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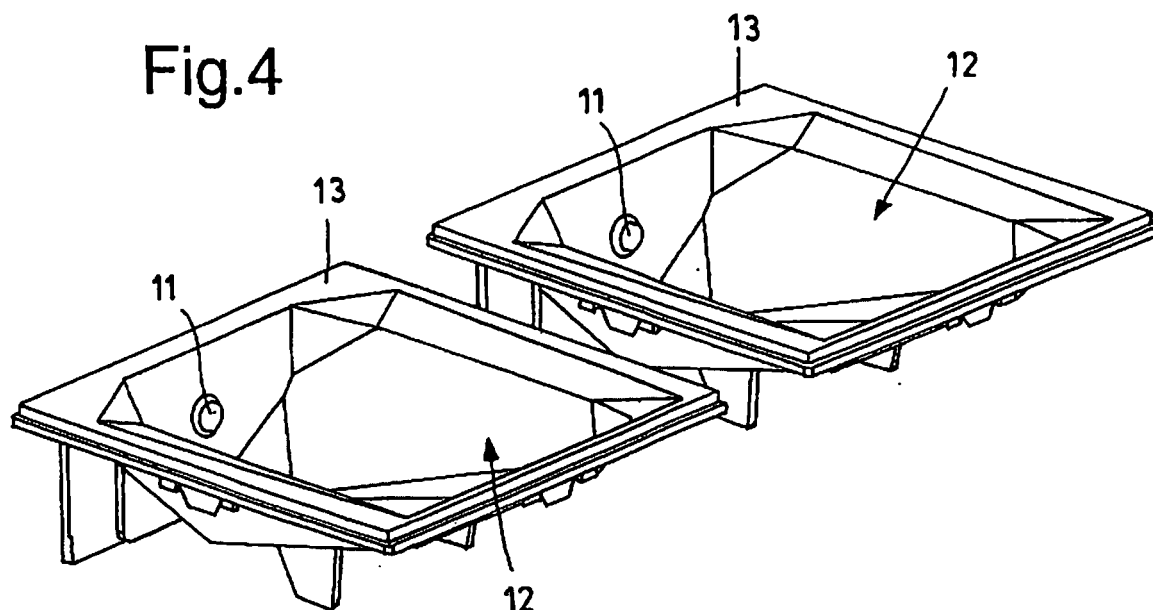
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(54) **Lighting fixture with LEDs, which is fixable to ceilings and to walls**

(57) A high-performance lighting fixture with optimum light distribution, which is fixable to ceilings and walls and comprising at least one light source, consisting of at least one power LED (11), placed on at least one of the surfaces of at least one reflector (12), made in composite surface and whose profile consists of at least

three segments of straight line (A, B, C), joined at the vertexes (D, E), in order to form a continuous interrupted line. In this way, it is defined an optics suitable to produce a photometric solid which determines high performance of the lighting fixture (10) and an optimal distribution of the light, both in the case the fixture (10) is wall installed, and in the case the same is ceiling installed.



Description

[0001] This invention relates to a high-performance lighting fixture with optimum light distribution which can be installed on the ceiling and on the wall.

[0002] More specifically, the invention refers to an innovative lighting apparatus, which uses power led light sources and which can be utilized for the simple lighting or for the emergency lighting, which includes at least one composite surface reflector, suitable to define an optics such as to assure the optimal distribution of the light, both in the case the fixture is wall installed, and in the case the fixture itself is ceiling installed.

[0003] A lighting apparatus of this type boasts an important content of lighting engineering and a remarkable aesthetic content.

[0004] A proper lighting has to guarantee, in the field of vision, high sufficiently and rationally distributed luminance to allow the perception of the important areas, as well as of the details, and minimise any form of dazzling.

[0005] In particular, the emergency lighting apparatus has to assure a sufficiently intense and concentrated luminous flux to make it possible to identify easily and quickly the way out, specially in case of danger. Luminance is defined as the ratio between the intensity of a light source in a given direction, and its apparent surface seen from the same direction; its value depends on the illumination, the reflection characteristics of the surfaces and the directions of lighting and observation.

[0006] Due to the dependence on the mentioned factors, the luminance is extremely difficult to calculate so, in practice, in the design of a lighting fixture, normally they always refer to the illumination.

[0007] The illumination in a point of a surface is defined as the ratio between the luminous flux which affects an element of the surface around the point and the surface of the element itself; therefore, the illumination can be easily envisaged and measured (by means of a luxmeter or an illuminometer), so it can be conveniently and simply used to deal with technical issues, such as for example the design of a lighting fixture.

[0008] The performance of a lighting apparatus, particularly an emergency lamp, are usually assessed by assigning a given illumination on a work or use top, consisted, by convention, of a horizontal plane placed at a certain distance from the floor; when the light reaches such a work top directly from the light source (at least 90% of the luminous flux), it is said that there's direct illumination, while, instead, when the light reaches the work top after being reflected from the walls and/or ceiling of the premises for several times too (at least 90% of the luminous flux), it is said there's indirect lighting. Of course, there a lot of intermediate cases where the luminous flux reaches the work top in direct and indirect percentages, which present intermediate values with respect to those cited above.

[0009] Apparatus for the direct lighting are widely utilized for the artificial lighting of buildings for civilian and

industrial use, both as a main source of light, and as an emergency or safety source.

[0010] Such lighting apparatus include usually a hollow body in which a light source, such as a fluorescent tube, can be accommodated, connecting it to terminals which allow the power supply; the body is closed by transparent protective screens associable in a removable way in order to always permit the access to the light source and the terminals.

[0011] The lighting apparatus of the known type, in particular the emergency ones, currently have an illumination distribution on the work top not very uniform and substantially unhomogeneous, even in relation to the relative position assumed by an observer with respect to the light source; moreover, the illumination is relatively concentrated and little intense, so it is not possible, in practice, to obtain an acceptable compromise between the intensity of the luminous flux and the concentration of the beam, important parameters in case an emergency situation occurs in the civil and work environments and it is necessary to resort to the lighting of the same with substitutive fluorescent lamps.

[0012] Finally, the performance of lighting apparatus of the known type depend on the positioning of the light source used, and, thus, from the positioning of the apparatus itself; consequently, the design of a lighting apparatus, suitable to realize an optimal distribution of light in case the cited apparatus is wall installed, does not provide the same performance in case the same apparatus is ceiling installed, and vice versa, forcing the designer to realize at least two different optics to carry out the desired installations.

[0013] Therefore, an aim of the present invention is to overcome the abovementioned disadvantages and, in particular, to realize a high-performance lighting fixture with optimum light distribution, which allows to achieve an illumination uniform and concentrated and intense enough at the same time, both in the case the fixture is ceiling installed and in the case such fixture is wall installed.

[0014] Another aim of the present invention is to create a high-performance lighting fixture with optimum light distribution, which is fixable to ceiling and to wall which allows to obtain, in any case, a desired illumination distribution and a considerable optics efficiency.

[0015] Another aim of the present invention is to realize a high-performance lighting fixture with optimum light distribution, which is fixable to ceiling and to wall, which, besides boasting an important illuminating-engineered content, as previously indicated, is strongly distinguished under the aesthetical point of view, both with the light source on and with the light source off.

[0016] These and other aims, according to the present invention, are achieved by realizing a high-performance lighting fixture with optimum light distribution, which can be installed in the ceiling and wall, according to the attached claim 1; further technical features are contained in the subsequent dependent claims.

[0017] Advantageously, the reflecting surface adopted in accordance with the present invention allows to illuminate very wide areas, assuring in any case a substantially uniform illumination on the work top, whether the lighting fixture is wall installed, or the same is wall installed; furthermore, it allows to obtain relatively concentrated light fluxes in a front direction of the diffusive screen.

[0018] Additional features and advantages of a high-performance lighting fixture with optimum light distribution which is fixable to ceiling and wall, according to the present invention, will be more apparent from the following description of a preferred, illustrative but not limiting, embodiment referred to the appended schematic drawings in which:

- figure 1 is a front view of a high performance lighting fixture with optimum light distribution which can be wall installed, according to the present invention;
- figure 2 is a front view of a high performance lighting fixture with optimum light distribution, which can be ceiling installed, according to the present invention;
- figure 3 is a front view of the lighting fixture according to the present invention, in which a rapid way of positioning of the reflector for the desired installation of the fixture is shown;
- figure 4 is a schematic view of the reflectors placement of the lighting fixture of figure 1, in wall installation condition, according to the present invention;
- figure 5 is a schematic view of the reflectors placement of the lighting fixture of figure 2, in ceiling installation condition, according to the present invention;
- figure 6 shows schematically the resulting photometric solid of the lighting fixture of figure 1, in wall installation condition, according to the present invention;
- figure 7 shows schematically the resulting photometric solid of the lighting fixture of figure 2, in ceiling installation condition, according to the present invention;
- figure 8 shows the schematic polar chart of the lighting fixture of figure 1, in wall installation condition, according to the present invention;
- figure 9 shows the schematic polar chart of the lighting fixture of figure 2, in ceiling installation condition, according to the present invention;
- figure 10 shows schematically the profile of each reflectors used in the lighting fixture, according to the present invention, which reports the position of the light source and the relative virtual sources.

[0019] With particular reference to the mentioned figures, the lighting fixture 10, according to the present invention, utilizes as light sources, in particular, power LEDs 11, placed properly on at least one surface of each reflector 12 used in the fixture 10.

[0020] This in order to achieve an optics of limited thickness and a reduced luminous surface of the lighting fixture 10.

ture 10.

[0021] The considerable and optimal lighting performance of the fixture 10 are obtained through a composite surfaces reflectors 12, so as to define an optics which produces a photometric solid so called universal, suitable to produce a proper illumination by the fixture 10, similarly, for ceiling and wall installations thereof.

[0022] In particular, such performance are achieved simply by extracting and turning each support 13 of the respective reflector 12 mounted on the fixture 10 with a given angle (as shown in detail in figure 3), in order to accomplish in such a way an asymmetrical optics for the wall installation of the fixture 10 (figure 4, where the light sources 11 are placed on the same plane and the reflectors 12 are one at the side of the other) and a symmetric optics for the ceiling installation of the fixture 10 (figure 5, where the light sources 11 are one opposed the other and the reflectors 12 are symmetrically positioned one each other).

[0023] As mentioned, each reflector 12 of the lighting fixture 10 according to the invention presents a composite surface, whose profile is obtained as follows.

[0024] Assume that each light source 11, whether punctiform or lambertian, placed on at least one of the surfaces of each reflector 12 and in particular consisted of at least one power LED, with the axis of maximum light intensity parallel to the plane of installation of the fixture 10 (wall or ceiling).

[0025] In the figures 6-9 are depicted the photometric solids and the polar charts of the light intensity of afore-said source 11, in both cases of the installation of the fixture 10, at wall and at ceiling respectively.

[0026] The profile of each reflector 12 (as shown in detail in figure 10) consists of at least three segments A, B, C straight line, joined at the vertexes D, E, in order to form a continuous interrupted line.

[0027] The mirror-like segments A, B, C, included among the lines indicated by F, G, H, L, M, N in figure 10, act as planes of symmetry, each of which generates a correspondent virtual source P, R, S; each virtual source P, R, S presents its polar chart of luminous intensity (visible in detail in figure 10).

[0028] Only the part of this chart contained among the straight lines F, G, H, L, M, N, which join each respective virtual source P, R, S and the edges of the output pupil of the reflector 12 is considered, as corresponding to the light which comes out of the reflector 12 after having undergone only one reflection.

[0029] By adding the intensity of the polar charts of the virtual sources, P, R, S and of the real source 11 and exclusively considering the directions according to which the light comes out of the reflector 12 undergoing a single reflection, the polar charts of the optical system are obtained, both in the case the fixture 10 is wall installed (figure 8) and ceiling installed (figure 9), which disclose a total efficiency of the optics of about 87% for both the installations.

[0030] An iterative procedure realizes a configuration

of the interrupted line, constituent the profile of each reflector 12, which produces a photometric solid sufficiently similar to the desired ideal solid.

[0031] Such a configuration consists, as said, on at least three segments A, B, C, which define:

- a first angle α , underlying the vertical T and the first segment A, which is greater than 90° and, in particular, included between 93° and 113° and, preferably, equal to 103° ,
- a second angle β , underlying the first segment A and the second segment B, which is included between 139° and 159° and, preferably, equal to 149° , and
- a third corner γ , underlying the second segment B and the third segment C, which is included between 143° and 163° and, preferably, equal to 153° .

[0032] Finally, the distance between the points V (end of the segment A opposed to D) and W (located at the same level of the point Z, end of the segment C opposed to E) of the vertical T is equal to about 24 mm and, more in general, is included between 23 mm and 24 mm, while the distance between points W and Z is approximately 67 mm and, more in general, is included between 65 mm and 70 mm.

[0033] A lighting fixture 10 which can be used, particularly, for emergency lighting, shaped as previously described, boasts an important content of lighting engineering and a remarkable aesthetic content.

[0034] From the technical point of view, it is marked out by one or more reflectors 12, each having a composite surface, conferred by the union of shaped interrupted surfaces, which allows to obtain the desired illumination distribution, similarly for wall installations and ceiling installations of the fixture 10, although in the absence of facilities specifically dedicated to obtain the distribution itself.

[0035] Moreover, using any type of installation and having only the attention to rotate properly at least one of the reflectors 12 (as shown in figure 3), passing from a wall installation to a ceiling installation or vice versa, the distribution of the illumination is advantageously devoid of alternating zones of light and dark and/or of sudden illumination variations.

[0036] As far as the aesthetic point of view is concerned, each reflector 12 is deeply marked out, both with the relative light source 11 (power LED) on and with the light source 11 off, since the reflections coming from the interrupted surfaces of the reflector 12 produce, through direct observation, a mosaic of miniaturized repeated images.

[0037] Practically, it was noticed that the lighting fixture 10, according to the present invention, is particularly advantageous for the great uniformity and area of lighting which it allows to get; furthermore, the particular interrupted profile of the reflector 12 permits to get controlled photometric performance, both in the case the fixture 10 is wall installed, and in the case the fixture 10 is ceiling

installed, and, thus, it also constitutes a reliable and versatile product for the emergency lighting.

[0038] Finally, it is clear that many other variations can be made to the high-performance lighting fixture with optimum light distribution, object of the present invention, without for this reason going out of the novelty principles inherent of the inventive idea, as it is clear that, in the practical implementation of the invention, materials, shapes and sizes of the illustrated details could be any depending on the needs and the same could be replaced with others technically equivalent.

[0039] In particular, as previously shown yet, the lighting fixture thus realized can be used similarly both for the punctual lighting of the environments, and for the emergency lighting, and it can be equally applied to walls or ceilings, with the orientation of the light beam both on the longitudinal plane and on the transversal one; such lighting fixture can also be planned for suspension or electrified bar installation, thanks to the high illumination level which can develop towards the ground also from considerable heights.

Claims

1. High-performance lighting fixture with optimum light distribution, which is fixable to ceiling and wall, of the type comprising at least one light source (11), suitable to spread the light through at least one diffuser, **characterized in that** the light source (11) is placed on at least one of the surfaces of at least one reflector (12), made with a composite surface and whose profile consists of at least three segments of straight line (A, B, C), joined at the vertexes (D, E), in order to form a continuous interrupted line, so as to define an optics suitable to produce a photometric solid which gives rise to high performance of the lighting fixture (10) and an optimal distribution of the light, both in the case the lighting fixture (10) is wall installed, and in the case it is ceiling installed.
2. Fixture (10) as claim 1, **characterized in that** the light source (11) includes at least one power LED.
3. Fixture (10) as claim 1, **characterized in that** each reflector (12) of the lighting fixture (10) is placed on at least a removable support (13) which can be placed in at least two different positions, reciprocally spaced of a given angle, in order to achieve an asymmetrical optics, according to which at least two reflectors (12) of the fixture (10) are one at the side of the other, for wall installation of the fixture (10), or a symmetrical optics, according to which at least two reflectors (12) of the fixture (10) are symmetrically positioned one each other and at least two light sources (11), each of which placed on a respective reflector (12), one opposed the other, for the ceiling installation of the fixture (10).

4. Fixture (10) as claim 1, **characterized in that** each light source (11), placed on at least one of the surfaces of each reflector (12) and consisted in particular of at least one power LED, is provided with at least one axis of maximum light intensity parallel to the installation plane of the lighting fixture (10). 5

5. Fixture (10) as claim 1, **characterized in that** the segments mirror-like to said three segments of straight line (A, B, C) act as symmetry planes, each of which generates at least one respective virtual source (P, R, S) with associated at least one respective polar chart of the luminous intensity, at least a portion of said chart being considered, said portion corresponding to the light which comes out of said reflector (12) after having undergone a single reflection. 10 15

6. Fixture (10) as claim 1, **characterized in that** said profile of each reflector (12) is realized in such a way as to produce a photometric solid similar to a predetermined ideal solid. 20

7. Fixture (10) as claim 1, **characterized in that** said three segments (A, B, C) of the profile of each reflector (12) define at least three respective angles greater than 90°. 25

8. Fixture (10) as claim 7, **characterized in that** a first angle (α), defined by at least one vertical (T) and at least one (A) of said three segments (A, B, C) is included between 93 ° and 113° and, preferably, is equal to 103°. 30

9. Fixture (10) as claim 7, **characterized in that** a second angle (β), defined by at least two (A, B) of said three segments (A, B, C) is included between 139° and 159° and, preferably, is equal to 149°. 35

10. Fixture (10) as claim 7, **characterized in that** a third angle (γ), defined by at least two (B, C) of said three segments (A, B, C) is included between 143° and 163° and, preferably, is equal to 153°. 40

11. Fixture (10) as claim 1, **characterized in that** it can be used similarly for the punctual lighting of the environments, and for the emergency lighting, and it can be applied to walls, ceilings or electrified bars, with orientation of the light beam both on the longitudinal plane and on the transversal plane. 45 50

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Fig.1

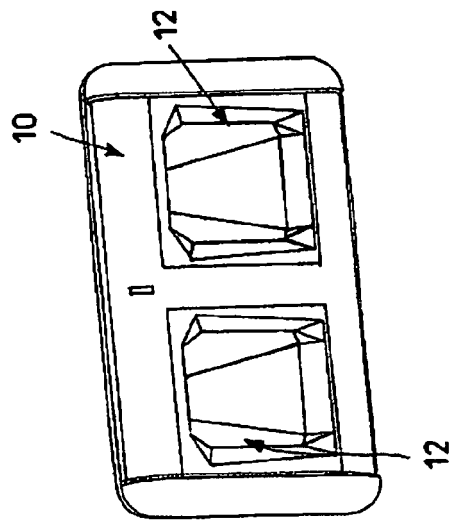


Fig.2

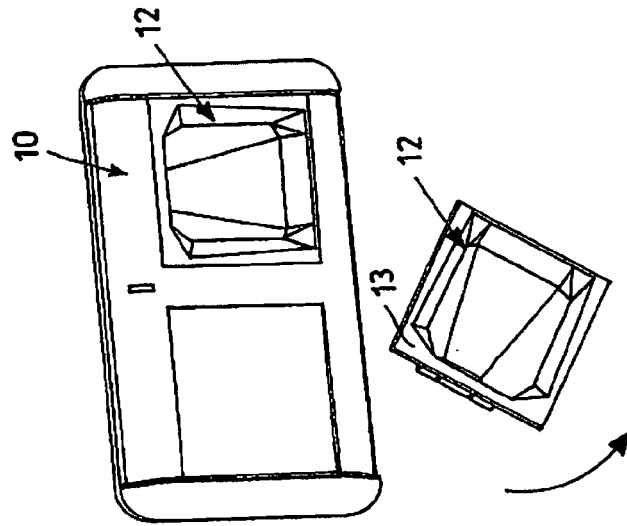


Fig.3

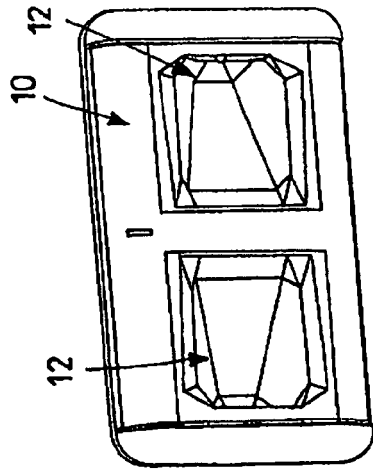


Fig.4

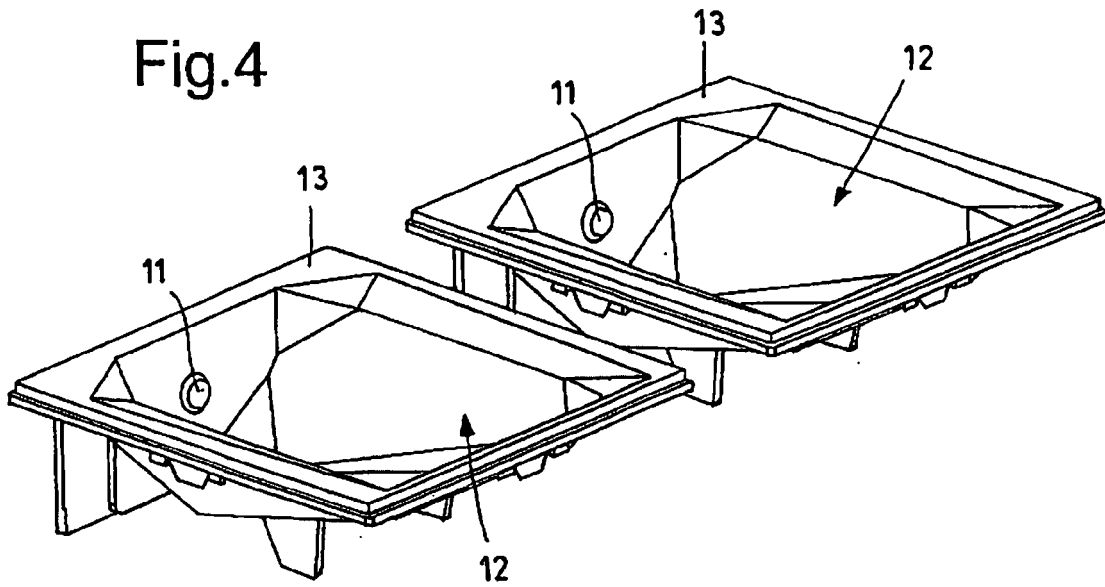


Fig.5

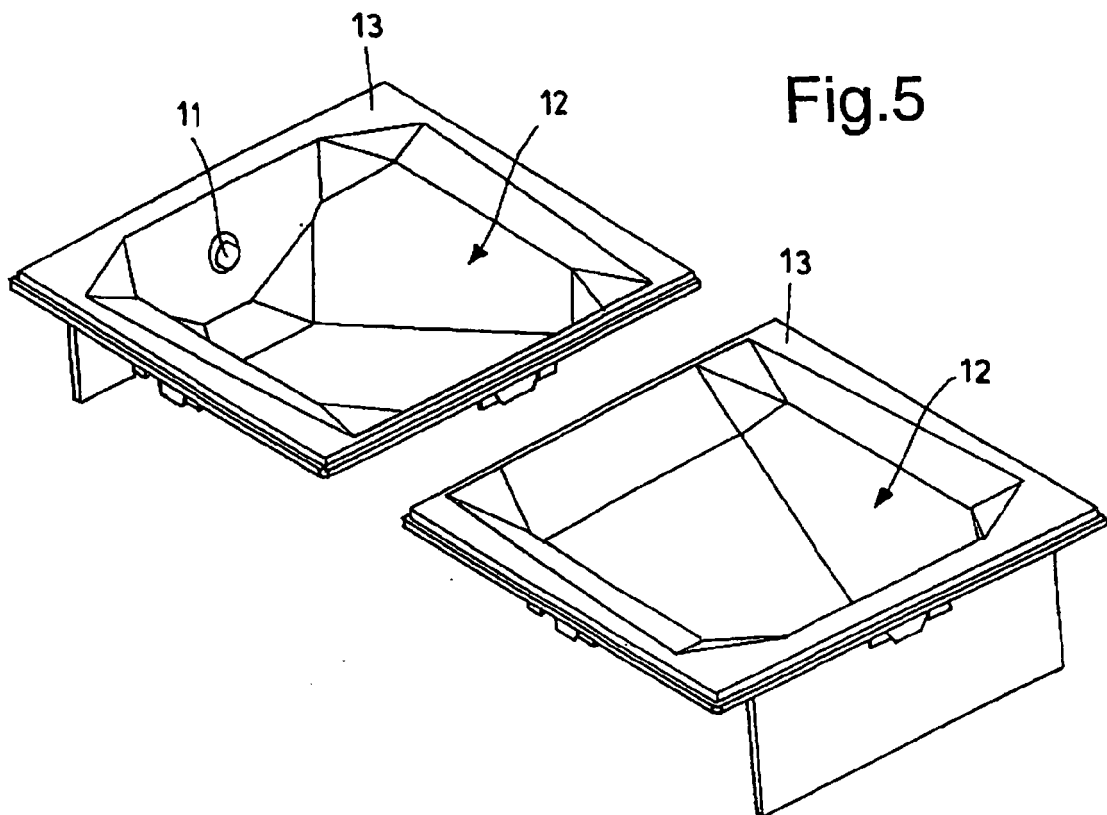


Fig.6

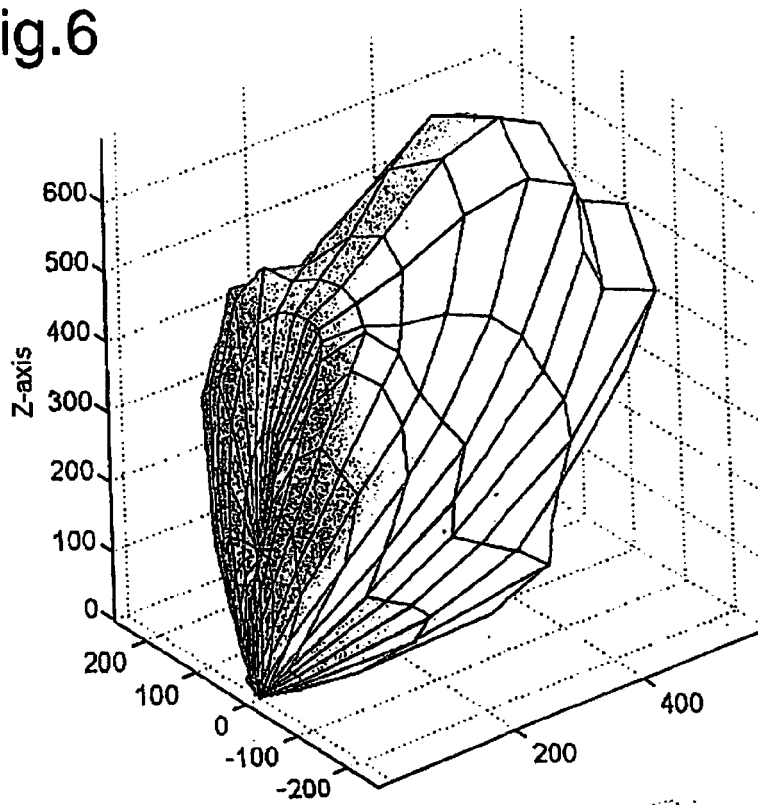


Fig.7

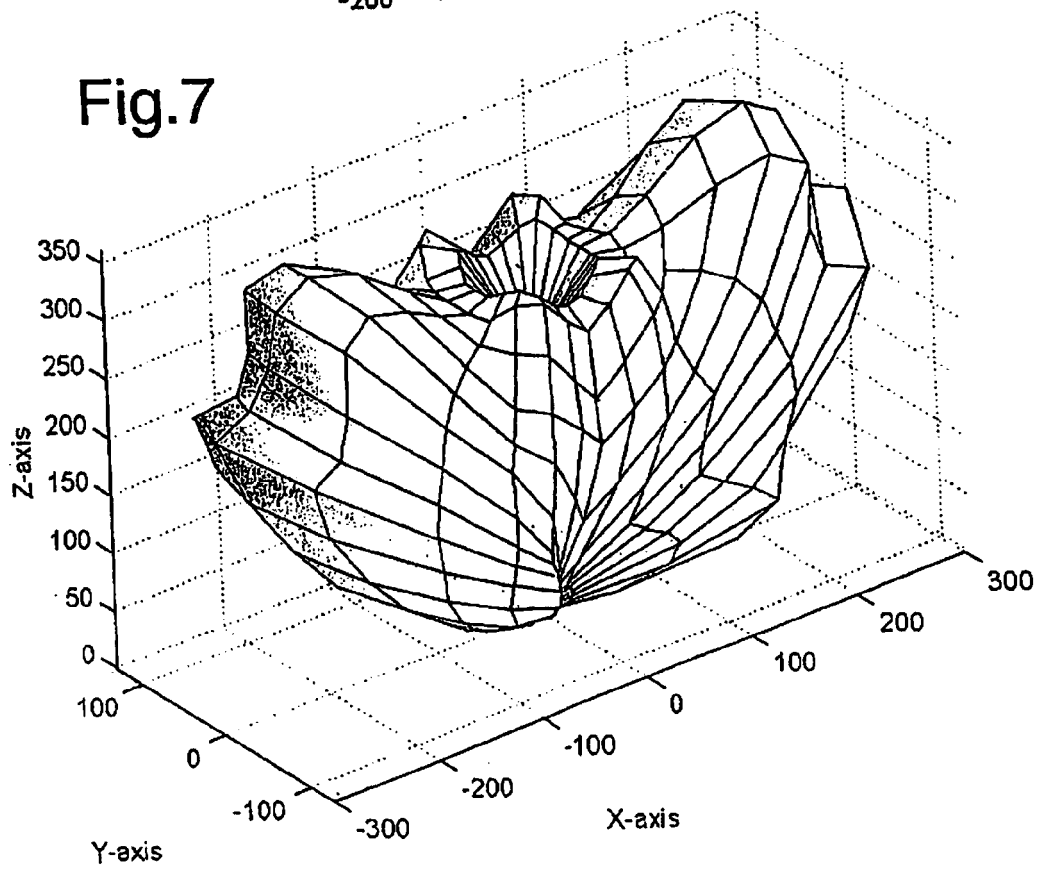


Fig.8

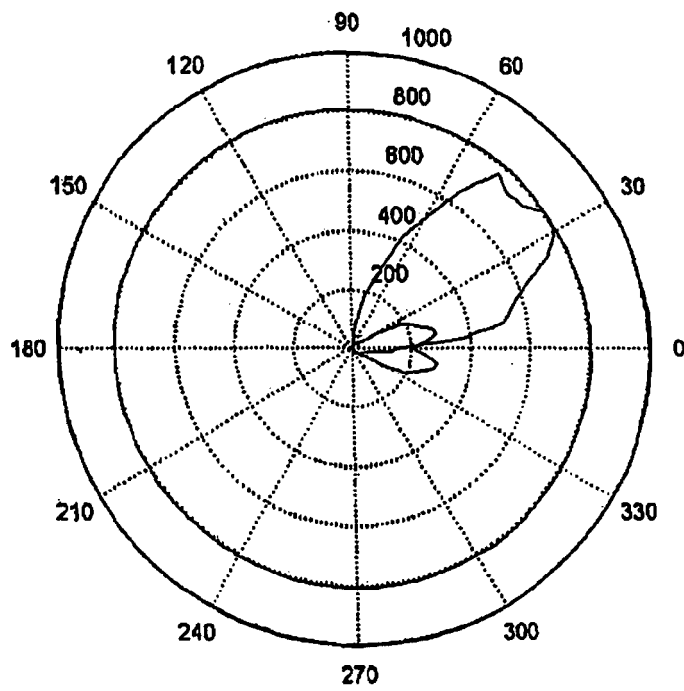


Fig.9

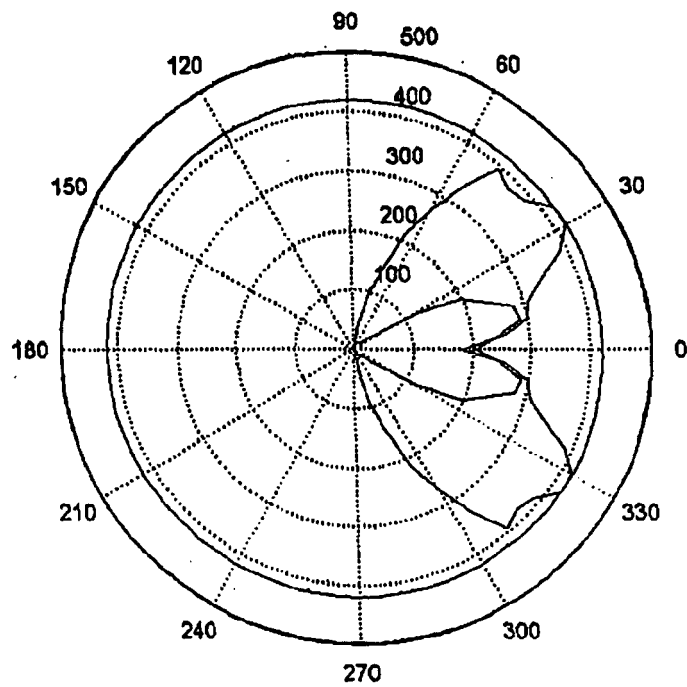


Fig.10

