(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 306 142 A2**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **88306857.9**

(51) Int. Cl.4: **F21V 7/09**

(22) Date of filing: **26.07.88**

(30) Priority: **29.08.87 GB 8720471**

(43) Date of publication of application:
08.03.89 Bulletin 89/10

(84) Designated Contracting States:
DE GB NL

(71) Applicant: **THORN EMI plc**
4 Tenterden Street
London W1A 2AY(GB)

(72) Inventor: **Gould, Allan Victor Stewart**
52 Farmway
Leicester, LE3 2XA(GB)

(74) Representative: **Fleming, Ian Alexander et al**
THORN EMI Patents Limited The Quadrangle
Westmount Centre Uxbridge Road
Hayes Middlesex, UB4 0HB(GB)

(54) Lamp reflector and a lamp arrangement including the lamp reflector.

(57) A lamp reflector (Figures 4) has a reflective surface 14 which is part ellipsoidal (region 15) and part spherical (regions 16, 16'). The part spherical regions distribute light from a transversely mounted arc lamp into zones which would otherwise be masked by the end portions of, and or end mountings for, the transversely mounted lamp. In the case of a reflector for use in conjunction with a double-ended discharge lamp there are two spherical regions arranged to either side of a plane through the longitudinal axis X of the reflector.

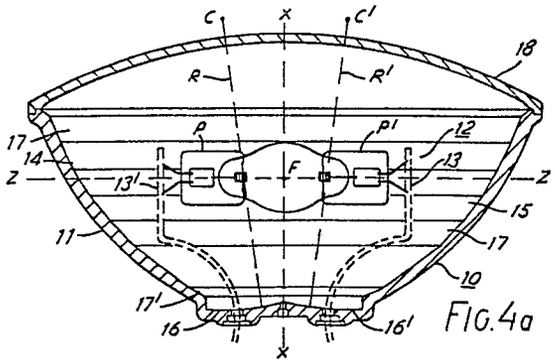

FIG.4a

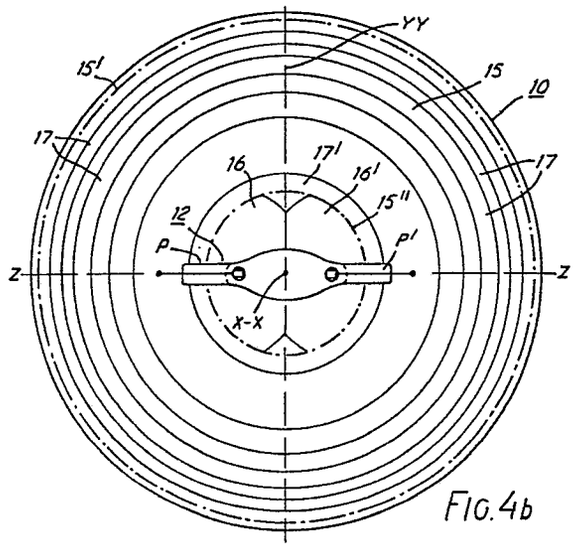

FIG.4b

EP 0 306 142 A2

LAMP REFLECTOR AND A LAMP ARRANGEMENT INCLUDING THE LAMP REFLECTOR

This invention relates to a lamp reflector suitable for use in association with a transversely mounted, discharge arc lamp. The invention also relates to a lamp arrangement including said lamp reflector in combination with a transversely mounted discharge arc lamp and it relates particularly, though not exclusively, to a sealed beam lamp arrangement including a transversely mounted, pinch-sealed discharge arc lamp.

Figure 1 of the accompanying drawings shows a transverse, cross-sectional view through a known sealed beam lamp arrangement which comprises a reflector envelope 1 having a parabolic reflective surface 2, a double-ended pinch sealed discharge arc lamp 3 mounted transversely in the reflector envelope on a pair of electrical lead-in members 4, 4′ and a cover 5, which normally incorporates a prismatic spreader lens, sealed to the reflector envelope. One such sealed beam lamp arrangement having application in photoprinting and allied fields, includes a high pressure metal halide discharge arc lamp emissive of radiation in the wavelength range from 315nm to 450nm.

Figure 2 of the drawings shows a distribution of light intensity 'I', over a substantially square field, derived from a sealed beam lamp arrangement of the kind illustrated in Figure 1. This distribution has a pronounced central peak and, for many applications, a more uniform distribution of light intensity would be desirable.

It is therefore an object of the present invention to provide a lamp reflector, suitable for use in associated with a transversely mounted discharge lamp which at least alleviates the afore-mentioned problem.

According to a first aspect of the present invention there is provided a lamp reflector suitable for use in association with a transversely mounted discharge arc lamp, the reflector being dish-shaped and comprising a reflective surface of which a part conforms substantially to an ellipsoid and of which a further part does not so conform, said further part being so shaped and positioned as to distribute light to a region in the field of illumination which, if said reflective surface conformed fully to said ellipsoid, would be masked by an end portion of, and or an end-mounting for, a said discharge arc lamp mounted transversely with respect to a major axis of the ellipsoid.

It will be understood that said part which conforms substantially to an ellipsoid encompasses an ellipsoidal surface which is facetted.

The lamp reflector is particularly suitable for use in association with a transversely mounted pinch sealed discharge arc lamp.

The inventor has found that a lamp reflector of the kind defined gives rise to a distribution of light intensity which, as compared with hitherto known configurations, is remarkably uniform.

The lamp reflector may be used in association with either a single or a double ended, pinch sealed discharge arc lamp and, in the latter case, said reflective surface may comprise two said further parts arranged symmetrically on either side of a plane containing said major axis of the ellipsoid. Said further part or parts may conform substantially to a sphere, the centre of curvature of the sphere being offset from said major axis of the ellipsoid. Alternatively, said further part or parts may conform substantially to a parabaloid with the focus of the parabaloid being offset from said major axis.

Facets may be provided on the ellipsoidal part of said reflective surface in order to further improve the uniformity of the distribution of light intensity and said facets may comprise contiguous, annular bands encircling said major axis of the ellipsoid. Each said facet may be flat in the transverse direction thereof.

In a preferred arrangement the facets are configured so as to achieve greater spreading of light closer to the centre of the reflector and, to this end, the widths of successive ones of at least some of said contiguous annular bands increase progressively in a direction approaching the centre of the reflector.

In addition the reflective surface may be stippled.

In accordance with another aspect of the present invention there is provided a lamp arrangement including a lamp reflector in accordance with said first aspect of the invention in combination with a transverely mounted discharge arc lamp.

The lamp arrangement may be a sealed beam lamp unit wherein said reflector comprises a glass envelope formed with said reflective surface and including a cover sealed to said glass envelope. The cover and or the reflective surface may be stippled and the cover may incorporate a spreader lens.

In order that the invention may be carried readily into effect an embodiment thereof is now described, by way of example only, by reference to the accompanying drawings of which,

Figure 1 shows a cross-section view through a known sealed beam lamp arrangement,

Figure 2 shows a distribution of light intensity derived using a lamp arrangement of the kind shown in Figure 1,

Figure 3 shows a distribution of light intensity derived using an entirely ellipsoidal lamp reflector,

Figures 4a and 4b show, respectively a cross-sectional view through, and a plan view of, a lamp arrangement in accordance with the present invention and Figure 5 shows a distribution of light intensity derived using the lamp arrangement of Figures 4.

Figure 3 of the drawings shows a distribution of light intensity 'I' derived using a reflector which is similar to that shown in Figure 1 but uses an ellipsoidal reflective surface to distribute the light. As before, the distribution of light intensity 'I' has a central peak but, in addition, exhibits two troughs, one on either side of the peak, attributable to "shadows" cast by the pinches of, and or end-mountings for, a transversely mounted discharge arc lamp.

The inventor has discovered that the shape of the ellipsoidal reflective surface can be modified in such a way as to distribute light to a region which would otherwise be masked by a pinch of the discharge arc lamp, and or its support, and this has the effect of reducing the prominence of the central peak while reinforcing the intensity in the troughs. The inventor finds that the resulting distribution of light intensity has a markedly improved uniformity as compared with that derived using an entirely ellipsoidal reflector or using a paraboloidal reflective surface in combination with a prismatic spreader lens.

Referring now to Figures 4a and 4b of the drawings a lamp arrangement 10 comprises a dish-shaped reflector envelope 11, in the form of a glass pressing, in combination with a double-ended pinch-sealed discharge arc lamp 12 mounted transversely within the reflector envelope. For clarity of illustration electrical lead-in members 13, 13′ used to support the lamp are represented in broken outline only.

Envelope 11 has a reflective inner surface 14 which, in this embodiment, is formed by a thin layer of aluminium though, alternatively a dichroic layer, for example, could be used.

One specific region of the reflective surface, identified at 15 in Figures 4a and 4b and being enclosed by chain-dotted boundary lines 15′, 15″ in Figure 4b, conforms substantially to an ellipsoid having a major axis XX, whereas two other surface regions 16, 16′ close to the centre of the reflector envelope, and arranged symmetrically on either side of a plane YY containing axis XX, are substantially spherical. Each spherical surface region 16, 16′ has a radius of curvature R, R′ centred at a point C, C′ which is offset from axis XX on a respective side of plane YY.

The discharge arc lamp 12 is mounted symmetrically with respect to plane YY, at or near the focus F of the ellipsoidal surface 15, with the longitudinal axis ZZ of the lamp intersecting axis XX orthogonally.

The inventor has found that the spherical regions 16, 16′ are effective to distribute light to regions which, if the reflective surface had been entirely ellipsoidal, would be masked by the lamp pinches P, P′ and or the lamp end-mountings, thereby providing a more uniform distribution of light intensity. For optinium effect it is preferable to mount the discharge lamp roughly halfway along the radii of curvative R, R′ of the spherical regions 16, 16′.

Uniformity may be further improved by providing facets on the ellipsoidal surface 15 and, in this embodiment, the facets comprise a plurality of contiguous, annular bands 17 enclosing the major axis XX. Each facet, which is flat in the transverse direction thereof, has the shape of a truncated cone.

The facets are configured to produce a greater spreading of light closer to the centre of the reflector and, to this end, the width of successive bands increases progressively in a direction approaching the centre of the reflector envelope, except for the innermost band 17′ which is made relatively narrow for ease of manufacture.

Figure 5 illustrates the distribution of light intensity 'I' attainable using a reflector of the kind illustrated in Figures 4. This distribution shows a remarkable degree of uniformity and exhibits no substantial fall off of the kind shown in the distributions of Figures 2 and 3.

The embodiment of Figures 4 relates to a sealed beam lamp arrangement, there being a glass cover 18 sealed to the envelope 11. The front face of cover 18 and or the reflective surface 14 may have a stippled pattern effective to further improve the uniformity of the distribution and, if desired, the cover may also incorporate a spreader lens.

Clearly, in other applications of the invention, the cover may be omitted, and the reflector envelope could be formed from pressed sheet metal eg aluminium. While the embodiment shown in Figures 4 has spherically shaped surface regions 16, 16′, the inventor envisages that alternatively shaped surface could be used to achieve the desired effect and, in particular, paraboloidal surfaces are envisaged.

A reflector in accordance with this invention could also be used in association with a single-ended, pinch sealed discharge arc lamp and, in that circumstance, only one said region 16 would be needed.

The invention is also applicable to transversely mounted discharge arc lamps, other than pinch

sealed lamps, wherein an end portion or portions and or a lamp end-mounting obscure light reflected at the reflector.

A lamp arrangement including a reflector in accordance with this invention finds particular application in photoprinting and allied fields but could be used in other applications requiring a uniform distribution of light intensity, for example in connection with plant cultivation and interior lighting (e.g. wall flooding and uplighting).

Claims

1. A lamp reflector suitable for use in association with a transversely mounted discharge arc lamp, the reflector being dish-shaped and comprising a reflective surface of which a part conforms substantially to an ellipsoid and of which a further part does not so conform, said further part being so shaped and positioned as to distribute light to a region in the field of illumination which, if said reflective surface conformed fully to said ellipsoid, would be masked by an end portion of, and or an end-mounting for, a said discharge arc lamp mounted transversely with respect to a major axis of the ellipsoid.

2. A lamp reflector according to Claim 1 for use in association with a double-ended discharge lamp mounted transversely with respect to said major axis, wherein said reflective surface comprises two said further parts which are arranged symmetrically on either side of a plane containing said major axis.

3. A reflector according to Claim 1 or Claim 2 wherein said further part or parts conform substantially to a sphere or a parabaloid.

4. A reflector according to any one of Claims 1 to 3 wherein either part is facetted.

5. A reflector according to Claim 4 wherein said one part has a plurality of facets comprising contiguous, elongate bands encircling said major axis.

6. A reflector according to Claim 5 wherein said facet is flat in the transverse direction thereof.

7. A reflector according to Claim 6 wherein the width of successive ones, of at least some of the facets, increases progressively in a direction approaching the centre of the reflector.

8. A reflector according to any one of claims 1 to 7 wherein said reflective surface is stippled.

9. A lamp arrangement including a dish-shaped reflector comprising a reflective surface of which one part conforms substantially to an ellipsoid in combination with discharge lamp mounted transversely with respect to the major axis of the ellipsoid, wherein said reflective surface has a further part which does not conform to said ellipsoid and which is so shaped and positioned as to distribute light to a region in the field of illumination which, if said reflective surface conformed fully to said ellipsoid, would be masked by an end portion of and or an end mounting for said transversely mounted discharge arc lamp.

10. A lamp arrangement according to Claim 9 wherein said lamp is a pinch sealed discharge arc lamp.

11. A lamp arrangement according to Claim 9 or Claim 10 wherein said discharge arc lamp is double-ended and said reflective surface comprises two said further parts arranged symmetrically on either side of a plane containing said major axis.

12. A lamp arrangement according to Claim 9 or Claim 10 wherein said further part or parts conform substantially to a sphere or a parabaloid.

13. A lamp arrangement according to any one of claims 9 to 11 wherein said one part of the reflective surface is facetted.

14. A lamp arrangement according to Claim 12 wherein said one part of the reflective surface has a plurality of facets comprising contiguous, elongate bands encircling said major axis.

15. A lamp arrangement according to Claim 13 wherein each said facet is flat in the transverse direction thereof.

16. A lamp arrangement according to Claim 14 wherein the width of successive ones of at least some of the facets increases progressively towards the centre of the reflector.

17. A sealed beam lamp unit comprising a lamp arrangement according to any one of Claims 9 to 15 wherein said reflector comprises a glass envelope provided with a coating of a reflective material, and a cover sealed to said glass envelope.

18. A sealed beam lamp unit according to Claim 16 wherein the cover and or the reflective surface is stippled.

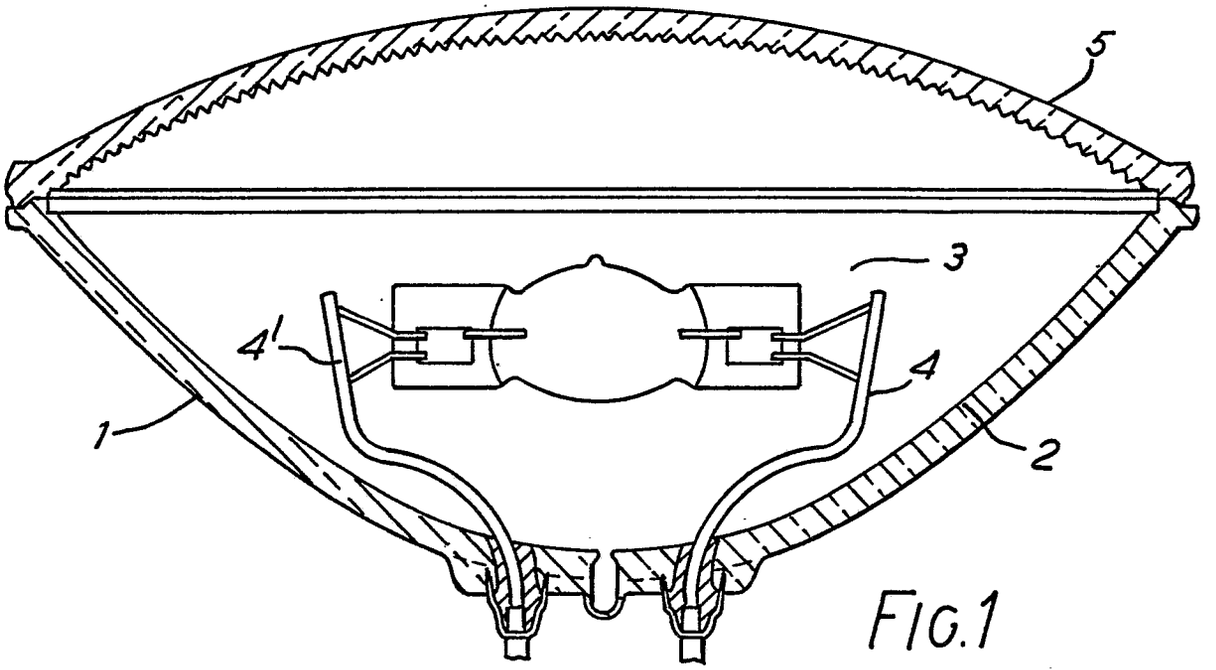

FIG.1

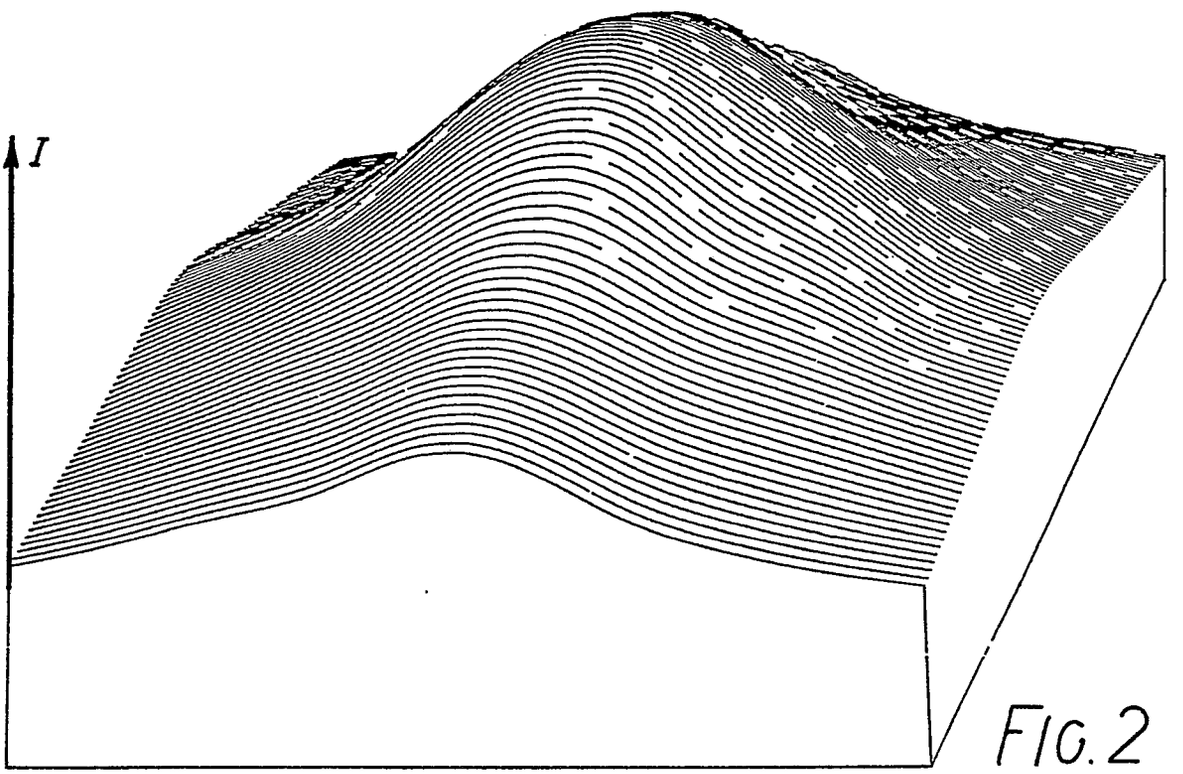

FIG.2

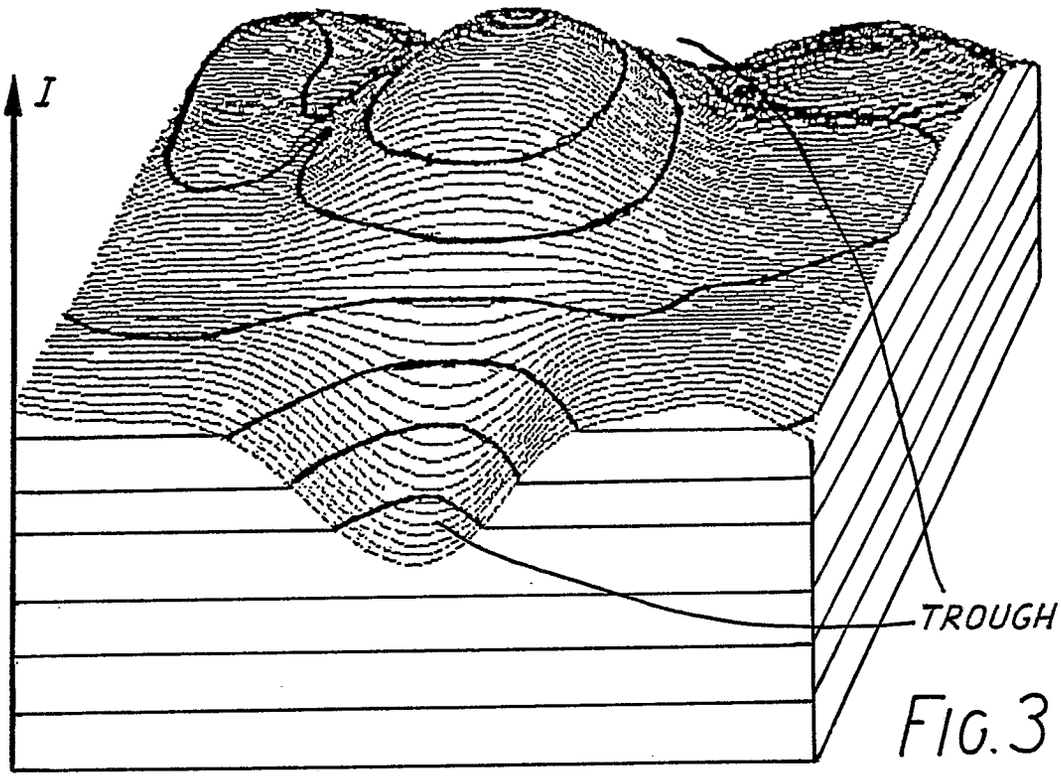

FIG.3

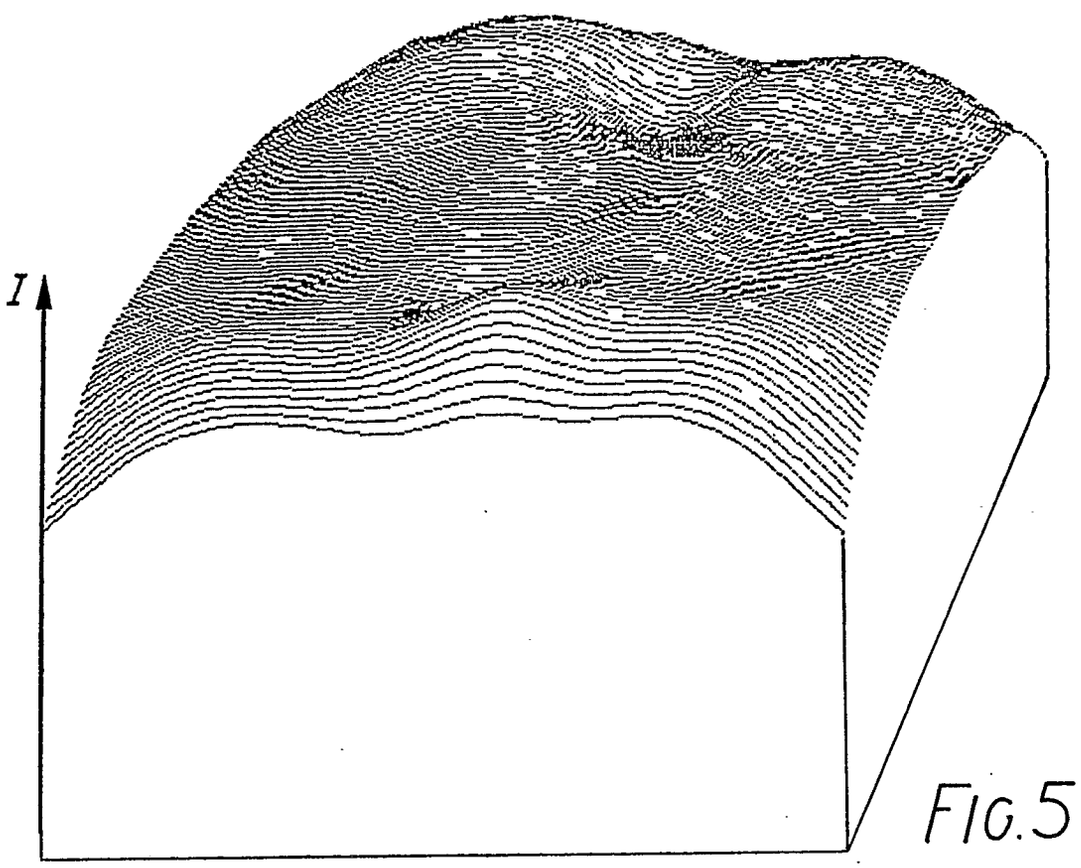

FIG.5

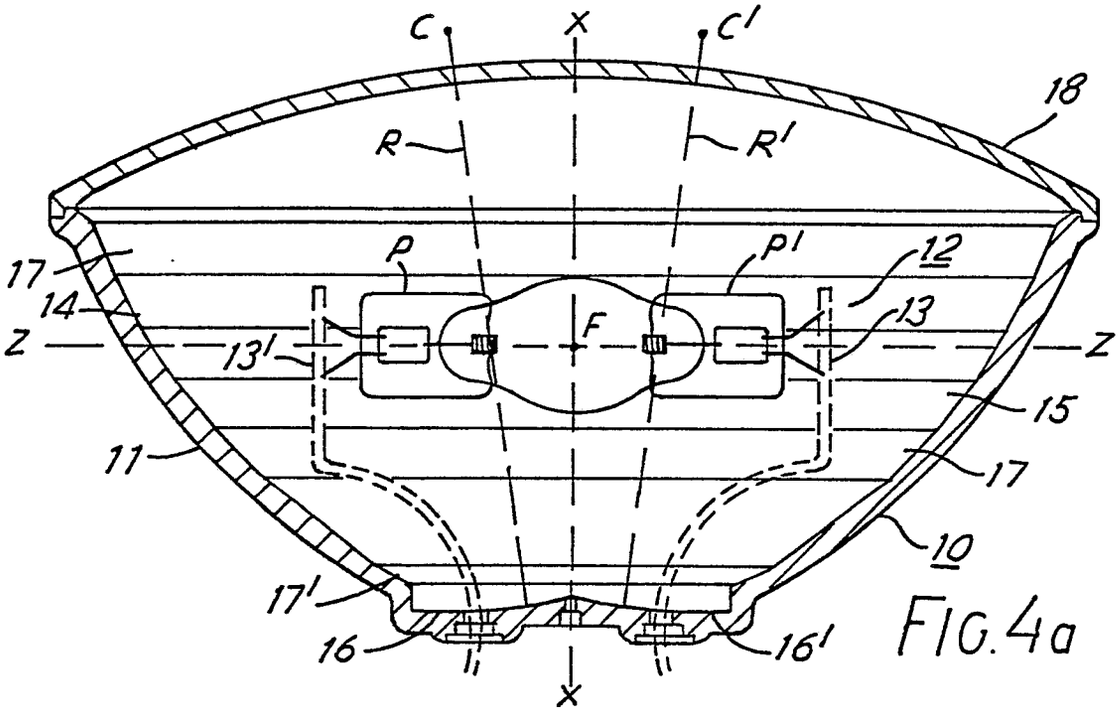
C
X
C'
18
R
R'
17
P
P'
12
14
Z
13'
F
13
Z
15
11
17
10
17'
16
16'
X

FIG.4a

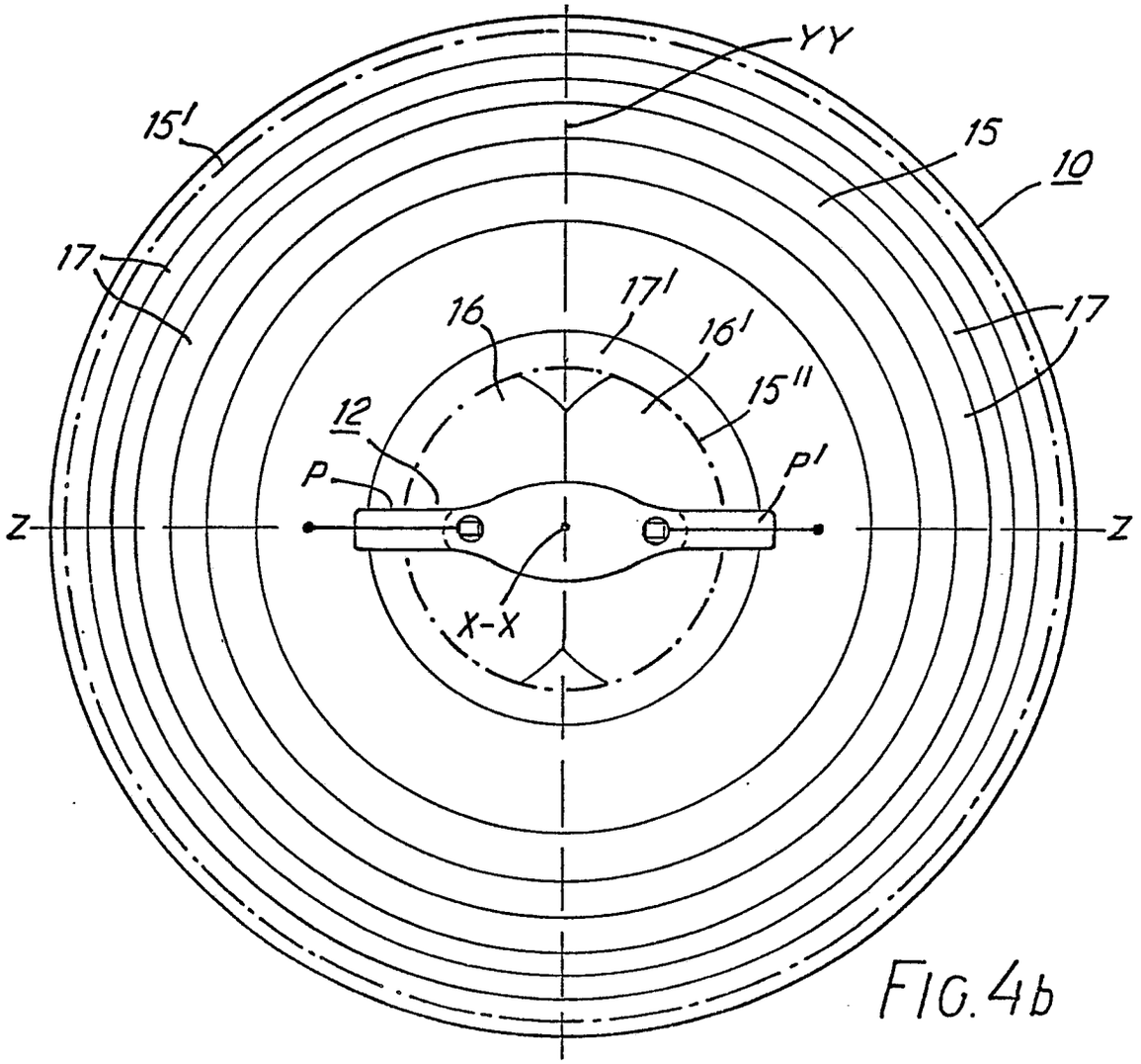
YY
15'
15
10
17
16
17'
16'
15''
12
P
P'
Z
Z
X-X

FIG.4b