



- (51) International Patent Classification:  
*B60Q 1/48* (2006.01)      *B60R 1/06* (2006.01)  
*G02B 5/10* (2006.01)
- (21) International Application Number:  
PCT/AU2012/001147
- (22) International Filing Date:  
24 September 2012 (24.09.2012)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:  
2012900300    27 January 2012 (27.01.2012)    AU
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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, BN, BR, BW, BY,  
BZ, CA, CH, CL, 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, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU,  
RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, 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, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ,  
UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ,  
TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK,  
EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV,  
MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM,  
TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW,  
ML, MR, NE, SN, TD, TG).

Published:  
— with international search report (Art. 21(3))

(54) Title: PARALLEL PARKING SYSTEM

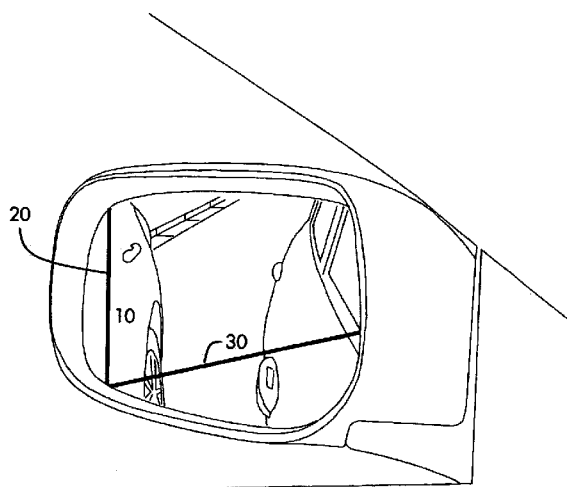


Figure 1a

(57) Abstract: A reverse parallel parking assistance system for a motor vehicle having a passenger side external rear view mirror, said system including the provision via said mirror of guide indicia corresponding to the apparent position of objects outside the vehicle during the parking procedure, when viewed via said mirror.

## **PARALLEL PARKING SYSTEM**

### **TECHNICAL FIELD**

The invention relates to the field of automotive manufacturing. In particular,  
5 the invention relates to a system for assisting a driver to park a vehicle accurately in  
a parking space.

### **BACKGROUND OF THE INVENTION**

Reverse parallel parking is the process of parking a motor vehicle within a  
confined space, usually defined between two stationary vehicles (one forward and  
10 one rearward) and the near kerb, such that the vehicle comes to rest in a position  
parallel to said kerb.

The procedure may vary slightly from driver to driver, but it typically involves  
the following steps:

- 15 1. Bringing the vehicle to be parked to rest next to the forward vehicle,  
parallel to the line of the kerb;
2. Engaging reverse gear and reversing until a particular position relative to  
the forward vehicle is reached;
3. Turning the steering wheel to full lock toward the near kerb;
4. Reversing until the vehicle is at an approximate angle of 45° to the kerb;
- 20 5. Turning the steering full lock away from the near kerb;
6. Reversing until the vehicle is approximately parallel with the near kerb, and  
preferable between 0.1m – 0.3m distant from the near kerb;
7. Straightening the front wheels and moving forward until the vehicle is  
approximately equidistant from the forward and rearward vehicles.

25 In spite of being a regular requirement for motor vehicle drivers, this  
procedure is often not well-executed. This is due at least in part to the difficulties  
inherent in the procedure, which requires the driver to have a clear idea of the

relative positioning of the front, rear and kerb-side of their vehicle, the rear of the forward vehicle, the front of the rearward vehicle and the kerb.

Poor attempts at this procedure can result in damage to the driver's vehicle, damage to the adjacent vehicles and/or damage to the kerb. Even when damage  
5 does not occur, poor execution of the procedure can result in multiple attempts needing to be made before parking is successfully completed. This can hold up traffic and cause frustration for the driver and other road users.

An attempt to provide a system to assist drivers in parallel parking was provided in US Patent No. 7,489,256. This system included the provision of a marker  
10 on the outside of the vehicle that could be viewed by the driver via the passenger side rear vision mirror, when the mirror is moved into the correct position. This system is designed to allow the driver to identify when the turning vehicle has reached an angle of 45° with the kerb by aligning the marker with the kerb in the mirror field. However, this invention does not take into account the requirement for  
15 equally accurate positioning of the vehicle relative to the kerb both at the beginning and the end of the parking procedure. It is also based on the presupposition that there is a suitable point on the external surface of the vehicle that can serve as the marker, and that this is aesthetically appropriate.

Accordingly, it is an object of the invention to provide a system and equipment  
20 for assisting motor vehicle drivers in executing the process of reverse parallel parking.

### **SUMMARY OF THE INVENTION**

According to one aspect of the invention, there is provided a reverse parallel parking assistance system for a motor vehicle having a passenger side external rear  
25 view mirror, said system including the provision via said mirror of guide indicia corresponding to the apparent position of objects outside the vehicle during the parking procedure, when viewed via said mirror.

The invention allows markings or other suitable forms of indicia on the mirror to guide the driver in correctly positioning the vehicle during the process of reverse

parallel parking. It does not rely on reference points on the external surface of the vehicle, that need to be viewed via reflection in the rear view mirror, as all visual markers are placed on the surface of the mirror. Preferably, the indicia indicate the position of the near kerb at the beginning and end of the parking procedure, as well  
5 as at intermediate points such as the point when the vehicle is at 45° to the near kerb.

Advantageously, indicia could be provided to allow the driver to line up the position of the stationary vehicle to the rear of the vehicle being parked.

Preferably, the passenger side external rear view mirror can be remotely  
10 positioned to a preset position, chosen for optimal accuracy of the apparent position of said objects to the driver. It is particularly preferred that said preset position is determined with reference to the position of the driver's seat, as this will have an effect on the optimal positioning of the indicia.

Preferably, said indicia are visible to the driver at night, via the provision of a  
15 suitable lighting system.

The indicia may be provided as a fixed marking on the passenger side rear vision mirror, or may advantageously be provided electronically as variably positionable indica, preferably so that said indicia can be varied to provide optimal accuracy of the apparent position of said objects to the driver. This would allow the  
20 indicia to be varied to suit different drivers and different driver seating positions.

According to another aspect of the invention, there is provided a passenger side external rear view mirror for a motor vehicle that is adapted to operate in the system as described above.

According to another aspect of the invention, there is provided the  
25 modification of a passenger side external rear view mirror for a motor vehicle in order to adapt it to operate in the system as described above.

Now will be described, by way of a particular, non-limiting example, a preferred embodiment of the invention.

**BRIEF DESCRIPTION OF THE FIGURES**

Figure 1a is a representation of a driver's view of a parking assistance system according to the invention, shown with the vehicle positioned to commence the parking procedure.

Figure 1b is a plan view of the driver's vehicle indicating the start position and the relationship with parking space and adjacent vehicles.

Figure 2a is a view of the passenger side rear view mirror as the parking procedure is commenced.

Figure 2b is a plan view of the driver's vehicle indicating the position of the vehicle and the relationship with a parking space and adjacent vehicles at the commencement of the parking procedure.

Figure 3a is a representation of said mirror, part-way through the parking procedure.

Figure 3b is a plan view of the vehicle indicating the position and the relationship with parking space and adjacent vehicles part-way through the parking procedure.

Figure 4a is a representation of the passenger side rear view mirror shown at the completion of the parking procedure.

Figure 4b is a plan view of the driver's vehicle indicating the position and the relationship with parking space and adjacent vehicles at the completion of the parking procedure.

Figure 5 is a photograph of a vehicle after completion of a parking procedure as per that described.

Figure 6 is a representation of the guide line template shown on the mirror in figure 1a.

Figure 7 is an alternative representation of the guide lines of figure 6.

## DETAILED DESCRIPTION OF THE INVENTION

In essence the invention can be embodied as a set of markings on an externally-mounted passenger side rear-view mirror, on a motor vehicle. The markings correspond to a preferred positioning of external objects that can be seen  
5 via said mirror by the driver of the vehicle as the process of reverse parallel parking proceeds.

### EXAMPLE 1

The invention will now be described in its simplest form, with reference to a number of diagrams.

10 In an effort to develop a relatively simple and reproducible reverse parallel parking assistance system it was determined through experimentation that a system of target of guide lines marked onto the existing passenger's side rear-view mirror would enable a series of predetermined 'setup points' and manoeuvring procedures to be established. Once determined and overlaid onto the mirror, the system ensured  
15 consistent parking as long as the correct normal parking procedures were followed by the driver.

The position of the lines were calculated by locating a (right hand drive) vehicle in a parking spot (on the left hand side of a street), adjusting the passenger side mirror to give a clear view required for parking and then marking the location of  
20 the kerb with a red marker pen. This first mark sets the correct 'final' distance away from the kerb. The car was then manoeuvred to each of the 'intermediate' positions required during the parking procedure and the corresponding guide lines transferred onto the mirror.

A template made of the guide lines could be used to re-set the guide lines  
25 onto the mirror after they have been removed.

This exercise took into consideration the following factors:-

- The driver had a clear line of sight ahead of the vehicle, particularly such that the kerb ahead was visible.

- The driver's seat location plays a major role in the system. In the described tests, the driver's seat was in the fully retracted position (furthest away from the steering wheel). If the seat was in another (fully forward) position, the mirror line markings may need to be positioned slightly differently.
- The mirror of the test vehicle was adjusted after each step to ensure the photographs taken, and attached to the description, truly reflected the driver's view of the guide system. Constant re-adjusting of the mirrors tended to introduce errors whereby the vehicle did not end up parallel to the kerb after the parking process was completed.

The parking procedure is outlined in detail below.

Step 1:

The vehicle 5 to be parked is pulled up alongside the vehicle 10 in front of the selected parking spot 15, as illustrated in Figure 1a and Figure 1b. Care obviously needs to be taken to select a parking spot that has adequate room for parking.

The guide lines on the mirror have no relevance while the mirror is used for normal driving, and do not affect the mirrors usability during normal driving.

Step 2:

The vehicle 5 is reversed in a straight line until the rear of the adjacent vehicle 10 is aligned with the vertical guide line 20, as per Figure 2a and Figure 2b. Once alignment has been reached the vehicle should be brought to a stop.

Step 3:

The steering wheel is rotated towards the kerb 25 until it has reached 'full lock'. The driver proceeds to reverse the vehicle 5 with the steering wheel still in the 'full lock' position until the second guide 30 line aligns with the mirror view of the top of the kerb 25, as shown in Figure 3a. Once alignment has been reached the vehicle 5 should be brought to a stop. Alignment to this guide line 30 ensures that the

vehicle 5 is in the correct location to commence entry into the parking spot 16 as shown in Figure 3b.

Step 4:

The steering wheel is rotated away from the kerb 25 (towards the traffic lane 5 40) until it has reached 'full lock'. The driver proceeds to reverse the vehicle 5 with the steering wheel still in the 'full lock' position, as shown in Figure 4a. At this point the vehicle will be parked parallel with the kerb 25, as shown in Figure 4b and Figure 5.

Figure 6 shows a not-to-scale representation of the guide line template 10 created for the above example. This template could be used to transfer the guide lines onto another mirror on a similar vehicle. Figure 7 shows a more 'formalised' representation of the line markings that could be used for a similar vehicle and driver position.

For different vehicles, the guide line template may need to be adapted for 15 accuracy. The relationship between the driver's seat location and the guide lines needs to be considered and potentially adapted for different situations. In instances where the driver's seat is adjusted away from the original position, the driver may need to utilise a different guide location for the rear of the vehicle prior to the first turning manoeuvre in step 3.

The final template may be calibrated such that the main guides can be used 20 where the seat is located at its midpoint. Guide lines corresponding to the extremities of the seat's range of travel may be added to accommodate these locations.

If the invention is embodied as a set of indicia permanently affixed to the rear 25 view mirror, the template could be added to the mirrors at a suitable after-market fitting station or alternatively could be added to the vehicle at the time of manufacture.

One suitable methodology for applying the indicia to the mirrors is by printing them on to cut and shaped clear laminate. One example of this would be the #8518



polymer laminate, as supplied by 3M. As an example, the indicia could be printed on to the laminate with Eco solvent ink.

Alternatively more sophisticated systems could be set up to represent the guide lines on the mirrors. For example, a backlit LED display could be used to show the guide lines only when required. Alternatively, an LCD 'skin' on the mirror's surface may be used to create a 'moveable' set of guide lines that are pre-programmed to take account of different driver profiles for the same car, having regards to different driver height, seat position, etc.

In developing the invention, the inventors have relied on a number of standards documents that govern the design and use of rear view mirrors in motor vehicles. There are listed below and incorporated herein by reference.

- Vehicle Standard (Australian Design Rule 14/02 –Rear Vision Mirrors) 2006
- Vehicle Standard (Australian Design Rule 3/03 –Seats and Seat Anchorages) 2006
- SAE International J182 ( 1997) Motor Vehicle Fiducial Marks and Three-dimensional Reference System
- SAE International J826- ( 1995) Devices for Use in Defining and Measuring Vehicle Seating Accommodation
- SAE International J941 (1997) Motor Vehicle Drivers' Eye Locations
- SAE J1050—Motor Vehicle Driver and Passenger Head Position
- SAE J1516—Accommodation Tool Reference Point
- SAE J1517—Driver Selected Seat Position
- SAE Paper 650464—Automobile Driver Eye Position, J.F. Meldrum (1965)
- SAE Paper 680105—The Eyellipse and Considerations in the Driver's Forward Field of View, W.A. Devlin and R.W. Roe (1968)
- SAE Paper 720200—Driver Head and Eye Positions, D.C. Hammond and R.W. Roe (1972)
- SAE Paper 750356—Describing the Driver's Workspace Eye, Head, Knee, and Seat Positions, R.W. Roe (1975)
- SAE Paper 980012—Development of an Improved Driver Eye Position Model, M.A. Manary, et al (1998)(in SAE SP-1358) W.A. Devlin (1975), "Visibility Design Guide," Proposed SAE Recommended Practice (also, ISO/ TC159/ SC4(USA1)6), SAE Driver Vision Committee, Troy, MI

It will be appreciated by persons skilled in the art that the above described embodiments are not the only ways in which the invention can be put into practice.

There are other alternative embodiments which, while different in some details, nevertheless fall within the scope of the invention. It will, for example, be a simple task to those skilled in the art to adapt the described system for use with left-hand drive vehicles that are to be parked adjacent the left kerb of a street.

- 5           Equally, it would be a simple task for a person skilled in the art to adapt the described invention to assist a driver to parallel park a vehicle adjacent a kerb on the 'driver's side', i.e. the left-hand kerb for a left-hand drive vehicle, using indicia on the driver-side rear view mirror, or the right-hand kerb for a right-hand drive vehicle, using indicia on the driver-side rear view mirror.

**THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:**

1. A reverse parallel parking assistance system for a motor vehicle having a passenger side external rear view mirror, said system including the provision via said mirror of guide indicia corresponding to the apparent position of objects outside the vehicle during the parking procedure, when viewed via said mirror.  
5
2. The system of claim 1, wherein said objects include the near kerb while the vehicle stands parallel to said kerb prior to commencing the parking procedure.
3. The system of any preceding claim, wherein said objects include the near kerb while the vehicle stands parallel to said kerb after completing the parking procedure.  
10
4. The system of any preceding claim, wherein said objects include stationary vehicle to the rear of the vehicle being parked.
5. The system of any preceding claim, wherein said objects include the near kerb at one or more points during the parking procedure.  
15
6. The system of claim 5, wherein one of said points is where the driver has to change the direction of the front wheels from toward the near kerb to toward the far kerb.
7. The system of any preceding claim, wherein said passenger side external rear view mirror can be remotely positioned to a preset position.  
20
8. The system of claim 7, wherein said preset position is chosen to provide optimal accuracy of the apparent position of said objects to the driver.
9. The system of claim 8, wherein said preset position is determined with reference to the position of the driver's seat.

10. The system of any preceding claim, wherein said indicia are visible to the driver at night.

11. The system of any preceding claim, wherein the position of said indicia can be varied to provide optimal accuracy of the apparent position of said objects to the driver.

12. A passenger side external rear view mirror for a motor vehicle that is adapted to operate in the system of any preceding claim.

13. The modification of a passenger side external rear view mirror for a motor vehicle in order to adapt it to operate in the system of any one of claims 1 to 11.

10

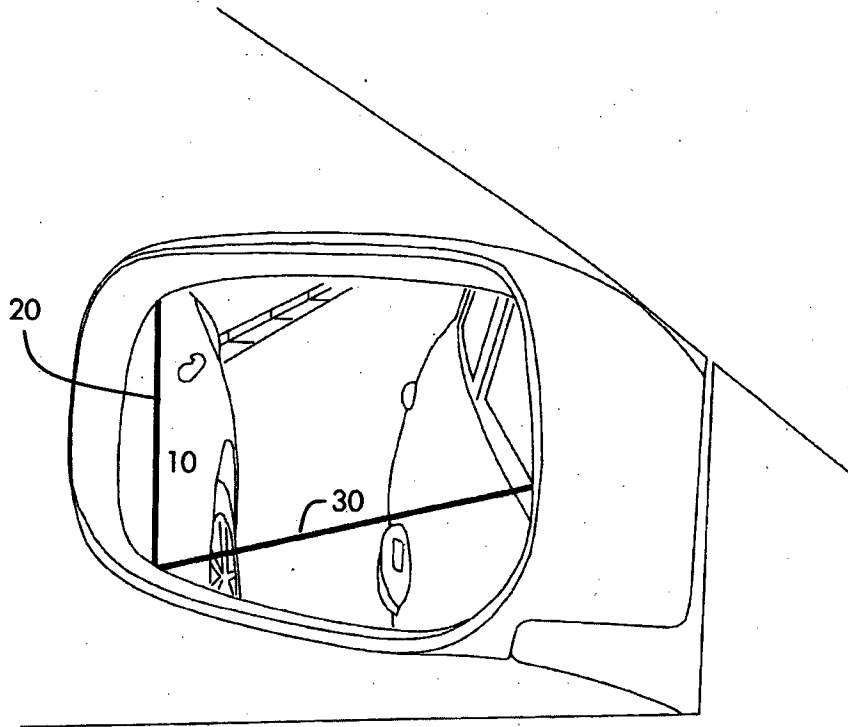


Figure 1a

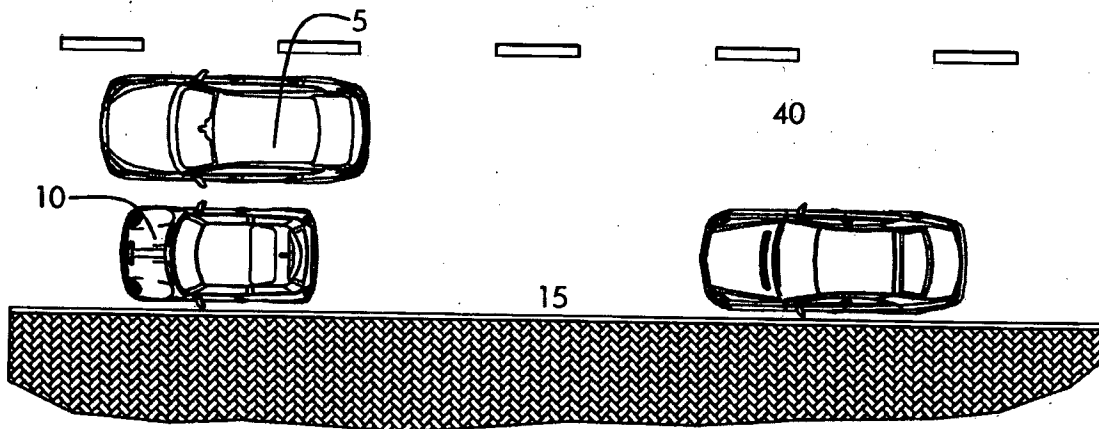


Figure 1b

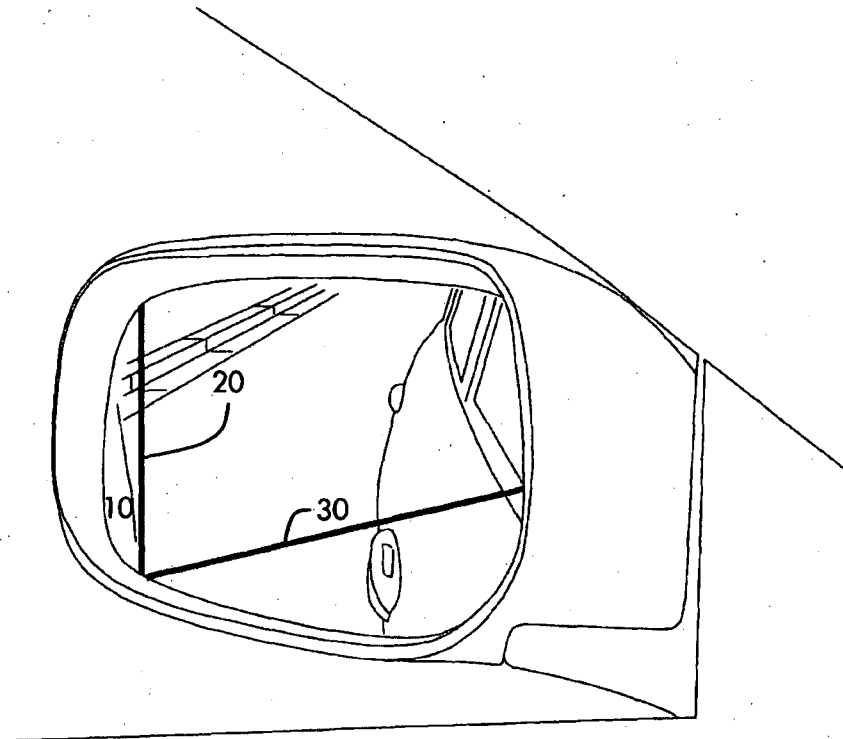


Figure 2a

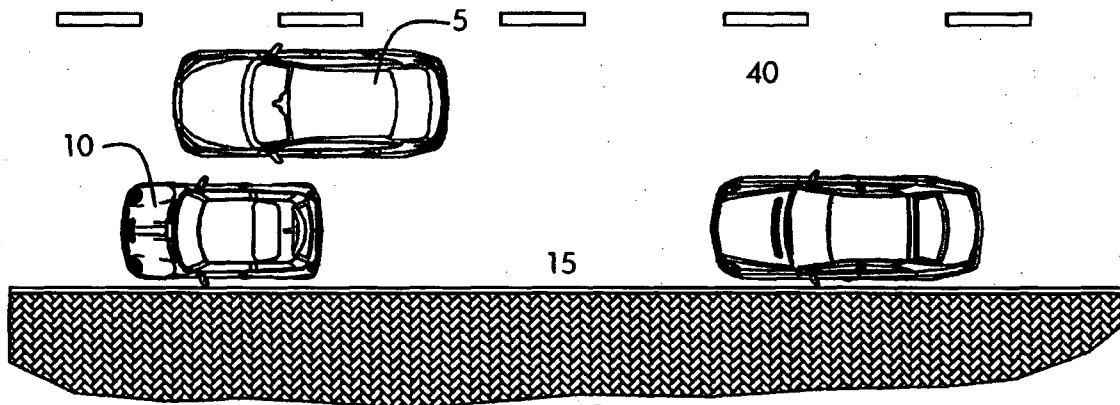


Figure 2b

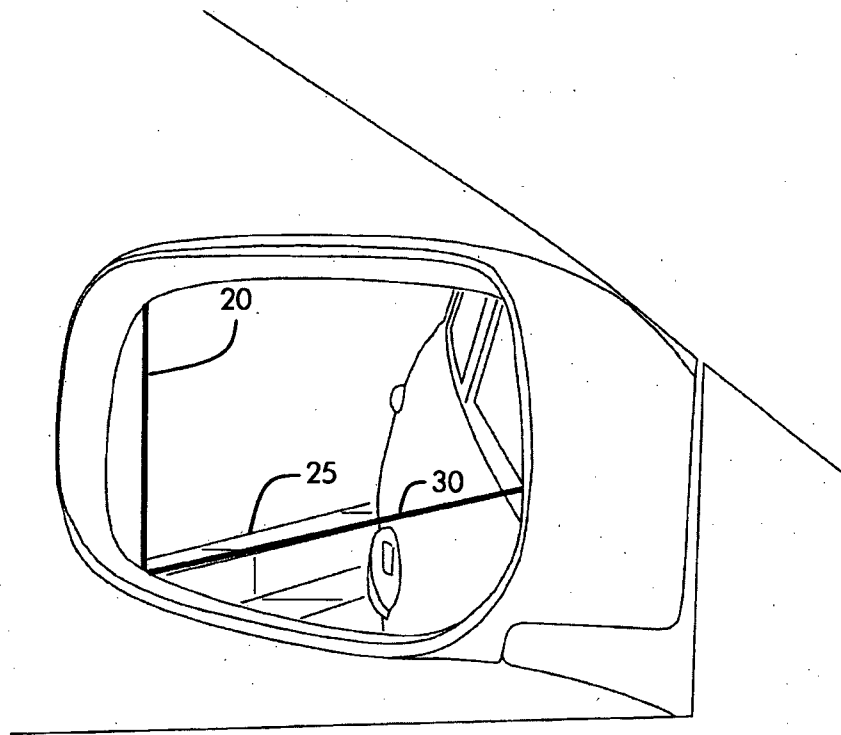


Figure 3a

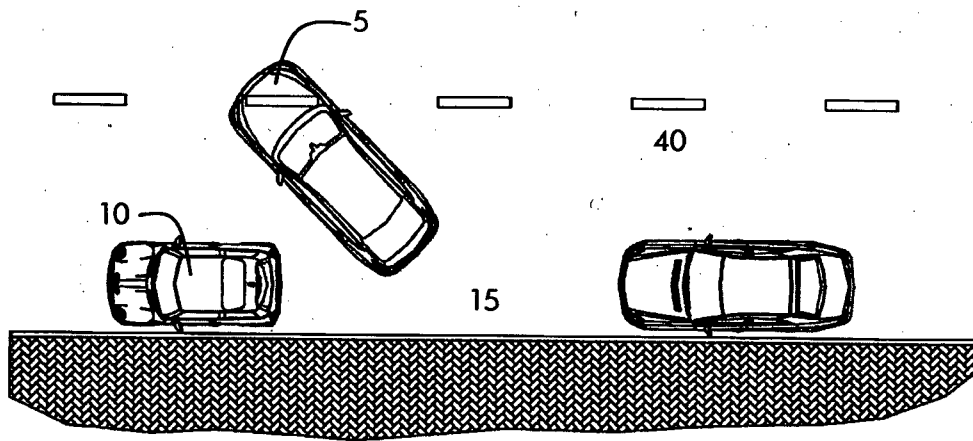


Figure 3b

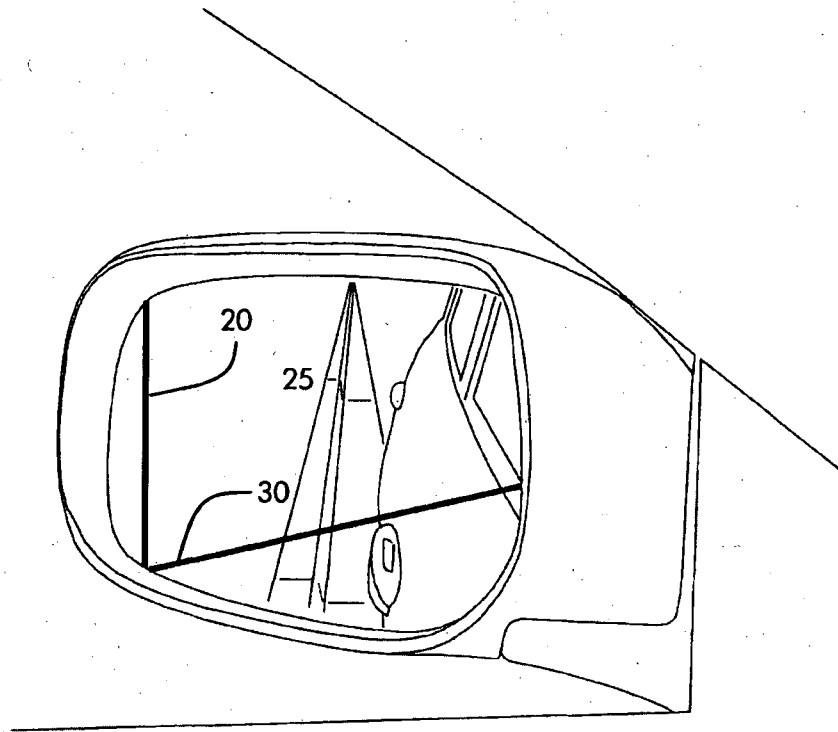


Figure 4a

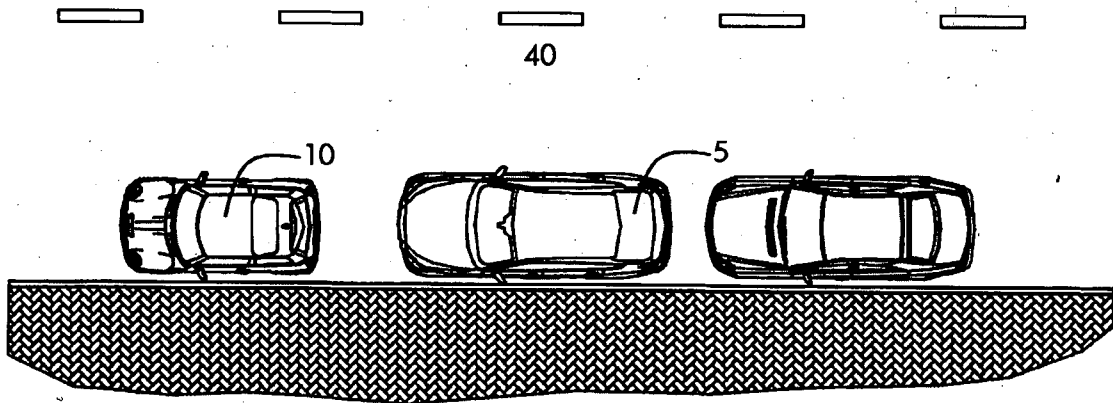


Figure 4b



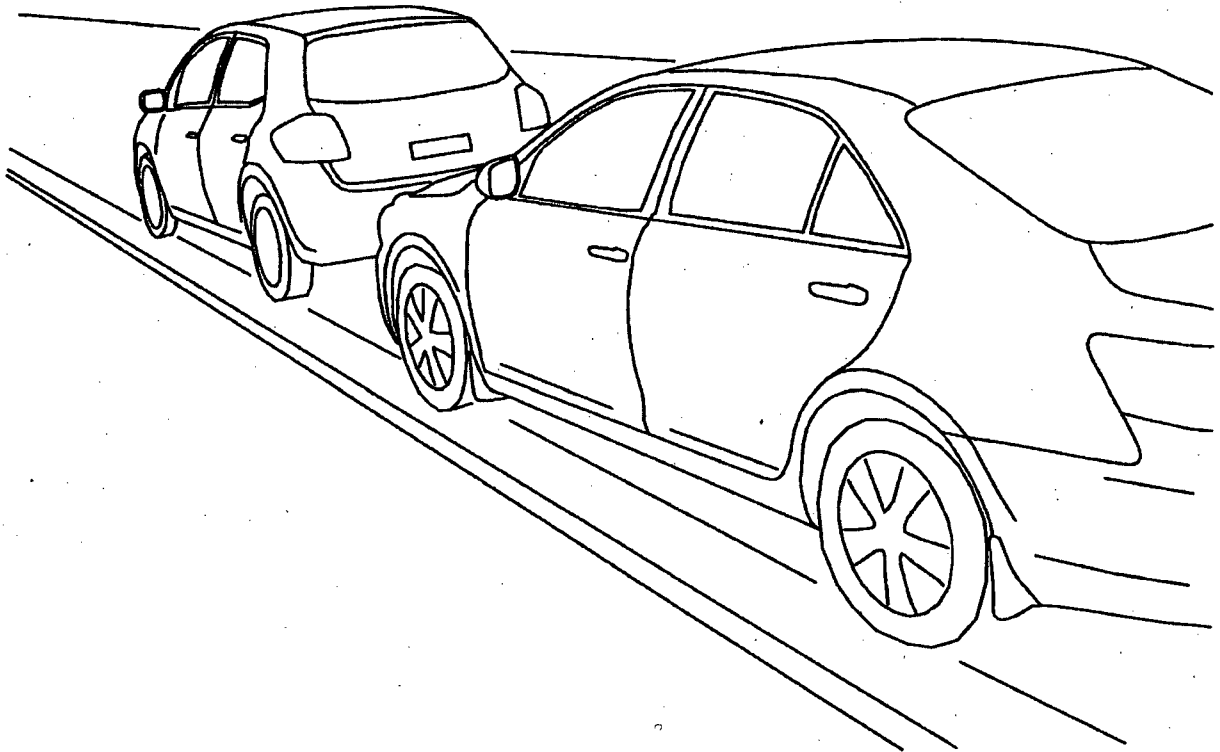


Figure 5

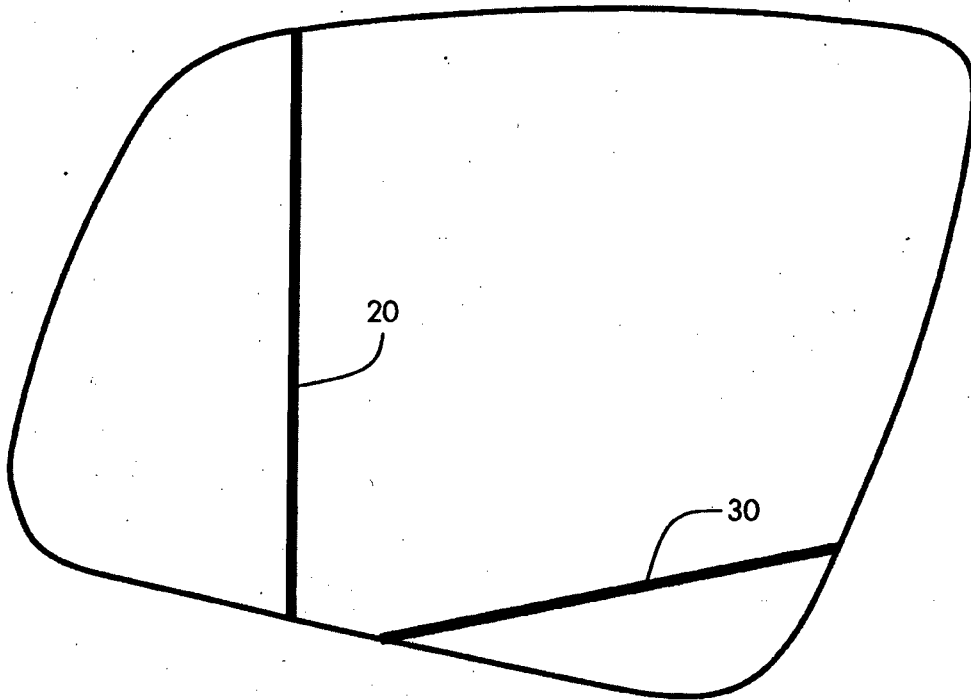


Figure 6

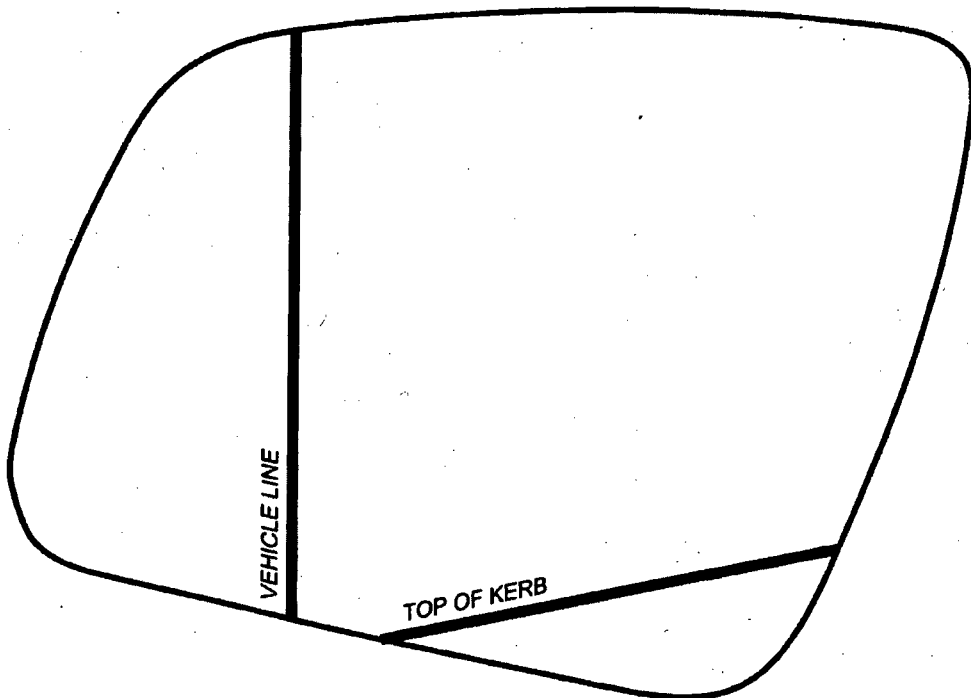


Figure 7

## INTERNATIONAL SEARCH REPORT

International application No.

**PCT/AU2012/001147**

A. CLASSIFICATION OF SUBJECT MATTER <b>B60Q 1/48 (2006.01) G02B 5/10 (2006.01) B60R 1/06 (2006.01)</b>		
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)		
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 practicable, search terms used)		
<ol style="list-style-type: none"> <li>1. WPI, EPODOC: Keywords (reverse, parallel, parking, mirror, indicia) and like terms</li> <li>2. WPI, EPODOC: Keywords (parallel, reverse, parking, vehicle, indicia, external, mirror, passenger) and like terms</li> <li>3. Google and Espace: Keywords (parallel, parking, passenger, mirror, indicia) and like terms.</li> </ol>		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	Documents are listed in the continuation of Box C	
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C <input checked="" type="checkbox"/> See patent family annex		
* "A"	Special categories of cited documents: document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E"	earlier application or patent but published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O"	document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P"	document published prior to the international filing date but later than the priority date claimed	
Date of the actual completion of the international search 6 November 2012	Date of mailing of the international search report 06 November 2012	
Name and mailing address of the ISA/AU  AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA Email address: pct@ipaustalia.gov.au Facsimile No.: +61 2 6283 7999	Authorised officer  Dr Arun Sharma AUSTRALIAN PATENT OFFICE (ISO 9001 Quality Certified Service) Telephone No. 0262223642	

<b>INTERNATIONAL SEARCH REPORT</b>		International application No.
C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		<b>PCT/AU2012/001147</b>
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2005-041376 A (NISSAN MOTOR) 17 February 2005 Figures 1-11, paragraphs [0023]-[0025], [0028], [0034]-[0039], [0052]-[0057], [0064]-[0067], [0085], [0137]-[0139],	1-13
X	US 7489256 B2 (DERGOUNOV et al.) 10 February 2009 Figures 1-3, whole document specifically column 4, lines 1-5	1, 5-13
X	JP 2005-112298 A (ICHIKOH INDUSTRIES LTD et al.) 28 April 2005 Figures 1-10, 13-29 and related paragraphs	1-13

**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International application No.

**PCT/AU2012/001147**

This Annex lists known patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

<b>Patent Document/s Cited in Search Report</b>		<b>Patent Family Member/s</b>	
<b>Publication Number</b>	<b>Publication Date</b>	<b>Publication Number</b>	<b>Publication Date</b>
JP 2005-041376 A	17 Feb 2005	JP 2005041376 A	17 Feb 2005
US 7489256 B2	10 Feb 2009	US 2008068219 A1	20 Mar 2008
		US 7489256 B2	10 Feb 2009
JP 2005-112298 A	28 Apr 2005	JP 2005112298 A	28 Apr 2005

**End of Annex**

Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.

Form PCT/ISA/210 (Family Annex)(July 2009)