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(71) Applicant: **IDEALED S.r.l. Unipersonale**
36100 Vicenza (IT)

(72) Inventor: **Zancan, Antonio**
36100 Vicenza (IT)

(74) Representative: **Vannini, Mario**
Maroscia & Associati S.r.l.
Contrà S. Caterina, 29
36100 Vicenza (IT)

(54) LED light unit

(57) A LED light unit, comprising at least one LED (4), a housing element (2) for the LED (4) and a cover element (5) mounted over the LED (4).

The housing element (2) is made of a first thermally conductive polymer material. The LED (4) and the cover element (5) are also integrally associated to the housing element (2) to form a unitary light unit therewith.

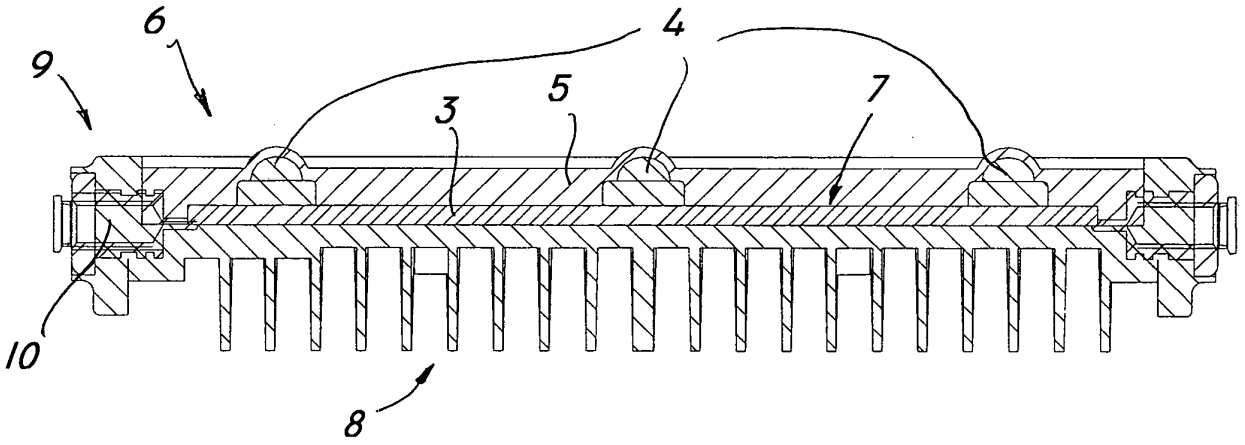

FIG. 2

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Description

Field of the invention

[0001] The present invention finds application in the field of both indoor and outdoor artificial lighting and particularly relates to a highly watertight light emitting module.

Background of the invention

[0002] Many lighting devices are known in the art, which use as a light source one or more light emitting diodes, commonly known as LEDs. In general, a LED is an electronic module adapted to generate electromagnetic radiations of various wavelengths, and particularly also in the visible light spectrum.

[0003] The Italian Patent application VI2003A000011 discloses a light emitting module comprising all the features as defined in the preamble of claim 1. Particularly, this prior art module comprises a support structure for one or more LED sources embedded in a protection and cover element, made of a polymer material which is mounted to the metal structure by screw or snap fit means, with a gasket interposed therebetween. Light sources are powered by electric means.

[0004] A well-known drawback of this prior art solution is that the metal structure does not ensure optimal dissipation of the heat generated by LED sources.

[0005] Furthermore, the screw or snap fit does not ensure watertightness, thereby involving the risk that both power supply connections and LEDs may be irremediably damaged.

Summary of the invention

[0006] The object of this invention is to overcome the above drawbacks, by providing a light unit that is highly efficient and relatively cost-effective.

[0007] A particular object is to provide a light unit that allows dissipation of large amounts of heat.

[0008] Yet another object is to provide a highly watertight light unit, which can be used underwater with no risk of liquid ingress.

[0009] These and other objects, as better explained hereinafter, are fulfilled by a LED unit as defined in claim 1, comprising at least one LED, a housing element for said at least one LED; a cover element mounted above said at least one LED, characterized in that said housing element is made of a first thermally conductive polymer material, said cover element and said at least one LED being integrally associated to said housing element to form a one-piece light unit.

[0010] Thanks to this particular configuration, the unit of the invention allows dissipation of large amounts of heat, while ensuring watertightness.

[0011] By making the housing element from polymer material, any oxidation problems will be avoided.

[0012] In another aspect, the invention relates to a LED lighting apparatus as defined in claim 12, which comprises at least one support plate for at least one light source designed to emit a light beam, and at least one lens associated to said light source, which is designed to change the conformation and optical path of said beam, characterized in that said light source comprises at least one LED source as claimed in one or more of the previous claims.

Brief Description of the Drawings

[0013] Further features and advantages of the invention will be more apparent from the detailed description of a preferred, non-exclusive embodiment of a unit according to the invention, which is described as a non-limiting example with the help of the annexed drawings, in which:

FIG. 1 is a perspective view of a light unit according to the invention;
FIG. 2 is a sectional view of the light unit of Fig. 1, as taken along a plane *II-II;*
FIG. 3 is a bottom perspective view of the light unit of FIG. 1;
FIG. 4 is a perspective view of an assembled configuration of a lighting apparatus according to the invention;
FIG. 5 is an exploded view of a lighting apparatus according to the invention;
FIG. 6 is an enlarged view of certain details of FIG. 5;
FIG. 7 is a plan view of a lighting apparatus according to the invention in a first operating position;
FIG. 8 is a plan view of a lighting apparatus according to the invention in a second operating position.

Detailed description of a preferred embodiment

[0014] Referring to the above figures, the lighting unit of the invention, generally designated by numeral 1, will be particularly but not exclusively suitable for residential or industrial lighting.

[0015] As shown in FIGS. 1 and 2, it comprises a housing element 2 for three LED sources 4, preferably mounted on a support element 3. It will be understood that the support element 3 may also be omitted, and the LEDs, with the electric contacts associated thereto, may also be directly embedded in the housing element 2. For this purpose, the latter may be made from an electrically insulating material.

[0016] In a known manner, the support element 3, typically a metal plate, may have sockets for connection to the LEDs 4, which are typically microsoldered thereto, and tracks for series or parallel connection therebetween.

[0017] It shall be understood that the LED sources may be provided in any number, without departure from the scope of the attached claims. These will preferably be of the high power type, for assuring optimal lighting.

[0018] A cover element 5, mounted over the LEDs 4, will be further provided.

[0019] In accordance with the invention, the housing element 2 is made of a first thermally conductive polymer material, which may consist of a base plastic material with particles of highly thermally conductive materials, preferably but without limitation metal particles, dispersed therein. This base plastic material may be selected from the group comprising polypropylene, polyamide, polysulfone or an elastomer, preferably EPDM.

[0020] According to the invention, the LEDs 4 and the cover element 5 are integrally associated to the housing element 2. Therefore, the LEDs are embedded in the cover element 5 and/or the housing element 2, to form a unitary, watertight unit 1, specially suitable for underwater use. Likewise, if the LEDs lie on the support element 3, the latter will be wholly embedded in the cover element 5 and/or the housing element 2. It will be understood that the LEDs 4 may be covered by a lens, itself embedded in the cover element 5, which is designed to change the optical path of the light beam emitted therefrom, without departure from the scope as defined by the annexed claims. This will avoid any lens fouling problem.

[0021] For this purpose, the cover element 5 may be made of a second optically transparent polymer material, preferably a silicone resin, a polyamide, a polycarbonate or PMMA, which may be chemically compatible with the first polymer material that forms the housing element 2. In this configuration of the invention, the second material will be chemically bonded to the first material, thereby providing a substantially watertight coupling, which will make the light unit of the invention specially suitable for underwater use.

[0022] Advantageously, the housing element 2 may comprise a substantially flat main body 6 having a seat 7 for the support element 3 with the LEDs 4 associated thereto and a plurality of outwardly extending heat-dissipating fins 8, as clearly shown in FIG. 3.

[0023] The fins 8 shall be appropriately sized and configured according to the power of the LEDs used, hence of the heat to be dissipated, especially when high power LEDs are used.

[0024] Suitably, the cover element 5 may be housed within the whole seat 7 to cover and incorporate the support 3 and the LEDs 4, as shown in FIG. 1

[0025] The light unit of the invention may comprise power supply means 9 for powering the LEDs 4, to be connected to a normal power supply mains.

[0026] Particularly, the power supply means 9 may have wiping contacts 10, as shown in FIGS. 1 and 2, known as IP55, for domestic use, or bayonet locking contacts, as shown in FIG. 3, known as IP68, for underwater use. It shall be understood that any other type of power supply means may be used without departure from the scope of the annexed claims.

[0027] Advantageously, the power supply means 9 may include voltage transformer means, not shown but well known per se, which are incorporated in the housing element 2.

[0028] In a further aspect, the invention relates to a LED lighting apparatus, comprising a support plate 12 for the unit 1 and for a sheet 13 which in turn supports three lenses 14 coincident with the LEDs 4 for changing the shape and the optical path of the light beam emitted therefrom.

[0029] As mentioned above concerning the LEDs, it will be understood that the lenses may be provided in any number, without departure from the scope of the attached claims.

[0030] The apparatus may have modular interconnection means 15 for coupling two or more units 1. In the embodiment of FIG. 4, the means 15 are a pair of complementary U-shaped plates 16, 16', which are adapted to connect two plates 12, 12' for supporting two units 1, 1' with their respective sheets 13, 13' and lenses 14 and 14'.

[0031] It will be understood that the units that form the assembly may be provided in any number, and that such units may be assembled in any configuration without departure from the scope as defined in the annexed claims. For instance, a single plate 12 may be even provided, for supporting a plurality of units 1, one next to or above the other.

[0032] Advantageously, the lenses 14 are associated to the unit 1 through suitable adjustment means 17.

[0033] As particularly shown in FIG. 6, the adjustment means 17 may comprise pivot means 18 adapted to selectively change the tilt angle α of the lenses 14 relative to the plate 12. In the illustrated embodiment, the pivot means 18 include a pair of pins 19 insertable in corresponding elongated holes 20 of the plate 12 for pivoting the unit 1, as well as the plate 13 and the lenses 14 to which it is rigidly connected, about the axis X, in the direction of arrows F_1 and F_2.

[0034] Furthermore, the adjustment means 17 may further comprise spacer means 21 for selectively adjusting the distance d of the lenses 14 from the unit 1.

[0035] As shown in FIGS. 7 and 8, the spacer means 21 may comprise a pair of teeth 22, 22' formed on the unit 1, insertable in a pair of locknuts 23, 23' formed on elongate extensions 24, 24' of the sheet 13, for radial displacement of the lenses 14 relative to the unit 1, in the direction of arrow F_3 and adjust the relative distance from d' to d". By this arrangement, the light beam emitted from the LEDs may be conformed and modeled as desired.

[0036] The plate 12 may be made of a plastic material and be subjected to a suitable conductive treatment next to the electric contacts 9 of the unit, e.g. by providing a nickel-plated surface portion, so that no exposed wire is required. A mains voltage transformer may be further embedded in the plate 12.

[0037] In view of the foregoing, it clearly appears that the unit and apparatus of the invention fulfill the intended objects and particularly meet the requirement of allowing dissipation of large amounts of heat, while ensuring safe watertightness.

[0038] By forming the housing element 2 from a thermally conductive polymer material, the large amounts of heat generated by the LEDs may be effectively dissipated, and any deformation and/or mechanical failure of the whole unit may be avoided.

[0039] The unit of this invention is susceptible of a number of changes and variants, within the inventive principle disclosed in the appended claims. All the details thereof may be replaced by other technically equivalent parts, and the materials may vary depending on different needs, without departure from the scope of the invention.

[0040] While the unit has been described with particular reference to the accompanying figures, the numerals referred to in the disclosure and claims are only used for the sake of a better intelligibility of the invention and shall not be intended to limit the claimed scope in any manner.

Claims

1. A LED unit, comprising:

- at least one LED (4),
- a housing element (2) for said at least one LED (4),
- a cover element (5) mounted above said at least one LED (4),

characterized in that said housing element (2) is made of a first thermally conductive polymer material, said at least one LED (4) and said cover element (5) being integrally associated to said housing element (2) to form a unitary, watertight light unit.

2. A light unit as claimed in claim 1, **characterized in that** said first thermally conductive polymeric material is an electrical insulator.

3. A light unit as claimed in claim 1, **characterized in that** said cover element (5) is made of a second polymer material.

4. A light unit as claimed in claim 3, **characterized in that** said second polymer material is optically transparent.

5. A light unit as claimed in claim 3, **characterized in that** said second polymer material is selected from the group comprising silicone resins, polyamides, polycarbonate, PMMA.

6. A light unit as claimed in claim 3, **characterized in that** said first polymer material is chemically compatible with said second polymer material.

7. A light unit as claimed in claim 1, **characterized in that** said first thermally conductive polymer material comprises a base plastic material with particles of highly thermally conductive materials dispersed therein.

8. A light unit as claimed in claim 7, **characterized in that** said base plastic material is selected from the group comprising polypropylene, polyamide, polysulfone, elastomers.

9. A light unit as claimed in claim 7, **characterized in that** said highly thermally conductive particles are metal materials.

10. A light unit as claimed in claim 1, **characterized in that** it comprises a support element (3) for said at least one LED (4).

11. A light unit as claimed in claim 1, **characterized in that** said housing element (2) comprises a substantially planar main body (6) having a seat 7 for housing said at least one LED (4) and a plurality of heat-dissipating fins (8), outwardly extending from said body (6).

12. A light unit as claimed in claim 11, **characterized in that** said cover element (5) is mounted over the whole of said cavity (7) to cover and incorporate said at least one LED (4).

13. A light unit as claimed in claim 1, **characterized in that** it comprises power supply means (9) for powering said at least one LED (4), to be connected to an external power supply mains.

14. A light unit as claimed in claim 13, **characterized in that** said power supply means (9) include voltage transformer means incorporated in said housing element (2).

15. A LED lighting apparatus comprising at least one support plate (12) for at least one light source designed to emit a light beam, and at least one lens (14) associated to said light source, which is designed to change the conformation and optical path of said beam, **characterized in that** said light source comprises at least one LED source (1) as claimed in one or more of the preceding claims.

16. An apparatus as claimed in claim 15, **characterized in that** said at least one lens (14) is associated to said LED unit (1) though suitable adjustment means (17).

17. An apparatus as claimed in claim 15, **characterized in that** said adjustment means (17) comprise pivot means (18) adapted to selectively change the tilt angle (α) of said at least one lens (14) relative to said plate (12).

18. An apparatus as claimed in claim 15, **characterized in that** said adjustment means (17) comprise spacer means (21) for selectively adjusting the distance of said at least one lens (14) from said LED unit (1).

19. An apparatus as claimed in claim 15, **characterized in that** said at least one lens (14) comprises a plurality of lenses associated to respective LEDs (4) of said LED unit (1).

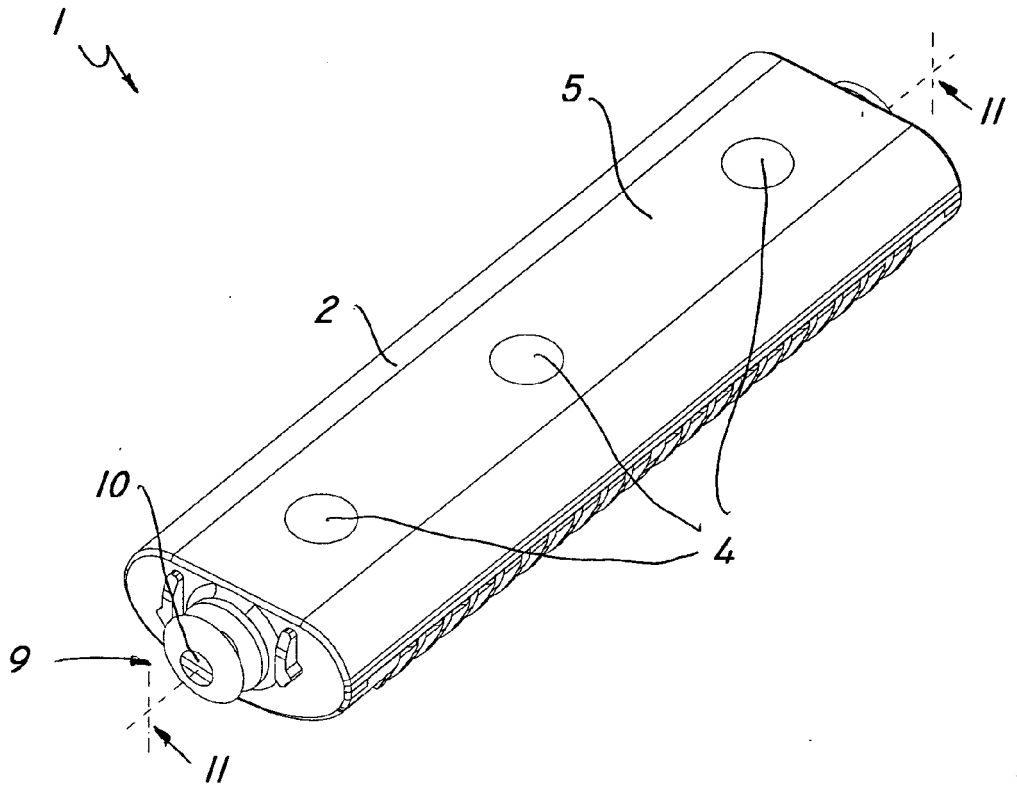

FIG. 1

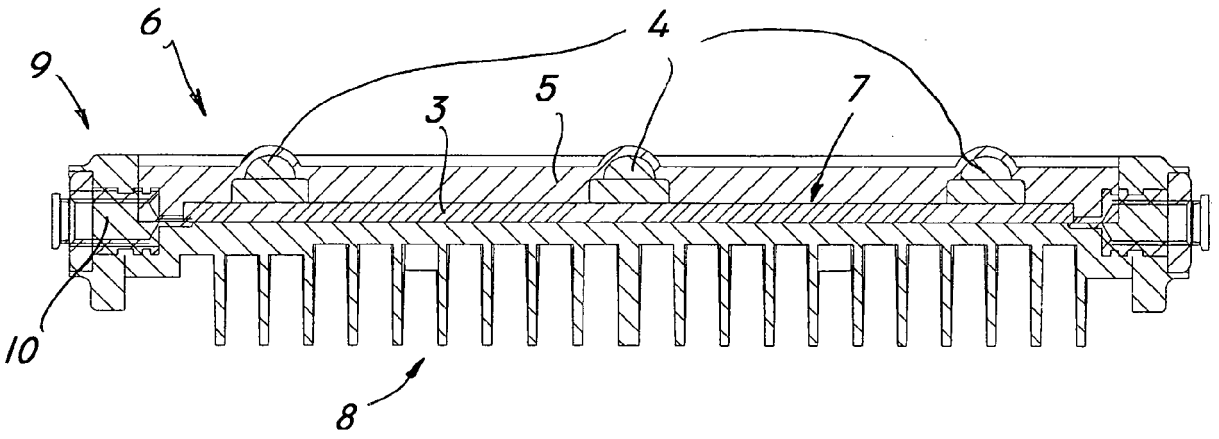

FIG. 2

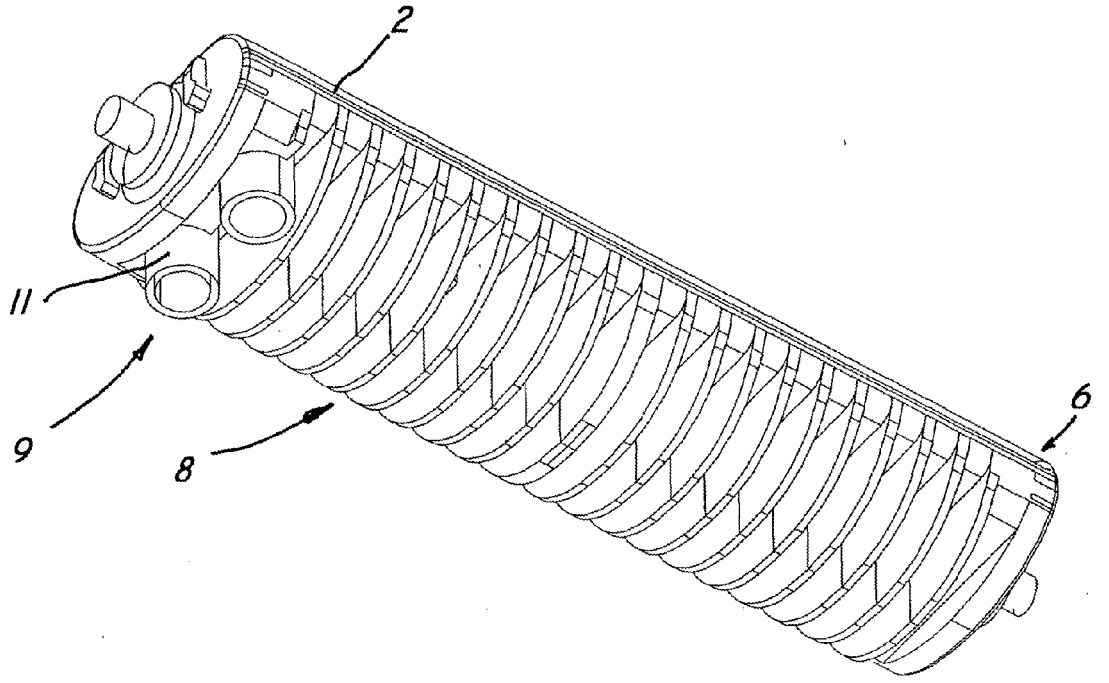

FIG. 3

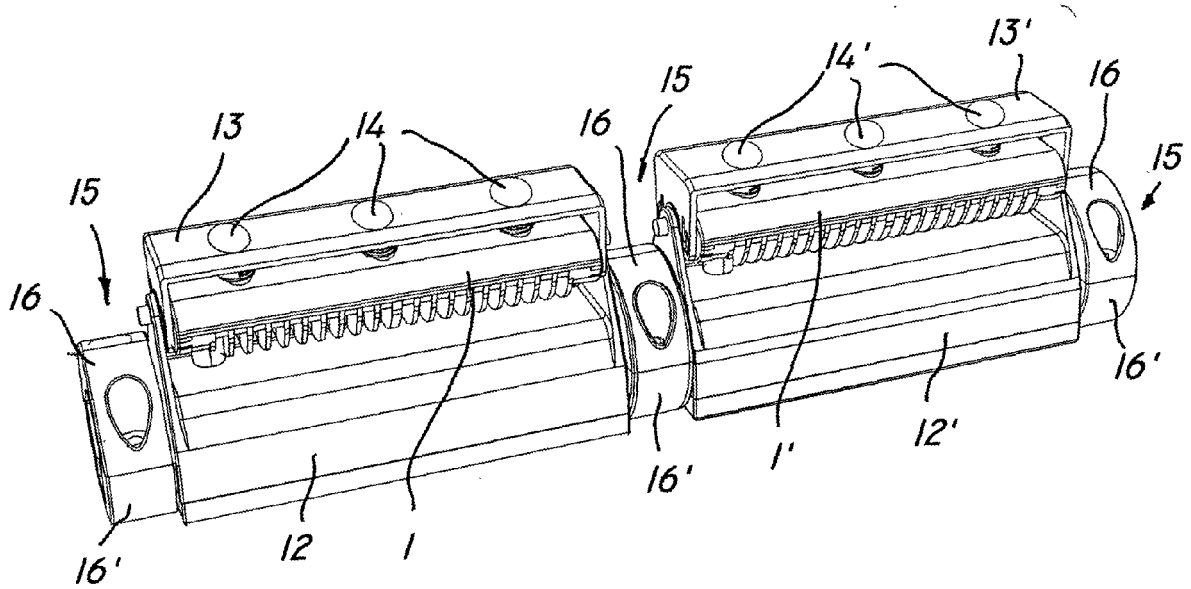

FIG. 4

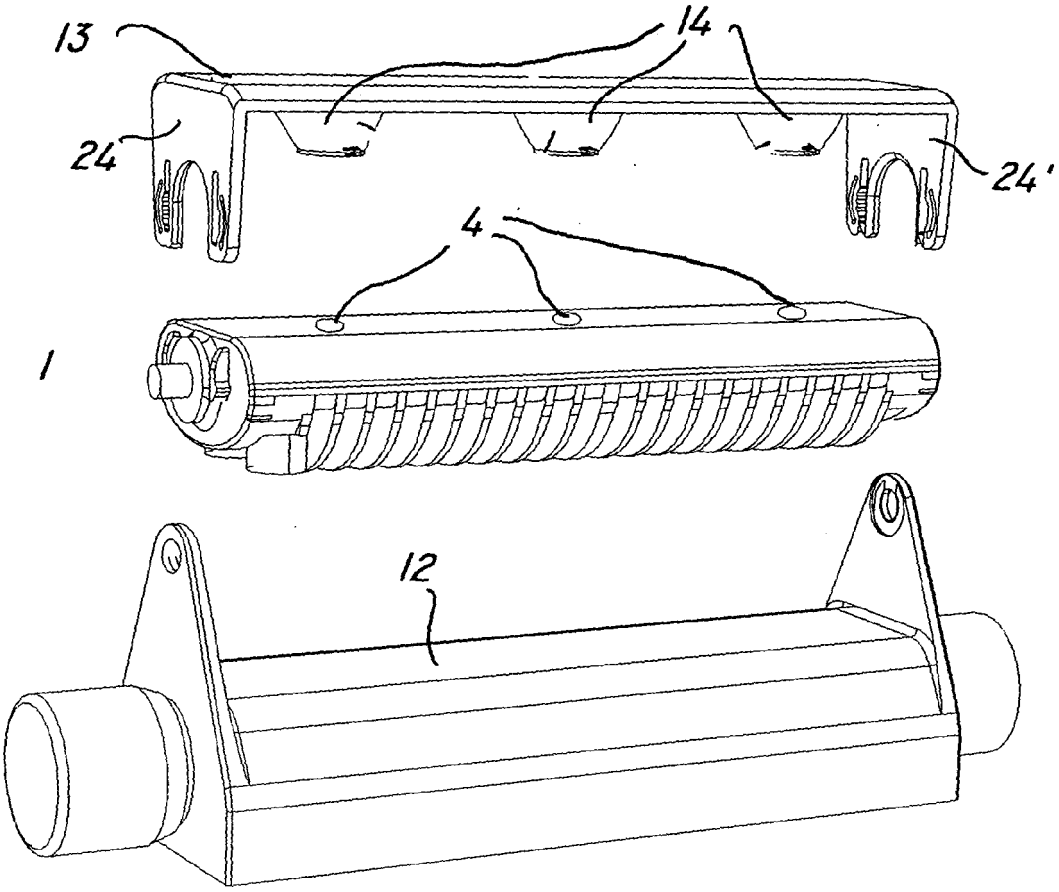

FIG. 5

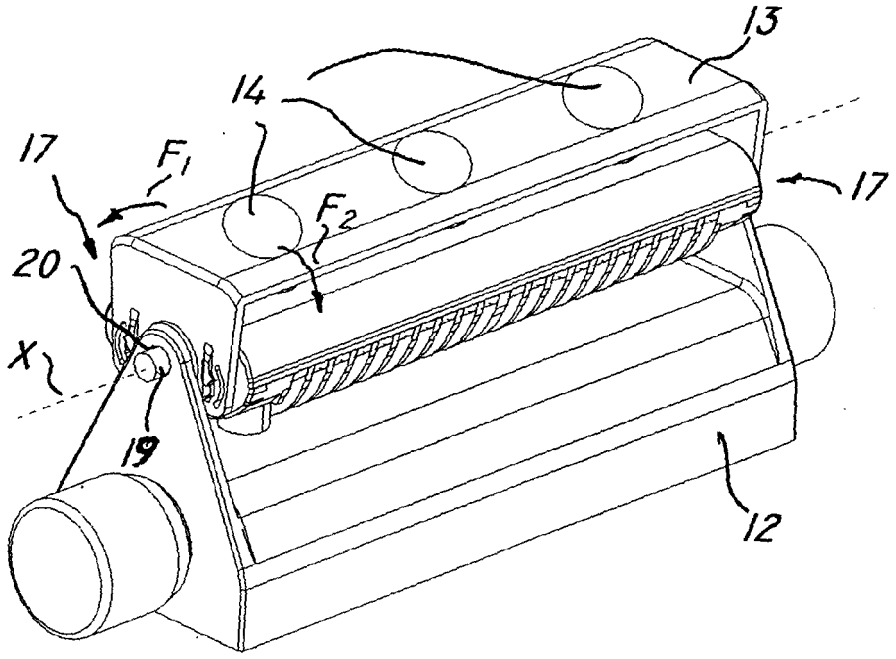

FIG. 6

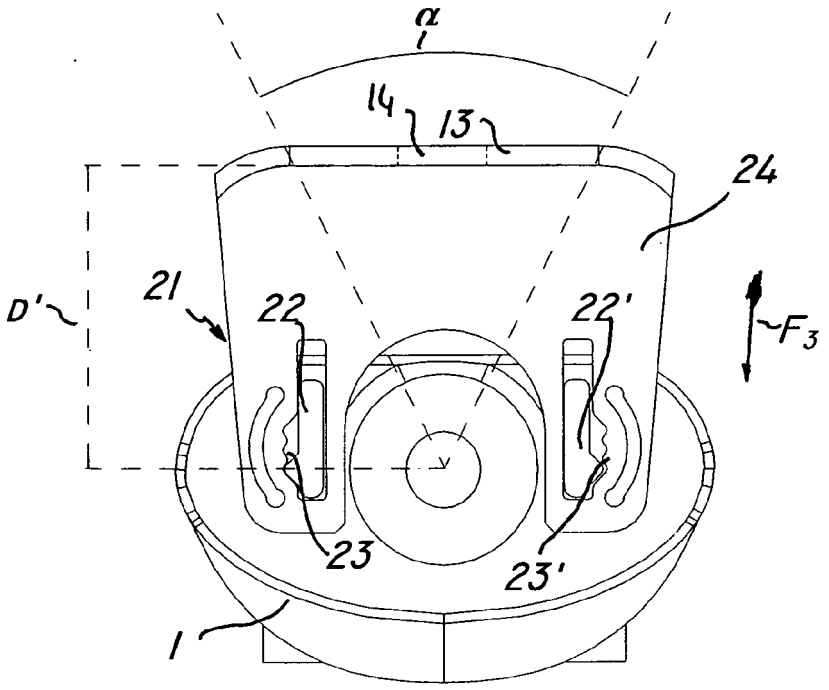

FIG. 7

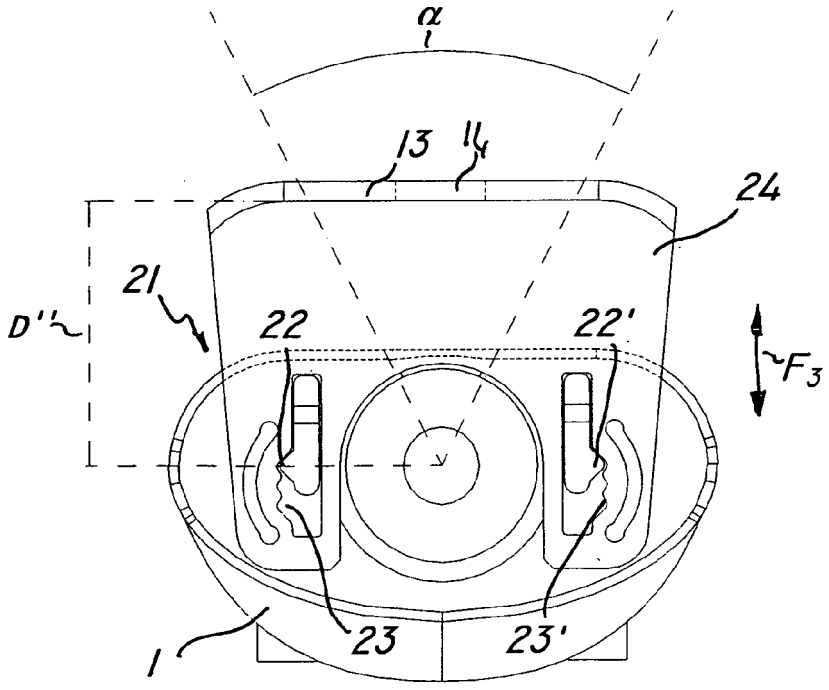

FIG. 8

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EUROPEAN SEARCH REPORT

Application Number
EP 07 00 2908

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	22 May 2007	Allen, Katie

CATEGORY OF CITED DOCUMENTS

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Place of search	Date of completion of the search	Examiner
The Hague	22 May 2007	Allen, Katie

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