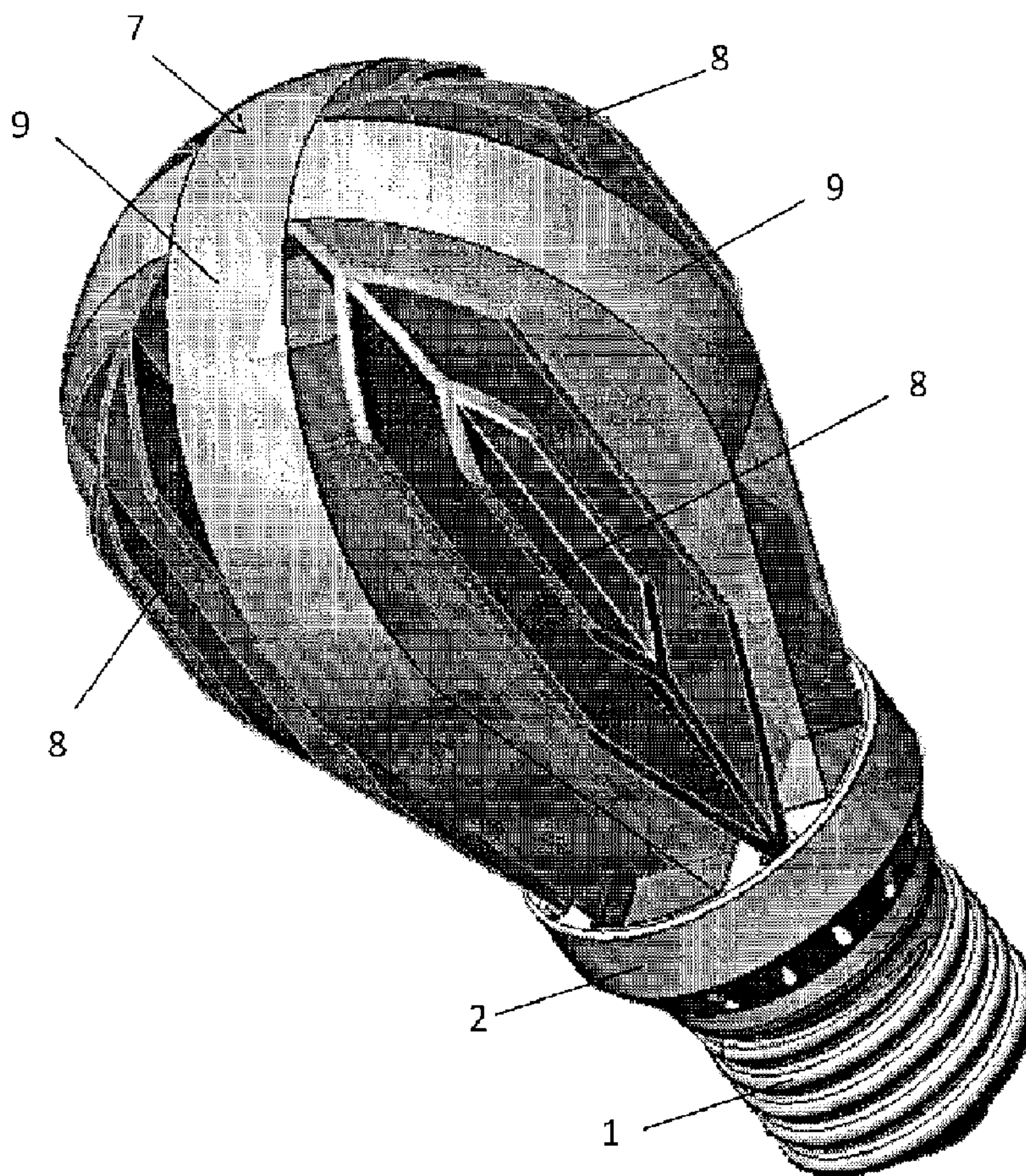




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(54) Title: LED LAMP



(57) Abrégé/Abstract:

The utility models relates to the field of lighting technology. The general lighting LED lamp includes the base, the transition isolating element connected therewith which is made of dielectric plastic with the cavity inside, wherein the power supply for lamp operation

(57) **Abrégé(suite)/Abstract(continued):**

in electrical networks is located, which is connected with LED modules made on the printed circuit board with the heat-conducting metal base and attached on the radiator. The radiator is made as rod-shaped section profile having side faces pointed at different directions, whereon said LED modules are placed, as well as ribs extending therefrom. The radiator is placed within the diffuser made of plastic which is close to glass in terms of optical performance. The radiator is made with longitudinally oriented ribs located at least on a portion of radiator height and extending from the surface of the radiator between faces for formation of heat removal surfaces. The diffuser represents the cap made as longitudinally oriented segmented shells, each of which is located in front of LED modules of one face and covers them, thereby isolating these LED modules from the ones on the adjacent face, whereas longitudinally oriented ribs are located between segmented shells.

Abstract

The utility models relates to the field of lighting technology. The general lighting LED lamp includes the base, the transition isolating element connected therewith which is made of dielectric plastic with the cavity inside, wherein the power supply for lamp operation in electrical networks is located, which is connected with LED modules made on the printed circuit board with the heat-conducting metal base and attached on the radiator. The radiator is made as rod-shaped section profile having side faces pointed at different directions, whereon said LED modules are placed, as well as ribs extending therefrom. The radiator is placed within the diffuser made of plastic which is close to glass in terms of optical performance. The radiator is made with longitudinally oriented ribs located at least on a portion of radiator height and extending from the surface of the radiator between faces for formation of heat removal surfaces. The diffuser represents the cap made as longitudinally oriented segmented shells, each of which is located in front of LED modules of one face and covers them, thereby isolating these LED modules from the ones on the adjacent face, whereas longitudinally oriented ribs are located between segmented shells.

LED lamp

The utility model relates to the field of lighting technology, in particular to lighting fixtures and is intended for use in domestic and industrial multipurpose lighting instruments.

The main distinctive feature of the LED lamp is distribution of its light flux in the environment. Subject to shapes and dimensions generally accepted for incandescent lamps, the LED lamp provides uniformly distributed diffused light unlike most of modern LED lamps, beam angle whereof does not correspond with lamps replaced thereby.

Thus, there is a known general lighting LED lamp which includes a base, a transition element (isolator) connected therewith which is made of dielectric plastic with an additional cavity in the middle, wherein a power supply for lamp operation in electrical networks is located, which is connected with a LED module made on a printed circuit board with a heat-conducting metal base and attached on a radiator; the radiator is made as rod-shaped profile of complex section having side planes pointed at different directions, whereon LED modules are placed, whereas the radiator is placed within a diffuser made of plastic which is close to glass in terms of optical performance, wherein LED modules on each radiator face are placed in front of diffuser sections located between radial projections on said diffuser (US 2012/0313518, H01K1/62, H05K13/00, H01J61/52, pubd. on 13.12.2012).

Process of generation of distributed diffused light in this LED lamp is that light from LED modules passes through the thin transparent plastic wall into the environment, whereas a portion of this light falls on walls of radial projections and is reflected from their surface. Thus, combinative lighting of the space in the area of 360° around the diffuser is ensured.

The diffuser has complex spatial shape of the shell with radial ribs, whereas the shell center opposite to the base has a through hole for heat removal from the radiator. However, this heat removal method is inefficient because it does not ensure removal of heat from the whole surface of such a rod-shaped element as the radiator. At the same time, the radiator in its bottom is spatially adjacent to the power supply of LED modules located in the base. In connection therewith, the bottom of the radiator is constantly overheated, while heat removal from the radiator top through the fixed orifice using convection in the diffuser is hardly efficient. Presence of excessive heat in the radiator bottom results in that heat affects diffuser plastic. Even when using such plastic as polycarbonate (light permeability and transparence are up to 86%) resistant to a wide range of high temperatures (up to 120°C), constant heating leads to material structure blushing which has impact on diffusion quality of LED light flux. Special coatings which reduce impact of heat radiation on the material structure are used for polycarbonate, but these coatings may not always be used for lighting technology.

It is known that efficiency factor of powerful LEDs is a sequence higher than that of incandescent lamps. On the other hand, most of energy consumed by LEDs (about 75%) is still spent for dissipated heat. Heat emission is increased along with growth of light flux from LED sources. According to estimates of some international and domestic experts, provision of efficient heat removal in LED lighting technology is one of the most crucial problems that faces developers and manufacturers of these products nowadays.

Unlike conventional incandescent and gas discharge lamps, modern LEDs are sensitive to high temperatures:

- firstly, when a LED is overheated, its efficiency is reduced, light flux is weakened, color temperature is changed, and service life can be decreased considerably;

- secondly, luminosity intensity is decreased approximately by 15% at the temperature of 80°C as compared to intensity at the room temperature. As a result, the lighting fixture with twenty LEDs at the temperature of 80°C can have light flux

equivalent to the flux of seventeen LEDs at the room temperature. Intensity of LED light may be reduced by 40% at the transition temperature of 150°C.

- thirdly, LEDs have the negative temperature factor of forward voltage, i.e. forward voltage of LEDs is reduced upon temperature increase. Usually this factor comprises -3 to -6 mV/K, that is why forward voltage of a standard LED may comprise 3.3 V at +25°C and not more than 3 V at +75°C. If the power supply does not allow reducing current on LEDs, this may result in further overheating and breakdown of LEDs. Moreover, many power supplies for LED lighting fixtures are designed for the operating temperature of up to +70°C.

Therefore, it is important to provide the temperature of not more than 80°C both in the p-n-transition area and in the power supply area for efficient operation of LED devices. Non-observance of the recommended temperature condition can result in light quantity and quality loss, increase of light cost of a LED device as well as reduction of service life of a lighting device.

The present utility model is aimed at achievement of the technical result which lies in enhancement of operational reliability of the LED lamp by way of provision of efficient heat removal from the whole radiator surface throughout its height.

The specified technical result is achieved in that inside the general lighting LED lamp which includes the base, the transition isolating element connected therewith which is made of dielectric plastic with the cavity inside, wherein the power supply for lamp operation in electrical networks is located, which is connected with LED modules made on the printed circuit board with the heat-conducting metal base and attached on the radiator; the radiator has the central part of rod-shaped section profile and ribs, whereas the central part of the radiator is made with side faces pointed at different directions, whereon said LED modules are located, and placed inside the diffuser made of plastic which is close to glass in terms of optical performance; the diffuser is made with outer surface sections stretched in the direction from the base and inner sections sunk between surfaces, in front of which LED modules are placed on radiator faces inside the diffuser; the radiator is made with longitudinally oriented ribs located at least on a portion of radiator height and extending from the surface of the radiator central part between its faces for formation of heat removal surfaces; and the diffuser represents a cap made as longitudinally oriented segmented shells, or the diffuser is made as separate longitudinally oriented segmented shells, each of which is located in front of LED modules of one face of the radiator central part and covers them, thereby

isolating these LED modules from the ones on the adjacent face, whereas longitudinally oriented ribs are located between segmented shells.

The specified features are essential and interrelated with formation of a stable combination of essential features which is sufficient for achievement of the required technical result.

The present utility model is explained by the certain embodiment which however is not the only possible one, but illustrates possibility of achievement of the required technical result.

Fig. 1 is the general view of the LED lamp for installation into standard electric holders (electrical holders) E27 (E14);

fig. 2 is the lamp view from the side of the transparent diffuser section on LED modules;

fig. 3 shows heat distribution in terms of temperature along the radiator height;

fig. 4 shows heat distribution in terms of temperature along the radiator cross section.

The structure of the general lighting LED lamp designed for installation into electric holders (electrical holders) E27 (E26, E14, E12, E17, B22d, B15d) is considered according to the present utility model. This lamp is made in standard (conventional / common) sizes for replacement of the corresponding utility light sources. Lighting modules which represent one-sided printed circuit boards of higher heat conduction with LEDs uniformly located thereon and incorporated by the combined scheme are placed under the diffuser made of lighting plastic. LEDs in modules are located in such a manner that they create uniform distribution of light flux from the lamp in all directions in the space (360°). The lamp body and base enclose the power supply for operation in alternating current systems 220 V / 50 Hz. The main problem solved by the suggested utility model is creation of a LED lamp which has high operational reliability, enhanced lighting efficiency (owing to uniform distribution of light flux in all directions).

The general lighting LED lamp (fig. 1 and 2) includes the base 1, the transition isolating element 2 (isolator) connected therewith which is made of dielectric plastic with the cavity inside, wherein the power supply 3 for operation of the lamp in electrical networks is located. This power supply is connected with LED modules 4 made on the printed circuit board with the heat-conducting metal base and attached on the radiator 5.

The radiator 5 has the central part of rod-shaped section profile with side faces 6 pointed at different directions, whereon the said LED modules 4 are located.

The radiator 5 is placed inside the diffuser 7 made of plastic which is close to glass in terms of optical performance. The radiator is made with longitudinally oriented ribs 8 located at least on a portion of radiator height and extending from the surface of the radiator between faces for formation of heat removal surfaces. The radiator is made as the complex section profile with longitudinally oriented ribs on the outside which lie in the planes passing through the lamp axis. The radiator is preferably made of aluminum or light alloys of aluminum, copper or ceramics.

The diffuser 7 represents the cap made as longitudinally oriented segmented shells 9, or the diffuser is made as separate longitudinally oriented segmented shells 9 of different shape (depending on the lamp type), each of which is located in front of LED modules 4 of one face 6 and covers them, thereby isolating these LED modules from the ones on the adjacent face. The diffuser of complex shape in vertical section represents the common lamp shape (A60, C37, G45, P45 etc.) and is made of plastic which is close to glass in terms of optical performance, e.g. polycarbonate.

Longitudinally oriented ribs 8 of the radiator are located between segmented shells 9 in such a manner that a part of the radiator with LEDs is located within the group of diffusers. The radiator made as complex section profile with longitudinally oriented ribs on the outside which lie in the planes passing through the lamp axis is installed into slots of the body made of dielectric plastic and attached thereto mechanically, whereas the body is also mechanically connected with the base isolator. The isolator has through holes 10 for additional heat removal from the location of the power supply.

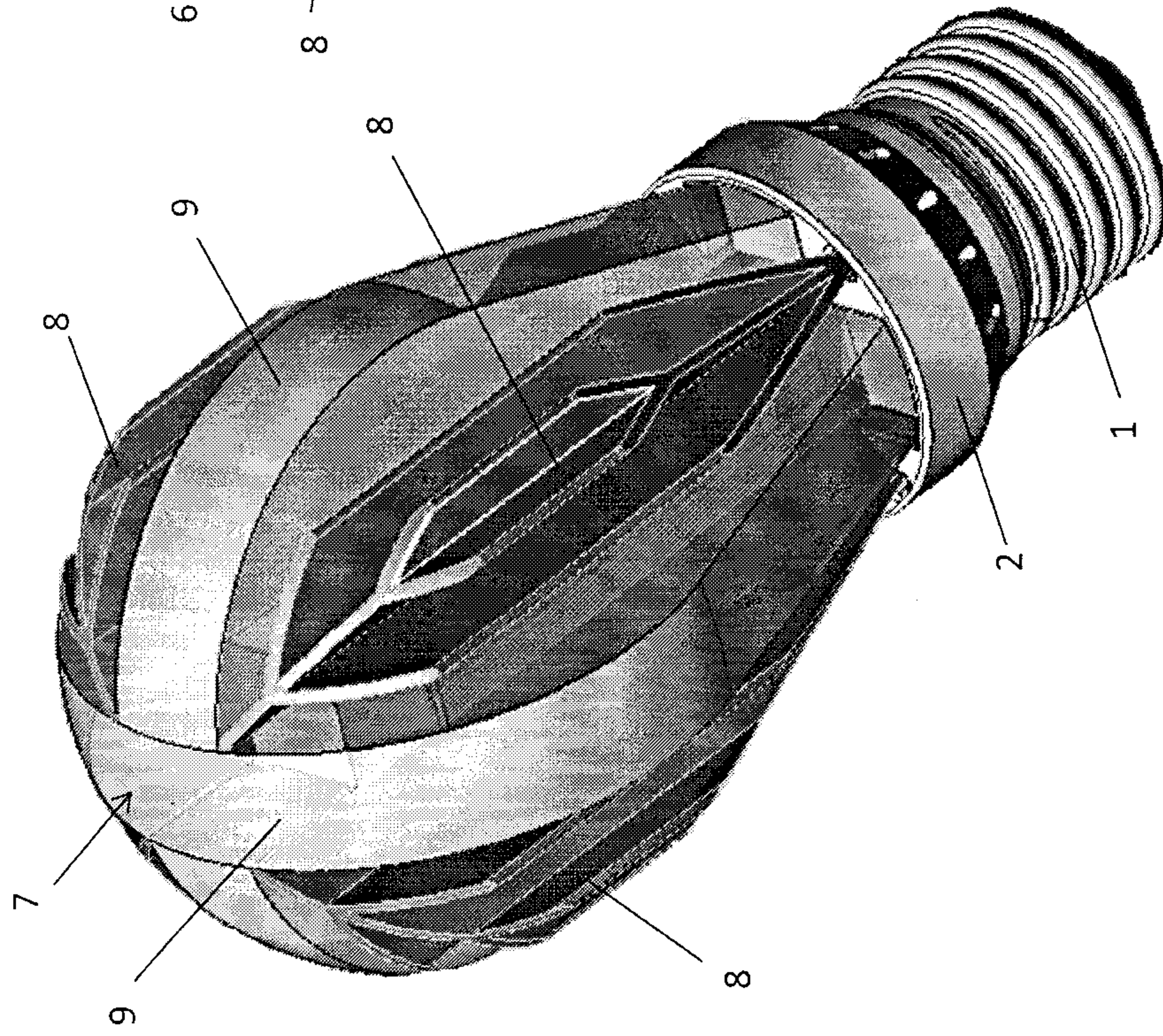
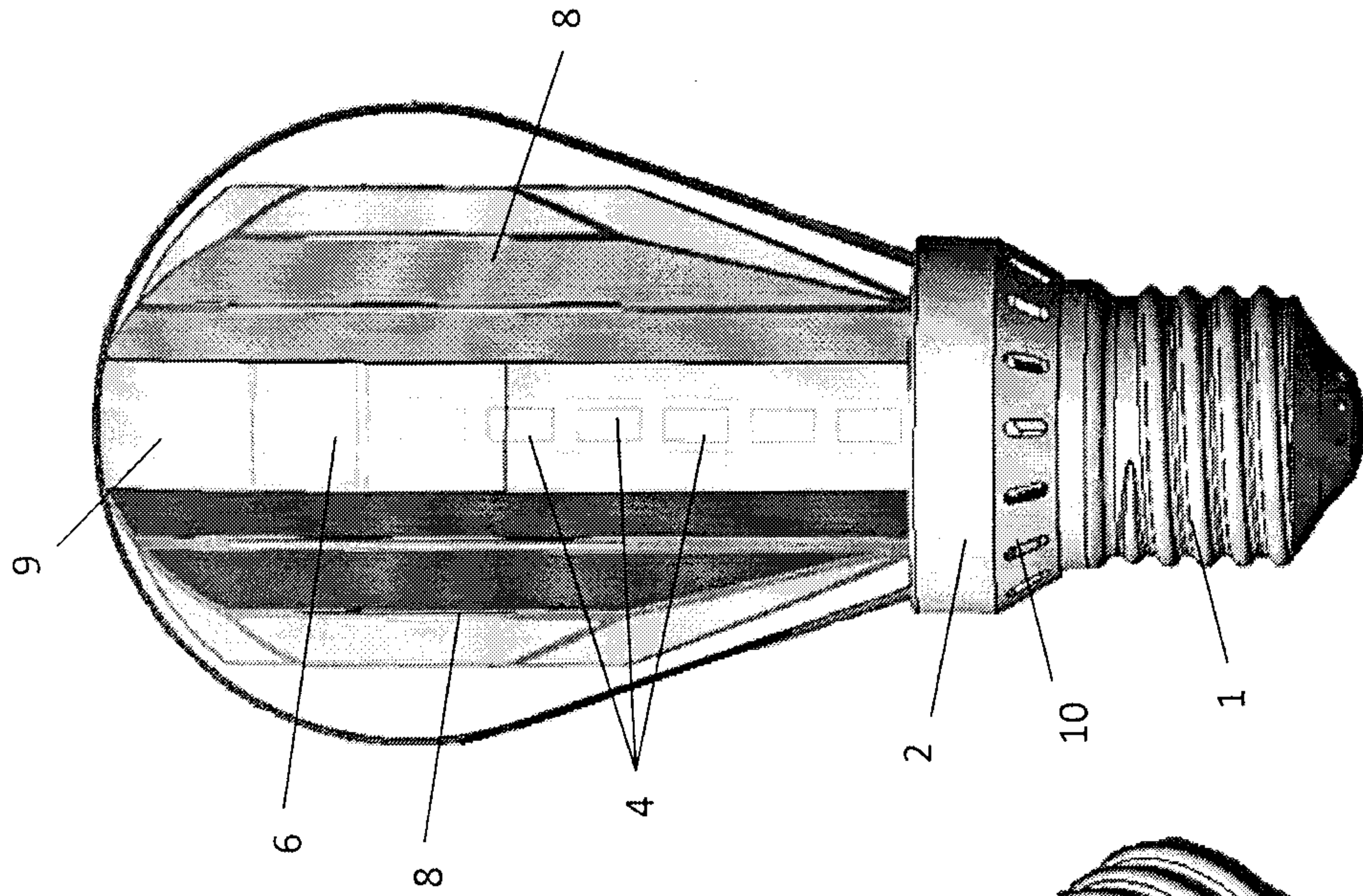
LEDs in the LED lamp are divided into several groups (modules) connected with each other into series or parallel or series-parallel or parallel-series circuits. LED modules are made with heat-conducting metal bases and installed on the radiator body, whereas modules are located in such a manner as to ensure uniform distribution of light flux in the inner volume of diffuser segments and thus the general light flux of the lamp. LEDs on the board are located in such a manner as to ensure uniform terminal flash of diffuser material.

Therefore, the feature of the LED lamp according to the present utility model is that LEDs on each radiator face are located in their own transparent shells, direct

emission onto the end surface and side surfaces of the shell. However, it should be noted in this respect that the most common method of removal of excess heat from powerful LEDs and microcircuits is its transfer to the printed circuit board (including boards with the metal base such as MC PCB, AL PCB, IM PCB), substrate or other structural elements of an electronic device. It is also applicable to install the radiator on an overheated component (or an overheated component on the radiator), which increases the area of radiant and convective interchange. Then heat is transferred to the environment mainly by way of convection. But surfaces of a heat source and heat absorber have undulations and irregularities in real life. Gaps (microcavities) which contain air appear in most cases upon contact of planes. As a result thereof, contact between planes occurs pointwise, thereby considerably increasing effective thermal resistance. It is important to remember that air has the heat conductivity factor of about 0.02 W/mK, which is a very low one and approximately 40 times lower than that of usual thermal conductive pastes. Thus, high resistance to heat flux appears between contact surfaces due to presence of air, and heat removal efficiency is decreased significantly. Heat-conductive material which fills gaps is used in order to prevent this negative effect due to presence of air. In this case, module heat is transferred to the radiator upon contact. At the same time, heat is removed by ribs which are withdrawn outside and located exterior to segments. Accordingly, temperature does not increase above the set level inside segmented shells. Studies have shown (see fig. 3 and 4) that upon long-term operation of the LED lamp the temperature of the radiator and its withdrawn ribs does not exceed 61°C, and the temperature within segmented shells is in the range of 40°C. These figures indicate absence of overheating of LEDs on the radiator. Thus, efficiency of LEDs is preserved, and light flux is maintained at the high-quality level without any change of color temperature.

Claims of the utility model

The general lighting LED lamp which includes the base, the transition isolating element connected therewith which is made of dielectric plastic with the cavity inside, wherein the power supply for lamp operation in electrical networks is located, which is connected with LED modules made on the printed circuit board with the heat-conducting metal base and attached on the radiator; the radiator has the central part of rod-shaped section profile and ribs, whereas the central part of the radiator is made with side faces pointed at different directions, whereon said LED modules are located, and placed inside the diffuser made of plastic which is close to glass in terms of optical performance, characterized in that the diffuser is made with outer surface sections stretched in the direction from the base and inner sections sunk between surfaces, in front of which LED modules are placed on radiator faces inside the diffuser; the radiator is made with longitudinally oriented ribs located at least on a portion of radiator height and extending from the surface of the radiator central part between its faces for formation of heat removal surfaces; and the diffuser represents the cap made as longitudinally oriented segmented shells, or the diffuser is made as separate longitudinally oriented segmented shells, each of which is located in front of LED modules of one face of the radiator central part and covers them, thereby isolating these LED modules from the ones on the adjacent face, whereas longitudinally oriented ribs are located between segmented shells.



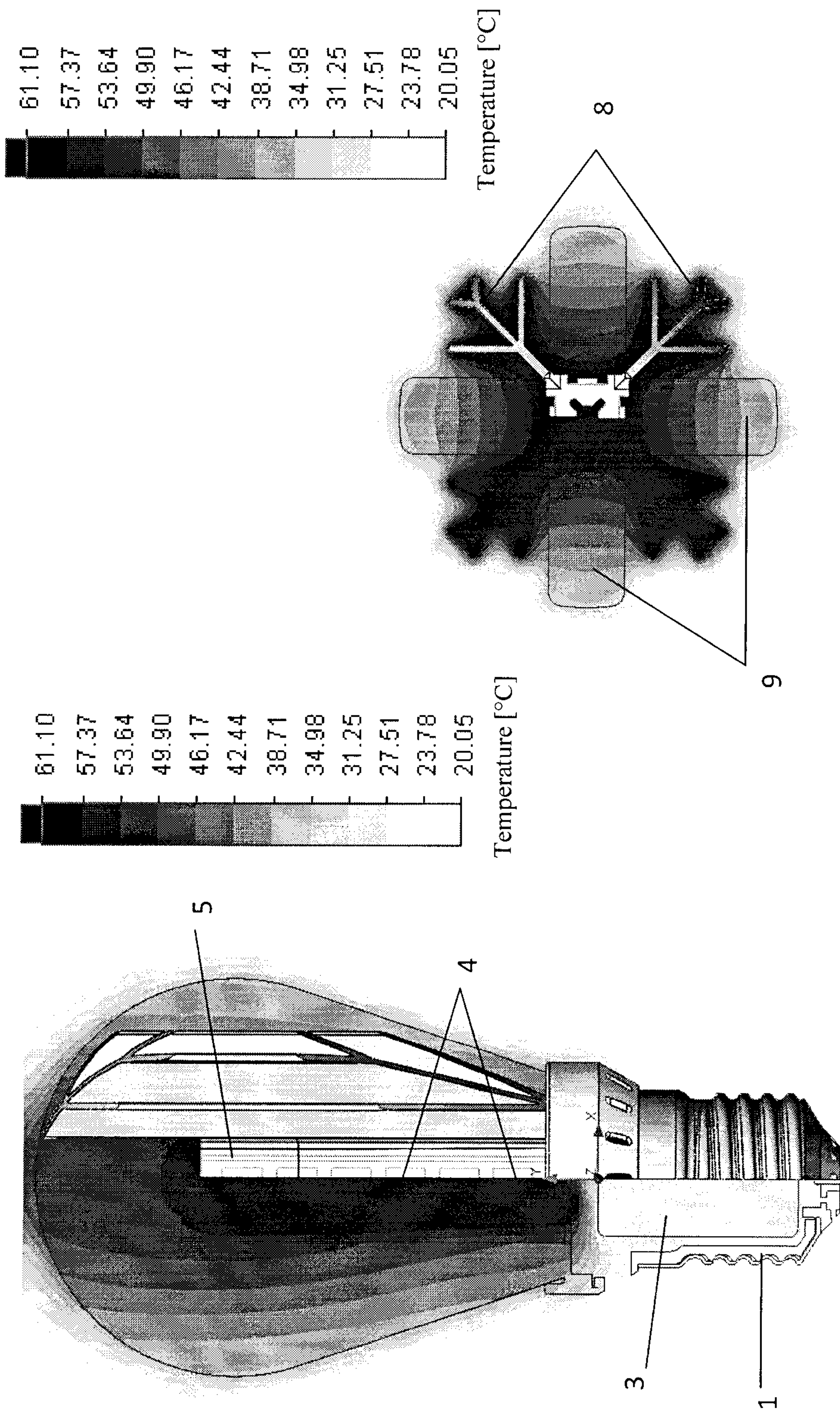
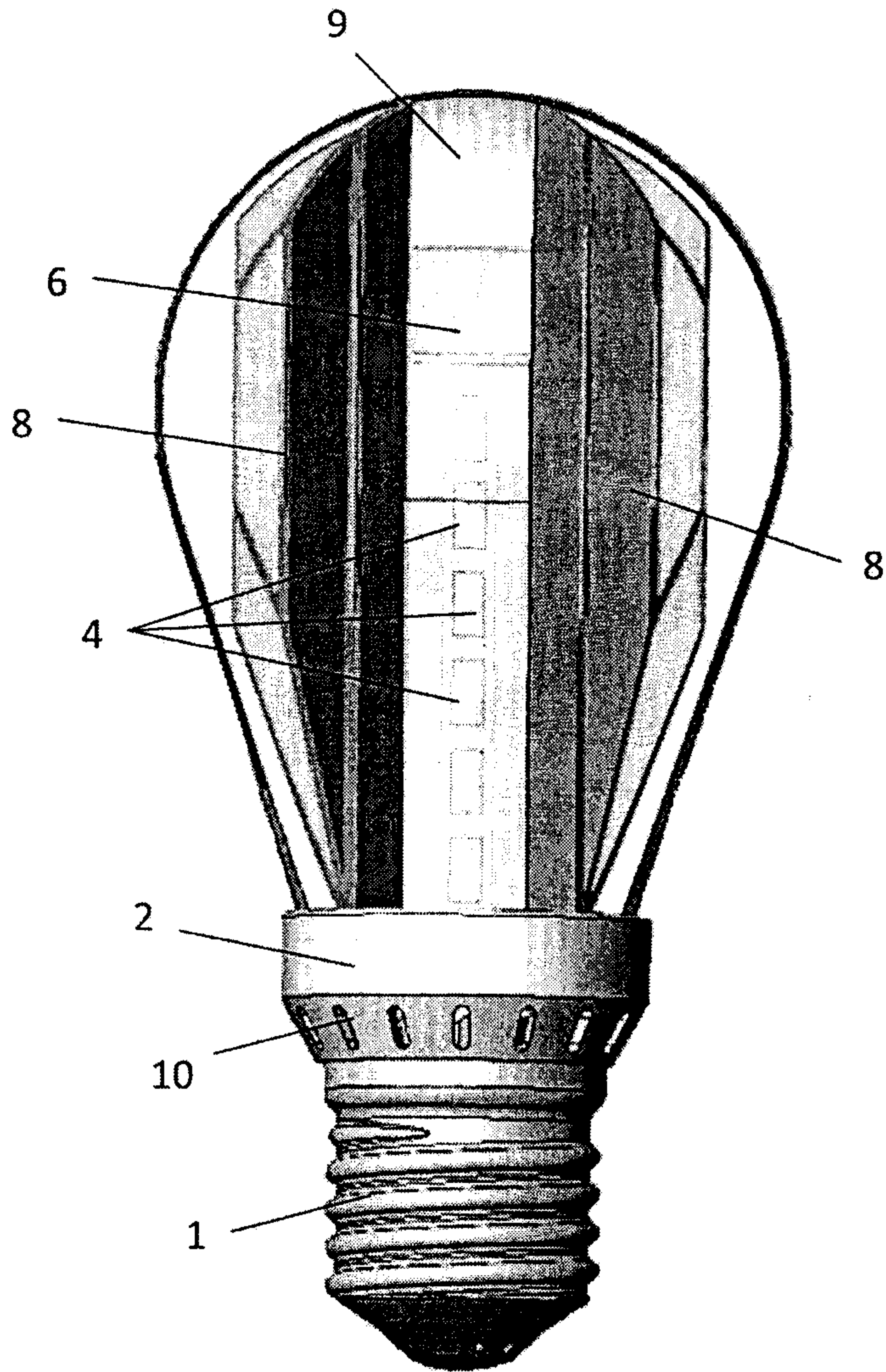


FIG. 4

FIG. 3



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