Title: LIGHT EMITTING DIODE (LED) LAMP

Abstract: A light emitting diode lamp is achieved to present a long-life, energy-saving illumination means which comprises a main body (1) mounted to a lamp socket; a plurality of light emitting diodes (2) mounted on a mounting means (5) attached to the main body (1); said light emitting diodes (2) being disposed face to face with a reflection means (4) which is also attached to the main body (1) so that the light emitted from the said light emitting diodes (2) is reflected on the surface of said reflection means (4) and radiated into a predetermined direction through the opening of the main body (1); said light emitting diodes (2) including blue, green, red and white LED's so as for the lamp to emit a selected color of light in a selected illumination intensity in response to the power supplied to each member LED's (2); and a cap (3) detachably adopted to cover the outer side of the lamp opposite to the lamp socket for preventing introduction of impurities into the lamp, and wherein the components of the lamp are reusable, thereby extending the life expectancy further and enhancing the economy of the product.
Published:

— With international search report.

Before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments.

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.
LIGHT EMITTING DIODE (LED) LAMP

TECHNICAL FIELD

The present invention relates to a light emitting diode (LED) lamp, and more particularly to, a socket-fitted lamp in which a plurality of light emitting diodes (LEDs) are disposed toward a light reflection means in a main body of the lamp, so as to present a high performance lamp which radiates much more luminous flux using far less electricity for much longer period than ordinary incandescent lamps, and the color as well as the intensity of the light radiated from the LED lamp can be adjusted by controlling the power supply to the individual member LEDs.

BACKGROUND ART

For lighting or illumination purposes, incandescent or fluorescent lamps have been used. Due to the lower energy consumption and long life, however, LEDs have recently been adopted for variable message signs such as traffic signals lights and other numerical or character indication elements. Fluorescent lamps offer a relative long life and less energy consumption than the incandescent lamps.

Still, the fluorescent lamps are disadvantageous that the shape of longitudinal tube does not fit into ordinary sockets, resulting in limited scope of applications, and the intensity of light from the fluorescent lamps cannot be controlled, either. Further, it is impossible to reuse the elements of both fluorescent and incandescent lamps, and the color of light cannot be changed.

DISCLOSURE OF THE INVENTION
The present invention is derived to solve the problems of the prior art and it is an object of the present invention to provide a socket-fitted light emitting diode lamp, in which a plurality of light emitting diodes are installed toward a reflection surface in a main body of the lamp, so as to improve electricity saving effect and durability.

It is another object to provide a socket-fitted light emitting diode lamp which is capable of adjusting intensity and colors of light by selectively controlling voltage or the number of the diodes of the light emitting diode.

It is a further object to provide a socket-fitted light emitting diode lamp of which parts and accessories may be reused so as to improve productivity and reliability.

In order to achieve the above objects of the present invention, a socket-fitted light emitting diode lamp is provided, essentially comprising: a main body 1 detachably mounted to a lamp socket with each component being fixed, including socket coupling portion 11 on an outer upper portion and a cap suspending groove 12 to fix a cap on an outer periphery; a plurality of light emitting diodes 2 provided inside the main body 1 or in an opening of the main body toward a reflection element 4 to radiate a plurality of colors of luminous flux in response to power supply; the reflection element provided inside the main body, for forward reflecting the emitted lights from the plurality of light emitting diodes 2 through the opening of the main body 1; and a cap 3 detachably installed from the opening of the main body, including a suspending ring portion 31 to be fixed in the cap-suspending groove 12 of the main body 1, for preventing impurities from being introduced.

The socket-fitted light emitting diode lamp of the present invention enables the illumination intensity and colors of light radiated from the lamp to be adjusted by
controlling power supply and the number of the light emitting diodes to be installed or to be energized, thereby reducing the electricity consumption.

Further, reuse of the parts and accessories of the lamp is readily achieved, thereby improving productivity and reliability of the lamp.

5

**BRIEF DESCRIPTION OF THE DRAWINGS**

The present invention will become more fully understood from the detailed description given hereinafter accompanying drawings which are given by way of illustration only, and thus are not limitative of the present invention, and wherein:

Fig. 1 is a cross-sectional view of a socket-fitted light emitting diode lamp according to a first embodiment of the present invention;

Fig. 2 is a cross-sectional view of a socket-fitted light emitting diode lamp according to a second embodiment of the present invention;

Fig. 3 is a cross-sectional view of a socket-fitted light emitting diode lamp according to a third embodiment of the present invention;

Fig. 4 is a perspective view of a socket-fitted light emitting diode lamp according to a fourth embodiment of the present invention;

Fig. 5 is a cross-sectional view of a socket-fitted light emitting diode lamp according to a fifth embodiment of the present invention; and

Fig. 6 is a perspective view of a socket-fitted light emitting diode lamp as shown in Fig. 5.

**BEST MODE FOR CARRYING OUT THE INVENTION**

Preferred embodiments of the present invention will be described in more
detail with reference to the accompanying drawings.

Fig. 1 is a cross-sectional view of a socket-fitted light emitting diode lamp according to a first embodiment of the present invention, Fig. 2 is a cross-sectional view of a socket-fitted light emitting diode lamp according to a second embodiment of the present invention, Fig. 3 is a cross-sectional view of a socket-fitted light emitting diode lamp according to a third embodiment of the present invention, Fig. 4 is a cross-sectional view of a socket-fitted light emitting diode lamp according to a fourth embodiment of the present invention; and Fig. 5 is a cross-sectional view of a socket-fitted light emitting diode lamp according to a fifth embodiment of the present invention.

A socket-fitted light emitting diode lamp includes a main body 1 which is detachably mounted to a lamp socket with each component being fixed and has a socket coupling portion 11 on an outer upper portion and a cap-suspending groove 12 to fix a cap on an outer periphery, a plurality of light emitting diodes 2 provided inside the main body 1 or in an opening of the main body 1 toward a reflection surface 4 to radiate a plurality of colors of light in response to power supply, the reflection surface 4 provided inside the main body 1 for reflecting the light which is radiated from the plurality of light emitting diodes 2 forward through the opening of the main body 1, and a cap 3 detachably installed from the opening of the main body, including a suspending ring portion to be fixed in the cap-suspending groove 12 of the main body 1, for preventing introduction of impurities.

The light emitting diodes 2 are mostly composed of white LED's when the light emitting diodes lamp of the present invention is used for illumination purpose, but in case of rendering different color of light, blue, green and red LED's are adopted
in the light emitting diodes 2.

The cap 3 includes a transparent or semi-transparent cap and concave and convex lenses to focus and disperse the light. The main body 1 may be formed in the shape of empty semi-sphere (Fig. 1 and Fig. 6) and in the shape of an empty reversed funnel (Fig. 2 and Fig. 3).

The shape of the light emitting diodes 2 and installation thereof may be altered depending on the shape of the light reflection means 4.

Referring to Fig. 1 and Fig. 2, the reflection means 4 covered with a reflection surface 41 is adopted on the inner surface of the main body 1, and faced with this reflection surface 41 a plurality of light emitting diodes 2 are adopted radially around the mounting means 5 which protrudes from the inner center of the main body 1, so that the light emitted from the light emitting diodes 2 is reflected on the reflection surface 41 and radiates through the opening.

The reflection means 4 in Fig. 1 formed as the inner surface of an empty semi-sphere will reflect the light beams emitted from the light emitting diodes 2 in one direction, while the reflection means 4 in Fig. 2 formed as the inner surface of a reversed funnel will reflect and spread the light beam as emitted from the light emitting diodes 2 into a wide angle. In this way, the angle of spreading the light beams can be determined by the shape and the curvature of the reflection means 4, and many other shape of reflection means can be adopted according to the desired angle of spreading the light beams.

Referring to Fig. 3, the reflection means 4 formed in a shape of a cone covered with a reflection surface 42 is adoptd to protrude from the inner center of the main body 1, and faced with this reflection surface 42, and surrounding the reflection
means 4, a plurality of light emitting diodes 2 are adopted on the mounting means 5 which is attached to the inner wall of the main body 1, so that the light emitted from the light emitting diodes 2 is reflected on the reflection surface 42 and radiates through the opening.

Fig. 4 shows the fourth preferred embodiment of the present invention which can be achieved by extending longitudinally the cross section shown in Fig. 1 or Fig. 2. It is obvious that by extending the length of the light emitting diodes lamp shown in Fig. 4, a desired level of illumination can be obtained.

Fig. 5 shows the cross-sectional view of the fifth preferred embodiment of the present invention, which is another alternative design of the third embodiment shown in Fig. 3, achieved by adopting the main body to have a plurality of supporting rods 7 to support the cap 3 and the mounting means 5 on which the light emitting diode 2 are disposed, the opening captured between the supporting rods 7 around the main body 1, and the reflection means 4 covering the surface of the cone-shaped reflection surface 42, so that the light emitted from the light emitting diodes 2 is reflected on the reflection surface 42 and radiated through the opening disposed around the main body 1.

Fig. 6 shows a perspective view of Fig. 5 in which the supporting rods 7 are formed with a predetermined interval.

The light emitting diode lamp of the third embodiment as shown in Fig. 3 and the fifth embodiment as shown in Fig. 5 may also be extended longitudinally in the same manner as shown in the fourth embodiment or in Fig. 4. Moreover the shape of the light emitting diode lamps shown in Figures 1, 2, 3 and 5, may be slightly extended in one direction to exhibit an oval type, and even further modification in
shape can be achieved within the scope of the invention.

Now, operation of the socket-fitted light emitting diode lamp will be described in detail.

Since the light emitting diodes 2 and the reflection means 4 are integrally formed with the socket coupling portion 11 on an outer upper portion of the main body 1, the socket-fitted light emitting diode lamp of the present invention is inserted into any socket of ordinary lamps. The lamp is easily detached to replace it with a new one when the life span of the lamp is run out.

The main body 1 is formed with a cap-suspending groove 12 on an outer periphery of an opening, for preventing the cap 3 from being unintentionally detached from the main body 1. Further, in case of cleaning inside the lamp or replacing worn out light emitting diodes 2 or reflection means 4 after a long time use, the cap 3 can be detached from the main body 1, and such cleaning and replacement can be carried out. It is also possible to recycle any part of the light emitting diode lamp after a long time use.

Further, it is possible to form the socket-fitted light emitting diode lamp of the present invention in such a manner that the main body 1 is sealed with the cap 3 by fixing the cap 3 on the main body 1 and keeping inside the main body 1 in a vacuum state as a general lamp, whereby introduction of impurities and humidity are completely prevented.

The main body 1 of the socket-fitted light emitting diode lamp may be formed in the shape of an empty semi-sphere (Fig. 1 and Fig. 5) or an empty reverse funnel (Fig. 2 and Fig. 3), so that it becomes possible to use the lamp by coupling with a socket as a general lamp.
Referring to Fig. 4, the socket-fitted light emitting diode lamp in which the main body 1 as well as the reflection means 4, the light emitting diodes 2, the mounting means 5 of the light emitting diodes 2 and the cap 3 may be formed in a longitudinally extended arrangement as a general fluorescent illumination instrument, however the embodiments shown in Figures 1, 2, 3 and 5 may show an oval shape by deforming slightly toward one direction.

The shape of the LED lamp of the present invention may yet be altered further depending on its purpose, installation and use of the lamp, so that the users may select and use such lamps as desired. The shape of the main body 1 is not limited to the semi-sphere or reverse shape or longitudinal shape, as shown in the drawings (Fig. 1 to Fig. 5) but further modifications in shape such as trumpet of main body 1 is possible within the scope of the invention.

The shape or installation of the light reflection means 4 may be changed depending on the shape of the light emitting diodes 2, wherein the light reflection means 4 is formed as a reflection surface 41 on the inner surface of the main body 1 by coating reflection paint on the inner surface with a predetermined thickness, or as a reflection sphere 42 in the shape of a cone or an umbrella in the center of the main body 1, so that the lights from the each light emitting diodes 2 are reflected on the light reflection means 4 toward the opening of the main body 1. The shape of opening is also differently adopted: it can be adopted toward the center of the cap 3 as in Fig. 1 to Fig. 3, or around the main body 1 as shown in Fig. 5.

In the same manner, the shape of the light emitting diodes 2 and installation thereof may be changed depending on the shape of the light reflection means 4.

In case that the light reflection means 4 is formed as a reflection surface 41
on the inner wall of the main body 1, the mounting means 5 protrudes in a rod or plate shape in the center of the main body 1, so that the light emitting diodes 2 are radially disposed with respect to the vertical direction of the mounting means 5. On the other hand, in case that the light emitting means 4 is formed in the cone or umbrella shaped sphere 42, the light emitting diodes 42 are disposed on the inner wall of the main body 1 with a predetermined interval.

Various colors of light from each light emitting diodes 2 installed in the mounting means 5 or the main body 1 are not gathered on a point but accurately reflected on the light reflection surface 41 or the light reflection sphere 42 and evenly dispersed through the opening of the main body 1.

In case that the light emitting diodes 2 are installed on the main body 1 as shown in Fig. 3 and Fig. 5, the light emitted from each light emitting diodes 2 are reflected on a cone or umbrella shaped light reflection sphere 42 in the main body 1 and evenly dispersed through the opening of the main body 1.

The light emitting diodes 2 has good durability with low electricity consumption, so as to obtain the electricity saving effect and long life span. Further, the intensity of lights radiated from the socket-fitted light emitting diode lamp is adjusted by increasing or decreasing the number of the light emitting diodes 2 adopted in the light emitting diodes lamp and by controlling the strength of the power supply.

Furthermore, the color of light radiated from the socket-fitted light emitting diode lamp can be selected by controlling the power supplied to blue, green and red LED’s adopted in the light emitting diodes lamp. Therefore, the lamp of the present invention may be utilized as a general light lamp as well as decorative illumination in party, exhibition halls or stages.
The cap 3 is detachably fixed to the main body 1 by inserting its border into the cap-suspending groove 12 which is formed on the inner periphery of the opening of the main body 1, for preventing impurities from being introduced into the main body 1. The cap 3 may be formed with a transparent or semi-transparent material, and the cap 3 itself may serve as a concave or convex lens.

In case that the cap 3 is formed as a concave or convex lens, lights from the light emitting diodes 2 are reflected on the light reflection means 4 of the main body 1 and focused and dispersed, thereby illuminating the emitted lights in a desired direction.

According to the present invention, the electricity saving effect and the durability of lamp is remarkably improved by utilizing a plurality of light emitting diodes as the light source, which is distinct from the prior art utilizing filaments as the light source.

The illumination intensity of the lamp is desirably adjusted by controlling the voltage and power supply to the light emitting diodes and light color of the lamp is desirably adjusted by controlling the number of the light emitting diodes to be installed or to be energized.

Further, according to the present invention, the parts and accessories of the lamp can be replaced when they are worn out, thereby extending the life and improving reliability of the lamp.

Although the preferred embodiments of the present invention have been disclosed for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as described in the accompanying claims.
CLAIMS

1. A socket-fitted light emitting diode lamp, comprising:
   a main body (1) fixed with a socket coupling portion (11) on its opposite
   outer side;
   a plurality of light emitting diodes (2) comprising with a combination of blue,
   green and red LED’s for selectively emitting a plurality of colors of light in different
   strength in response to power supply to each member LED;
   said light emitting diodes (2) being mounted on a mounting means (5) which
   is fixed to the main body (1), and arranged face to face with the reflection means (4);
   said reflection means (4) which is covered with reflecting surface (41), and
   reflects the lights emitted from said light emitting diodes (2) in a pre-arranged
   direction through an opening of the main body (1); and
   a cap (3) detachably installed on the outer portion of the main body (1) so as
   to cover the main body (1) and to protect the whole lamp structure, and also to
   prevent impurities from being introduced into the inside of the socket-fitted light
   emitting diode lamp.

2. The socket-fitted light emitting diode lamp according to claim 1,
   wherein the plurality of light emitting diodes (2) include certain proportion of white
   color LED’s to generate the white illumination light that is close to the ordinary
   incandescent light or fluorescent light.

3. The socket-fitted light emitting diode lamp according to claim 1,
wherein the cap (3) is formed to serve as a concave or convex lens.

4. The socket-fitted light emitting diode lamp according to claim 1 and 2, wherein the reflection means (4) is coated by the reflection paint on the inner surface of the main body (1) with a predetermined thickness to form the reflection surface (41), and the plurality of light emitting diodes (2) are radially mounted with respect to a central axis of a mounting means (5) which protrudes from the inner center point of the main body (1), so that the lights from the plurality of light emitting diodes are reflected on the reflection surface (41) and emitted through the opening of the main body (1).

5. The socket-fitted light emitting diode lamp according to claim 1 and 2, wherein the reflection means (4) is protrudently and integrally formed in the shape of a cone attached to the center of the main body (1), and the plurality of light emitting diodes (2) are fixed on an inner wall of the main body (1), so that the lights are reflected on the cone-shaped reflection surface (42) and emitted through the opening of the main body (1).

6. The socket-fitted light emitting diode lamp according to claim 1 and 2, wherein the reflection means (4) is protrudently and integrally formed in the shape of an umbrella attached to the center of the main body (1), a plurality of supporting rods (7) is adopted to support the mounting means (5) on which the light emitting diodes (2) are disposed, and the openings are captured between the supporting rods (7) around the main body (1), so that the light emitted from the light emitting diodes
(2) is reflected on the reflection surface (42) are spread through the opening of the main body (1).

7. The socket-fitted light emitting diode lamp according to any proceeding claims, wherein the main body (1), the reflection means (4), the cap (3), and a plurality of light emitting diodes (2) for generating a plurality of colors toward the reflection means (4) are formed to have an elongated shape in any direction.
INTERNATIONAL SEARCH REPORT

CLASSIFICATION OF SUBJECT MATTER

IPC7: H05B 33/00, 43/00; F21V 7/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: H05B 33/00, 43/00; F21V 7/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI, EPODOC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>US 5136483 A (SCHÖNIGER et al.) 4 August 1992 (04.08.92) abstract, claims, figs.</td>
<td>1-7</td>
</tr>
<tr>
<td>A</td>
<td>US 4929866 A (MURATA et al.) 29 May 1990 (29.05.90) abstract, claims, figs.</td>
<td>1-7</td>
</tr>
<tr>
<td>A</td>
<td>US 5608290 A (HUTCHISSON et al.) 4 March 1997 (04.03.97) abstract, claims, figs.</td>
<td>1-7</td>
</tr>
</tbody>
</table>

☑ Further documents are listed in the continuation of Box C.  ☒ See patent family annex.

* Special categories of cited documents:

A*: document defining the general state of the art which is not considered to be of particular relevance

E*: earlier application or patent but published on or after the international filing date

L*: document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

O*: document referring to an oral disclosure, use, exhibition or other means

P*: document published prior to the international filing date but later than the priority date claimed

\[\text{\textsuperscript{T}}\] later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

\[\text{\textsuperscript{X}}\] document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

\[\text{\textsuperscript{Y}}\] document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

\[\text{\textsuperscript{&}}\] document member of the same patent family

Date of the actual completion of the international search: 29 August 2000 (29.08.2000)

Date of mailing of the international search report: 22 February 2001 (22.02.2001)

Name and mailing address of the ISA/AT

Austrian Patent Office
Kohlmarkt 8-10; A-1014 Vienna
Facsimile No. 1/53424/535

Form PCT/ISA/210 (second sheet) (July 1998)

Authorized officer: FELLNER

Telephone No. 1/53424/345
<table>
<thead>
<tr>
<th>Patent document cited in search report</th>
<th>Publication date</th>
<th>Patent family member(s)</th>
<th>Publication date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>JP A2 1251502</td>
<td>06-10-1989</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DE A1 3929955</td>
<td>14-03-1991</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DE C0 59009086</td>
<td>22-06-1995</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DK T3 416253</td>
<td>10-07-1995</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EP A3 416253</td>
<td>19-02-1992</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EP B1 416253</td>
<td>17-05-1995</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PS T3 2071708</td>
<td>01-07-1995</td>
</tr>
</tbody>
</table>