“Stand Kicker”, a Heat Pipe Radiator for Power LEDs

1. INTRODUCTION

LEDs are the expected asset card of energy saving. Their applications for large illumination devices and UV irradiators, which need high brightness, have been spreading rapidly. The luminance efficiencies (lm/W) of white LEDs have been being developed significantly since they were put to practical use in 1996. They last longer than fluorescents, which are the mainstream illumination devices. Also, their luminance efficiencies are in the process of reaching the same level as those of fluorescents.

However, the luminance efficiencies above indicate the values of LED elements alone. When they are installed and used in illumination devices, efficiencies decrease due to rise in the temperature, and about 80% of the power consumption becomes a loss under the present emission characteristics.

Loss heat, which accounts to a large part of the loss, is diffused from the elements themselves. The luminance efficiencies decrease when the temperatures of LEDs rise. Also, radiation is important because related parts such as packages deteriorate due to heat, and that has an influence on its lower luminance and its life.

In the case of LED illumination devices used in living rooms, applying simple die casting fins is enough against radiation because their heat release values are several W. On the other hand, when changing high-ceiling illumination devices in factories, gyms, auditoriums, stages, and etc. into LED illumination devices, the heat release values of LED elements in LED illumination devices, which have the same level of brightness comparable to 600 W-class mercury lamps for example, are about 150 W. Moreover, when changing greater than or equal to 1 kW-class, outdoor (race tracks, airports, expressways, etc.) mercury lamps into LED illumination devices, they generate more than 300 W of heat.

It was difficult to put them in practical use because their frequent applications in high altitudes make radiators themselves too large and heavy if radiation was attempted by existing extruded materials or die casting fins.

In order to put long-lived and highly reliable LED illumination devices into practical use, there is a need to develop a new lightweight, small sized and high-performance radiator which cools down effectively without fans.

Our company has developed the “Stand Kicker”, a lightweight (less or equal to 30%: solid heat sink basis) and small sized high-performance radiator, which cools down with natural convection. It is consisted of “heat pipes”, which are the superconductors of heat, and longitudinal fins, which are suitable for natural convection cooling.

2. CONSTRUCTION OF THE PRODUCT AND CHARACTERISTICS

The following explains the construction of this product. Heat pipes are placed on a heat receiving base plate which is intended to LED elements attachment, and the pipes are extended in nearly perpendicular directions. Several aluminum radiation fins are placed longitudinally in the direction of the heat pipes at intervals with the heat receiving base plate. The effective joint of longitudinal fins and heat pipes brought the achievement of lightweight and small sized natural convection cooling. The developed “Stand Kicker” lines up with various forms in order to apply to heat release values of LEDs from 100 to 1,000 W. We can also provide the heat pipe radiator “Stand Kicker” in various forms according to the design requirements of customers.

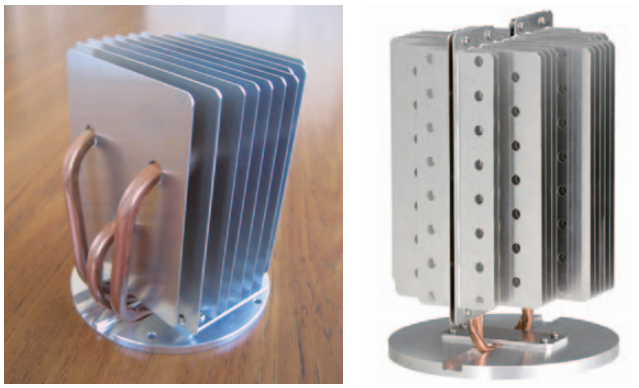

Figure 1 Appearance of “Stand Kicker”.

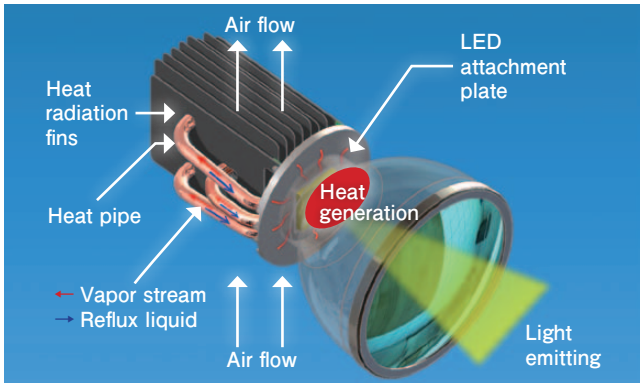

Figure 2 Application to a LED illumination device.

3. CONCLUSION

The developed "Stand Kicker" is optimal for ceiling illumination devices and projectors using high brightness LEDs especially placed in high altitudes because it is smaller and lighter compared with the existing heat sinks.

In addition, applications for outdoor illuminations such as road illuminations and ground illuminations, for indoor illuminations such as stage and museum illuminations, and also for industrial equipment such as UV irradiators and exposure equipment, are effective.

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