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(54) **Lighting device that can be constructed with reduced thickness, especially a headlamp or other external vehicle lamp**

Beleuchtungsvorrichtung, die mit einer reduzierten Dicke herstellbar ist, insbesondere Scheinwerfer oder andere äussere Fahrzeuglampe

Appareil d'éclairage qui peut-être construit avec une épaisseur réduite, notamment projecteur ou autre lampe extérieure pour véhicule

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EP 0 766 037 B1

Description

[0001] The present invention relates to a lighting device that can be constructed in such a way that its thickness, that is, its space requirement in terms of depth, is much less than its other dimensions, especially than the surface area of the lens. Such a lighting device is useful as a headlamp or other external vehicle lamp.

[0002] As is well known, lighting devices in many automotive applications, such as headlamps and/or other external lamps, require high power, good optical distribution of the light beam, low power consumption and small size, especially in the direction of depth, that is, parallel with the optical axis of propagation of the final light beam that is to be produced.

[0003] In order to fulfil these demands a variety of ways of making thin lighting devices are known. US Patent 5,046,805 relates to a device in which the light beam emitted by the source, transversely to the direction in which it is to be aimed, is collected by a lightguide along which the beam is transmitted by internal reflection and from which it is extracted at the desired points by means of scatterers; while Italian Patent Application No. TO94A000773 by the present Applicant discloses a device in which the light beam is collected by a lightguide defined by two mouldings presenting a plurality of appropriately angled interfaces along which the two mouldings, which are transparent, are glued by means of a layer of optical adhesive with a defined refractive index: in this way the propagation of the light beam along the guide produces, as it passes each interface, phenomena of partial refraction/reflection by means of which the light is extracted and guided.

[0004] Both the devices described therefore employ a lightguide as a modifier/extractor of the desired beam. However, they have very serious drawbacks from the point of view of achievable performance: the first device, in accordance with the cited US patent, gives excellent uniformity of illumination of the guide, but allows no control over the distribution of the light intensity and divergence of the final beam output by the device: such control is necessary in the case of automotive devices. These functions must therefore be handled, where possible, by the lens, so that manufacture is made more complex and the space requirement increased.

[0005] Contrariwise, in the second described known device, the efficiency of the lightguide can be shown to be very low: efficiency is a function of the number of interfaces and only if this number is large enough (greater than 100) is it possible to achieve more than 45% efficient extraction of the light. However, the possibility of using a large number of interfaces is limited by the physical dimensions available to the lightguide, which will be small if the space requirements of the device are to be kept down. The small dimensions of the final device are therefore achieved at the cost of light efficiency, making it necessary to use high-power lamps and/or a large number of lamps, which in turn means heavy power consumption. In addition, in this type of device, uniformity of illumination is inversely proportional to the number of interfaces. Therefore in order to obtain good uniformity the guides must be inefficient, or alternatively the reflective/refractive characteristics of each interface of the guides must be modified. This can be done either by having different dimensions for each succeeding interface, or by modifying the refractive index of the adhesive between them; however, either method introduces a complication into the manufacturing process and the problem in question is not always satisfactorily solved.

[0006] EP-A-0 364 228 also does not solve the described drawbacks.

[0007] It is an object of the invention to provide a lighting device that solves the problems described above, in particular by making it possible to combine high uniformity of illumination with an equally high efficiency. It is also an object of the invention to provide a device that is compact, reliable and comparatively simple to manufacture.

[0008] The invention therefore provides a lighting device, usable as a headlamp or other external vehicle lamp, whose thickness is less than its other dimensions, as defined in claim 1.

[0009] Moreover, in another aspect of the invention, the surfaces defining the oblique sides of the reliefs are given diffractive optics or microoptics, either formed directly on these surfaces or applied to them; these diffractive microoptics may optionally be formed directly on a surface of the second reflector that has no reliefs, instead of part of the sawtooth reliefs themselves.

[0010] Lastly, the lens is preferably provided with a plurality of refractive, diffractive or hybrid diffractive/refractive lenses/microlenses for receiving the light beam after the second reflector has modified and deflected it and giving it a desired definitive distribution.

[0011] Other objects and advantages of the present invention will become clear in the following description of certain non-restrictive embodiments. This description refers to the figures of the accompanying drawings, in which:

- Figure 1 is a schematic elevation of a headlamp or other external vehicle lamp constructed in accordance with the invention;
- Figure 2 is a schematic perspective view of the device of Figure 1;
- Figures 3 and 4 show examples, on an enlarged scale, of different details of the construction of the device of Figure 1; and
- Figures 5, 6, 7 and 8 illustrate different possible alternative embodiments of the device of the invention.

[0012] With reference to Figures 1 and 2, the numeral 10 is a general reference for a lighting device, in the present case a headlamp or other external vehicle lamp, that basically comprises an envelope 2 of known type, illustrated only schematically for simplicity's sake, of, for

example, parallelepipedal shape and containing a light source 1 and a reflector 3, of for example parabolic profile; the envelope 2 is closed on the outside (sealed against the ingress of fluids, for example) by a transparent screen or lens 6 (Fig. 1). According to the invention, the thickness S of the device 10 measured parallel to an optical axis A along which the rays 11 produced by the device 10 are directed, is much smaller (for example by an order of magnitude) than the length L of the envelope 2, whereas it may be of any width, meaning its dimension perpendicular to the length L and to the thickness S, depending on what the lighting requirements are. The reflector 3, and the source 1, are arranged at one end 4 of the envelope 2, in such a way that the reflector 3 collimates the various light rays 9 emitted by the source 1 and directs them, parallel to each other, along a direction of propagation X - indicated by the arrow in Figure 1 and parallel with the lens 6 and with the side of dimension L of the envelope 2 - perpendicularly and on one side of the optical axis A.

[0013] Furthermore the envelope 2 also houses a modifier/extractor component, the function of which is to collect the rays 9 collimated by the reflector 3 and deflect them; with defined divergence and intensity with respect to the optical axis A through the lens 6, to form the rays 11 of the final light beam which it is desired to obtain. According to the invention, this modifier/extractor component consists of a second reflector 13 facing the reflector 3, opposite from it and in front of the lens 6, for the entire length L of the envelope 2.

[0014] The reflector 13 has a completely reflective upper surface 14 directly facing the lens 6 and arranged obliquely to the direction X of propagation of the beam of rays 9. The reflector 13 is consequently basically wedge-shaped in cross section (cutting in direction X). In addition, the surface 14 is defined, wholly or at least in part, by a plurality of mutually adjacent reliefs 15, each of which has, in the direction X of propagation of the light beam collimated by the reflector 3, a sawtooth profile (Figures 3 and 5); each relief 15 (Figures 3 and 5) is therefore defined by an oblique side 16, turned towards the light source 1 and lying at a defined angle relative to the direction of propagation X, and by an opposite side 18 situated approximately perpendicularly to the lens 6.

[0015] Both sides 16, 18 are defined, in the present example, by reflective surfaces. These surfaces may be planar, as illustrated, or may be curved, either in direction X or at right angles to this direction, the curvature being described by a single equation or, if required, by a series of different equations (complex surface), in order to control the divergence of the beam of rays 11 leaving the device 10 in the two directions perpendicular to the optical axis A.

[0016] Whichever form is adopted, according to the invention the reliefs 15 are so shaped that respective peaks 20 of said sawtooth teeth all lie on a continuous curved profile of defined shape, illustrated by a dashed line marked 21 in Figure 3. The profile 21 is such as to give the reflective surface 14 as a whole a generally concave configuration made up of all the mutually adjacent reliefs 15 put together and, depending on how the final beam of rays 11 is to be distributed and deflected through the lens 6, this profile 21 may have a single equation (may for example be parabolic or elliptical) or, preferably, be a complex profile made up of a plurality of curves of different equations (for example a parabola, a portion of an ellipse, a portion of a circle, a portion of a hyperbole, etc.) fitted together without discontinuities up to a defined order of derivative, preferably to the second order.

[0017] The profile 21 is chosen by calculation, in such a way as to find the best possible compromise between the following requirements:

- achieve initial control over the divergence of the beam of rays 11 leaving the device 10 in one of the two directions perpendicular to the optical axis A, which will subsequently be refined by the lens 6;
- smooth out the distribution of illumination on the lens 6 at the outlet of the device 10, from the combined distribution ("pattern") of intensity of the beam of rays 9 collimated by the reflector 3 and of the directly output light.

[0018] Whichever approach is adopted, the selection of the possible profile 21 is limited by the physical dimensions of the device 10, in particular by the two heights h1 and h2 (Figure 3) at the beginning and end of the component 13, which are laid down at the start of the design according to the final thickness S to be achieved. Figure 4 illustrates, though not in scale, three different possible profiles 21a, 21b and 21c and shows how the same ray 9 collimated by the reflector 3 is reflected at different angles by each profile 21, thus producing outgoing rays 11a, 11b and 11c having different divergences and striking the lens 6 at quite different points.

[0019] As illustrated in Figures 1 to 3, the teeth or reliefs 15 are all of the same profile, so that the oblique sides 16 all have the same inclination, or, in the variant illustrated in Figure 5, the reflective surface 14 of the reflector, marked 13a, is composed of reliefs 15 whose profiles differ from each other, so that the oblique sides 16 have different inclinations, in order to modify the light distribution (as is indicated by the differing divergences of the resulting outgoing rays 11) without altering the uniformity of illumination of the lens 6.

[0020] In the other possible variant illustrated not in scale in Figure 6, the reliefs 15, especially the surfaces defining their oblique sides 16, can be provided with diffractive optics or microoptics 25a and 25b, different from each other (or identical to each other), their function being the initial distribution of the desired final light beam. These optics 25a, 25b may be formed directly on the surfaces 16, as a series of microreliefs produced directly

along with the component 13, which is preferably a moulding in a synthetic plastic resin, or be made, by a known technique, on respective transparent films (known and not shown), which in turn are applied to the surfaces 16 as a coating, for example by adhesive bonding.

[0021] If diffractive microoptics are employed, these may in some cases completely replace some of the sawtooth reliefs 15: in other words, in this case, some areas of the surface 14 have no reliefs 15 and only a diffractive optic. Either way, these surface 14 areas must still lie on the overall profile 21 defining the shape of the surface 14 as a whole.

[0022] Lastly, the lens 6 is provided with a plurality of refractive, diffractive or hybrid diffractive/refractive lenses/microlenses 6a (Figure 1) for receiving the light beam after the surface 14 has modified and deflected it, and giving it the desired definitive distribution. These optics 6a may likewise be formed directly on the lens 6, or on films which are then adhesively bonded to the lens 6, for example on the inside of the device 10.

[0023] The light source 1 may be of any type capable of emitting monochromatic, polychromatic, coherent, partially coherent or totally incoherent light; for instance, it may be a filament (incandescent), gas, ion-discharge, solid-state polymer, LED (optionally with suitable collimating lenses), halogen or neon lamp, or may consist of an optical fibre; if it is wished not to use the direct rays, moreover, the source 1 can be masked, as known, by a concealing shield arranged near the second reflector 13.

[0024] The example illustrated in Figures 1 and 2 uses a single source of light 1 arranged at one end 4 of the device 10; however, on the basis of the available space and of the power needed to produce the desired final light beam, many other embodiments of the device 10 are possible, two of which, marked 10a and 10b, are illustrated in Figures 7 and 8, as alternatives using more light sources.

[0025] For instance, Figure 7 shows a device 10a of elongate shape comprising a pair of opposing in-line reflectors 3, each provided with its own light source 1, and a modifier/extractor consisting of another reflector 13b in the shape of a double wedge arranged between and in line with the two reflectors 3, and defined by a pair of oblique reflective upper surfaces 14a and 14b, whose inclinations are opposite and which each face a reflector 2 and are each defined by a plurality of adjacent reliefs 15, which diminish away from a common middle top portion 34 towards the respective reflectors 3. If the lighting power needs to be increased, this variant, and also the previous one, as shown in Figures 1 and 2, can serve as an infinitely replicable module along the. direction perpendicular to the side L, in which the sources 1 are arranged in succession on the same side (or on the two opposite sides).

[0026] Lastly, in the variant shown in Figure 8, a device 10c according to the invention can also be made with circular symmetry about the optical axis A: the device 10c in this case comprises a reflector 13c defined by a reflective upper surface 14 of generally conical form, formed by a plurality of annular reliefs 15, each having a sawtooth profile in the radial direction; this reflector 13c, arranged so that its axis is on the optical axis A, is arranged inside a suitable envelope 2 together with a plurality of reflectors 3, each having its own light source 1, disposed radially in a ring around the reflector 13c; at the front, the device 10c is closed by a lens 6. In this way, essentially the same operational configuration is reproduced in any radial direction defined by the axis of a reflector 3 as that of the device 10 of Figures 1 and 2.

Claims

1. Lighting device (10), usable as a headlamp or other external vehicle lamp, whose thickness is less than its other dimensions, comprising

- at least one light source (1),
- a modifier/extractor (13),
- at least one reflector (3) for collimating a beam of light rays from the source (1) towards the modifier/extractor (13),
- and a lens (6) arranged approximately parallel to the direction of propagation of the beam and in front of the modifier/extractor (13),

wherein the modifier/extractor (13) is designed to deflect the beam through said lens (6);
and wherein the modifier/extractor is a second reflector (13) facing the first, the upper surface, directly facing the lens (6), of which second reflector (13) is arranged obliquely to the direction of propagation of the beam; said upper surface being defined at least in part by a plurality of mutually adjacent reliefs (15); each said relief (15) having, in the direction of propagation of the beam (X), a sawtooth profile defined by an oblique side (16) turned toward the light source (1) and lying at an individually defined angle relative to the direction of propagation (X) of the beam; wherein said upper surface is such that said sawtooth reliefs (15) all lie on a continuous curved profile of defined shape; **characterized in that, in combination**

(i)- each sawtooth profile is further defined by an opposite side (18) situated perpendicular to said lens (6);
(ii)- said oblique sides (16) of the reliefs (15) comprise means to enable the modifier/extractor of controlling the divergence and intensity distribution of the beam.

2. Lighting device (10) according to Claim 1, **characterized in that** said profile is a complex profile made

up of a plurality of curves of different equations fitted together without discontinuity up to a defined order of derivative.

3. Lighting device (10) according to Claim 2, **characterized in that** said defined order of derivative is the second order.

4. Lighting device (10) according to any one of the previous claims, **characterized in that** said oblique sides of the reliefs (15) are defined by respective planar surfaces.

5. Lighting device (10) according to any one of Claims 1 to 3, **characterized in that** said oblique sides of the reliefs (15) are defined by respective curved surfaces, said means to enable the modifier/extractor (13) of controlling the divergence and intensity distribution of the beam comprising said curved surfaces.

6. Lighting device (10) according to and one of the previous claims, **characterized in that** said reliefs (15) all have a constant profile, said oblique sides (16) all having the same angle relative to the direction of propagation (X) of the beam.

7. Lighting device (10) according to any one of Claims 1 to 5 **characterized in that** said reliefs (15) differ in profile from each other, said oblique sides (16) having different angles relative to the direction of propagation (X) of the beam, said means to enable the modifier/extractor (13) of controlling the divergence and intensity distribution of the beam comprising said different angles.

8. Lighting device (10) according to any one of the previous claims, **characterized in that** at least the surfaces defining said oblique sides (16) of the reliefs (15) are given diffractive optics or microoptics (15a, 25b), either formed directly on these surfaces or applied to them; said means to enable the modifier/extractor (13) of controlling the divergence and intensity distribution of the beam comprising said diffractive optics (25a, 25b).

9. Lighting device (10) according to any one of the previous claims, **characterized in that** said lens (6) is provided with a plurality of refractive, diffractive or hybrid diffractive/refractive lenses/microlenses (6a) for receiving the light beam after the second reflector (13) has modified and deflected it and giving it a desired definitive distribution.

10. Lighting device (10a) according to any one of the previous claims, **characterized in that** it is of elongate shape and comprises a pair of first opposing in-line reflectors (3), each provided with its own light source, and a second reflector (13b) in the shape of a double wedge arranged between and in line with said first reflectors (3) and defined by a pair of oblique reflective upper surfaces (14a, 14b), which each face a first reflector and are each defined by a plurality of said adjacent reliefs (15), which diminish away from a common middle top portion towards said first reflector.

11. Lighting device (10c) according to any of the previous claims, **characterized in that**, at right angles to the direction of propagation of the light beam which it emits, it is of a generally circular shape comprising a second reflector (13c) defined by a reflective upper surface formed by a plurality of annular reliefs (15), each having a sawtooth profile in the radial direction, and a plurality of first reflectors (3), each having its own light source (1), disposed radially in a ring around the second reflector (13c).

Patentansprüche

1. Beleuchtungsvorrichtung (10), die als ein Scheinwerfer oder eine andere Fahrzeugaußenleuchte verwendet werden kann und deren Dicke kleiner als ihre anderen Abmessungen ist, umfassend:

- wenigstens eine Lichtquelle (1);
- eine Modifizierungs-/Extraktionseinrichtung (13);
- wenigstens einen Reflektor (3) zum Richten eines Lichtstrahls (X) von der Quelle (1) zur Modifizierungs-/Extraktionseinrichtung (13);
- und eine Linse (6), die im wesentlichen parallel zur Ausbreitungsrichtung des Strahls und vor der Modifizierungs-/Extraktionseinrichtung (13) angeordnet ist,

wobei die Modifizierungs-/Extraktionseinrichtung (13) so beschaffen ist, daß sie den Strahl durch die Linse (6) lenkt;

und wobei die Modifizierungs-/Extraktionseinrichtung ein zweiter Reflektor (13) ist, der dem ersten zugewandt ist, wobei die obere Oberfläche des zweiten Reflektors (13) die der Linse (6) direkt zugewandt ist, schräg zur Ausbreitungsrichtung des Strahls angeordnet ist, wobei die obere Oberfläche wenigstens teilweise durch mehrere zueinander benachbarte Reliefs (15) definiert ist, wobei jedes Relief (15) in der Ausbreitungsrichtung des Strahls (X) ein Sägezahnprofil aufweist, das durch eine schräge Seite (16), die zur Lichtquelle (1) geneigt ist und in einem individuell definierten Winkel zur Ausbreitungsrichtung (X) des Strahls liegt, wobei die obere Oberfläche derart ist, daß alle (Sägezahn-) Profile (15) auf einem durchgehenden gekrümmten Profil mit definierter Form liegen, **da-**

durch gekennzeichnet, daß in Kombination

(i) jedes Sägezahnprofil ferner durch eine gegenüberliegende Seite (18) definiert ist, die senkrecht zur Linse (6) angeordnet ist, und
(ii) die schrägen Seiten (16) der Reliefs (15) Mittel umfassen, durch die die Modifizierungs-/Extraktionseinrichtung die Divergenz und die Intensitätsverteilung des Strahls steuem kann.

2. Beleuchtungsvorrichtung (10) nach Anspruch 1, **dadurch gekennzeichnet, daß** das Profil ein komplexes Profil ist, das aus mehreren Krümmungen mit unterschiedlichen Gleichungen aufgebaut ist, die bis zu einer definierten Ordnung der Ableitung ohne Unstetigkeit zusammengefügt sind.

3. Beleuchtungsvorrichtung (10) nach Anspruch 2, **dadurch gekennzeichnet, daß** die definierte Ordnung der Ableitung die zweite Ordnung ist

4. Beleuchtungsvorrichtung (10) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, daß** die schrägen Seiten der Reliefs (15) jeweils durch ebene Oberflächen definiert sind.

5. Beleuchtungsvorrichtung (10) nach einem der Ansprüche 1 bis 3, **dadurch gekennzeichnet, daß** die schrägen Seiten der Reliefs (15) jeweils durch gekrümmte Oberflächen definiert sind, wobei die Mittel, durch die die Modifizierungs-/Extraktionseinrichtung (13) die Divergenz und die Intensitätsverteilung des Strahls steuem kann, die gekrümmten Oberflächen umfassen.

6. Beleuchtungsvorrichtung (10) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, daß** alle Reliefs (15) ein konstantes Profil besitzen, wobei alle schrägen Seiten (16) denselben Winkel zur Ausbreitungsrichtung (X) des Strahls aufweisen.

7. Beleuchtungsvorrichtung (10) nach einem der Ansprüche 1 bis 5, **dadurch gekennzeichnet, daß** sich die Profile (15) untereinander unterscheiden, wobei die schrägen Seiten (16) unterschiedliche Winkel zur Ausbreitungsrichtung (X) des Strahls aufweisen, wobei die Mittel, durch die die Modifizierungs-/Extraktionseinrichtung (13) die Divergenz und die Intensrtätsverteilung des Strahls steuem kann, die unterschiedlichen Winkel umfassen.

8. Beleuchtungsvorrichtung (10) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, daß** wenigstens die Oberflächen, die die schrägen Seiten (16) der Reliefs (15) definieren, lichtbeugende Optikeinrichtungen oder Mikrooptikeinrichtungen (15a, 25b) sind, die entweder direkt auf diesen Oberflächen ausgebildet sind oder auf diese aufgebracht sind, wobei die Mittel, durch die die Modifizierungs-/Extraktionseinrichtung (13) die Divergenz und die Intensitätsverteilung des Strahls steuern kann, die lichtbeugenden Optikeinrichtungen (25a, 25b) umfassen.

9. Beleuchtungsvorrichtung (10) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, daß** die Linse (6) mit mehreren brechenden, lichtbeugenden oder brechenden/lichtbeugenden Hybrid-Linsen/-Mikrolinsen (6a) versehen ist, die den Lichtstrahl empfangen, nachdem der zweite Reflektor (13) ihn modifiziert und abgelenkt und ihm eine gewünschte endgültige Verteilung verliehen hat.

10. Beleuchtungsvorrichtung (10a) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, daß** sie eine längliche Form besitzt und ein Paar erster gegenüberliegender In-line-Reflektoren (3), von denen jeder mit seiner eigenen Lichtquelle versehen ist, und einen zweiten Reflektor (13b) in Form eines Doppelkeils umfaßt, der zwischen den ersten Reflektoren (3) und mit diesen in Reihe angeordnet und durch ein Paar schräger reflektierender oberer Oberflächen (14a, 14b) definiert ist, wovon jede einem ersten Reflektor zugewandt und durch mehrere benachbarte Reliefs (15) definiert ist, die von einem gemeinsamen mittleren Spitzenabschnitt weg zum ersten Reflektor kleiner werden.

11. Beteuchtungsvorrichtung (10c) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, daß** sie im rechten Winkel zur Ausbreitungsrichtung des von ihr ausgesendeten Lichtstrahls eine im allgemeinen kreisförmige Form aufweist und einen zweiten Reflektor (13c), der durch eine reflektierende obere Oberfläche definiert ist, die durch mehrere kreisförmige Reliefs (15) gebildet ist, die jeweils in der radialen Richtung ein Sägezahnprofil aufweisen, und mehrere erste Reflektoren (3) umfaßt, die jeweils ihre eigene Lichtquelle (1) aufweisen, die radial in einem Ring um den zweiten Reflektor (13c) angeordnet ist.

Revendications

1. Dispositif d'éclairage (10), utilisable en tant que phare ou autre lampe de véhicule externe, dont l'épaisseur est inférieure à ses autres dimensions, comportant

- au moins une source lumineuse (1),
- un modificateur/extracteur (13),
- au moins un réflecteur (3) pour collimater un faisceau de rayons lumineux (X) provenant de

la source (1) en direction du modificateur/extracteur (13),

- et une lentille (6) agencée approximativement parallèlement à la direction de propagation du faisceau et située devant le modificateur/extracteur (13),

dans lequel le modificateur/extracteur (13) est conçu pour dévier le faisceau à travers ladite lentille (6),

et dans lequel le modificateur/extracteur est un second réflecteur (13) faisant face à la première surface supérieure, faisant face directement à la lentille (6), dont le second réflecteur (13) est agencé de manière oblique par rapport à la direction de propagation du faisceau, ladite surface supérieure étant définie au moins en partie par une pluralité de reliefs mutuellement adjacents (15), chacun desdits reliefs (15) ayant, dans la direction de propagation du faisceau (X), un profil en dents de scie défini par un côté oblique (16) tourné vers la source lumineuse (1) et se trouvant à un angle défini individuellement par rapport à la direction de propagation (X) du faisceau, dans lequel la surface supérieure est telle que lesdits reliefs en dents de scie (15) se trouvent tous sur un profil incurvé continu ayant une forme définie, **caractérisé en ce que**, en combinaison

(i) - chaque profil en dents de scie est de plus défini par un côté opposé (18) situé perpendiculairement à ladite lentille (6),
(ii) - lesdits côtés obliques (16) des reliefs (15) comportent des moyens pour permettre au modificateur/extracteur de commander la divergence et la distribution d'intensité du faisceau.

2. Dispositif d'éclairage (10) selon la revendication 1, **caractérisé en ce que** ledit profil est un profil complexe constitué d'une pluralité de courbes d'équations différentes ajustées ensemble sans discontinuité jusqu'à un ordre défini de dérivée.

3. Dispositif d'éclairage (10) selon la revendication 2, **caractérisé en ce que** ledit ordre défini de dérivée est le second ordre.

4. Dispositif d'éclairage (10) selon l'une quelconque des revendications précédentes, **caractérisé en ce que** lesdits côtés obliques des reliefs (15) sont définis par des surfaces planes respectives.

5. Dispositif d'éclairage (10) selon l'une quelconque des revendications 1 à 3, **caractérisé en ce que** lesdits côtés obliques des reliefs (15) sont définis par des surfaces incurvées respectives, lesdits moyens pour permettre au modificateur/extracteur (13) de commander la divergence et la distribution d'intensité du faisceau comportant lesdites surfaces incurvées.

6. Dispositif d'éclairage (10) selon l'une quelconque des revendications précédentes, **caractérisé en ce que** lesdits reliefs (15) ont tous un profil constant, lesdits côtés obliques (16) ayant tous le même angle par rapport à la direction de propagation (X) du faisceau.

7. Dispositif d'éclairage (10) selon l'une quelconque des revendications 1 à 5, **caractérisé en ce que** lesdits reliefs (15) différent en termes de profil les uns par rapport aux autres, lesdits côtés obliques (16) ayant différents angles par rapport à la direction de propagation (X) du faisceau, lesdits moyens pour permettre au modificateur/extracteur (13) de commander la divergence et la distribution d'intensité du faisceau comportant lesdits différents angles.

8. Dispositif d'éclairage (10) selon l'une quelconque des revendications précédentes, **caractérisé en ce qu'**au moins les surfaces définissant lesdits côtés obliques (16) des reliefs (15) sont munies d'optiques ou de micro-optiques de diffraction (15a, 25b) formées directement sur ces surfaces ou appliquées à celles-ci, lesdits moyens pour permettre au modificateur/extracteur (13) de commander la divergence et la distribution d'intensité du faisceau comportant lesdites optiques de diffraction (25a, 25b).

9. Dispositif d'éclairage (10) selon l'une quelconque des revendications précédentes, **caractérisé en ce que** ladite lentille (6) est munie dune pluralité de lentilles/microlentilles (6a) de réfraction, diffraction ou diffraction/réfraction hybrides pour recevoir le faisceau lumineux après que le second réflecteur (13) ait modifié et dévié celui-ci et lui donner une distribution définitive voulue.

10. Dispositif d'éclairage (10) selon l'une quelconque des revendications précédentes, **caractérisé en ce qu'**il est d'une forme allongée et comporte une paire de premiers réflecteurs en ligne opposés (3), chacun muni de sa propre source lumineuse, et un second réflecteur (13b) ayant la forme d'un double-coin agencé entre lesdits premiers réflecteurs (3) et en ligne avec ceux-ci et défini par une paire de surfaces supérieures réflectrices obliques (14a, 14b), qui font face chacune au premier réflecteur et sont chacune définies par une pluralité desdits reliefs adjacents (15), qui diminuent en s'éloignant d'une partie supérieure médiane commune en direction dudit premier réflecteur.

11. Dispositif d'éclairage (10c) selon l'une quelconque des revendications précédentes, **caractérisé en ce**

que, à des angles droits par rapport à la direction de propagation du faisceau lumineux qu'il émet, il a une forme globalement circulaire comportant un second réflecteur (13c) défini par une surface supérieure réflectrice formée par une pluralité de reliefs annulaires (15), ayant chacun un profil en dents de scie dans la direction radiale, et une pluralité de premiers réflecteurs (3), ayant chacun sa propre source lumineuse (1), disposés radialement en anneau autour du second réflecteur (13c).

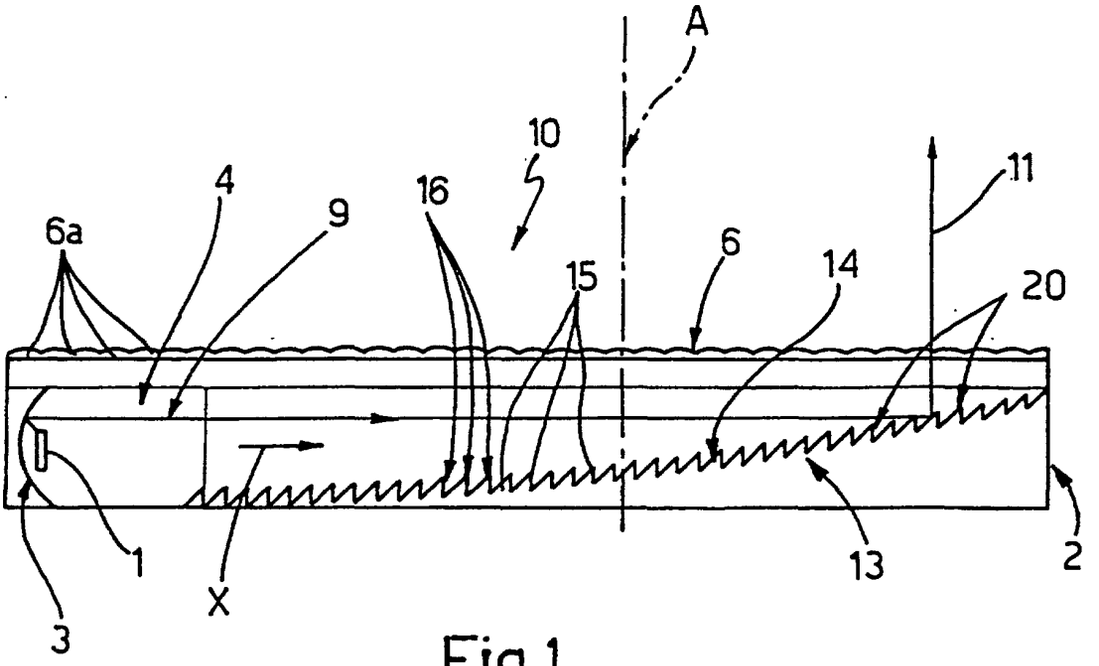


Fig.1

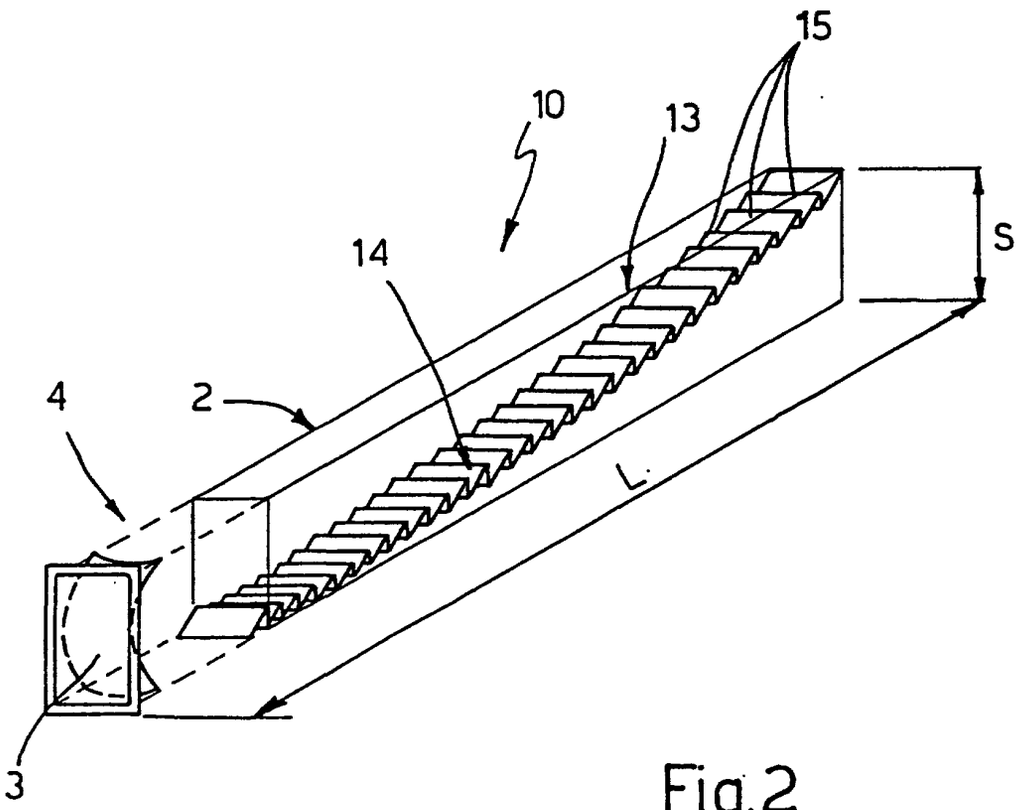
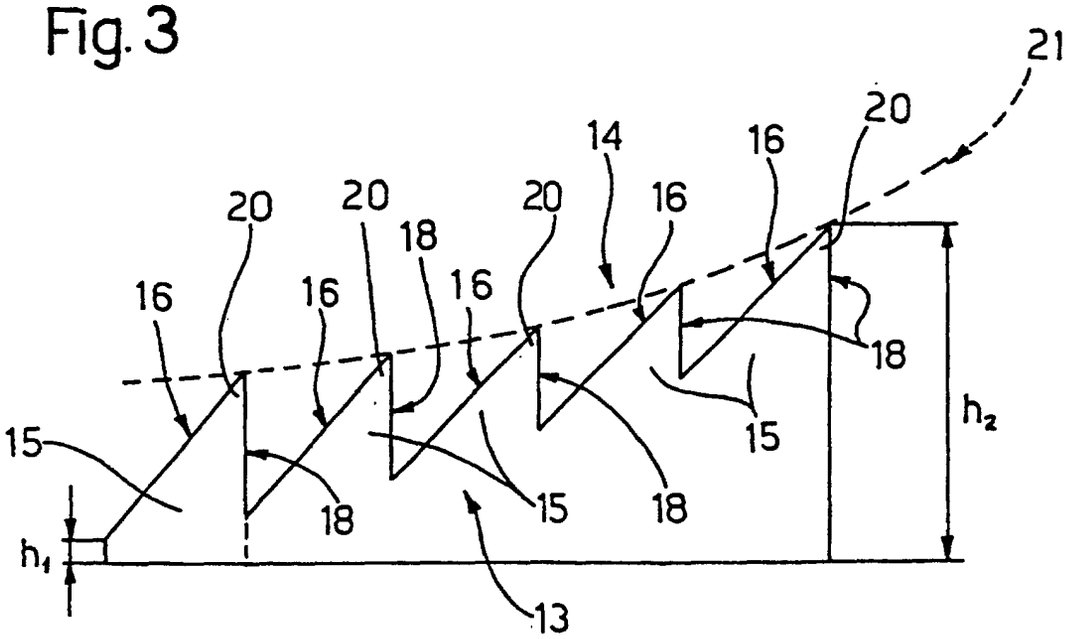


Fig.2

Fig. 3


21
20
14
16
20
20
20
16
18
16
16
16
18
15
18
15
18
15
h_2
h_1
13

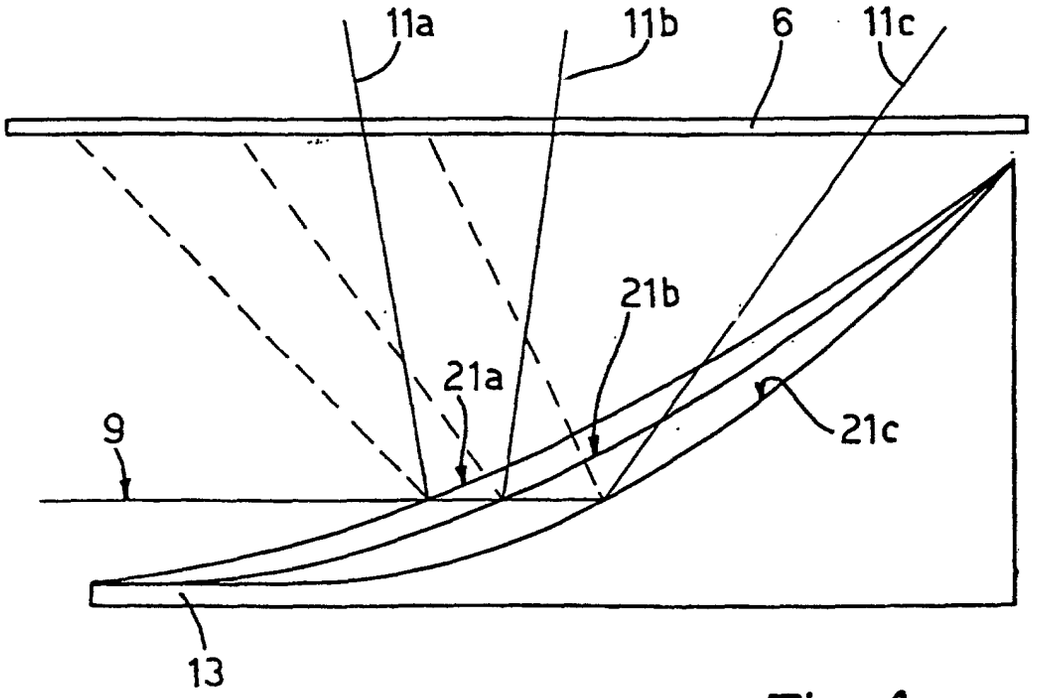

11a
11b
6
11c
21b
21a
21c
9
13

Fig. 4

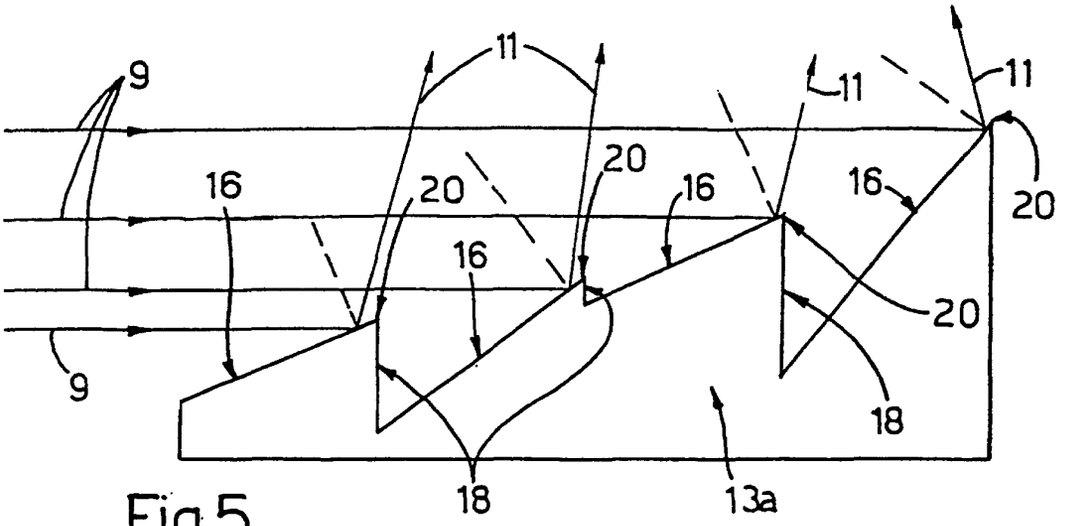


Fig.5

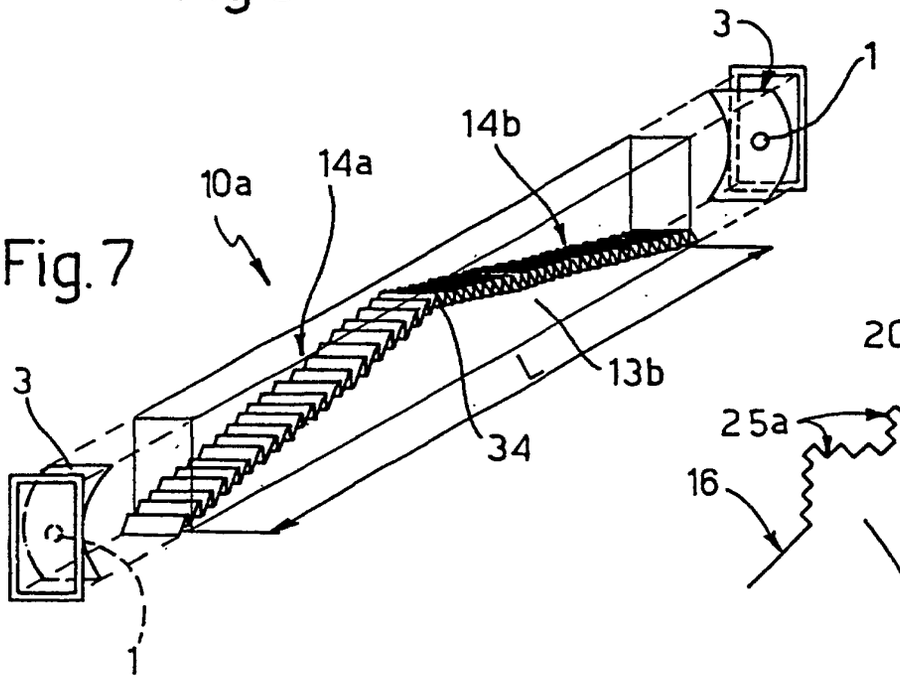
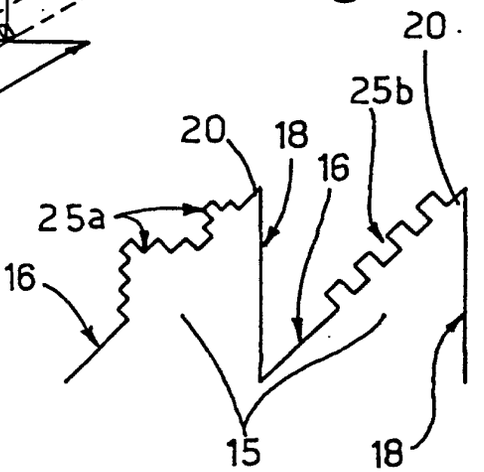


Fig.7

Fig.6



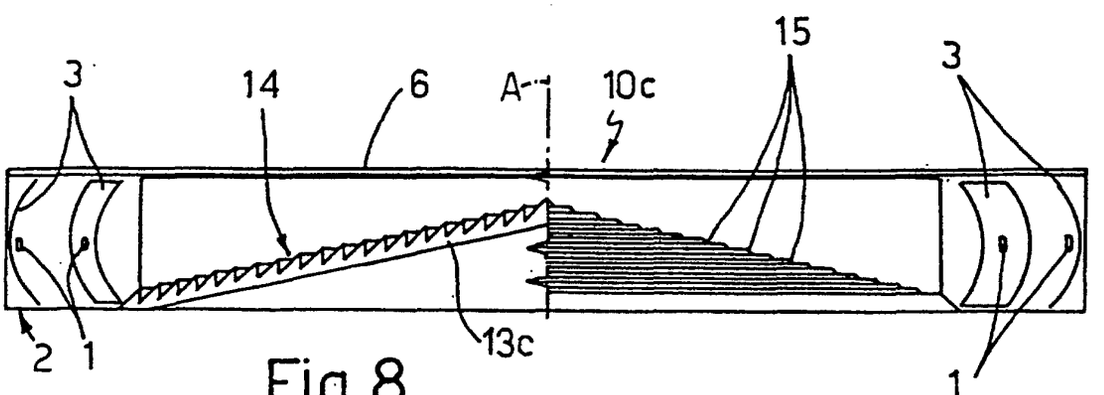


Fig. 8