(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
12 September 2008 (12.09.2008)

PCT

(10) International Publication Number
WO 2008/107728 A1

(51) International Patent Classification:
B60R 1/02 (2006.01)

(21) International Application Number:
PCT/HR2008/000006

(22) International Filing Date: 4 March 2008 (04.03.2008)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
P20070090A 6 March 2007 (06.03.2007) HR

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*
— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

(54) **Title:** A VEHICLE REAR-VIEW MIRROR SHIFTING SYSTEM IMPLEMENTED WITH AIM TO ELIMINATE THE DEAD ANGLE

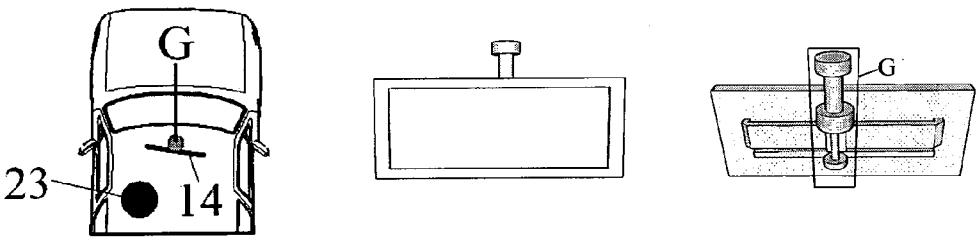

FIGURE 6a

(57) **Abstract:** The vehicle shifting rear-view mirror system implemented with aim to eliminate the dead angle, where the system consists of the external rear-view mirrors and the rear-view mirror located in the vehicle itself, the controlling unit of the system located in the car, where the shifts of the external rear-view mirrors are accomplished by shift of the mirror in both directions from the "zero" position around z axis which is vertical to the plain of the car, and the shift of the internal rear-view mirror is performed around both z axis in both directions and along the plain on which the central rear-view mirror is laying. Where the said system, besides the rear-view mirrors and the controlling system in the vehicle, also contains the control system which is provided with data concerning the control of the motors used for before mentioned shifting and turning so that the internal and external rear-view mirrors perform the previously defined movements, with the defined movement speed between two successive angles, where the final position of the rear-view mirrors depend on the parameters of the steering wheel turning angle, on the status of the direction indicators, and on the logic of the system which was activated by the driver.

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A VEHICLE REAR-VIEW MIRROR SHIFTING SYSTEM IMPLEMENTED WITH AIM TO ELIMINATE THE DEAD ANGLE

DESCRIPTION

Technical Problem

The technical problem solved with the said invention is represented by the installation of an active rear-view mirrors system in cars with the purpose to eliminate the dead angle and to enhance the driver's field of view in different driving conditions, which can be activated by the driver's intervention to asses and eliminate the dead angle in connection to the reaction of the driver to the situation on the road.

Previous State of Art

There were many attempts to solve this problem. As the State of Art which is the closest to the here mentioned solution we can take the American patent registration request US 60/647,699 (Khaled Malhas), which describes a system of rotating side rear-view mirrors activated by pressing a button or by activation of vehicle direction indicators. This system solves the problem only partially and only in certain situations. The good side of this invention is that it can be installed on all vehicles, which already have motors for shifting of the side rear-view mirrors installed. The down side of the solution described here is that it does not shift the central (internal) mirror to cover the field of view which disappeared by shifting the side rear-view mirrors. Also,

before mentioned patent registration request does not enable the automatic activation, which is offered by the said invention.

Summary of the Invention

The above mentioned technical problem to cover the dead angle when the driver is checking it - is solved by moving all three rear-view mirrors of a car so that the driver's view field is focused on the area required in that specific situation, and that the movements are made automatically.

Detailed Description of the Invention

When driving on multilane road to change tracks is more than common. During changing lanes there is a big danger from the so called dead angle. The driver before changing lanes checks his rear-view mirrors, and the dead angle is often neglected due to the commotion or simply because of the gap between vehicles is not respected.

Even if the dead angle is checked by the conventional method, due to its inefficiency, there is still a high risk that the driver can oversee a vehicle or an object hidden by the dead angle. The big problem is that if the driver wants to check the dead angle he must turn his head backwards. Therefore for a few seconds he does not see what is in front of his vehicle which is posing even bigger risks. Most of drivers in this situation rely on experience, but generally the largest part of smaller accidents in cities is a consequence of wrong evaluation and inefficient checking of the dead angle.

The system of active rear-view mirrors described here removes the dead angle without disturbing or adding tasks for the

driver. The system can be activated in different ways: automatically or semi-automatically.

The automatic way of activation is linked with the leverage for activation of the direction indicator, to the rotating sensor of the steering wheel and to the speed indicator.

The semi-automatic activation method is linked with the buttons on the vehicle steering wheel.

Movable parts: side rear-view mirrors are rotating around the vertical **z axis** (if we take that x-y plain is parallel to the road, the z axis is vertical to it) clockwise and anticlockwise. The central rear-view mirror is moving sideways left and right, and at the same time it is simultaneously rotating with the external rear-view mirrors around the z axis. This complex movements of the rear-view mirror located in the car is using the geometry of the car itself to reduce the dead angle.

The procedure that the said invention uses to control this system is very simple. The driver positions the external rear-view mirrors by using the standard commands. The position selected in this way is taken as a starting or a zero position and it is communicated to the central system in one of the standard ways, or the vehicle can just accept this position as a zero position. The central rear-view mirror is positioned in the standard way i.e. manually; this position is also taken as a standard or zero position and it is communicated to the central control system in one of the standard ways.

The maximum tilt of the external rear-view mirrors from the zero position is programmed between 7° to 16°, depending on the type of the vehicle. Maximal side shift of the central rear-view mirror from the zero position ranges, depending on

the type of the vehicle, between 4 and 12 cm. The maximum rotation of the central rear-view mirror from the zero position ranges, depending on the type of the vehicle, between 6° and 28°. Of course, only the approximate values for easier understanding of the essence of the invention are mentioned here.

Semi-automatic Activation of the System: Two buttons are located on the steering wheel of the vehicle. One is located on the left and the other on the right side of the steering wheel. If the driver presses the left button then the left rear-view mirror will rotate around its z axis in the clockwise direction from its zero position to the end position programmed in advance. At the same time the central rear-view mirror is moving sideways to the right on the previously programmed value and is rotating around the z axis clockwise till it reaches the final position. The right rear-view mirror is not moving. When the left and the central rear-view mirror reach their final position they remain fixed until the driver does not release the button. When the driver releases the button the left rear-view mirror and the internal rear-view mirror immediately return to their initial position.

If the driver presses the right button, then the right rear-view mirror will rotate anticlockwise around the z axis from the zero position to the final previously programmed one. At the same time the central rear-view mirror is moving sideways to the left on the previously programmed value and is rotating around the z axis anticlockwise till it reaches the final position. The left rear-view mirror is not moving at all. When the right and the central rear-view mirror reach their final position they remain in that position until the driver does not release the button. When the driver releases the button the right rear-view mirror and the internal rear-view mirror immediately return to their initial position.

If the driver releases the button before the rear-view mirrors reach their final position, then both rear-view mirrors immediately return to their initial position not to disturb the driver in evaluation of his current situation on the road.

Automatic Activation of the System: The system is activated automatically in two ways: by the activation of the direction indicator and by rotating the steering wheel.

When activating the mechanism by direction indicator - the driver before changing lanes activates e.g. left direction indicator. Then the left external rear-view mirror rotates around its z axis clockwise. The central rear-view mirror also rotates clockwise and shifts sideways on the right. The right rear-view mirror is not moving. Thus activated the central rear-view mirror and the left rear-view mirror shift and rotate to their final position. The rear-view mirrors keep their new position for some time so the driver has enough time to check the dead angle. When the sensor of the steering wheel detects that the driver moved to the next lane the rear-view mirrors immediately return to their initial position. If the system does not register a rotation of the steering wheel after the side and the central rear-view mirrors reached their final position, and where they remained fixed for 0.5 up to 3 seconds, to give to the driver enough time to check the situation, the system returns the mirrors back to the initial position. For return of the rear-view mirrors to their initial position after they were activated by the direction indicators, qualify only rotations of the steering wheel over 15° in relation to the zero position of the steering wheel. And the zero position of the wheel is defined by the position on which the steering wheel was in the moment when the direction indicators were activated. If at any moment the driver deactivates the direction indicators, the rear-view

mirrors both external and internal ones are immediately returned to their initial position.

The activation by turning the steering wheel is especially important in curves where this system, if activated, can significantly help the driver. The rotation and the shift of the rear-view mirrors depend on the angle of rotation of the steering wheel, as it is represented on **figure 8** and it is determined empirically for each car model. When the driver is going through a left curve the left external rear-view mirror rotates around its z axis clockwise to a certain empirically determined position. At the same time, the central rear-view mirror shifts right and rotates around its z axis clockwise to the predetermined position. The right rear-view mirror is not moving. When the driver is going through a right curve the right external rear-view mirror is going to rotate from its initial position around its z axis anticlockwise, while at the same time the central rear-view mirror is shifting to the left and rotating around its z axis in the same direction till it also reaches the empirically determined position which depends on the car model. The left rear-view mirror is not moving at all. Those actions are performed in continuation. It is extremely important to mention that the left and right side rear-view mirrors, as also the central rear-view mirror, always turn and shift e.g. by a curve given on the **figure 7** which is also empirically determined or calculated according to a certain algorithm. By the said graph, the shift and turn of the mirrors in the beginning are made at maximum speed and later the speed reduces as the mirror is getting closer to the final position and in this way it enables the driver to use the mirrors even while they change positions.

One of the possible ways how to implement the said invention is given by the figures.

Figure 1 represents a standard situation in which vehicles **A** and **B** drive in parallel in two adjacent lanes. To the driver of the vehicle **A**, the vehicle **B** is covered by the dead angle (5). The field of view (4) through the windshield and the field of view of the side rear-view mirrors (2) and (3) do not cover the dead angle (5). To the driver of the vehicle **A**, the vehicle **B** is completely covered by the dead angle. If in the said situation the driver of the vehicle **A** would like to get over to the lane on the left the accident is inevitable, because the driver of the vehicle **A** can not see the vehicle **B**, of course the assumption here is that the vehicle **B** is relatively faster than the vehicle **A**.

Figure 2 shows a vehicle **A** with the system of active rear-view mirrors. Before he changes lanes the driver of the vehicle **A** activates the left direction indicator and this activates the system of active rear-view mirrors. The left rear-view mirror is positioned so that the driver of the vehicle **A** can see the vehicle **B**. The central rear-view mirror also shifts its position so to cover with the view field (5) i.e. the area that remained uncovered when the left rear-view mirror shifted its position. Now the driver of the vehicle **A** can see the vehicle **B** in his field of view (6). In this situation the central rear-view mirror field of view (5) and the right rear-view mirror field of view (3) cover the remaining areas relevant for the driver. The dead angle (7) is reduced to a negligible area.

When the driver of the vehicle **A** in his rear-view mirrors spots the vehicle **B** he is not going to change the lain any more and he turns off the direction indicators, then the active rear-view mirror system returns the mirrors back to the starting position.

Figure 3 shows a situation when the vehicle **C** with standard rear-view mirrors enters a sharp right curve. The field of view (8) which has the driver of the vehicle when he looks in his rear-view mirrors is tangential to the trajectory of the car. In such a sharp curve classical rear-view mirrors do not make possible to evaluate the traffic situation. The dead angle (9) in this situation is such that the driver of the vehicle **C** cannot see all the relevant areas, for example the vehicle **D**. The area (10) is the field of view for the driver of the vehicle **C** through the right front window.

Figure 4 shows a very similar situation like **figure 3**. The difference is that the vehicle **E** has active rear-view mirror system. The system registers the angle by which the steering wheel is turned, and depending on this angle and on the base of the speed of the vehicle determines the new position of the rear-view mirrors (see **figure 8**). The potential of the right rear-view mirror is used much more effectively than it is on the classical rear-view mirror. With the active system of rear-view mirrors the driver of the **vehicle E** in the right rear-view mirror field of view (12) can see the whole curve. The central rear-view mirror is positioned to cover the area which disappeared from the vehicle **E** driver's field of view as the right rear-view mirror moved. The field of view of the central rear-view mirror (11) is also directed to the inner side of the curve. Therefore the dead angle (13) is reduced to such an extent that it no longer poses a threat.

Figure 5 shows a simplified example of the construction of the central rear-view mirror. The rear-view mirror is made of the frame with the mirror (14), electromotor (15) for turning around the z axis, electromotor for in line shifting movements (19), slide (16), rack (17), transmission gears (18), link (20) between the electromotor (15) and the slide (16), ring (21) for fixing of the slide (16) and mandrel (22) which is

linking the gears (18) and the drive (19). The mentioned elements (15), (19), (20), (21), (22) and (18) are integrated in one unit **G**, while other elements (16), (17) and (14) are part of a movable unit. The unit **G** is attached to a fix point in a car, e.g. window or the roof of the car, and therefore it does not move in relation to the car.

The system for shifting and turning of the side rear-view mirrors is known to the present state of technology, therefore for the implementation of this invention any commercially available system which can be found on the market, and which makes possible to rotate the mirrors around the previously mentioned z axis, can be used. The description of this system is omitted here as superfluous.

Figure 6 shows three possible situations where the central rear-view mirror is in different positions. On **figure 6a** the presumption is that the car is moving in a straight line. The central rear-view mirror is in standard "zero" position. **Figure 6b** shows the situation when the car goes through the left curve or when changing lanes to the left. In this situation the frame of the rear-view mirror (14) shifts, from the driver prospective (23) to the right and turns clockwise around the z axis of the **G** point. **Figure 6c** shows the situation where a car goes through a right turn or is changing lanes to the right. In this situation the frame of the rear-view mirror (14) shifts, from the driver prospective (23) to the left and turns anticlockwise around the z axis of the **G** point.

Figure 7 on the y axis shows the speed of turning the rear-view mirror (or the shift of the central rear-view mirror) in function of the turning angle of said rear-view mirrors and it is represented along the x axis. From the exposed materials we can see the speed of shifting rear-view mirrors is small for

very small and also for very large turns, while the speed for the remaining turning angles is - maximum possible - and is determined by the specifications of the electromotor and its transmission rates.

Figure 8 on the y axis shows the turn of the steering wheel in percentage points "+" or "-" 100%. The x axis indicates an example of empirically determined functional dependency of turn (or shift) of the central rear-view mirror and side rear-view mirrors from the zero position in dependence of the turning of the steering wheel.

Here also it is necessary to mention that the electronic circuits which take care of the logic, shifts and position of the rear-view mirrors can be easily accomplished in a way which is self evident to any expert from the area. Predetermined shifts and speeds are best accomplished by step motors, which unconditionally follow the commands previously stored in the memory of the standard hardware controllers, where those controllers control the peripheral motors for shifting of rear-view mirrors. Of course, each car model is managing its own rear-view mirrors in a specific way, especially as thus it is possible to optimise the efficiency in which the design of the vehicle is used.

Industrial Application of the Invention

The industrial application of the invention is obvious, especially on city cars where the design of their window surfaces can be enhanced to their maximum if the invention for reducing or complete removal of the dead angle is implemented.

CLAIMS

1. The vehicle shifting rear-view mirror system implemented with aim to eliminate the dead angle, where the system consists of the external rear-view mirrors and the rear-view mirror located in the vehicle itself, the controlling unit of the system located inside the car, where the shifts of the external rear-view mirrors are accomplished by shift of the mirror in both directions from the "zero" position around z axis which is vertical to the plain of the car, and the shift of the internal rear-view mirror which is performed around two reference points - on z axis in both directions and along the plain on which the central rear-view mirror is laying, where the said system is, **characterised by that,** the mentioned system also contains the control system which is provided with data concerning the control of the motors used for before mentioned shifting and turning so that the internal and external rear-view mirrors perform the previously defined movements, with the predefined speed of movement between two successive angles, where the final position of the rear-view mirror can depend on the parameters of the steering wheel turning angle and on the status of the direction indicators about which decides the logic of the system activated by the driver.

2. The system according to the claim 1, where the controlling part of the system has additionally, inside the vehicle, on the steering wheel, two buttons, one located on the left and the other on the right of the steering wheel, **characterised by** that:

   a.) pressing the left button the left rear-view mirror will rotate around its z axis in the clockwise direction from its zero position to the end position programmed in advance,

b.) at the same time the central rear-view mirror is moving sideways to the right on the previously programmed position and is rotating around the z axis clockwise till it reaches its final position,

c.) the right rear-view mirror is not moving, until the left and the central rear-view mirror reach their final position and then they remain fixed until the driver does not release the button;

or

d.) by pressing the right button then the right rear-view mirror will rotate around its z axis in the anticlockwise direction from its zero position to the end position programmed in advance,

e.) at the same time the central rear-view mirror is moving sideways to the left on the previously programmed value and is rotating around the z axis anticlockwise till it reaches the final position,

f.) the left rear-view mirror is not moving at all, until the right and the central rear-view mirror reach their final position and then they remain fixed until the driver does not release the button;

and

when the driver releases the button the engaged rear-view mirror and the internal rear-view mirror immediately return to their initial position.

3. The system according to the claim 1, which can be activated by the direction indicator, **characterised by that** it performs the following actions after the left direction indicator is activated:

a.) the left external rear-view mirror rotates around its z axis clockwise,

b.) the central rear-view mirror inside the vehicle also rotates clockwise and shifts sideways on the right,

c.) the right rear-view mirror is not moving, and thus activated the central rear-view mirror and the left rear-view mirror shift and rotate to their final positions, and

d.) the rear-view mirrors keep their new position for a certain predetermined period so the driver has enough time to check the dead angle, and moreover

e.) when the sensor of the steering wheel detects that the driver moved to the next lane rear-view mirrors immediately return to their initial position,

f.) and if the system does not register a rotation of the steering wheel after the side and the central rear-view mirrors reached their final position, and where they remained fixed for 0.5 up to 3 seconds, so to give to the driver enough time to check the situation, the system returns the mirrors back to the initial position,

where the angle of turning of the steering wheel which are taken in consideration are over 15° from the zero position, **and**

when the right direction indicator is activated the symmetrically mirrored activities are performed with regard to the symmetry plane which is longitudinally splitting the car in two.

4. The system according to the claim 1, which can be activated by turning of the steering wheel where the turn and shift of each rear-view mirror is depending on the turn of the steering wheel, which is separately defined for each car model, whether empirically (figure 8) or by computer calculations, **characterised by** that:

a.) when the driver is going through a left curve the left rear-view mirror is going to rotate from its initial position around its z axis clockwise, and at the same time the central rear-view mirror is shifting to the

right and rotating around its z axis in the same direction till it reaches the predetermined position, while the right rear-view mirror is not moving;

or

b.) when the driver is going through a right curve the right rear-view mirror is going to rotate from its initial position around its z axis anticlockwise, and at the same time the central rear-view mirror is shifting to the left and rotating around its z axis in the same direction till it reaches the predetermined position, while the left rear-view mirror is not moving;

and the speed with which those activities a) and b) are performed is defined empirically (figure 7) or by computer simulation, where all the required parameters are stored in the controlling system.

5. The system by any of the previously mentioned claims **characterised by the fact** that the driver in any moment can choose one of the ways in which the system will perform according to the claims 2, 3 or 4.

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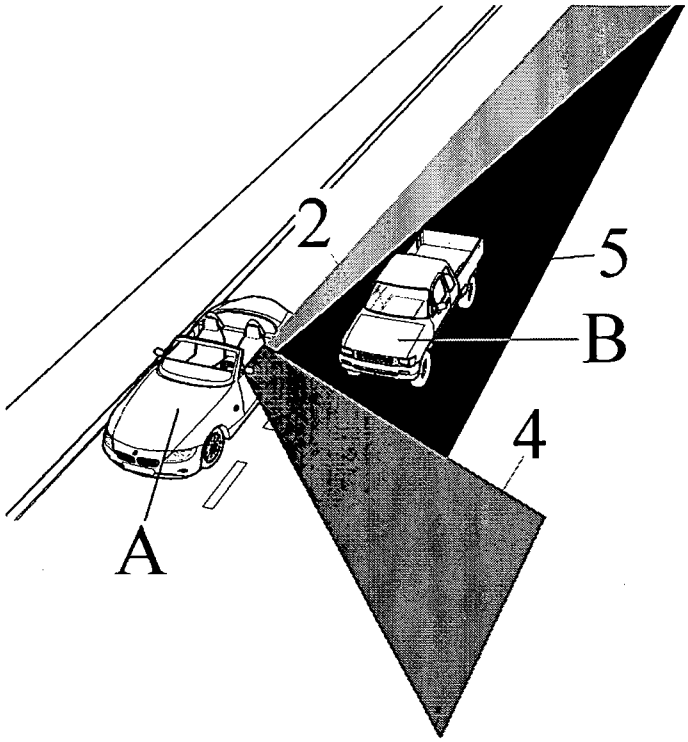


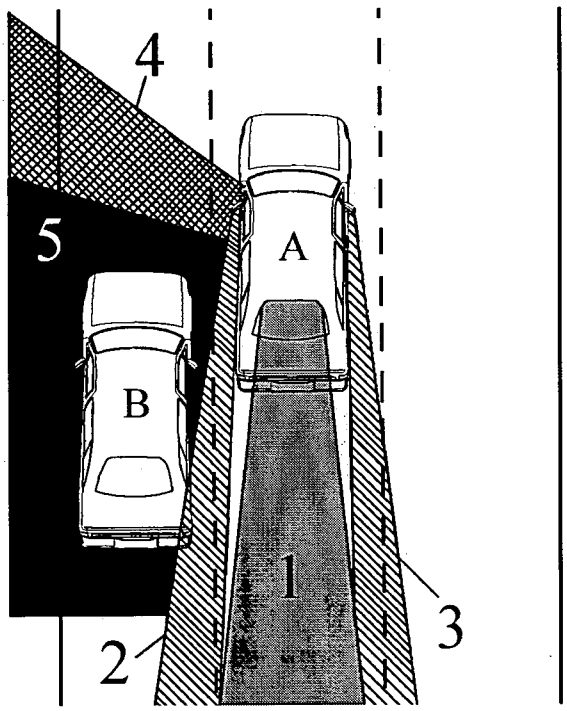


FIGURE 1

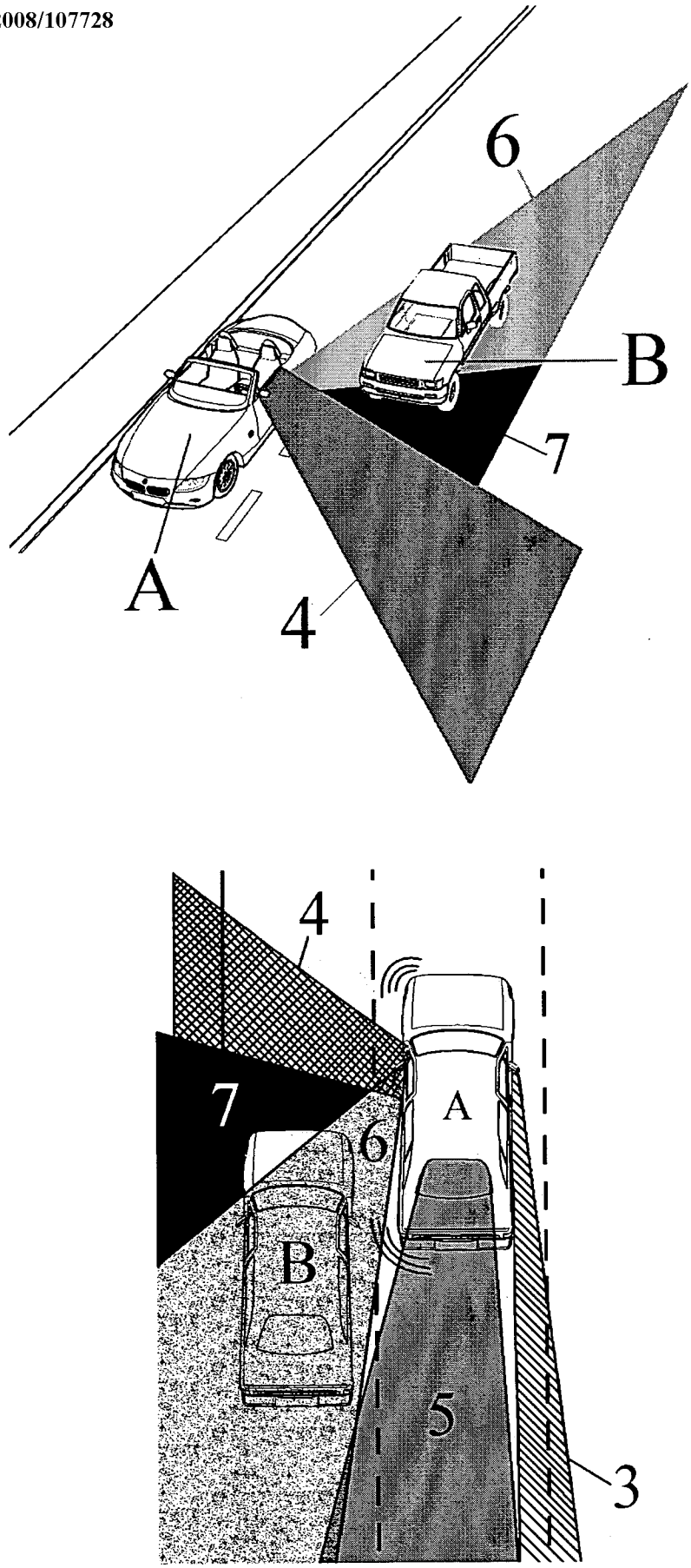


FIGURE 2

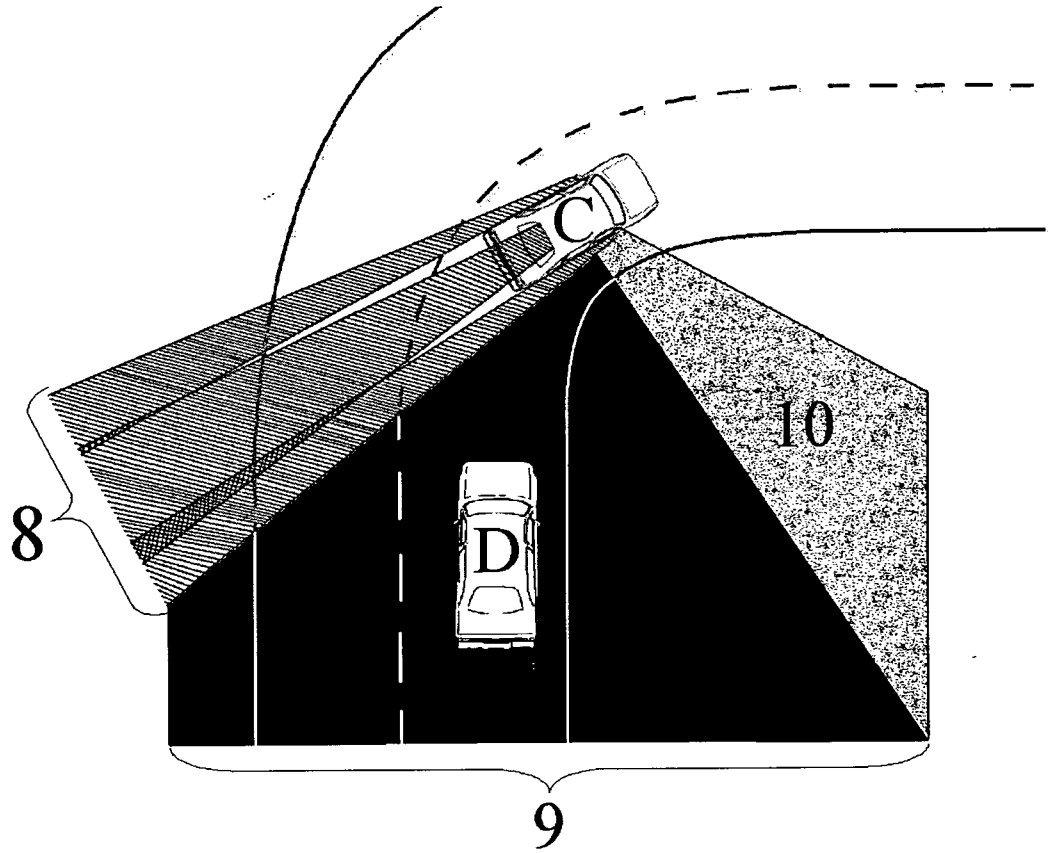


FIGURE 3

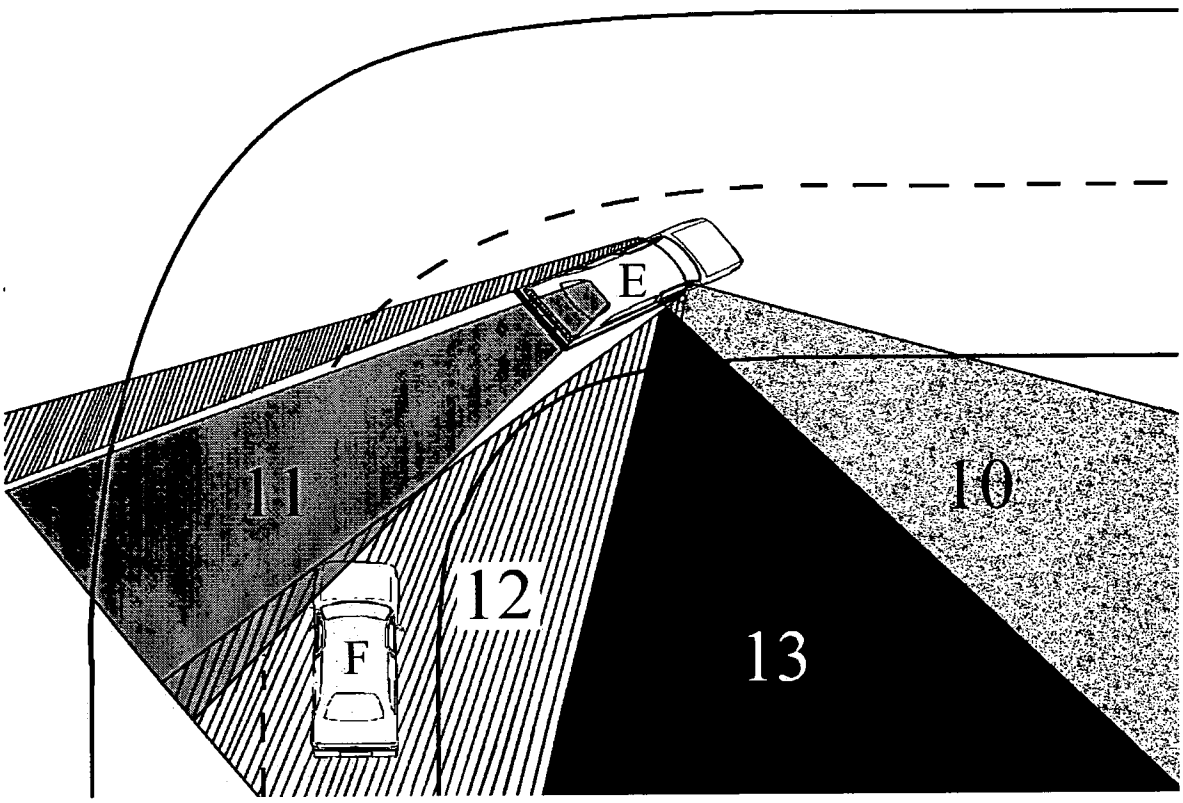
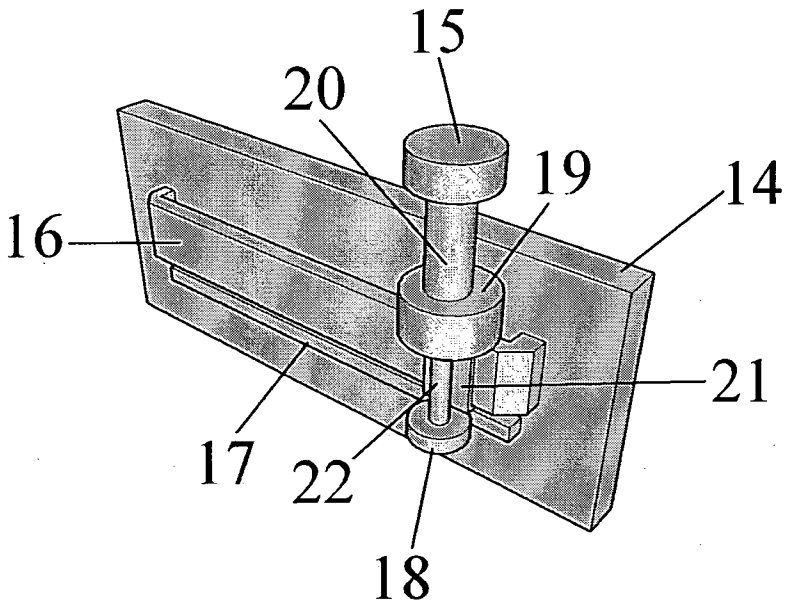


FIGURE 4



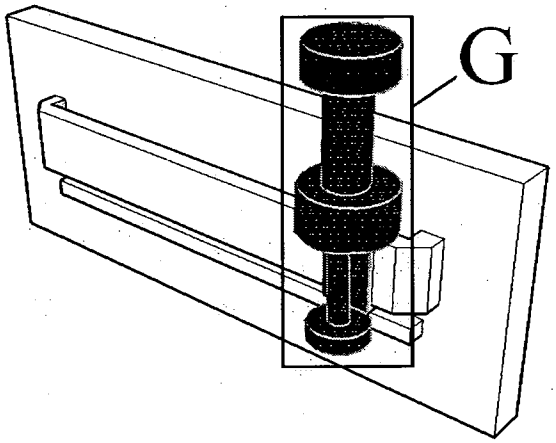


FIGURE 5

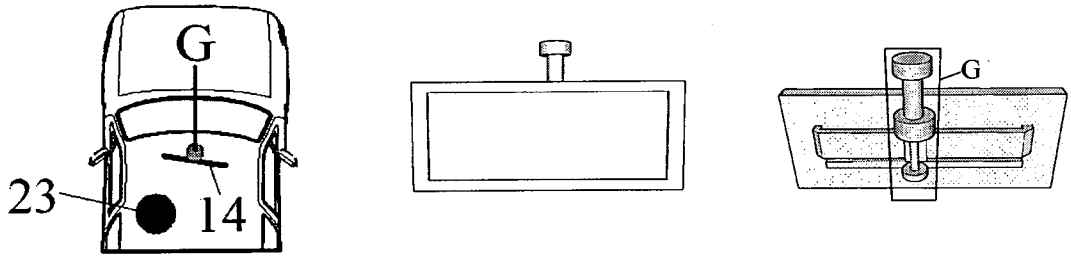


FIGURE 6a

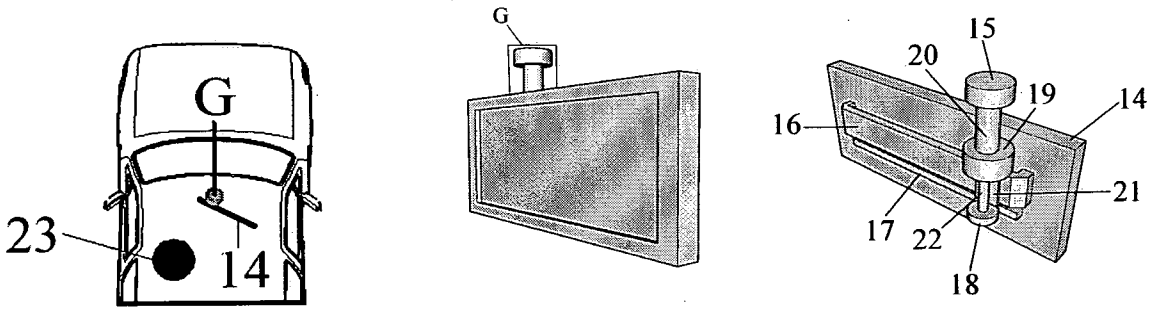


FIGURE 6b

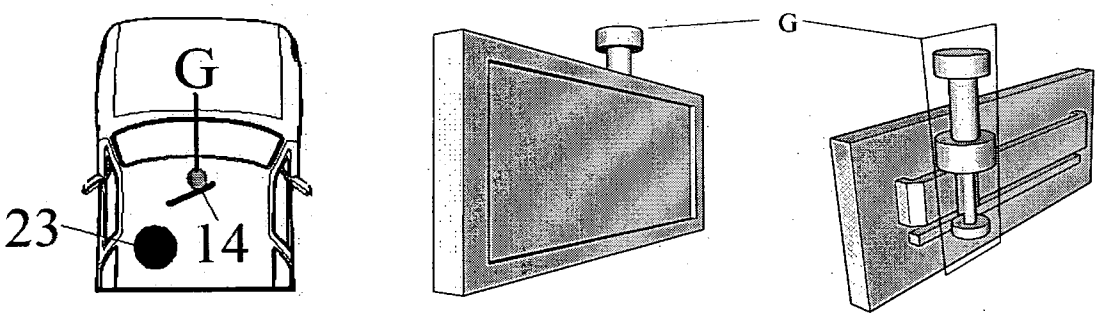


FIGURE 6c

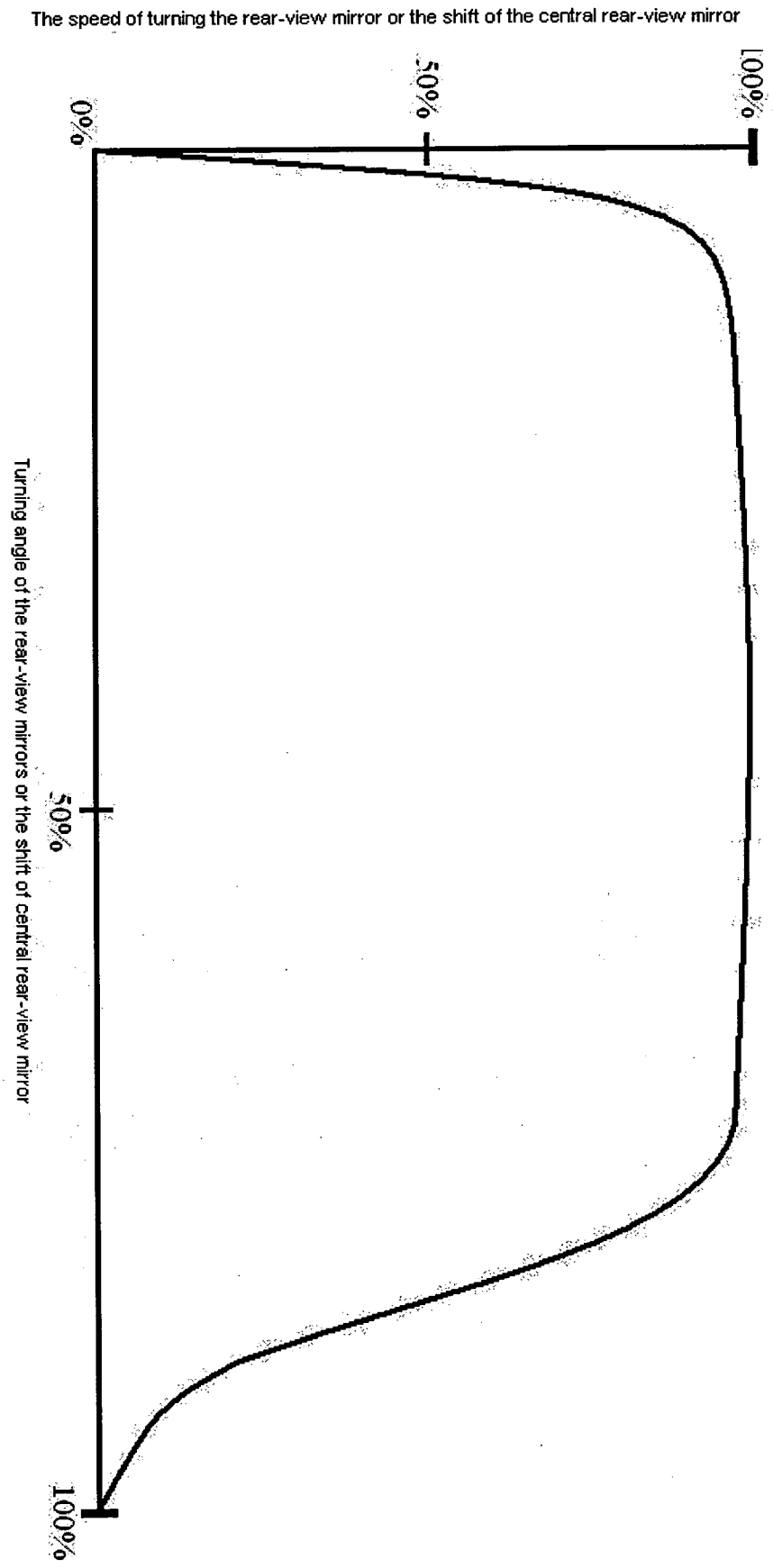

The speed of turning the rear-view mirror or the shift of the central rear-view mirror
0%
50%
100%
Turning angle of the rear-view mirrors or the shift of central rear-view mirror
50%
100%

FIGURE 7

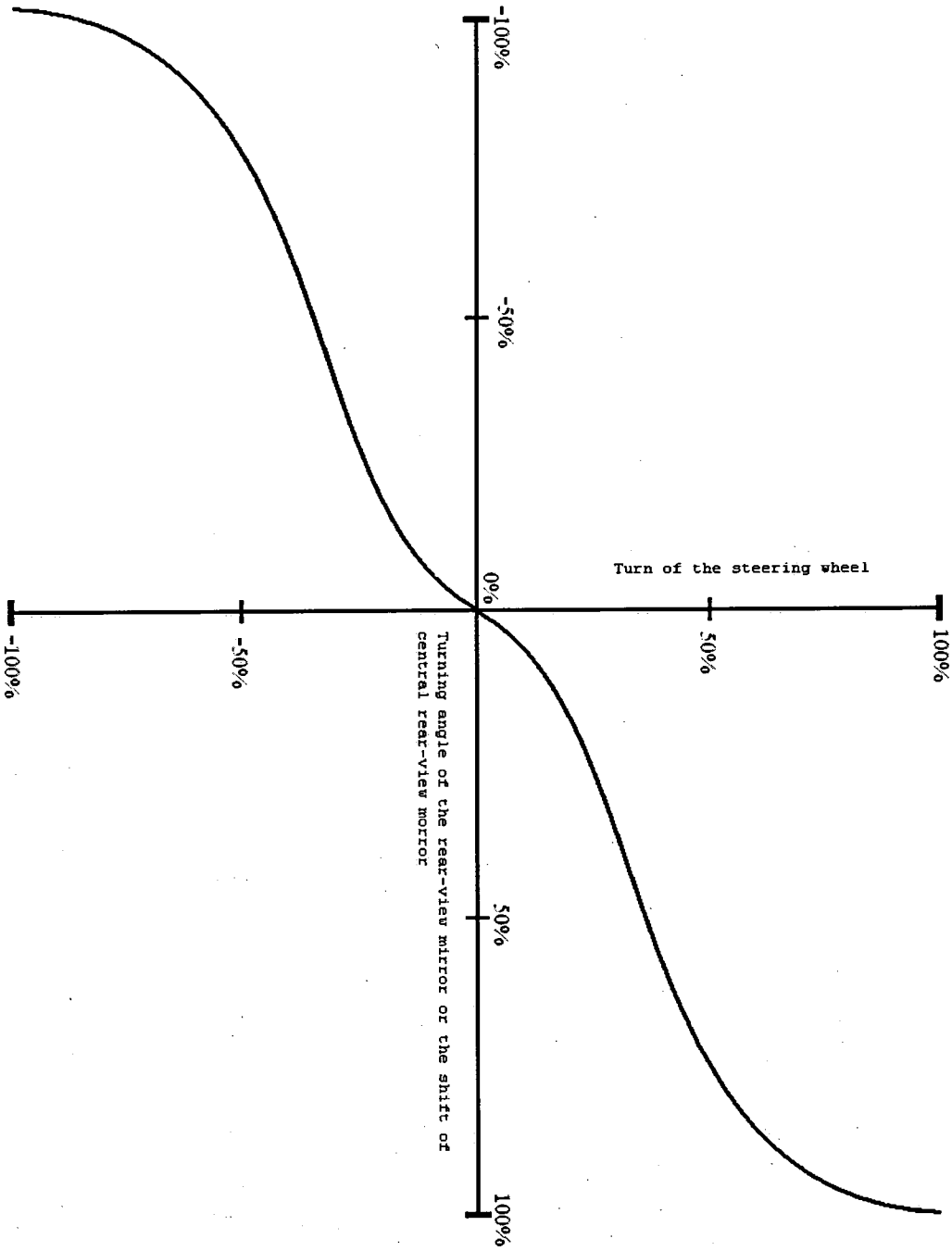

-100%
-50%
0%
50%
100%
Turn of the steering wheel
-100%
-50%
50%
100%
Turning angle of the rear-view mirror or the shift of central rear-view mirror

FIGURE 8

INTERNATIONAL SEARCH REPORT

International application No
PCT/HR2008/000006

A. CLASSIFICATION OF SUBJECT MATTER
INV. B60R1/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B60R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2004/110817 A (AGREST ZOHAR [IL]) 23 December 2004 (2004-12-23) abstract page 1, line 20 - page 2, line 15 page 15, line 20 - page 16, line 4 page 17, line 29 - page 18, line 18; figure 5 claims 14,40,52	1,3
Y		2,4,5

A	US 2006/167606 A1 (MALHAS KHALED [US]) 27 July 2006 (2006-07-27) cited in the application paragraphs [0002], [0011] - [0017], [0042], [0043], [0054] - [0058] figure 8	1
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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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24 July 2008	01/08/2008

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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Information on patent family members

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