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(71) Applicant(s):
L.T.G.W. Limited
58 Moorbank Road, SHEFFIELD, S10 5TR,
United Kingdom

(72) Inventor(s):
John Stewart Oppenshaw

(74) Agent and/or Address for Service:
Hulse & Co
St James House, 2nd Floor, Vicar Lane,
SHEFFIELD, S1 2EX, United Kingdom

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(56) Documents Cited:
US 5786665 A **US 2247969 A**
US 20070006493 A1 **US 20030117793 A1**
US 20010049893 A1

(58) Field of Search:
INT CL **B60Q, G02B**
Other: **EPODOC, WPI**

(54) Abstract Title: **A sign back-lighted by LEDs through a planar light-guide and a reflective surface**

(57) An illuminable sign 1 comprises a light-guide 2 which takes the form of a relatively planar sheet of material having front and rear surfaces 3, 4, the light-guide sheet being generally transparent and having an interrupted 7 rear surface, a reflective coating / mirror 17 being provided adjacent/on the rear surface, the sign being illuminated when LEDs 10 emit light which then impacts the interrupted surface and the reflective coating and passes through the front face to back-light up signage 15 on/adjacent the front surface. Preferably the interruptions / deformations on the surface take the form of grooves / ribs / score lines, while the diode light preferably enters the light-guide from the side to reflect off the grooves and the reflective plate. Ideally, a vehicle registration plate is located on / ahead of the front face of light-guide. The planar sheet may be made of plastic or glass, and may possess a slot 8 with a PCB within.

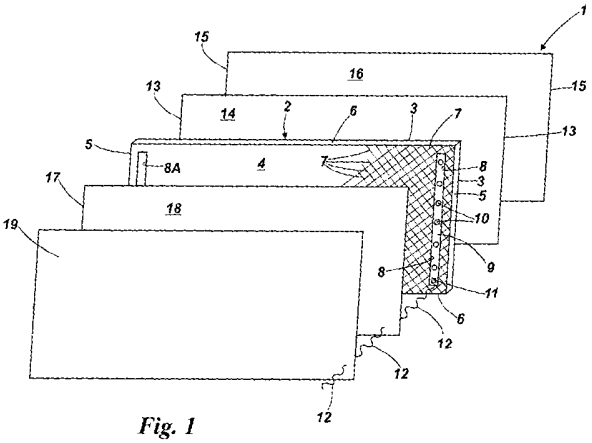

Fig. 1

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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

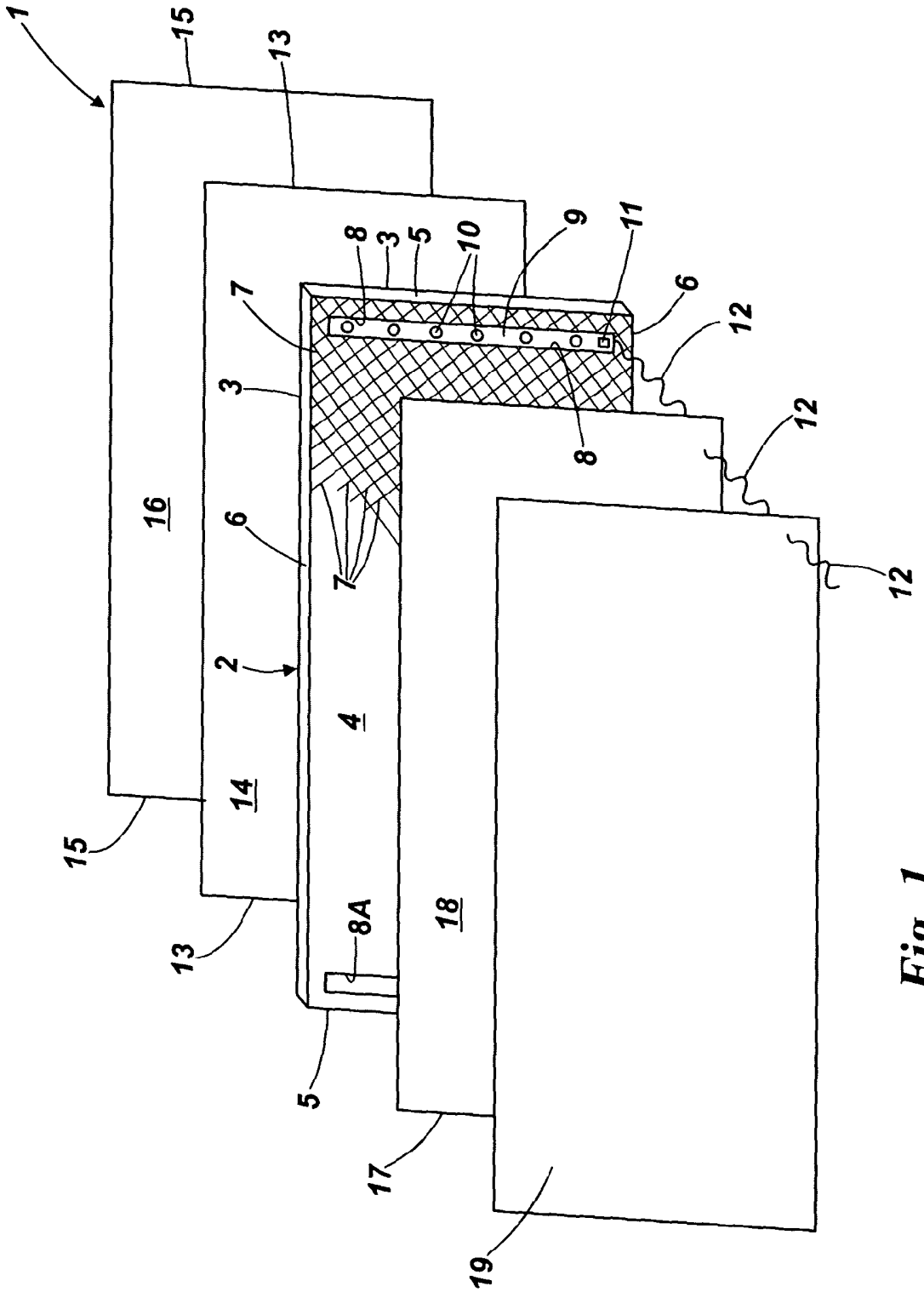

Fig. 1

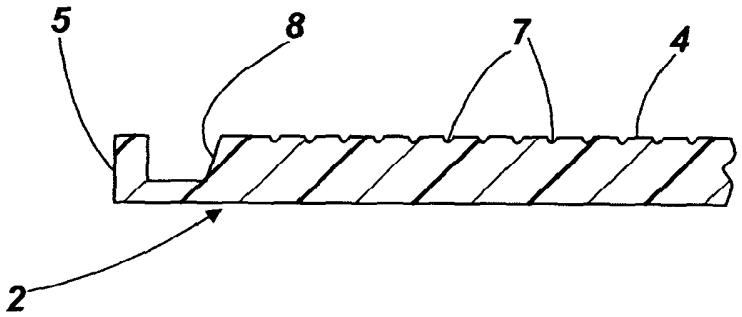

Fig. 2

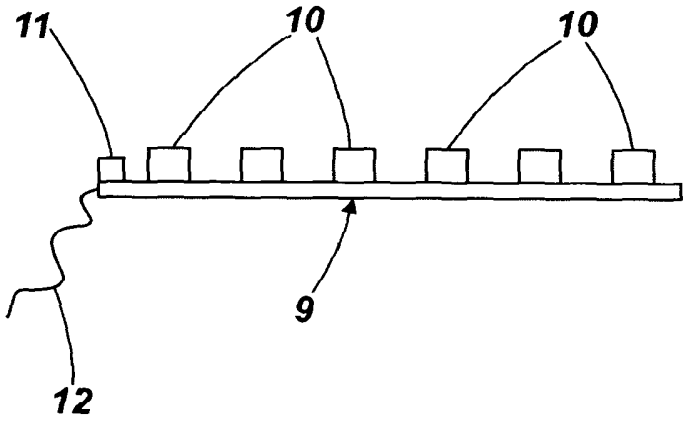

Fig. 3

Title of the Invention

Illuminatable signs

Field of the Invention

This invention relates to an illuminatable sign such as a vehicle number plate, a road sign, an emergency exit sign etc.

Background of the Invention

In the UK, whilst there is a legal requirement to mount vehicle number plates on both the front and the rear of a vehicle (and also in the case of a trailer on the rear of a trailer), there is only a legal requirement for an illumination facility to be provided for the rear number plate, and to meet this requirement vehicle manufacturers have been obliged to provide at least one lamp holder, or light housing, adapted to hold at least one replaceable lamp (usually of 5 watt), with an connection to the electrical system of the vehicle. In most instances the rear number plate is only illuminated when the driver turns on the side and/or headlights, although some manufacturers provide day running lights. Whilst the lamp(s) is/are intended to illuminate the entire number plate, and effective illumination is achieved in the vicinity of the lamp(s), clearly, the illumination of certain areas of the number plate diminishes proportionally to the distance of those areas from the lamp(s).

It follows that, with the absence of a legal requirement to illuminate a front number plate, manufacturers understandably refrain from incurring the avoidable costs of providing an illumination facility, such that front number plates with their propensity for grime pick-up from preceding vehicles are frequently difficult to read either manually e.g. by the police, or automatically by speed cameras, toll cameras etc.

In addition, all lamps are prone to eventual filament failure involving maintenance costs, and the driver may or may not be aware of such failure, rendering even a supposedly illuminated rear number plate difficult to read with certainty.

All road signs, whether permanent, or temporary during road works, are also required to be illuminated in hours of darkness and again this is by shining an associated lamp(s) on to the sign, inevitably resulting in a mixed level of illumination over the area of the sign.

Also in the UK, there is a requirement to illuminate certain signs, such as emergency exit signs of all manner of buildings. Again illumination has been by one or more lamps connected to the main supply of a building and also an emergency backup supply, and illumination of areas distant from the lamp(s) will be with mixed success. Again, such emergency and other signs require maintenance i.e. regular and conscientious checking so that the lamp(s) function in an emergency situation, with a facility for the replacement of failed lamps.

Object of the invention

A basic object of the present invention is the provision of an improved illuminatable sign capable of illuminating with certainty the entire area of the sign, and which in addition is maintenance free.

Summary of a First Aspect of the Invention

According to a first aspect of the invention there is provided an illuminatable sign comprising a relatively thin, planar sheet or strip of self-supporting material having a front surface and a rear surface, **characterised in that**

(i) the self-supporting material is transparent, or semi-transparent, with an interrupted surface;

(ii) signage is carried directly, or indirectly, by the front surface of the self-supporting material;

(iii) at least one L.E.D. light source is associated with the self-supporting material which light source, upon provision of electrical power, serves to dissipate and diffuse light into the self-supporting material, resulting in internal illumination of the entire sign aided by the surface interruption;

(iv) a reflective sheet provided at or adjacent the rear surface; and

(v) means is provided to connect the L.E.D.(s) to a source of electrical power.

Summary of a Second Aspect of the Invention

According to a second aspect of the invention there is provided a motor vehicle or trailer provided with at least one number plate constructed in accordance with the sign defined in the first aspect.

Advantages of the Invention

Illumination of the sign in accordance with the invention is, unlike most prior proposals, not dependent on an associated lamp, but rather is self-illuminating, the sign being capable of illumination over its entire area to the same intensity, thus avoiding any partially illuminated zones, yet is totally maintenance free.

With the sign in the form of a vehicle number plate, the invention provides a vehicle number plate/vehicle capable of being fitted not only to the rear but also to the front of the vehicle and which number plate, unless accident damaged, has a life (typically of 16 years or longer) that would normally exceed the life of the vehicle.

The invention also provides vehicle manufacturers with an opportunity to design the rear of vehicles without the need to incorporate rear number plate light housing.

The signage may be of a mandatory, warning or emergency nature, and may be lettering, insignia, numerals, graphics, or a mixture of these, as required by the user.

Preferred or Optional Features of the Invention

The self-supporting material is a sheet or strip of synthetic plastics.

The synthetic plastics is acrylic.

The synthetic plastics is Perspex™.

The synthetic plastics self-supporting sheet is of 6mm to 8mm thickness.

The self-supporting material is glass, which is more durable than an acrylic for say an exit/emergency exit sign in a building if the building could present a fire hazard.

The self-supporting material is etched glass.

The signage consists of a coloured or printed layer of material designed to show light to varying degrees to achieve an illuminatable signage effect.

The sign is constructed as a multi-layer laminate secured together by adhesive.

In an embodiment where the signage is applied indirectly to the self-supporting material, it is applied to a transparent, or semi-transparent signage, sheet or layer, with the latter itself then applied to the front surface of the self-supporting material.

The signage sheet is of synthetic plastics.

The signage, for a vehicle number plate, is black lettering on the signage sheet of sufficient density to limit light transmission therethrough so that its appearance is solid black.

The signage sheet is secured to the front surface of the self-supporting layer by adhesive.

To the front surface of the signage layer is applied a protective layer.

Apart from providing physical protection, the protective layer is provided with a U.V or I.R. screen or filter to shield the signage from deterioration.

The protective layer is secured to the signage layer by adhesive.

The protective layer is of synthetic plastics.

To the rear surface of the self-supporting sheet is applied the reflective layer.

The reflective sheet is secured by a front surface thereof to the self-supporting layer by adhesive.

The reflective sheet not only reflects light from the L.E.D.s, but is also retro-reflective to show light from an external source, such as vehicle headlights.

To a rear surface of the reflective layer is applied a protective backing.

The protective backing is secured to the rear surface of the reflective layer by adhesive.

All the various layers making up the laminated sign are of the same size and profile.

The sign is provided with drilled mounting holes or other attachment/mounting means.

The sign is rectangular.

The sign is oblong.

The sign is circular.

The sign is triangular.

The interrupted surface is the rear surface of the self-supporting material.

The surface interruption is provided by at least one surface score line.

If the self-supporting material is synthetic plastics, the score line(s) is/are cut into the rear surface.

If the self-supporting material is glass, the score line(s) is/are etched into the rear surface.

The surface interruption is provided by multiple, parallel score lines, typically spaced apart by 1.5 mm.

The score lines extend end-to-end along, and across, the self-supporting plate.

The score lines extend diagonally across the self-supporting plate.

The surface interruption is provided by multiple protuberances, projections, blisters or dimples.

Multiple L.E.D.s e.g. 6-10 are provided.

A strip of electrically interconnected L.E.D.s are mounted on a common circuit board.

The circuit board is provided with in-line resistors to regulate power delivery.

L.E.D.s are provided at one perimeter area, or multiple perimeter areas of the sign.

L.E.D.s are provided along one and/or both ends of a rectangular or oblong sign.

L.E.D.s are provided along the top and/or bottom of a rectangular or oblong sign.

The, or each L.E.D. is mounted in a cavity or groove machined, moulded, or cast into the self-supporting material.

The cavity or groove is provided in the rear surface of the self-supporting material.

The cavity or groove is closed off by the application of a sealant such as a silicone or bitumous product, whereby the L.E.D. is weatherproof.

The, or each L.E.D. emits white visible light.

The, or each L.E.D. emits non-white e.g. yellow, red, green, blue visible light.

With the sign in the form of a vehicle number plate, the, or each L.E.D. emits infra-red radiation (invisible to the naked eye) to enable police or other cameras to detect/read the number plate irrespective of conditions.

With the sign in the form of a vehicle number plate, the number plate is provided with at least one white light emitting L.E.D., and at least one IR emitting L.E.D.

With the sign in the form of a vehicle number plate, also mounted in the same cavity as that accommodating the L.E.D.s, or a different cavity or groove, is a vehicle ID number chip capable of interrogation.

The source of electrical energy is a vehicle electrical system, if the sign is in the form of a vehicle mounted number plate.

The source of electrical energy is a solar panel(s) attached to, or integral with the sign.

The source of electrical energy is a battery.

The battery is of a rechargeable kind.

Connection to the vehicle electrical system is such that the number plate is illuminated under the control of the driver, typically upon switching on the side or headlights.

Alternatively, connection to the vehicle electrical system is such that constant illumination is provided, irrespective of whether the side light or headlights are switched on or off. A typical number plate in accordance with the first aspect of the invention has been found to consume 3 watts compared for example with two 5 watt lamps of a conventional rear vehicle illumination system.

Brief Description of the Drawings

As sign in accordance with the first aspect of the invention will now be described by way of example only in the accompanying drawings, in which

Figure 1 is an exploded perspective view of an illuminatable sign in accordance with the invention, in an embodiment suitable as a vehicle number plate;

Figure 2 is a diagrammatic, part-sectional view through a portion of an assembled sign; and

Figure 3 is a diagrammatic view on one end of a P.C.B. carrying the L.E.D.s and a resistor.

In the drawings, an illuminatable sign (1) consists of laminate of five sheets or strips, secured together by adhesive, as follows.

The principal component of the sign (1) is a central, self-supporting strip (2) of Perspex™ or other transparent, or semi-transparent acrylic, having a front surface (3) and a rear surface (4), the strip (2) being oblong, of standard vehicle number plate dimensions and thus having opposite ends (5) and top end and bottom edges (6). The rear surface (4) is provided with a plurality of parallel score lines (7) which may be criss-crossed, as indicated in Figure 1, or may be as a grid with some score lines parallel to the top and bottom edges 6, and orthogonal score lines parallel to the end (5). The front surface could also be scored, but is preferably plain.

Adjacent each end (5) is machined or moulded a transverse groove (8) which does not break through to the front surface (4). Into the groove (8) is pushed a P.C.B. (9) carrying typically six L.E.D.s (10) for this vehicle number plate embodiment, and a resistor (11), and provided with electrical leads (12) for connection to any suitable form of electrical power e.g. the electrical system of the vehicle to which the number plate is fitted. The relative dimensions are such that the P.C.B., and its components

engage at least some walls of the groove, so as to be gripped by the groove rather than being free to float within the groove. A water and weatherproof sealant (not shown) is then applied e.g. by an industry-standard gum to the P.C.B., to close off the groove. As indicated, a second groove or slot (8) may be provided at the other end of the strip (2) for alternative location of the P.C.B. strip, or for the location of a second P.C.B. strip, so that when powered, illumination is provided from both ends of the strip.

Signage, in the form of a vehicle registration number, is printed on a signage strip (13) e.g. of thin flexible plastics e.g. P.V.C., with a rear surface (14) of the strip (13) provided with adhesive to make contact with the front surface (3) of the self-supporting strip (2), thereby to apply the signage indirectly to the self-supporting strip (2).

To a front face of the strip (13) is secured a protective strip (15) provided as a rear surface (16) with adhesive to make contact with the front surface of the strip (13), the strip (15) not only protecting the signage against minor physical damage such as scratches, or store damage from other vehicles, but also with UV/IR filter(s) to protect the signage from deterioration.

To the rear surface (4) of the strip (2) is applied a reflective strip (17), again being secured by a suitable adhesive.

Finally, to rear surface (18) of the reflective strip (17) is applied a protection strip (19) e.g. of P.V.C., again being secured to the reflective strip by adhesive, the electrical leads (12) passing through the various strips for connection to a suitable source of electrical power.

CLAIMS

1. An illuminatable sign comprising a relatively thin, planar sheet or strip of self-supporting material having a front surface and a rear surface, **characterised in that**

(i) the self-supporting material is transparent, or semi-transparent, with an interrupted surface;

(ii) signage is carried directly, or indirectly, by the front surface of the self-supporting material;

(iii) at least one L.E.D. light source is associated with the self-supporting material which light source, upon provision of electrical power, serves to dissipate and diffuse light into the self-supporting material, resulting in internal illumination of the entire sign aided by the surface interruption;

(iv) a reflective sheet provided at or adjacent the rear surface; and

(v) means is provided to connect the L.E.D.(s) to a source of electrical power.

2. A sign as claimed in Claim 1, wherein the self-supporting material is a sheet or strip of synthetic plastics.

3. A sign as claimed in Claim 2, wherein the synthetic plastics is acrylic.

4. A sign as claimed in Claim 3, wherein the synthetic plastics is Perspex™.

5. A sign as claimed in any one of Claims 2 to 4, wherein the sheet or strip is of 6mm to 8mm thickness.

6. A sign as claimed in Claim 1, wherein the self-supporting material is glass.

7. A sign as claimed in Claim 6, wherein the self-supporting material is etched glass.

8. A sign as claimed in any preceding claim, wherein the signage consists of a coloured or printed layer of material designed to show light to varying degrees to achieve an illuminatable signage effect.

9. A sign as claimed in any preceding claim, wherein the sign is constructed as a multi-layer laminate secured together by adhesive.

10. A sign as claimed in any preceding claim, wherein in an embodiment where the signage is applied indirectly to self-supporting material, it is applied to a transparent, or semi-transparent signage, sheet or layer, with the latter itself then applied to the front surface of the self-supporting material.

11. A sign as claimed in Claim 10, wherein the signage sheet is of synthetic plastics.

12. A sign as claimed in Claim 10 or 11, wherein the signage, for a vehicle number plate, is black lettering on the signage sheet of sufficient density to limit light transmission therethrough so that its appearance is solid black.

13. A sign as claimed in any one of Claims 10 to 12, wherein the signage sheet is secured to the front surface of the self-supporting layer by adhesive.

14. A sign as claimed in any one of Claims 10 to 13, wherein to the front surface of the signage layer is applied a protective layer.

15. A sign as claimed in Claim 14, wherein apart from providing physical protection, the protective layer is provided with a U.V or I.R. screen or filter to shield the signage from deterioration.

16. A sign as claimed in Claim 15, wherein the protective layer is secured to the signage layer by adhesive.

17. A sign as claimed in Claim 14 or 15, wherein the protection layer is of synthetic plastics.

18. A sign as claimed in any preceding claim, wherein to the rear surface of the self-supporting sheet is applied the reflective layer.

19. A sign as claimed in Claim 18, wherein the reflective layer is secured by a front surface thereof to the self-supporting layer by adhesive.

20. A sign as claimed in any preceding claim, wherein the reflective sheet not only reflects light from the L.E.D.s, but is also retro-reflective to show light from an external source, such as vehicle headlights.

21. A sign as claimed in Claim 19 or 20, wherein to a rear surface of the reflective layer is applied a protective backing.

22. A sign as claimed in Claim 21, wherein the protective backing is secured to the rear surface of the reflective layer by adhesive.

23. A sign as claimed in Claim 9, and any claim appended thereto, wherein all the various layers making up the laminated sign are of the same size and profile.

24. A sign as claimed in any preceding claim, wherein the sign is provided with drilled mounting holes or other attachment/mounting means.

25. A sign as claimed in any preceding claim, of rectangular form.

26. A sign as claimed in any one of Claims 1 to 24, of oblong form.

27. A sign as claimed in any one of Claims 1 to 24, of circular form.

28. A sign as claimed in any one of Claims 1 to 24, of triangular form.

29. A sign as claimed in any preceding claim, wherein the interrupted surface is the rear surface of the self-supporting material.

30. A sign as claimed in any preceding claim, wherein the surface interruption is provided by at least one surface score line.

31. A sign as claimed in Claim 30, wherein if the self-supporting material is synthetic plastics, the score line(s) is/are cut into the rear surface.

32. A sign as claimed in Claim 30, wherein if the self-supporting material is glass, the score line(s) is/are etched into the rear surface.

33. A sign as claimed in any one of Claims 30 to 32, wherein the surface interruption is provided by multiple, parallel score lines.

34. A sign as claimed in Claim 33, wherein the multiple, parallel score lines are spaced apart by 1.5 mm.

35. A sign as claimed in any one of Claims 30 to 34, wherein the score lines extend end-to-end along, and across, the acrylic plate.

36. A sign as claimed in any one of Claims 30 to 34, wherein the score lines extend diagonally across the acrylic plate.

37. A sign as claimed in any one of Claims 1 to 29, wherein the surface interruption is provided by multiple protuberances, projections, blisters or dimples.

38. A sign as claimed in any preceding claim, wherein multiple L.E.D.s, typically 6-10 are provided.

39. A sign as claimed in Claim 38, wherein a strip of electrically interconnected L.E.D.s are mounted on a common circuit board.

40. A sign as claimed in Claim 39, wherein the circuit board is provided with in-line resistors to regulate power delivery.

41. A sign as claimed in any preceding claim, wherein L.E.D.s are provided at one perimeter area or multiple perimeter areas of the sign.

42. A sign as claimed in Claim 25 or 26, or any claim appended thereto, where L.E.D.s are provided along one and/or both ends or edges of the sign.

43. A Illuminatable sign as claimed any one of Claims 25, 26, 41 or 42, wherein L.E.D.s are provided along the top and/or bottom ends or edges of a sign.

44. A sign as claimed in any preceding claim, wherein the, or each L.E.D. is mounted in a cavity or groove machined, moulded, or cast into the self-supporting material.

45. A sign as claimed in Claim 44, wherein the cavity or groove is provided in the rear surface of the self-supporting material.

46. A sign as claimed in Claim 44 or 45, wherein the cavity or groove is closed off by the application of a sealant such as a silicone or bitumous product, whereby the L.E.D. is weatherproof.

47. A sign as claimed in any preceding claim, wherein the, or each L.E.D. emits white visible light.

48. A sign as claimed in any one of Claims 1 to 46, wherein the, or each L.E.D. emits non-white e.g. yellow, red, green, blue visible light.

49. A sign as claimed in any preceding claim, and in the form of a vehicle number plate, wherein the, or each L.E.D. emits infra-red radiation to enable police or other cameras to detect/read the number plate irrespective of conditions.

50. A sign as claimed in any preceding claim, and in the form of a vehicle number plate, wherein the number plate is provided with at least one white light emitting L.E.D., and at least one IR emitting L.E.D.

51. A sign as claimed in Claim 44, and any claim appended thereto, wherein also mounted in the same cavity or groove as that accommodating the L.E.D.s, or a different cavity or groove, is a vehicle ID number chip capable of interrogation.

52. A sign as claimed in any preceding claim, wherein the source of electrical energy is a vehicle electrical system, if the sign is in the form of a vehicle mounted number plate.

53. A sign as claimed in any one of Claims 1 to 51, wherein the source of electrical energy is a solar panel(s) attached to, or integral with the sign.

54. A sign as claimed in any one of Claims 1 to 51, wherein the source of electrical energy is a battery.

55. A sign as claimed in Claim 54, wherein the battery is of a rechargeable kind.

56. A sign as claimed in Claim 52, wherein connection to the vehicle electrical system is such that the number plate is illuminated under the control of the driver, typically upon switching on the side or headlights.

57. A sign as claimed in Claim 52, wherein alternatively, connection to the vehicle electrical system is such that constant illumination is provided, irrespective of whether the side light or headlights are switched on or off.

58. A sign substantially as herein before described with reference to the accompanying drawings.

Application No:	GB0912915.6	**Examiner:**	Mr Nithi Nithiananthan
Claims searched:	1 at least	**Date of search:**	16 November 2009

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1 at least	US5786665 A (Sharp); see figures 35-37 showing back-lit display, with light-guide 50 having its rear surface interrupted with V-shaped grooves 110 and reflective plate 112
X	1 at least	US2003/117793 A1 (LG); see figures 9 and 13 showing light-guide with grooved back surface and reflective sheet 32 provided adjacent / reflective coating provided thereon
X	1 at least	US2001/049893 A1 (Koninkl); see figures 1a & 3, and paragraph 56 which mention that the grooved surface of the light-guide may have a reflective coating
X	1 at least	US2247969 A (Stewart); see figure 2 showing an illuminated sign having a light-guide with an interrupted back surface, and that the back surface is silvered to reflect the light rays, and also take note of the date of the document
X	1 at least	US2007/006493 A1 (Eberwein); see figures showing a vehicle number plate being lit by LEDs, the light-guide having a reflective surface provided behind it

Categories:

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.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC[X] :

Worldwide search of patent documents classified in the following areas of the IPC

B60Q; G02B

The following online and other databases have been used in the preparation of this search report

EPODOC, WPI

International Classification:

Subclass	Subgroup	Valid From
B60Q	0001/56	01/01/2006
G02B	0006/00	01/01/2006
G09F	0013/04	01/01/2006