

(19)



(11)

**EP 1 895 232 B1**

(12)

**EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention  
of the grant of the patent:  
**05.05.2010 Bulletin 2010/18**

(51) Int Cl.:  
**F21V 29/00** <sup>(2006.01)</sup> **F21S 8/08** <sup>(2006.01)</sup>

(21) Application number: **06119702.6**

(22) Date of filing: **29.08.2006**

(54) **Improved heat sink structure for light-emitting diode based streetlamp**

Verbesserte Kühlkörperstruktur für LED Strassenleuchte

Structure de dissipation thermique améliorée pour lampe d'éclairage public avec diodes électroluminescentes

(84) Designated Contracting States:  
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR  
HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI  
SK TR**

(43) Date of publication of application:  
**05.03.2008 Bulletin 2008/10**

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## Description

### BACKGROUND OF THE INVENTION

#### 1. Field of the invention

[0001] The invention relates to a heat sink structure according to the preamble of claim 1.

[0002] Hence, the present invention relates generally to a heat sink structure for a light-emitting diode (LED) based streetlamp, and particularly to an improved heat sink structure for LED based streetlamp.

#### 2. Description of the prior art

[0003] A heat sink structure of the initially-mentioned type is known, e.g., from WO 02/101285.

[0004] Conventionally, the streetlamps are generally in the form of bulbs. However, they are considered having the disadvantages of high power consumption and short lifetime. Recently, light-emitting diode (LED) has been used for the torch as a power source. High power LED is a kind of LED which can emit light normally even only with the power 0.5 to 3 watts supplied. In addition to the torch, such kind of LED has also been used in the headlight. However, the high power LED still can not be effectively used as a backlight source for liquid crystal display (LCD) since the light emitting efficiency thereof is too low therefor. So far, there are still few LEDs for the LCD on market, since they have to be further developed for the practical use.

[0005] With development of the LEDs for the recent decade, the high power LEDs have gradually become indispensable in our daily life. Being technically limited by the LED materials and packaging technology, the LEDs still have not lived up to the specifications of the general lighting means in luminance and lifetime. Further, the heat energy, generated when the LED emits light, has to be properly removed therefrom. If the heat sink mechanism is not properly provided, the high temperature contributed by the heat energy will cause the luminance and lifetime reduced and the light wavelength shifted with respect to the LEDs. In the case of the streetlamp, the poor heat sink mechanism also leads to a quick damage thereof.

[0006] In view of these problems encountered in the prior art, the Inventors have paid many efforts in the related research and finally developed successfully a heat sink structure for LED based streetlamp, which is taken as the present invention.

### SUMMARY OF THE INVENTION

[0007] It is, therefore, an object of the present invention to provide a heat sink structure for light-emitting diode (LED) based streetlamp, through which heat energy generated from LEDs therein can be rapidly removed therefrom.

[0008] The invention provides a heat sink structure according to claim 1. Further embodiments of the invention are described in the dependent claims.

[0009] In accordance with the present invention, the heat sink structure for LED based streetlamp comprises an upper cover on which a plurality of heat sink fins are formed integrally and a lower cover. The heat energy generated from the LEDs, mounted on a polymer-coated gold substrate, within the upper and lower covers can be removed through the heat sink fins, effectuate rapid removing of the heat energy. Depending on the power specification for the LEDs, the polymer-coated gold substrate may be varied in area and shape. An upper silicone glue and a lower silicon glue are provided in the upper and lower covers, respectively, so that the heat sink structure can be water resistant. A fastening member is disposed between the upper and lower covers so that the upper and lower covers may be not totally separated from each other when one of them is moved from the other for maintenance and replacement of elements in the heat sink structure. A rear hole and a lower hole are formed on the upper and lower covers, respectively, for insertion and fixation of a lamp post. When the lamp post is absent, an upper plug and a lower plug may be used to choked up the rear and lower holes, respectively, so that the heat sink structure can be water resistant.

### BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The drawings disclose an illustrative embodiment of the present invention which serves to exemplify the various advantages and objects hereof, and are as follows:

FIG. 1A is an exploded view of a heat sink structure for light-emitting diode (LED) based street light according to an embodiment of the present invention; FIG. 1B is an exploded view of the heat sink structure for LED based street light according to another embodiment of the present invention; FIG. 2A is a side view of the heat sink structure for LED based street light shown in FIG. 1A; FIG. 2B is a side view of the heat sink structure for LED based street light shown in FIG. 1B; FIG. 3 is a perspective view of the heat sink structure for LED based street light shown in FIG. 1A; and FIG. 4 is a perspective view of the heat sink structure for LED based street light shown in FIG. 1B.

### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0011] The present invention discloses a heat sink structure for light-emitting diode (LED) based streetlamp, which will be described taken with the preferred embodiments in conjunction with the drawings. However, they should not be deemed limitative but merely for description.

**[0012]** Referring to FIG. 1A, the heat sink structure for high power LED based streetlamp according to an embodiment of the present invention is schematically shown therein. The heat sink structure comprises an upper cover 1, a lower cover 2 and a polymer-coated gold substrate 5. Between the upper cover 1 and the lower cover 2, there is a fastening member 13 for fixing the two covers 1, 2 together. The fixation member 13 is disposed on an outer surface of the upper cover 1 at a front end thereof, or on an inner surface of the upper cover 1 at a rear end thereof. As such, the upper cover 1 may be moved from the lower cover 2 but without being totally separated from the lower cover 2. Referring to FIG. 4, the upper and lower covers 1, 2 are each a rectangular body. On the outer surface of the upper cover 1 at the rear end, a rear hole 11 for fixation of a lamp post is formed. On the outer surface of the lower cover 2 at a lower end, a lower hole 21 for fixation of the lamp post is formed. With the rear hole 11 and the lower hole 21, the lamp post can be firmly fixed. Viewed externally, each of the upper and lower covers 11, 21 may also have a circular or other structure.

**[0013]** Referring to FIG. 2A, an upper plug 16 and a lower plug 26 may be used to choke up the rear and lower holes 11, 21 so that the heat sink structure can be water resistant. In addition, a lamp mask 3 is disposed on the outer surface of the lower cover 2.

**[0014]** Referring again to FIG. 1A, the upper and lower covers 1, 2 have an upper slot 17 and a lower slot 27, respectively. The upper slot 17 is formed at a rim of the inner surface of the upper cover 1. An upper silicone glue 15 may be received within the upper slot 17. The lower slot 27 is formed at a rim of the inner surface of the lower cover 2. A lower silicone glue 25 may be received within the lower slot 27. With the upper and lower slots 17, 27, the heat sink structure can be water resistant when the upper and lower covers 1, 2 are assembled together. A plurality of high power LEDs 4 are fixedly mounted on the polymer-coated gold substrate 5. Referring to FIG. 1 and FIG. 1B, the polymer-coated gold substrate 5 may also take the form of rectangular or circular shape. The polymer-coated gold substrate 5 is fixed on the inner surface of the upper cover 1 by means of a screw 18. In this manner, the heat energy generated from the high power LEDs can be transmitted through the polymer-coated gold substrate 5 to a plurality of heat sink fins 12, which may be made of aluminum, and further to the ambient air.

**[0015]** Referring to FIG. 3, the plurality of heat sink fins 12 are integrally formed on the outer surface of the upper cover 1. As such, the heat energy generated from the LEDs 4 can be rapidly moved therefrom.

**[0016]** Many changes and modifications in the above described embodiment of the invention can, of course, be carried out without departing from the scope thereof. Accordingly, to promote the progress in science and the useful arts, the invention is disclosed and is intended to be limited only by the scope of the appended claims.

## Claims

1. A heat sink structure for a light-emitting diode, "LED", (4) based streetlamp, comprising:

an upper cover (1) having an upper outer surface and an upper inner surface and comprising a rear hole (11) on the upper outer surface at a rear end thereof for fixing a lamp post, wherein a plurality of heat sink fins (12) are formed on an upper portion of the upper outer surface;

### characterized by

the upper cover (1) further comprising a fastening member (13) on the upper outer surface at a front end thereof, an upper slot (17) formed on a rim on the upper inner surface, wherein an upper silicone glue (15) is received on the upper slot (17); a lower cover (2) having a lower outer surface and a lower inner surface and comprising the fastening member (13) on the lower outer surface at a front end thereof, a lower hole (21) on the lower outer surface at a rear end thereof for fixing the lamp post and a lower slot (27) formed at a rim of the lower inner surface of the lower cover (2), wherein a lower silicone glue (25) is received in the lower slot (27); and a polymer-coated gold substrate (5) disposed within the upper cover (1) and being a printed circuit board, "PCB", having a copper material for heat conduction.

2. The heat sink structure as claimed in claim 1, wherein the fastening member (13) is disposed at the rear ends of the upper and lower covers (2, 1), so that the upper and lower covers (2, 1) are still connected to each other when one of the upper and lower covers (2, 1) is moved from the other.
3. The heat sink structure as claimed in claim 1, wherein the rear hole (11) is choked up with an upper plug (16) when the lamp post is absent.
4. The heat sink structure as claimed in claim 1, wherein the lower hole (21) is choked up with a lower plug (26) when the lamp post is absent.
5. The heat sink structure as claimed in claim 1, wherein a plurality of LEDs (4) is fixedly mounted on the polymer-coated gold substrate (5).
6. The heat sink structure as claimed in claim 1, wherein the polymer-coated gold substrate (5) has a rectangular shape.
7. The heat sink structure as claimed in claim 1, wherein the polymer-coated gold substrate (5) has a circular shape.

8. The heat sink structure as claimed in claim 1, wherein each of the upper and lower covers (2,1) has a circular shape.
9. The heat sink structure as claimed in claim 1, wherein each of the upper and lower covers (2, 1) has a rectangular shape.

#### Patentansprüche

1. Kühlkörperstruktur für eine auf einer Leuchtdiode "LED" (4) basierende Straßenlampe, aufweisend:

eine obere Abdeckung (1), die eine obere Außenfläche und eine obere Innenfläche hat und eine hintere Öffnung (11) in der oberen Außenfläche an einem hinteren Ende davon zum Fixieren eines Lichtmastes aufweist, wobei eine Mehrzahl von Kühlkörperrippen (12) an einem oberen Abschnitt der oberen Außenfläche ausgebildet sind;

#### gekennzeichnet durch

die obere Abdeckung (1), die ferner ein Befestigungselement (13) an der oberen Außenfläche an einem vorderen Ende davon und einen oberen Schlitz (17) aufweist, der an einem Rand an der oberen Innenfläche ausgebildet ist, wobei ein oberer Silikonkleber (15) in dem oberen Schlitz (17) aufgenommen ist;

eine untere Abdeckung (2), die eine untere Außenfläche und eine untere Innenfläche hat und das Befestigungselement (13) an der unteren Außenfläche an einem vorderen Ende davon, eine untere Öffnung (21) an der unteren Außenfläche an einem hinteren Ende davon zum Fixieren des Lichtmastes, und einen unteren Schlitz (27) aufweist, der an einem Rand der unteren Innenfläche der unteren Abdeckung (2) ausgebildet ist, wobei ein unterer Silikonkleber (25) in dem unteren Schlitz (27) aufgenommen ist; und

ein polymerbeschichtetes Goldsubstrat (5), das in der oberen Abdeckung (1) angeordnet ist und eine gedruckte Leiterplatte "PBC" mit einem Kupfermaterial zur Wärmeleitung ist.

2. Kühlkörperstruktur nach Anspruch 1, wobei das Befestigungselement (13) an den hinteren Enden der oberen und der unteren Abdeckung (2, 1) angeordnet ist, so dass die obere und die untere Abdeckung (2, 1) noch miteinander verbunden sind, wenn die eine von der oberen und der unteren Abdeckung (2, 1) von der anderen bewegt wird.
3. Kühlkörperstruktur nach Anspruch 1, wobei die hintere Öffnung (11) mit einem oberen Stöpsel (16) verstopft ist, wenn der Lichtmast abwesend ist.

4. Kühlkörperstruktur nach Anspruch 1, wobei die untere Öffnung (21) mit einem unteren Stöpsel (26) verstopft ist, wenn der Lichtmast abwesend ist.

5. Kühlkörperstruktur nach Anspruch 1, wobei eine Mehrzahl von LEDs (4) an dem polymerbeschichteten Goldsubstrat (5) fest montiert sind.

6. Kühlkörperstruktur nach Anspruch 1, wobei das polymerbeschichtete Goldsubstrat (5) eine rechteckige Form hat.

7. Kühlkörperstruktur nach Anspruch 1, wobei das polymerbeschichtete Goldsubstrat (5) eine kreisrunde Form hat.

8. Kühlkörperstruktur nach Anspruch 1, wobei jede der oberen und der unteren Abdeckung (2, 1) eine kreisrunde Form hat.

9. Kühlkörperstruktur nach Anspruch 1, wobei jede der oberen und der unteren Abdeckung (2, 1) eine rechteckige Form hat.

#### Revendications

1. Structure de puits de chaleur pour réverbère à base de diode électroluminescente, "DEL", (4) comprenant :

un couvercle supérieur (1) ayant une surface supérieure externe et une surface supérieure interne et comprenant un orifice arrière (11) sur la surface supérieure externe à son extrémité arrière pour y fixer un poteau de réverbère, dans laquelle une pluralité d'ailettes de puits de chaleur (12) sont formées sur une partie supérieure de la surface supérieure externe ; **caractérisée par :**

le couvercle supérieur (1) qui comprend en outre un élément de fixation (13) sur la surface supérieure externe à son extrémité avant, une fente supérieure (17) formée sur un rebord de la surface supérieure interne, une couche de colle de silicone supérieure (15) étant appliquée sur la fente supérieure (17) ;

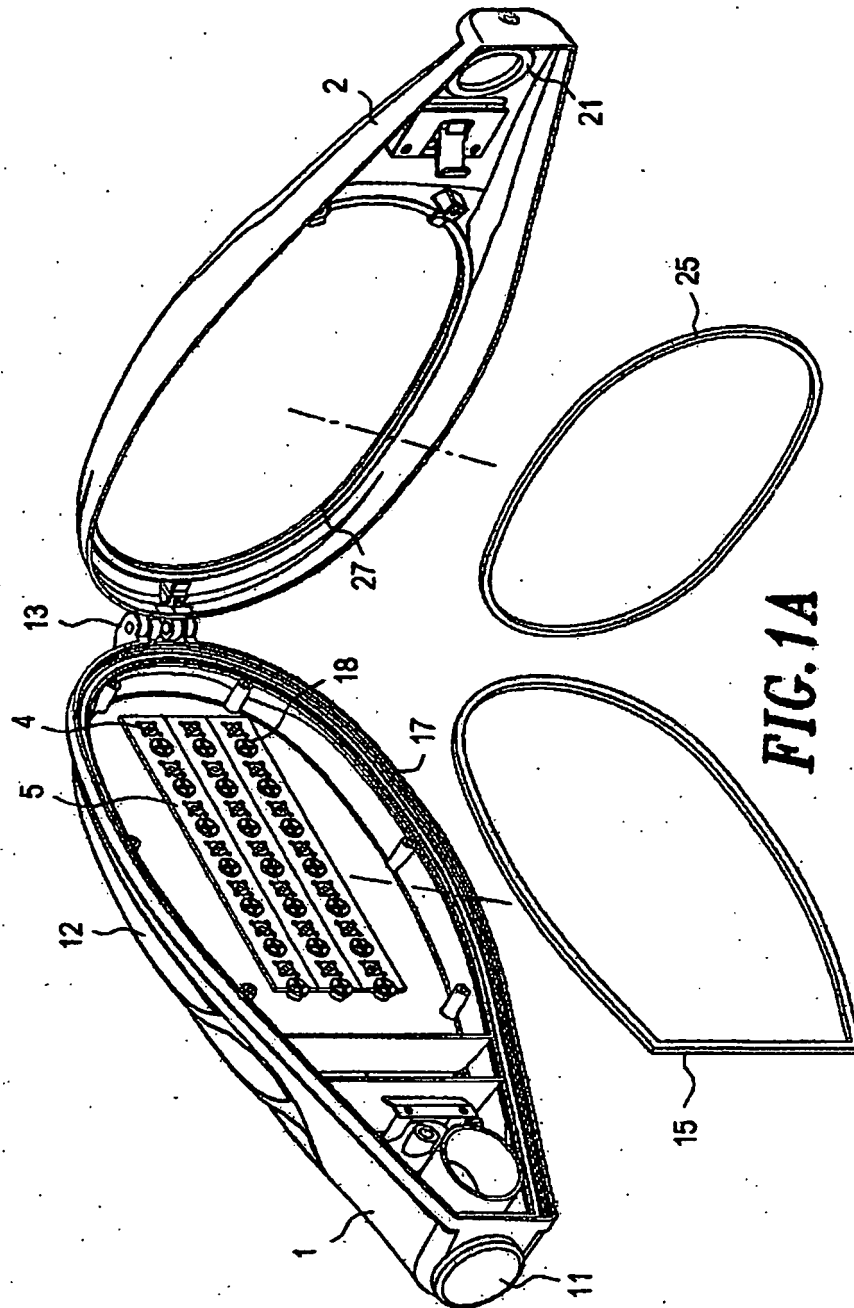
un couvercle inférieur (2) ayant une surface inférieure externe et une surface inférieure interne et comprenant l'élément de fixation (13) sur la surface inférieure externe à son extrémité avant, un orifice inférieur (21) sur la surface inférieure externe à son extrémité arrière pour y fixer le poteau de réverbère et une fente inférieure (27) formée sur un rebord de la surface inférieure interne du

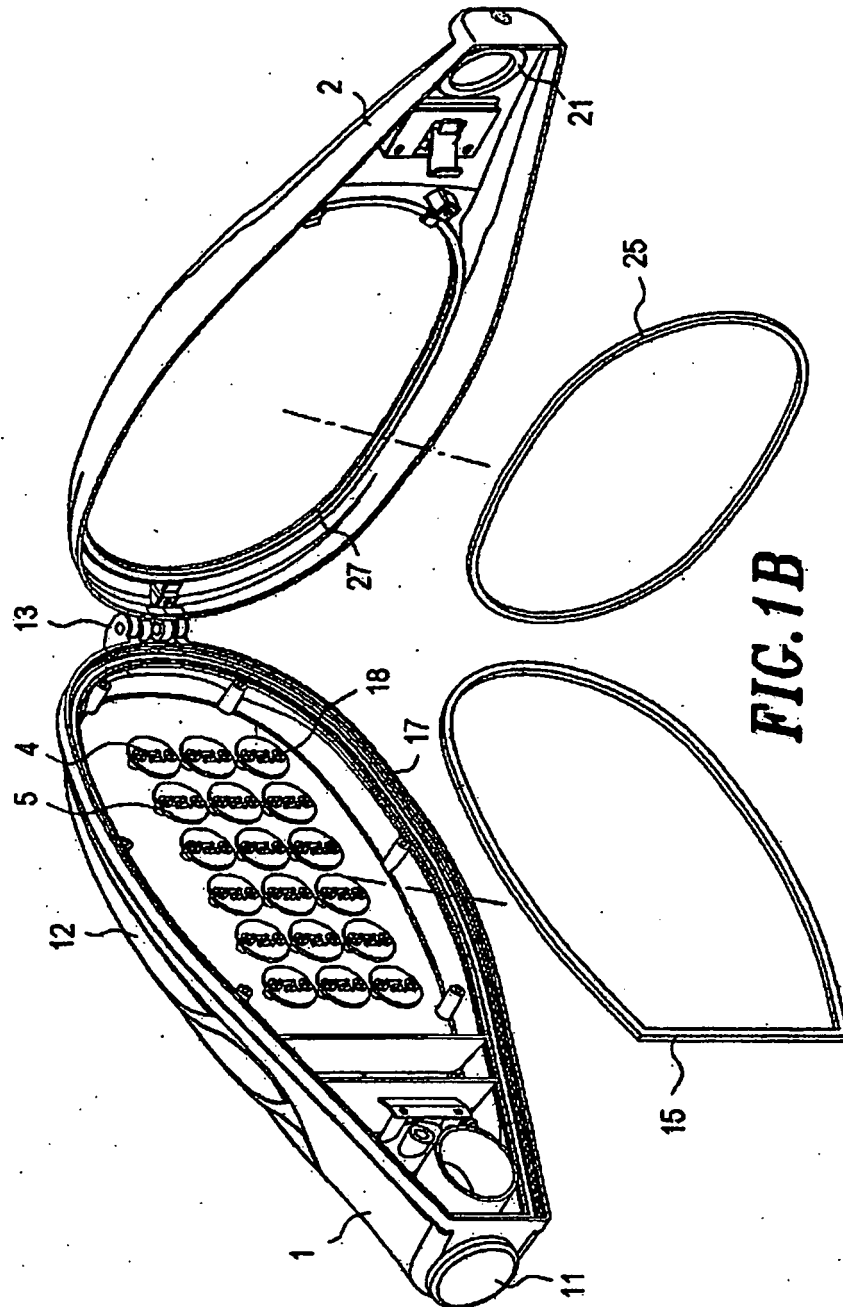
couvercle inférieur (2), une couche de colle de silicone inférieure (25) étant appliquée dans la fente inférieure (27) ; et un substrat d'or revêtu de polymère (5) disposé à l'intérieur du couvercle supérieur (1) et formé d'une carte de circuit imprimé, "PCB", ayant un matériau à base de cuivre pour conduction de la chaleur. 5

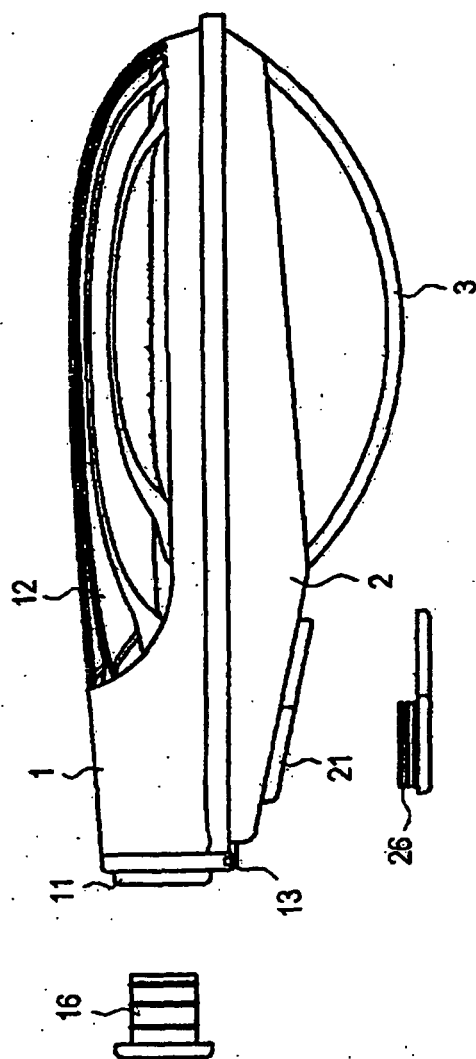
2. Structure de puits de chaleur selon la revendication 1, dans laquelle l'élément de fixation (13) est disposée aux extrémités arrière des couvercles supérieur et inférieur (2, 1), de sorte que les couvercles supérieur et inférieur (2, 1) soient encore raccordés l'un à l'autre lorsque l'un des couvercles supérieur et inférieur (2, 1) est déplacé par rapport à l'autre. 10 15
3. Structure de puits de chaleur selon la revendication 1, dans laquelle l'orifice arrière (11) est bouché par un bouchon supérieur (16) lorsqu'il n'y a pas de plateau de réverbère. 20
4. Structure de puits de chaleur selon la revendication 1, dans laquelle l'orifice inférieur (21) est bouché par un bouchon inférieur (26) lorsqu'il n'y a pas de plateau de réverbère. 25
5. Structure de puits de chaleur selon la revendication 1, dans laquelle une pluralité de DEL (4) est montée de manière fixe sur le substrat d'or revêtu de polymère (5). 30
6. Structure de puits de chaleur selon la revendication 1, dans laquelle le substrat d'or revêtu de polymère (5) a une forme rectangulaire. 35
7. Structure de puits de chaleur selon la revendication 1, dans laquelle le substrat d'or revêtu de polymère (5) a une forme circulaire. 40
8. Structure de puits de chaleur selon la revendication 1, dans laquelle chacun des couvercles supérieur et inférieur (2, 1) a une forme circulaire. 45
9. Structure de puits de chaleur selon la revendication 1, dans laquelle chacun des couvercles supérieur et inférieur (2, 1) a une forme rectangulaire. 50

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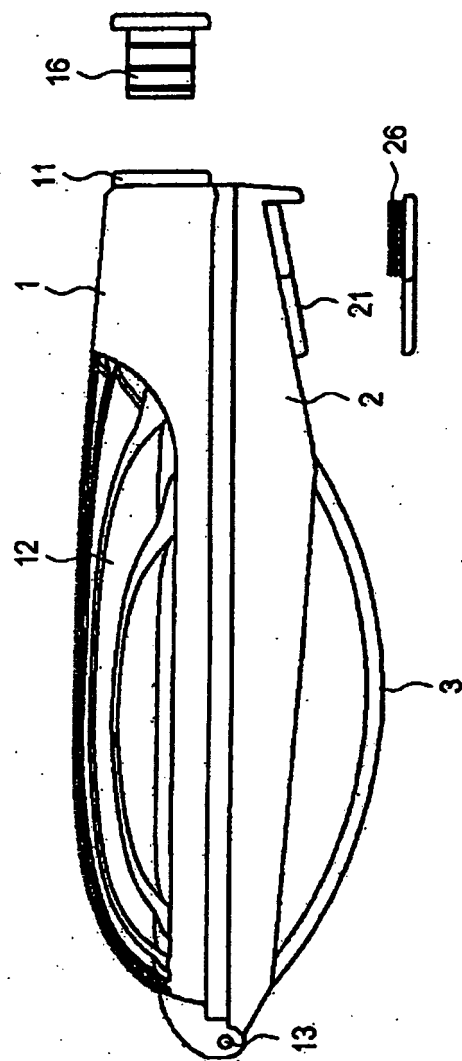
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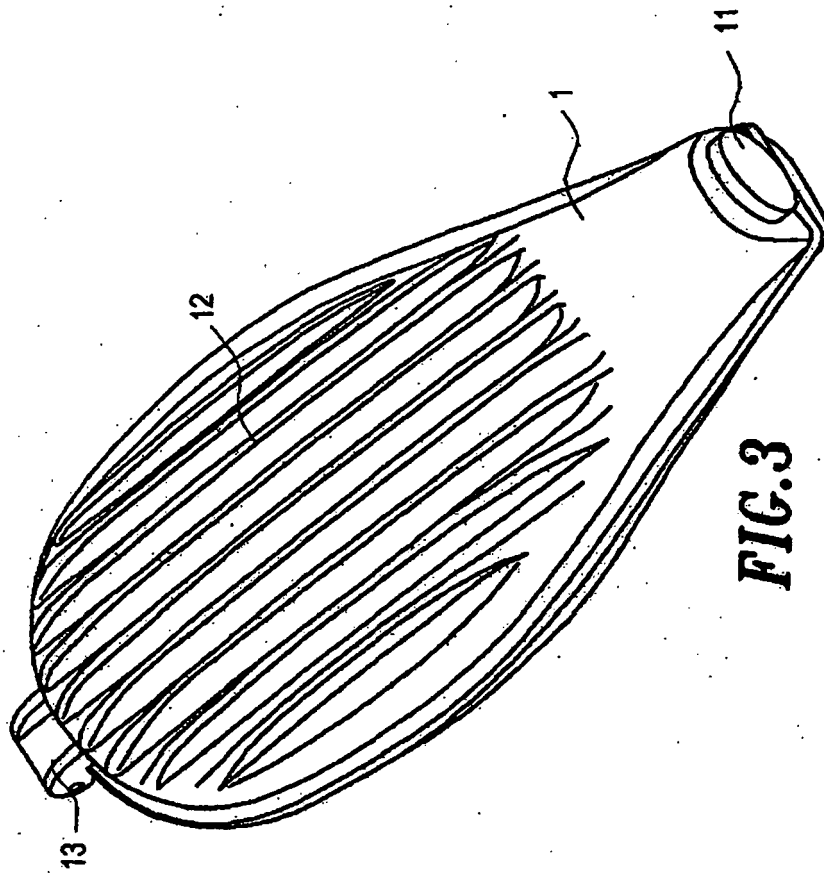


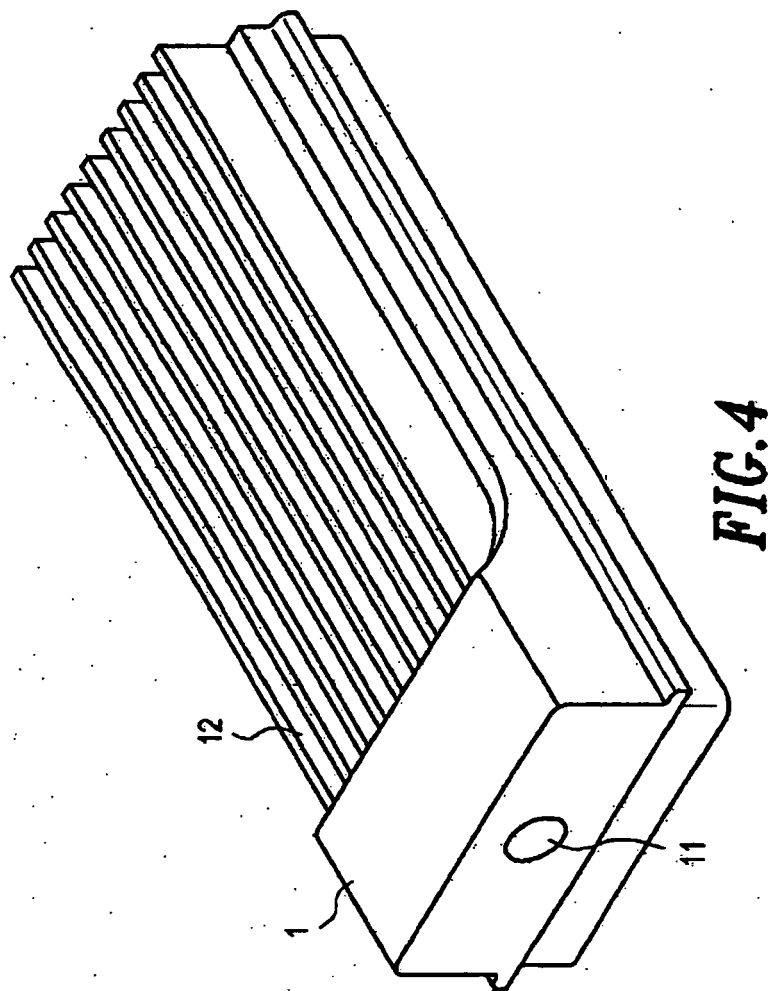


**FIG. 2A**



**FIG. 2B**





**REFERENCES CITED IN THE DESCRIPTION**

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