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(54) **Motor-vehicle adaptive head-lamp having a central adjustable diaphragm**

Adaptiver Kraftfahrzeug-Scheinwerfer mit einer verstellbaren, zentralen Blende

Projecteur adaptif pour véhicule automobile avec un cache central ajustable

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## Description

**[0001]** The present invention relates to motor-vehicle head-lamps, of the type indicated in the pre-characterizing portion of claim 1. A head-lamp of this type is known from DE-A-196 42 467.

**[0002]** In particular, the invention relates to an adaptive type head-lamp, i.e. a head-lamp adapted to generate an output light beam whose pattern can be varied as a function of the travel conditions of the motor-vehicle (steering angle, speed, etc.) and the environment and light conditions, as well as the road conditions.

**[0003]** The object of the present invention is that of providing an adaptive head-lamp which on one hand provides an optimized pattern in any condition of use, and on the other hand has a relatively simple structure, with a very reduced bulk and a relatively low cost.

**[0004]** In view of achieving this object, the invention provides a head-lamp having the features of claim 1.

**[0005]** Preferably the above mentioned central area where the diaphragm is located is slightly offset downwardly, below the horizontal line passing through the centre of the reflector.

**[0006]** According to a further feature of the invention, motor means are provided for driving movement of diaphragm between its fully closed position and its fully opened position and electronic control means for controlling said motor means are also provided, which receive signals from sensor means for sensing the travel and environment conditions and control the motor means as a function of said signals.

**[0007]** The above mentioned sensor means may comprise for instance a sensor of the motor-vehicle steering angle, a speed sensor, a light sensor, a GPS receiver, or also a video camera located on board the vehicle having the function of monitoring both the environment conditions and the conditions of the road on which the motor-vehicle travels.

**[0008]** In the preferred embodiment of the invention, the light source is constituted by a discharge lamp, such as of the D2S of D2R type. The transparent element is preferably a totally transparent element, with no lenses or prisms.

**[0009]** In the above mentioned preferred embodiment, the diaphragm is constituted by a substantially rectangular element made of a metal sheet which can be wound or bent.

**[0010]** Further features and advantages of the invention will become apparent from the description which follows with reference to the annexed drawings, given purely by way of non limiting example, in which:

figure 1 is a cross-sectional of diagrammatic view of a head-lamp according to the invention,
figure 2 is a front-view of the head-lamp of figure 1,
figures 3, 3A, 3B, 3C, 3D show different embodiments of the diaphragm forming part of the head-lamp according to the invention,
figure 4 is a block diagram which shows the principle of operation of the diaphragm,
and figure 5 is a diagram showing the various light patterns which can be obtained by the head-lamp according to the invention.

**[0011]** With reference to the drawings, numeral 1 generally designates a motor-vehicle head-lamp, comprising a reflector 2 associated with a light source 3, preferably a discharge lamp, such as of the type marketed under the codes D2S or D2R. A transparent element 4 which is totally transparent, i. e. has no lenses or prisms, is located at the front of the reflector 2. In the example shown, the reflector 2 has two planar walls 5, located at the top and at the bottom, having absorbing features. The materials chosen for reflector 2 and transparent element 4 may be those which are used traditionally in the head-lamps of this type.

**[0012]** Between the transparent element 4 and the reflector 2 there is placed a diaphragm 6 which can be adjusted continuously between a fully closed position (shown in figure 2 and the left-hand part of figure 3) and a fully opened position (shown in the right-hand part of figure 3). When diaphragm 6 is in the fully closed condition, it occupies an area corresponding to a substantially central area of the reflector 2, as shown in figure 2. The reflector 2 has an annular area 2a surrounding said central area and having a surface which is shaped so as to generate a light beam coming out of the head-lamp having a basic predetermined pattern, of the "low beam" type.

**[0013]** Figure 5 shows the pattern which can be obtained with the head-lamp according to the invention in a plane orthogonal to the optical axis of the head-lamp located at a distance of 25 meters therefrom. In this figure, axes H and V respectively designate the horizontal and vertical directions, whereas the various lines indicate the profiles of the area illuminated by the head-lamp in the different conditions of use. The basic beam generated by the annular area 2a of reflector 2 is that which gives rise to the pattern designated by line B, of the "low beam" or "cross-beam" type, having features defined by the regulations or more specifically by the car manufacturers.

**[0014]** In the embodiment shown in the drawings, the diaphragm 6 is constituted by a curtain - like element having a substantially rectangular shape, which can be wound on one side (figure 3) or bent in various manners (see the variants of figures 3A, 3B, 3C, 3D). The movement of the diaphragm 6 is controlled by an electric motor which is not shown in figure 3, but is designated by 7 in the block diagram of figure 4. The details of construction of the electric motor controlling the diaphragm 6 and the way by which it is mounted within the head-lamp are not shown herein, since they can be provided in any known way, and since the deletion of these details from the drawings renders the latter simpler and easier to understand. With reference to figure 4, the electric

motor 7 which controls the diaphragm 6 is controlled by an electronic control unit 8 which receives a plurality of signals 9 from sensor means sensing the travel and environment conditions of the motor-vehicle.

**[0015]** Also with reference to figure 1, in front of the diaphragm 6, i. e. between the diaphragm 6 and the transparent element 4 (or alternatively at the rear of the diaphragm) there is located an optical element 10 defining a series of lens sectors which are "uncovered" and thus activated, as a function of the opening degree of the diaphragm 6. When the diaphragm 6 is fully closed, none of these sectors is active, so that the head-lamp only generates the basic pattern B of figure 5. When the diaphragm is opened, the lens sectors of the element 10 are progressively activated to give rise to a number of additional light beams which added to the basic pattern give rise to an overall light beam coming out of the head-lamp having the more appropriate features for any condition of use.

**[0016]** Thus, for example, with reference to figure 5, in the case of activation for driving in town, the basic pattern B is added with two distinct areas C, as shown in the figure. For driving out of town, the two areas D are activated, whereas pattern E is generated for driving on a highway. If desired, the elevated illumination pattern F can be generated, for example for reading elevated street signals. The area G is activated instead when a glaring beam has to be obtained. Areas L and R are activated for illuminating the road in a curve to the left or the right, respectively, whereas the sum of the two areas L and R is activated when an anti-fog illumination is wished.

**[0017]** In an embodiment of the device according to the invention, the head-lamp had a dimension of 130 mm in the vertical direction and 112 mm in the horizontal direction, with a diaphragm which in the fully closed condition occupied an area of 36 mm (horizontally) x 30 mm (vertically). In a variant, the diaphragm 6 had an elliptical section of 38 mm x 32 mm and in another variant a circular section with a radius of 36 mm.

**[0018]** As already indicated in the foregoing, the signals 9 sent to the electronic control unit 8 may come from sensors of various type, such as a sensor of the motor-vehicle steering angle, a speed sensor, a GPS receiver, and sensors of the environment and light conditions. Additionally or alternatively, a video camera may be used, located on board the motor-vehicle and adapted to the detect both the environment conditions and the conditions of the road on which the motor-vehicle travels.

**[0019]** Naturally, while the principle of the invention remains the same, the details of construction and the embodiments may widely vary with respect to what has been described and illustrated purely by way of example, without departing from the scope of the present invention.

**[0020]** In particular, it is possible to provide for many diaphragms adapted to cooperate with each other in order to "uncover" and thus activate any portion of the optical element 10.

## Claims

1. Motor-vehicle head-lamp, comprising a light source (3), a reflector (2) associated with the source (3), and a transparent element (4) located in front of the reflector (2), wherein:

   - between the reflector (2) and the transparent element (4) there is located at least one diaphragm (6), and
   - in front or at the rear of the diaphragm (6) there is located an optical element (10), said head-lamp being **characterized in that**:

   - said diaphragm (6) can be adjusted between a fully opened position and a fully closed position,
   - said diaphragm (6) occupies an area corresponding to a substantially central area of the reflector (2) in the fully closed position of said diaphragm (6),
   - said reflector (2) has an annular area, surrounding said central area, having a surface which is shaped so as to generate a light beam coming out of the head-lamp having a predetermined basic pattern B, and
   - said optical element (10) is constituted by a plurality of lens sectors which are uncovered in a variable manner as a function of the opening degree of the diaphragm (6) and are shaped so that they give rise to a plurality of additional light beams, which may be selected by means of the diaphragm (6) so as to generate an overall pattern which is different for each condition of use.

2. Head-lamp according to claim 1, **characterized in that** motor means (7) are provided for driving movement of the diaphragm (6) between its fully closed position and its fully opened position, and electronic control means (8) are provided for controlling said motor means (7), said control means (8) for receiving signals (9) from said sensor means of the motor-vehicle travel conditions and the environment conditions and controlling said motor means (7) as a function of said signals.

3. Head-lamp according to claim 2, **characterized in that** said sensor means comprises one or more sensors chosen among: a sensor of the motor-vehicle steering angle, a speed sensor, a sensor of environment light, a GPS receiver.

4. Head-lamp according to claim 2, **characterized in that** said sensor means comprises a video camera located on board the motor-vehicle and adapted to

detect the environment conditions and the conditions of the road on which the motor-vehicle travel.

5. Head-lamp according to claim 1, **characterized in that** said transparent element (4) has a totally transparent surface having no prisms or lenses.

6. Head-lamp according to claim 1, **characterized in that** said diaphragm (6) is made by at least one sheet element having a substantially rectangular shape which can be wound or bent.

7. Head-lamp according to claim 1, **characterized in that** said diaphragm (6) is shaped so as to selectively activate any portion of said optical element in each partially opened condition thereof.

**Patentansprüche**

1. Kraftfahrzeug-Scheinwerfer, aufweisend eine Lichtquelle (3), einen Reflektor (2), der Quelle (3) zugeordnet, und ein transparentes Element (4), angeordnet vor dem Reflektor (2), wobei:

   - zwischen dem Reflektor (2) und dem transparenten Element (4) dort zumindest eine Blende (6) angeordnet ist, und
   - vor oder hinter der Blende (6) dort ein optisches Element (10) angeordnet ist,

   wobei der Scheinwerfer **dadurch gekennzeichnet ist, dass**

   - die Blende (6) zwischen einer völlig geöffneten Stellung und einer völlig geschlossenen Stellung eingestellt werden kann,
   - die Blende (6) eine Fläche einnimmt, welche einer im Wesentlichen zentralen Fläche des Reflektors (2) in der völlig geschlossenen Position der Blende (6) entspricht,
   - der Reflektor (2) eine kreisförmige Fläche aufweist, welche die zentrale Fläche umgibt, welche eine Oberfläche aufweist, die so geschnitten ist, um einen Lichtstrahl zu erzeugen, der aus dem Scheinwerfer kommt, der ein vorbestimmtes Basismuster B aufweist, und
   - das optische Element (10) zusammengesetzt ist aus einer Mehrzahl von Linsenabschnitten, welche in veränderbarer Art und Weise als Funktion des Öffnungsgrades der Blende (6) freigegeben sind, und die so geformt sind, dass sie zu einer Mehrzahl von zusätzlichen Lichtstrahlen führen, die durch die Blende (6) ausgewählt werden können, um so ein Gesamtmuster zu erzeugen, welches für jeden Benutzungszustand unterschiedlich ist.

2. Scheinwerfer nach Anspruch 1, **dadurch gekennzeichnet, dass** Motormittel (7) vorgesehen sind zur antreibenden Bewegung der Blende (6) zwischen ihrer völlig geschlossenen Position und ihrer völlig geöffneten Position, und elektronische Steuermittel (8) vorgesehen sind zur Steuerung der Motormittel (7), wobei die Steuermittel (8) vorgesehen sind zum Empfangen von Signalen (9) von den Sensormitteln der Fahrzeugfortbewegungsbedingungen und der Umweltbedingungen, und die Motormittel (7) als Funktion dieser Signale steuern.

3. Scheinwerfer nach Anspruch 2, **dadurch gekennzeichnet, dass** die Sensormittel einen oder mehrere Sensoren aufweisen, ausgewählt aus: einem Sensor für den Kraftfahrzeugsteuerwinkel, einem Geschwindigkeitssensor, einem Sensor für Umgebungslicht, einem GPS-Empfänger.

4. Scheinwerfer nach Anspruch 2, **dadurch gekennzeichnet, dass** die Sensormittel eine Videokamera aufweisen, angeordnet an Bord des Kraftfahrzeugs und angepasst, um die Umweltbedingungen und die Straßenbedingungen zu detektieren, auf welcher sich das Fahrzeug fortbewegt.

5. Scheinwerfer nach Anspruch 1, **dadurch gekennzeichnet, dass** das transparente Element (4) eine vollständig transparente Oberfläche aufweist, welche keine Prismen oder Linsen aufweist.

6. Scheinwerfer nach Anspruch 1, **dadurch gekennzeichnet, dass** die Blende (6) aus zumindest einem Blattelement gemacht ist, welches eine im Wesentlichen rechteckige Form aufweist, die gewunden oder gekrümmt sein kann.

7. Scheinwerfer nach Anspruch 1, **dadurch gekennzeichnet, dass** die Blende (6) so geformt ist, um selektiv irgendeinen Teil des optischen Elements in jedem teilweise geöffneten Zustand davon selektiv zu aktivieren.

**Revendications**

1. Phare pour véhicule automobile, comprenant une source de lumière (3), un réflecteur (2) associé à la source (3), et un élément transparent (4) situé devant le réflecteur (2), et dans lequel :

   - au moins un diaphragme (6) est placé entre le réflecteur (2) et l'élément transparent (4) ; et
   - un élément optique (10) est placé devant ou derrière le diaphragme (6),

   ledit phare étant **caractérisé en ce que** :

- ledit diaphragme (6) peut être réglé entre une position complètement ouverte et une position complètement fermée,
- ledit diaphragme (6) occupe une zone correspondant à une zone sensiblement centrale du réflecteur (2), dans la position complètement fermée dudit diaphragme (6),
- ledit réflecteur (2) présente une zone annulaire, entourant ladite zone centrale et ayant une surface qui est conformée de manière à produire un faisceau lumineux, qui sort du phare avec une forme prédéterminée de base B du rayonnement, et
- ledit élément optique (10) est constitué par une pluralité de secteurs dé lentille, qui sont découverts de manière variable en fonction du degré d'ouverture du diaphragme (6) et qui sont conformés de façon à pouvoir engendrer une pluralité de faisceaux lumineux supplémentaires, qui peuvent être sélectionnés au moyen du diaphragme (6) afin de produire une forme globale de rayonnement, qui est différente pour chaque condition d'utilisation.

**2.** Phare selon la revendication 1, **caractérisé en ce qu'**il est prévu des moyens formant moteur (7) pour commander le mouvement du diaphragme (6) entre sa position complètement fermée et sa position complètement ouverte, et **en ce que** des moyens de commande électronique (8) sont prévus pour commander lesdits moyens formant moteur (7), lesdits moyens de commande (8) recevant des signaux (9) provenant de moyens de détection des conditions de déplacement du véhicule automobile et des conditions ambiantes, et commandant lesdits moyens formant moteur (7) en fonction desdits signaux.

**3.** Phare selon la revendication 2, **caractérisé en ce que** lesdits moyens de détection comprennent un ou plusieurs capteurs, choisis parmi : un capteur d'angle de braquage du véhicule automobile, un capteur de vitesse, un capteur de lumière ambiante, un récepteur GPS.

**4.** Phare selon la revendication 2, **caractérisé en ce que** lesdits moyens de détection comprennent une caméra vidéo, placée à bord du véhicule automobile et propre à détecter les conditions ambiantes et l'état de la route sur laquelle roule le véhicule automobile.

**5.** Phare selon la revendication 1, **caractérisé en ce que** ledit élément transparent (4) présente une surface totalement transparente, sans prismes ni lentilles.

**6.** Phare selon la revendication 1, **caractérisé en ce que** ledit diaphragme (6) consiste en au moins un élément en feuille, présentant une forme sensiblement rectangulaire, et qui peut être enroulé ou plié.

**7.** Phare selon la revendication 1, **caractérisé en ce que** ledit diaphragme (6) est conformé de manière à mettre sélectivement en fonction une partie quelconque dudit élément optique, dans chacun de ses états partiellement ouverts.

FIG. 2

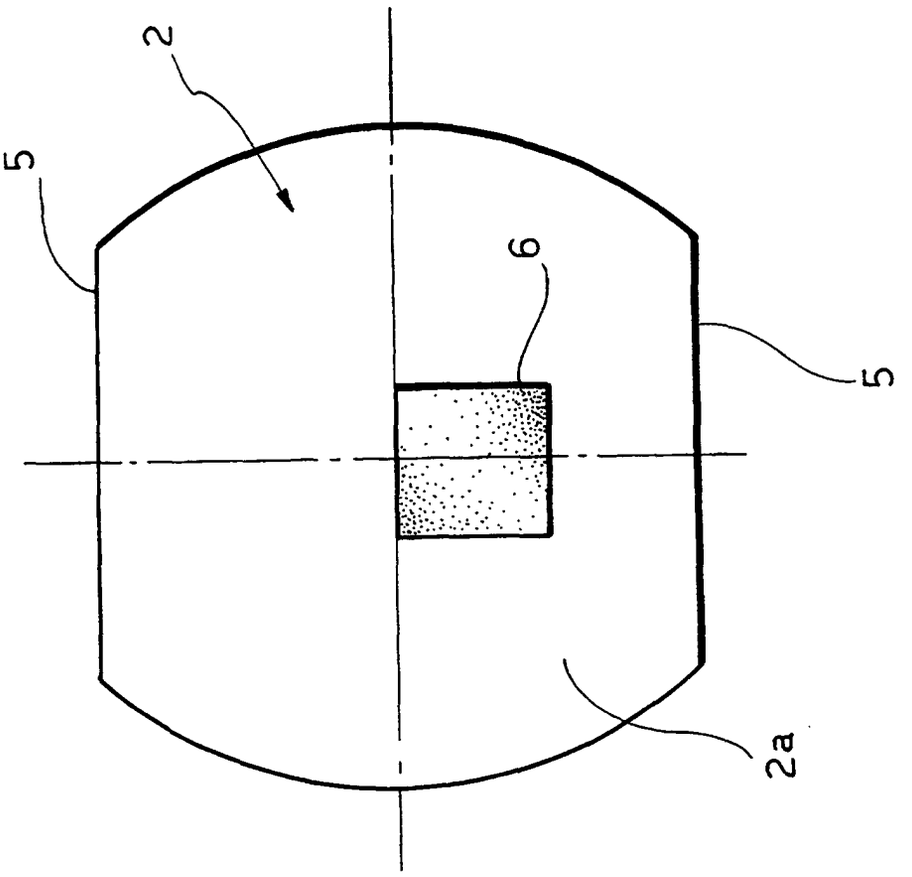



FIG. 1

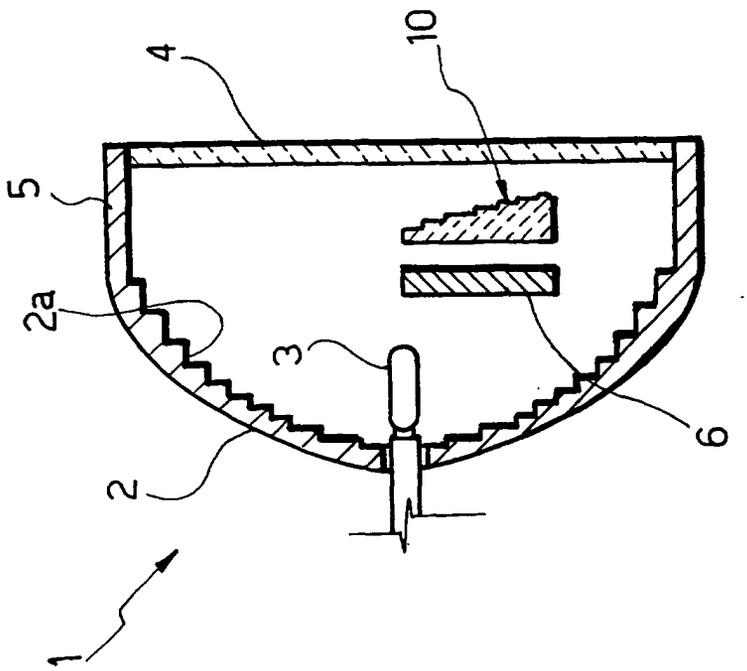


FIG. 3

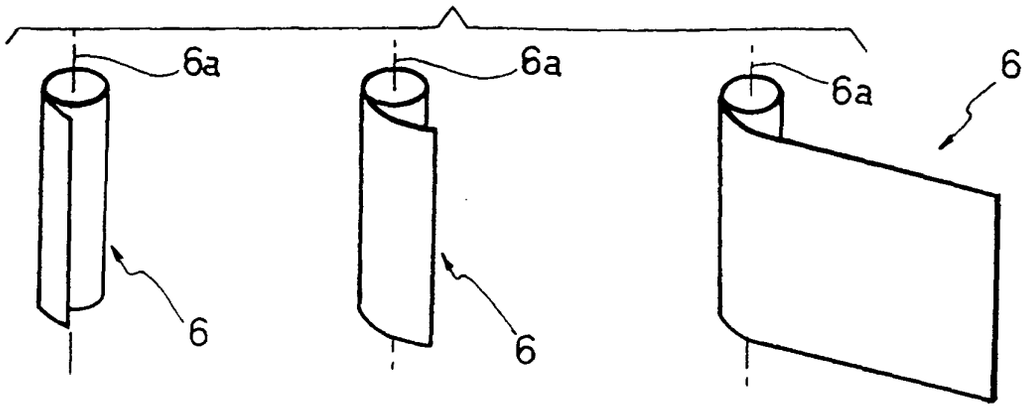
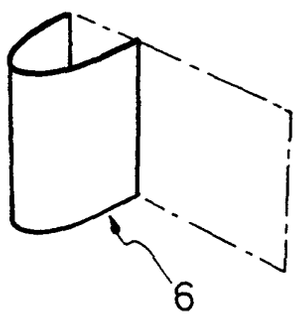



FIG. 3A

FIG. 3B



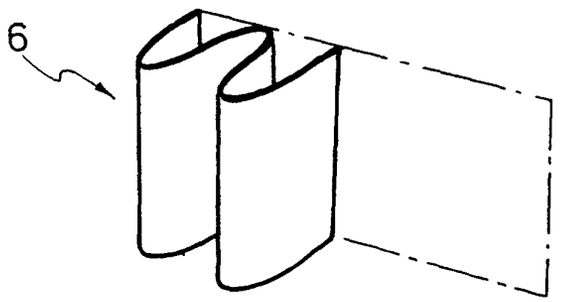
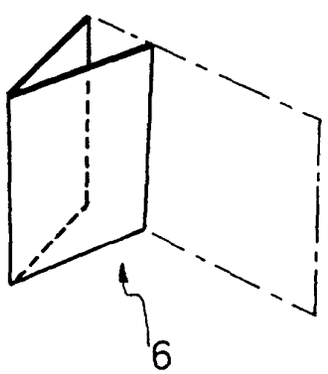




FIG. 3C

FIG. 3D



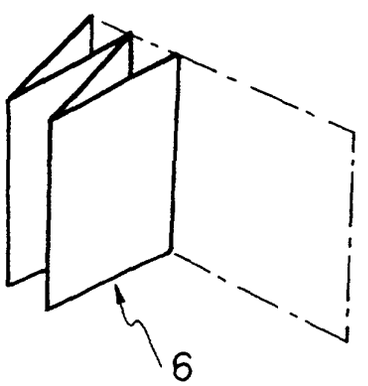




FIG. 4

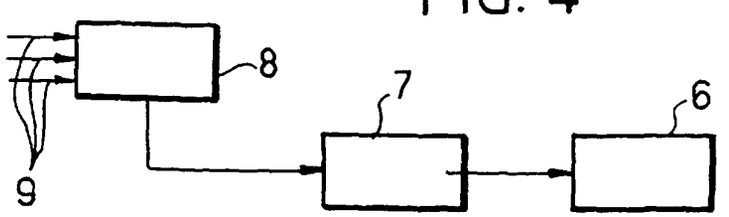


FIG. 5