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(71) Applicant(s)
Paul Dayan Metcalfe
19 Long Chaulden, HEMEL HEMPSTEAD,
HP1 2HT, United Kingdom

Rodney John Rogers
8 Castle Mead, Boxmoor,
Hemel Hempstead, HP1 1PR,
United Kingdom

(72) Inventor(s)
Paul Dayan Metcalfe
Rodney John Rogers

(74) Agent and/or Address for Service
Bowles Horton
Felden House, Dower Mews, High Street,
BERKHAMSTED, Herts, HP4 2BL,
United Kingdom

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(56) Documents Cited
EP 1057937 A1 US 6082886 A
US 5908263 A
WPI Abstract Accession No.1997-095753 & JP 8333729
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(54) Abstract Title
Illuminated paving slab

(57) A paving slab has at least one light source 4 located so as to be visible from its upper surface. The source is preferably a light emitting diode 4 and is mounted on a circuit board 5. A light guide 6, in the form of a clear plastic rod, conducts the light to the viewing surface, and preferably extends slightly beyond the surface so that it can be seen from a wider angle. The plastic rod 6 may be filled with a clear sealant 7 to prevent the slab material from invading the cavity during manufacture. The circuit board is held in position by pillars 8 during formation of the slab. The pillars are cut flush with the base of the slab after it has set.. There may be a plurality of light sources embedded within the paving slab arranged in a pattern. Also, there may be two separate supporting circuit boards provided, with a row of lights located at the opposite edges of a slab.

FIGURE 2

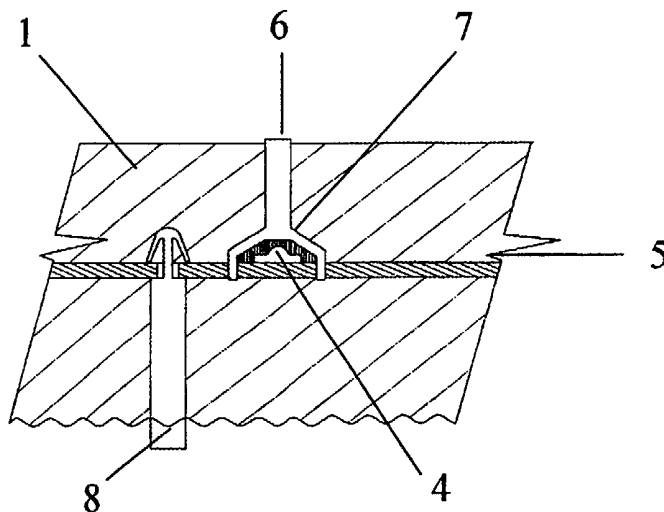


FIGURE 1

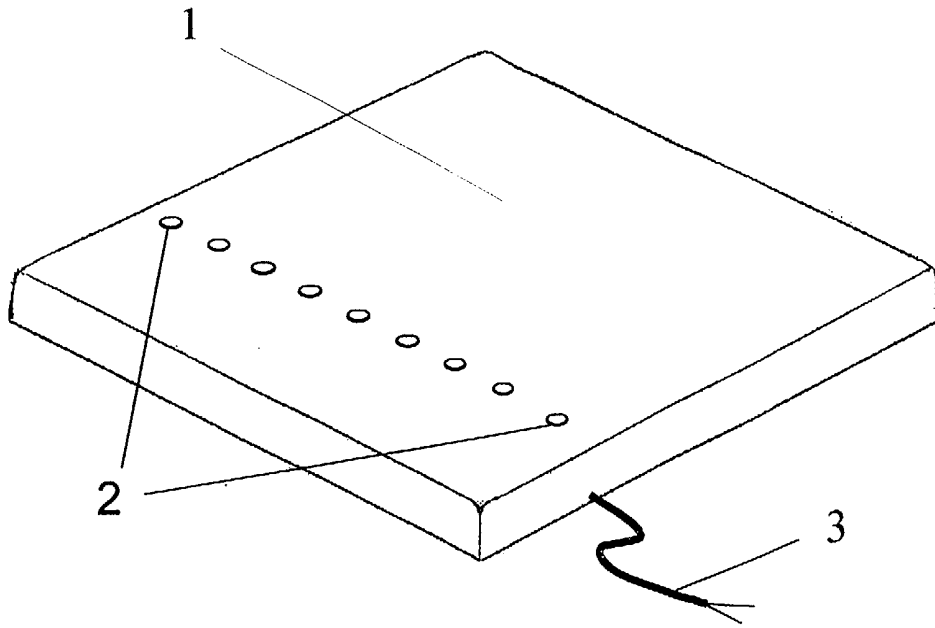
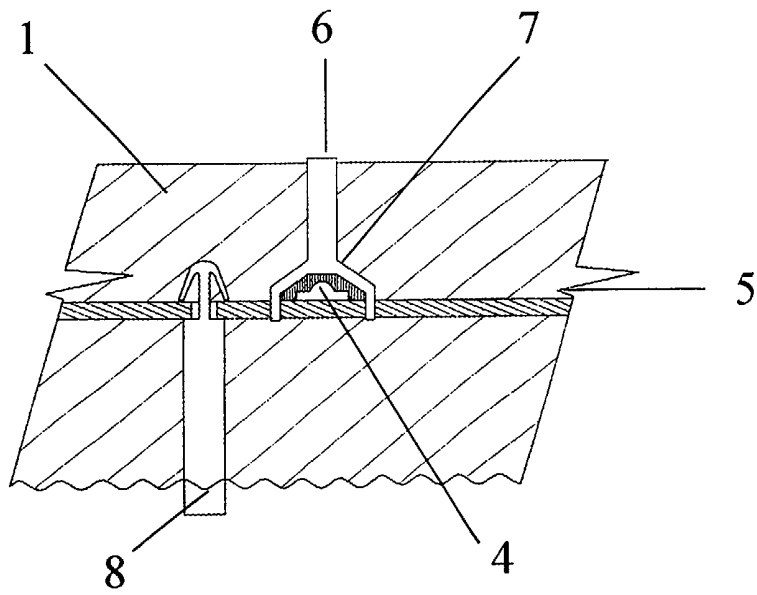


FIGURE 2



Illuminated Paving Slab

This invention relates to paving slabs.

5 In recent years there has been an increasing demand for attractive and varied paving slabs for both domestic patio and commercial use. Often there is also a demand for lighting both for decorative and safety purposes.

10 Provision of separate lighting may add to expense and complexity and can itself become a hazard if it is not permanently fixed or is located where it can cause a fall or cause injury if fallen upon.

The present invention is directed towards providing lighting that is integral to a paving slab and avoids separate lighting units and their attendant problems.

15 The invention is now described by way of example with reference to the accompanying drawings in which:

20 Figure 1 illustrates schematically a preferred embodiment of the invention in external perspective view, and

Figure 2 is a schematic cross section through the preferred embodiment of Figure 1.

25 Referring to the drawings, the figures show a paving slab with a plurality of integral light sources for use in garden and commercial paving applications. It has an especially useful application in illuminating or highlighting the perimeter of a pathway or paved area. The slabs can also be used to add decorative lighting effects to a paved area or paved footpath.

30 Light Emitting Diodes (LEDs) are used as light sources to reduce the maintenance normally associated with external incandescent and florescent lighting. The LEDs are cast inside the slab at the time of manufacture and are therefore maintenance free. This LED structure also provides safety as there are no loose parts.

The LED lighting may be arranged in different patterns and colours to achieve various effects, the most useful pattern being a single row of lights to highlight the edge of the slab. When the slabs are used in a pathway application they can highlight the safe edge of the path in poor light conditions. Other configurations are also envisaged, for example border slabs or edging, which may incorporate lights in a similar way both as an alternative or additional illumination. Within the context of this specification 'paving slab' incorporates all shapes and also edging which may not be planar and which may have a larger vertical than lateral dimension.

In the preferred embodiment the lights in each slab are powered by a low voltage direct current (DC) power supply connected by an external cable.

The LED light sources are preferably supported on a substrate, most conveniently on a circuit board, which is protected from corrosion by any suitable means and cast deep inside the slab. The light is transferred through the slab material to its surface via light guides such as clear plastic rods. In some configurations the rods may be at an incline or be curved. Usually there will be a plurality of light sources, but in some instances a single light may be provided, for example as part of a pattern or for small slab units.

Normally the paving slabs are constructed from concrete but other materials could be used, such as plastics or ceramics, either alone or in combination with one another and/or concrete.

Various construction techniques may be employed to produce the slabs including casting, vacuum or pressure moulding. The construction may vary depending on the manufacturing process as long as the circuit board or other substrate is held in position inside the slab until the material has set. In some modifications more than one substrate may be provided. For example two substrates each with a row of lights located at opposite edges of a slab.

Figure 1 shows the external appearance of a typical slab incorporating illumination in accordance with the invention. In this example, nine lights 2 are arranged in a straight

row marking the edge of the slab. The slabs could be laid end to end to make a path with a continuous strip of edge lighting. In this particular embodiment the lights are carefully positioned within the slab to maintain equidistance between lights from slab to slab. A double width path illuminated on both sides could be made using the same slab/lighting design with pairs of slabs side by side rotated at 180° with respect to one another.

It will be appreciated that other slab shapes may be used and lights provided in patterns and/or along more than one edge.

Each slab is connected to a low voltage electrical supply via a short connection cable 3. Permanent electrical supply would be provided by an external mains operated power supply with suitable isolation and appropriate maximum current limitation. Operation from battery power or from solar charged sources is also envisaged in some modifications

Figure 2 shows the internal construction of the preferred embodiment of the invention. The LED lights 4 are soldered directly to a circuit board 5. Each LED is covered with a clear plastic rod 6 which conducts the light to the surface of the slab material. The plastic rods are preferably positioned slightly proud of the slab's surface to make the lights visible from a wider viewing angle. The gap between each LED and plastic rod is filled with a clear sealant 7 to prevent the slab material from invading the cavity during manufacture

At various positions along the circuit board 5 mounting pillars 8 are installed which are used to hold the lighting assembly in position as the slab material sets. Once the slab material has solidified the support pillars are cut flush with the under surface of the finished slab. Other means of supporting the substrate or other circuit board are possible, including using a strengthened light guide or light guide locator and fabricating upside down.

The circuit board 5 contains a printed copper electrical circuit routing power to each LED 4. The complete circuit board is fully covered with a conformal coating to protect it against corrosion from the slab material. The conformal coating material will be

selected to offer protection against the slab material being used. For example, varnish can be used in a concrete slab. There are also plastics and resin coatings that may be used including plastic sheets and shrink-wrap

- 5 Various modifications are possible, for example edging may have lighting provided in more than one surface, e.g. on opposite side edges or on a top and side edge.

Claims

1. A paving slab with at least one integral light source.
5
2. A paving slab according to claim 1 in which the light source is mounted on a substrate embedded with the slab.
3. A paving slab according to claim 2 in which the substrate is a circuit board.
10
4. A paving slab according to claim 1 or claim 2 in which the light source is embedded within the slab and a light guide extends from the source to the surface of the slab.
- 15 5. A paving slab according to claim 4 in which the light guide extends above the surface of the slab to enlarge the viewing angle for the light.
6. A paving slab according to any preceding claim in which the light source is an LED.
20
7. A paving slab according to any preceding claim in which a plurality of light sources are arranged in a pattern.
8. A paving slab according to claim 7 in which the pattern comprises a row of lights proximate on edge of the slab.
25
9. A method of fabricating a paving slab with at least one integral light source, the method comprising providing a substrate on which said at least one light source is mounted, providing a light guide extending upwardly from the substrate, forming the slab around the substrate, light source and light guide while supporting the substrate in
30 position with the light guide extending to a surface of the slab

10. A method according to claim 9 in which the substrate is supported from below on mounting pillars with the light guide extending upwardly.

11. A method according to claim 10 in which the pillars are cut flush with the slab bottom surface after formation.

Amendments to the claims have been filed as follows

1. A paving slab with integral light sources comprising a cast or moulded paving slab having an upper, a lower and side surfaces, and embedded therein at least one substrate on which a plurality of LEDs are mounted with light from the LEDs visible at the upper or side surfaces of the slab, and in which the substrate comprises a circuit board for routing power to each LED, the substrate having a covering protecting it from corrosion by the slab material.
2. A paving slab with integral light source according to claim 1, in which a clear plastic rod light guide extends from a respective one of each of the LEDs.
3. A paving slab with integral light source according to claim 2, in which the light guides extend above the surface of the slab thereby enlarging the viewing angle for the light.
4. A paving slab according to claim 2 or claim 3 in which space between the LED and light guide is filled with a clear sealant.
5. A paving slab according to any preceding claim including support pillars extending from the circuit board to the lower surface of the slab.
6. A method of fabricating a paving slab with integral light sources, the method comprising providing a substrate on which a plurality of LEDs are mounted, the substrate comprising a circuit board for routing power to each LED, and each LED having an associated light guide forming the slab around the substrate, LEDs and light guides while supporting the substrate in position with the light guides extending to the surface of the slab.
7. A method according to claim 6 in which the substrate is supported from below on mounting pillars with the light guides extending upwardly.

8. A method according to claim 6 in which the pillars are cut flush with the slab bottom surface after formation.



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Claims searched: 1-11

Examiner: Kathryn Orme
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Patents Act 1977 Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:
UK Cl (Ed.T): F4R (RAG)
Int Cl (Ed.7): F21K, F21S, F21V, F21W, F21Y
Other: Online: WPI, EPODOC, PAJ

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	EP 1057937 A1 (NEW TOKYO INTL AIRPORT) see especially col 1 lines 5-10, col 3 lines 55-59, col 4 lines 1-11, col 6 lines 35-40 and fig 1	1 and 2 at least
X	US 6082886 A (STANFORD) see especially col 2 lines 29-67, col 3 lines 1-43, col 5 lines 5-12 and figs 1 and 3	1-4 and 7-9
X	US 5908263 A (CONNERS ET AL) see especially cols 1 and 2 and fig 4	1,2,9,10 and 11 at least
X	WPI Abstract Accession No. 1997-095753 & JP 8333729 (Dainichi Sizai) 17/12/1996 (see abstract)	1,2,4,7 and 9
X	WPI Abstract Accession No. 1996-167594 & JP 8049219 (Yamau KK) 20/02/1996 (see abstract)	1,2,4,5 and 7 at least
X	Patent Abstracts of Japan JP5179621 (Toshiba Lighting & Technology) 20/07/1993 (see abstract)	1,2,4,5 and 6

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.