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(54) **LED spotlight**

(57) A spotlight (1), which comprises a support piece (5) and a plurality of LEDs (51) mounted on said support piece (5), a ring (2) and a cup-shaped member (6,7) configured so as to contain the support piece (5), is described. The ring (2) comprises eyelets (23) which are designed to allow the entry of cooling air (8) and the out-flow of heated air (9). The ring (2) is also provided with openings (25) and the cup-shaped member (6,7) with empty spaces (67) for introducing cooling air (8) onto a surface of the support piece (5) and the cup-shaped member (6,7) is provided with windows (65) for expelling heated air (9).

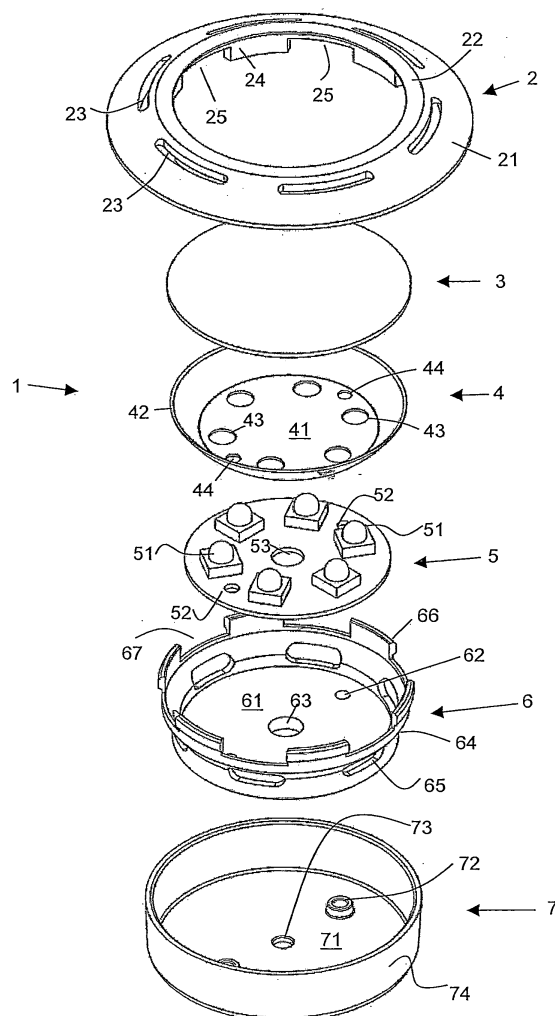


Fig. 1

Description

[0001] The present invention relates to an LED spotlight, in particular suitable for use as a fitted spotlight.

[0002] LEDs are light-emitting components which are particularly attractive from a technical point of view. In fact, they have small dimensions, consume a very small amount of power and have an extremely long working life. However, all LED manufacturers point out that the advantageous features in terms of consumption and working life depend greatly on the operating temperature. Moreover, one disadvantage of LEDs is that they produce light which is extremely concentrated.

[0003] This drawback has discouraged lamp manufacturers from using LEDs to produce fitted spotlights or the like.

[0004] However, different types of fitted LED spotlights are known in the art. For example a spotlight comprising three LEDs with three respective lenses for magnifying the light produced by the LEDs is known. Despite the fact that the light beam is significantly amplified owing to the lenses, the overall light beam is nevertheless concentrated and unsuitable for illuminating relatively large surfaces.

[0005] The object of the present invention is to provide an LED spotlight which is particularly suitable for use as a fitted spotlight, with an optimum lighting performance and working life.

[0006] According to the invention a spotlight, which comprises a support piece and a plurality of LEDs mounted on said support piece, a ring and a cup-shaped member configured so as to contain the support piece, is provided. The ring comprises eyelets which are designed to allow the entry of cooling air and the outflow of heated air. The ring is also provided with openings and the cup-shaped member with empty spaces for introducing cooling air onto a surface of the support piece, and the cup-shaped member is provided with windows for expelling heated air.

[0007] Conveniently, the cup-shaped member comprises a spotlight body and a cover made of insulating material.

[0008] Preferably, the body and the ring can be joined together so as to retain between them at the least the support piece. In a preferred embodiment, the body and the ring can be joined together by means of a thread.

[0009] Preferably, the spotlight also comprises a reflective dish and a diffuser screen.

[0010] The support piece may consist of Thermal Clad®.

[0011] In the preferred embodiment, the LEDs are six in number, the support piece is in the form of a circular disk and the LEDs are arranged equally spaced circumferentially on the support piece.

[0012] The present invention will become entirely clear from the detailed description which follows, to be read with reference to the accompanying figures in which:

- Figure 1 is an exploded view of the spotlight according to an embodiment of the invention;
- Figures 2a and 2b are, respectively, a bottom view and a top view of the assembled spotlight according to an embodiment of the invention;
- Figure 3 is a side view of the assembled spotlight according to an embodiment of the invention;
- Figure 4 is a first cross-sectional view of the assembled spotlight according to an embodiment of the invention;
- Figure 5 is a second cross-sectional view of the assembled spotlight according to an embodiment of the invention;
- Figure 6 is a side view of the spotlight body according to an embodiment of the invention;
- Figure 7 is a cross-sectional view of the spotlight body according to an embodiment of the invention;
- Figure 8 is a top view of the spotlight body according to an embodiment of the invention; and
- Figure 9 is a cross-sectional view the same as that in Figure 4, but showing, by means of arrows, the incoming air flow (right-hand side) and outgoing air flow (left-hand side).

[0013] The spotlight 1 according to an embodiment of the invention comprises a ring 2, an optical dish 4, a printed circuit 5, a spotlight body 6 and an insulating cover 7. Preferably, the spotlight 1 also comprises a filter or screen 3 between the ring 2 and the optical dish 4.

[0014] The printed circuit 5 is preferably in the form of a disk. The LEDs 51 are soldered (or fixed in another manner) onto the printed circuit 5, being preferably equally spaced circumferentially. In the preferred embodiment shown in the drawings six LEDs 51 are mounted, but it is obvious that a greater or smaller number of LEDs may be mounted.

[0015] In a very advantageous embodiment the printed circuit consists of Thermal Clad®.

[0016] In the embodiment shown, the printed circuit 5 has a central hole 53 and two holes 52 in diametrically opposite positions. The holes 52 are used for joining and holding together the printed circuit 5, the body 6 and the insulating cover 7. Advantageously, pull rivets or the like (not shown) may be used. The central hole 53 instead allows the insertion of power supply wires (not shown) which are connected to suitable soldering pads.

[0017] The optical dish 4 has a bottom 41 substantially corresponding to the printed circuit 5 and a frustoconical side wall 42. The bottom 41 is provided with holes 43 which in number (and size/position) correspond to the number (and size/position) of the LEDs 51. There are also preferably two holes 44 corresponding to the holes 52 on the printed circuit. In a preferred embodiment, the optical dish is made of aluminium.

[0018] The filter 3 is in the form of a disk made of material such as optical methacrylate luminaire suitable for diffusing the light produced by the LEDs 51 and reflected by the dish 4. The filter 3 ensures optimum uniformity of

light and moreover filters out the laser emissions produced by the LEDs in keeping with the values stipulated by safety regulations for lighting products (1 M).

[0019] The ring 2 comprises a rim 21 which is preferably circular and preferably has a frustoconical surface, as shown more clearly in Figure 2. Centrally, the ring has a flat annular surface 22 (Figures 1 and 2). Eyelets 23 are formed in the rim 21. Preferably, the eyelets 23 are curved, arranged along a circumference and correspond in number to the number of LEDs 51. In the embodiment shown in the various Figures, there are six eyelets 23. Underneath the annular surface 22 there is a circular neck 24. Openings 25 are formed in the neck 24. Preferably the openings are equal in number to the number of LEDs 51 and are not positioned opposite the eyelets 23. The neck 24 is thus formed by teeth 24 configured as to mate by means of screwing with corresponding teeth 66 (which will be described below) formed on the body 6 of the spotlight 1.

[0020] The body 6 of the spotlight is substantially cup-shaped with a closed bottom 61, which is circular in the preferred embodiment, and a continuous wall 64. The bottom, preferably, is provided with a central hole 63 corresponding to the hole 53 in the printed circuit 5 and two diametrically opposite holes 62 corresponding to the holes 52. Windows 65 are formed in the side wall 64, close to the bottom 61. In one embodiment the windows 65 are oval. Preferably, the windows 65 are identical and equally spaced circumferentially. Conveniently, the windows 65 are equal in number to the number of LEDs 51.

[0021] Incisions are formed in the portion of the side wall 64 furthest from the bottom. Basically, teeth 66 which alternate with empty spaces 67 are formed. Preferably, the number of teeth 66 is equal to the number of windows 65. Preferably, the empty spaces 67 are arranged opposite the windows 65.

[0022] Conveniently, the outer surface of the teeth 66 is provided with a thread 67 (Figure 7) able to mate with a corresponding thread formed on the inner surface of the teeth 24. Mating between the two threads is clearly illustrated in Figure 4.

[0023] Preferably, the spotlight body 6 is made of aluminium or aluminium alloy for heat dispersion and reduced weight reasons.

[0024] Preferably, the side wall 64 is flared from the bottom towards the teeth, as shown in Figures 4, 5, 6 and 7. This has the advantage of increasing the space between it and the insulating cover 7 which will be described immediately hereinbelow. Figure 8 shows a top plan view of the spotlight body 6.

[0025] The insulating cover 7 also has a substantially cup-shaped form with a substantially closed bottom 71 and continuous side wall 74. Preferably, the bottom 71 is substantially flat. Conveniently, it has a circular form. In the embodiment shown in the various figures, a central hole 73 and two holes 72 corresponding, respectively, to the holes 53, 52 in the printed circuit 5 are provided. Conveniently, as shown in Figure 1 and in Figure 4, at least

the holes 72 have an inner shoulder 72. In this way, when the spotlight is mounted, the bottom 61 of the spotlight body 6 is spaced from the bottom 71 of the insulating cover 7.

[0026] Assembly of the spotlight 1 is performed by inserting inside the body 6, in succession, the printed circuit 5, the dish 4 and the filter 3. The ring 2 and the body 6 are joined together by means of screwing so as to retain between them the circuit 5, the dish 4 and the filter 3. Finally, the assembly thus obtained is inserted inside the insulating cover 7. Figure 3 shows a side view of the assembled spotlight. Figures 4 and 5 show cross-sectional views of the assembled spotlight.

[0027] The spotlight according to the present invention may be mounted so as to project the light upwards or downwards. It has compact dimensions and, conveniently, may be seated inside a suitable recess 10 (Figure 9) formed in a panel, for example a piece of furniture. A particular preferred application is, in a kitchen, as a fitting underneath a wall unit for illumination of a work surface. In a very advantageous embodiment, the spotlight is able to be inserted inside a recess which is only about 15-20 mm deep.

[0028] According to the present invention, the power consumption of the spotlight is very low and the working life very high owing to an air flow which keeps the LEDs always below a critical temperature.

[0029] The cross-section in Figure 9 shows in schematic form, by means of arrows, the cooling air flow 8 (right-hand side) and heated air flow 9 which leaves the spotlight (left-hand side).

[0030] The fresh air 8 at room temperature enters through the eyelets 23 of the ring 2, passes through the openings 25 in the ring and the corresponding empty spaces 67 in the spotlight body 6. Passing between the wall of the body 6 and the wall of the dish 4, the air 8 manages to cool the LEDs 51 and the entire printed circuit 5. A cooling air flow 8 infiltrates between the outer wall of the spotlight body and the insulating cover. This allows improved cooling of the base of the spotlight body.

[0031] The air 9 which, after being heated, leaves the spotlight, passes through the windows 65, the gap between the body 6 and the cover 7 and the eyelets 23. A part of the air 9 comes from the gap between the bottom 71 of the cover 7 and the bottom 61 of the body 6 and joins to the main flow.

Claims

1. Spotlight (1) comprising a support piece (5) and a plurality of LEDs (51) mounted on said support piece (5), a ring (2) and a cup-shaped member (6, 7) configured so as to contain the support piece (5), **characterized in that** said ring (2) comprises eyelets (23) which are designed to allow the entry of cooling air (8) and the outflow of heated air (9) and **in that** the ring (2) is also provided with openings (25) and the

cup-shaped member (6) with empty spaces (67) for introducing cooling air (8) onto a surface of the support piece (5) and the cup-shaped member (6) is provided with windows (65) for expelling heated air (9).

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2. Spotlight (1) according to Claim 1, **characterized in that** said cup-shaped member (6, 7) comprises a spotlight body (6) and a cover (7) made of insulating material.

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3. Spotlight according to Claim 2, **characterized in that** said body (6) and said ring (2) can be joined together so as retain between them at the least the support piece (5).

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4. Spotlight according to Claim 3, **characterized in that** said body (6) and said ring (6) can be joined together by means of a thread.

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5. Spotlight according to any one of the preceding claims, **characterized in that** it also comprises a reflective dish (4) and a screen (3).

6. Spotlight according to any one of the preceding claims, **characterized in that** said support piece (5) consists of Thermal Clad®.

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7. Spotlight (1) according to any one of the preceding claims, **characterized in that** the LEDs (51) are six in number, the support piece (5) is in the form of a circular disk and said LEDs (51) are arranged equally spaced circumferentially on the support piece (5).

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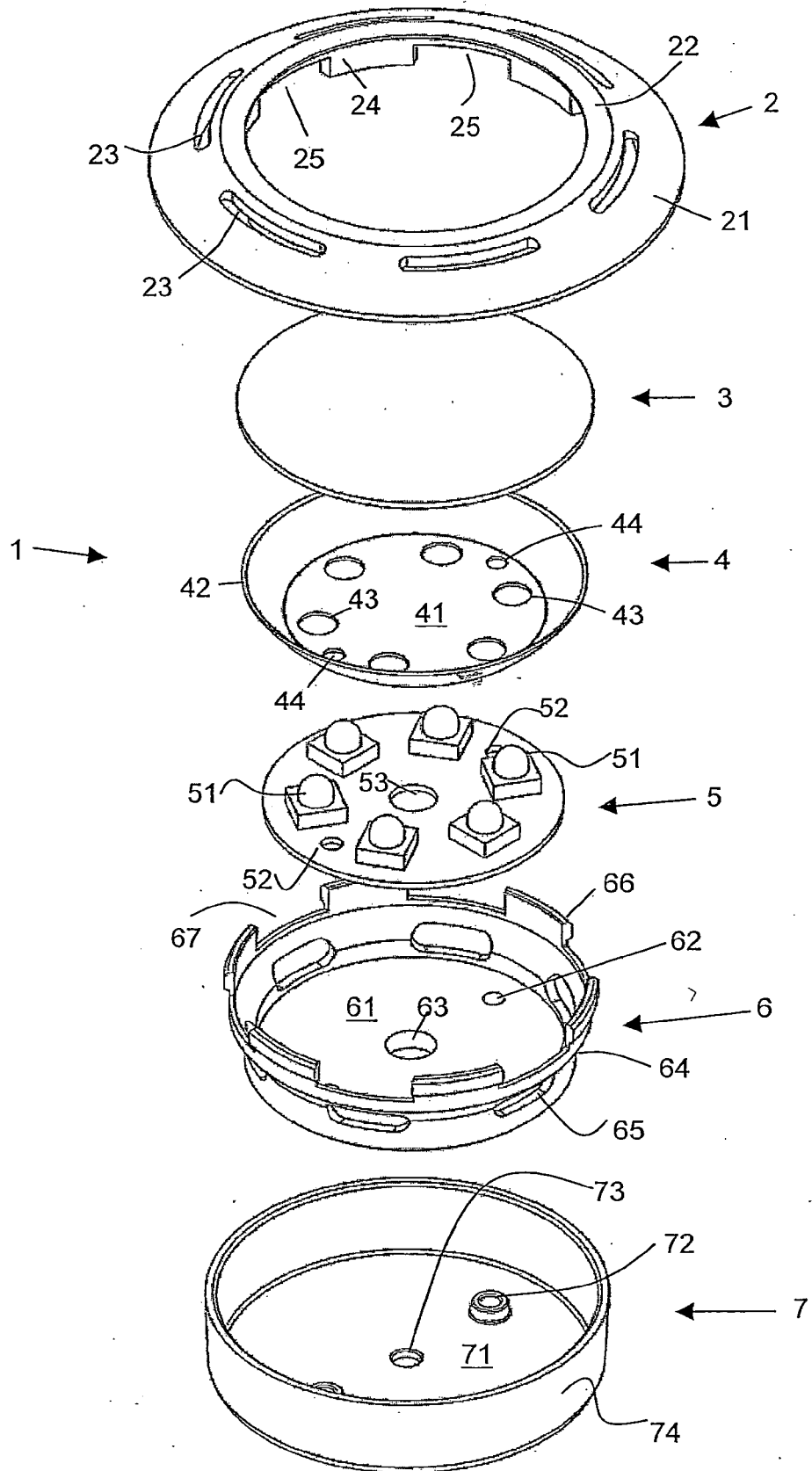


Fig. 1

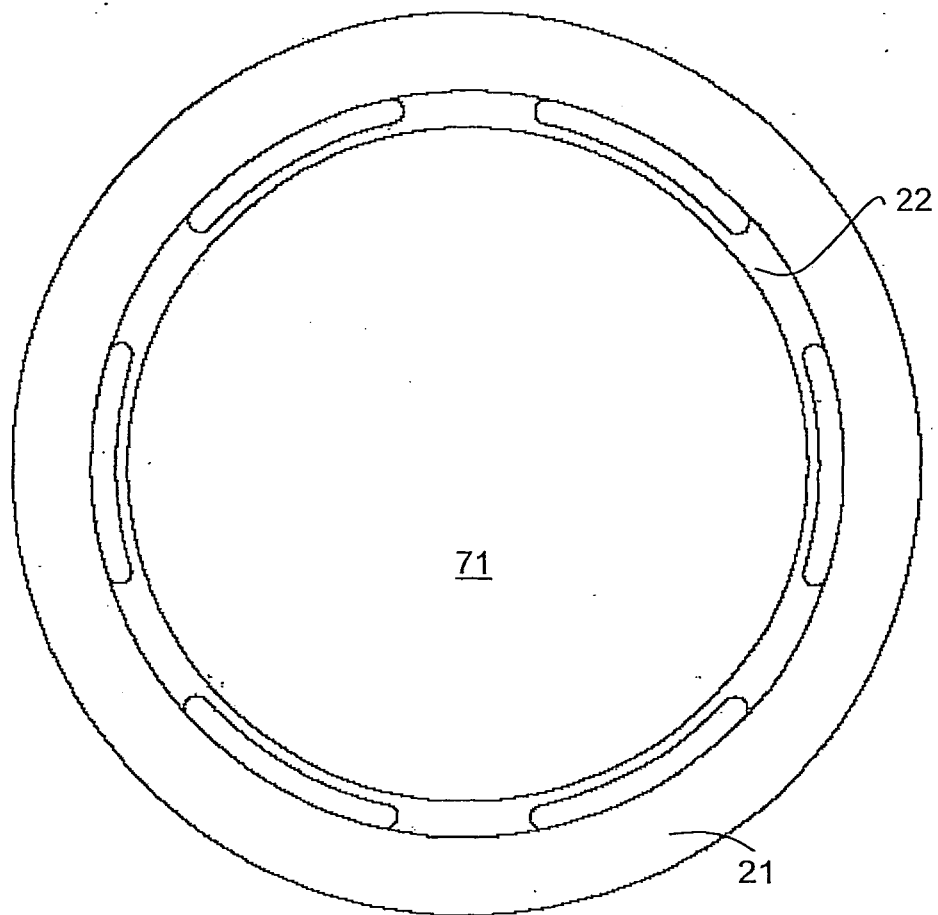


Fig. 2a

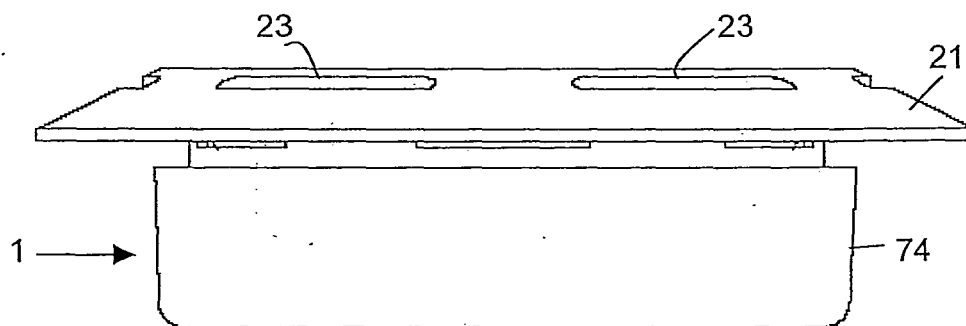


Fig. 3

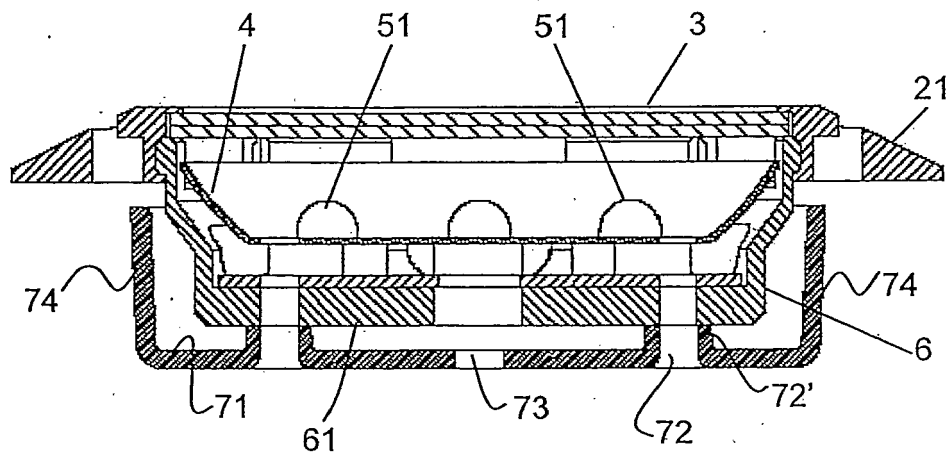


Fig. 4

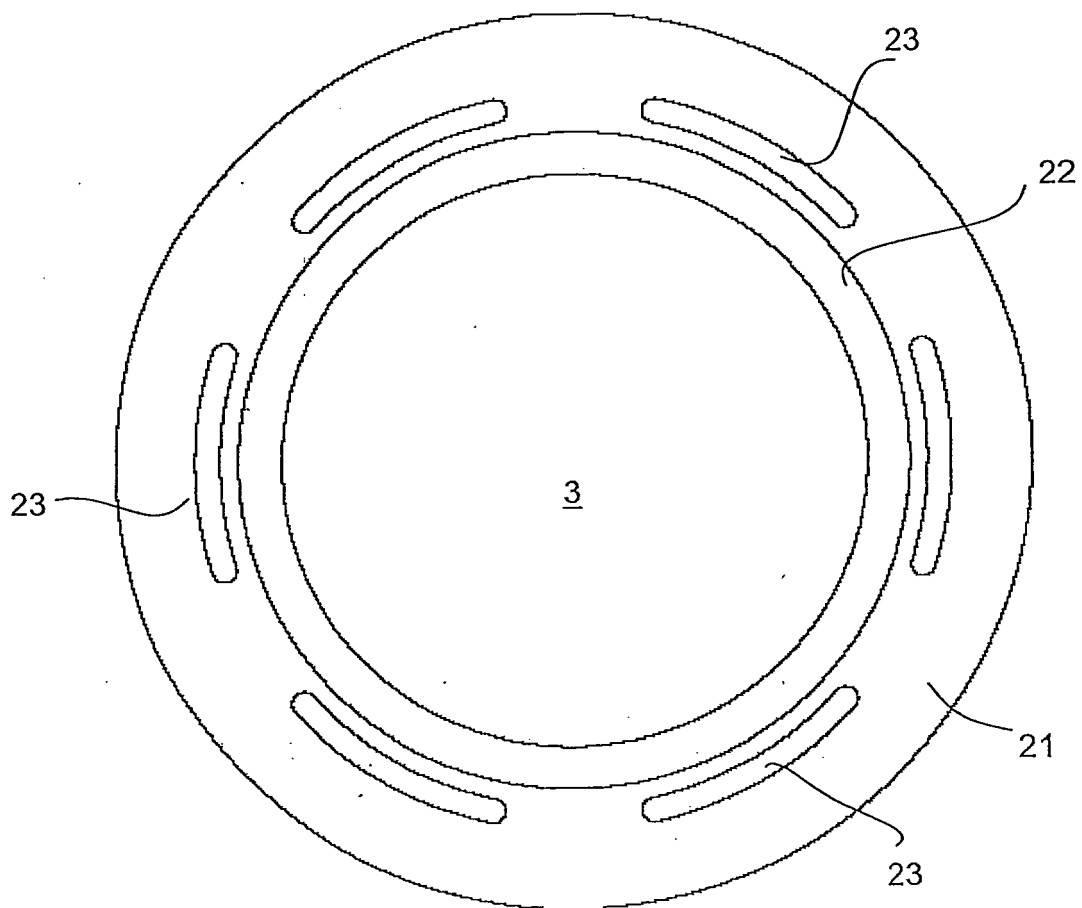


Fig. 2b

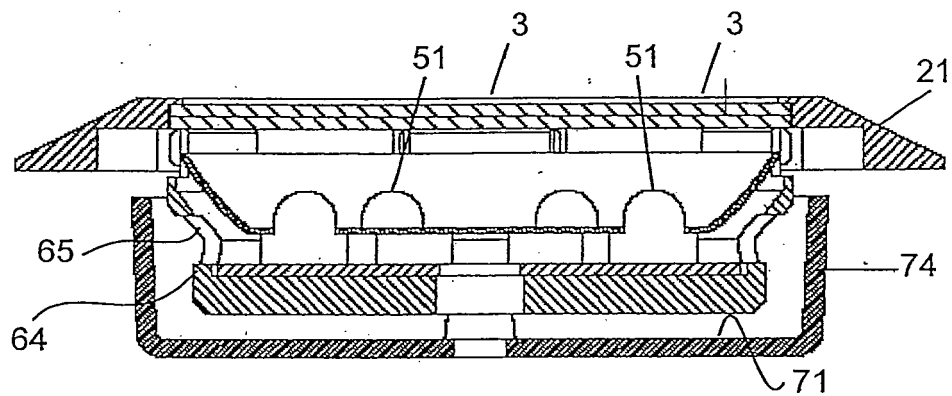


Fig. 5

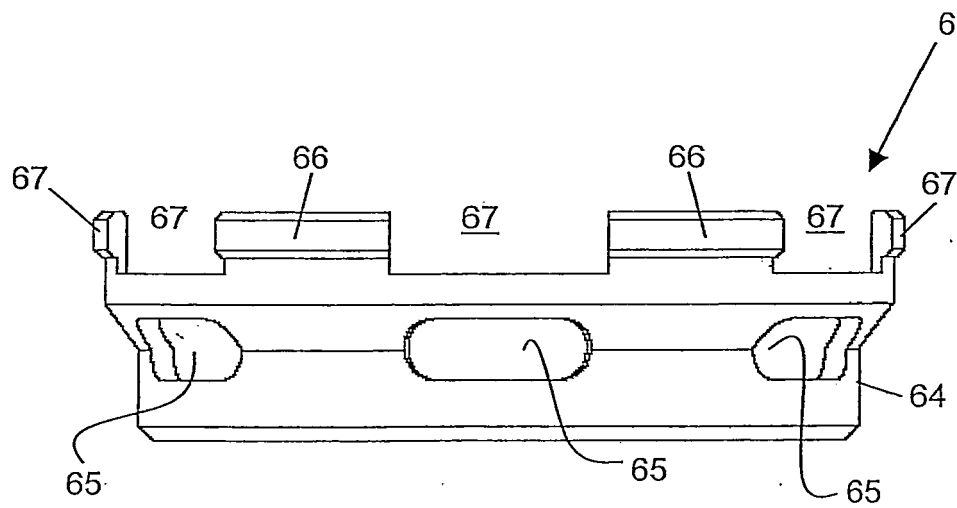


Fig. 6

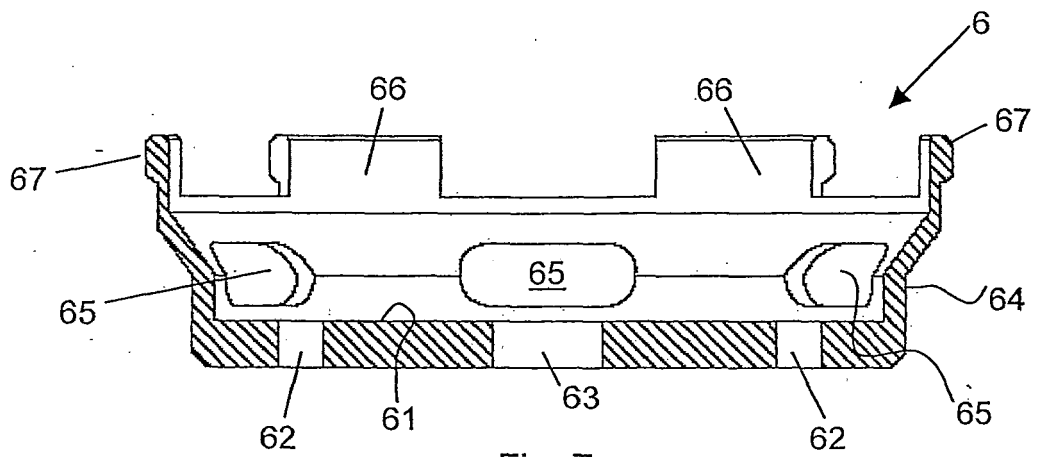


Fig. 7

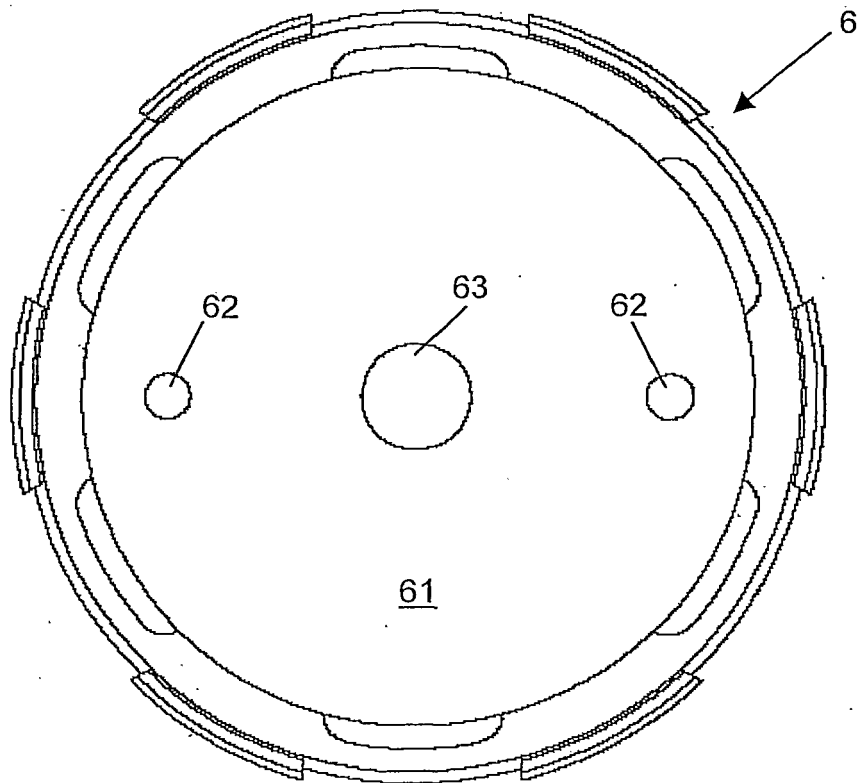


Fig. 8

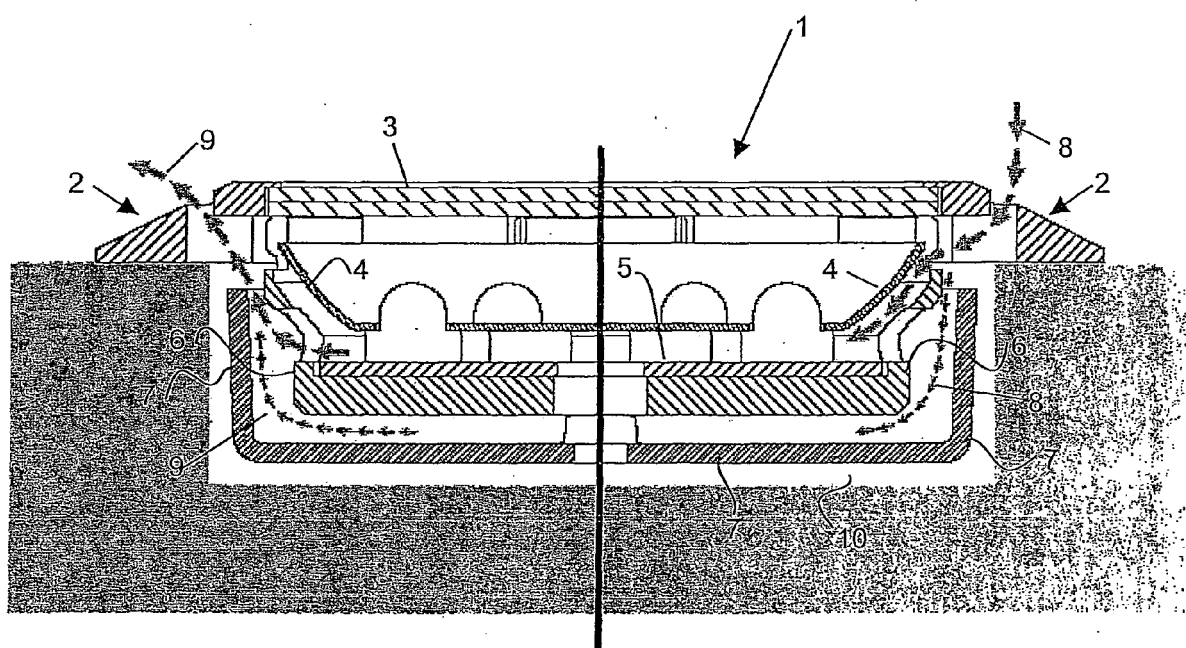


Fig. 9



European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 08 07 5038

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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			TECHNICAL FIELDS SEARCHED (IPC)
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 26 March 2008	Examiner Chao, Oscar
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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 08 07 5038

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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