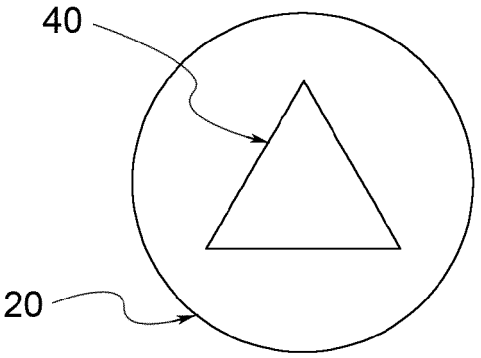

Fig.22

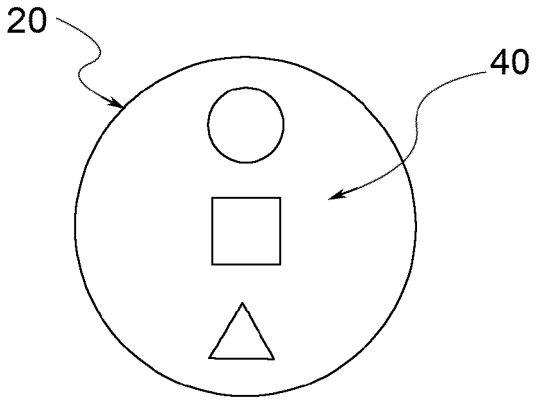

Fig.23

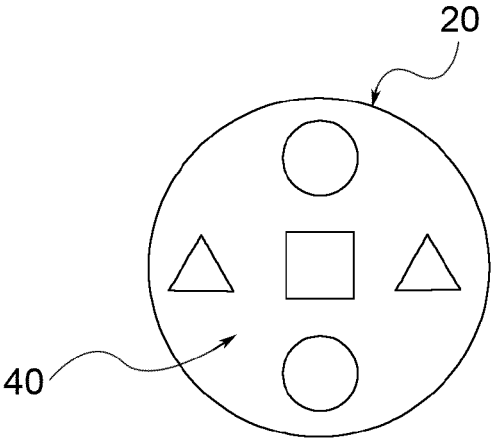

Fig.24

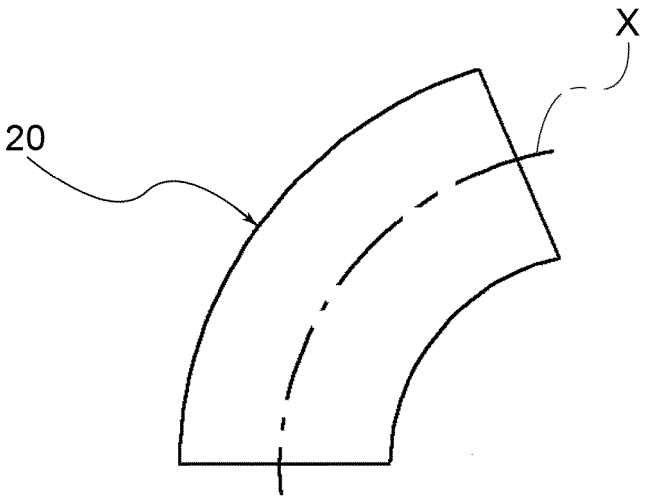

Fig. 25

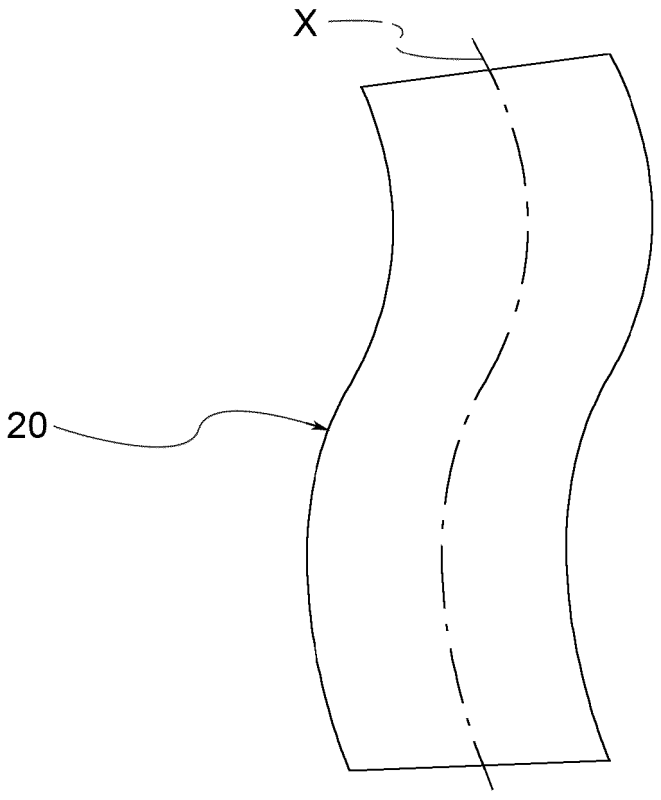

Fig. 26

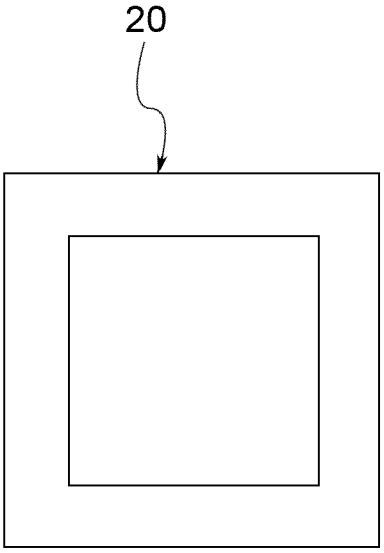

Fig.27

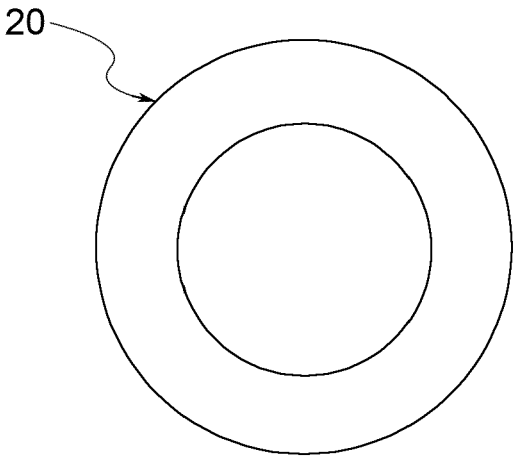

Fig.28

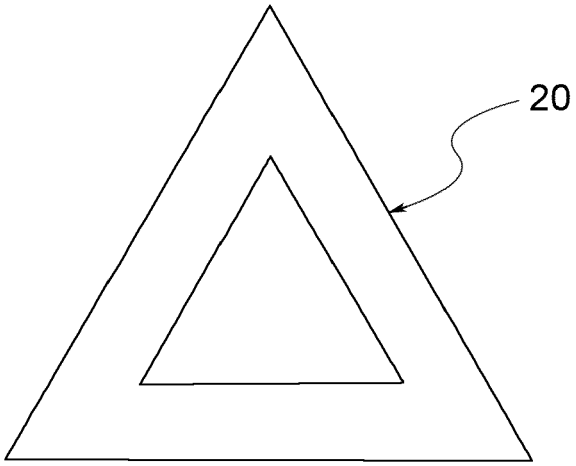

Fig.29

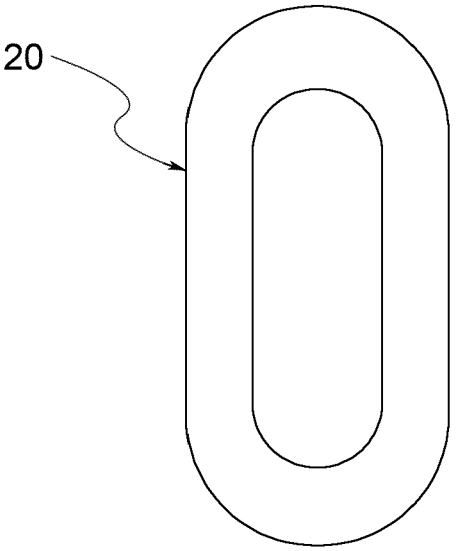

Fig.30

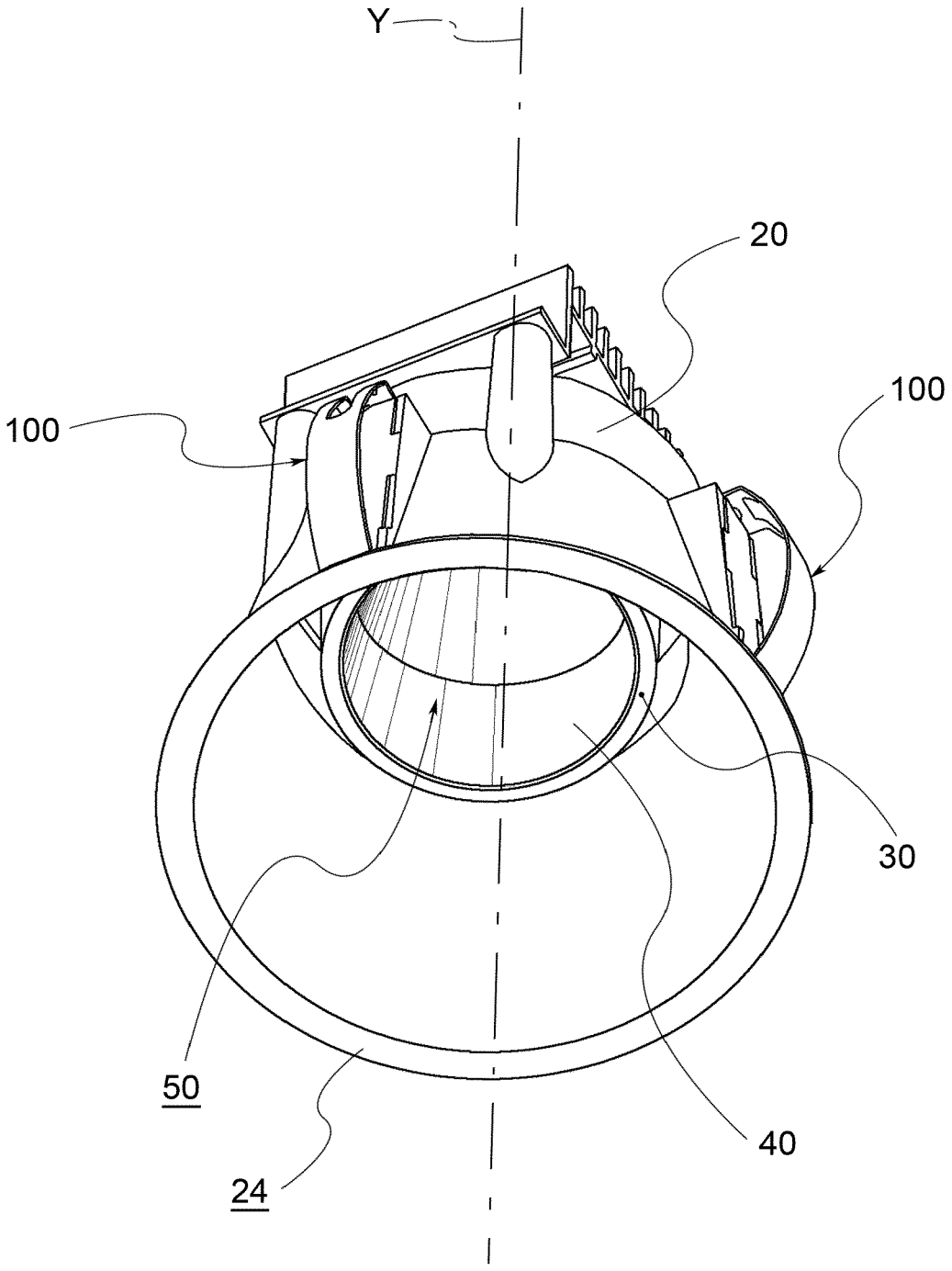

Fig.31

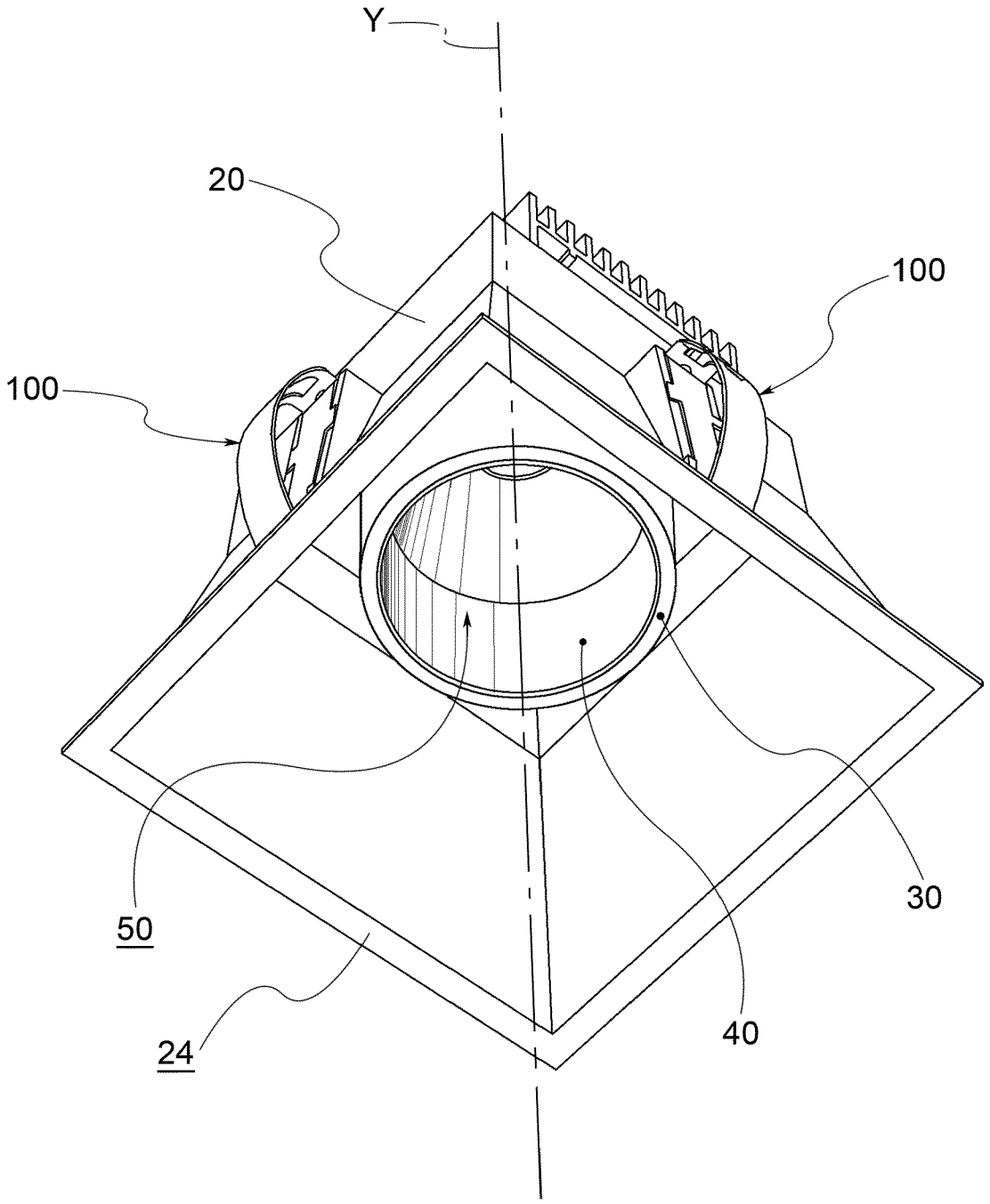

Fig.32

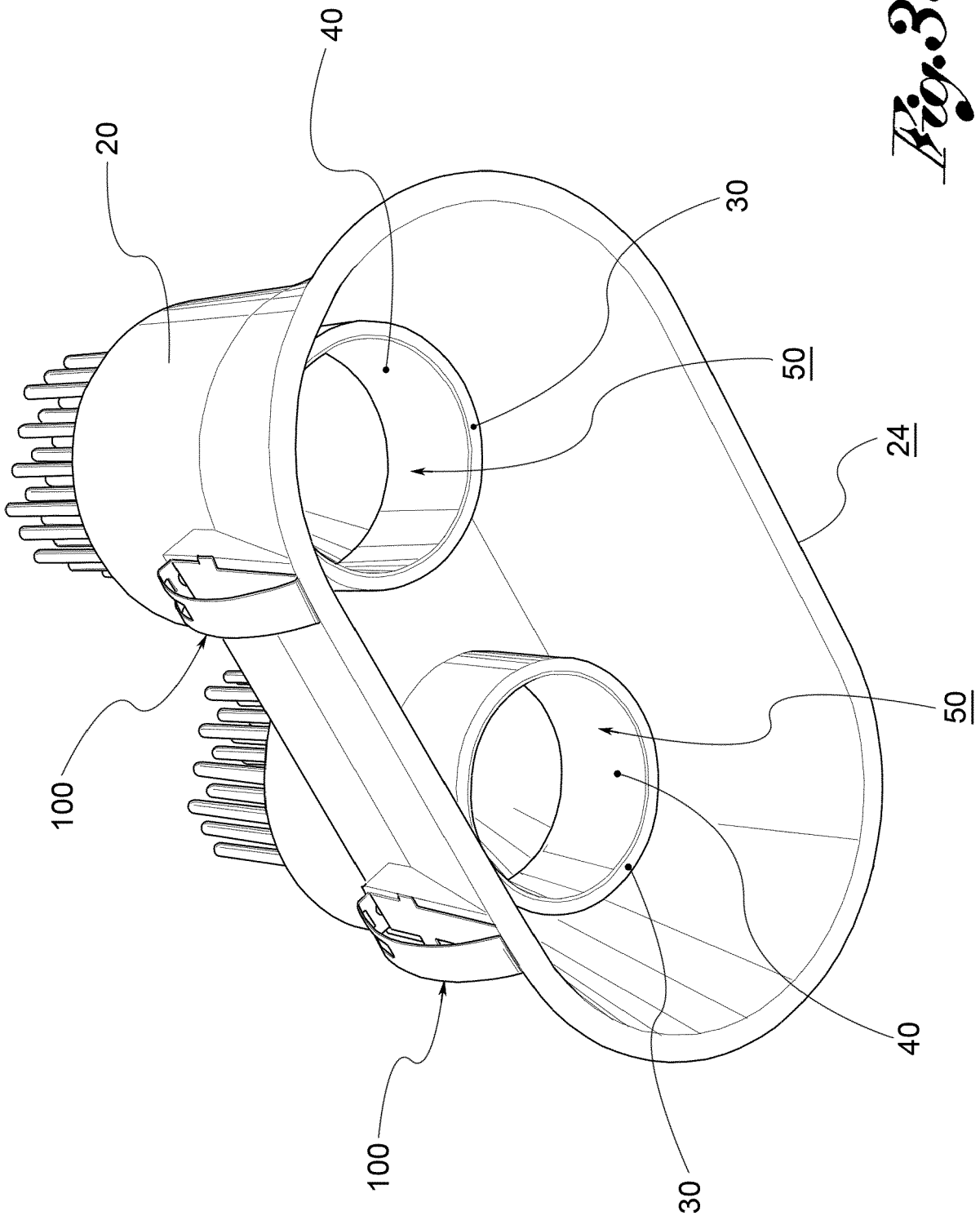

Fig.33

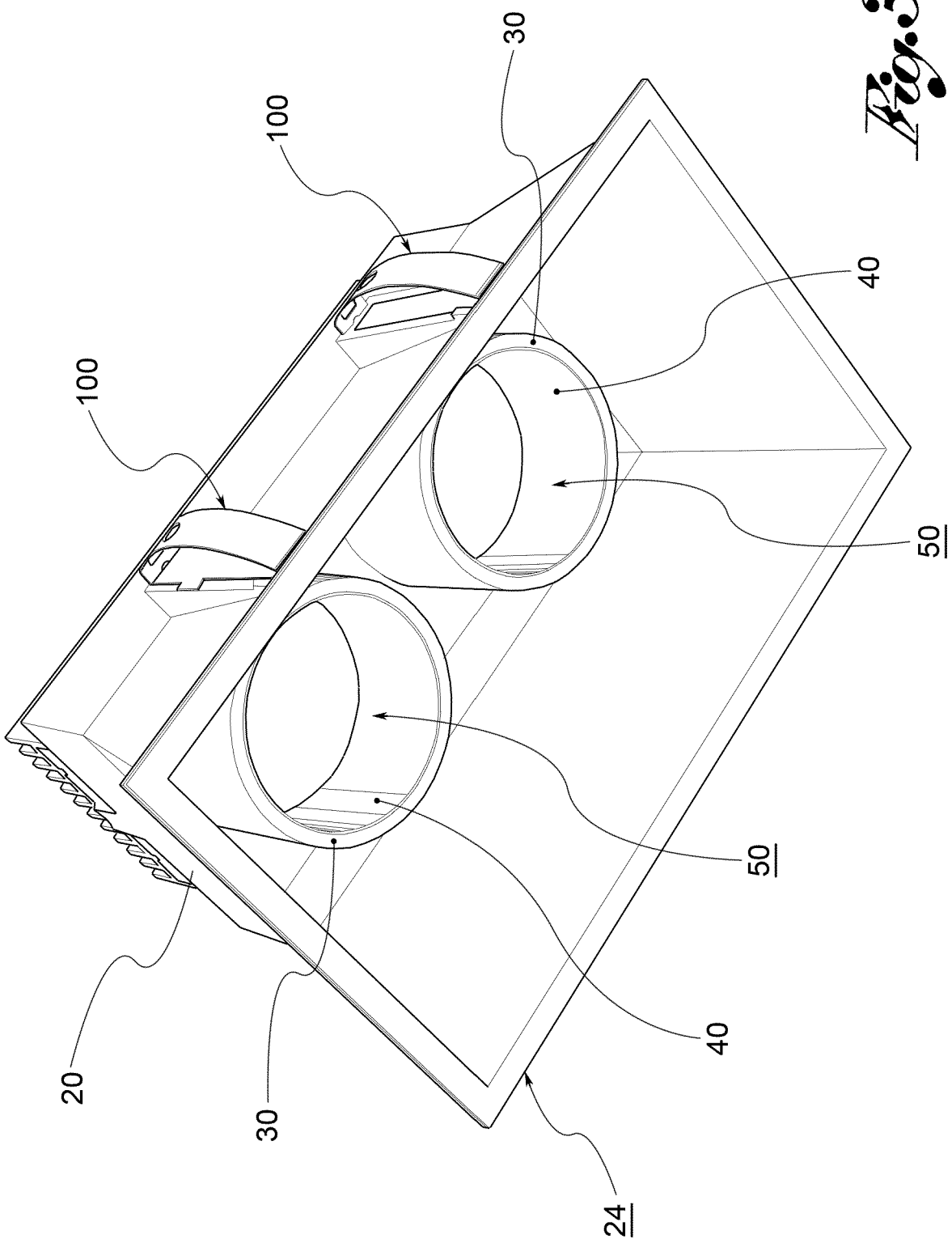

Fig.34

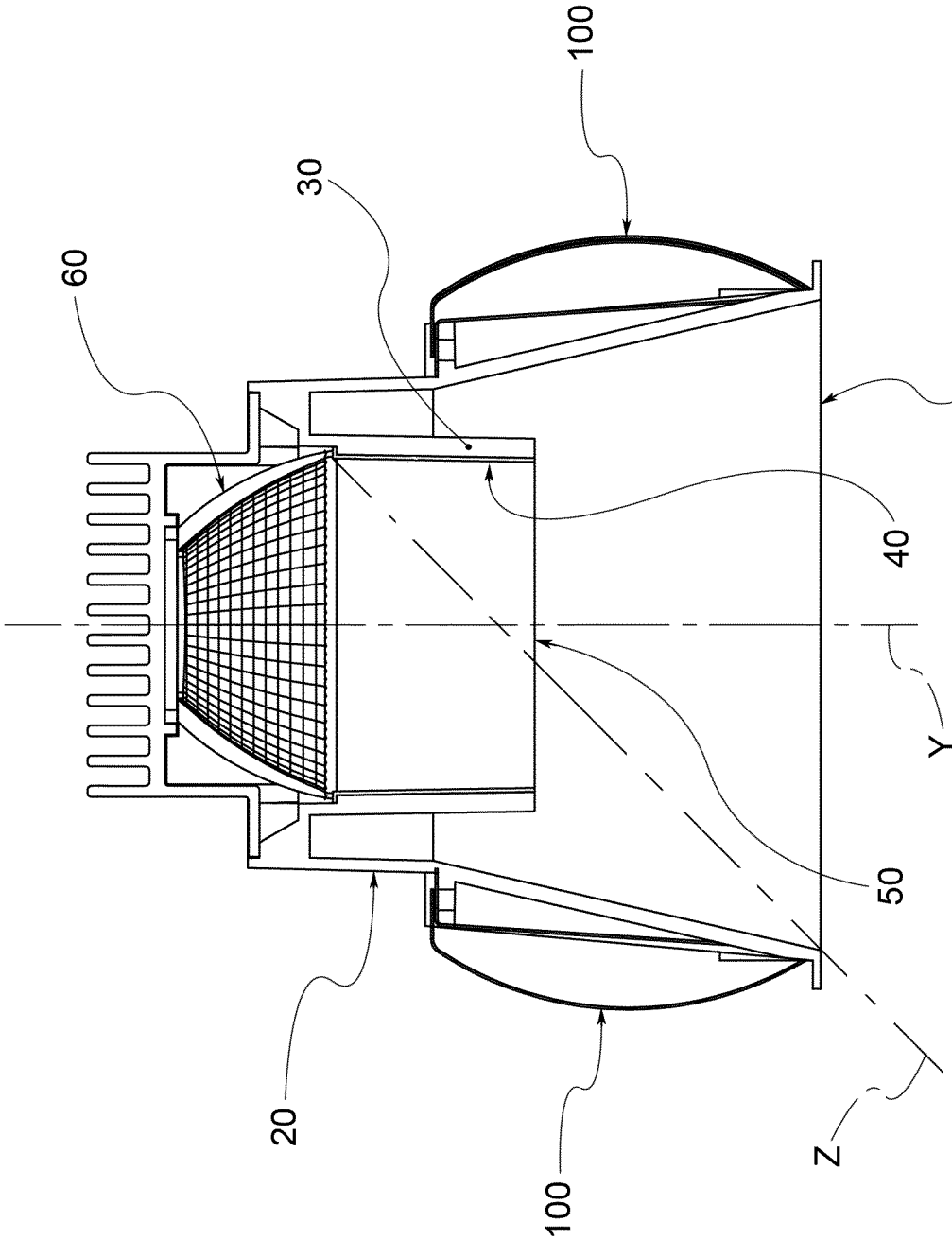

Fig.3.5

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EUROPEAN SEARCH REPORT

Application Number
EP 12 15 4373

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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X	FR 2 909 160 A1 (DAVID FRANCIS [FR]) 30 May 2008 (2008-05-30) * page 5, line 10 - page 7, line 10; figures 1-6, 9 * -----	1,9-14, 16-18	F21S8/02 F21S8/04 F21V3/04 ADD.
A	EP 1 724 516 A1 (IVELA S P A [IT]) 22 November 2006 (2006-11-22) * the whole document * -----	1	F21V7/00 F21V15/01 F21V21/005 F21V21/04 F21Y101/02

TECHNICAL FIELDS SEARCHED (IPC)
F21S F21V

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	26 April 2012	von der Hardt, M

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