

## INDICATING LIGHT

The invention refers to an indicating light for optical display.

Most prior art indicators, equipped with light-emitting diodes, suffer of inadequate light distribution and uneven lighting, thus making indicators worse than comparable lighting systems based on incandescent lamps. There are various types of light-emitting diodes resulting in highly variable lighting patterns. A light-emitting diode having a tight lighting angle will generate light, sharp spot lighting but no surface lighting. A light-emitting diode having a wide lighting angle will generate sufficient brightness, in order to meet requirements for emitting a clear signal. It is prior art to use a printed circuit board having a multitude of light-emitting diodes bonded to it, a so-called multi-LED. However, this variation is relatively expensive, and irrespective of its price, only marginally better lighting will be the result. In addition, it will generate much heat, thus limiting its use in explosive atmospheres, based on standard specifications in accordance with DIN EN 50014/18/19. In addition, it is a known fact that standard light-emitting diodes must be arranged in circles and must provide a lighting area comprising a multitude of small lenses. Alternating light and dark spots occurring in this, however, are a nuisance, in particular when symbols or letters are arranged on the lighting surface. Furthermore, this arrangement is expensive.

There is a need that exists to create an indicating light for optical display, offering a high functionality by simple means, based on a low operating temperature and bright and even lighting.

This problem may be resolved by example embodiments of the present invention.

According to a first aspect of the present invention, there is provided an indicating light for optical display, comprising a housing with electrical lead parts, a light-emitting diode arranged in a light rod

1a

which has a translucent round head the inner side of which facing the light-emitting diode has a refracting fine pearl structure.

Preferred embodiments and developments of the invention are characterised by the features of the subclaims.

For other benefits and essential details of embodiments of the invention, see the following specification and the drawing, showing as an example a preferred embodiment in a single schematic section.

The indicating light according to an embodiment of the invention comprises a housing 1, including a cover 2 and a foot section 3 that may be fastened to a sectional rail not shown here. The housing 1 comprises electrically conducting components 4 for the connection of electrical supply and terminal leads and/or connecting terminals.

In addition, the housing 1 comprises a light rod 5, made of an opaque material, predominantly designed as a circular cylindrical tube extending through the cover and projecting over it. The part of the light rod 5 within the housing 1 comprises a rectangular tubular section 6 anchored in the housing 1, the rectangular dimension of which is somewhat larger than the remaining part of the light rod 5. At the beginning of the tubular section 6, a shoulder 7 is formed because of the larger rectangular dimension. In this area, the light rod 5 has been surrounded by a moulding resin 8, extending into the shoulder 7. The moulding resin 8 has been cast to comply with standard requirements of explosion protection in accordance with DIN EN 50014/18/19.

The end section of the tubular end section 6 located away from the light rod 5, has been designed as a round head 9, thus closing the tubular light rod 5. The light rod 5 is a solid piece of material, with the wall thickness both at the round head 9 and the tubular end section 6 and between these end sections being essentially identical. For use in explosive areas, the light rod 5 may be conveniently designed as a pressure-resistant capsule in compliance with the requirements of the explosion protection standard DIN EN 50014/18/19.

A circuit board 10 may be arranged within the light rod 5, preferably held between web-shaped holding ribs 11. A light-emitting diode may be arranged on the circuit board 10 just below the round head 9 and

aligned towards the latter. In addition, the circuit board 10 may be provided with electronic components 13 supporting the function of the light-emitting diode 12.

In order to obtain even and bright lighting, at least the inner side 14 of the round head 9, facing the light-emitting diode 12, may be of a fine pearl-shaped structure, preferably designed to allow a multitude of globular and/or pearl-shaped elevations, alternating with a multitude of small troughs being directly located next to each other, thus not making the inner side 14 smooth but finely roughened. A finely roughened inner side structure like this may be preferably obtained by erosion, etching, grit blasting or any other appropriate design of the mould surface. This finely roughened inner side structure has the effect that any light emitted by the light-emitting diode 12 will diffract and be captured on the entire inner side 14 of the round head 9, thus making the round head as such shine as a uniform large luminous element. Moreover, it may be of benefit to colour the light rod 5 but at least the round head 9, diffusely milky or milky/coloured and fluorescent. This colouring would accentuate translucency in a manner that a certain inherent shine of the light rod 5 and/or the round head 9 would occur, thus making lighting more even and intensive.

As also shown in the drawing, the indicating light may comprise a front casing 15, covering the part of the light rod 5 projecting from the cover 2. The front casing 15 comprises an insert housing 16 surrounding the light rod 5 like a tube and a light cap 17, attached to the insert housing 16 by means of a front ring 18. A sealing ring 20 is arranged between the edge 19 of the light cap 17 and the insert housing 16. A threaded nut 22 may be rotatably arranged on the insert housing 16 for attaching the front casing 15 in a secure position, due to being firmly screwed against the inside of the mounting wall 21.

The light cap 17 is made of an opaque material and covers the round head 9, leaving a small clearance. The inside 23 of the light cap 17,

facing the round head 9, may also be of a fine pearly-shaped structure. This structure may be designed to cause a multitude of small pearl-shaped elevations and a multitude of small troughs to be alternative directly positioned next to each other, thus finely roughening the inside 23. This finely roughened inside structure may be essentially identical with the finely roughened internal structure of the round cap 9 and may be made by an identical production process. In addition, it may also be beneficial to colour the light cap 17 diffusely milky or milky/coloured and fluorescent, in order to reduce its translucency, with an inherent shine of the light cap 17 and/or more even and intensive lighting being achieved. In addition, optimally even and uniform lighting may be achieved by both the round cap 9 of the light rod 5 and the light cap 17 of the front casing 15 being coloured according to the light and colour wave lengths of the light-emitting diode 12.

**CLAIMS:**

1. An indicating light for optical display, comprising a housing with electrical lead parts, a light-emitting diode arranged in a light rod which has a translucent round head the inner side of which facing the light-emitting diode has a refracting fine pearl structure.
2. An indicating light according to the preceding Claim, characterised in that at least the round head of the light rod has a milky tinge.
3. An indicating light according to any one of the preceding Claims, characterised in that at least the round head of the light rod is of a fluorescent milky colour.
4. An indicating light according to any one of the preceding Claims, characterised in that the light rod is formed in one piece with the round head and from the same material.
5. An indicating light according to any one of the preceding Claims, characterised in that the light rod is formed as a cylindrical tube, one end of which is closed by the round head.
6. An indicating light according to any one of the preceding Claims, characterised in that the light rod is fixed in the housing by the tube end section which is away from the round head.
7. An indicating light according to any one of the preceding Claims, characterised in that part of the light rod in the housing is cast over with moulding resin according to the explosion protection requirements.

8. An indicating light according to any one of the preceding Claims, characterised in that the light rod is designed as a pressure-resistant capsule for the purpose of way of explosion protection.
9. An indicating light according to any one of the preceding Claims, characterised in that the housing is closed by a cover into which the light rod protrudes.
10. An indicating light according to any one of the preceding Claims, characterised in that a printed circuit board with the light-emitting diode and electronic components arranged on it is provided within the light rod.
11. An indicating light according to any one of the preceding Claims, characterised in that the printed circuit board is securely located in position between the holding ribs in the light rod.
12. An indicating light according to any one of the preceding Claims, characterised in that a front casing extends over the part of the light rod which protrudes past the cover of the housing.
13. An indicating light according to any one of the preceding Claims, characterised in that the front casing has a translucent light cap extending over the round head of the light rod.
14. An indicating light according to any one of the preceding Claims, characterised in that the inner side of the light cap facing the round head of the light rod has a refracting fine pearl structure.

15. An indicating light according to any one of the preceding Claims, characterised in that the fine pearl structure of the inner side of the light rod and the fine pearl structure of the inner side of the light cap are essentially identical.
16. An indicating light according to any one of the preceding Claims, characterised in that the light cap has a milky or milky/coloured fluorescent tint.
17. An indicating light according to any one of the preceding Claims, characterised in that the round head of the light rod and the light cap are tinted to suit the wavelength of the light colour of the light-emitting diode.
18. An indicating light according to any one of the preceding Claims, characterised in that the light cap is held by a front ring which can be attached at an insert housing.
19. An indicating light according to any one of the preceding Claims, characterised in that the front casing is attachable to the mounting wall which is arranged between the front ring and a threaded nut located at the insert housing.