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- (56) Related Art
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20 **Abstract**

A low voltage spot light for use as substitute for a mains voltage PAR38 reflector lamp which comprises a chamber for LED clusters with reflectors and an enclosure for an electronic power supply to step down the incoming mains voltage.

25 The LED clusters are mounted in the central area of the heat sink within the chamber and are accessible via a removable window.

The LED chamber is weatherproof ventilated to prevent condensation.

The spotlight is designed for outdoor use in conjunction with the PAR38 style weather proof lamp holder but can be operated indoors from any standard E 27 lamp

30 holder.

**TITLE: PAR38-COMPATIBLE SPOT/FLOOD LIGHT
"ENVIROPAR-L" WITH LEDS**

FIELD OF THE INVENTION

The present invention relates to spotlights and more particularly to a low voltage spotlight which can be used as a replacement for a standard mains voltage parabolic aluminised PAR38 reflector lamp for outdoor use. Mains voltage is the supply
5 voltage as provided by the Electricity Supply Authority, typically:
110 or 220V 60 Hz USA, 230V 50Hz Europe, 240V 50Hz Australia.

BACKGROUND OF THE INVENTION

5 A standard mains voltage spotlight widely used throughout the world is the PAR38 which consists of an incandescent light source usually of 120 to 150 watt rating mounted within a sealed glass enclosure. Their low installation costs – low purchase price and simple installation in conjunction with the PAR38 style lamp holder - have made it the most widely used spot light for ratings up to 150W and outdoor applications.

However being incandescent lamps their big disadvantages are

- 10
- low efficiency with high power consumption
 - short service life
 - Dangerously high surface temperatures.

15 Governments are now requesting the replacement of incandescent lamps with more efficient light sources.

Numerous designs of adaptor lights to replace incandescent lamps are available, however none of them entails a compact weatherproof fitting, which uses LEDs as light source and can be used in a weatherproof PAR38 style lamp holder as a substitute for PAR38 reflector lamps.

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The spotlights which are the subject of this invention satisfy these difficult criteria and the term 'spotlight' as used throughout this specification includes within its scope lights, which are commonly referred to as 'floodlights'.

In my Australian Patent No. 677927, I describe a spotlight that permits a 120W PAR38 lamp to be replaced with a 50W ELV IRC halogen lamp.

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Although fluorescent lamps are more efficient than ELV halogen lamps, they are not ideal as substitutes for spotlights where concentrated, natural, brilliant light with a full colour spectrum is required. Also their service life is only about 5 times longer and they produce much industrial waste on replacement.

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5 **SUMMARY OF THE INVENTION**

The invention entails a low voltage spotlight comprising two weatherproof enclosures separated by an air gap.

10 The rear end enclosure is made from plastics and houses an electronic power supply with insulated switch mode transformer for the mains voltage input and a constant current DC output for the LEDs with protection. The power supply is embedded in permanent elastic potting which in the plastics enclosure provides double insulation.

The lid of this enclosure has a rim flange surrounding the forward end to accommodate the adhesive used for assembly and 3 integrated spacers which connect
15 the 2 enclosures and provide a path for leads from the power supply to the LED cluster. The rear end of this enclosure has a mounting base with an Edison screw cap for fitting into the socket of a mains voltage PAR38 weather proof lamp holder. For indoor applications the spotlight can be operated from any standard E27 lamp holder.

The front end enclosure is made from Aluminium alloy and consists of a top chamber
20 which houses the LED cluster with reflectors or collimators and a lower tray with a well protected ventilation vent in its centre. A heat sink dish made from 3mm Aluminium alloy is clamped between the two sections. The one piece heat sink has holes for internal ventilation and dark coating for good emissivity except in its central area where the LED cluster is mounted. The front of the chamber is enclosed by a
25 removable transparent cover attached via an elastic weather proof annular seal with a dust and insect proof vent. The position of the vent can be adjusted by rotation of the transparent cover. Heat is conducted from the Led cluster into the dish and emitted from its surface to ambient air for cooling.

Currently 14W suffice to produce a light beam comparable to a 100W PAR38 lamp.

30 The weatherproof ventilation of the front end Led chamber prevents condensation.

5 **BRIEF DESCRIPTION OF THE DRAWINGS**

The invention is now described with reference to the accompanying drawings in which:

Figure 1 is a section through a spot light.

- 10 Figure 2 is a plan of the spot light of Figure 1 with the LEDs, glass cover and chamber seal removed.

DETAILED DESCRIPTION WITH RESPECT TO THE DRAWINGS

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Referring now to the drawings, a LV spot light intended as a replacement for an existing PAR38 lamp comprises a standard Edison screw cap (2) mounted at the corner end of a frusto conical housing (4) which merges into a cylindrical shape (6). This housing (4/6) is made from UV stabilised plastics and contains the electronic power supply (52). The outer profile of the casing from the base (2) to a position adjacent the transition from the conical housing (4) to the cylindrical shape (6) matches the profile of existing PAR38 lamps, thus permitting the spot light to be fitted into an existing PAR38 lamp holder which consists of a tubular socket with an annular seal interposed between the lamp holder and the conical housing to form a weather - and dust- proof seal between the spot light and the lamp holder. This arrangement protects the electrical contact area from contamination.

20

At the opposite end of the spot light the LED chamber (12) made from Aluminium alloy with circular flange (14) seats on the central portion of Aluminium dish (18). The dish is 120mm in diameter and apart from the central portion (16) it is powder coated black. The base of the dish outside the collar (12) has 6 evenly spaced holes (20), about 10mm in diameter for ventilation cooling and drainage.

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The circuit board supporting a cluster of LEDs lies inside circular flange (14). Dependent on the design of the LED cluster and the specification of the supplier, they are either mounted on base plates for connection onto the heat sink (18) with screws

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2009202051 25 Feb 2010

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or with double-sided temperature conducting tape. The collar (12) creates the LED chamber (30) in to which the LEDs emit heat. The chamber is closed off by glass cover (42) kept in place by rim seal (34) which contains a single dust and insect protected vent (28). The dish also has a trio of passages (46) which allow electrical leads (32) to access the LEDs and holes (22) for internal ventilation.

The flange (14) is attached to the central portion (16) of the dish by three screws (38). Each screw passes through the dish into an arcuate spacer (40) which extends from a circular lid (26). The spacers are about 11mm long and create an air gap (44) between the lid (26) and the underside of the lower tray (48). This permits the option for weather protected ventilation. Adjacent to each screw hole in the spacer is a passage (46) which aligns with a matching passage (36) in the dish. These holes lead the wires (32) from the power supply (52) to the LED cluster.

The circular tray (48) is locked into position between the spacers (40) and the underside of dish (18). The well protected centre of the tray (48) has a vent opening with internal filter (50) to provide dust and insect protected ventilation.

The contact surfaces between flange (14), dish (18) and tray (48) are treated with heat sink compound to ensure reliable heat transfer.

The interior of the cylindrical housing (6) accommodates an electronic power supply (52) which steps the incoming voltage down to the voltage required by the LED cluster. The power supply (52) is in the form of an insulated switch mode transformer for the AC input combined with a constant current DC output for the LEDs, including protection.

The metallic LED chamber consisting of upper body (12) and lower tray (48) optimises the cooling surface of the heat sink. The chamber is accessible via the removable window (42). This permits replacement of the LEDs with alternative types such as ones with different efficiency, different colours or otherwise different characteristics. It is a commercial decision to either use multi-element LED modules in combination with commercially available reflectors or LEDs with integrated collimators to generate the required light beam.

Naturally the best efficiency is achieved with the lowest possible operating current and an increased number of LEDs.

The constant current power supply (52) is rated for an ELV output of maximum 24V. The input is universal for 90 to 240V, 47 to 64Hz for ambient temperatures of -40 to +50°C with protection against short circuit, over current and over voltage. It is

encapsulated in permanent elastic potting (54) and meets international safety requirements.

5

We have found the commercial advantages of the above embodiment to be:

1. Superior efficiency with low power consumption and the certainty for further improvements in the near future.
- 10 2. Long service life - only limited by the power supply to about 50.000 hrs.
3. Relatively low, non-dangerous surface temperatures.
4. Low weight- below 400 g.
5. The intensive development of LEDs will not only improve the efficiency resulting in reduced power consumption but will result in cost reductions as more applications will result in higher production quantities.
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The more "patent" orientated advantages are:

- 20 6) The LEDs emit about 50 lumens/watt of warm white directional light at current state of art.
- 7) The Led chamber is weather proof ventilated to prevent condensation.
- 8) The LEDs can be changed because they are accessible through the removable window.
- 9) The spot light can be used with existing outdoor PAR38-style lamp holders and existing indoor standard E27 lamp holders.
- 25

It is to be understood that the word "comprising" as used throughout the specification is to be interpreted in its inclusive form, i.e. use of the word "comprising" does not exclude the addition of other element. Various modifications of and/or additions to the invention can be made without departing from the basic nature of the invention and these modifications and/or additions are therefore considered to fall within the scope of the invention.

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THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A low voltage spotlight, comprising a weather proof casing having at the rear end portion a base for engagement with the socket of a mains voltage PAR 38 style outdoor lamp holder and at a forward end portion, a chamber containing an LED spotlight cluster with reflectors or collimators, a removable transparent cover for the chamber, a step down device within the casing for reducing the incoming mains voltage to the LED voltage, heat sink elements in contact with the chamber, insulating elements which includes an air gap separating both chamber with heat sink from the step down device, whereby the LED spotlight substitutes for a PAR38 reflector lamp.
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2. A low voltage spotlight as claimed in Claim 1, wherein the heat sink is a one piece metal dish, which is positioned between the upper and the lower body of the LED chamber.
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3. A low voltage spotlight as claimed in Claim 1 or 2, wherein the insulating means further comprises a lid for confining the step down device in the casing and spacers extending from the lid thereby defining an air gap between the heat sink and the lid.
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4. A low voltage spotlight as claimed in any one of Claims 2-3, wherein the metal dish is made from an Aluminium alloy 2-4mm thick or from another metal with equivalent thermal conductivity.
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5. A low voltage spotlight as claimed in any one of Claims 2-4, wherein the metal dish has at least 3 ventilation passages in the central area which opens into the chamber space for internal ventilation.
- 30 6. A low voltage spot light as claimed in any one of Claims 2-5 wherein the metal dish and the LED chamber including lower body (tray) has a dark coating to increase emissivity.

7. A low voltage spot light as claimed in any one of Claims 2-6, wherein the heat sink has at least 6 evenly spaced bore holes of about 10mm diameter for air flow and drainage positioned adjacent to the outside of the LED chamber.
- 5 8. A low voltage spotlight as claimed in any one of Claims 2-7, wherein the floor of the chamber is the central portion of the dish and the LED cluster is attached to the central portion.
- 10 9. A low voltage spotlight as claimed in any one of Claims 2-8, wherein the spacers are integral with the lid and contain passages which provide a path for leads from the step down device to the LED cluster.
- 15 10. A low voltage spotlight as claimed in Claim 1, wherein the LED cluster has directional reflectors to create a spotlight. These can be one reflector for the cluster, reflectors for groups of LEDs or individual collimators.
- 20 11. A low voltage spotlight as claimed in any one of Claims 1-10, wherein the LED cluster - at current state of LED development - requires 14W at ELV up to 24V to substitute for Par 38 lamps up to 100W.
- 25 12. A low voltage spotlight as claimed in any one of Claims 1-11, wherein the forward end portion of the casing is made of 2 parts of metal and the rear end is made of UV stabilised plastics, the metal forward end portion being attached to the forward end of the plastics portion and an Edison screw cap being attached to the rear of the plastics portion.
- 30 13. A low voltage spot light as claimed in Claims 1-12, wherein the lower body of the LED chamber has in its well protected centre a vent opening which in combination with the vent in the window seal provides ventilation to prevent condensation. Both vents are internally fitted with dust filters treated with insect repellent (like surface spray) to prevent entry of insects. The filters can be cotton balls or other suitable material held in position by silicon glue or similar.

14. A low voltage spotlight as claimed in any one of Claims 1-13, wherein the lid has a rim flange surrounding the forward end of the plastics portion for confining adhesive used during assembly.
- 5
15. A low voltage spotlight as claimed in any one of Claims 1-14, wherein the step down device comprises an insulated switch mode transformer for universal AC input like 90 -264V, 47-64Hz at an ambient temperature of -40 to+50°C combined with a constant current DC ELV output up to 24V, embedded in permanent elastic potting for uniform heat distribution and to provide double insulation in combination with the plastics enclosure.
- 10
16. A low voltage spotlight as claimed in any one of Claims 1-15, wherein the Transparent cover is removable and attached to the chamber via a weatherproof annular seal made from UV stabilised elastic material like Santoprene. The seal has one dust and insect protected vent and can be rotated for positioning of the vent opening to face downwards regardless of the installed spotlight orientation.
- 15

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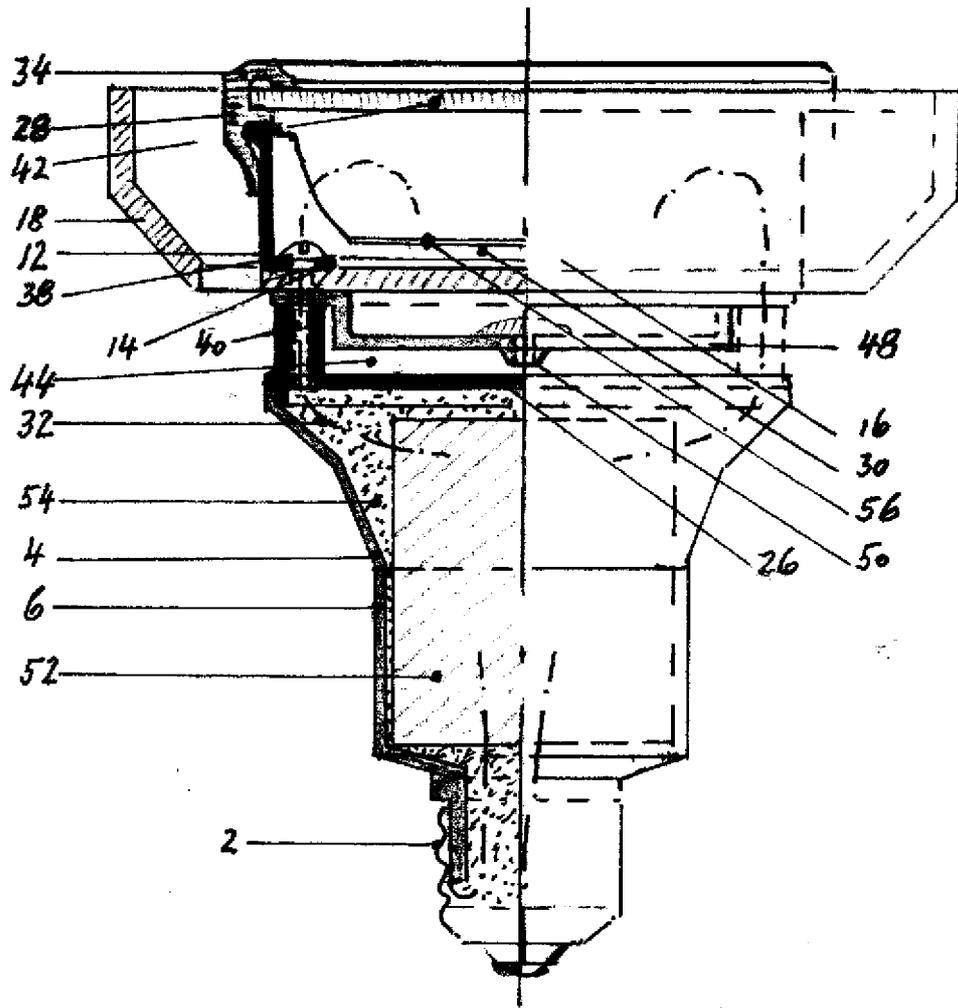


Fig. 1

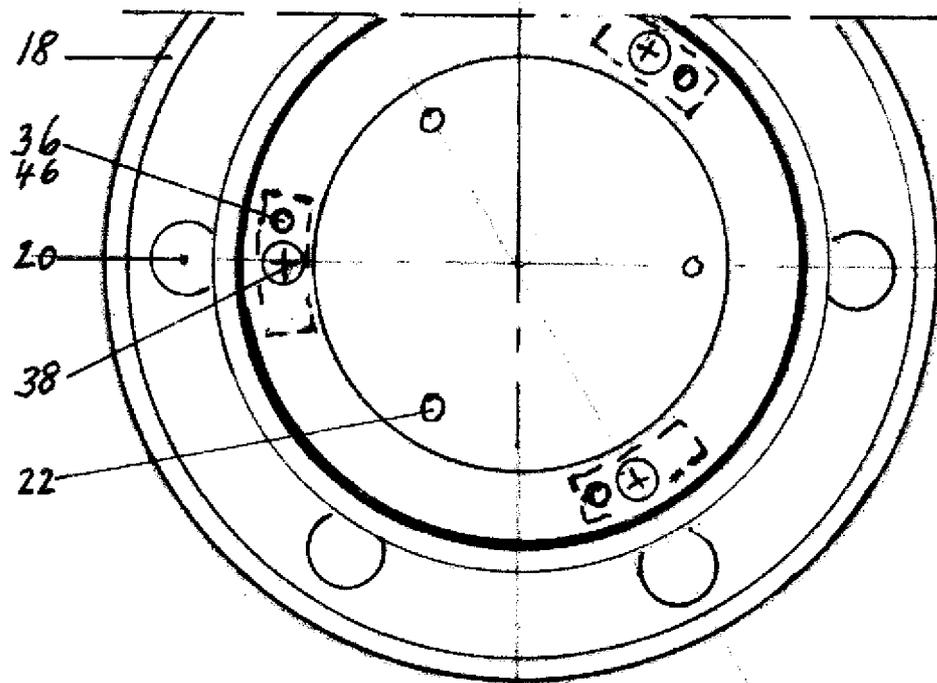


Fig. 2