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(71) Applicant: **MAGNETI MARELLI U.K. Ltd.**
Staffordshire WS11 3LP (GB)

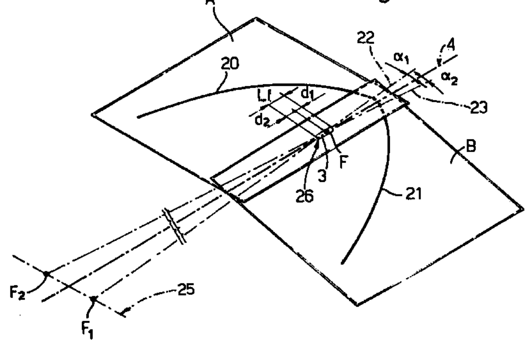
(72) Inventor: **Fray, William Simon**
Shelfield, Walsall (GB)

(74) Representative: **Plebani, Rinaldo et al**
c/o Studio Torta,
Via Viotti 9
I-10121 Torino (IT)

(54) Vehicle headlight with a complex-surface reflector

(57) A headlight including a light source (3) and a reflector (5), and wherein the reflector (5) collects the source-emitted light over 360° about the source (3) to emit a beam concentrated entirely below the cutoff line (2). The reflector (5) presents a complex reflecting surface including four sectors (10,11,12,13), a first pair (10,11) of which is located on one side of the optical axis (4), and a second pair (12,13) of which is located on the opposite side. The surfaces of the sectors in each pair are connected continuously to each other at respective half planes (A,B) extending through the optical axis (4) and arranged according to the cutoff line (2), form a respective branch of an ellipse (20,21) at each half plane (A,B), and are defined over at least 75% of their angular extension by the envelope of arcs (33,34,35,36) having centers (C_1,C_2,C_3,C_4) offset on either side of the optical axis (4). The source (3) is defined by a filament centered on the optical axis (4) but off-centered axially in relation to a first focal point (F) common to the ellipse branches (20,21).

Fig. 2



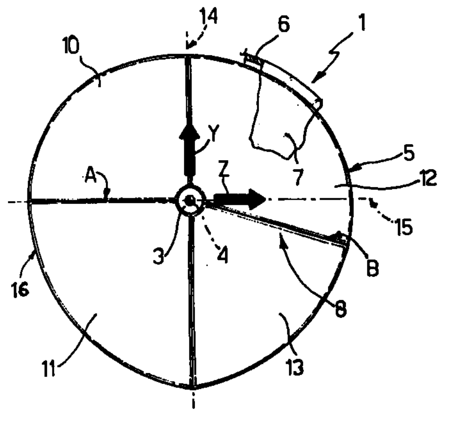


Fig.1

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Description

The present invention relates to a road vehicle headlight, in particular a lower beam, featuring a complex-surface reflector in conjunction with a prism optical system.

By law, vehicle lower beam and/or fog lights must concentrate the beam below an ideal so-called cutoff line to avoid dazzling motorists traveling in the opposite direction. French Patent n. 2.536.502, for example, relates to a road vehicle lower beam headlight comprising a body housing a reflector and a light source, and a prism lens in front of the reflector and closing the body. As opposed to the usual single, e.g. parabolic or elliptical, reflecting surface of revolution, the reflector is defined by a complex surface formed by the continuous connection of various types of reflecting surfaces defined by various equations. More specifically, the complex surface described in French Patent n. 2.536.502 comprises two parabolic surface portions arranged at the regulation cutoff line angle; and two portions of a surface not of revolution, described by a mathematical equation and which, on the one hand, connects the two parabolic portions and, on the other, in conjunction with the lens prisms of the light, provides for collecting and distributing the source-emitted beam over 360° about the source.

Unlike previously known headlights, wherein the cutoff line was achieved by means of a dimming screen for preventing reflection of part of the rays emitted by the source, the lower beam light according to French Patent n. 2.536.502 provides for exploiting all the light emitted by the source, thus enabling the use of low-power lamps (and so reducing consumption and heating) or smaller reflectors for a given brightness of the beam. On the other hand, however, it fails to provide for optimum distribution of the beam. As stated in German Patent n. DE-B-3341773, which represents the German counterpart of French Patent n. 2.536.502, for sufficiently defining the cutoff line, all the reflected images must be projected on the 25 m reference screen with an upper angle flush with the cutoff line, which, on the one hand, prevents the light from being concentrated where it is most needed for increasing visibility, i.e. below the cutoff line and in the center, and, on the other, requires highly prismed lenses, whereas, for reasons of style, the majority of headlights for last-generation vehicles present steeply inclined lenses in which highly prismed portions are difficult to form.

In the known state of the art, no solution has yet been devised for solving the above drawbacks, not even using reflectors with discontinuous surfaces which, as is known, seriously impair lighting performance at the point of discontinuity.

It is an object of the present invention to provide a vehicle headlight featuring a reflector designed to overcome the aforementioned drawbacks and defined by a complex surface ensuring optimum distribution of the reflected beam while at the same time exploiting the source-emitted light over 360° about the source.

According to the present invention, there is provided a vehicle headlight for generating a lower or fog light beam concentrated entirely beneath the cutoff line for preventing glare; the headlight comprising a light source and a reflector, and being of the type wherein the reflector collects the source-emitted light over 360° about the source; characterized in that the reflector presents a complex reflecting surface comprising four sectors, a first pair of which is located on one side of the optical axis, and a second pair of which is located on the opposite side; the surfaces of the sectors in each pair being connected to each other continuously at respective half planes extending through the optical axis and arranged according to the cutoff line; said surfaces being defined in section, at each half plane, by a respective branch of an ellipse, and being defined, over at least 75% of their angular extension, measured from said half planes towards the vertical plane, by the envelope of arcs having centers aligned with said half planes, and offset on either side of the optical axis.

The light source is off-centered axially in relation to the focal point of the headlight, which is defined by a first focal point common to both said ellipse branches and located along the optical axis, close to the reflector; a second focal point of each ellipse branch being located roughly 25 m from the reflector. More specifically, the light source is defined by a single filament substantially aligned with but slightly above the optical axis, and with its lower side coincident with the optical axis. Roughly 25% of the length of the filament extends behind the focal point of the headlight, towards the reflector, and the remaining roughly 75% of its length extends on the opposite side, frontwards of the focal point of the headlight; said values varying within a maximum tolerance of roughly 5% of the length of the filament.

As such, continuous connection of the surfaces of the sectors above and below the half planes defining the cutoff line is automatically ensured, and the optical system of the reflector is such that the beams reflected by the surface portions of the sectors close to the vertical plane are always entirely below the cutoff line.

The present invention therefore provides for producing headlights wherein the surfaces of the reflector sectors are defined over 100% of their angular extension by said arcs, and wherein, at the vertical plane, the reflector presents a step at the connection of the sectors below the half planes and at the connection of the sectors above the half planes; which discontinuity, however, in no way impairs performance of the headlight by virtue of the distorted rays being projected well below the cutoff line.

Similarly, the present invention also provides for producing headlights with an entirely smooth reflector - which is easier to mold - wherein the remaining 25% of the angular extension of the sector surfaces is formed by connecting curves between the arcs defining the adjacent sectors above and below the half planes. In this case also, the distorted images obviously generated by said 25% of the sector surfaces are well below the cutoff line and, despite contributing light, therefore have practically no effect on the definition of the beam.

The axes of said two ellipse branches preferably do not coincide with the optical axis of the headlight, but extend through it at said first focal point common to both branches and, in the respective half planes, are oppositely inclined in relation to the common focal point by an angle ranging between 0.5° and 2°, so that the second focal points of the two ellipse branches are separated by a predetermined distance perpendicular to the optical axis.

This results, at a distance of 25 m, in blurring of the beam at the cutoff line and hence in a reduction of the amount of light to be controlled for preventing glare.

A non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawings, in which:

- Figure 1 shows a schematic front view of a headlight in accordance with the present invention;
- Figure 2 shows a schematic view in perspective of a first characteristic of the Figure 1 headlight;
- Figure 3 shows the effect of the Figure 2 characteristic on the images of the filament projected on a screen 25 m from the headlight;
- Figures 4 to 6 show, schematically, the method for producing the headlight according to the present invention;
- Figure 7 shows a schematic front view of a reflector produced using the method shown in Figures 4 to 6;
- Figure 8 shows a variation of the Figure 7 reflector;
- Figures 9 to 12 show isolux test curves relative to the sectors of the Figure 1 headlight.

With reference to Figures 1 to 3, number 1 indicates a headlight for generating a lower or a fog light beam which, as is known, must be concentrated entirely below a cutoff line 2 (Figure 3) to avoid dazzling motorists traveling in the opposite direction. The non-limiting example described shows a European cutoff line 2 for lower beam headlights, defined by two lines 2a, 2b, the second inclined at 15° in relation to the first.

Headlight 1 comprises a light source 3 consisting of a spiral filament of an incandescent lamp, parallel to the optical axis 4 of headlight 1; a reflector 5; a casing 6 housing reflector 5 and source 3; and a prism lens 7 opposite reflector 5 and closing casing 6. As opposed to an appropriately shaped dimming screen, which is dispensed with, cutoff line 2 is defined by the particular light distribution effected by reflector 5, the reflecting surface 8 of which, facing lens 7, collects the source-emitted light over all 360° about source 3 and projects all the reflected images of filament 3 below cutoff line 2.

For this purpose, reflecting surface 8 is a complex surface, i.e. comprising a number of sectors defined by surfaces (reflecting or deflecting) with different optical characteristics as compared with those of the adjacent sector surfaces. In the example shown, surface 8 comprises four sectors 10, 11, 12, 13. When viewed from the front (Figure 1), sectors 10 and 11 are arranged one over the other, on one side of optical axis 4 and to the left of a vertical plane 14 through axis 4; and sectors 12 and 13 are arranged one over the other on the opposite side, i.e. to the right of plane 14. With reference to axes Z and Y indicated by the arrows in Figure 1 and lying respectively in a horizontal plane 15 and vertical plane 14 (shown by the dotted lines in Figure 1), the reflecting surfaces of sectors 10 and 11 are automatically connected (as will be seen) continuously at a respective half plane A through optical axis 4 and, in the example shown, coincident with horizontal plane 15.

Similarly, sectors 12 and 13 are defined by respective reflecting surfaces which are connected continuously at a half plane B also through axis 4 and at an angle to half plane A. According to the present invention, half planes A and B present the same configuration as the required cutoff line 2, so that, in the case of the lower beam described, half plane B forms and angle of fifteen degrees in relation to half plane A. The following description, however, obviously also applies to headlights with a cutoff line of any other configuration; and, though reflector 5 in the non-limiting example shown presents a curved peripheral edge 16, the following description obviously also applies to headlights featuring reflectors 5 of any shape and contour.

According to the present invention (Figure 2), the surfaces of sectors 10 and 11 are defined in section, at half plane A, by an ellipse branch 20 common to both surfaces; and the surfaces of sectors 12 and 13 are defined in section, at half plane B, by a respective ellipse branch 21 also common to both surfaces. In other words, if the reflector according to the present invention is cut along the two half planes A and B, the contour of the section will correspond geometrically to ellipse branches 20 and 21.

Moreover, the surfaces of sectors 10, 11 and 12, 13 are so formed that ellipses 20 and 21 are defined by a first, common, focal point F close to reflector 5, e.g. roughly 25 mm from surface 8, and by a second focal point, indicated F1 for ellipse 20 and F2 for ellipse 21, located roughly 25 m from surface 8, i.e. substantially at a standard regulation vehicle headlight test screen. According to a further characteristic of the present invention, shown in Figure 2, the respective axes 22 and 23 of branches 20 and 21 do not coincide with optical axis 4 but intersect it at common focal point F, and, in respective half planes A and B, are oppositely inclined in relation to axis 4 by respective angles α_1 and α_2 generally equal to each other and at any rate ranging between 0.5° and 2°.

Consequently, as opposed to being coincident (Figure 3a) if angles α were equal to zero, the second focal points F1 and F2 of ellipse branches 20 and 21 (Figure 3) are separated by a predetermined distance perpendicular to optical axis 4 at a screen 25 m away and indicated 25 in Figure 2. This provides for projecting the images of filament 3 on to the screen as shown schematically in Figure 3b as opposed to Figure 3a, thus reducing the amount of light at the intersection of portions 2a and 2b of cutoff line 2 to be controlled for preventing glare

According to the present invention, the common focal point F of ellipses 20 and 21 is assumed as the (virtual) focal point of headlight 1, and the source defined by filament 3 is off-centered axially in relation to focal point F. More specifically (Figure 2), filament 3, which presents a length Lf, is substantially aligned parallel to but slightly above optical axis 4, with its axis offset radially by a distance equal to half its diameter, so that its lower side 26 is coincident with optical axis 4, as previously claimed and described in the U.K. patent Application No. 25310/76 in the name of LUCAS Ind.. A portion d_1 of filament 3, equal to roughly 25% of its length Lf, extends behind focal point F of headlight 1, towards reflector 5; and a portion d_2, equal to the remaining roughly 75% of its length Lf, extends on the opposite side, in front of focal point F. To ensure correct operation of reflector 5, the above location values of source 3 in relation to axis 4 and focal point F must be respected accurately, when assembling headlight 1, within a maximum tolerance of 5% of length Lf.

According to the main characteristic of the present invention, the surfaces of sectors 10, 11 and 12, 13 are defined, over at least 75% of their angular extension measured from half planes A and B towards vertical plane 14, by the envelope of arcs all having their centers in a plane aligned coplanar with one of half planes A and B, and offset by a predetermined amount on either side of optical axis 4.

More specifically, and as shown more clearly later on, the centers C_1 and C_4 (Figure 7) of the arcs whose envelope defines the surfaces of diagonally-opposed sectors 10 and 13 respectively above and below half planes A and B, as well as the centers C_2 and C_3 (Figure 7) of the arcs whose envelope defines the surfaces of sectors 11 and 12 opposite sectors 10 and 13, are located at a distance from optical axis 4, measured parallel to respective half plane A or B, equal to the geometric difference (in modulus and sign) of the coordinates of the points of respective ellipse branch 20 or 21 defined at respective half plane A or B, and the location of the corresponding points of a respective (fictitious) ellipse branch 30 (Figure 4) or 31 (Figure 6) located in vertical plane 14 respectively above and below optical axis 4, and so located as to be respectively converging or diverging in relation to the location of focal point F.

As shown in Figure 7, a first possible embodiment of reflector 5 for a headlight 1 according to the invention presents, at vertical plane 14, steps 35 and 36 respectively connecting adjacent upper sectors 10, 12, and corresponding lower sectors 11, 13; in which case, the surfaces of sectors 10, 11 and 12, 13 are defined over 100% of their angular extension by said arcs. As will be seen, steps 35 and 36 are formed as a result of the "construction" method adopted for the surfaces of reflector 5, do not constitute a serious drawback from the construction standpoint, and, according to the present invention, in no way constitute an optical drawback in that, by virtue of the steps being aligned coplanar with the fictitious ellipses 30 and 31 used, as will be seen, for forming surface 8, the images projected by them are located at the lower limit of the images projected by reflector 5.

In the embodiment shown in Figures 1 and 8, on the other hand, the surfaces of adjacent sectors 10, 12 and 11, 13 are connected continuously also at vertical plane 14, so that steps 35 and 36 are absent. As will be seen, this is achieved by the arc envelope forming only roughly 75% of the angular extension of the surfaces of the adjacent sectors, the remaining roughly 25% of the surface of sectors 10 and 11 being formed by the envelope of specific curves (one of which is indicated as 41 in Figure 8) connecting the arcs at the same location along optical axis 4, to define the adjacent sectors above and below half planes A and B, i.e. by the envelope of the curves respectively connecting the adjacent portions of sectors 10, 12 and 11, 13.

As regards actual construction, the method for obtaining the surfaces forming the sectors of reflector 5 is based on preliminary computer-aided design (CAD) and, successively, on transferring the designs, complete with all the dimensions calculated point by point, directly to chip-forming production machines (CIM) for producing dies of suitable material with which reflector 5 is injection molded from plastic (or drawn from sheet metal) in conventional manner.

Using an innovative method which is also an object of the present invention, the first step in the formation of surface 8 of reflector 5 comprises arbitrarily establishing an optical axis and a focal point along the optical axis about which to construct "in reverse" the required surface. According to the invention, the fictitious optical axis selected is axis 4 which is the one extending along the lower edge 26 of the filament of the light source 3 used, e.g. an incandescent lamp of given power; and the fictitious focal point F selected is a point along axis 4, located roughly 1/4 (±5%) of the way along the length Lf of the filament, as of the end facing reflector 5. At this point, after establishing half planes A and B with the same orientation as the required cutoff line 2, two ellipses 20 and 21 (Figure 2) are drawn in half planes A and B, with the first, common, focal point at F and the second focal point at a distance of 25 m. Ellipses 20 and 21 are preferably so drawn as to present noncoincident axes 22 and 23 inclined slightly in relation to axis 4.

The above geometric characteristics mathematically define ellipses 20 and 21 which may be expressed by an equation defining the single points of the ellipses within the three-dimensional Y, Z, X reference system, wherein optical axis 4 is selected as the X axis (Figures 4, 5 and 6). At this point (Figure 4), a further two ellipses 30 and 31 are defined in vertical plane 14, but which, unlike ellipses 20 and 21, do not actually form part of surface 8 and are merely a fictitious mathematical construction for calculation purposes. According to the invention, ellipses 30 and 31 are defined with the second focal point (the one furthest away from reflector 5) at a distance of 25 m along axis 4, i.e. at the test screen, and with the respective first focal points so located along axis 4 that all the points of ellipse 30 produce converging reflections of the rays from source 3, and all the points of ellipse 31 produce diverging reflections. This is achieved mathematically by determining the first focal points of ellipses 30 and 31 according to the following formulas:

$$Fc = [\ (Fl/4) + (FT/2)\ ] * C \text{ and} \qquad (I)$$

$$Fd = [\ (Fl*3/4) + (FT/2)\ ] * C \text{ where:} \qquad (II)$$

Fc is the location along axis 4 of the converging focal point from point F, i.e. the first focal point of ellipse 30; Fd is the location along axis 4 of the diverging focal point from point F, i.e. the first focal point of ellipse 31; Fl is the axial length of filament 3; FT is the maximum fabrication tolerance of filament 3; and C is a constant expressed as a percentage and depending on the fabrication tolerances of reflector 5. With a roughly 3 mm long filament and focal point F located 25 mm from surface 8, the axial position of focal points Fc and Fd (focal length) will be 22.8 mm and 28.2 mm respectively.

At this point, the surface of each sector 10, 11, 12, 13 is defined mathematically. Commencing, for example, with the surface of sector 10 (Figure 4), there is defined, for each Xn coordinate along axis 4, a respective circle 33 with a radius Rn and a center C1n at coordinates Xn and Yn, where:

$$Yn = \text{ordinate of } C1n = (\ Y1n - Y4n) \text{ and} \qquad (III)$$

$$Rn = Y4n \text{ where:} \qquad (IV)$$

Y1n is the ordinate (on the Z axis, taken with its sign, which is negative in the case in point, with reference to the versus shown for axis Z) of a point of ellipse 20 corresponding to abscissa Xn; and Y4n is the corresponding ordinate of the corresponding point of abscissa Xn on ellipse 30, taken with the same sign of the ordinate Y1n. Circumference 33 is drawn from half plane A, i.e. from the point of ellipse 20 at coordinate Y1n, to the vertical plane, i.e. over an arc greater than 90°, in that, in relation to axis 4 at which the Xn coordinates are measured, C1n is offset laterally by quantity Yn which in this case, calculating the algebraic sum, is negative (i.e. shifted to the left of axis 4 looking towards reflector 5) and represents the eccentricity of circumference 33 in relation to axis 4. The envelope of all the circumferences 33 defined for each point Xn obviously defines a surface constituting the reflecting surface of sector 10 and which, though not obtained by revolution or translation of a base curve, is nevertheless derived from ellipse 30. As only straightforward mathematical operations are involved, a CAD system is obviously capable of rapidly drafting the surface of sector 10 point by point to supply the dimensions required for its fabrication.

The surfaces of the other sectors are also drafted by computer (CAD) implementing, via software, algorithms similar to that described above. More specifically (Figure 5), to define the surface of sector 11 below sector 10, use is again made of ellipse 20 in half plane A on the sector 10, 11 side, but, as sector 11 is located below axis 4, diverging ellipse 31 with focal point Fd is used in place of ellipse 30. In this case also, therefore, for each point of abscissa Xn along axis 4, a circle is defined with a radius Rn and a center C3n at coordinates Xn and Yn, where:

$$Yn = \text{ordinate of } C3n = (\ Y1n - Y3n) \text{ and} \qquad (V)$$

$$Rn = Y3n \text{ where:} \qquad (VI)$$

Y1n is the ordinate (on the Z axis) of a point of ellipse 20 corresponding to abscissa Xn, also in this case taken with its sign (which is negative); and Y3n is the corresponding ordinate of the corresponding point of abscissa Xn on ellipse 31, taken with the same sign of Y1n. In this case, calculating the algebraic sum, the value of Yn is positive (because Y3n is grater than Y1n in modulus), so that point C3n lies to the right of axis 4 (looking towards reflector 5). From point C3n, a circumference 34 is again drawn from half plane A to vertical plane 14, and which in this case presents an angular extension of less than 90° in that radius Rn is greater than Y1n.

The same applies also to sectors 12 and 13, the only difference being that half plane B is used as the reference plane, and respective ellipse 21 in place of ellipse 20, which means that Y1n in formulas (III) and (V) must be replaced by the corresponding value of Y2n. Figure 6, for example, shows the construction for obtaining lower sector 13. In this case also, for each abscissa Xn, two ordinates are defined: Y3n relative to ellipse 31 and Y2n relative to ellipse 21, the algebraic expression of the which (taking Y2n with its sign and Y3n with the same sign as per Y1n) gives coordinate Yn negative, e.g. situated on the left, looking towards reflector 5. Sector 12 is constructed in the same way - and is therefore not described for the sake of simplicity - except that, in this case, the geometric difference is calculated between values Y2n of ellipse 21 and Y4n of ellipse 30 to give positive offsets and a number of circumferences 36 (Figure 7).

The resulting four surfaces of sectors 10, 11, 12, 13 give a cross section of reflector 5 as shown in Figure 7 wherein the surfaces of sectors 10, 11 and 12, 13 are perfectly blended along planes A and B, whereas those of sectors 10 and 12 present a step 35 and those of sectors 11 and 13 present a step 36 at plane 14.

In the Figure 8 embodiment, the surfaces of sectors 10, 12 and 11, 13 are blended at the vertical plane by making a slight adjustment to the algorithms described above. This consists in so setting the CAD system that only 75% of the angular extension of each sector 10, 11, 12, 13, or of at least two of these sectors, opposite to each other (the 75% is calculated from respective half plane A or B) is defined by the envelope of the various circumferences of radius Rn and center Cn, the remaining 25% of each surface being defined by the envelope of individual connecting lines 41 draftable for each Xn coordinate for respectively connecting circumferences 33, 36 (Figure 8) and 34, 35 (not shown in Figure 8 for the sake of simplicity). Said curves are calculated in known manner using any type of approximation algorithm.

The outcome is the reflector 5 shown in Figure 1 and of which Figures 9-12 show the isolux test curves produced for each sector of reflector 5 on a screen at 25 m from headlight 1. Figure 9 shows the curves relative to sector 10, Figure 10 those of sector 12, Figure 11 those of sector 11, and Figure 12 those of sector 13. As can be seen, the alteration to the original optical system produced by substituting connecting curves for part of circumferences 33, 34, 35, 36 in no way impairs lighting performance according to the present invention, in that, by virtue of the manner in which the surfaces are formed, the images distorted by the connecting portions are all reflected well below cutoff line 2.

Claims

1. A vehicle headlight for generating a light beam, e.g. a lower beam, concentrated entirely beneath a cutoff line for preventing glare; the headlight comprising a light source and a reflector, and being of the type wherein the reflector collects the source-emitted light over 360° about the source; characterized in that the reflector presents a complex reflecting surface comprising four sectors, a first pair of which is located on one side of the optical axis, and a second pair of which is located on the opposite side; the surfaces of the sectors in each pair being connected to each other continuously at respective half planes extending through the optical axis and arranged according to the cutoff line; said surfaces being defined in section, at each half plane, by a respective branch of an ellipse, and being defined, over at least 75% of their angular extension, measured from said half planes towards the vertical plane, by the envelope of arcs having centers aligned with said half planes, and offset on either side of the optical axis.

2. A headlight as claimed in Claim 1, characterized in that said light source is axially off-centered in relation to the focal point of the headlight, which is defined by a first focal point common to both said ellipse branches and located along the optical axis, close to the reflector; the second focal point of each ellipse branch being located approximately 25 m from the reflector.

3. A headlight as claimed in Claim 2, characterized in that the axes of said two ellipse branches do not coincide with the optical axis of the headlight but extend through it at said first, common, focal point of the two ellipse branches and, in the respective half planes, are oppositely inclined in relation to said optical axis by an angle ranging between 0.5° and 2°, so that the second focal points of the two ellipse branches are separated by a predetermined distance perpendicular to the optical axis.

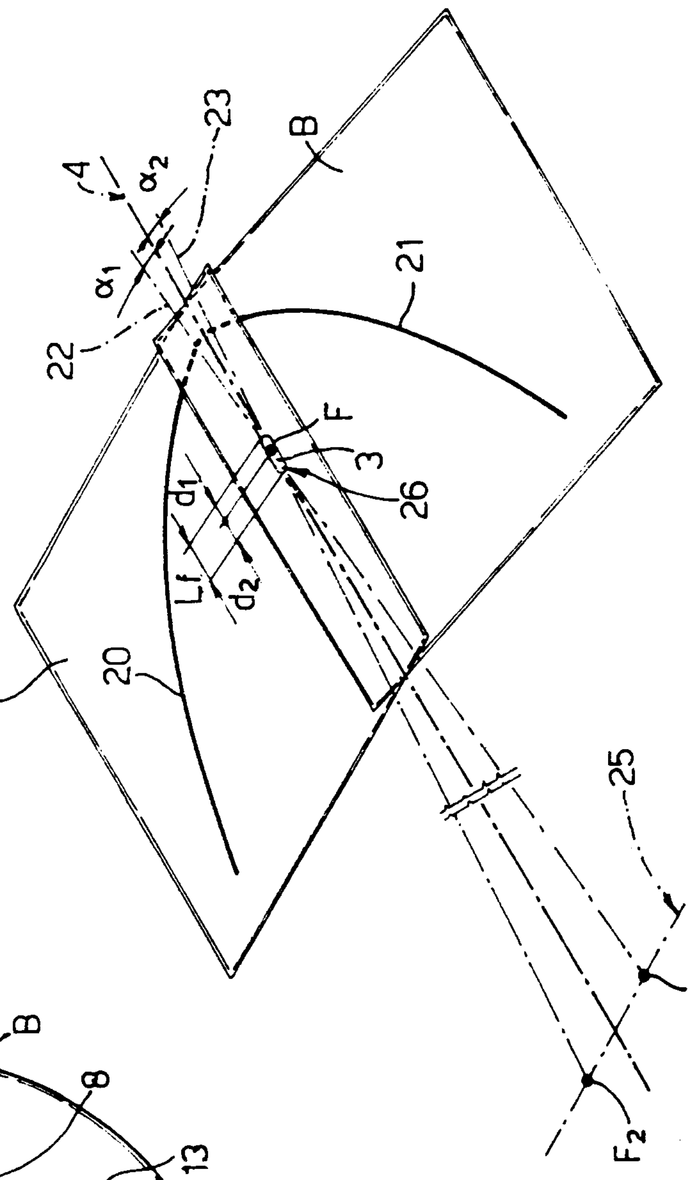
4. A headlight as claimed in Claim 2 or 3, characterized in that said light source is defined by a single filament substantially aligned with but slightly above the optical axis, with its lower side coincident with the optical axis; and roughly 25% of the length of said filament extends behind the focal point of the headlight, towards the reflector, the remaining roughly 75% of its length extending on the opposite side, frontwards of the focal point of the headlight; said values varying within a maximum tolerance of roughly 5% of the length of the filament.

5. A headlight as claimed in any one of the foregoing Claims 2 to 4, characterized in that the centers of the arcs whose envelope defines the surfaces of said sectors are located at a distance from the optical axis, measured parallel to the respective half plane, equal to the geometric difference between the coordinates of first points of respective ellipse branches defined at a respective said half plane, said coordinates being taken with their modulus and sign, and the coordinates of corresponding second points of respective fictitious ellipse branches located in said vertical plane, respectively above and below said optical axis; said coordinates of said second points being taken with their modulus but with the same sign of the coordinates of the corresponding fist points; and said fictitious ellipse branches being so located as to be respectively converging or diverging in relation to the location of said first, common, focal point.

6. A headlight as claimed in any one of the foregoing Claims, characterized in that 100% of the angular extension of the surfaces of said sectors is defined by the envelope of said arcs; the reflector presenting a step discontinuity at the vertical plane, at the connection between the two upper sectors and at the connection between the two lower sectors.

7. A headlight as claimed in one of the foregoing Claims from 1 to 6, characterized in that the remaining roughly 25% of the angular extension of the surfaces of said sectors is formed by curves connecting the arcs defining the adjacent sectors above and below said half planes.

Fig. 2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α1
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d1
Lf
d2
A
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F1
F2

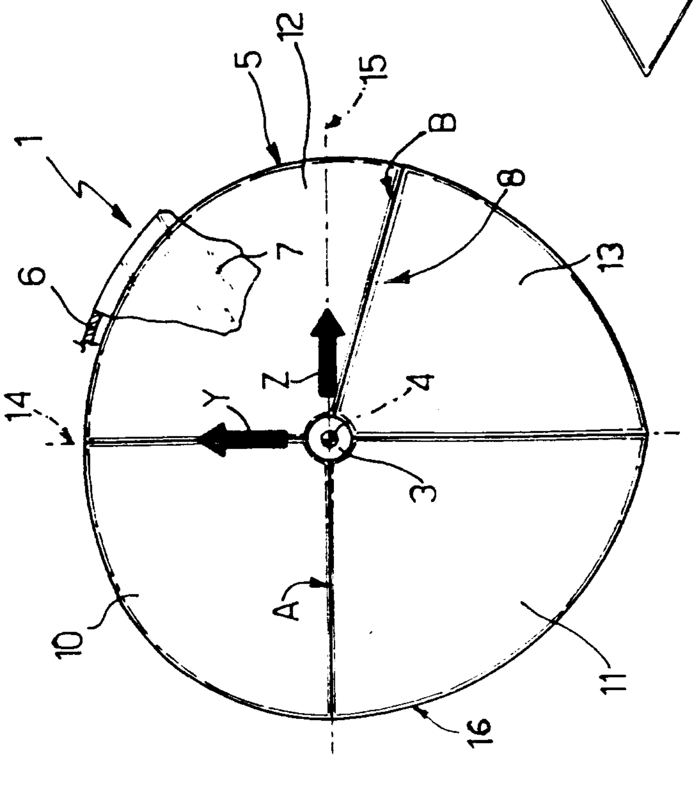
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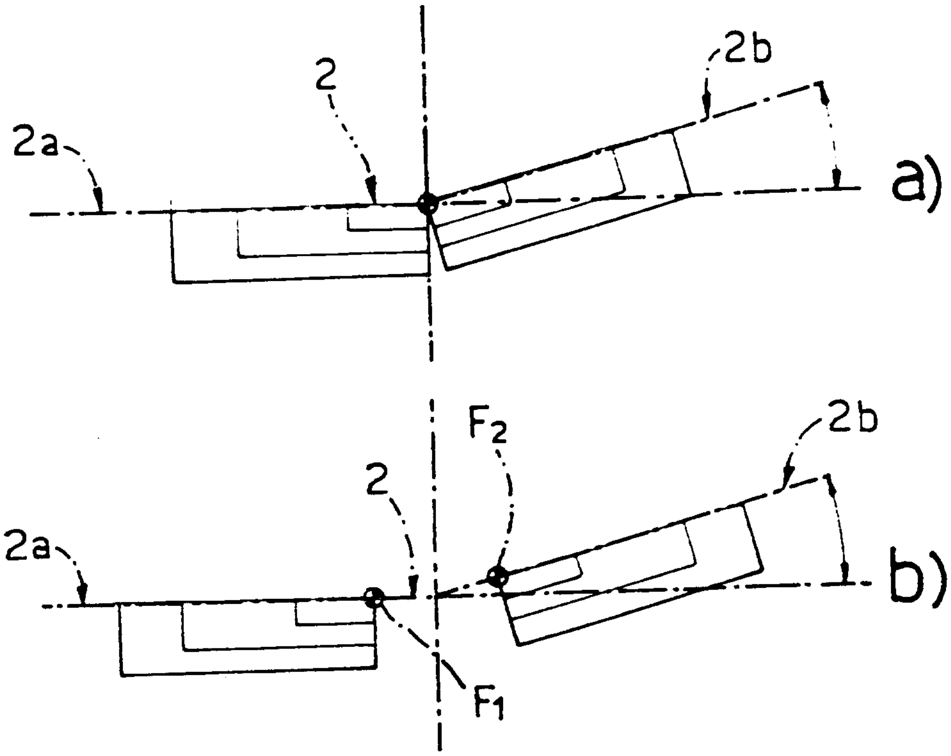
Fig.1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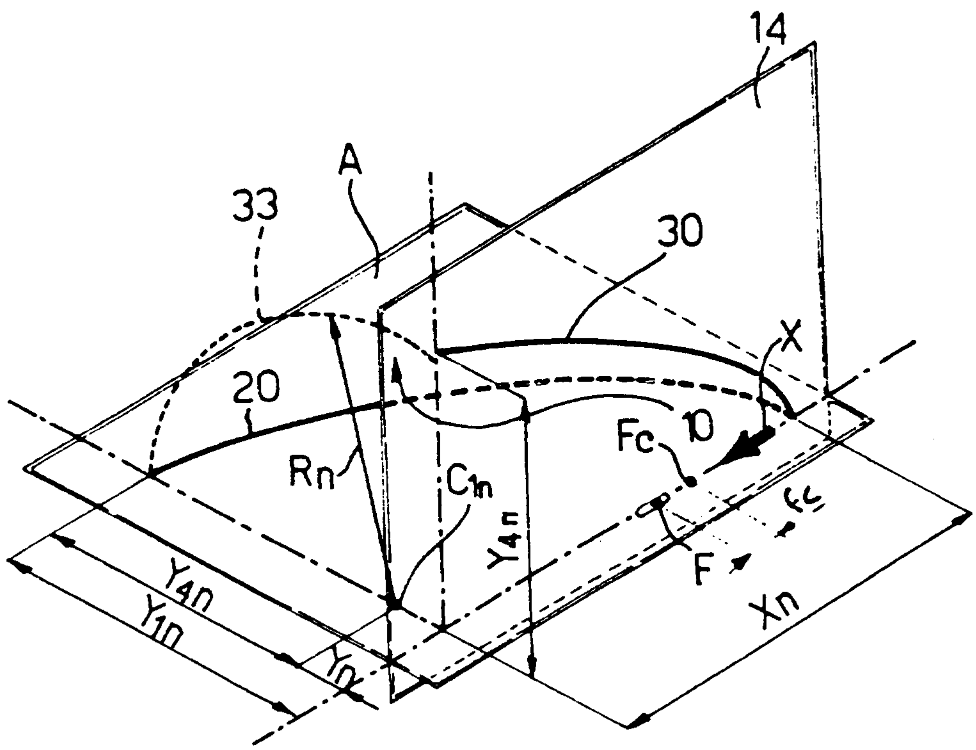
F2
2b
2
2a
b)
F1

Fig. 3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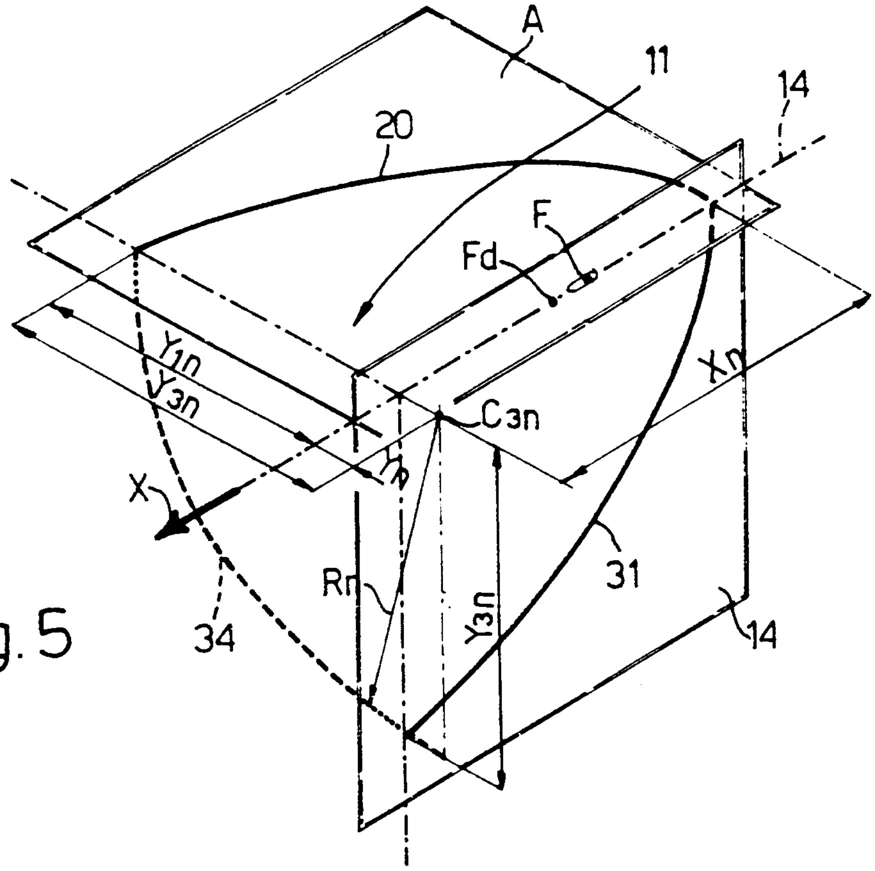
Y4n
Y1n
Yn
Xn

Fig.4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Fd
Y1n
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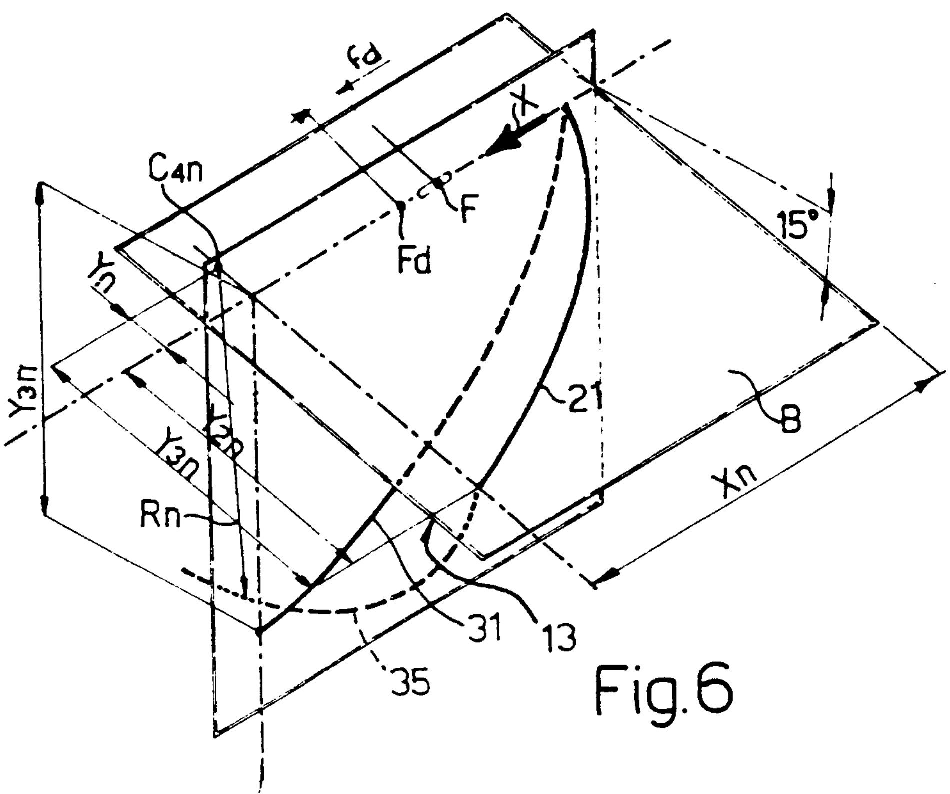
31
14
34

Fig. 5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C4n
F
Fd
15°
Yn
Y3n
Y2n
Y3n
21
B
Rn
Xn
31
13
35

Fig.6

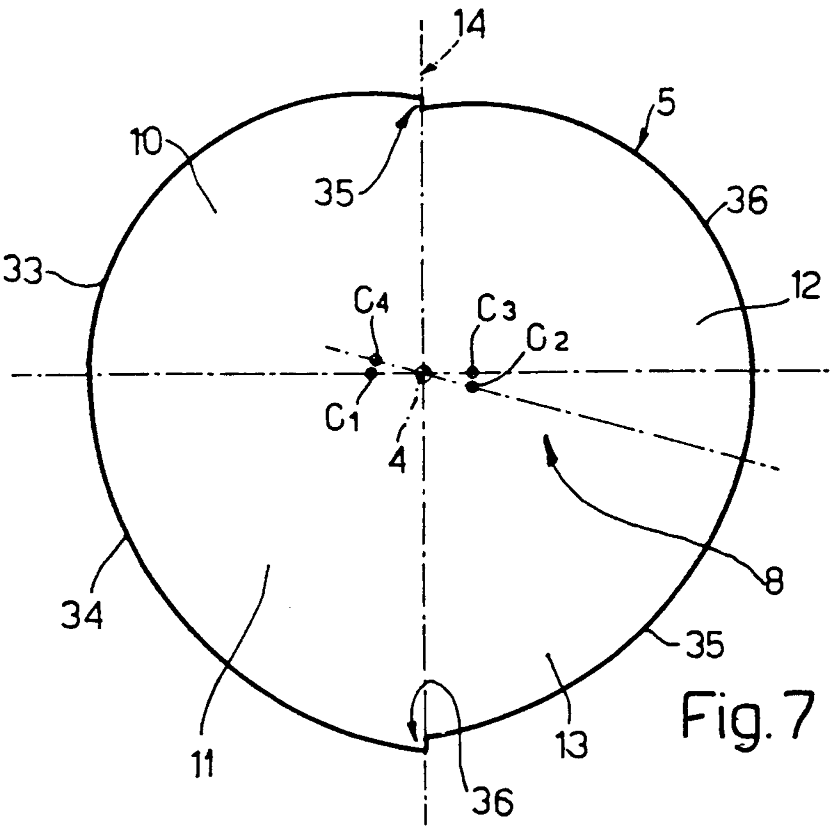
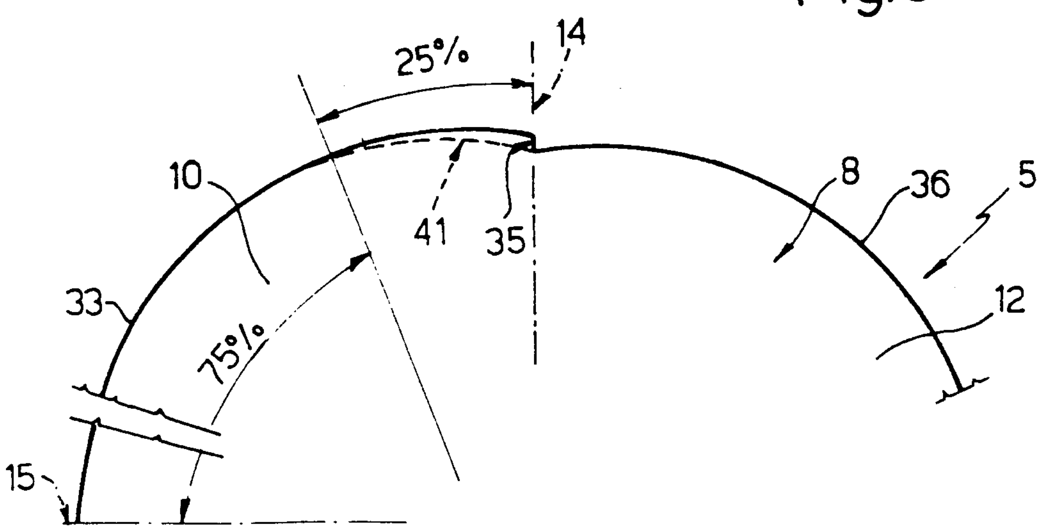

14
5
10
35
36
33
12
C4
C3
C2
C1
4
8
34
35
11
13
36

Fig. 7

Fig.8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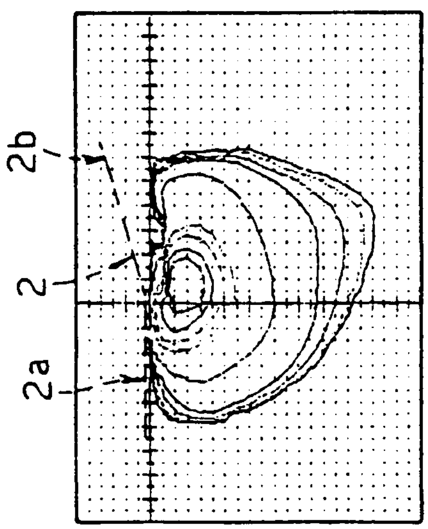

Fig.9

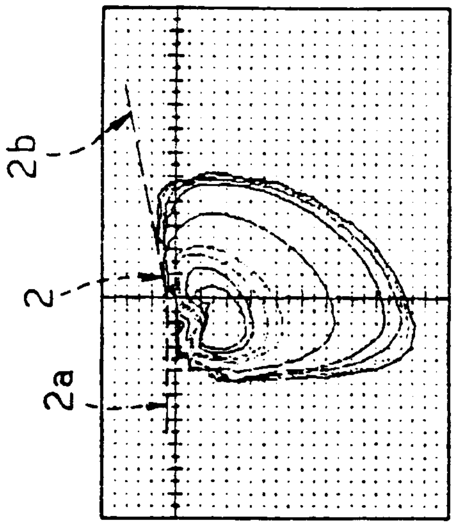

Fig.10

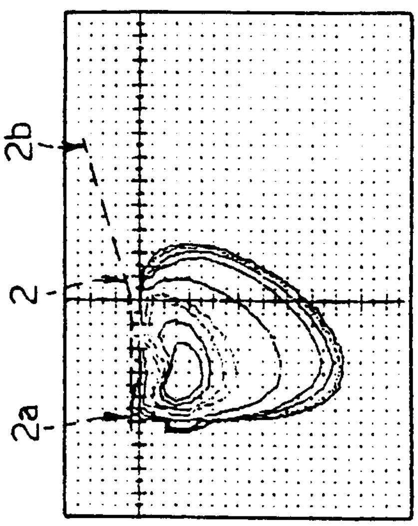

Fig.11

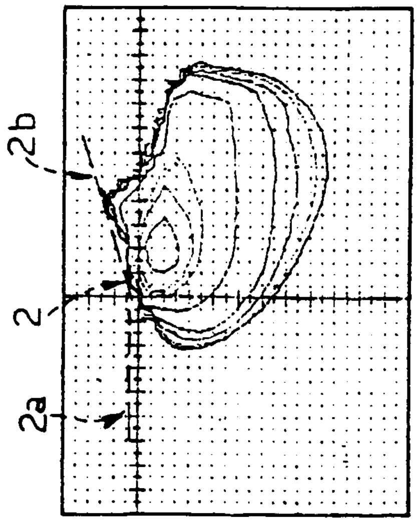

Fig.12

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 95 11 6738

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	EP-A-0 558 949 (ROBERT BOSCH GMBH) * page 2, line 18 - line 31 * * page 2, line 46 - page 3, line 48 * * figures 1-4 * ---	1,2,4,7	F21M3/08
A	EP-A-0 307 657 (ROBERT BOSCH GMBH) * column 1, line 28 - line 45 * * column 2, line 31 - column 3, line 25 * * column 4, line 40 - line 49 * * column 5, line 16 - line 33 * * figures 1,2 * ---	1,7	
A	DE-A-43 35 833 (KOITO MFG. CO. LTD.) * page 2, line 4 - line 28 * * page 3, line 2 - page 5, line 63 * * figures 1-5 * -----	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

F21M

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	30 January 1996	De Mas, A

CATEGORY OF CITED DOCUMENTS

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