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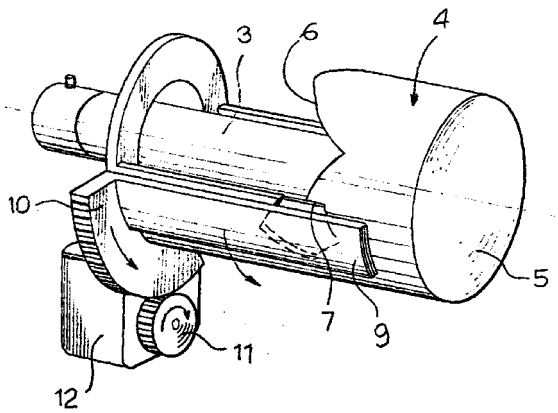
(54) Adaptive head-lamp for motor-vehicles

(57) An adaptive headlamp for motor vehicles comprises a reflector (2) associated to a light source (3), for example a discharge lamp, which is surrounded by a hood-like element (4) presenting one or more openings, the position and configuration of which is calculated in such a way as to generate, in combination with a pre-determined geometry of the reflector (2), which is also calculated for this purpose, a light beam issuing from the headlamp which has a pre-determined basic pattern. Mounted in a mobile manner around the hood (4) is a shutter (9) designed to cover and uncover at least some of the aforesaid openings (7, 8) of the hood (4) selectively in such a way as to illuminate selected areas of the reflector and thus generate an overall pattern which is different for each condition of use.

Fig_3



EP 1 054 211 A2

Description

[0001] The present invention relates to headlamps for motor vehicles, of the type comprising a light source and a reflector associated to said source.

[0002] In particular, the invention regards a headlamp of the adaptive type, i.e., designed to generate as output a light beam, the pattern of which can be varied according to the driving conditions of the vehicle (steering angle, speed, etc.), the environmental and lighting conditions, as well as to the type of road.

[0003] The purpose of the present invention is to provide an adaptive headlamp which on the one hand makes it possible to obtain an optimal beam pattern in any condition of use and on the other presents a relatively simple structure, with very reduced overall dimensions and a relatively low cost.

[0004] In order to achieve the above purpose, the subject of the invention is a headlamp of the type specified above, characterized in that the light source is surrounded by a hood-like element presenting one or more openings, the position and configuration of which is calculated in such a way as to generate, in combination with a pre-determined geometry of the reflector, which is also calculated for this purpose, a light beam issuing from the headlamp which has a pre-determined basic pattern, and in that mounted in a mobile manner around the hood is a shutter designed to cover and uncover at least some of the aforesaid openings of the hood selectively in such a way as to illuminate selected areas of the reflector and thus generate an overall beam pattern which is different for each condition of use.

[0005] In a preferred embodiment, motor means are provided for controlling displacement of the shutter, and electronic means for controlling the aforesaid motor means, which receive signals from sensing means, such as means for detecting the driving conditions of the motor vehicle and/or the environmental conditions, and which control the motor means according to said signals. The aforementioned sensing means may comprise one or more sensors chosen from among a steering-angle sensor, a speed sensor, an environmental-lighting sensor, a GPS receiver, or else a visible-light and infrared-light telecamera situated on board the motor vehicle and designed to record the environmental conditions and the conditions of the road along which the motor vehicle is travelling.

[0006] Alternatively, the aforesaid motor means may be controlled directly by the person driving the motor vehicle.

[0007] The invention will now be described with reference to the attached drawings, which are provided purely as non-limiting examples, and in which:

Figure 1 is a schematic perspective view of an embodiment of the headlamp according to the invention in a first operating condition;

Figure 2 is another perspective view of the headlamp of Figure 1 in a second operating condition;

Figure 3 is a perspective view at an enlarged scale of the lamp, with the corresponding hood and mobile shutter, set at the centre of the headlamp illustrated in Figures 1 and 2;

Figure 4 is a development on a plane of the surface of the hood illustrated in Figure 3; and

Figures 5 and 6 illustrate light patterns that can be obtained with the headlamp according to the invention in two different operating conditions.

[0008] With reference to the drawings, the reference number 1 designates, as a whole, an adaptive headlamp for motor vehicles, comprising a reflector 2 and a light source 3, which in the example illustrated consists of a D2S-type discharge lamp with a relatively elongated bulb. As may be clearly seen in Figure 3, the lamp 3 is surrounded by a hood 4 which, in the example illustrated, has a cylindrical shape with its axis substantially coinciding with the axis of the lamp 3. The hood 4 can of course have any different conformation, for example it can be shaped like a cone. In the example illustrated, as may be clearly deduced also from the plane development shown in Figure 4, the hood 4 has an end wall 5 which prevents direct emission of light rays along the axis of the lamp 3, and a side wall which presents slits or openings 6, 7, 8, the position and configuration of which is calculated in such a way as to generate, in combination with a pre-determined geometry of the headlamp 2, which is also calculated for this purpose, a light beam issuing from the headlamp that has a pre-determined basic pattern, such as the one illustrated tin Figure 5.

[0009] Set around the hood 4, in such a way as it is free to move, is a shutter 9 designed to cover and uncover the opening 7 located in the bottom half of the hood 4 selectively, so as to illuminate a selected area of the headlamp 2 and thus generate an overall pattern which is different for each condition of use.

[0010] In the particular example illustrated, the shutter 9 consists of a flattened and elongated arm which projects in cantilever fashion from a toothed sector 10 that meshes with an actuating pinion 11 driven by an electric motor 12. Figures 1 and 2 show the headlamp in two different operating conditions, corresponding to two different positions of the shutter 9.

[0011] In the preferred embodiment, the device according to the invention is pre-arranged for creating light beams with different conformations in the presence of the following different driving conditions: out-of-town driving, high-speed driving, curving, and town driving. The condition of out-of-town driving is considered as a basic condition corresponding to the diagram illustrated in Figure 5. Additional light beams are superimposed on this basic configuration, the said additional light beams being obtained by displacement of the shutter in order to improve visibility whenever so required in the driving conditions referred to above.

[0012] The diagram of Figure 5 illustrates the isolux lines on a projection of the beam on a screen set at a distance of 25 metres from the headlamp. The distribution of illuminance illustrated in Figure 5 enables a good vision of the obstacles, during driving, up to a distance of approximately 60 metres and has at the same time a good angular aperture. This condition corresponds to the operating condition illustrated in Figure 1, in which the area of the reflector that is not illuminated is hatched.

[0013] In order to increase the depth of vision in the condition of high-speed driving, it is necessary to add light in the central region of the pattern, where already in the basic beam of Figure 5 there is maximum illuminance, so as to obtain the pattern illustrated in Figure 6. The increased light is combined with the effect of a movement of the entire headlamp through approximately 0.5° in the vertical direction, which can be obtained by means of any system of known type for moving the headlamp. In this way, a good vision is obtained of obstacles up to distances of approximately 100 metres.

[0014] During curving, it is necessary to add light at the ends of the beam, i. e., in horizontal angular positions of +35° and ?35°. This is obtained by appropriately displacing the shutter 9.

[0015] In the case where a discharge lamp is used, the shape of the hood 4 is designed so as to reduce spurious beams that are generated on account of reflections inside the quartz bulb that create undesired dazzling effects on the resulting beam. The amount of light emitted by the source in proportion to the flux necessary for obtaining a beam suitable for out-of-town driving makes it possible to use only one half of the flux emitted by the source, and to shut off the remaining part. As has been said, a slit 6 is therefore provided that extends over the entire top half of the hood 4. This opening contributes to forming the basic beam, and in particular the asymmetric part of the pattern of Figure 5 above the horizontal axis, whilst the opening 7 is closed in the basic-beam condition and is opened independently to add the amount of light necessary in the various driving conditions.

[0016] The added light is directed to the correct position (central for high-speed driving, or to the right or left when curving), using a pre-determined calculated geometry of the reflector 2. In particular, the reflector 2 is designed in such a way as to supply an asymmetric distribution of the light pattern without having to resort to the use of a diaphragm. The principle on which the reflector is based is that of using two portions, a top one 2a and a bottom one 2b, which have two distinct focuses set in the vicinity of the ends of the discharge arc of the lamp 3. Control over the horizontal divergence is carried out on a reference curve lying in a plane containing the horizontal axis itself, whilst vertical control of divergence of the beam is obtained by using sections of ellipsoids having one focus in one of the two main points close to the source and the other on a curve in the space passing through the aforementioned reference curve.

[0017] In order to use a single motor for moving the shutter 9, the right-hand curving and left-hand curving conditions are obtained on two distinct headlamps: the right-hand headlamp of the vehicle contributes to the creation of the condition of curving to the right, whilst the left-hand headlamp contributes to the creation of the condition of curving to the left. The high-speed driving condition is instead obtained using both headlamps or proportionally favouring the right-hand one with respect to the left-hand one, or vice versa, as required.

[0018] Of course, without prejudice to the principle of the invention, the details of construction and the embodiments may vary widely with respect to what is described and illustrated herein purely for the purpose of providing an example, without thereby departing from the sphere of the present invention.

Claims

1. An adaptive headlamp for motor vehicles, comprising a light source (3) and a reflector (2) associated to the light source (3), characterized in that the light source (3) is surrounded by a hood-like element (4) presenting one or more openings (6, 7, 8), the position and configuration of which is calculated in such a way as to generate, in combination with a pre-determined geometry of the reflector (2), which is also calculated for this purpose, a light beam issuing from the headlamp which has a pre-determined basic pattern, and in that mounted in a mobile manner around the hood (4) is a shutter (9) designed to cover and uncover the aforesaid openings (7, 8) of the hood (4) selectively in such a way as to illuminate selected areas of the reflector (2) and thus generate an overall pattern which is different for each condition of use.

2. A headlamp according to Claim 1, characterized in that the aforesaid hood element (4) has a main opening (6) which is permanently open to generate a basic pattern corresponding to an out-of-town driving condition, said shutter (9) being mobile to cover and uncover selectively further openings (7, 8) so as to generate additional beams that are thus added to the basic beam so as to create a total beam corresponding to each particular driving condition.

3. A headlamp according to Claim 1, characterized in that motor means (12) are provided for controlling displacement of the shutter, and electronic means for controlling said motor means (12), said electronic means receiving signals from sensing means, such as means detecting the driving conditions of the motor vehicle and/or environmental conditions, and controlling the motor means

according to said signals.

4. A headlamp according to Claim 3, characterized in that the aforesaid sensor means comprise one or more sensors chosen from among a sensor of the steering angle of the motor vehicle, a speed sensor, an environmental-lighting sensor, and a GPS receiver.

5. A headlamp according to Claim 3, characterized in that the aforesaid sensor means also comprise a visible-light or infrared-light telecamera located on board the motor vehicle and designed to record the environmental conditions and the conditions of the road along which the motor vehicle is travelling.

6. A headlamp according to any one of the foregoing claims, characterized in that the reflector (2) presents two portions (2a, 2b), which have two distinct focuses set in the vicinity of the ends of the lamp (3), said lamp (3) having an elongated configuration along the axis of the headlamp.

7. A headlamp according to Claim 6, characterized in that said sections (2a, 2b) of the reflector have vertical sections corresponding to ellipsoids.

Fig_1

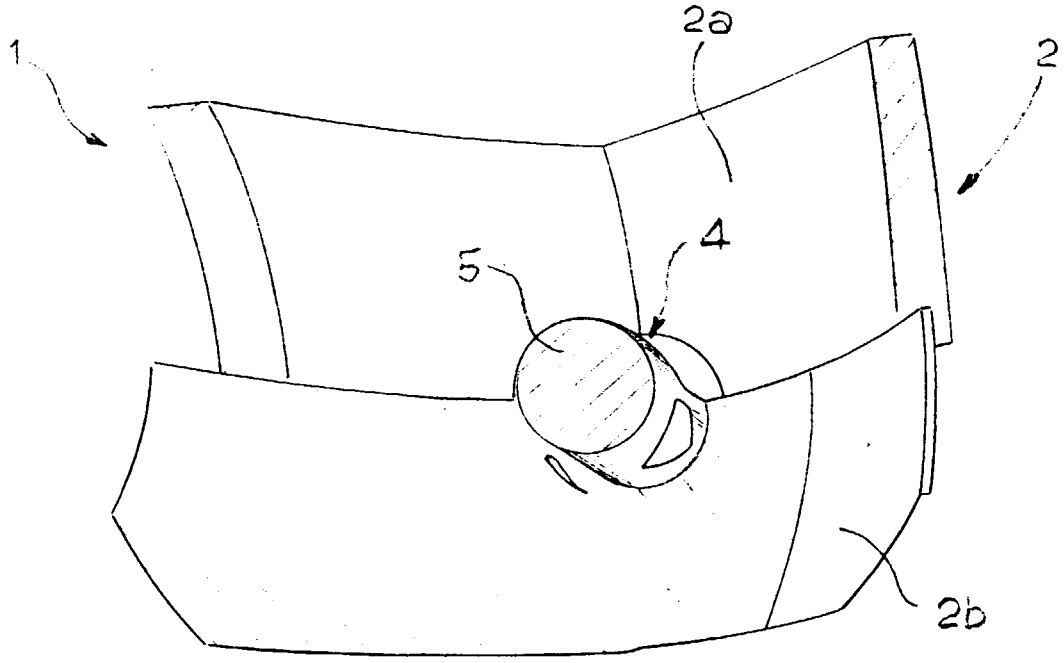


Fig_2

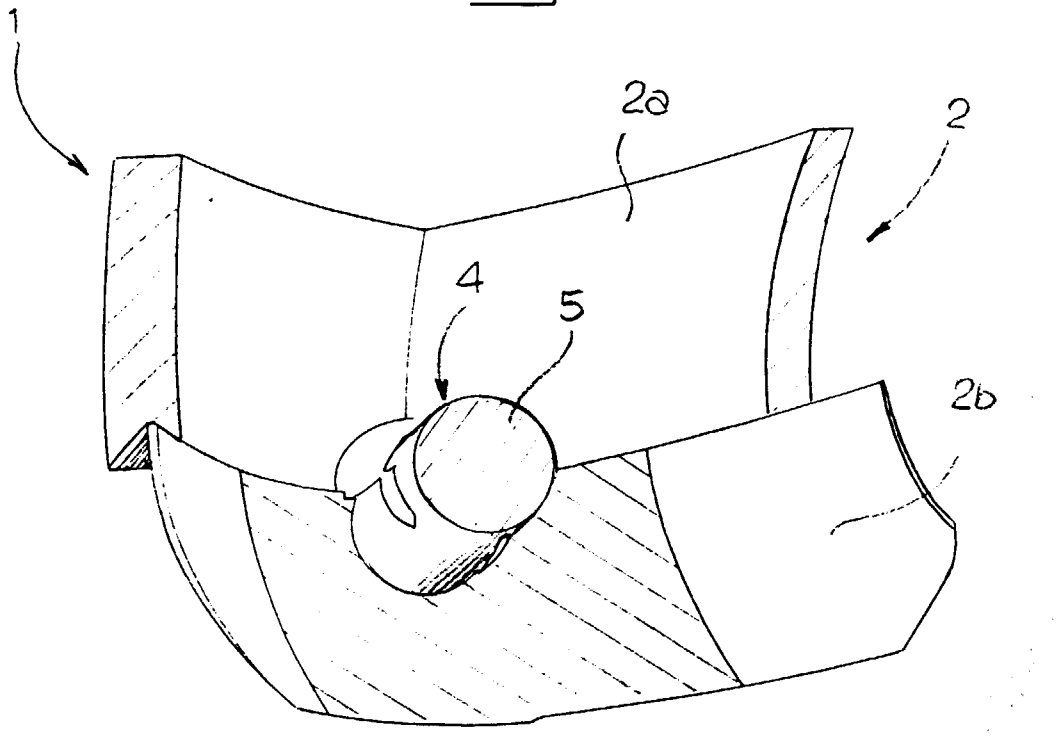


Fig_3

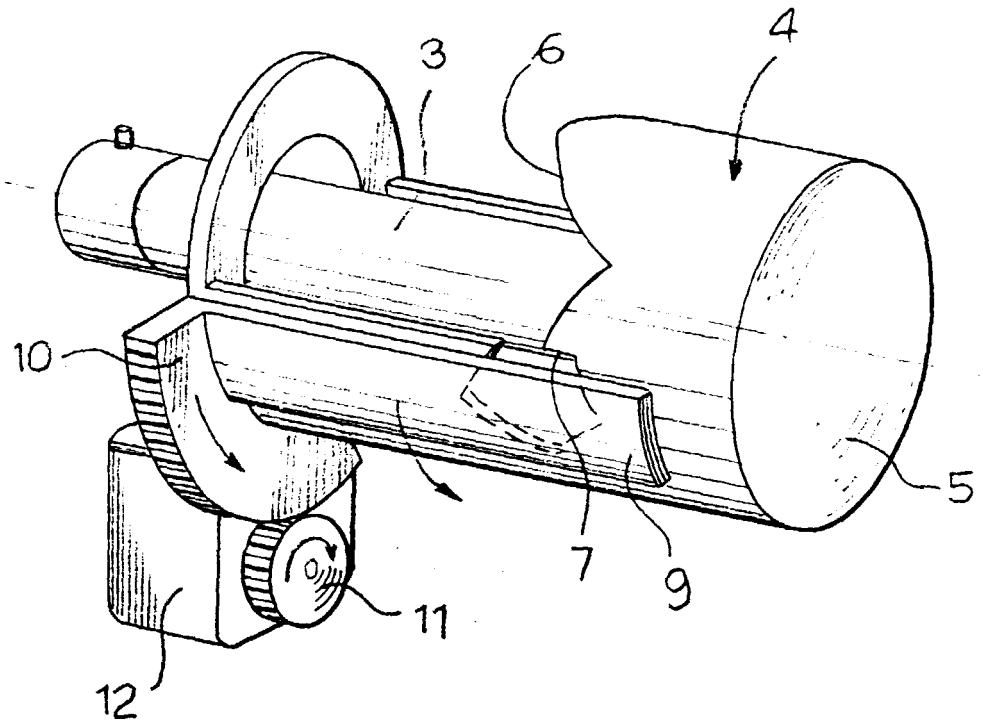


Fig_4

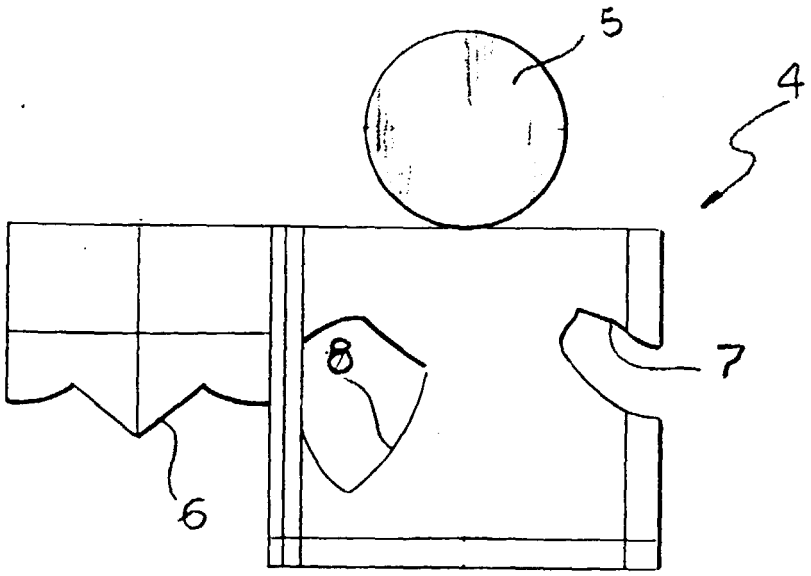
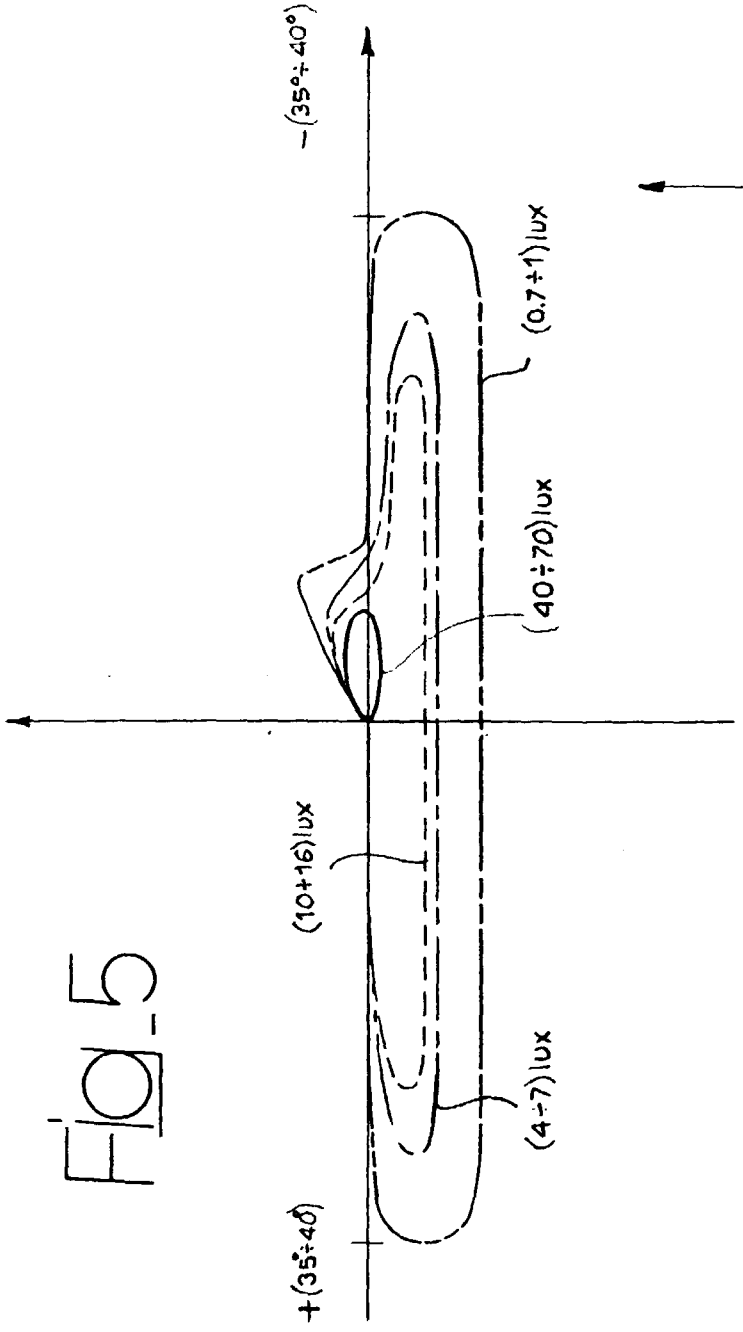


Fig_5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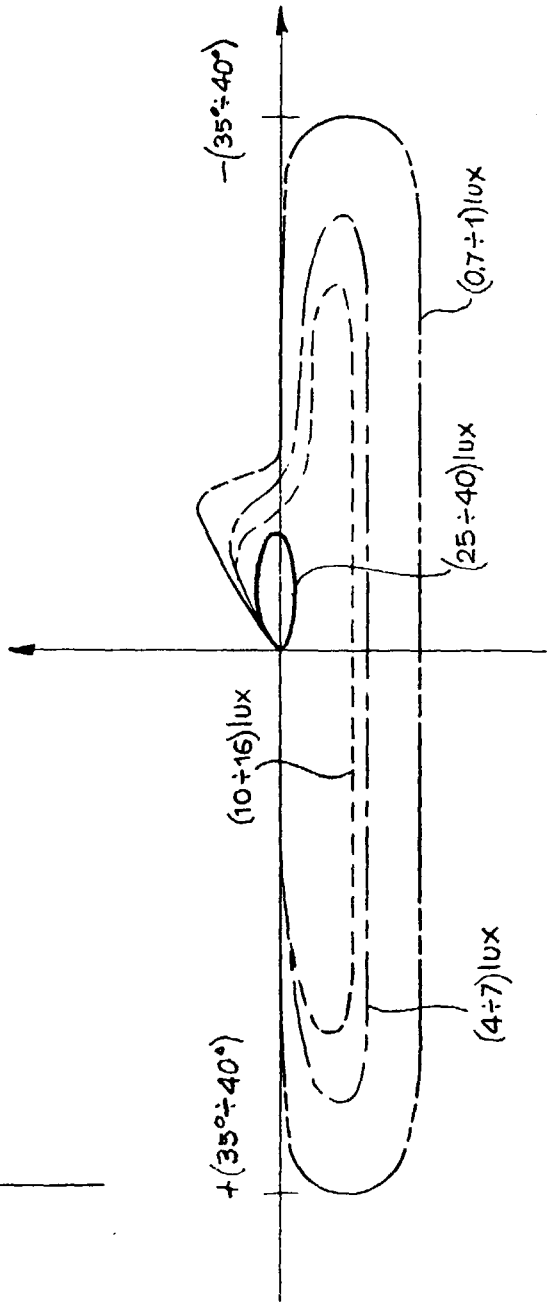
(10÷16)lux
(4÷7)lux
+(35°÷40°)

Fig_6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