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(54) **IMPROVEMENT IN FIXTURES FOR LUMINOUS TUBES.**

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Description

The present invention relates to an improvement in fixtures for luminous tubes or bulbs, and more specifically an improved version of the transverse lamellas or fins in the light shielding grid of the fixture.

In an early stage it was realized that ceiling-mounted illumination with luminous bulbs could be provided with an opportune and comfortable design or mode of operation by fitting the fixture with a light shielding grid which provides a downward directing of the light by shielding and reflections. In their simplest form, such grid devices will, in addition to side and end reflectors intended for reflecting light mainly downward, be equipped with simple crossbar-like transverse fins in the form of vertically upright plates just below the luminous bulb or bulbs, mounted in a suitable number between the side reflectors, and with number, height and interval distance adapted for maximum allowable light scatter angle, maximum desirable construction height of the fixture etc.

It was also soon realized that the lighting conditions below a fixture could be improved further by introducing an improved type of transverse fins, namely (in cross section) Y-or V-shaped fins with concavely curved outer sides, often with parabolic type of curvature. Using such a design, improved darkening or shielding conditions are achieved, even though the light output or efficiency will be somewhat lower due to loss "inside" the fins or lamellas.

European patent application no. 138.747 discloses an example of such V-shaped transverse fins. In addition, the fins shown in said European application are designed with a three-dimensional curvature in the reflecting surfaces in order to improve the shielding conditions regarding obliquely reflected light rays.

Curved and reflecting fins are also known from German Gebrauchsmuster DE-U-1984108, however, the grid is in this case a two-dimensional grid consisting of both transverse and longitudinal fins for dividing the light output into small "cells". Particularly in the embodiment regarding curved fins, the effect in said Gebrauchsmuster is explicitly stated to be that of creating light "funnels" in a downward direction. The present invention is, however, directed to providing a one-dimensional grid fixture allowing a much larger part of the light to escape down into the room.

Other variants have been developed, and it is referred to figures 2, 3 and 4 which show previously known shapes of transverse lamellas. Fig. 2 corresponds approximately to the above mentioned cross-sectional shape. Fig. 3 shows a closed top part of the V-fin, for achieving a reflection back again of the light, which then entails a higher light yield from the fixture due to inter-reflections which pass the upward reflected light from the fins, down again. However, some loss still exists. The structure shown in fig. 4 provides a good increase of the light yield, but this implies the disadvantage of increasing the fixture construction height with a height difference of H2-H.

The purpose of the present invention is to provide a fixture with transverse lamellas or fins which results in a corresponding increase in the light yield as the last mentioned variant, however without increasing the construction height in comparison with the variants of fig. 2 and 3. Said purpose is fulfilled by providing a luminous bulb fixture as defined in the patent claims.

A closer description of the invention shall be given in the following, referring to the embodiment example appearing from fig. 5 and 6,

fig. 1 showing a general design of a luminous bulb fixture of previously known type in a perspective view, obliquely from below,

fig. 2-4 showing cross sections of the alreday mentioned previously known shapes of transverse lamellas,

fig. 5 showing a corresponding cross section of a pair of fins or lamellas constituting part of the present invention, and

fig. 6 showing in a schematical manner light ray conditions in connection with a fixture in accordance with the invention.

It should first be noted that the following description for simplicity reasons merely mentions horizontal mounting of the fixture, that is the usual ceiling mounting, however, it is also of course possible with other mounting conditions (slanting ceilings, or even on walls). The patent claims have been worded in a manner which is independent of horizontal mounting of the luminous bulb, i.e. independent of fixture position.

Fig. 1 shows a ceiling mounted fixture with one single luminous tube 4. The fixture is equipped with side reflectors 1, end reflectors 2 and quite simple plate-shaped transverse fins 3 for shielding and downward directing of the light from the luminous tube or bulb. As a starting point, here the height of each fin or lamella 3, as well as the distance between fins, determine the maximum angle with the vertical direction for escaping light rays in the case of a direct reflection, however multiple reflections imply a much wider scatter angle and poorer control of the darkening conditions.

In figs. 2, 3 and 4 which have been mentioned above, reference numeral 5 refers to more advanced designs of fins or lamellas, where the result is a poorer light yield than in the first case, however in return, better control of the shielding angle is achieved, and consequently more correct and comfortable illumination conditions. As previously mentioned, the solution in fig. 4 gives the better light yield, but the problem in this case is the increased construction height, which is usually not desirable.

In fig. 5 is shown a lamella example in accordance with the present invention. The same external

geometry as in the V-shapes in figs. 2, 3 and 4 has been retained, i.e. preferably a parabolic curvature type for the the outer surfaces 7. However, the previous "V"-lamella has now been spilt into two single fins 6 in a mirror symmetrical relation, in such a manner that light can pass also "inside" or "through" the pair of fins 6-6. On the inside, surfaces 8 and 9 are of a reflecting type in the same manner as the outer surfaces 7. The upper and lower edges are shown respectively with reference numerals 10 and 11. 12 indicates an edge line (into the paper plane) separating the two inner surfaces 8 and 9. An imaginary symmetry plane in the center is indicated by reference numeral 13, and is positioned perpendicularly to the luminous tube or bulb. Reference numeral 14 indicates the axis of the luminous bulb.

The inner surfaces 8 are either flat or shaped with a slightly convex curvature type. Preferably the lower inner surfaces 9 have the same curvature type as the outer surfaces 7, however in a re-scaled, i.e. reduced version, so that the radius of curvature varies in the same manner, but is scaled down with a fixed factor.

The upper inner surface 8 follows to a larger or smaller extent the curve of the lamella outside 7, however deviates slowly in a downward direction, either by a somewhat different curvature, or by being a flat surface, so that the "inversely curved" lower inner surface 9 starts from an edge 12 and curves back to the lower end edge 11.

The distance between the single fins 6 in a fin pair is adjusted in such a manner that the same maximum exit angle is achieved also for light passing through said pair, as for light passing either directly or via reflections between the pairs. This is achieved by a proper choice of dimensions, as will be dealt with in more detail below.

The splitting up of tranverse lamellas of the V-type in two parts, so that light passes also "through" the lamella, either directly or via reflections, as indicated in the present invention, increases the efficiency of the fixture without renouncing the requirements for technical illumination characteristics.

Fig. 6 shows examples of oblique ray passage through a grid of transverse lamellas 6 in accordance with the present invention. If a maximum light exit angle α with the vertical direction is desirable, and the construction height implies a maximum lamella height H, the new lamellas or fins are placed with a distance from one lamella pair to the next pair equal to B, so that $\tan \alpha = B'/H$ where B′ is the horizontal distance from the top of one lamella or fin to the lower edge of the closest lamella or fin in the adjacent pair of fins. With the curvature type in question, it is then ensured that any light ray in the space between pairs is reflected downward and out from the grid with an angle equal to or smaller than α.

Regarding the light passage "inside" a pair of fins, the preferred solution ensures, with regard to the lower reflection surfaces 9, that the same maximum exit angle α is obtained, and at the same time the total light yield is increased substantially in relation to the previously known solutions.

In order to achieve the same maximum angle α, the distance A is adjusted in the preferred embodiment with similar surfaces 9 as the surfaces 7, in such a manner that the ratio A′/h, h being the height from the lower edge 11 to the edge 12, and A′ being the horizontal distance between lower edge 11 and inside edge 12 for two respective lamellas in a pair, equals $\tan \alpha$.

Thus, in this case, the two geometrical figures marked S-S-S-S and L-L-L-L in fig. 6, will be similar.

Any light ray, directly or indirectly from the light source, is thus reflected from surfaces 7 or 9 with an angle β which is smaller than or equal to α.

Claims

1. A fixture means for luminous tubes or bulbs, said fixture being equipped with a light shielding grid consisting of side reflectors (1), end reflectors (2) and transverse fins or lamellas (6) extending between said side reflectors (1), said fins or lamellas (6) having curved and possibly also flat reflection surfaces (7, 8, 9),
characterized in that said transverse fins (6) are arranged two by two in pairs where single fins (6) in a pair are constructed in a mutually mirror symmetrical fashion about a plane (13) perpendicular to the axis (14) of the luminous tube and the distance between two single fins (6) in a pair is smaller than the distance from one single fin to the closest single fin in an adjacent pair, distances between fins being measured in a direction parallel with the tube axis and in any level along the principal extent direction of the fin cross sections.

2. Fixture means in accordance with claim 1,
characterized in that each single fin (6) is shaped like a substantially thin and flat, however curved and thickness-wise structured plate with two principal sides (7, 8/9).

3. Fixture means in accordance with claim 2,
characterized in that the two principal sides (7, 8/9) of one single fin (6) have different curvature conditions.

4. Fixture means in accordance with claim 3,
characterized in that that principal side (7) which for the pair in question is an outer side, has a concave and two-dimensional curvature along its complete extent in a direction perpendicular to the luminous tube or tubes (4), as viewed in that

cross section through said fin (6) which also contains a luminous tube axis (14) and is vertically upright when said luminous tube (4) is placed horizontally, which outer side is uniformly shaped in the direction of view for said cross section.

5. Fixture means in accordance with claim 4, **characterized in** that that principal side (8/9) which for the pair in question is an inside, is divided into two areas (8 resp. 9), where an area (8) proximal to the luminous tube substantially follows the curvature of the outer side (7), and is either curved convexly and slightly deviating therefrom, or substantially flat, and where an area (9) distal to the luminous tube has a concave curvature from a sharply marked area transition edge (12) to the single fin edge (11) which is distal to said luminous tube.

6. Fixture means in accordance with claim 5, **characterized in** that said area (9) distal to the luminous tube has a curvature of the same type as the single fin outer side (7), however with reduced radius or radii of curvature.

7. Fixture means in accordance with claim 6, **characterized in** that the geometrical dimensions are chosen in such a manner that the trapezium-like figures appearing in said cross section when their delimitation line is constituted by
   a) the two areas (9) distal from the luminous tube and on the insides of the single fins (6) of one pair of fins, the imaginary connection line parallel to the luminous tube and between the two area transition edges (12) in the pair and the imaginary connection line parallel to the luminous tube and between the two edges (11) of the single fins (6) distal from the luminous tube,
   and
   b) the two fin outer sides (7) facing each other for two adjacent pairs of fins, the imaginary connection line parallel to the luminous tube and between the corresponding fin edges (10) proximal to the luminous tube, and the imaginary connection line between the corresponding fin edges (11) distal from the luminous tube,
   are similar geometrical figures with a predetermined magnitude ratio.

8. Fixture means in accordance with any of the preceding claims, **characterized in** that the curved reflection surfaces (7, 9) have a parabolic curvature type.

Patentansprüche

1. Befestigungsmittel für Beleuchtungsröhren oder -kolben, das mit einer Lichtschutzelektrode, bestehend aus Seitenreflektoren (1), Stirnseitenreflektoren (2) und Querrippen oder -lamellen (6), die sich zwischen den Seitenreflektoren (1) erstrecken, ausgestattet ist, wobei die Rippen oder Lamellen (6) gekrümmte oder möglicherweise auch ebene Reflexionsflächen (7, 8, 9) aufweisen, dadurch gekennzeichnet, daß die Querrippen (6) paarweise angeordnet sind, wobei Einzelrippen (6) eines Paares in einer beiderseitigen spiegelsymmetrischen Form um eine Ebene (13) senkrecht zur Achse (14) der Beleuchtungsröhre ausgebildet sind und der Abstand zwischen zwei Einzelrippen (6) eines Paares geringer ist als der Abstand von einer Einzelrippe zur nächsten Einzelrippe eines benachbarten Paares, wobei die Abstände zwischen den Rippen in einer Richtung parallel mit der Röhrenachse und in irgendeinem Niveau entlang der Haupterstreckungsrichtung der Rippenquerschnitte gemessen werden.

2. Befestigungsmittel nach Anspruch 1, dadurch gekennzeichnet, daß jede Einzelrippe (6) gleich einer im wesentlichen dünnen und flachen, aber gebogenen und verstärkt geformten Platte mit zwei Hauptseiten (7, 8/9) ausgebildet ist.

3. Befestigungsmittel nach Anspruch 2, dadurch gekennzeichnet, daß die zwei Hauptseiten (7, 8/9) einer Einzelrippe (6) unterschiedlich gebogene Beschaffenheiten haben.

4. Befestigungsmittel nach Anspruch 3, dadurch gekennzeichnet, daß die Hauptseite (3), die für das in Frage kommende Paar eine Außenseite ist, eine konkave und zweidimensionale Krümmung entlang ihrer vollen Erstreckung in einer Richtung senkrecht zur Beleuchtungsröhre oder -röhren (4), in diesem Querschnitt durch die Rippe (6) gesehen, aufweist, der auch eine Beleuchtungsröhrenachse (14) enthält und vertikal aufrecht liegt, wenn die Beleuchtungsröhre (4) horizontal angeordnet ist, wobei deren Außenseite gleichmäßig in Sichtrichtung für den Querschnitt ausgebildet ist.

5. Befestigungsmittel nach Anspruch 4, dadurch gekennzeichnet, daß die Hauptseite (8/9), die für das in Frage kommende Paar eine Innenseite ist, in zwei Flächen (8 bzw. 9) geteilt ist, wobei eine Fläche (8) proximal zur Beleuchtungsröhre im wesentlichen der Krümmung der Außenseite (7) folgt und entweder konvex oder leicht versetzt davon gekrümmt oder im wesentlichen eben ausgebildet ist, und wobei eine Fläche (9) distal zur

Beleuchtungsröhre eine konkave Krümmung von einer ausgeprägt geformten Flächenübergangskante (12) zu der Einzelrippenkante (11) aufweist, die sich distal zur Beleuchtungsröhre befindet.

6. Befestigungsmittel nach Anspruch 5, dadurch gekennzeichnet, daß die Flächen (9) distal zur Beleuchtungsröhre eine Krümmung des gleichen Typs wie die Einzelrippenaußenseite (7), jedoch mit verringertem Radius oder Krümmungsradien aufweist.

7. Befestigungsmittel nach Anspruch 6, dadurch gekennzeichnet, daß die geometrischen Abmessungen in einer solchen Weise gewählt werden, daß die trapezähnlichen Figuren, die im Querschnitt erscheinen, wenn ihre Abgrenzungslinie gebildet wird von

a) den zwei Flächen (9) distal von der Beleuchtungsröhre und auf der Seite der Einzelrippe (6) eines Rippenpaares, der imaginären Verbindungslinie parallel zur Beleuchtungsröhre und zwischen den zwei Flächenübergangskanten (12) des Paares und der imaginären Verbindungslinie parallel zur Beleuchtungsröhre und zwischen den zwei Kanten (11) der Einzelrippen (6) distal von der Beleuchtungsröhre,

und

b) den zwei Rippenaußenseiten (7), die zueinander zweier benachbarter Rippenpaare zeigen, der imaginären Verbindungslinie parallel zur Beleuchtungsröhre und zwischen den korrespondierenden Rippenkanten (10) proximal zur Beleuchtungsröhre und der imaginären Verbindungslinie zwischen den korrespondierenden Rippenkanten (11) distal von der Beleuchtungsröhre

ähnliche geometrische Figuren mit einem vorbestimmten Magnitudenverhältnis sind.

8. Befestigungsmittel nach irgendeinem der vorangegangenen Ansprüche, dadurch gekennzeichnet, daß die gekrümmten Reflexionsflächen (7, 9) eine parabolisch-typische Krümmung aufweisen.

Revendications

1. Moyen d'armature pour des tubes fluorescents ou des ampoules, ladite armature étant équipée d'une grille de protection légère constituée de réflecteurs latéraux (1), de réflecteurs d'extrémité (2) et d'ailettes transversales ou lamelles (6) se prolongeant entre lesdits réflecteurs latéraux (1), lesdites ailettes ou lamelles (6) ayant des surfaces réfléchissantes incurvées et pouvant être également plates (7, 8. 9).

caractérisé en ce que lesdites ailettes transversales (6) sont agencées deux par deux, en paires, où les ailettes individuelles (6), dans une paire, sont fabriquées d'une façon symétrique, inversées réciproquement par rapport à un plan (13) perpendiculaire à l'axe (14) du tube fluorescent, et la distance entre deux ailettes individuelles (6), dans une paire, est plus faible que la distance d'une ailette individuelle à l'ailette individuelle la plus proche dans une paire adjacente, les distances entre les ailettes étant mesurées suivant une direction parallèle à l'axe du tube et à n'importe quel niveau le long de la direction de la longueur principale des sections transversales des ailettes.

2. Moyen d'armature selon la revendication 1, caractérisé en ce que chaque ailette individuelle (6) est formée comme une plaque sensiblement fine et plate, cependant incurvée et structurée en ce qui concerne l'épaisseur, avec deux côtés principaux (7, 8/9)

3. Moyen d'armature selon la revendication 2, caractérisé en ce que les deux côtés principaux (7, 8/9) d'une ailette individuelle (6) ont différentes natures de courbure.

4. Moyen d'armature selon la revendication 3, caractérisé en ce que ce côté principal (7), qui pour la paire en question est un côté extérieur, a une courbure concave et bidimensionnelle d'une extrémité à l'autre de sa longueur complète dans une direction perpendiculaire au tube fluorescent ou aux tubes fluorescents (4), comme on le voit dans cette coupe transversale à travers ladite ailette (6) qui contient également un axe de tube fluorescent (14) et est dressée verticalement quand le tube fluorescent (4) est placé horizontalement, lequel côté extérieur est formé uniformément dans le sens de la vue pour ladite coupe transversale.

5. Moyen d'armature selon la revendication 4, caractérisé en ce que ce côté principal (8/9), qui pour la paire en question est un côté intérieur, est divisé en deux surfaces (8, 9), où une surface (8), la plus proche du tube fluorescent, suit sensiblement la courbure du côté extérieur (7) et est, ou incurvée de façon convexe et déviant légèrement de celui-ci, ou pratiquement plate, et ou une surface (9) la plus éloignée du tube fluorescent a une courbure concave depuis un bord de transition (12) marqué de façon aiguë, vers le bord d'ailette individuelle (11) qui est le plus éloigné dudit tube fluorescent.

6. Moyen d'armature selon la revendication 5, caractérisé en ce que ladite surface (9), la plus éloignée du tube fluorescent a une courbure du mème type que le côté extérieur (7) d'une ailette individuelle, cependant avec un rayon de courbure réduit, ou des rayons de courbure réduits.

7. Moyen d'armature selon la revendication 6, caractérisé en ce que les dimensions géométriques sont choisies de telle manière que les figures en forme de trapèze apparaissant à ladite coupe transversale quand leur ligne de délimitation est constituée par

   a) Les deux surfaces (9) les plus éloignées du tube fluorescent et, sur les intérieurs des ailettes individuelles (6) d'une paire d'ailettes, la ligne de raccordement imaginaire parallèle au tube fluorescent et entre les deux bords de transition de surfaces (12) dans la paire, et la ligne de raccordement imaginaire parallèle au tube fluorescent et entre les deux bords (11) des ailettes individuelles (6) les plus éloignées du tube fluorescent,
   et
   (b) les deux côtés extérieurs (7) des ailettes se faisant face l'une à l'autre pour deux paires adjacentes d'ailettes, la ligne de raccordement imaginaire parallèle au tube fluorescent et entre les bords d'ailettes correspondants (10) les plus proches du tube fluorescent, et la ligne de raccordement imaginaire entre les bords d'ailettes correspondants (11) les plus éloignés du tube fluorescent,

   sont des figures géométriques similaires avec un rapport de dimensions prédéterminé.

8. Moyen d'armature selon l'une quelconque des revendications précédentes caractérisé en ce que les surfaces réfléchissantes incurvées (7, 9) ont un type de courbure parabolique.

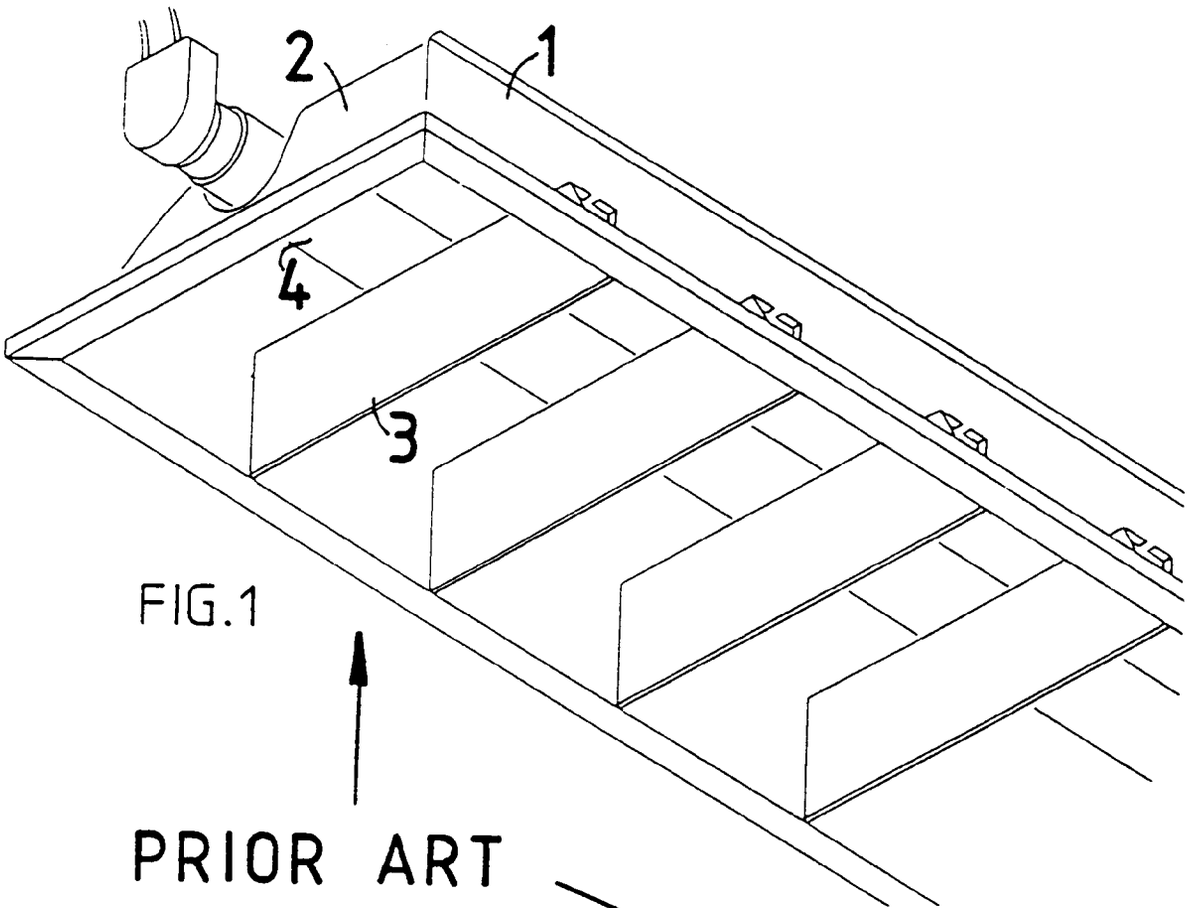

FIG.1

PRIOR ART

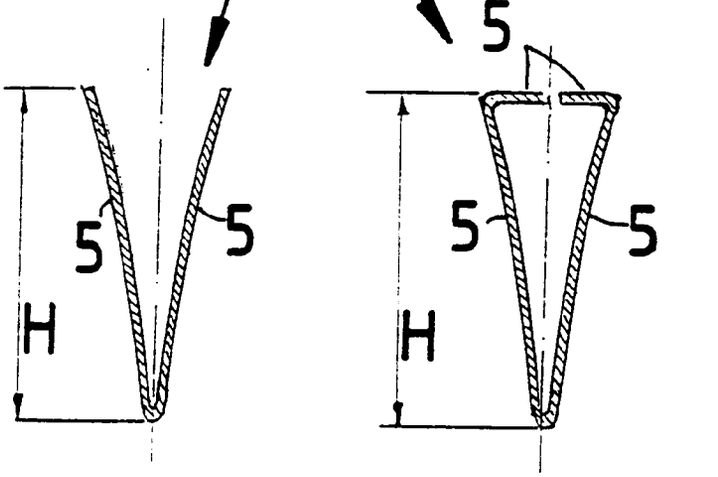

FIG.2

FIG.3

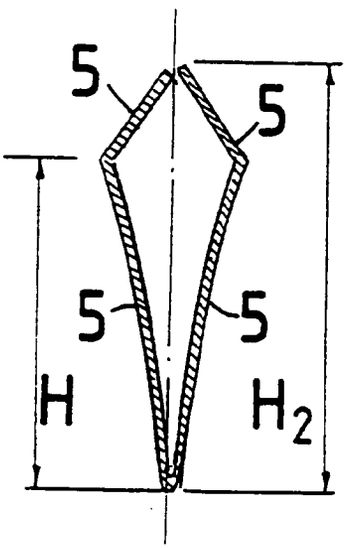

FIG.4

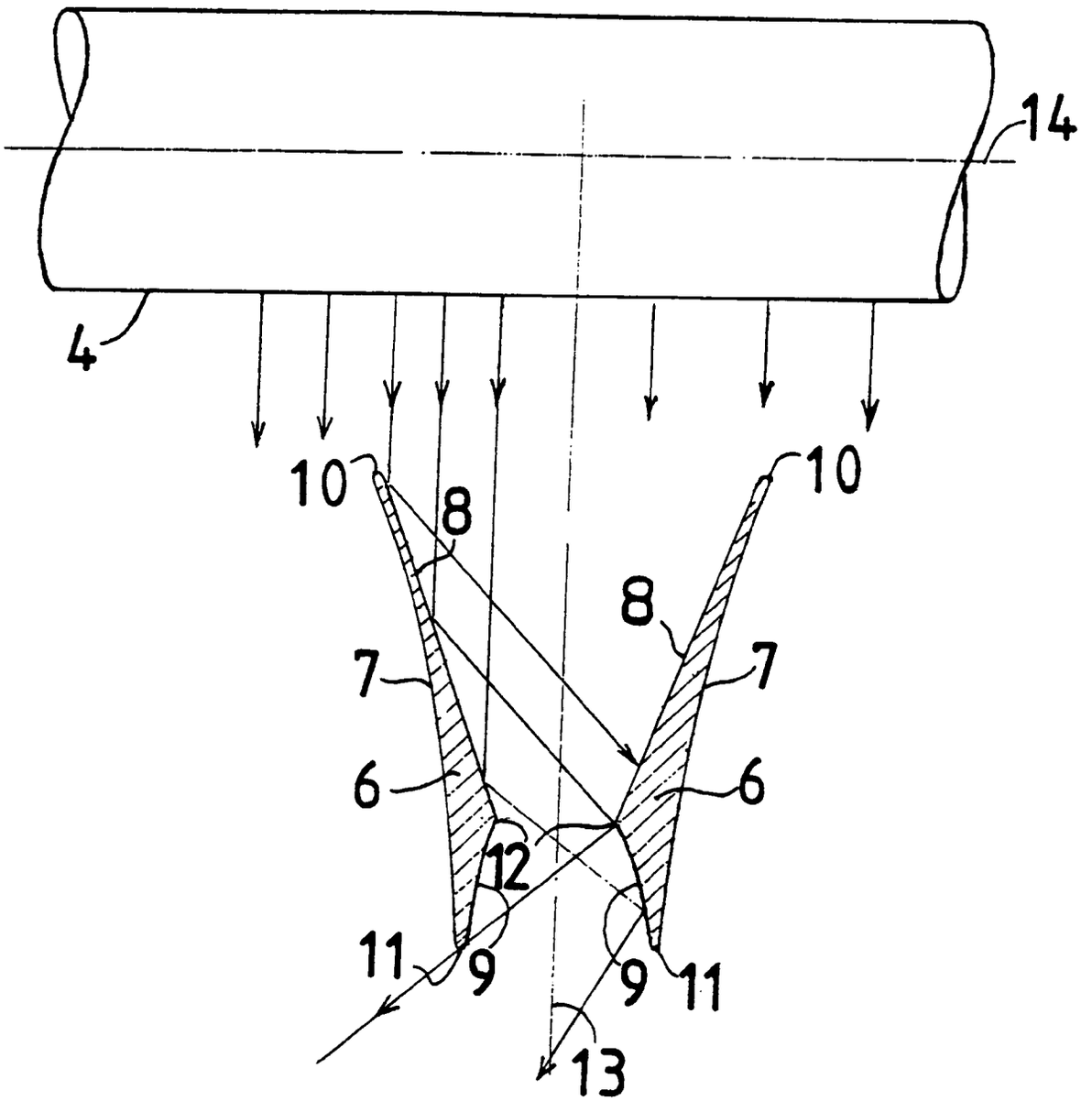

FIG. 5

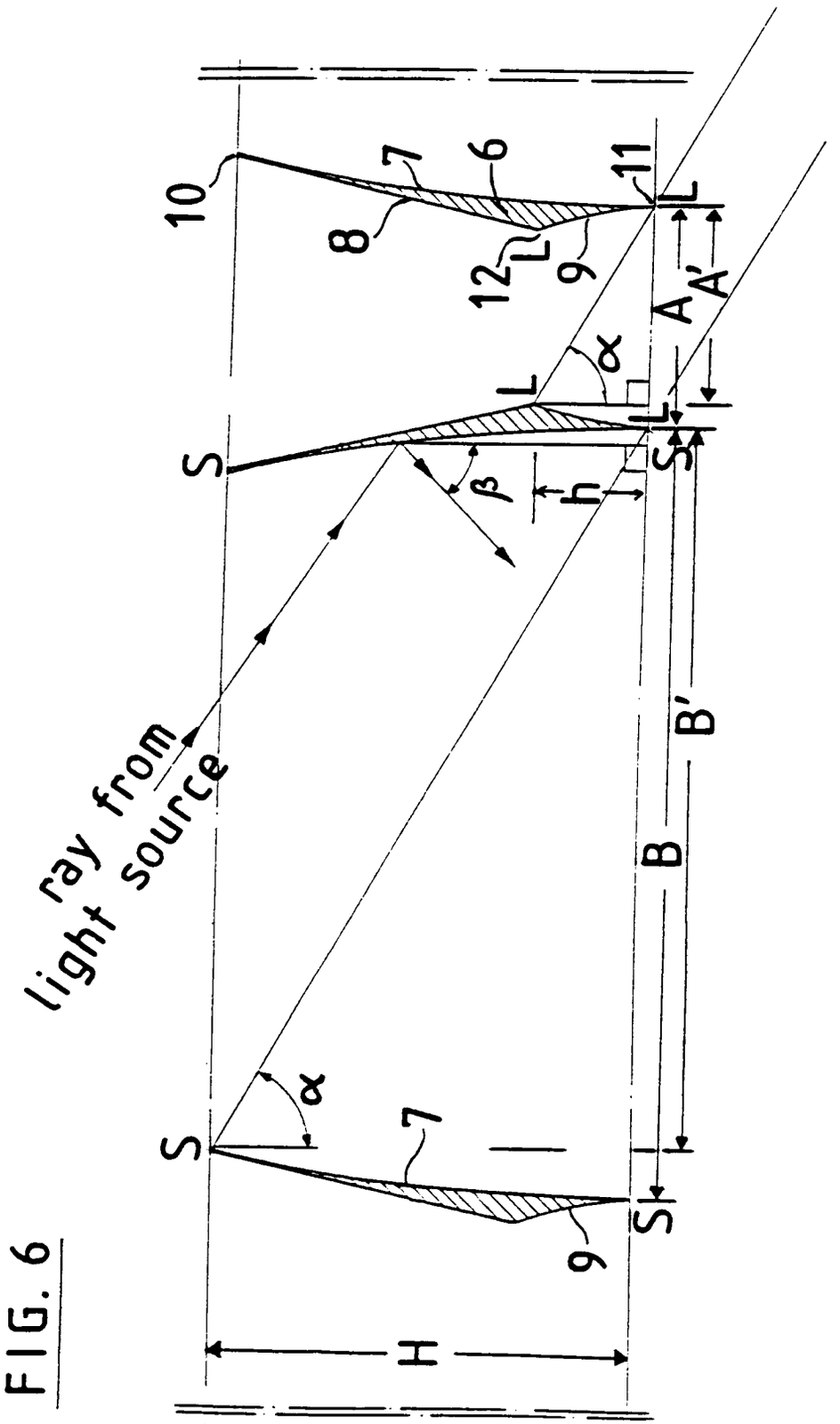

FIG. 6