AO 120 (Rev. 08/10)

TO: **Mail Stop 8** **Director of the U.S. Patent and Trademark Office** **P.O. Box 1450** **Alexandria, VA 22313-1450**	**REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK**

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court Western District of Michigan on the following

☐ Trademarks or ☑ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
1:17-cv-77	1/23/2017	Western District of Michigan

PLAINTIFF	DEFENDANT
MAGNA MIRRORS OF AMERICA, INC.	SAMVARDHANA MOTHERSON REFLECTEC GROUP HOLDINGS LIMITED, et al.

PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1		SEE ATTACHED
2		
3		
4		
5		

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1		
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4		
5		

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE
Thomas L. Dorwin, Clerk of Court	/s/ P. Woods	1/25/2017

Copy 1—Upon initiation of action, mail this copy to Director Copy 3—Upon termination of action, mail this copy to Director
Copy 2—Upon filing document adding patent(s), mail this copy to Director Copy 4—Case file copy

Patent No.	Date of Patent	Holder
U.S. Patent 7,934,843	May 3, 2011	Magna Mirrors of America, Inc.
U.S. Patent 8,128,243	March 6, 2012	Magna Mirrors of America, Inc.
U.S. Patent 8,128,244	March 6, 2012	Magna Mirrors of America, Inc.
U.S. Patent 8,147,077	April 3, 2012	Magna Mirrors of America, Inc.
U.S. Patent 8,267,534	September 18, 2012	Magna Mirrors of America, Inc.
U.S. Patent 8,550,642	October 8, 2013	Magna Mirrors of America, Inc.
U.S. Patent 8,591,047	November 26, 2013	Magna Mirrors of America, Inc.
U.S. Patent 8,783,882	July 22, 2014	Magna Mirrors of America, Inc.
U.S. Patent 8,899,762	December 2, 2014	Magna Mirrors of America, Inc.

AO 120 (Rev. 08/10)

TO: Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	**REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK**

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court Western District of Michigan on the following

☐ Trademarks or ☑ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
1:15-cv-183	2/19/2015	Western District of Michigan
PLAINTIFF Magna Mirrors of America, Inc.		DEFENDANT Ficosa International S.A., et al

PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1		SEE ATTACHED LIST
2		
3		
4		
5		

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	**DATE OF PATENT OR TRADEMARK**	**HOLDER OF PATENT OR TRADEMARK**
1		
2		
3		
4		
5		

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT
Voluntarily Dismissed on 3/23/2016

CLERK	(BY) DEPUTY CLERK	DATE
Clerk of Court	/s/ Paula J. Woods	3/24/2016

Copy 1—Upon initiation of action, mail this copy to Director Copy 3—Upon termination of action, mail this copy to Director
Copy 2—Upon filing document adding patent(s), mail this copy to Director Copy 4—Case file copy

Patent No.	Date of Patent	Holder
U.S. Patent 7,934,843	May 3, 2011	Magna Mirrors of America, Inc.
U.S. Patent 8,128,243	March 6, 2012	Magna Mirrors of America, Inc.
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U.S. Patent 8,783,882	July 22, 2014	Magna Mirrors of America, Inc.
U.S. Patent 8,899,762	December 2, 2014	Magna Mirrors of America, Inc.

AO 120 (Rev. 08/10)

TO: **Mail Stop 8** **Director of the U.S. Patent and Trademark Office** **P.O. Box 1450** **Alexandria, VA 22313-1450**	**REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK**

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☐ Trademarks or ☑ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
1:15-cv-183	2/19/2015	Western District of Michigan
PLAINTIFF Magna Mirrors of America, Inc.		DEFENDANT Ficosa International S.A.; Ficosa North America Corporation; Ficosa North America S.A. de C.V.; and Fico Mirrors, S.A.

PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1		SEE ATTCHED LIST
2		
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DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	**DATE OF PATENT OR TRADEMARK**	**HOLDER OF PATENT OR TRADEMARK**
1		
2		
3		
4		
5		

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE
TRACEY CORDES, CLERK OF COURT	/s/ Paula J. Woods	2/20/1015

Copy 1—Upon initiation of action, mail this copy to Director Copy 3—Upon termination of action, mail this copy to Director
Copy 2—Upon filing document adding patent(s), mail this copy to Director Copy 4—Case file copy

Patent No.	Date of Patent	Holder
U.S. Patent 7,934,843	May 3, 2011	Magna Mirrors of America, Inc.
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U.S. Patent 8,899,762	December 2, 2014	Magna Mirrors of America, Inc.

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 7,934,843 B2
APPLICATION NO. : 12/851045
DATED : May 3, 2011
INVENTOR(S) : Niall R. Lynam

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 1
Line 24, "minor" should be --mirror--

Column 14
Line 61, "Cavity" should be --cavity--

Column 17
Line 7, "minor" should be --mirror--
Line 12, "application" should be --applications--

Column 20
Lines 15-16, "spottermirrors" should be --spotter mirrors--

Column 24
Line 37, "material," should be --material.--

Column 25
Line 54, "application" should be --applications--
Line 67, "application" should be --applications--

Column 26
Line 48, "application" should be --applications--

Column 29
Line 59, Claim 11, "minor" should be --mirror--

Signed and Sealed this
Twenty-second Day of November, 2011

David J. Kappos

David J. Kappos
Director of the United States Patent and Trademark Office

PTO/SB/44 (09-07)
Approved for use through 08/31/2013. OMB 0651-0033
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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(Also Form PTO-1050)

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 7,934,843

APPLICATION NO.: 12/851,045

ISSUE DATE : May 3, 2011

INVENTOR(S) : Niall R. Lynam

It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 1
Line 24, "minor" should be --mirror--

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Line 61, "Cavity" should be --cavity--

Column 17
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Line 67, "application" should be --applications--

Column 26
Line 48, "application" should be --applications--

Column 29
Line 59, Claim 11, "minor" should be --mirror--

MAILING ADDRESS OF SENDER (Please do not use customer number below):

GARDNER, LINN, BURKHART & FLORY, LLP
2851 Charlevoix Dr., S.E., Suite 207
Grand Rapids, MI 49546

Electronic Acknowledgement Receipt

EFS ID:	11201877
Application Number:	12851045
International Application Number:	
Confirmation Number:	1992
Title of Invention:	EXTERIOR SIDEVIEW MIRROR SYSTEM
First Named Inventor/Applicant Name:	Niall R. Lynam
Customer Number:	28101
Filer:	Timothy A. Flory/Amanda Sytsma
Filer Authorized By:	Timothy A. Flory
Attorney Docket Number:	DON09 P-1624
Receipt Date:	17-OCT-2011
Filing Date:	05-AUG-2010
Time Stamp:	16:22:01
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	TransmittalForm.pdf	80980 05b96ee773aa9605a565234c39e98c25d43d67ec	no	1

Warnings:

Information:

2	Request for Certificate of Correction	RequestforCertificateofCorrection.pdf	113832 ad7caa7c99223ef7279774fd0518b2ad52ab387c	no	1
Warnings:					
Information:					
		Total Files Size (in bytes):	194812		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Doc Code: TRAN.LET

Document Description: Transmittal Letter

PTO/SB/21 (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Application Number	12/851,045
Filing Date	August 5, 2010
First Named Inventor	Niall R. Lynam
Art Unit	2872
Examiner Name	Alessandro V. Amari
Attorney Docket Number	DON09 P-1624

Total Number of Pages in This Submission

ENCLOSURES *(Check all that apply)*

- [ ] Fee Transmittal Form
  - [ ] Fee Attached
- [ ] Amendment/Reply
  - [ ] After Final
  - [ ] Affidavits/declaration(s)
- [ ] Extension of Time Request
- [ ] Express Abandonment Request
- [ ] Information Disclosure Statement
- [ ] Certified Copy of Priority Document(s)
- [ ] Reply to Missing Parts/ Incomplete Application
  - [ ] Reply to Missing Parts under 37 CFR 1.52 or 1.53
- [ ] Drawing(s)
- [ ] Licensing-related Papers
- [ ] Petition
- [ ] Petition to Convert to a Provisional Application
- [ ] Power of Attorney, Revocation Change of Correspondence Address
- [ ] Terminal Disclaimer
- [ ] Request for Refund
- [ ] CD, Number of CD(s) ____________
  - [ ] Landscape Table on CD
- [ ] After Allowance Communication to TC
- [ ] Appeal Communication to Board of Appeals and Interferences
- [ ] Appeal Communication to TC **(Appeal Notice, Brief, Reply Brief)**
- [ ] Proprietary Information
- [ ] Status Letter
- [x] Other Enclosure(s) (please identify below):

-Request for Certificate of Correction

Remarks

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm Name	GARDNER, LINN, BURKHART & FLORY, LLP		
Signature	TAFlory		
Printed name	Timothy A. Flory		
Date	October 17, 2011	Reg. No.	42540

CERTIFICATE OF TRANSMISSION/MAILING

I hereby certify that this correspondence is being facsimile transmitted to the USPTO or deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the date shown below:

Signature	Amanda R. Sytsma		
Typed or printed name	Amanda R. Sytsma	Date	October 17, 2011

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/851,045	05/03/2011	7934843	DON09 P-1624	1992

28101 7590 04/13/2011

VAN DYKE, GARDNER, LINN & BURKHART, LLP
SUITE 207
2851 CHARLEVOIX DRIVE, S.E.
GRAND RAPIDS, MI 49546

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

Niall R. Lynam, Holland, MI;

IR103 (Rev. 10/09)

Receipt date: 08/10/2010

PTO/SB/08A (07-05)
Approved for use through 07/31/2006. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

12851045 - GAU: 2872

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Substitute for form 1449/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT				Application Number	12/851,045
(Use as many sheets as necessary)				Filing Date	August 5, 2010
				First Named Inventor	Niall R. Lynam
				Art Unit	2872
				Examiner Name	
Sheet	3	of	12	Attorney Docket Number	DON09 P-1624

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		6,315,419	2001-11-13	Platzer, Jr.	
		6,310,611	2001-10-30	Caldwell	
		6,294,989	2001-09-25	Schofield et al.	
		6,286,965	2001-09-11	Caskey et al.	
		6,276,821	2001-08-21	Pastrick et al.	
		6,270,225	2001-08-07	Goolsby	
		6,260,608	2001-07-17	Kim	
		6,257,746	2001-07-10	Todd et al.	
		6,250,148	2001-06-26	Lynam	
		6,245,262	2001-06-12	Varaprasad et al.	
		6,227,689	2001-05-08	Miller	
		6,207,083	2001-03-27	Varaprasad et al.	
		6,201,642	2001-03-13	Bos	
		6,199,993	2001-03-13	Mou	
		6,198,409	2001-03-06	Schofield et al.	
		6,196,688	2001-03-06	Caskey et al.	
		6,178,034	2001-01-23	Allemand et al.	
		6,176,602	2001-01-23	Pastrick et al.	
		6,172,613	2001-01-09	DeLine et al.	
		6,164,564	2000-12-26	Franco et al.	
		6,154,306	2000-11-28	Varaprasad et al.	
		~~6,135,419~~ 6,315,419	2001-11-13	Platzer, Jr.	
		6,128,860	2000-10-10	~~Varaprasad et al.~~ Kepp et al.	
		6,124,647	2000-09-26	Marcus et al.	
		6,116,743	2000-09-12	Hoek	
		6,111,684	2000-08-29	Forgette et al.	
		6,109,586	2000-08-29	Hock	
		6,097,023	2000-08-01	Schofield et al.	
		6,074,068	2000-06-13	Palathingal	
		6,065,840	2000-05-23	Caskey et al.	
		6,033,078	2000-03-07	Su et al.	
		6,032,323	2000-03-07	Smith et al.	
		6,030,084	2002-02-29	Schmidt	
		~~6,022,511~~ 6,002,511	1999-12-14	Varaprasad et al.	
		~~6,011,486~~ 6,001,486	1999-12-14	Varaprasad et al.	
		6,007,207	1999-12-28	Liu	

Change(s) applied to document, /D.A.G./ 3/29/2011

Change(s) applied to document, /D.A.G./ 3/29/2011

Examiner Signature	/Alessandro Amari/	Date Considered	01/11/2011

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation it not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.A./

PTO/SB/08A (07-05)
Approved for use through 07/31/2006. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Substitute for form 1449/PTO	Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	12/851,045
(Use as many sheets as necessary)	Filing Date	August 5, 2010
	First Named Inventor	Niall R. Lynam
	Art Unit	2872
	Examiner Name	
Sheet 10 of 12	Attorney Docket Number	DON09 P-1624

Change(s) applied to document, /D.A.G./ 3/29/2011

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		2,135,262	1938-11-01	Schumacher	
		1,672,559	1928-06-05	Doble	
		1,114,559	1914-10-20	Weed	
		D297,926	1988-10-04	Kesler	
		D493,394	2004-07-27	Lawlor et al.	
		D493,131	2004-07-20	Lawlor et al.	
	2004	~~2007~~/0032638	2004-02-19	Tonar et al.	
		2004/0032675	2004-02-19	Weller et al.	
		2004/0032676	2004-02-19	Drummond et al.	
		2002/0036828	2002-03-28	Wong	
		2003/0043589	2003-03-06	Blank	
		2006/0050018	2006-03-09	Hutzel et al.	
		2005/0078389	2005-04-14	Kulas et al.	
		2005/0083577	2005-04-21	Varaprasad et al.	
		2005/0099693	2005-05-12	Schofield et al.	
		2006/0126150	2006-06-15	Tonar et al.	
		2005/0134983	2005-06-23	Lynam	
		2002/0159169	2002-10-31	McCord	
		2002/0159270	2002-10-31	Lynam et al.	
		2008/0308219	2008-12-18	Lynam	
		2009/0237820	2009-09-24	McCabe et al.	
		2004/0264011	2004-12-30	Lynam	
		20020105741	08-08-2002	Platzer, Jr.	
		20030117731	06-26-2003	Platzer, Jr.	
		20040165291	08-26-2004	Platzer, Jr.	
		20050232469	10-20-2005	Schofield et al.	
		20050248859	11-10-2005	Platzer, Jr.	
		20060061008	03-23-2006	Karner et al.	
		20060125919	06-15-2006	Camilleri et al.	
		20060171704	08-03-2006	Bingle et al.	
		20060184297	08-17-2006	Higgins-Luthman	
		20060268440	11-30-2006	Platzer, Jr.	
		20070058257	03-15-2007	Lynam	
		20070285789	12-13-2007	Lindahl et al.	
		20080212189	09-04-2008	Baur et al.	
		20080225421	09-18-2008	Platzer	

Examiner Signature	/Alessandro Amari/	Date Considered	01/11/2011

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation it not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.A./

Amendments to the Specification:

Change(s) applied
to document,
/L.M.C./
3/28/2011

Please amend paragraph [0001] on page 1 as follows:

0001
[~~0045~~] The present application is a continuation of U.S. patent application Ser. No. 12/197,666, filed Aug. 25, 2008, now U.S. Pat. No. 7,842,154 ~~(Attorney Docket DON09 P-1462)~~, which is a division of U.S. patent application Ser. No. 10/709,434, filed May 5, 2004, now U.S. Pat. No. 7,420,756, which claims the benefit of U.S. provisional application, Ser. No. 60/471,872, filed May 20, 2003, which are hereby incorporated herein by reference in their entireties.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

28101 7590 03/22/2011

VAN DYKE, GARDNER, LINN & BURKHART, LLP
SUITE 207
2851 CHARLEVOIX DRIVE, S.E.
GRAND RAPIDS, MI 49546

EXAMINER	
AMARI, ALESSANDRO V	
ART UNIT	PAPER NUMBER
2872	

DATE MAILED: 03/22/2011

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/851,045	08/05/2010	Niall R. Lynam	DON09 P-1624	1992

TITLE OF INVENTION: EXTERIOR SIDEVIEW MIRROR SYSTEM

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1510	$300	$0	$1810	06/22/2011

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.

B. If the status above is to be removed, check box 5b on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above, or

If the SMALL ENTITY is shown as NO:

A. Pay TOTAL FEE(S) DUE shown above, or

B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and 1/2 the ISSUE FEE shown above.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

28101 7590 03/22/2011

VAN DYKE, GARDNER, LINN & BURKHART, LLP
SUITE 207
2851 CHARLEVOIX DRIVE, S.E.
GRAND RAPIDS, MI 49546

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)

(Signature)

(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/851,045	08/05/2010	Niall R. Lynam	DON09 P-1624	1992

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nonprovisional	NO	$1510	$300	$0	$1810	06/22/2011

EXAMINER	ART UNIT	CLASS-SUBCLASS
AMARI, ALESSANDRO V	2872	359-872000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,

(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 ____________

2 ____________

3 ____________

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. The following fee(s) are submitted:

❑ Issue Fee

❑ Publication Fee (No small entity discount permitted)

❑ Advance Order - # of Copies ____________

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**

❑ A check is enclosed.

❑ Payment by credit card. Form PTO-2038 is attached.

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number ____________ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)

❑ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.

❑ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature ____________ Date ____________

Typed or printed name ____________ Registration No. ____________

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

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GRAND RAPIDS, MI 49546

EXAMINER	
AMARI, ALESSANDRO V	
ART UNIT	PAPER NUMBER
2872	

DATE MAILED: 03/22/2011

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)

(application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 0 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 0 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No. 12/851,045	Applicant(s) LYNAM, NIALL R.	
	Examiner ALESSANDRO AMARI	Art Unit 2872	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *amendment of 1/19/2011*.

2. ☒ The allowed claim(s) is/are *1-39*.

3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☐ All b) ☐ Some* c) ☐ None of the:
   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
   1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☐ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

DETAILED ACTION

Terminal Disclaimer

The terminal disclaimer filed on 19 January 2011 disclaiming the terminal portion of any patent granted on this application which would extend beyond the expiration date of US Patent 6522451 has been reviewed and is accepted. The terminal disclaimer has been recorded.

Affidavit

The Declaration filed on 19 January 2011 under 37 CFR 1.131 is sufficient to overcome the Lynam et al US 2002/0072026 reference.

REASONS FOR ALLOWANCE

Claims 1-39 are allowed.

The following is an examiner's statement of reasons for allowance:

Claim 1 is allowable for at least the reason, "wherein said backing plate element comprises a polymeric substrate that is formed as a single element by injection molding of a polymeric resin; wherein said backing plate element is capable of supporting said plano reflective element and said auxiliary reflective element; wherein said first support portion of said backing plate element comprises a flat portion and wherein said plano reflective element is disposed at said flat portion; wherein said second support portion of said backing plate element comprises a curved portion and wherein said auxiliary reflective element is disposed at said curved portion; wherein the rearward field of view of said auxiliary reflective element is different from and angled to the rearward field of view of said plano reflective element when both are attached to said backing plate element of said piano-auxiliary reflective element assembly when said piano-auxiliary reflective element assembly is included in said exterior sideview mirror assembly and when said exterior sideview mirror assembly is attached to the side of the automobile; wherein angling of the rearward field of view of said auxiliary reflective element relative to the rearward field of view of said plano reflective clement is achieved, at least in part, by an angling of said second support portion of said backing plate element supporting said auxiliary reflective element relative to said first support portion of said backing plate element supporting said plano reflective element; wherein, when said exterior sideview mirror assembly is attached to the side of the automobile, the field of view of said plano reflective element generally views rearwardly of the equipped automobile and the field of view of said auxiliary reflective element generally views towards a blind spot in the side lane adjacent the side of the automobile to which said exterior sideview mirror assembly is attached, said blind spot being generally outside the rearward field of view of said plano reflective element when said plano reflective element is viewed by a driver of the equipped automobile when said exterior sideview mirror assembly is attached to the side of the automobile; and wherein at least one of said plano reflective element and said auxiliary reflective element comprises one of(a) a glass substrate having a surface coated with a metallic reflector coating and (b) a polymeric substrate having a thin glass element applied to a surface thereof and with an opposing surface thereof having a reflecting layer applied thereto" as set forth in the claimed combination. Claims 2-39 are allowable due to their dependence on claim 1.

Applicant has overcome the prior art rejection and questions regarding priority by filing a 37 CFR 1.131 affidavit which proved sufficient to overcome the Lynam et al reference. The 37 CFR 1.131 affidavit proves that Niall Lynam conceived or invented the subject matter disclosed in the patent application publication.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled “Comments on Statement of Reasons for Allowance.”

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ALESSANDRO AMARI whose telephone number is (571)272-2306. The examiner can normally be reached on Monday-Friday 8:00 AM to 5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner’s supervisor, Stephone B. Allen can be reached on (571) 272-2434. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

16 March 2011

/Alessandro Amari/
Primary Examiner, Art Unit 2872

Issue Classification

Application/Control No.	Applicant(s)/Patent Under Reexamination
12851045	LYNAM, NIALL R.
Examiner	**Art Unit**
ALESSANDRO AMARI	2872

ORIGINAL	
CLASS	SUBCLASS
359	866

INTERNATIONAL CLASSIFICATION					
CLAIMED					NON-CLAIMED
G	0	2	B	5 / 08 (2006.0)	
G	0	2	B	7 / 182 (2006.0)	

CROSS REFERENCE(S)

CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)				
359	877				

☒ Claims renumbered in the same order as presented by applicant ☐ CPA ☒ T.D. ☐ R.1.47

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
	1		17		33										
	2		18		34										
	3		19		35										
	4		20		36										
	5		21		37										
	6		22		38										
	7		23		39										
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	10		26												
	11		27												
	12		28												
	13		29												
	14		30												
	15		31												
	16		32												

NONE (Assistant Examiner)	(Date)	**Total Claims Allowed:** 39	
/ALESSANDRO AMARI/ Primary Examiner.Art Unit 2872 (Primary Examiner)	03/16/2011 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 16

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	3846	(359/866,872,877,883).CCLS.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	OFF	2011/03/16 15:41

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L2	1	plano-auxiliary.clm.	US-PGPUB; USPAT; UPAD	ADJ	ON	2011/03/16 15:42
L3	68	sideview mirror.clm.	US-PGPUB; USPAT; UPAD	ADJ	ON	2011/03/16 15:42
L4	5	plano reflective element.clm.	US-PGPUB; USPAT; UPAD	ADJ	ON	2011/03/16 15:42
L5	395	(side view or side-view or sideview) mirror.clm.	US-PGPUB; USPAT; UPAD	ADJ	ON	2011/03/16 15:43
L6	4719	backing plate.clm.	US-PGPUB; USPAT; UPAD	ADJ	ON	2011/03/16 15:43
L7	16742	field near1 view.clm.	US-PGPUB; USPAT; UPAD	ADJ	ON	2011/03/16 15:44
L8	5	4 and 5 and 6 and 7	US-PGPUB; USPAT; UPAD	ADJ	ON	2011/03/16 15:44
L10	7	auxiliary reflective element.clm.	US-PGPUB; USPAT; UPAD	ADJ	ON	2011/03/16 15:48
L11	1	8 and 10	US-PGPUB; USPAT; UPAD	ADJ	ON	2011/03/16 15:48

3/16/2011 3:49:23 PM
C:\Documents and Settings\aamari\My Documents\EAST\Workspaces\12851045.wsp

Search Notes	Application/Control No. 12851045	Applicant(s)/Patent Under Reexamination LYNAM, NIALL R.
	Examiner ALESSANDRO AMARI	Art Unit 2872

SEARCHED

Class	Subclass	Date	Examiner
359	866,872,877,883	1/11/2011	AA
Update	above	3/16/2011	AA

SEARCH NOTES

Search Notes	Date	Examiner
EAST search	1/11/2011	AA
Consulted with C. Spyrou on affidavit	3/15/2011	AA

INTERFERENCE SEARCH

Class	Subclass	Date	Examiner
	PG-Pub/USPAT/UPAD text search	3/16/2011	AA

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Alexandria, Virginia 22313-1450
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VAN DYKE, GARDNER, LINN & BURKHART, LLP
SUITE 207
2851 CHARLEVOIX DRIVE, S.E.
GRAND RAPIDS, MI 49546

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Amanda R. Sytsma	(Depositor's name)
Amanda R. Sytsma	(Signature)
March 22, 2011	(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/851,045	08/05/2010	Niall R. Lynam	DON09 P-1624	1992

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(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 VAN DYKE, GARDNER, LINN & BURKHART, LLP
2 ____
3 ____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE
DONNELLY CORPORATION

(B) RESIDENCE: (CITY and STATE OR COUNTRY)
HOLLAND, MI

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:
☒ Issue Fee
☒ Publication Fee (No small entity discount permitted)
☐ Advance Order - # of Copies ____

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**
☐ A check is enclosed.
☐ Payment by credit card. Form PTO-2038 is attached.
☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number 22-0190 (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.
☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature [signature] Date March 22, 2011

Typed or printed name Timothy A. Flory Registration No. 42540

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Electronic Patent Application Fee Transmittal

Application Number:	12851045
Filing Date:	05-Aug-2010
Title of Invention:	EXTERIOR SIDEVIEW MIRROR SYSTEM
First Named Inventor/Applicant Name:	Niall R. Lynam
Filer:	Timothy A. Flory/Amanda Sytsma
Attorney Docket Number:	DON09 P-1624

Filed as Large Entity

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Utility Appl issue fee	1501	1	1510	1510
Publ. Fee- early, voluntary, or normal	1504	1	300	300

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**1810**

Electronic Acknowledgement Receipt

EFS ID:	9707973
Application Number:	12851045
International Application Number:	
Confirmation Number:	1992
Title of Invention:	EXTERIOR SIDEVIEW MIRROR SYSTEM
First Named Inventor/Applicant Name:	Niall R. Lynam
Customer Number:	28101
Filer:	Timothy A. Flory/Amanda Sytsma
Filer Authorized By:	Timothy A. Flory
Attorney Docket Number:	DON09 P-1624
Receipt Date:	22-MAR-2011
Filing Date:	05-AUG-2010
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Application Type:	Utility under 35 USC 111(a)

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Deposit Account	220190
Authorized User	FLORY,TIMOTHY A

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Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	IssueFeeTransmittal.pdf	134310 9a41754e594354fb8a16edbd2085cddea75cab74	no	1
Warnings:					
Information:					
2	Fee Worksheet (PTO-875)	fee-info.pdf	31896 b96d8f6ab895f97d4360820dfc510f6f625999c2	no	2
Warnings:					
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			Total Files Size (in bytes):	166206	

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If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

<u>National Stage of an International Application under 35 U.S.C. 371</u>
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

<u>New International Application Filed with the USPTO as a Receiving Office</u>
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Application Number	Application/Control No.	Applicant(s)/Patent under Reexamination
	12/851,045	LYNAM, NIALL R.

Document Code - DISQ	**Internal Document – DO NOT MAIL**

TERMINAL DISCLAIMER	☒ APPROVED	☐ DISAPPROVED
Date Filed : 01JAN 2011	**This patent is subject to a Terminal Disclaimer**	

Approved/Disapproved by:
JAB

U.S. Patent and Trademark Office

PATENT
DON09 P-1624

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Group Art	:	2872
Examiner	:	Alessandro V. Amari
Applicant	:	Niall R. Lynam
Serial No.	:	12/851,045
Filing Date	:	August 5, 2010
For	:	EXTERIOR SIDEVIEW MIRROR SYSTEM

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

REQUEST FOR RECONSIDERATION

Responsive to the Office Action mailed January 13, 2011, Applicants wish to submit the following:

Amendments to the Specification are on page 2 of this paper.

Amendments to the Claims begin on page 3 of this paper.

Remarks begin on page 13 of this paper.

A **Terminal Disclaimer** is attached.

Amendments to the Specification:

Please amend paragraph [0001] on page 1 as follows:

[0045] The present application is a continuation of U.S. patent application Ser. No. 12/197,666, filed Aug. 25, 2008, now U.S. Pat. No. 7,842,154 ~~(Attorney Docket DON09 P-1462)~~, which is a division of U.S. patent application Ser. No. 10/709,434, filed May 5, 2004, now U.S. Pat. No. 7,420,756, which claims the benefit of U.S. provisional application, Ser. No. 60/471,872, filed May 20, 2003, which are hereby incorporated herein by reference in their entireties.

Amendments to the Claims:

This listing of claims will replace all prior versions and listings of claims in the present application:

1 (original): An exterior sideview mirror system suitable for use on an automobile, said exterior sideview mirror system comprising:

an exterior sideview mirror assembly adapted for attachment to a side of an automobile;

said exterior sideview mirror assembly including a reflective element having a rearward field of view when attached to the side of the automobile;

said reflective element attached to an electrically-operated actuator of said exterior sideview mirror assembly and movable by said actuator in order to position said rearward field of view to a driver-desired position when said exterior sideview mirror assembly is attached to the side of the automobile;

wherein said reflective element comprises a plano-auxiliary reflective element assembly, said plano-auxiliary reflective element assembly comprising a plano reflective element having unit magnification and a separate auxiliary reflective element having a curvature;

said plano reflective element and said auxiliary reflective element of said plano-auxiliary reflective element assembly mounted adjacently at said plano-auxiliary reflective element assembly in a side-by-side relationship and not superimposed with one reflective element on top of the other reflective element;

said plano reflective element and said auxiliary reflective element supported at a backing plate element, said backing plate element mounting to said actuator such that movement of said backing plate element of said plano-auxiliary reflective element assembly by said actuator simultaneously and similarly moves said plano reflective element and said auxiliary reflective element;

said auxiliary reflective element having a wide-angle field of view encompassing a blind spot in the side lane adjacent the side of the automobile to which said exterior sideview mirror assembly is attached;

said backing plate element having a first support portion supporting said plano reflective element and a second support portion supporting said auxiliary reflective element;

wherein said auxiliary reflective element is positioned at an outboard portion of said plano-auxiliary reflective element assembly when said exterior sideview mirror assembly is mounted to the side of the automobile;

wherein said backing plate element comprises a polymeric substrate that is formed as a single element by injection molding of a polymeric resin;

wherein said backing plate element is capable of supporting said plano reflective element and said auxiliary reflective element;

wherein said first support portion of said backing plate element comprises a flat portion and wherein said plano reflective element is disposed at said flat portion;

wherein said second support portion of said backing plate element comprises a curved portion and wherein said auxiliary reflective element is disposed at said curved portion;

wherein the rearward field of view of said auxiliary reflective element is different from and angled to the rearward field of view of said plano reflective element when both are attached to said backing plate element of said plano-auxiliary reflective element assembly when said plano-auxiliary reflective element assembly is included in said exterior sideview mirror assembly and when said exterior sideview mirror assembly is attached to the side of the automobile;

wherein angling of the rearward field of view of said auxiliary reflective element relative to the rearward field of view of said plano reflective element is achieved, at least in part, by an angling of said second support portion of said backing plate element supporting said auxiliary reflective element relative to said first support portion of said backing plate element supporting said plano reflective element;

wherein, when said exterior sideview mirror assembly is attached to the side of the automobile, the field of view of said plano reflective element generally views rearwardly of the equipped automobile and the field of view of said auxiliary reflective element generally views towards a blind spot in the side lane adjacent the side of the automobile to which said exterior sideview mirror assembly is attached, said blind spot being generally outside the rearward field of view of said plano reflective element when said plano reflective element is viewed by a driver of the equipped automobile when said exterior sideview mirror assembly is attached to the side of the automobile; and

wherein at least one of said plano reflective element and said auxiliary reflective element comprises one of (a) a glass substrate having a surface coated with a metallic reflector coating and (b) a polymeric substrate having a thin glass element applied to a surface thereof and with an opposing surface thereof having a reflecting layer applied thereto.

2 (original): The exterior sideview mirror system of claim 1, wherein at least a portion of said auxiliary reflective element adjacent said plano reflective element has its front surface generally coplanar with the front surface of said plano reflective element.

3 (original): The exterior sideview mirror system of claim 2, wherein an element of said backing plate element at least partially partitions said backing plate element into a first region where said plano reflective element is disposed and a separate and adjacent second region where said auxiliary reflective element is disposed, and wherein said first region is adapted to receive said plano reflective element and said second region is adapted to receive said auxiliary reflective element.

4 (original): The exterior sideview mirror system of claim 1, wherein said plano reflective element and said auxiliary reflective element are adjacently supported at said backing plate element at a joint, and wherein said plano-auxiliary reflective element assembly includes a demarcation element, said demarcation element disposed at said joint to form a demarcation between said plano reflective element and said auxiliary reflective element, said demarcation element having a portion visible to a driver of the automobile when said exterior sideview mirror assembly is attached to the side of the automobile.

5 (original): The exterior sideview mirror system of claim 4, wherein said demarcation element is dark colored.

6 (original): The exterior sideview mirror system of claim 5, wherein said demarcation element is dark colored with a color selected from the group consisting of black, grey, blue and brown.

7 (original): The exterior sideview mirror system of claim 5, wherein said demarcation element comprises at least one of a polymer material, a tape, a plastic film, a paint, a lacquer and a caulk.

8 (original): The exterior sideview mirror system of claim 7, wherein said demarcation element comprises a polymer material.

9 (original): The exterior sideview mirror system of claim 5, wherein the rearward field of view of said auxiliary reflective element is at an angle of at least about 3 degrees relative to the rearward field of view of said plano reflective element.

10 (original): The exterior sideview mirror system of claim 4, wherein said joint comprises a space between said plano reflective element and said auxiliary reflective element.

11 (original): The exterior sideview mirror system of claim 10, wherein said demarcation element is at least partially disposed at said space between said plano reflective element and said auxiliary reflective element.

12 (original): The exterior sideview mirror system of claim 4, wherein said demarcation element comprises a wall on said backing plate element, said wall located on said backing plate element at said joint, said wall disposed between said plano reflective element and said auxiliary reflective element.

13 (original): The exterior sideview mirror system of claim 1, wherein an element of said backing plate element at least partially partitions said backing plate element into a first region where said plano reflective element is disposed and a separate and adjacent second region where said auxiliary reflective element is disposed, and wherein said first region is adapted to receive

said plano reflective element and said second region is adapted to receive said auxiliary reflective element.

14 (original): The exterior sideview mirror system of claim 1, wherein the rearward field of view of said auxiliary reflective element is generally directed at least one of outwardly and downwardly with respect to the longitudinal axis of the equipped automobile when said exterior sideview mirror assembly is attached to the side of the automobile.

15 (original): The exterior sideview mirror system of claim 1, wherein the rearward field of view of said auxiliary reflective element is generally directed outwardly and downwardly with respect to the longitudinal axis of the equipped automobile when said exterior sideview mirror assembly is attached to the side of the automobile.

16 (original): The exterior sideview mirror system of claim 1, wherein said plano reflective element is supported at said backing plate element by at least one of an adhesive attachment and a mechanical attachment, and wherein said auxiliary reflective element is supported at said backing plate element by at least one of an adhesive attachment and a mechanical attachment.

17 (original): The exterior sideview mirror system of claim 1, wherein said plano reflective element comprises a flat glass substrate having a surface coated with a metallic reflector coating and wherein said auxiliary reflective element comprises a bent glass substrate having a surface coated with a metallic reflector coating, and wherein said bent glass substrate has a spherical curvature.

18 (original): The exterior sideview mirror system of claim 1, wherein said plano reflective element comprises a flat glass substrate having a surface coated with a metallic reflector coating and wherein said auxiliary reflective element comprises a bent glass substrate having a surface coated with a metallic reflector coating, and wherein said bent glass substrate has a multiradius curvature.

19 (original): The exterior sideview mirror system of claim 1, wherein said plano reflective element comprises a flat glass substrate having a surface coated with a metallic reflector coating and wherein said auxiliary reflective element comprises a bent glass substrate having a surface coated with a metallic reflector coating, and wherein said bent glass substrate has an aspherical curvature.

20 (original): The exterior sideview mirror system of claim 1, wherein said plano reflective element comprises a substrate having a surface coated with a metallic reflector coating and wherein said auxiliary reflective element comprises a substrate having a surface coated with a metallic reflector coating.

21 (original): The exterior sideview mirror system of claim 20, wherein said curved portion of said backing plate element comprises a curvature corresponding to a curvature of said auxiliary reflective element.

22 (original): The exterior sideview mirror system of claim 21, wherein said curved portion of said backing plate element has at least one of (a) a spherical curvature, (b) an aspherical curvature and (c) a multiradius curvature.

23 (original): The exterior sideview mirror system of claim 22, wherein a demarcation element is disposed between said plano reflective element and said auxiliary reflective element and wherein said demarcation element comprises a part of said backing plate element, and wherein said demarcation element comprises a wall structure that at least partially partitions said backing plate element into a first region where said plano reflective element is disposed and a separate and adjacent second region where said auxiliary reflective element is disposed, and wherein at least one of (a) said first region is adapted to receive said plano reflective element and (b) said second region is adapted to receive said auxiliary reflective element.

24 (original): The exterior sideview mirror system of claim 1, wherein said plano reflective element comprises a substrate formed from elongated sheet of substrate material comprising a polymeric resin material, and wherein said elongated sheet has a substantially transparent functional film applied at a surface thereof, and wherein said substantially transparent functional film provides at least one of (a) an anti-abrasion function, (b) a hydrophobic function and (c) a hydrophilic function, and wherein said functional film comprises an ultrathin glass material which is sufficiently flexible to be provided in a reel or roll, and wherein said functional film is sufficiently flexible to conform to said substrate of said plano reflective element, and wherein said plano reflective element comprises a reflective film disposed at a surface of said substrate opposite said substantially transparent functional film.

25 (original): The exterior sideview mirror system of claim 1, wherein said plano reflective element comprises a thin flexible glass sheet and a polymeric substrate, said thin flexible glass sheet existing as a pre-formed glass sheet that is separate from said polymeric substrate, said thin glass sheet having an attaching surface, said attaching surface being opposed to and adhered to said surface of said polymeric substrate when said thin flexible sheet is adhered to said exterior surface of said polymeric substrate, said thin flexible sheet providing an anti-abrasion function at said surface of said polymeric substrate when adhered thereto, said thin flexible glass sheet substantially conforming to said exterior surface of said polymeric substrate when adhered thereto, said thin glass sheet having a thickness of less than approximately 0.8 mm and greater than approximately 0.3 mm.

26 (original): The exterior sideview mirror system of claim 25, wherein said substrate is cut from a molded or extruded or cast strip or sheet, said glass sheet being laminated to said strip or sheet and wherein said plano reflective element comprises a reflective film applied to an inner surface of said substrate opposite said exterior surface, and wherein said reflective film comprises a polymeric reflective film at least one of laminated, adhered and applied to said inner surface of said substrate.

27 (original): The exterior sideview mirror system of claim 1, wherein said auxiliary reflective element comprises a heater element operable to demist/deice the outmost surface of said auxiliary reflective element when said auxiliary reflective element is disposed at said backing plate element and when said exterior sideview mirror assembly is attached and operated on the side of the automobile.

28 (original): The exterior sideview mirror system of claim 1, wherein said exterior sideview mirror assembly including said plano-auxiliary reflective element having a rearward field of view when attached to the side of the automobile comprises a driver-side exterior sideview mirror assembly, and wherein, when attached to the side of the automobile, said driver-side exterior sideview mirror assembly provides to the driver of the equipped automobile a total field of view that generally subtends an angle of at least about 25 degrees with respect to the side of the equipped automobile.

29 (original): The exterior sideview mirror system of claim 1, wherein said exterior sideview mirror assembly including said plano-auxiliary reflective element having a rearward field of view when attached to the side of the automobile comprises a driver-side exterior sideview mirror assembly, and wherein, when attached to the side of the automobile, said driver-side exterior sideview mirror assembly provides to the driver of the equipped automobile a total field of view that generally subtends an angle of at least about 30 degrees with respect to the side of the equipped automobile.

30 (original): The exterior sideview mirror system of claim 1, wherein said auxiliary reflective element has an aspherical curvature.

31 (original): The exterior sideview mirror system of claim 1, wherein said auxiliary reflective element has a spherical curvature.

32 (original): The exterior sideview mirror system of claim 1, wherein the ratio of the width of said plano reflective element to the width of said auxiliary reflective element is greater than 1.5.

33 (original): The exterior sideview mirror system of claim 1, wherein the ratio of the width of said plano reflective element to the width of said auxiliary reflective element is greater than 2.5.

34 (original): The exterior sideview mirror system of claim 1, wherein said exterior sideview mirror assembly comprises a door-mounted exterior sideview mirror assembly adapted for attachment to a side of the automobile adjacent a driver seating location of a driver of the automobile and wherein the rearward field of view of said auxiliary reflective element generally views downwardly towards the road surface adjacent to the driver seating location at least at a distance in the range of about 1 foot to about 24 feet to the rear of the driver seating location.

35 (original): The exterior sideview mirror system of claim 1, wherein at least one of said plano reflective element and said auxiliary reflective element comprises a glass substrate having a surface coated with a metallic reflector coating, and wherein said metallic reflector coating is selected from the group consisting of (i) a chromium coating, (ii) a titanium coating, (iii) a rhodium coating, (iv) a metal-alloy coating, (v) a nickel alloy coating, (vi) an aluminum coating and (vii) a silver coating.

36 (original): The exterior sideview mirror system of claim 1, wherein at least one of said plano reflective element and said auxiliary reflective element comprises an electro-optic reflective element.

37 (original): The exterior sideview mirror system of claim 1, wherein said plano reflective element comprises an electro-optical reflective element, and wherein said electro-optical reflective element comprises an electrochromic reflective element.

38 (original): The exterior sideview mirror system of claim 37, wherein said auxiliary reflective element comprises a fixed reflectance mirror reflector.

39 (original): The exterior sideview mirror system of claim 38, wherein said fixed reflectance mirror reflector comprises a spherically bent glass substrate coated with a metallic reflector coating.

40-92 (canceled).

Remarks:

The amendments and remarks presented herein are believed to be fully responsive to the Office Action dated January 13, 2011. Claims 1-39 are pending in the application and claims 40-92 (drawn to non-elected inventions) have been canceled herein without prejudice so that the subject matter of these claims can be pursued in a divisional application in the future. The specification has been amended to update an incorporated parent patent application that has now issued as a United States patent. No new matter has been added.

Priority Claim:

The Office Action alleged that the disclosure of the prior-filed applications fail to provide adequate support or enablement in the manner provided by the first paragraph of 35 U.S.C. §112 for one or more claims of this application. Applicant respectfully traverses.

The present application is a continuation of U.S. patent application Serial No. 12/197,666, filed August 25, 2008, now U.S. Patent No. 7,842,154, which is a division of U.S. patent application Serial No. 10/709,434, filed May 5, 2004, now U.S. Patent No. 7,420,756, which claims the benefit of U.S. provisional application, Serial No. 60/471,872, filed May 20, 2003.

The present application and each of the parent patent applications Serial Nos. 12/197,666 and 10/709,434 have identical disclosures. For example, the present application and each of the parent patent applications Serial Nos. 12/197,666 and 10/709,434 incorporate by reference U.S. Patent Nos. 6,522,451 and 6,717,712. See, for example, paragraph [0045] on page 6 of the present application (reproduced below) and the corresponding paragraph in each of the parent patent applications Serial Nos. 12/197,666 and 10/709,434.

> **[0045]** Reflective element 12 may comprise an aspheric or multi-radius or wide angle single element reflective element substrate. The reflective element 12 may provide a field of view similar to the plano-auxiliary reflective element assembly disclosed in U.S. Pat. Nos. 6,522,451 and 6,717,712, which are hereby incorporated herein by reference.

With respect to the priority provisional application Serial No. 60/471,872, this application similarly incorporates by reference U.S. Patent No. 6,522,451 and U.S. patent application Serial No. 09/745,172, filed December 20, 2000. U.S. patent application Serial No. 09/745,172 issued as U.S. Patent No. 6,717,712. Thus, the present application and each of the priority applications incorporate by reference the same disclosures.

As stated at page 2 of the Request for Continuation Application filed with the present application, "[t]he copy of the application includes Figures 9-22 and discussion thereof, which are from U.S. Patent No. 6,717,712, which is incorporated by reference in the present application and its priority applications." Thus, although the present application as filed included Figures 9-22 and the text of paragraphs that were identical to Figures 1-14 and the respective paragraphs from U.S. Patent No. 6,717,712, the addition of these Figures and paragraphs does not add new matter to the application since the present application and each of its priority applications incorporated by reference U.S. Patent No. 6,717,712.

Thus, each of the priority applications of the present application incorporates by reference the disclosures of U.S. Patent Nos. 6,522,451 and 6,717,712, and the additional Figures and text included in the present application were previously included in the priority applications via the incorporation by reference of U.S. Patent Nos. 6,522,451 and 6,717,712. No new matter was thus added to the present application. Thus, the present application should be accorded its priority date of May 20, 2003 (the filing date of U.S. provisional application Serial No. 60/471,872).

Further, Applicant submits that the incorporated patents, U.S. Patent Nos. 6,522,451 and 6,717,712, provide support for at least each of the claim limitations alleged in the Office Action to be absent in the present application (such as set forth at pages 3 and 4 of the Office Action). For example, U.S. Patent No. 6,522,451 discloses:

(a) an electrically-operated actuator (see, for example, column 6, lines 30-42 of U.S. Patent No. 6,522,451, reproduced below);

> Alternately, when actuator **36** comprises an electrically actuated actuator that is electrically operable incorporating at least one motor, control **37** can comprise a switch (which, preferably, is operable under control of the driver seated in cabin **25**) or control **37** can comprise a memory controller, as known in the automotive mirror art, that controls actuator **36** to move the position of plano-multiradius reflective element assembly **30** to a preset orientation that suits the rearward field of view preference of an individual driver. Actuator **36** is mounted to bracket **38** which attaches to vehicle body side **11**. Plano-multiradius reflective element assembly **30** is positionable by actuator **36** within exterior mirror housing **40**.

(b) a plano-auxiliary reflective element assembly comprising a plano reflective element having unit magnification and a separate auxiliary reflective element having a curvature (see, for example, column 4, lines 24-28 of U.S. Patent No. 6,522,451, reproduced below);

> The reflective element comprises a plano-multiradius reflective element assembly which comprises a plano reflective element having unit magnification and a separate multiradius reflective element having a multiradius curvature.

and (c) a backing plate element having a first support portion supporting said plano reflective element and a second support portion supporting said auxiliary reflective element and the angling of the rearward field of view of the auxiliary reflective element relative to the rearward field of view (see, for example, column 15, lines 7-17 of U.S. Patent No. 6,522,451, reproduced below).

> In order to conveniently achieve an angling of the multiradius portion with respect to the plano portion (and preferably a downward angling), the portion of the backing plate element that the multiradius reflective element is attached to can be angled relative to the adjacent portion of the backing plate element that the plano reflective portion is attached to. Thus, and referring to FIG. **6**, plano-multiradius reflective element assembly **130** includes a molded polymeric backing plate element **160** comprising a generally flat portion **162** (between BB and CC in FIG. **6**) and an adjacent curved portion **161** (between AA and BB).

Thus, Applicant submits that the present application fully supports the presently claimed invention, and such support for the claimed invention is also found in each of the priority applications of the present application, including U.S. provisional application Serial No.

60/471,872 that was filed on May 20, 2003. Thus, the present application is entitled to an effective filing date of at least May 20, 2003. Reconsideration and withdrawal of the refusal of the priority date of May 20, 2003 for the present application is respectfully requested.

Claim Rejections:

Claims 1-23 and 27-39 were rejected under 35 U.S.C. §102(b) as being anticipated by Lynam, U.S. Publication No. US 2002/0072026 ("Lynam '026"), while claims 24-26 were rejected under 35 U.S.C. §103(a) as being unpatentable over Lynam, in view of Lynam, U.S. Publication No. US 2004/0264011 ("Lynam '011").

With respect to the §103(a) rejection, Lynam '011 is the publication of U.S. patent application 10/709,434, and the present application is a continuation of U.S. patent application Serial No. 12/197,666, which is a division of U.S. patent application Serial No. 10/709,434 (which published as Lynam '011). Because, as discussed above, each of the parent patent applications (including application Serial No. 10/709,434, which published as Lynam '011) fully supports the present claims and the present application is thus entitled to claim the filing benefit of each priority application, Lynam '011 (being one of the parent patent applications to which the present application claims priority) clearly is not prior art to the presently claimed invention.

Also, with respect to the §102(b) and §103(a) rejections, Applicant submits that Lynam '026 is not prior art under 35 U.S.C. §102(b). Lynam '026 published June 13, 2002, and, as discussed above, the present application has an effective filing date of May 20, 2003 (the filing date of U.S. provisional application 60/471,872). Thus, Lynam '026 published less than one year prior to the priority date of the presently claimed invention and Lynam '026 cannot be cited as prior art under 35 U.S.C. §102(b).

Also, because the present application has a priority date of May 20, 2003 that is less than one year after the publication date of Lynam '026 (June 13, 2002), and because (as discussed below) Applicant conceived and reduced to practice the invention claimed in at least the independent claims prior to the effective date of Lynam '026, Applicant respectfully submits that Lynam '026 is also not prior art under 35 U.S.C. §102(a) or §102(e).

In accordance with 37 CFR 1.131, Applicant submits herewith a Declaration which declares that the invention claimed in at least independent claims 1, 40, 62, 78, 85, 89 and 91 was invented by Applicant prior to the publication date of Lynam '026, namely, June 13, 2002. The specification and drawings (Exhibit A) of U.S. patent application Serial No. 09/478,315, which was filed on January 6, 2000 by Niall R. Lynam (the sole named inventor of the present application), along with U.S. Patent No. 6,522,451 (Exhibit B), which issued to Lynam from U.S. patent application Serial No. 09/478,315, are submitted with the Declaration as evidence that the present invention was reduced to practice at least as of January 6, 2000, which is well prior to the Lynam '026 publication date of June 13, 2002 (and prior to the December 20, 2000 filing date of the application that published as Lynam '026). The Declaration is signed by the named inventor (Niall R. Lynam) for the present application. The attached specification and drawings of Exhibits A and B clearly indicate that the inventions claimed in at least independent claims 1, 40, 62, 78, 85, 89 and 91 were reduced to practice well prior to June 13, 2002, the publication date of Lynam '026, and well prior to December 20, 2000, the filing date of the application that published as Lynam '026.

Accordingly, the rejections of claims 1-39 under §102(b) and §103(a) in view of Lynam '026 are obviated, and reconsideration and withdrawal of these rejections is respectfully requested.

Terminal Disclaimer:

Applicant submits herewith a terminal disclaimer that disclaims the term of any patent that will issue from the present application beyond the term of U.S. Patent No. 6,522,451. Please charge Account No. 22-0190 for the $140 terminal disclaimer fee due and for any additional fees which may be due.

Claims 1-39 are pending in the application. Applicant respectfully submits that claims 1-39 are in condition for allowance and a notice to that effect is earnestly and respectfully requested.

Respectfully submitted,

NIALL R. LYNAM

By: Van Dyke, Gardner, Linn & Burkhart, LLP

Date: January 19, 2011.

Timothy A. Flory
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TERMINAL DISCLAIMER TO OBVIATE A DOUBLE PATENTING REJECTION OVER A "PRIOR" PATENT	Docket Number (Optional) DON09 P-1624

In re Application of: Niall R. Lynam

Application No.: 12/851,045

Filed: August 5, 2010

For: EXTERIOR SIDEVIEW MIRROR SYSTEM

The owner*, Donnelly Corporation, of 100 percent interest in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term **prior patent** No. 6,522,451 as the term of said prior patent is defined in 35 U.S.C. 154 and 173, and as the term of said **prior patent** is presently shortened by any terminal disclaimer. The owner hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and the **prior patent** are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns.

In making the above disclaimer, the owner does not disclaim the terminal part of the term of any patent granted on the instant application that would extend to the expiration date of the full statutory term as defined in 35 U.S.C. 154 and 173 of the **prior patent**, "as the term of said **prior patent** is presently shortened by any terminal disclaimer," in the event that said **prior patent** later:
- expires for failure to pay a maintenance fee;
- is held unenforceable;
- is found invalid by a court of competent jurisdiction;
- is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321;
- has all claims canceled by a reexamination certificate;
- is reissued; or
- is in any manner terminated prior to the expiration of its full statutory term as presently shortened by any terminal disclaimer.

Check either box 1 or 2 below, if appropriate.

1. ☐ For submissions on behalf of a business/organization (e.g., corporation, partnership, university, government agency, etc.), the undersigned is empowered to act on behalf of the business/organization.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

2. ☑ The undersigned is an attorney or agent of record. Reg. No. 42540

[signature] — Signature — January 19, 2011 — Date

Timothy A. Flory
Typed or printed name

(616) 975-5500
Telephone Number

☑ Terminal disclaimer fee under 37 CFR 1.20(d) included.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

*Statement under 37 CFR 3.73(b) is required if terminal disclaimer is signed by the assignee (owner). Form PTO/SB/96 may be used for making this certification. See MPEP § 324.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Group Art	:	2872
Examiner	:	Alessandro V. Amari
Applicant	:	Niall R. Lynam
Serial No.	:	12/851,045
Filing Date	:	August 5, 2010
For	:	EXTERIOR SIDEVIEW MIRROR SYSTEM

Mail Stop Amendment
Commissioner for Patents
Washington, D.C. 20231

DECLARATION UNDER RULE 131(a)

Niall R. Lynam, the inventor and Applicant in the above referenced patent application, declares as follows:

1. Prior to June 13, 2002, the inventor and Applicant conceived of the claimed invention of at least the independent claims as filed in the present application. For example, and with reference to claim 1 of the present application, the inventor and Applicant conceived of an exterior sideview mirror system comprising:

   a. an exterior sideview mirror assembly adapted for attachment to a side of an automobile;

   b. said exterior sideview mirror assembly including a reflective element having a rearward field of view when attached to the side of the automobile;

   c. said reflective element attached to an electrically-operated actuator of said exterior sideview mirror assembly and movable by said actuator in order to position said rearward field of view to a driver-desired position when said exterior sideview mirror assembly is attached to the side of the automobile;

   d. wherein said reflective element comprises a plano-auxiliary reflective element assembly, said plano-auxiliary reflective element assembly comprising a plano reflective element having unit magnification and a separate auxiliary reflective element having a curvature;

e. said plano reflective element and said auxiliary reflective element of said plano-auxiliary reflective element assembly mounted adjacently at said plano-auxiliary reflective element assembly in a side-by-side relationship and not superimposed with one reflective element on top of the other reflective element;

f. said plano reflective element and said auxiliary reflective element supported at a backing plate element, said backing plate element mounting to said actuator such that movement of said backing plate element of said plano-auxiliary reflective element assembly by said actuator simultaneously and similarly moves said plano reflective element and said auxiliary reflective element;

g. said auxiliary reflective element having a wide-angle field of view encompassing a blind spot in the side lane adjacent the side of the automobile to which said exterior sideview mirror assembly is attached;

h. said backing plate element having a first support portion supporting said plano reflective element and a second support portion supporting said auxiliary reflective element;

i. wherein said auxiliary reflective element is positioned at an outboard portion of said plano-auxiliary reflective element assembly when said exterior sideview mirror assembly is mounted to the side of the automobile;

j. wherein said backing plate element comprises a polymeric substrate that is formed as a single element by injection molding of a polymeric resin;

k. wherein said backing plate element is capable of supporting said plano reflective element and said auxiliary reflective element;

l. wherein said first support portion of said backing plate element comprises a flat portion and wherein said plano reflective element is disposed at said flat portion;

m. wherein said second support portion of said backing plate element comprises a curved portion and wherein said auxiliary reflective element is disposed at said curved portion;

n. wherein the rearward field of view of said auxiliary reflective element is different from and angled to the rearward field of view of said plano reflective element when both are attached to said backing plate element of said plano-auxiliary reflective element assembly when said plano-auxiliary reflective element assembly is included in said exterior sideview mirror assembly and when said exterior sideview mirror assembly is attached to the side of the automobile;

o. wherein angling of the rearward field of view of said auxiliary reflective element relative to the rearward field of view of said plano reflective element is achieved, at least in part, by an angling of said second support portion of said backing plate element supporting said auxiliary reflective element relative to said first support portion of said backing plate element supporting said plano reflective element;

p. wherein, when said exterior sideview mirror assembly is attached to the side of the automobile, the field of view of said plano reflective element generally views rearwardly of the equipped automobile and the field of view of said auxiliary reflective element generally views towards a blind spot in the side lane adjacent the side of the automobile to which said exterior sideview mirror assembly is attached, said blind spot being generally outside the rearward field of view of said plano reflective element when said plano reflective element is viewed by a driver of the equipped automobile when said exterior sideview mirror assembly is attached to the side of the automobile; and

q. wherein at least one of said plano reflective element and said auxiliary reflective element comprises a glass substrate having a surface coated with a metallic reflector coating.

2. The invention of at least the independent claims of the present application was reduced to practice sometime prior to June 13, 2002, as evidenced by the attached specification and drawings (Exhibit A), which were filed with the United States Patent and Trademark Office on January 6, 2000 by Niall R. Lynam, and assigned Serial No. 09/478,315, as evidenced by the attached U.S. Patent No. 6,522,451 (Exhibit B), which issued February 18, 2003 from the 09/478,315 application.

3. I am the sole named inventor of U.S. patent application Serial No. 12/851,045 (the present application) and I am the sole named inventor of U.S. patent application Serial No. 09/478,315 (Exhibit A), which issued as U.S. Patent No. 6,522,451 (Exhibit B).

I hereby declare that all activities relating to the conception and reduction to practice of the above invention occurred in the United States.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further, that the statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment or both, as set forth under section 1001, title 18, of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Inventor: Niall Lynam

Date: JANUARY 17 2011

Niall R. Lynam

PATENT
DON01 P-793
Express Mail No. EL399135945US

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Niall R. Lynam

For : EXTERIOR MIRROR PLANO-AUXILIARY REFLECTIVE ELEMENT ASSEMBLY

Box Patent Application
Assistant Commissioner for Patents
Washington, D.C. 20231

Dear Sir:

CERTIFICATE OF EXPRESS MAIL

I certify that the attached return postcard, Transmittal Letter (in duplicate), Form PTO-1619 Recordation Form Cover Sheet, Assignment, a check in the amount of $40.00 for the recordal fee, 23 pages of Specification, 12 pages of claims (83 claims), 1 page of Abstract, 7 sheets of drawings (in duplicate), Declaration and Power of Attorney, and a check in the amount of $1,824.00 for the filing fee are being deposited with the United States Postal Service as Express Mail in an envelope having Express Mail Label Number EL US addressed to:

Box Patent Application
Assistant Commissioner for Patents
Washington, D.C. 20231

on January 6, 2000.

Lynette M. S. Clark

Lynette M. S. Clark
Van Dyke, Gardner, Linn & Burkhart, LLP
P.O. Box 888695
Grand Rapids, MI 49588-8695
(616) 975-5500

CSC:lmsc
Enclosures

EXHIBIT A

PATENT
DON01 P-793
Express Mail No. EL399135945US

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Niall R. Lynam

For : EXTERIOR MIRROR PLANO-AUXILIARY REFLECTIVE ELEMENT ASSEMBLY

BOX PATENT APPLICATION
Assistant Commissioner for Patents
Washington, D.C. 20231

Dear Sir:

Enclosed herewith is the above identified patent application comprising the following parts:

1) Postcard

2) Assignment, Form PTO-1619 Recordation Form Cover Sheet, and Assignment Recording Fee of $40.00

3) 23 Pages of Specification

4) 12 Pages of Claims (83 claims)

5) 1 Page of Abstract

6) 7 Sheets of Drawings (in duplicate)

7) Declaration and Power of Attorney

Filing Fee:

Basic Fee $690.00	$690.00
Additional Fees	
Each independent claim in excess of three, times $78.00	$
Number of claims in excess of twenty, times $18.00	$1,134.00
Filing multiple dependent claims per application $260.00	$
Total Filing Fee	$1,824.00

Checks in the amount of $1,824.00 and $40.00 are enclosed to cover the fees noted above.

The Commissioner is hereby authorized to charge payment of the following fees associated with this communication, and during the pendency of this application, or to credit any overpayment, to Deposit Account No. 22-0190. A duplicate copy of this sheet is enclosed.

1) Any additional filing fees required under 37 CFR 1.16 for which full payment has not been tendered.

2) Any patent application processing fees under 37 CFR 1.17 for which full payment has not been tendered.

Respectfully submitted,

NIALL R. LYNAM

By: Van Dyke, Gardner, Linn & Burkhart, LLP

January 6, 2000
Date

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CSC:lmsc

FORM PTO-1619A
Expires 06/30/99
OMB 0651-0027

U.S. Department of Commerce
Patent and Trademark Office
PATENT

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Conveying Party(ies)

[ ] Mark if additional names of conveying parties attached

Name (line 1) LYNAM, Niall R.

Execution Date Month Day Year: 01/06/2000

Name (line 2)

Second Party

Name (line 1)

Execution Date Month Day Year

Name (line 2)

Receiving Party

[ ] Mark if additional names of receiving parties attached

Name (line 1) Donnelly Corporation

Name (line 2)

Address (line 1) 414 East Fortieth Street

Address (line 2)

Address (line 3) Holland (City) Michigan (State/Country) 49423 (Zip Code)

[ ] If document to be recorded is an assignment and the receiving party is not domiciled in the United States, an appointment of a domestic representative is attached. *(Designation must be a separate document from Assignment.)*

Domestic Representative Name and Address

Enter for the first Receiving Party only.

Name

Address (line 1)

Address (line 2)

Address (line 3)

Address (line 4)

FOR OFFICE USE ONLY

Mail documents to be recorded with required cover sheet(s) information to:
Commissioner of Patents and Trademarks, Box Assignments, Washington, D.C. 20231

Correspondent Name and Address

Area Code and Telephone Number: (616) 975-5500

Name: Catherine S. Collins

Address (line 1): Van Dyke, Gardner, Linn & Burkhart, LLP

Address (line 2): 2851 Charlevoix Drive, S.E., Suite 207

Address (line 3): P.O. Box 888695

Address (line 4): Grand Rapids, Michigan 49588-8695

Pages

Enter the total number of pages of the attached conveyance document including any attachments. # 1

Application Number(s) or Patent Number(s)

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Enter either the Patent Application Number or the Patent Number (DO NOT ENTER BOTH numbers for the same property).

Patent Application Number(s)			Patent Number(s)		

If this document is being filed together with a new Patent Application, enter the date the patent application was signed by the first named executing inventor. Month Day Year: 01/06/2000

Patent Cooperation Treaty (PCT)

Enter PCT application number only if a U.S. Application Number has not been assigned.

PCT ☐ PCT ☐ PCT ☐
PCT ☐ PCT ☐ PCT ☐

Number of Properties

Enter the total number of properties involved. # 1

Fee Amount

Fee Amount for Properties Listed (37 CFR 3.41): $ 40.00

Method of Payment: Enclosed [X] Deposit Account ☐

Deposit Account
(Enter for payment by deposit account or if additional fees can be charged to the account.)

Deposit Account Number: # 22-0190

Authorization to charge additional fees: Yes [X] No ☐

Statement and Signature

To the best of my knowledge and belief, the foregoing information is true and correct and any attached copy is a true copy of the original document. Charges to deposit account are authorized, as indicated herein.

Catherine S. Collins 37 599	[signature]	January 6, 2000
Name of Person Signing	Signature	Date

Express Mail No. EL399135945US
DON01 P-793

ASSIGNMENT

WHEREAS, Niall R. Lynam residing at 248 Foxdown, Holland, Michigan 49424, (hereinafter referred to as Assignor), have invented certain new and useful improvements in EXTERIOR MIRROR PLANO-AUXILIARY REFLECTIVE ELEMENT ASSEMBLY for which an application for United States Letters Patent was executed on even date herewith.

WHEREAS, Donnelly Corporation, a corporation of the State of Michigan, having a place of business at 414 East Fortieth Street, Holland, Michigan 49423 (hereinafter referred to as Assignee), is desirous of acquiring the entire right, title and interest in and to said invention and in and to any Letters Patent that may be granted therefor in the United States and in any and all foreign countries.

NOW, THEREFORE, in consideration of the sum of one dollar ($1.00), the receipt of which is hereby acknowledged, and for other good and valuable considerations, Assignor hereby sells, assigns and transfers unto said Assignee the full and exclusive right, title and interest to the said invention in the United States and in all foreign countries and the entire right, title and interest in and to any and all Letters Patent which may be granted therefor in the United States and in any and all foreign countries and in and to any and all divisions, reissues, continuations, continuation-in-part, and extensions thereof including the full right to claim for any such applications the benefits of the International Convention.

Assignor hereby authorizes and requests the Patent Office Officials in the United States and in any and all foreign countries to issue any and all of said Letters Patent, when granted, to said Assignee as the owner of the entire right, title and interest in and to the same, for the sole use and behoof of said Assignee, its successors and assigns.

FURTHER, Assignor agrees to communicate to said Assignee or its representatives any facts known to Assignor respecting said invention, and testify in any legal proceeding, sign all lawful papers, execute all divisional, continuation, continuation-in-part, substitution, renewal, and reissue applications, execute all necessary assignment papers to cause any and all of said Letters Patent to be issued to said Assignee, make all rightful oaths and generally do everything possible to aid said Assignee, its successors and assigns, to obtain and enforce proper protection for said invention in the United States and in any and all foreign countries.

IN TESTIMONY WHEREOF, I have hereunto set my hand on the date appearing next to my signature.

Witness:	Inventor:	Date:
Danetta D. VanDine	Niall Lynam	JAN 6 2000
	Niall R. Lynam	

PATENT
DON01 P-793
Express Mail No. EL399135945US

EXTERIOR MIRROR PLANO-AUXILIARY REFLECTIVE ELEMENT ASSEMBLY

TECHNICAL FIELD AND BACKGROUND OF THE INVENTION

The present invention relates to exterior sideview mirror assemblies suitable for use on an automobile, and more specifically, to plano-auxiliary reflective element assemblies for use in automobile exterior sideview mirror assemblies.

Automobiles are typically equipped with an interior rearview mirror assembly (adapted for providing a rearward field of view immediately rearward of the vehicle, typically principally in the road lane the vehicle is traveling in) and at least one exterior sideview mirror assembly attached to the side of the vehicle (typically adjacent a front side window portion). The exterior side view mirror assembly typically comprises a reflective element adapted to provide a rearward field of view of the side lane adjacent the vehicle so as to allow the driver see whether a side approaching vehicle is present when the driver is contemplating a lane change. Conventionally, automobiles are equipped with a driver-side exterior mirror assembly and, very often, with a passenger-side exterior sideview mirror assembly mounted to the side of the automobile body opposite to that of the driver-side assembly. While the combination of an interior rearview mirror with a driver-side exterior mirror (and especially in a three-mirror system comprising an interior rearview mirror with a driver-side exterior mirror and a passenger-side exterior mirror) works well in many driving situations, rear vision blind spots present a potential safety hazard while driving. A rear vision blind spot is an area adjacent the side of an automobile where a view of another vehicle (overtaking on that side) is not captured in the rearward field of view of the exterior mirror reflector on that side. This presents a potential safety hazard as the driver, upon checking the view in the exterior sideview mirror and seeing no overtaking vehicle therein, may deem it safe to initiate a lane change, unaware that there is a vehicle immediately adjacent in a blind-spot of the exterior mirror reflector.

Various attempts have been made conventionally to minimize and/or eliminate exterior mirror blind-spots on vehicles. One approach is to make the exterior mirror reflector larger, and particularly wider with respect to the vehicle body. By increasing the width of the exterior mirror reflector, it has a wider field of view rearwards, and hence the reflector blind-spot is reduced. While use of a wide exterior mirror reflector is an option for trucks, buses and commercial vehicles, increasing the width of the reflector used in an exterior sideview mirror assembly mounted on automobiles (such as sedans, station wagons, sports cars, convertibles, minivans, sports utility vehicles, pick-up trucks and similar passenger carrying automobiles) is often not an option. In such domestic automobiles, increasing the width of the exterior mirror reflector increases the size of the exterior sideview mirror assembly with a concomitant increase in aerodynamic drag, increase in fuel consumption, increased difficulty in parking in tight parking spaces, and increased reflector vibration. Use of a non-flat, curved exterior mirror reflector is commonly used to increase rearward field of view without increasing reflector size.

While working well to increase field of view, use of a curved reflector (such as a convex, spherically-curved reflector) has disadvantages. The field of view rearward increases as the degree of curvature of the bent substrate increases (i.e., the field of view rearward increases as the radius of curvature of the bent substrate decreases). However, such wide-angle mirrors have non-unit magnification and distance perception rearward is distorted. For this reason, convex (spherically-bent) exterior mirror reflectors are required in some countries (such as the United States) to carry a safety warning "OBJECTS IN MIRROR ARE CLOSER THAN THEY APPEAR". Distance perception is particularly important for a driver-side exterior mirror. Indeed, Federal Vehicle Safety Standard No: 111 in the United States (the entire disclosure of which is hereby incorporated by reference herein) requires that the driver-side exterior mirror reflector exhibit unit magnification, and places restrictions on the radius of curvature allowed for any bent passenger-side mirror as well as requiring a safety warning be placed thereon. As an improvement over spherically bent/convex mirror reflectors, aspherical or multiradius mirror reflectors (such as are disclosed in U.S. Patents 4,449,786 and 5,724,187, the entire disclosures of which are hereby incorporated by reference herein) have been developed. Such mirrors are widely used in Europe and Asia for both driver-side exterior mirror reflectors and for passenger-side exterior mirror reflectors. The aspherical or multiradius mirror reflectors typically have a less curved (larger radius of curvature) reflective region that is inboard or closest to the driver when mounted on a vehicle and, usually separated by a demarcation line or the like, have a more curved (smaller radius of curvature) region that is outboard or farthest from the driver when mounted on a vehicle. However, such aspherical or multiradius reflectors do not have unit magnification and so cannot be used when unit magnification is mandated (such as by FMVSS 111, referenced above).

To supplement a flat driver-side exterior mirror reflector, an auxiliary and separate bent reflector is sometimes incorporated into the driver-side exterior sideview mirror assembly. However, this is often not suitable for passenger automobiles because of the extra space required in the sideview mirror assembly to accommodate an auxiliary reflector element. Also, in most passenger automobiles, the position of the side view mirror reflector is adjustable by the driver (such as by a hand-adjust, or by a manually adjustable cable such as a Bowden cable or by an electrically operable actuator, as known in the art) in order to provide to that driver his or her desired rearward field of view, which ill-suits use of a separate, auxiliary reflector. Likewise, addition of stick-on blind-spot mirror reflectors (such as are commonly sold in automotive parts stores and the like) onto an automobile exterior sideview mirror reflector has disadvantages, including obscuring field of view of the automobile mirror reflector and adding to mirror element vibration.

There is thus a need to provide an automobile exterior sideview reflective element, and particularly a driver-side automobile exterior sideview reflective element, that overcomes the disadvantages above and that provides the driver of the automobile with a distortion-free field of view with unit magnification that is supplemented with a wide-angle view of a side lane blind spot, and there is a need that this be provided in a unitary reflective element assembly module suitable to mount onto, and be adjusted by, the mirror reflector adjustment mechanism (such as an electrically operated, motorized actuator) provided in the exterior sideview mirror assembly.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view of an automobile equipped with exterior sideview mirror assemblies according to this present invention;

Fig. 2 is a top plan partial fragmentary view of the driver's side exterior rearview mirror assembly of Fig. 1;

Fig. 3 is an enlarged sectional view of a plano-multiradius reflective element assembly of the mirror assembly in Fig. 2;

Fig. 4 is an enlarged sectional view of a demarcation element of the plano-multiradius reflective element assembly of Fig. 3;

Fig. 5A-5H illustrate views of various locations for a plano reflective element and an auxiliary reflective element according to this present invention;

Fig. 6 is a sectional view of a second embodiment of a plano reflective element assembly according to the present invention including a demarcation element formed as a dividing wall in a backing plate element;

Fig. 6A is a cross-section taken along line XX of Fig.6;

Fig. 6B is a cross-sectional view taken along line YY of Fig.6; and

Fig. 7 is a schematic of a third embodiment of a plano-auxiliary reflective element assembly according to this present invention.

SUMMARY OF THE INVENTION

This invention provides a plano reflective element with unit magnification and an auxiliary reflector element for use in an exterior sideview mirror assembly on an automobile. More specifically, this invention provides a plano-multiradius reflective element assembly suitable for use in an exterior sideview mirror assembly mounted to the side body of an automobile. The plano-multiradius reflective element assembly of this invention is especially suitable for mounting in a driver-side exterior sideview mirror assembly that is mounted to the side of the automobile body adjacent to the seating position of the driver in the front of the interior vehicular cabin. The plano-multiradius reflective element assembly of this invention comprises a plano portion which has a rearward field of view, when mounted in an exterior sideview mirror assembly mounted to the side body of an automobile, with unit magnification. This plano portion comprises a flat substrate, typically a flat glass substrate, provided with a reflective surface. The plano-multiradius reflective element assembly of this invention also includes a multiradius portion with a rearward field of view, when mounted in an exterior sideview mirror assembly mounted to the side body of an automobile, that has non-unit magnification. The plano portion provides a distortion-free rearward field of view and serves as the principal rearward-viewing portion of the plano-multiradius reflective element. The multiradius portion provides a wide angle rearward field of view, and typically supplements the rearward field of view of the plano portion. This multiradius portion comprises a curved substrate, typically a bent glass substrate, provided with a reflective surface. The plano portion and the multiradius portion are demarcated apart by a demarcation element. The demarcation element enables the driver of a vehicle equipped with the plano-multiradius reflective element of this invention to readily delineate a rearward view in the plano portion from a rearward view in the multiradius portion. The plano portion comprises a flat reflective element and the multiradius portion comprises a bent reflective element. The flat, plano reflective element and the curved, multiradius reflective element are individually and separately manufactured, and are adjacently attached to a single backing plate (which typically comprises a polymeric substrate, most typically a molded polymeric substrate), and with the demarcation element disposed at the joint of the plano, flat reflective element and the multiradius, bent reflective element. The backing plate is fabricated (typically by polymeric molding) to have a flat portion that corresponds to the plano, flat reflective element, and a curved surface that corresponds to the multiradius, curved reflective element. The attachment of the plano reflective element and an auxiliary reflective element to a single backing plate produces a unitary plano-auxiliary reflective element assembly module suitable for mounting in an exterior sideview mirror assembly. By adjusting the position of the backing plate within the exterior sideview mirror assembly, the rearward fields of view of both the plano reflective element and the auxiliary reflective element are simultaneously and similarly aligned.

One embodiment of the invention includes an exterior sideview mirror system suitable for use in an automobile comprising an exterior sideview mirror assembly adapted for attachment to a side of the automobile. The exterior sideview mirror assembly includes a reflective element having a rearward field of view when attached to said side of the automobile. The reflective element is attached to an actuator and is movable by the actuator in order to position the reflective element's rearward field of view in response to a control. The reflective element comprises a plano-multiradius reflective element assembly which comprises a plano reflective element having unit magnification and a separate multiradius reflective element having a multiradius curvature. The plano element and the separate multiradius element of the plano-multiradius reflective element assembly are attached to a backing plate element. The backing plate element is mounted to the actuator such that movement of the backing plate element (and hence the plano-multiradius reflective element assembly) by the actuator simultaneously and similarly moves the plano element and the multiradius element. The plano element and the multiradius element are separately and, preferably, adjacently attached to the backing plate element at a joint.

In a further embodiment, a demarcation element is disposed at this joint to form a demarcation between the plano element and the multiradius element; this demarcation element having a portion visible to a driver of the automobile. Preferably, the demarcation element is dark colored, such as with a color selected from the group consisting of black, grey, blue and brown. Optionally, there is a space at the joint of the plano element and the multiradius element and the demarcation element is at least partially disposed in said space between said plano element and said multiradius element. The demarcation element can comprise at least one of a polymer material, a tape, a plastic film, a paint, a lacquer and a caulk.

In a further embodiment, the demarcation element comprises a wall on the backing plate element; this wall being located on the backing plate element at the joint of the plano element and the multiradius element, this wall separating the respective elements apart.

In preferred embodiments, the portion of the demarcation element visible to a driver of an automobile equipped with the plano-multiradius reflective element assembly of this invention has a width from about 0.5 mm to about 4 mm.

In preferred embodiments, the plano element is attached to the backing plate element by at least one of an adhesive attachment and a mechanical attachment.

In preferred embodiments, the multiradius element is attached to the backing plate element at a location such that, when the exterior mirror assembly is attached to a side of an automobile, at least portion, and preferably at least a substantial portion, of the plano element is disposed closer to the side of the vehicle than any portion of the multiradius element element.

In preferred embodiments, the multiradius element comprises a bent glass substrate with radii of curvature in the range of from about 4000 mm to about 50 mm, and the ratio of the width of the plano element to the width of the multiradius element is greater than 1.

In preferred embodiments, the principal axis of the rearward field of view of the auxiliary, multiradius element is different from and angled to the principal axis of the rearward field of view of the plano element when both are attached to the backing plate element of the plano-multiradius reflective element assembly and when the plano-multiradius reflective element assembly is mounted in an exterior sideview mirror assembly on an automobile. The principal axis of the rearward field of view of the plano element is directed generally parallel to the longitudinal axis of an automobile equipped with the plano-multiradius reflective element assembly and the principal axis of the rearward field of view of the multiradius element is directed generally at an angle downwards to the longitudinal axis of the vehicle.

In a preferred embodiment, the exterior sideview mirror assembly equipped with the plano-multiradius reflective element assembly comprises a fixedly attached exterior sideview mirror assembly. In another preferred embodiment, the exterior sideview mirror assembly equipped with the plano-multiradius reflective element assembly comprises a break-away exterior sideview mirror assembly. In another preferred embodiment, the exterior sideview mirror assembly equipped with the plano-multiradius reflective element assembly comprises a powerfold exterior sideview mirror assembly. In another preferred embodiment, the actuator of the exterior sideview mirror assembly to which the plano-multiradius reflective element assembly is mounted comprises an electrically operable actuator. In another preferred embodiment, the actuator of the exterior sideview mirror assembly to which the plano-multiradius reflective element assembly is mounted is controlled by a switch or by a memory controller. In another preferred embodiment, the plano element and/or the multiradius element of the plano-multiradius reflective element assembly comprises an electro-optic reflective element, preferably an electrochromic reflective element. In another preferred embodiment, the plano element of the plano-multiradius reflective element assembly comprises an electro-optic reflective element, preferably an electrochromic reflective element, and the multiradius element comprises a fixed reflectance mirror reflector, such as a fixed reflectance mirror reflector comprises a bent glass substrate coated with a metallic reflector coating.

In a preferred embodiment, the plano-auxiliary reflective element assembly is assembly is formed in an integral molding operation.

These and other advantages, features, and modifications will become more apparent when reviewed in conjunction with the drawings and the detailed description which follows.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

As illustrated in Fig. 1, passenger automobile 10 (which may be a sedan, a station-wagon, a sports car, a convertible, a minivan, a sports utility vehicle, a pick-up truck or a similar passenger carrying non-commercial, personal transportation automobile) includes an interior rearview mirror assembly 18 positioned within interior vehicle cabin 25. Interior vehicle cabin 25 further includes a steering wheel 16, a driver seat 20 positioned at steering wheel 16, a front passenger seat 21 adjacent to driver seat 20 in the front portion of cabin 25, and a rear passenger seat 23 in the rear portion of cabin 25. Automobile 10 further includes a driver-side exterior sideview mirror assembly 12 and a passenger-side exterior sideview mirror assembly 14, each adapted for attachment to opposing sides of automobile body 11, most preferably adjacent to the seating position of the driver seated in driver seat 20 for driver-side assembly 12 and adjacent to the front passenger seat 21 for passenger-side assembly 14. Exterior sideview mirrors, mounted as shown in Fig. 1 close to the driver seating location, are commonly referred to as door-mounted exterior sideview mirror assemblies. Driver-side exterior sideview mirror assembly 12 includes, as illustrated in Fig. 2, a plano-multiradius exterior sideview reflective element assembly 30. Plano-multiradius reflective element assembly 30 is mounted to a reflective element positioning actuator 36. The orientation of plano-multiradius reflective element assembly 30, and hence its rearward field of view, is adjustable by actuator 36 in response to control 37. Control 37 can comprise a handset control that allows the driver manually move the orientation of plano-multiradius reflective element assembly 30 within exterior mirror housing 40 (such as by a lever control or by a cable control) and hence reposition the rearward field of view of plano-multiradius reflective element assembly 30. Alternately, when actuator 36 comprises an electrically actuated actuator that is electrically operable incorporating at least one motor, control 37 can comprise a switch (which, preferably, is operable under control of the driver seated in cabin 25) or control 37 can comprise a memory controller, as known in the automotive mirror art, that controls actuator 36 to move the position of plano-multiradius reflective element assembly 30 to a pre-set orientation that suits the rearward field of view preference of an individual driver. Actuator 36 is mounted to bracket 38 which attaches to vehicle body side 11. Plano-multiradius reflective element assembly 30 is positionable by actuator 36 within exterior mirror housing 40.

Plano-multiradius reflective element assembly 30, as shown in Fig. 3, comprises a plano element 50 and a separate multiradius element 55. Preferably, plano element 50 is adjacent to multiradius element at a joint. At their joint, plano element 50 and separate multiradius element 55 can touch leaving substantially no gap or space therebetween, or plano element 50 and separate multiradius element 55 can be spaced apart at their joint by a space or gap, as in Fig. 3. Plano element 50 and multiradius element 55 are both mounted to surface 59 of, and are both supported by, a single backing plate element 60.

Plano element 50 and multiradius element 55 are demarcated apart by demarcation element 65. Surface 61 of backing plate element 60 is preferably adapted to attach, such as by attachment member 64, to actuator 36 when plano-multiradius reflective element assembly 30 is mounted in driver-side exterior sideview mirror assembly 12 (and/or in passenger-side exterior side view mirror assembly 14) such that plano element 50 and multiradius element 55 are adjusted and positioned in tandem and simultaneously when the driver (or alternatively, when a mirror memory system, as is conventional in the rearview mirror arts) activates actuator 36 to reposition the rearward field of view of plano-multiradius reflective element assembly 30. Thus, since elements 50, 55 are part of plano-multiradius reflective element assembly 30, movement of plano-multiradius reflective element assembly 30 by actuator 36 simultaneously and similarly moves plano element 50 and multiradius element 55.

Plano element 50 preferably comprises a flat reflector-coated glass substrate having unit magnification, and comprises a reflective surface through which the angular height and width of the image of an object is equal to the angular height and width of the object when viewed at the same distance (except for flaws that do not exceed normal manufacturing tolerances). Plano element 50 may comprise a conventional fixed reflectance mirror reflector or it may comprise a variable reflectance mirror reflector whose reflectivity is electrically adjustable. For example, plano element 50 may comprise a flat glass substrate coated with a metallic reflector coating such as a chromium coating, a titanium coating, a rhodium coating, a metal alloy coating, a nickel-alloy coating, a silver coating, an aluminum coating (or any alloy or combination of these metal reflectors). The metal reflector coating of plano element 50 may be a first surface coating (such as on surface 66) or a second surface coating (such as on surface 67), as such terms are known in the mirror art. The reflector coating on plano element 50 may also comprise a dielectric coating, or a multilayer of dielectric coatings, or a combination of a metal layer and a dielectric layer to form automotive mirror reflectors as known in the automotive mirror art. If a variable reflectance reflector element, plano element 50 preferably comprises an electro-optic reflector element and, most preferably, an electrochromic reflector element.

When mounted into exterior side view mirror assembly 12 and/or 14, plano-multiradius reflective element assembly 30 is preferably orientated so that at least a portion of (more preferably a substantial portion of) the reflector surface of plano element 50 is positioned closer to the vehicle body (and hence to the driver) than any portion of the reflector surface of multiradius element 55. Thus, and referring to Figure 3, side A of plano element 50 of plano-multiradius reflective element assembly 30 is positioned closer to the driver than side D of multiradius element 55 when plano-multiradius reflective element assembly 30 is mounted on an automobile. Also, when mounted into exterior side view mirror assembly 12 and/or 14, surfaces 66, 68 of plano-multiradius reflective element assembly 30 face rearwardly in terms of the direction of vehicle travel.

Multiradius element 55 of plano-multiradius reflective element assembly 30 preferably comprises a curved/bent mirrored glass substrate. The degree of curvature preferably increases (and hence the local radius of curvature decreases) across the surface of multiradius element 55 with the least curvature (largest radius of curvature) occurring at the side of multiradius element 55 (side C in Fig. 3) positioned adjacent its joint to plano element 50 when both are mounted on backing plate element 60. Thus, and referring to Figure 3, the local radius of curvature at side C of multiradius element 55, when mounted on backing plate element 60, is larger than at side D. Also, the local radius of curvature preferably progressively decreases across multiradius element 55 from side C to side D. Preferably, the local radius of curvature at side C of multiradius element 55 is at least about 1000 mm; more preferably is at least about 2000 mm and most preferably is at least about 3000 mm whereas the local radius of curvature at side D of multiradius element 55 is, preferably, less than about 750 mm, more preferably less than about 350 mm; most preferably less than about 150 mm. Preferably, multiradius element 55 comprises a bent glass substrate with radii of curvature in the range of from about 4000 mm to about 50 mm. The multiradius prescription for the multiradius element to be used in a particular exterior mirror assembly can vary according to the specific field of view needs on a specific automobile model.

The total field of view rearwardly of the automobile of the plano-auxiliary reflective element assembly (which is a combination of the field of view of the plano reflective element and of the auxiliary reflective element) preferably generally subtends an angle of at least about 20 degrees (and more preferably, generally subtends an angle of at least about 25 degrees and most preferably, generally subtends an angle of at least about 30 degrees) with respect to the side of an automobile to which is attached an exterior sideview mirror assembly equipped with the plano-auxiliary reflective element assembly.

Multiradius element 55 may comprise a conventional fixed reflectance mirror reflector or it may comprise a variable reflectance mirror reflector whose reflectivity is electrically adjustable. For example, multiradius element 55 may comprise a flat glass substrate coated with a metallic reflector coating such as a chromium coating, a titanium coating, a rhodium coating, a metal alloy coating, a nickel-alloy coating, a silver coating, an aluminum coating (or any alloy or combination of these metal reflectors). The metal reflector coating of multiradius element 55 may be a first surface coating (such as on surface 68) or a second surface coating (such as on surface 69), as such terms are known in the mirror art. The reflector coating on multiradius element 55 may also comprise a dielectric coating, or a multilayer of dielectric coatings, or a combination of a metal layer and a dielectric layer to form automotive mirror reflectors as known in the automotive mirror art. If a variable reflectance reflector element, multiradius element 55 preferably comprises an electro-optic reflector element and, most preferably, an electrochromic reflector element.

Also, it is preferable that the thickness of plano element 50 and multiradius element 55 be substantially the same in dimension so that their respective outer surfaces, 66 and 68, are substantially coplanar so that a driver can readily view images in either or both elements. The thickness dimension of elements 50,55 is determined by the thickness of the substrate (or in the case of laminate-type electrochromic reflective elements, the thickness of the two substrates between which the electrochromic medium is disposed). For example, plano element 50 and/or multiradius element 55 can comprise a reflector coated glass substrate or panel of thickness preferably equal to or less than about 2.3 mm, more preferably equal to or less than about 1.6 mm, most preferably equal to or less than about 1.1 mm. Use of a thinner substrate is beneficial in terms of improving the overall stability/vibration performance of the image seen in plano-multiradius reflective element assembly 30 when mounted to an automobile.

The reflector area of plano element 50 is preferably larger than that of multiradius element 55. Preferably, the width dimension of plano element 50 is larger than the width dimension of multiradius element 55 (both width dimensions measured at their respective widest dimension and with the width of the respective element being gauged with the respective element oriented as it would be orientated when mounted on the automobile). Thus, and referring to Figure 3, the distance from side A to side B of plano element 50 is larger than the distance from side C to side D of multiradius element 55. Thus, the ratio of the width of plano element 50 to the width of multiradius element 55 is preferably greater than 1; more preferably greater than 1.5; most preferably greater than 2.5 in order to provide a large, unit magnification plano element 50 as the principal rear viewing portion of plano-multiradius reflective element assembly 30 and providing multiradius element 55 as a smaller, auxiliary, separate, wide-angle viewing portion of plano-multiradius reflective element assembly 30. For plano-multiradius reflective element assemblies to be mounted to the exterior sideview assemblies of passenger automobiles used non-commercially and for non-towing purpose, the width of plano element 50 (at its widest dimension) is preferably in the range of from about 50 mm to about 225 mm; more preferably in the range of from about 75 mm to about 175 mm; most preferably in the range of from about 100 mm to about 150 mm.

Backing plate element 60 is preferably a rigid polymeric substrate capable of supporting plano element 50 and multiradius element 55. Backing plate element 60 comprises a flat portion (generally between E and F as shown in Fig. 3) that corresponds to and is aligned with plano element 50. Backing plate element 60 also comprises a curved portion (generally between G and H as shown in Fig. 3) that corresponds to and is aligned with multiradius element 55. Preferably, curved portion G-H of multiradius element 55 is fabricated with a multiradius prescription that is substantially the same as the multiradius prescription of multiradius element 55. Backing plate element 60 is formed as a single element to which elements 50 and 55 are separately attached. Preferably, backing plate element 60 is formed by injection molding of a thermoplastic or a thermosetting polymer resin. Materials suitable to use for backing plate element 60 include unfilled or filled polymeric materials such as glass and/or mineral filled nylon or glass and/or mineral filled polypropylene, ABS, polyurethane and similar polymeric materials. For example, backing plate element 60 can be formed of ABS in an injection molding operation. Plano element 50 can be cut from a stock lite of flat chromium mirror-coated 1.6 mm thick glass. Multiradius element 55 can be cut from a stock lite of multiradiusly-bent chromium mirror-coated 1.6 mm thick glass. Plano element 50 and multiradius element 55 can then be attached (such as by an adhesive attachment such as an adhesive pad or by mechanical attachment such by clips, fasteners or the like) to the already molded backing plate element 60. Alternatively, plano element 50 and multiradius element 55 can each by individually loaded into an injection molding tool. Once loaded, a polymeric resin (or the monomers to form a polymeric resin) can be injected into the mold in order to integrally form backing plate element 60 with elements 50, 55 integrally molded thereto. Integral molding of the backing plate element to plano element 50 and multiradius element 55 (along with any other elements such as the demarcation element 65) in a single integral molding operation, is a preferred fabrication process for plano-multiradius reflective element assembly 30.

Plano-multiradius reflective element assembly 30 further preferably includes demarcation element 65 that functions to delineate and demarcate the plano region of the assembly from the wide-angle, multiradius region and also preferably functions to prevent ingress of debris, dirt, water and similar contaminants (such as road splash, car wash spray, rain, snow, ice, leaves, bugs and similar items that plano-multiradius reflective element assembly 30 would be subject to when mounted and used on an automobile) into any gap between plano element 50 and multiradius element 55 when both are attached to backing plate element 60. Optionally, at least a portion of demarcation element 65 can be disposed in any gap between plano element 50 and multiradius element 55 at their joint on backing plate element 60. Preferably, demarcation element 65 is formed of a polymeric material that is dark colored (such as black or dark blue or dark brown or dark grey or a similar dark color) such as a dark colored polypropylene resin or a dark colored nylon resin or a dark colored polyurethane resin or a dark colored polyvinyl chloride resin or a dark colored silicone material. Most preferably demarcation element 65 is formed of an at least partially elastomeric material (such as silicone, or EPDM, or plasticized PVC or the like) in order to provide a degree of vibration dampening for elements 50, 55. As shown in Fig. 4, demarcation element 65 optionally includes a crown portion 70 that includes wing portions 73, 73'and a stem portion 71. Stem portion 71 preferably has a cross-sectional width CCC of less than about 4 mm, more preferably less than about 3 mm and, most preferably less than about 2 mm. Crown portion 70 preferably is dimensioned to not protrude substantially beyond surfaces 66, 68 of elements 50, 55 when demarcation element 65 is installed between elements 50 and 55. Also, wings 73, 73' are preferably dimensioned to protrude (most preferably slightly) onto surfaces 66, 68 of elements 50, 55 when demarcation element 65 is installed between elements 50 and 55 in order to provide a weather barrier seal and/or to at least partially accommodate any dimensional tolerances of elements 50, 55 that could lead to variation in the inter-element gap between sides C and B. While the demarcation element shown in Fig. 4 is one embodiment, other constructions are possible including a demarcation element that has minimal or no crown portion. Likewise, a demarcation element can have little or no stem portion, especially when the joint between plano element 50 and multiradius element 55 includes no gap to receive a stem. Also, where a gap at the plano to multiradius joint exists, any stem of the demarcation element can at least partially be disposed in such gap so as to at least partially fill the gap (or it can optionally substantially fill the gap). Optionally, demarcation element 65 is fabricated by injection molding of a polymeric resin. After plano element 50 and multiradius element 55 have been attached to backing plate element 60, a separately formed demarcation element 65 can then be inserted (and secured such as by an adhesive or by a mechanical attachment such as by a fastener) into a space between elements 50 and 55. Note that, optionally, side B of plano element 50 and side C of multiradius element 55 can touch (leaving substantially no gap or space therebetween). In such a situation, demarcation element 65 can comprise a dark colored strip such as of a tape or of a plastic film that covers the joint between elements 50 and 55. Alternatively, demarcation element 65 can comprise a preferably dark-colored paint, lacquer, caulk or similar material that can be applied to, and that can preferably fill into, the joint between elements 50 and 55. The width of the portion of demarcation element 65 that is visible to the driver is preferably less than about 4 mm, more preferably less than about 3 mm and most preferably less than about 2 mm, but is equal to or greater than about 0.5 mm, more preferably is equal to or greater than about 0.75 mm, most preferably is equal to or greater than about 1 mm in order to provide adequate demarcation of the plano region from the multiradius radius region without unduly obscuring the rearward field of view of the respective elements. Optionally, demarcation element 65 can be formed as part of backing plate element 60 such as by forming demarcation element 65 as a wall structure of the backing plate element that partitions backing plate element 60 into two regions: A first region adapted to receive plano reflective element 50 and a separate and adjacent second region adapted to receive multiradius reflective element 55.

Thus, and referring to Fig. 6, a second embodiment of plano-multiradius reflective element assembly 130 may include a backing plate element 160 which comprises a plate molded from a polymer resin (such as a polyolefin such as polypropylene or such as ABS or nylon) with a demarcation element 165 that is molded as a wall structure that partitions backing plate element 165 into a first region (from CC to BB) adapted to receive and accommodate plano reflective element 150 and into a second region (from BB to AA) adapted to receive and accommodate wide-angle optic multiradius reflective element 155. Note that section AA to BB of backing plate element 160 is angled to section BB to CC. Such angling of the auxiliary reflective element relative to the plano element can be advantageous in allowing the auxiliary reflective element view a portion of the road adjacent the automobile that is in a blind spot of the plano reflective element. In this regard, it is preferable that the multiradius element be angled away from the plane of the plano element, as shown in Fig. 6 by the angling of section AA to BB to section BB to CC.

Preferably, demarcation element 65 is formed in an integral molding operation, along with formation of backing plate element 60, and attachment of elements 50, 55 thereto. For example, plano element 50 and multiradius element 55 can each by individually loaded into an injection molding tool. Once loaded, a polymeric resin (or the monomers to form a polymeric resin) can be injected into the mold in order to integrally form backing plate element 60 with elements 50, 55 integrally molded thereto and, in the same molding operation and in the same tool, also form by molding the demarcation element. Integral molding of the backing plate element to plano element 50 and multiradius element 55 along with creation in the single molding operation of demarcation element 65 (along with any other elements such as attachment member 64) in a single integral molding operation, is a preferred fabrication process for plano-multiradius reflective element assembly 30. By loading all the sub components of plano-multiradius reflective element assembly 30 into a molding tool, and then injecting polymeric resin to form the backing plate, demarcation member and any attachment member, a substantially complete or fully complete plano-multiradius reflective element assembly can be unloaded from the tool at the completion of the integral molding operation (as known in the molding art), thus enabling economy in manufacturing and accommodation of any dimensional tolerances in the sub components. Where integral molding is so used, it is preferable to use a reactive molding operation such as reactive injection molding of a urethane as such reactive injection molding operations occur at relatively modest temperatures.

Plano element 50 and/or multiradius element 55 can comprise a heater element, as known in the automotive mirror art, that is operable to deice/demist surfaces 66, 68. Such heater elements are conventional and can comprise a positive temperature coefficient heater pad, a resistive heater element and/or a conductive coating. Plano element 50 and/or multiradius element 55 can also optionally comprise a scatterproofing member, as known in the automotive mirror art, such as an adhesive tape, to enhance safety in an accident.

Also, plano element 50 and/or multiradius element 55 can comprise a variable reflectance electro-optic element such as an electrochromic mirror reflector. Thus, both element 50 and element 55 can comprise an electrochromic mirror element or either of element 50 and element 55 can comprise an electrochromic mirror element and the other can comprise a fixed reflectance non-variable reflectance mirror element such as a metal reflector coated glass panel such as a chromium coated glass substrate. Also, if both plano element 50 and multiradius element 55 comprise an electro-optic element such as an electrochromic mirror element capable of electrically dimmable reflectivity, both elements 50, 55 can dim together and in tandem under control of a common dimming control signal (typically provided by an electro-optic automatic dimming interior mirror assembly mounted in the cabin of the automobile and equipped with photosensors to detect incident glare and ambient light). Alternately, if both plano element 50 and multiradius element 55 comprise an electro-optic element such as an electrochromic mirror element capable of electrically dimmable reflectivity, element 50 can dim independently of element 55 (such as is disclosed in U.S. Patent No. 5,550,677, the entire disclosure of which is hereby incorporated by reference herein). If either or both of elements 50, 55 comprise an electrochromic element, preferably, the electrochromic reflective element comprises a front substrate and a rear substrate with an electrochromic medium disposed between, such as a solid polymer matrix electrochromic medium such as is disclosed in U.S. patent application Serial No. 09/350,930, filed July 12, 1999, en titled "ELECTROCHROMIC POLYMERIC SOLID FILMS, MANUFACTURING ELECTROCHROMIC DEVICES USING SUCH FILMS, AND PROCESSES FOR MAKING SUCH SOLID FILMS AND DEVICES" to Desaraju V. Varaprasad et al., or such as is disclosed in U.S. Patent Nos. 5,668,663; 5,724,187; 5,910,854; and 5,239,405, the entire disclosures of which are hereby incorporated by reference herein. Most preferably, in such laminate-type electrochromic mirror reflective elements, the front substrate comprises a glass plate of thickness less than about 1.6 mm, most preferably about 1.1 mm thickness or lower, and the rear substrate comprises a glass plate of thickness equal to or greater than about 1.6mm, more preferably greater than about 1.8 mm thickness, most preferably equal to or greater than about 2.0 mm thickness. The rearmost surface of the rear substrate (the fourth surface as known in the mirror art) is reflector coated with a high reflecting metal film such as of aluminum or silver, or an alloy of aluminum or silver. Most preferably, the front-most surface of the rear substrate (the third surface as known in the mirror art) is reflector coated with a high reflecting metal film such as of aluminum or silver, or an alloy of aluminum or silver.

Backing plate element 65 of plano-multiradius reflective element assembly 30 is optionally equipped on its rearmost surface with attachment member 64 to facilitate attachment to the reflector-positioning actuator of the exterior sideview mirror assembly that plano-multiradius reflective element assembly 30 is mounted to. Attachment of plano-multiradius reflective element assembly 30 to the actuator can be by mechanical attachment such as by a tab, clip or fastener, or may be by adhesive attachment such as by a silicone adhesive, a urethane adhesive or a similar adhesive material such as a tape coated on both surfaces with a pressure sensitive adhesive to form a "double-sticky" tape. The exterior sideview mirror assembly, on whose mirror reflector-positioning actuator the plano-multiradius reflective element assembly is mounted, can be a fixedly attached exterior sideview mirror assembly, a break-away exterior sideview mirror assembly and a powerfold exterior sideview mirror assembly, as known in the automotive mirror art.

Figs. 5A-5H shows various arrangements of multiradius reflective element 55 relative to its adjacent plano reflective element 50 (with demarcation element 65 disposed at their joint). In Figs. 5A, 5B, 5C, 5E and 5F, plano element 50 is mounted wholly inboard of multiradius element 55. Thus, in Figs. 5A, 5B, 5C, 5E and 5F, plano element 50 would be disposed closer to the vehicle body (and hence to the driver) than multiradius element 55 when plano-multiradius reflective element assembly 30 was mounted in an exterior sideview mirror attached to a side of an automobile. Therefore, in Figs. 5A, 5B, 5C, 5E and 5F, plano element 50 would be mounted inboard relative to the side of the automobile and multiradius element 55 would be mounted outboard relative to the side of the automobile. In general, the location of the multiradius reflective element in the outboard, upper portion of the plano-multiradius reflective element assembly, as in Figs. 5B and 5E, is preferred as this allows the plano portion provide a desired rearward field of view along the side of the vehicle. The configuration as shown in Fig. 5G (where the multiradius reflective element is along the inboard side of the assembly) is also desirable as this allows the driver view the side of the vehicle (something many drivers desire in order to have a frame of reference for their rearward field of view) while facilitating having a wide field of view for the plano portion.

Unlike trucks, busses and commercial vehicles the size of an exterior sideview mirror assembly suitable for use on an automobile (and especially when the automobile is not towing a trailer or the like) is restricted. Automobiles generally are non-commercial vehicles intended for personal transportation. Automobiles typically carry 5 passengers or less, although minivans and large sports utility vehicles (which are classified herein as automobiles) can have seat accommodation for up to 10 passengers (although accommodation for 7 passengers or less is more common). The tandem mounting of a plano element of unit magnification and a separate auxiliary element onto a common, single backing plate element, and the mounting of this backing plate element onto an actuator of an exterior sideview mirror assembly so that a driver can simultaneously and similarly move the auxiliary element and the plano element so as to position their respective rearward fields of view, and to achieve this within the relatively restricted space available in a standard automobile-sized exterior sideview mirror assembly is an important element of this present invention. By utilizing a plano element of unit magnification in the plano-multiradius reflective element assembly, and by sizing the reflector area of the plano element larger than the reflector area of the multiradius element and, preferably, by sizing the reflector area of the plano element at a sufficiently large size that the rearward field of view provided by the plano element alone meets and satisfies the minimum field of view requirement mandated by an automaker specification and/or a government regulation, the need to provide a safety warning indicia such as "OBJECTS IN MIRROR ARE CLOSER THAN THEY APPEAR" in the plano element and/or in the multiradius element can be obviated. Preferably, the plano element comprises a reflector surface area of a size sufficient, when mounted as part of a plano-multiradius reflective element assembly in a driver-side exterior sideview mirror assembly on an automobile, to provide the driver of the automobile a view of a level road surface extending to the horizon from a line, perpendicular to a longitudinal plane tangent to the driver's side of the automobile at the widest point, extending 8 feet out from the tangent plane 35 feet behind the driver's eyes (at a nominal location appropriate for any 95th percentile male driver or at the driver's eye reference points established in Federal Motor Vehicle Standard No. 104), with the driver seated in the driver's seat and with the driver's seat in the rearmost position. Also, preferably, the aspect ratio of the plano-multiradius reflective element assembly (defined as the ratio of its largest vertical dimension to its largest horizontal dimension, measured with the plano-multiradius reflective element assembly oriented as it would be oriented when mounted in an exterior sideview mirror assembly on an automobile, and with "horizontal" being generally parallel with the road surface the automobile travels on and "vertical" being generally perpendicular to the road surface the automobile travels on) is preferably less than 1, more preferably less than 0.8, most preferably less than 0.6. Further, it is preferable that the multiradius element be disposed outboard (relative to the side of the vehicle and with the plano-multiradius reflective element assembly oriented as it would be when mounted in an exterior sideview mirror assembly on an automobile) on the plano-multiradius reflective element assembly so that the multiradius element is positioned to provide an auxiliary, wide-angle view of a "blind-spot" region in an adjacent sidelane while the more inboard-disposed plano element with unit magnification provides the principal sideview image to the driver.

Also, it is preferable that the principal axis of the rearward field of view of the multiradius element be different from and angled to the principal axis of the rearward field of view of the plano element when both are attached to the backing plate element of the plano-multiradius reflective element assembly and when the plano-multiradius reflective element assembly is mounted and operated in an exterior sideview mirror assembly on an automobile. Preferably, the principal axis of the rearward field of view of the plano element is directed generally parallel to the road that the automobile equipped with the plano-multiradius reflective element assembly is travelling on (i.e. generally parallel to the longitudinal axis of the automobile) so as to provide the driver with a long-distance view of approaching vehicles in the side lane that the plano element views). However, preferably the principal axis of the rearward field of view of the multiradius element of, for example, a door-mounted driver-side (or passenger-side) exterior sideview mirror assembly in which the plano-multiradius reflective element assembly is mounted is directed generally downwardly towards the road surface adjacent to the driver seating location and/or several feet (such as about 1 foot to about 24 feet; more preferably, about 1 foot to about 12 feet; most preferably about 1 foot to about 8 feet in distance) to its rear (in order to capture a field of view of a rear approaching vehicle that is approaching to overtake, or is about to overtake, or is overtaking the automobile equipped with the plano-multiradius reflective element assembly). Thus, preferably, the principal axis of the rearward field of view of the multiradius element is angled and directed generally downwardly with respect to the longitudinal axis of the automobile and thus is at an angle to the principal axis of the rearward field of view of the plano element. For example, multiradius element 155 when attached to surface 173 of backing plate 160 (see Fig. 6B) would have its principal axis of rearward view as indicated by 180 as in Fig. 6B, and as such would be canted towards the road surface when mounted in an exterior sideview mirror assembly attached to the side of an automobile. By contrast, plano element 150 when attached to surface 174 of backing plate 160 (see Fig. 6A) would have a principal axis as indicated by 185 as in Fig. 6A and, as such, would be generally parallel to the road surface when mounted in an exterior sideview mirror assembly attached to the side of an automobile. Having the multiradius element canted somewhat downwards towards the road surface assists visual detection by the driver of overtaking vehicles in the traditional "blind-spot" in the adjacent side lane. The angle that the multiradius element is angled on the backing plate element of the plano-multiradius reflective element assembly relative to the plane of the plano reflective element will vary from automobile model to model, but generally is preferred to be in the about 1 degree to about 10 degree range; about 2 degree to about 8 degree range more preferred; and about 3 degree to about 6 degree range most preferred. In order to conveniently achieve an angling of the multiradius portion with respect to the plano portion (and preferably a downward angling), the portion of the backing plate element that the multiradius reflective element is attached to can be angled relative to the adjacent portion of the backing plate element that the plano reflective portion is attached to. Thus, and referring to Fig. 6, plano-multiradius reflective element assembly 130 includes a molded polymeric backing plate element 160 comprising a generally flat portion 162 (between BB and CC in Fig. 6) and an adjacent curved portion 161 (between AA and BB). As indicated by 190 and 195, portion AA to BB of backing plate element 160 is generally angled to portion BB to CC of backing plate 160. Preferably, the portion of backing plate element 160 to which the auxiliary reflective element attaches is angled towards the front (compared to the angling of plano reflective element) of an automobile equipped with the plano-auxiliary reflective element assembly of the present invention. Fig. 6 is a view of plano-multiradius reflective element assembly 130 as it would appear from above the vehicle as it would be orientated in use (with portion 162 closer to the driver than portion 161). The wall section, section XX in Fig. 6, taken through section 162 of backing plate element 160 is of substantially constant dimension (as illustrated in Fig. 6A) whereas the wall section, section YY in Fig. 6B, taken through section 161 of backing plate element 160 is of varying dimension and is angled. Plano reflective element 150 and multiradius reflective element

155 (for example, plano element 150 can comprise an electrochromic mirror element and multiradius element 155 can comprise a chrome coated glass reflector) are attached to portions 162 and 161, respectively. By being supported on the angled face 173 (see Fig. 6B) of portion 161, the principal viewing axis of multiradius reflector element 155 is angled downwards towards the road surface, as compared to the more horizontal-viewing principal viewing axis of plano element 150, when plano-multiradius reflective element 130 is mounted in an exterior sideview mirror assembly on an automobile. Demarcation element 165 is preferably molded in the same molding tool as is used to mold backing plate element 160, and so demarcation element 165 is formed as an integral part of backing plate element 160, forming a wall thereof that partitions the surface of backing plate element 160 into a region for receiving the plano reflective element 150 and a region for receiving the auxiliary reflective element 155. Also, end-caps 170 and 171 are optionally provided. Plano reflective element 150 can attach into the cavity formed between demarcation element 165 and end-cap 171; multiradius reflective element 155 can attach into the cavity formed between demarcation element 165 and end-cap 170. Note that the portion of the backing plate element where the wide-angle optic multiradius element attaches can have a thicker wall thickness than that of the portion of the backing plate element where the unit magnification optic element attaches in order to allow for the angling of the multiradius element downwardly relative to the angle of the plano element, as illustrated in Figs. 6A-B. As illustrated in Figs. 6A-B, the angle downwards to the longitudinal axis of the vehicle of the multiradius element can generally be set by an angling of a surface of the backing plate element in order to ensure that the principal axis of the rearward field of view of the plano element is directed generally parallel to the longitudinal axis of an automobile equipped with the plano-multiradius reflective element assembly and that the principal axis of the rearward field of view of the multiradius element is directed generally at an angle downwards to the longitudinal axis of the automobile.

Note that the provision of the plano-multiradius reflective element assembly of this invention as a unitary module has manufacturing advantages, particularly for exterior sideview mirror assembly manufacturers who can procure a plano-multiradius reflective element assembly module from a mirror reflector supplier and then mount the plano-multiradius reflective element assembly module onto an actuator.

Referring to Fig. 7, a third embodiment 230 of a plano-multiradius reflective element assembly is illustrated. Plano-multiradius reflective element assembly 230 includes a plano reflective element 250 and a separate multiradius reflective element assembly 255, both individually attached to a backing plate element, and with demarcation element 265 disposed at their joint. Plano-multiradius reflective element assembly 230 is about 8.5 inches wide and about 4.25 inches tall (aspect ratio of 0.5), at their largest dimension. Shown as the shaded triangle 240 in plano reflective element 250 is the image of a triangular target object set about 35 feet rearward and of width about 8 feet and of height of about 4.1 feet as would be seen were plano-multiradius reflective element assembly 230 mounted in a driver-side exterior sideview mirror assembly in an automobile such as a sports utility vehicle. In general, it is desirable that the plano reflective element be dimensioned and configured so as to have its rearward field of view capture an image (that is visible, by reflection in the plano reflective element, to a driver seated in the driver's seat in an automobile to which is attached an exterior sideview mirror assembly equipped with the plano-auxiliary reflective element assembly according to this present invention) of a triangular shaped target located about 35 feet rearward of the driver seating location, extending about 8 feet out from the plane defined by the side of the automobile and reaching a height of between about 4 feet and about 5 feet from the road surface at that location 35 feet rearward of the automobile. The total field of view rearwardly of the vehicle of plano-multiradius reflective element assembly 230 (which is a combination of the field of view of plano reflective element 250 and of the auxiliary multiradius reflective element 255) preferably generally subtends an angle of at least about 30 degrees (and more preferably, generally subtends an angle of at least about 35 degrees and most preferably, generally subtends an angle of at least about 40 degrees) with respect to the side of an automobile to which is attached an exterior sideview mirror assembly equipped with plano-multiradius reflective element assembly 230.

Also, although it is preferable to utilize a multiradius or compound curvature reflective element such as an aspherical element or a compound curvature element for the auxiliary mirror element adjacent the plano reflective element (as this enables least discontinuity in image at the joint between the adjacent elements of the assembly), a spherical reflective element (that has substantially only one radius of curvature and, as such, is a section from a sphere) can optionally be used adjacent the plano reflective element instead of, or in addition to, the multiradius reflective element. Also, a plano auxiliary mirror such as a flat mirrored substrate can be used, less preferably, as a substitute for a multiradius reflective element in those embodiments where the auxiliary reflective element is angled relative to the plane of the principal, plano reflective element so as to view a blind spot region of the principal plano element. Also, the plano-multiradius reflective element assembly can optionally be fixedly attached to an exterior sideview mirror assembly housing that is not movable, or, alternately, the exterior sideview mirror assembly housing to which the plano-multiradius reflective element assembly is fixedly attached can itself be actuated to move, such as by motor action, so that by moving the exterior sideview mirror assembly housing, the field of rearward view of the plano-multiradius reflective element assembly fixedly attached thereto can correspondingly move and be repositioned to suit the field of view need of a particular driver seated in the automobile cabin.

The above description is considered that of the preferred embodiments only. Modification of the invention will occur to those skilled in the art and to those who make or use the invention. Therefore, it is understood that the embodiments shown in the drawings and described above are merely for illustrative purposes and are not intended to limit the scope of the invention, which is defined in the following claims as interpreted according to the principles of patent law, including the doctrine of equivalents.

I claim:

1. An exterior sideview mirror system suitable for use in an automobile, said exterior sideview mirror system comprising:

an exterior sideview mirror assembly adapted for attachment to a side of an automobile;

said exterior sideview mirror assembly including a reflective element having a rearward field of view when attached to said side of the automobile;

said reflective element attached to an actuator and movable by said actuator in order to position said rearward field of view in response to a control;

wherein said reflective element comprises a plano-multiradius reflective element assembly, said plano-multiradius reflective element assembly comprising a plano reflective element having unit magnification and a separate multiradius reflective element having a multiradius curvature; and

said plano reflective element and said multiradius reflective element of said plano-multiradius reflective element assembly attached to a backing plate element, said backing plate element mounting to said actuator such that movement of said backing plate element of said plano-multiradius reflective element assembly by said actuator simultaneously and similarly moves said plano reflective element and said multiradius reflective element.

2. The exterior sideview mirror system of Claim 1, wherein said plano reflective element and said multiradius reflective element are adjacently attached to said backing plate element at a joint, and wherein said plano-multiradius reflective element assembly includes a demarcation element, said demarcation element disposed at said joint to form a demarcation between said plano reflective element and said multiradius reflective element, said demarcation element having a portion visible to a driver of the automobile.

3. The exterior sideview mirror system of Claim 2, wherein said demarcation element is dark colored.

4. The exterior sideview mirror system of Claim 3, wherein said demarcation element is dark colored with a color selected from the group consisting of black, grey, blue and brown.

5. The exterior sideview mirror system of Claim 2, wherein said joint comprises a space between said plano reflective element and said multiradius reflective element.

6. The exterior sideview mirror system of Claim 5, wherein said demarcation element is at least partially disposed in said space between said plano reflective element and said multiradius reflective element.

7. The exterior sideview mirror system of Claim 3, wherein said demarcation element comprises at least one of a polymer material, a tape, a plastic film, a paint, a lacquer and a caulk.

8. The exterior sideview mirror system of Claim 7, wherein said demarcation element comprises a polymer material.

9. The exterior sideview mirror system of Claim 2, wherein said demarcation element comprises a wall on said backing plate element, said wall located on said backing plate element at said joint, said wall separating said plano reflective element from said multiradius reflective element.

10. The exterior sideview mirror system of Claim 2, wherein said portion visible to a driver of the automobile has a width less than about 4 mm.

11. The exterior sideview mirror system of Claim 2, wherein said portion visible to a driver of the automobile has a width less than about 3 mm.

12. The exterior sideview mirror system of Claim 2, wherein said portion visible to a driver of the automobile has a width less than about 2 mm.

13. The exterior sideview mirror system of Claim 2, wherein said portion visible to a driver of the automobile has a width greater than about 0.5 mm.

14. The exterior sideview mirror system of Claim 2, wherein said portion visible to a driver of the automobile has a width greater than about 0.75 mm.

15. The exterior sideview mirror system of Claim 2, wherein said portion visible to a driver of the automobile has a width greater than about 1 mm.

16. The exterior sideview mirror system of Claim 1, wherein said plano reflective element is attached to said backing plate element by at least one of an adhesive attachment and a mechanical attachment.

17. The exterior sideview mirror system of Claim 1, wherein said multiradius reflective element is attached to said backing plate element by at least one of an adhesive attachment and a mechanical attachment.

18. The exterior sideview mirror system of Claim 1, wherein said multiradius reflective element is attached to said backing plate element at a location such that, when said exterior mirror assembly is attached to a side of an automobile, at least a portion of said plano reflective element is disposed closer to said side of the automobile than any portion of said multiradius reflective element.

19. The exterior sideview mirror system of Claim 1, wherein said multiradius reflective element comprises a bent glass substrate with radii of curvature in the range of from about 4000 mm to about 50 mm.

20. The exterior sideview mirror system of Claim 1, wherein the ratio of the width of said plano reflective element to the width of said multiradius reflective element is greater than 1.

21. The exterior sideview mirror system of Claim 1, wherein the ratio of the width of said plano reflective element to the width of said multiradius reflective element is greater than 1.5.

22. The exterior sideview mirror system of Claim 1, wherein the ratio of the width of said plano reflective element to the width of said multiradius reflective element is greater than 2.5.

23. The exterior sideview mirror system of Claim 1, wherein the principal axis of the rearward field of view of said multiradius reflective element is different from and angled to the principal axis of the rearward field of view of said plano reflective element when both are attached to said backing plate element of said plano-multiradius reflective element assembly and when said plano-multiradius reflective element assembly is mounted in said exterior sideview mirror assembly on an automobile.

24. The exterior sideview mirror system of Claim 23, wherein the principal axis of the rearward field of view of said plano reflective element is directed generally parallel to the longitudinal axis of an automobile equipped with the plano-multiradius reflective element assembly and wherein the principal axis of the rearward field of view of said multiradius reflective element is directed generally at an angle downwards to the longitudinal axis of the automobile.

25. The exterior sideview mirror system of Claim 24, wherein said angle downwards to the longitudinal axis of the automobile is in the range from about 1 degree to about 10 degrees.

26. The exterior sideview mirror system of Claim 24, wherein said angle downwards to the longitudinal axis of the automobile is in the range from about 2 degrees to about 8 degrees.

27. The exterior sideview mirror system of Claim 24, wherein said angle downwards to the longitudinal axis of the automobile is in the range from about 3 degrees to about 6 degrees.

28. The exterior sideview mirror system of Claim 24, wherein said angle downwards to the longitudinal axis of the automobile is generally set by an angling of a surface of said backing plate element.

29. The exterior sideview mirror system of Claim 24, wherein said exterior sideview mirror assembly comprises a door-mounted exterior sideview mirror assembly adapted for attachment to a side of the automobile adjacent a driver seating location of a driver of the automobile and wherein the principal axis of the rearward field of view of said multiradius reflective element is directed generally downwardly towards the road surface adjacent to the driver seating location at a distance in the range of about 1 foot to about 24 feet to the rear of the driver seating location.

30. The exterior sideview mirror system of Claim 24, wherein said exterior sideview mirror assembly comprises a door-mounted exterior sideview mirror assembly adapted for attachment to a side of the automobile adjacent a driver seating location of a driver of the automobile and wherein the principal axis of the rearward field of view of said multiradius reflective element is directed generally downwardly towards the road surface adjacent to the driver seating location at a distance in the range of about 1 foot to about 12 feet to the rear of the driver seating location.

31. The exterior sideview mirror system of Claim 24, wherein said exterior sideview mirror assembly comprises a door-mounted exterior sideview mirror assembly adapted for attachment to a side of the automobile adjacent a driver seating location of a driver of the automobile and wherein the principal axis of the rearward field of view of said multiradius reflective element is directed generally downwardly towards the road surface adjacent to the driver seating location at a distance in the range of about 1 foot to about 8 feet to the rear of the driver seating location.

32. The exterior sideview mirror system of Claim 1, wherein said exterior sideview mirror assembly comprises a fixedly attached exterior sideview mirror assembly.

33. The exterior sideview mirror system of Claim 1, wherein said exterior sideview mirror assembly comprises a break-away exterior sideview mirror assembly.

34. The exterior sideview mirror system of Claim 1, wherein said exterior sideview mirror assembly comprises a powerfold exterior sideview mirror assembly.

35. The exterior sideview mirror system of Claim 1, wherein said actuator comprises an electrically operable actuator.

36. The exterior sideview mirror system of Claim 1, wherein said control comprises a memory controller.

37. The exterior sideview mirror system of Claim 1, wherein at least one of said plano reflective element and said multiradius reflective element comprises an electro-optic reflective element.

38. The exterior sideview mirror system of Claim 1, wherein both said plano reflective element and said multiradius reflective element comprise an electro-optic reflective element.

39. The exterior sideview mirror system of Claim 1, wherein said plano reflective element comprises an electro-optical reflective element.

40. The exterior sideview mirror system of Claim 39, wherein said electro-optical reflective element comprises an electrochromic reflective element.

41. The exterior sideview mirror system of Claim 40, wherein said multiradius reflective element comprises a fixed reflectance mirror reflector.

42. The exterior sideview mirror system of Claim 41, wherein said fixed reflectance mirror reflector comprises a bent glass substrate coated with a metallic reflector coating.

43. The exterior sideview mirror system of Claim 1, wherein said plano-multiradius reflective element assembly is formed in an integral molding operation.

44. An exterior sideview mirror system suitable for use in an automobile, said exterior sideview mirror system comprising:

an exterior sideview mirror assembly adapted for attachment to a side of an automobile;

said exterior sideview mirror assembly including a reflective element having a rearward field of view when attached to said side of the automobile;

said reflective element attached to an electrically operable actuator and movable by said actuator in order to position said rearward field of view in response to a control;

wherein said reflective element comprises a plano reflective element having unit magnification and a separate auxiliary reflective element;

said plano reflective element and said auxiliary reflective element attached to a backing plate element, said backing plate element mounting to said actuator such that movement of said backing plate element by said actuator simultaneously and similarly moves said plano reflective element and said auxiliary reflective element; and

wherein said plano reflective element and said auxiliary reflective element are adjacently attached to said backing plate element at a joint, and wherein a demarcation element is disposed at said joint to form a demarcation between said plano reflective element and said auxiliary reflective element, said demarcation element having a portion visible to a driver of the automobile.

45. The exterior sideview mirror system of Claim 44, wherein demarcation element is dark colored.

46. The exterior sideview mirror system of Claim 44, wherein said demarcation element is dark colored with a color selected from the group consisting of black, grey, blue and brown.

47. The exterior sideview mirror system of Claim 44, wherein said joint comprises a space between said plano reflective element and said auxiliary reflective element.

48. The exterior sideview mirror system of Claim 47, wherein said demarcation element is at least partially disposed in said space between said plano reflective element and said auxiliary reflective element.

49. The exterior sideview mirror system of Claim 44, wherein said demarcation element comprises at least one of a polymer material, a tape, a plastic film, a paint, a lacquer and a caulk.

50. The exterior sideview mirror system of Claim 44, wherein said demarcation element comprises a polymer material.

51. The exterior sideview mirror system of Claim 44, wherein said demarcation element comprises a wall on said backing plate element, said wall located on said backing plate element at said joint, said wall separating said plano reflective element from said auxiliary reflective element.

52. The exterior sideview mirror system of Claim 44, wherein said portion visible to a driver of the automobile has a width less than about 4 mm.

53. The exterior sideview mirror system of Claim 44, wherein said portion visible to a driver of the automobile has a width less than about 3 mm.

54. The exterior sideview mirror system of Claim 44, wherein said portion visible to a driver of the automobile has a width less than about 2 mm.

55. The exterior sideview mirror system of Claim 44, wherein said portion visible to a driver of the automobile has a width greater than about 0.5 mm.

56. The exterior sideview mirror system of Claim 44, wherein said portion visible to a driver of the automobile has a width greater than about 0.75 mm.

57. The exterior sideview mirror system of Claim 44, wherein said portion visible to a driver of the automobile has a width greater than about 1 mm.

58. The exterior sideview mirror system of Claim 44, wherein said plano reflective element is attached to said backing plate element by at least one of an adhesive attachment and a mechanical attachment.

59. The exterior sideview mirror system of Claim 44, wherein said auxiliary reflective element is attached to said backing plate element by at least one of an adhesive attachment and a mechanical attachment.

60. The exterior sideview mirror system of Claim 44, wherein said auxiliary reflective element is attached to said backing plate element at a location such that, when said exterior mirror assembly is attached to a side of an automobile, at least a portion of said plano reflective element is disposed closer to said side of the automobile than any portion of said auxiliary reflective element.

61. The exterior sideview mirror system of Claim 44, wherein said auxiliary reflective element comprises one of a flat glass substrate and a bent glass substrate

62. The exterior sideview mirror system of Claim 44, wherein the ratio of the width of said plano reflective element to the width of said auxiliary reflective element is greater than 1.

63. The exterior sideview mirror system of Claim 44, wherein the ratio of the width of said plano reflective element to the width of said auxiliary reflective element is greater than 1.5.

64. The exterior sideview mirror system of Claim 44, wherein the ratio of the width of said plano reflective element to the width of said auxiliary reflective element is greater than 2.5.

65. The exterior sideview mirror system of Claim 44, wherein the principal axis of the rearward field of view of said auxiliary reflective element is different from and angled to the principal axis of the rearward field of view of said plano reflective element when both are attached to said backing plate element and are mounted in said exterior sideview mirror assembly on an automobile.

66. The exterior sideview mirror system of Claim 65, wherein the principal axis of the rearward field of view of said plano reflective element is directed generally parallel to the longitudinal axis of an automobile equipped with said reflective element and wherein the principal axis of the rearward field of view of said auxiliary reflective element is directed generally at an angle downwards to the longitudinal axis of an automobile equipped with said reflective element.

67. The exterior sideview mirror system of Claim 66, wherein said angle downwards to the longitudinal axis of the automobile is in the range from about 1 degree to about 10 degrees.

68. The exterior sideview mirror system of Claim 66, wherein said angle downwards to the longitudinal axis of the automobile is in the range from about 2 degrees to about 8 degrees.

69. The exterior sideview mirror system of Claim 66, wherein said angle downwards to the longitudinal axis of the automobile is in the range from about 3 degrees to about 6 degrees.

70. The exterior sideview mirror system of Claim 66, wherein said angle downwards to the longitudinal axis of the automobile is generally set by an angling of a surface of said backing plate element.

71. The exterior sideview mirror system of Claim 66, wherein said exterior sideview mirror assembly comprises a door-mounted exterior sideview mirror assembly adapted for attachment to a side of the automobile adjacent a driver seating location of a driver of the automobile and wherein the principal axis of the rearward field of view of said auxiliary reflective element is directed generally downwardly towards the road surface adjacent to the driver seating location at a distance in the range of about 1 foot to about 24 feet to the rear of the driver seating location.

72. The exterior sideview mirror system of Claim 66, wherein said exterior sideview mirror assembly comprises a door-mounted exterior sideview mirror assembly adapted for attachment to a side of the automobile adjacent a driver seating location of a driver of the automobile and wherein the principal axis of the rearward field of view of said auxiliary reflective element is directed generally downwardly towards the road surface adjacent to the driver seating location at a distance in the range of about 1 foot to about 12 feet to the rear of the driver seating location.

73. The exterior sideview mirror system of Claim 66, wherein said exterior sideview mirror assembly comprises a door-mounted exterior sideview mirror assembly adapted for attachment to a side of the automobile adjacent a driver seating location of a driver of the automobile and wherein the principal axis of the rearward field of view of said auxiliary reflective element is directed generally downwardly towards the road surface adjacent to the driver seating location at a distance in the range of about 1 foot to about 8 feet to the rear of the driver seating location.

74. The exterior sideview mirror system of Claim 44, wherein said exterior sideview mirror assembly comprises a fixedly attached exterior sideview mirror assembly.

75. The exterior sideview mirror system of Claim 44, wherein said exterior sideview mirror assembly comprises a break-away exterior sideview mirror assembly.

76. The exterior sideview mirror system of Claim 44, wherein said exterior sideview mirror assembly comprises a powerfold exterior sideview mirror assembly.

77. The exterior sideview mirror system of Claim 44, wherein said control comprises a memory controller.

78. The exterior sideview mirror system of Claim 44, wherein at least one of said plano reflective element and said auxiliary reflective element comprises an electro-optic reflective element.

79. The exterior sideview mirror system of Claim 44, wherein both said plano reflective element and said auxiliary reflective element comprise an electro-optic reflective element.

80. The exterior sideview mirror system of Claim 44, wherein said plano reflective element comprises an electro-optical reflective element.

81. The exterior sideview mirror system of Claim 80, wherein said electro-optical reflective element comprises and electrochromic reflective element.

82. The exterior sideview mirror system of Claim 81, wherein said auxiliary reflective element comprises a fixed reflectance mirror reflector.

83. The exterior sideview mirror system of Claim 82, wherein said fixed reflectance mirror reflector comprises a bent glass substrate coated with a metallic reflector coating.

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EXTERIOR MIRROR PLANO-AUXILIARY REFLECTIVE ELEMENT ASSEMBLY

ABSTRACT

This invention provides a plano-multiradius reflective element assembly suitable for use in an exterior sideview mirror assembly mounted to the side body of an automobile. The plano-multiradius reflective element assembly includes a plano reflective element which has a rearward field of view, when mounted in an exterior sideview mirror assembly mounted to the side body of an automobile, with unit magnification. The plano-multiradius reflective element assembly also includes an auxiliary reflective element including a multiradius portion with a rearward field of view. The plano reflective element provides a distortion-free rearward field of view and serves as the principal rearward-viewing portion of the plano-multiradius reflective element assembly. The multiradius portion provides a wide angle rearward field of view, and typically supplements the rearward field of view of the plano portion. The plano reflective element and the multiradius portion are separated by a demarcation element which enables the driver to readily delineate a rearward view in the plano portion from a rearward view in the multiradius portion. The plano reflective element and the multiradius reflective element are individually, separately, and adjacently attached to a single backing plate which is mounted to an actuator of the exterior sideview mirror assembly. By adjusting the position of the backing plate within the housing of the exterior sideview mirror assembly via the actuator, the rearward field of view of both the plano reflective element and the multiradius reflective element are simultaneously and similarly aligned.

DON01 P-793
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DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor, if only one name is listed below, or an original, first and joint inventor, if plural names are listed below, of the subject matter which is claimed and for which a patent is sought on the invention entitled EXTERIOR MIRROR PLANO-AUXILIARY REFLECTIVE ELEMENT ASSEMBLY, the specification of which is attached hereto.

I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the United States Patent and Trademark Office (the Office), all information which is known by me to be material to patentability as defined in Title 37, Code of Federal Regulations (C.F.R.), Section 1.56.

CLAIM OF PRIORITY

I hereby claim foreign benefits under Title 35, United States Code (U.S.C.), Section 119, of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed.

Application Ser. No. __None__, filed in (country) ________________ on ________________.

I hereby claim the benefit under 35 U.S.C. ∍ 120, of any United States application(s) listed below and, insofar as the above-identified specification, including claims, discloses and claims subject matter in addition to that disclosed in the prior copending application(s), listed below, I acknowledge the duty to disclose to the Office, all information which is known by me to be material to patentability as defined in 37 C.F.R. ∍ 1.56, which became available between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. Serial No. __None__, filed on ________________, and now (status) _____________.

I hereby claim the benefit under Title 35, United States Code, ∍ 119(e) of any United States provisional application(s) listed below:

U.S. Serial No. __None__, filed on __________________.

POWER OF ATTORNEY

I hereby appoint the patent law firm of Van Dyke, Gardner, Linn & Burkhart, LLP, 2851 Charlevoix Drive, S.E., Suite 207, Grand Rapids, Michigan 49546, telephone number 616/975-5500, facsimile number 616/975-5505, and the individual patent attorneys and patent agents at such patent law firm, namely, Daniel Van Dyke, Reg. No. 25 046; Donald S. Gardner, Reg. No. 25 975; Terence J. Linn, Reg. No. 30 283; Frederick S. Burkhart, Reg. No. 29 288; Catherine S. Collins, Reg. No. 37 599; Matthew L. Goska, Reg. No. 42 594; Anthony A. Bisulca, Reg. No. 40 913; and Timothy A. Flory, Reg. No. 42 540, my attorney(s) or agent(s) with full power of substitution and revocation, to prosecute this application and to transact all business in and to receive all correspondence from the Patent and Trademark Office connected therewith.

All statements made herein of my own knowledge are true and all statements made on information and belief are believed to be true, and further, these statements are made with the knowledge that willful false statements and the like are punishable by fine or imprisonment, or both, under 18 U.S.C. ∍ 1001, and that such willful false statements may jeopardize the validity of this application or any patent issued thereon.

Sole inventor:

Niall Lynam JAN 6 2000

Niall R. Lynam Date
Citizenship: USA
Residence: 248 Foxdown
Holland, Michigan 49424
Post Office Address: Same as above.

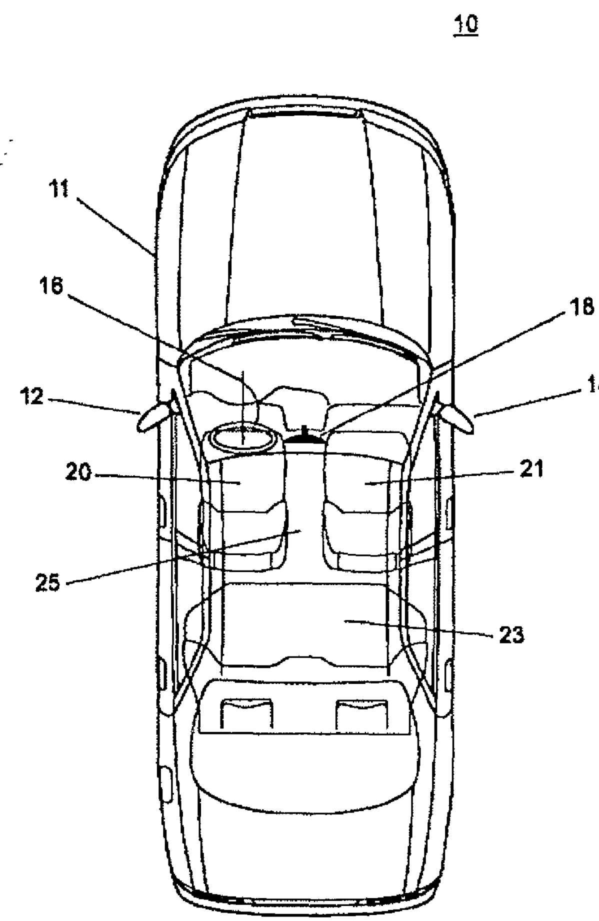


Figure 1

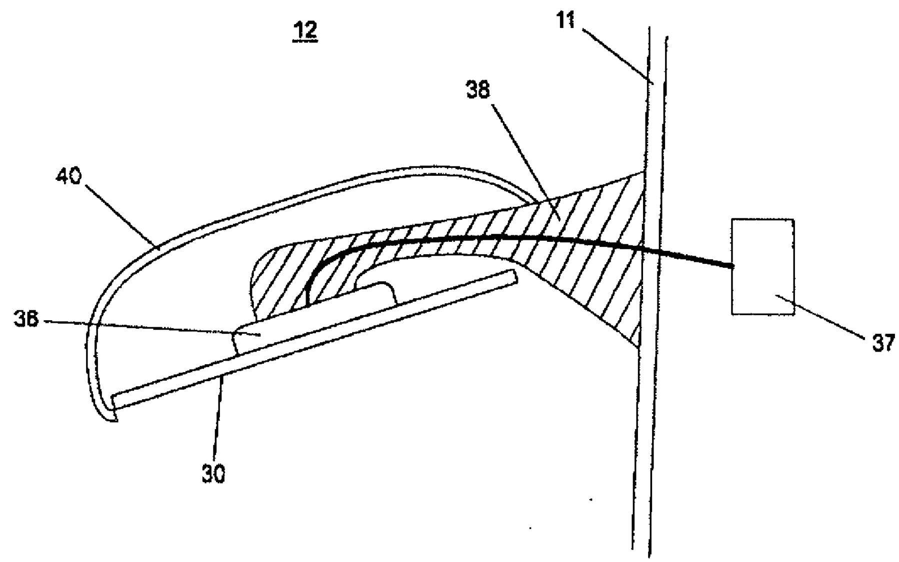


Figure 2

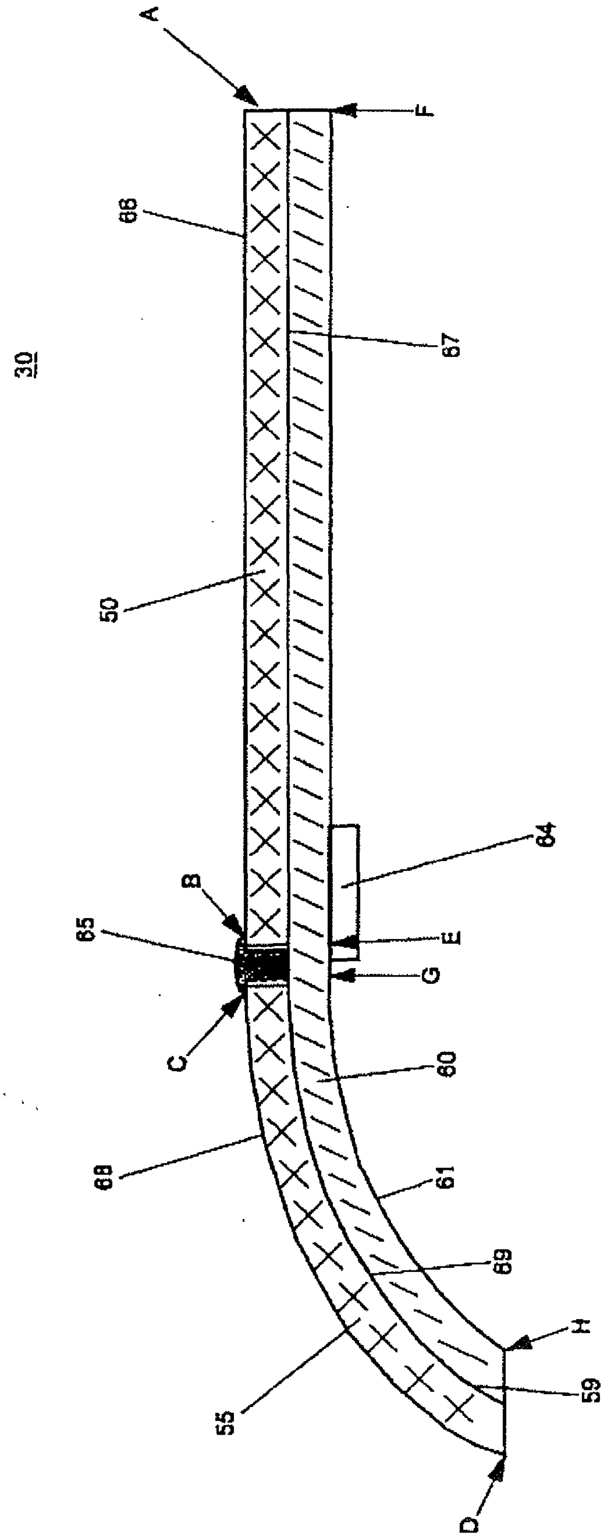
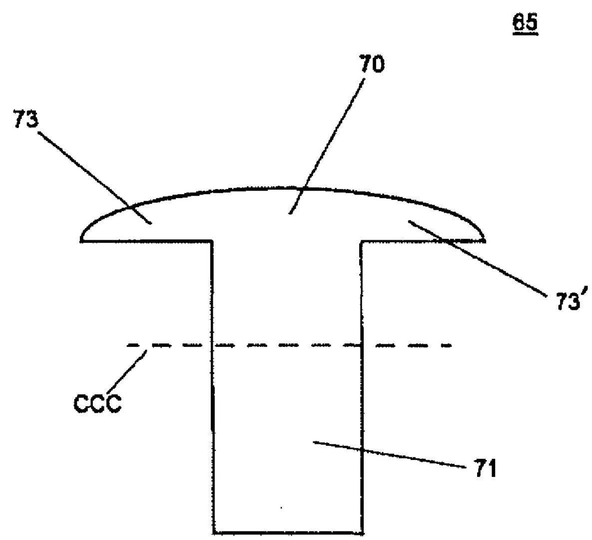


Figure 3



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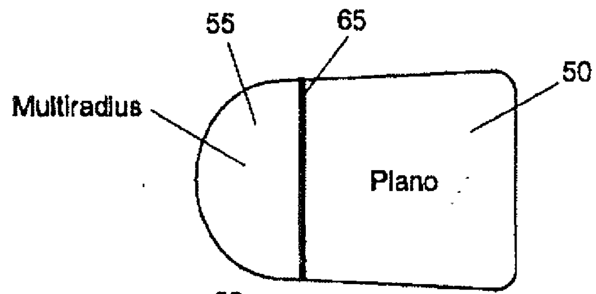

FIG. 5A

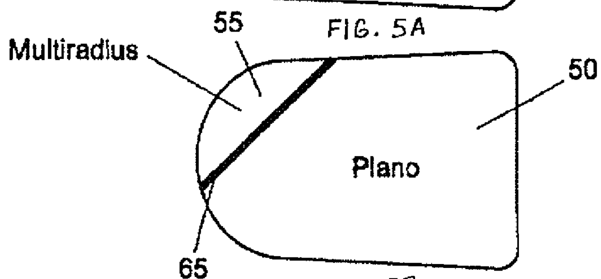

FIG. 5B

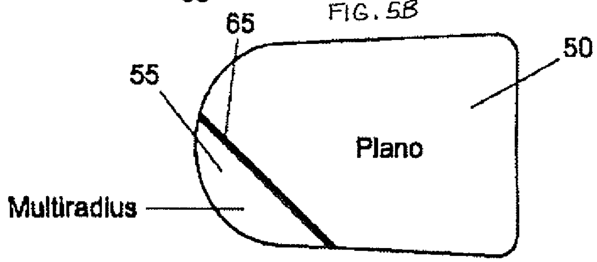

FIG. 5C

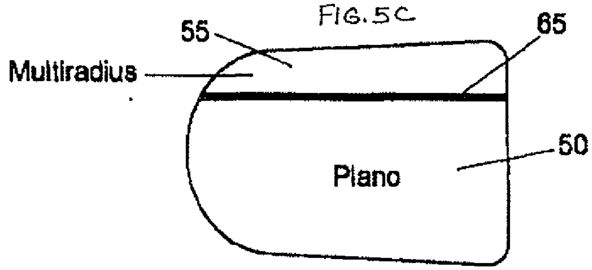

FIG. 5D

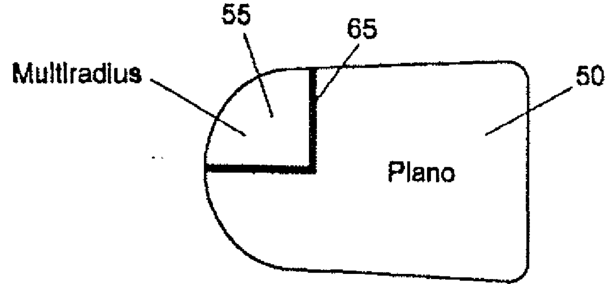

FIG. 5E

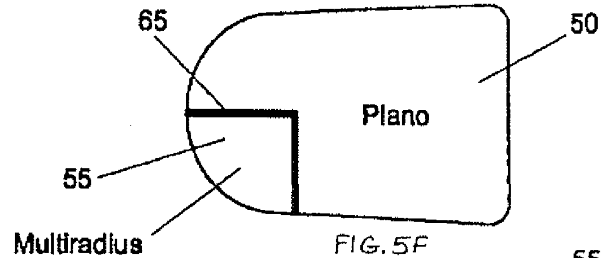

FIG. 5F

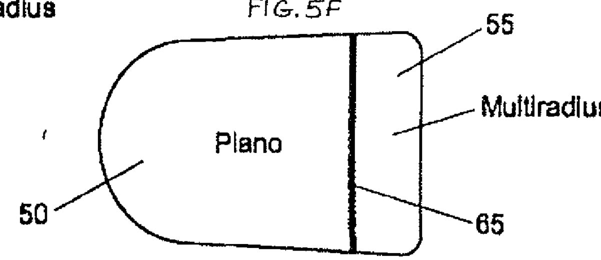

FIG. 5G

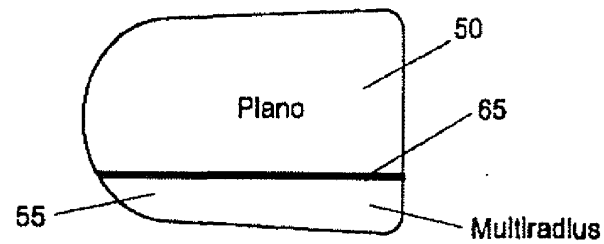

FIG. 5H

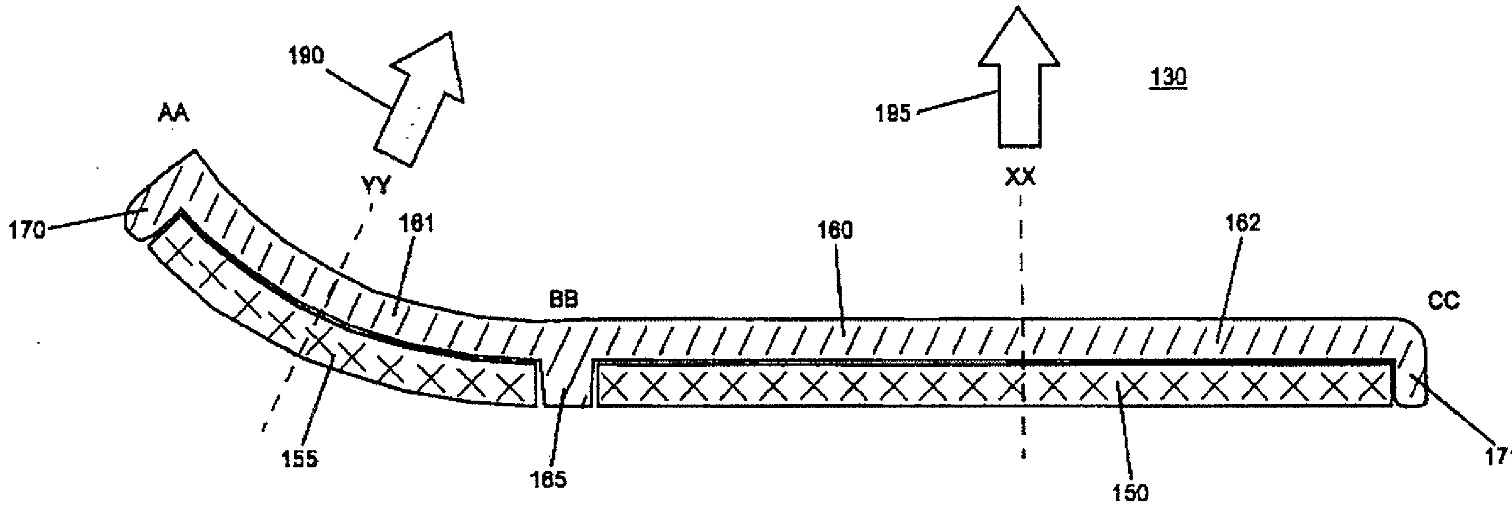

Figure 6

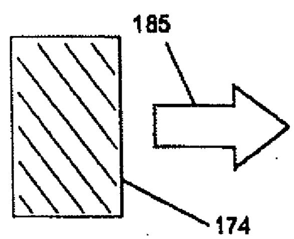

Figure 6A

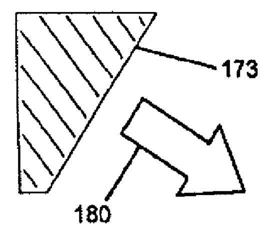

Figure 6B

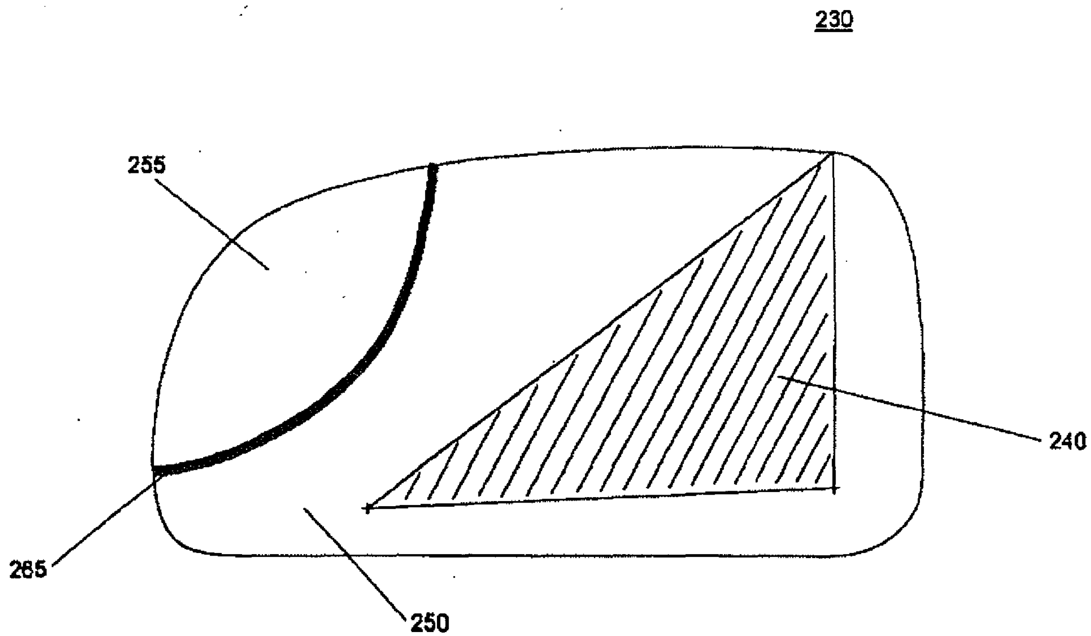

Figure 7

US006522451B1

(12) **United States Patent**
Lynam

(10) **Patent No.: US 6,522,451 B1**
(45) **Date of Patent: Feb. 18, 2003**

(54) **EXTERIOR MIRROR PLANO-AUXILIARY REFLECTIVE ELEMENT ASSEMBLY**

(75) Inventor: **Niall R. Lynam**, Holland, MI (US)

(73) Assignee: **Donnelly Corporation**, Holland, MI (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/478,315**

(22) Filed: **Jan. 6, 2000**

(51) **Int. Cl.**[7] **G02F 1/15**; G02B 5/08; G02B 5/10; G02B 7/182; B60R 1/06

(52) **U.S. Cl.** **359/265**; 359/267; 359/841; 359/850; 359/864; 359/866; 359/868; 359/872; 359/877; 248/549; 248/900

(58) **Field of Search** 359/841, 850, 359/851, 855, 864, 865, 866, 868, 872, 877, 265, 267; 248/549, 900

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Primary Examiner—Ricky D. Shafer
(74) *Attorney, Agent, or Firm*—Van Dyke, Gardner, Linn & Burkhart, LLP

(57) **ABSTRACT**

This invention provides a plano-multiradius reflective element assembly suitable for use in an exterior sideview mirror assembly mounted to the side body of an automobile. The plano-multiradius reflective element assembly includes a plano reflective element which has a rearward field of view, when mounted in an exterior sideview mirror assembly mounted to the side body of an automobile, with unit magnification. The plano-multiradius reflective element assembly also includes an auxiliary reflective element including a multiradius portion with a rearward field of view. The plano reflective element provides a distortion-free rearward field of view and serves as the principal rearward-viewing portion of the plano-multiradius reflective element assembly. The multiradius portion provides a wide angle rearward field of view, and typically supplements the rearward field of view of the plano portion. The plano reflective element and the multiradius portion are separated by a demarcation element which enables the driver to readily delineate a rearward view in the plano portion from a rearward view in the multiradius portion. The plano reflective element and the multiradius reflective element are individually, separately, and adjacently attached to a single backing plate which is mounted to an actuator of the exterior sideview mirror assembly. By adjusting the position of the backing plate within the housing of the exterior sideview mirror assembly via the actuator, the rearward field of view of both the plano reflective element and the multiradius reflective element are simultaneously and similarly aligned.

40 Claims, 8 Drawing Sheets

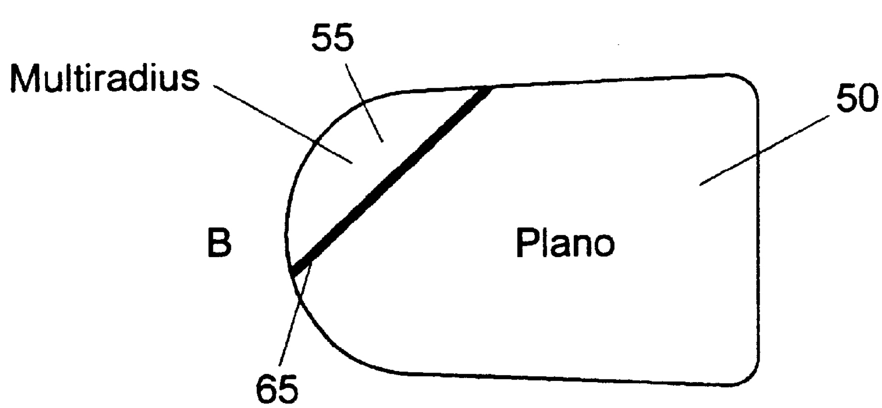

EXHIBIT B

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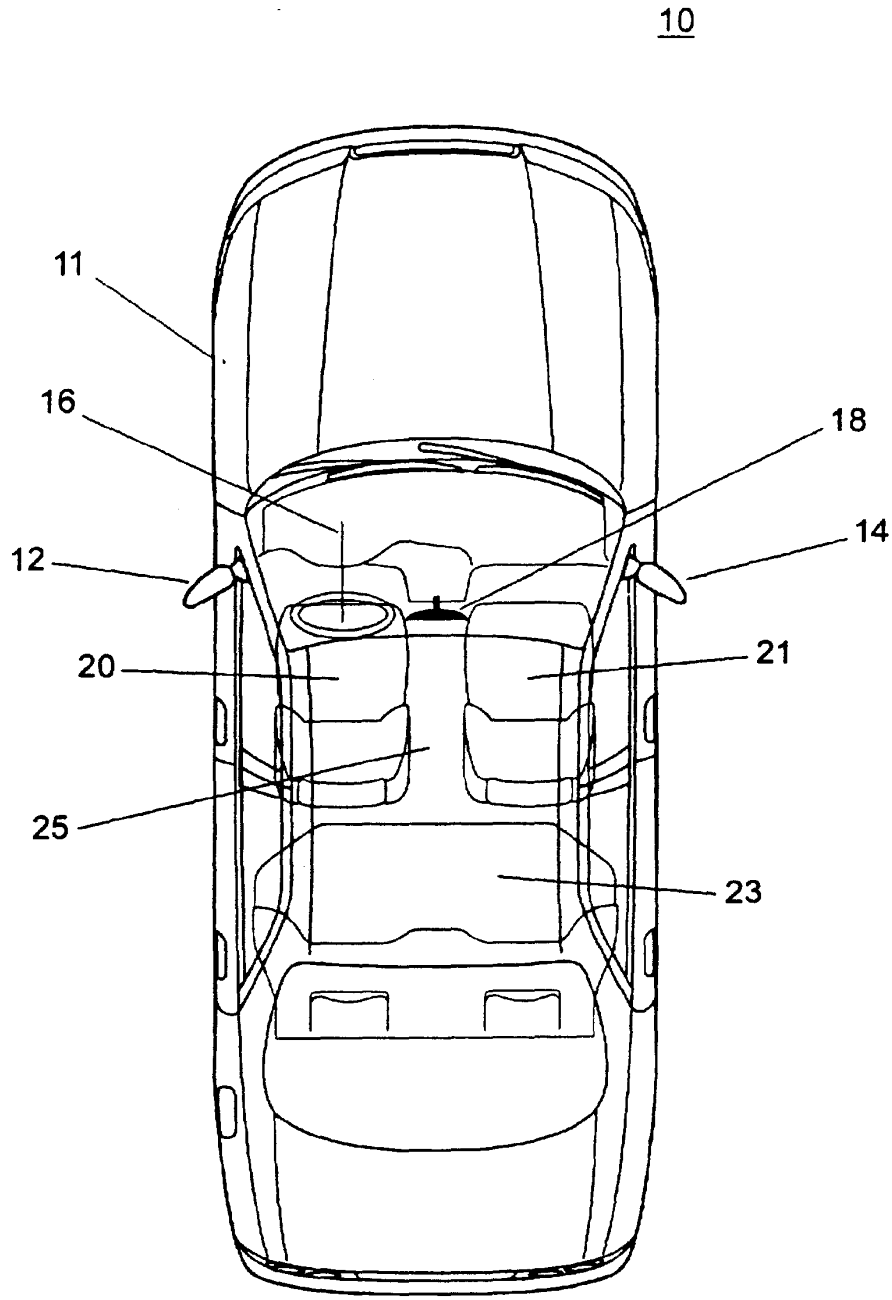

Figure 1

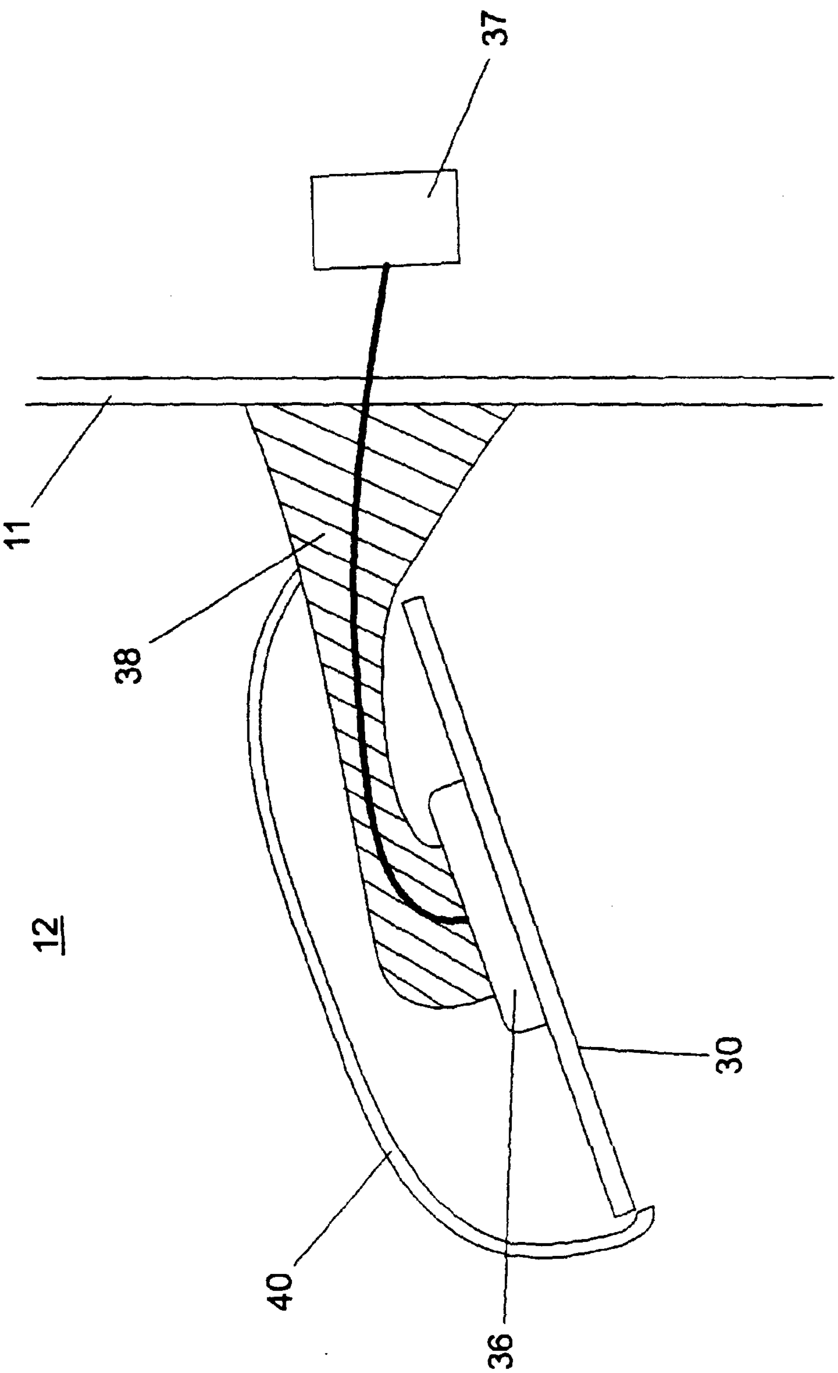

Figure 2

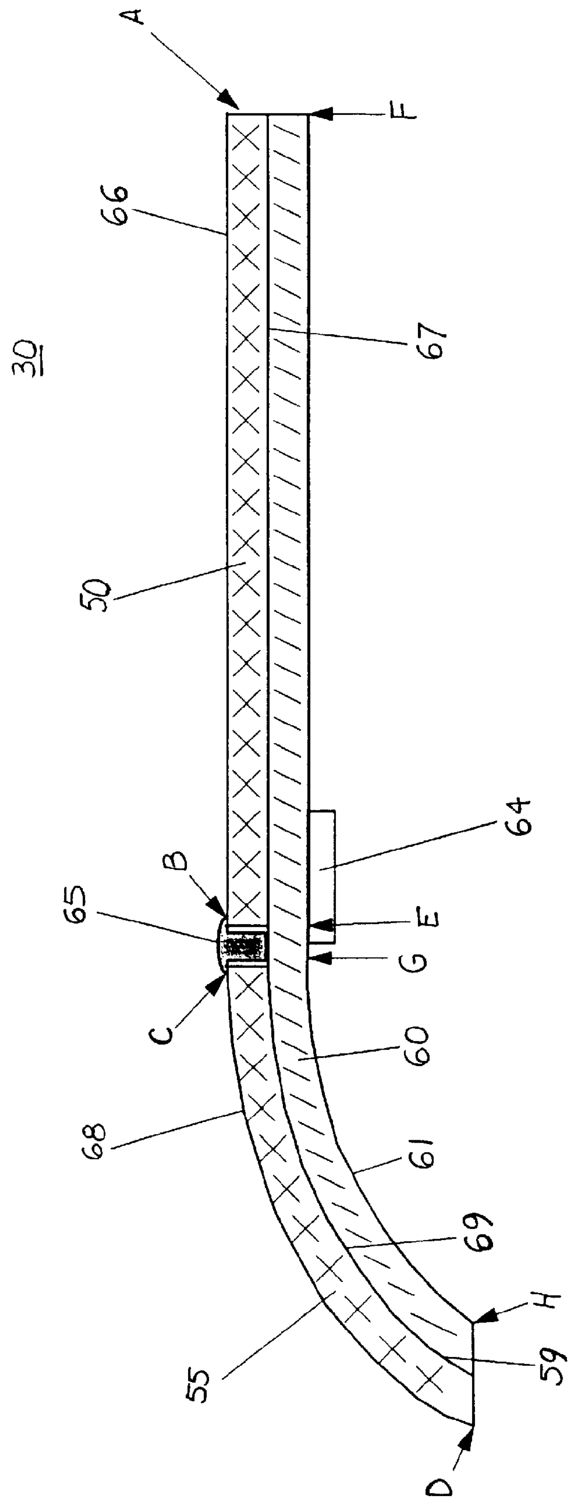

Figure 3

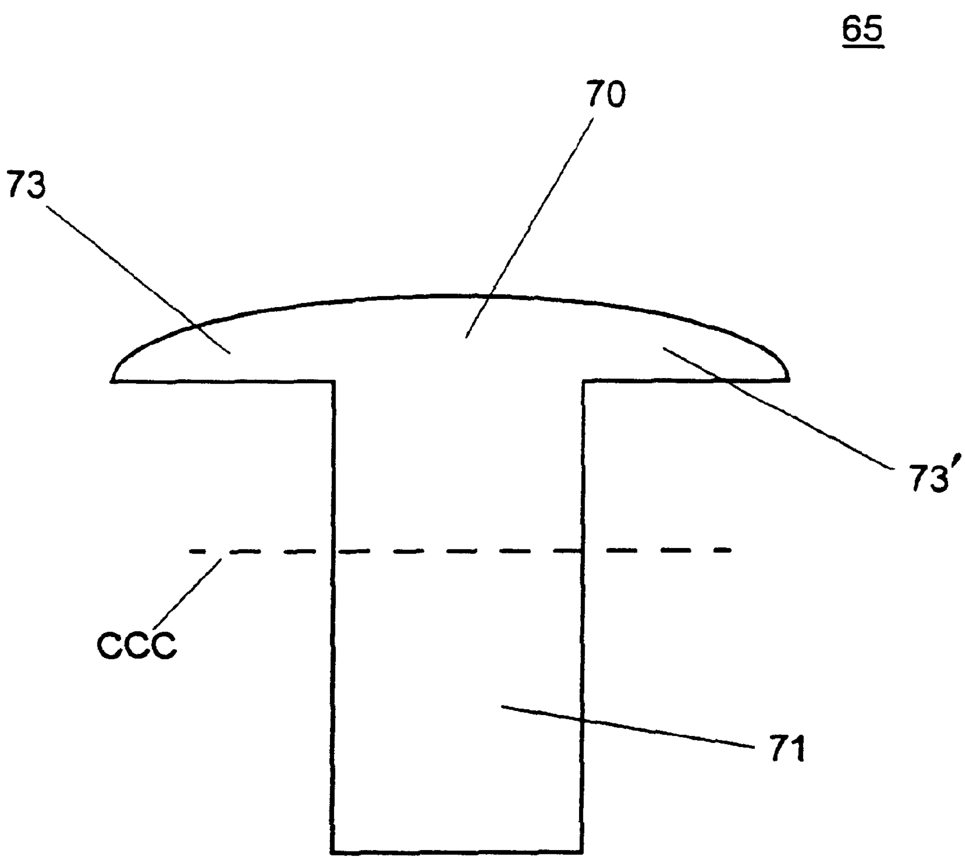

Figure 4

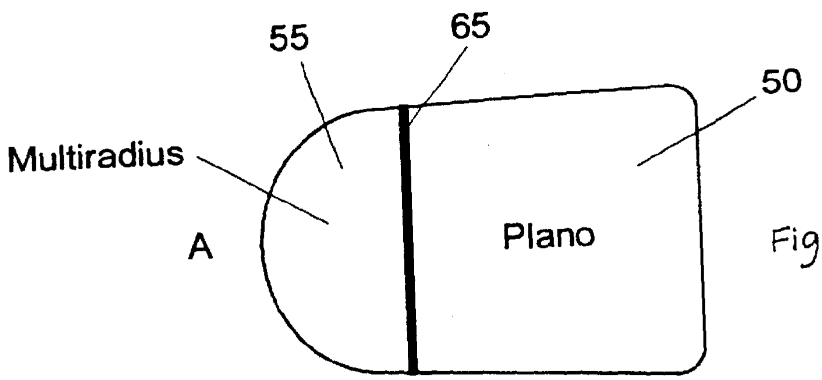

Figure 5A

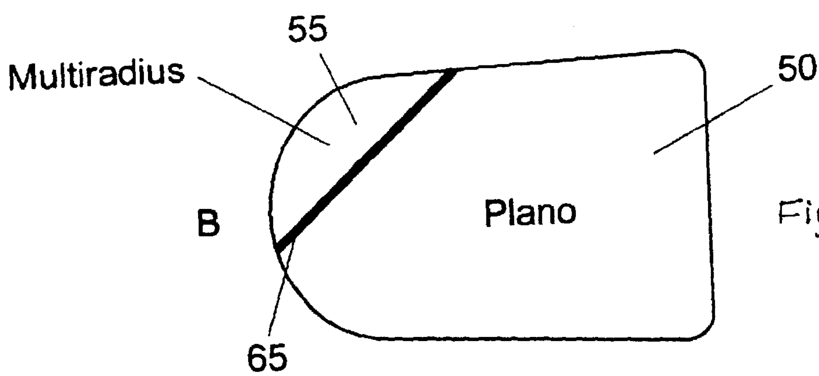

Figure 5B

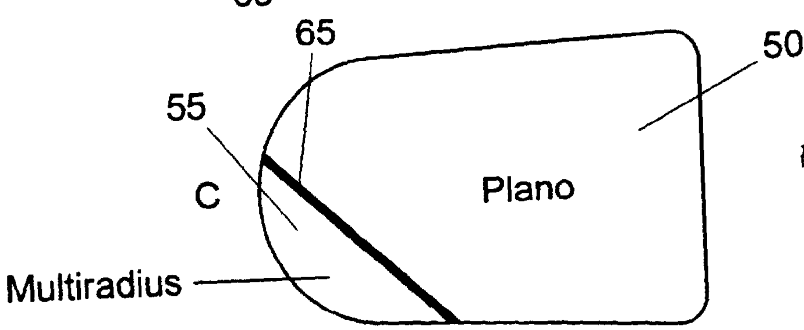

Figure 5C

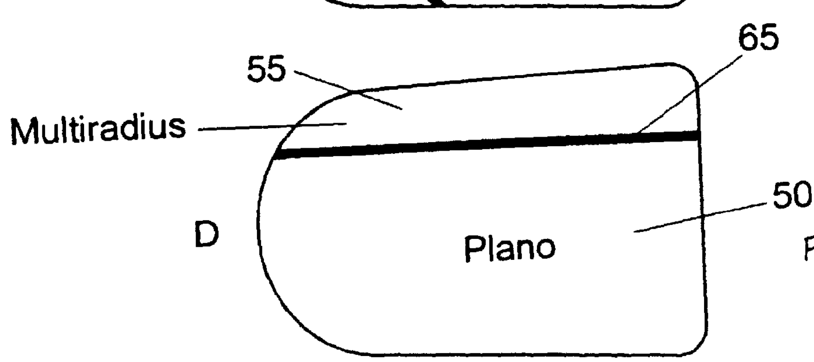

Figure 5D

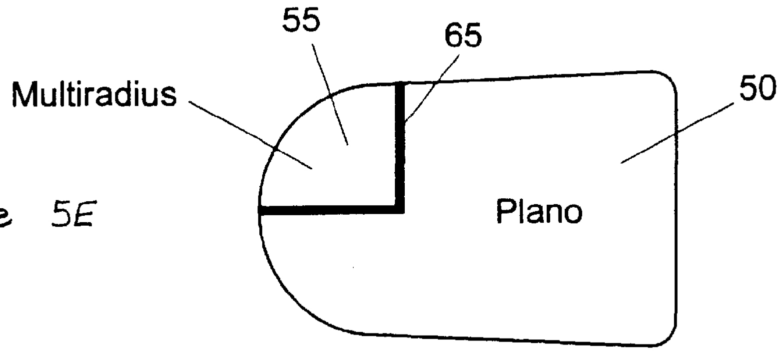

Figure 5E

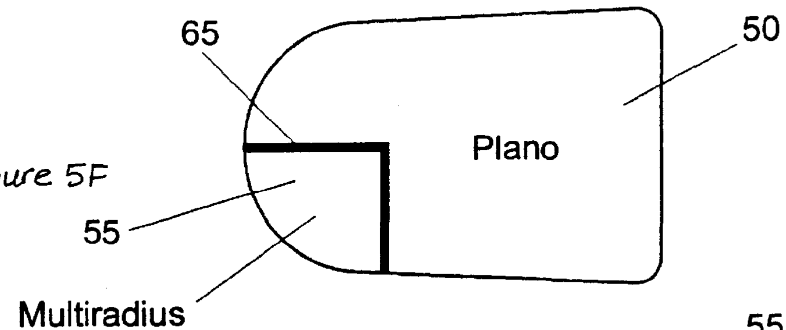

Figure 5F

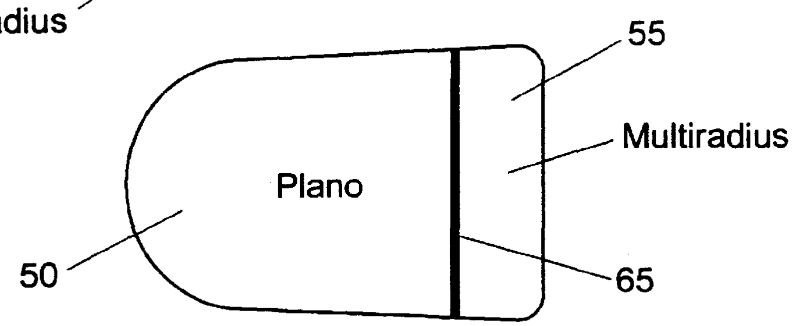

Figure 5G

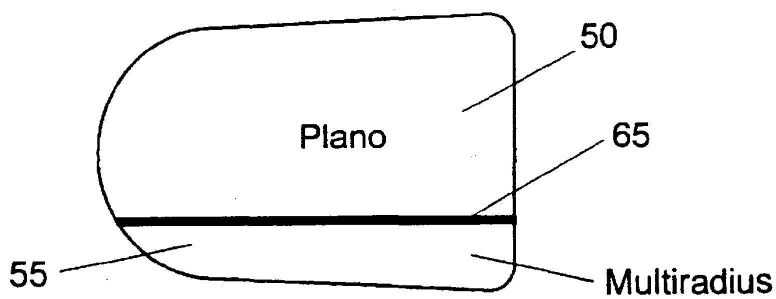

Figure 5H

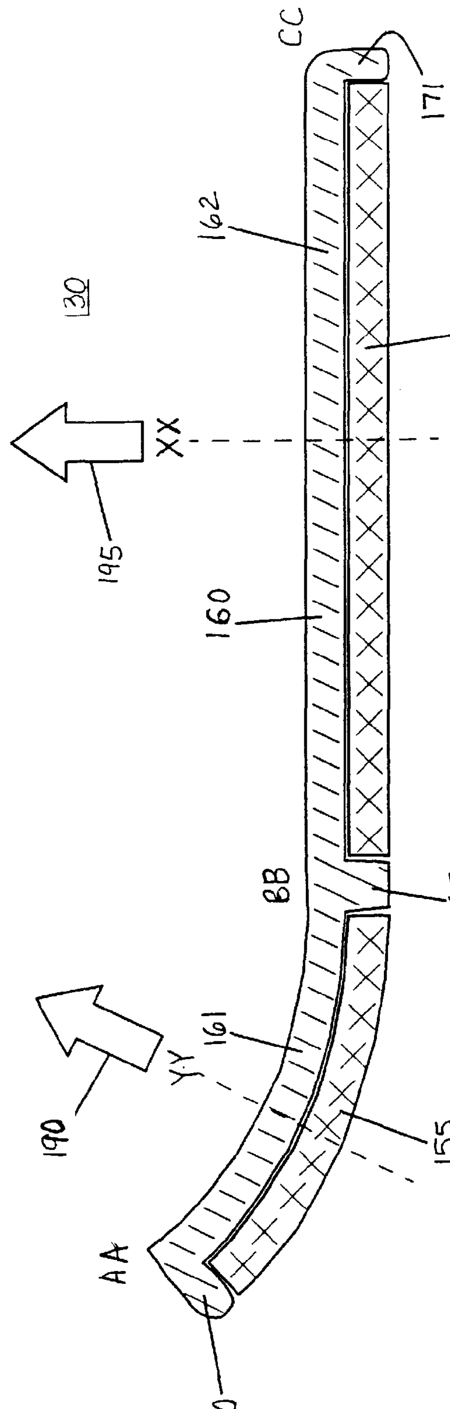

Figure 6

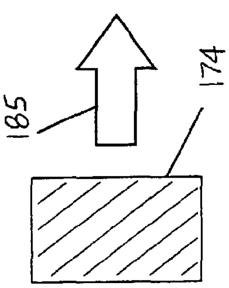

Figure 6A

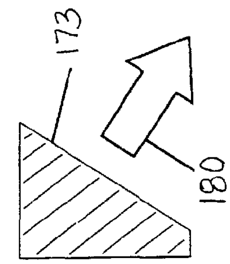

Figure 6B

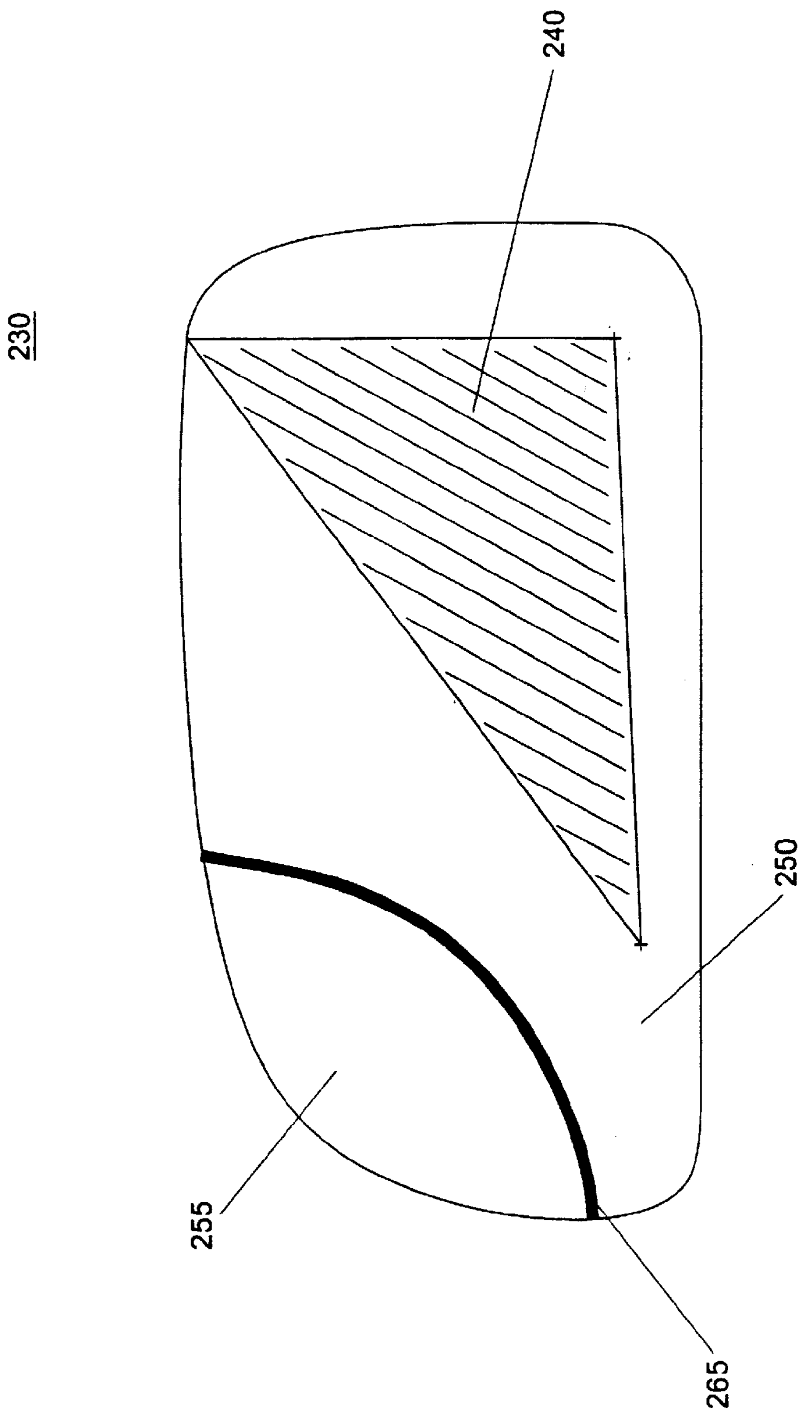

Figure 7

EXTERIOR MIRROR PLANO-AUXILIARY REFLECTIVE ELEMENT ASSEMBLY

TECHNICAL FIELD AND BACKGROUND OF THE INVENTION

The present invention relates to exterior sideview mirror assemblies suitable for use on an automobile, and more specifically, to plano-auxiliary reflective element assemblies for use in automobile exterior sideview mirror assemblies.

Automobiles are typically equipped with an interior rearview mirror assembly (adapted for providing a rearward field of view immediately rearward of the vehicle, typically principally in the road lane the vehicle is traveling in) and at least one exterior sideview mirror assembly attached to the side of the vehicle (typically adjacent a front side window portion). The exterior side view mirror assembly typically comprises a reflective element adapted to provide a rearward field of view of the side lane adjacent the vehicle so as to allow the driver see whether a side approaching vehicle is present when the driver is contemplating a lane change. Conventionally, automobiles are equipped with a driver-side exterior mirror assembly and, very often, with a passenger-side exterior sideview mirror assembly mounted to the side of the automobile body opposite to that of the driver-side assembly. While the combination of an interior rearview mirror with a driver-side exterior mirror (and especially in a three-mirror system comprising an interior rearview mirror with a driver-side exterior mirror and a passenger-side exterior mirror) works well in many driving situations, rear vision blind spots present a potential safety hazard while driving. A rear vision blind spot is an area adjacent the side of an automobile where a view of another vehicle (overtaking on that side) is not captured in the rearward field of view of the exterior mirror reflector on that side. This presents a potential safety hazard as the driver, upon checking the view in the exterior sideview mirror and seeing no overtaking vehicle therein, may deem it safe to initiate a lane change, unaware that there is a vehicle immediately adjacent in a blind-spot of the exterior mirror reflector.

Various attempts have been made conventionally to minimize and/or eliminate exterior mirror blind-spots on vehicles. One approach is to make the exterior mirror reflector larger, and particularly wider with respect to the vehicle body. By increasing the width of the exterior mirror reflector, it has a wider field of view rearwards, and hence the reflector blind-spot is reduced. While use of a wide exterior mirror reflector is an option for trucks, buses and commercial vehicles, increasing the width of the reflector used in an exterior sideview mirror assembly mounted on automobiles (such as sedans, station wagons, sports cars, convertibles, minivans, sports utility vehicles, pick-up trucks and similar passenger carrying automobiles) is often not an option. In such domestic automobiles, increasing the width of the exterior mirror reflector increases the size of the exterior sideview mirror assembly with a concomitant increase in aerodynamic drag, increase in fuel consumption, increased difficulty in parking in tight parking spaces, and increased reflector vibration. Use of a non-flat, curved exterior mirror reflector is commonly used to increase rearward field of view without increasing reflector size.

While working well to increase field of view, use of a curved reflector (such as a convex, spherically-curved reflector) has disadvantages. The field of view rearward increases as the degree of curvature of the bent substrate increases (i.e., the field of view rearward increases as the radius of curvature of the bent substrate decreases). However, such wide-angle mirrors have non-unit magnification and distance perception rearward is distorted. For this reason, convex (spherically-bent) exterior mirror reflectors are required in some countries (such as the United States) to carry a safety warning "OBJECTS IN MIRROR ARE CLOSER THAN THEY APPEAR". Distance perception is particularly important for a driver-side exterior mirror. Indeed, Federal Vehicle Safety Standard No: 111 in the United States (the entire disclosure of which is hereby incorporated by reference herein) requires that the driver-side exterior mirror reflector exhibit unit magnification, and places restrictions on the radius of curvature allowed for any bent passenger-side mirror as well as requiring a safety warning be placed thereon. As an improvement over spherically bent/convex mirror reflectors, aspherical or multiradius mirror reflectors (such as are disclosed in U.S. Pat. Nos. 4,449,786 and 5,724,187, the entire disclosures of which are hereby incorporated by reference herein) have been developed. Such mirrors are widely used in Europe and Asia for both driver-side exterior mirror reflectors and for passenger-side exterior mirror reflectors. The aspherical or multiradius mirror reflectors typically have a less curved (larger radius of curvature) reflective region that is inboard or closest to the driver when mounted on a vehicle and, usually separated by a demarcation line or the like, have a more curved (smaller radius of curvature) region that is outboard or farthest from the driver when mounted on a vehicle. However, such aspherical or multiradius reflectors do not have unit magnification and so cannot be used when unit magnification is mandated (such as by FMVSS 111, referenced above).

To supplement a flat driver-side exterior mirror reflector, an auxiliary and separate bent reflector is sometimes incorporated into the driver-side exterior sideview mirror assembly. However, this is often not suitable for passenger automobiles because of the extra space required in the sideview mirror assembly to accommodate an auxiliary reflector element. Also, in most passenger automobiles, the position of the side view mirror reflector is adjustable by the driver (such as by a hand-adjust, or by a manually adjustable cable such as a Bowden cable or by an electrically operable actuator, as known in the art) in order to provide to that driver his or her desired rearward field of view, which ill-suits use of a separate, auxiliary reflector. Likewise, addition of stick-on blind-spot mirror reflectors (such as are commonly sold in automotive parts stores and the like) onto an automobile exterior sideview mirror reflector has disadvantages, including obscuring field of view of the automobile mirror reflector and adding to mirror element vibration.

There is thus a need to provide an automobile exterior sideview reflective element, and particularly a driver-side automobile exterior sideview reflective element, that overcomes the disadvantages above and that provides the driver of the automobile with a distortion-free field of view with unit magnification that is supplemented with a wide-angle view of a side lane blind spot, and there is a need that this be provided in a unitary reflective element assembly module suitable to mount onto, and be adjusted by, the mirror reflector adjustment mechanism (such as an electrically operated, motorized actuator) provided in the exterior sideview mirror assembly.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of an automobile equipped with exterior sideview mirror assemblies according to this present invention;

FIG. **2** is a top plan partial fragmentary view of the driver's side exterior rearview mirror assembly of FIG. **1**;

FIG. **3** is an enlarged sectional view of a plano-multiradius reflective element assembly of the mirror assembly in FIG. **2**;

FIG. **4** is an enlarged sectional view of a demarcation element of the plano-multiradius reflective element assembly of FIG. **3**;

FIGS. **5A–5H** illustrate views of various locations for a plano reflective element and an auxiliary reflective element according to this present invention;

FIG. **6** is a sectional view of a second embodiment of a plano reflective element assembly according to the present invention including a demarcation element formed as a dividing wall in a backing plate element;

FIG. **6A** is a cross-section taken along line XX of FIG. **6**;

FIG. **6B** is a cross-sectional view taken along line YY of FIG. **6**; and

FIG. **7** is a schematic of a third embodiment of a plano-auxiliary reflective element assembly according to this present invention.

SUMMARY OF THE INVENTION

This invention provides a plano reflective element with unit magnification and an auxiliary reflector element for use in an exterior sideview mirror assembly on an automobile. More specifically, this invention provides a plano-multiradius reflective element assembly suitable for use in an exterior sideview mirror assembly mounted to the side body of an automobile. The plano-multiradius reflective element assembly of this invention is especially suitable for mounting in a driver-side exterior sideview mirror assembly that is mounted to the side of the automobile body adjacent to the seating position of the driver in the front of the interior vehicular cabin. The plano-multiradius reflective element assembly of this invention comprises a plano portion which has a rearward field of view, when mounted in an exterior sideview mirror assembly mounted to the side body of an automobile, with unit magnification. This plano portion comprises a flat substrate, typically a flat glass substrate, provided with a reflective surface. The plano-multiradius reflective element assembly of this invention also includes a multiradius portion with a rearward field of view, when mounted in an exterior sideview mirror assembly mounted to the side body of an automobile, that has non-unit magnification. The plano portion provides a distortion-free rearward field of view and serves as the principal rearward-viewing portion of the plano-multiradius reflective element. The multiradius portion provides a wide angle rearward field of view, and typically supplements the rearward field of view of the plano portion. This multiradius portion comprises a curved substrate, typically a bent glass substrate, provided with a reflective surface. The plano portion and the multiradius portion are demarcated apart by a demarcation element. The demarcation element enables the driver of a vehicle equipped with the plano-multiradius reflective element of this invention to readily delineate a rearward view in the plano portion from a rearward view in the multiradius portion. The plano portion comprises a flat reflective element and the multiradius portion comprises a bent reflective element. The flat, plano reflective element and the curved, multiradius reflective element are individually and separately manufactured, and are adjacently attached to a single backing plate (which typically comprises a polymeric substrate, most typically a molded polymeric substrate), and with the demarcation element disposed at the joint of the plano, flat reflective element and the multiradius, bent reflective element. The backing plate is fabricated (typically by polymeric molding) to have a flat portion that corresponds to the plano, flat reflective element, and a curved surface that corresponds to the multiradius, curved reflective element. The attachment of the plano reflective element and an auxiliary reflective element to a single backing plate produces a unitary plano-auxiliary reflective element assembly module suitable for mounting in an exterior sideview mirror assembly. By adjusting the position of the backing plate within the exterior sideview mirror assembly, the rearward fields of view of both the plano reflective element and the auxiliary reflective element are simultaneously and similarly aligned.

One embodiment of the invention includes an exterior sideview mirror system suitable for use in an automobile comprising an exterior sideview mirror assembly adapted for attachment to a side of the automobile. The exterior sideview mirror assembly includes a reflective element having a rearward field of view when attached to said side of the automobile. The reflective element is attached to an actuator and is movable by the actuator in order to position the reflective element's rearward field of view in response to a control. The reflective element comprises a plano-multiradius reflective element assembly which comprises a plano reflective element having unit magnification and a separate multiradius reflective element having a multiradius curvature. The plano element and the separate multiradius element of the plano-multiradius reflective element assembly are attached to a backing plate element. The backing plate element is mounted to the actuator such that movement of the backing plate element (and hence the plano-multiradius reflective element assembly) by the actuator simultaneously and similarly moves the plano element and the multiradius element. The plano element and the multiradius element are separately and, preferably, adjacently attached to the backing plate element at a joint.

In a further embodiment, a demarcation element is disposed at this joint to form a demarcation between the plano element and the multiradius element; this demarcation element having a portion visible to a driver of the automobile. Preferably, the demarcation element is dark colored, such as with a color selected from the group consisting of black, grey, blue and brown. Optionally, there is a space at the joint of the plano element and the multiradius element and the demarcation element is at least partially disposed in said space between said plano element and said multiradius element. The demarcation element can comprise at least one of a polymer material, a tape, a plastic film, a paint, a lacquer and a caulk.

In a further embodiment, the demarcation element comprises a wall on the backing plate element; this wall being located on the backing plate element at the joint of the plano element and the multiradius element, this wall separating the respective elements apart.

In preferred embodiments, the portion of the demarcation element visible to a driver of an automobile equipped with the plano-multiradius reflective element assembly of this invention has a width from about 0.5 mm to about 4 mm.

In preferred embodiments, the plano element is attached to the backing plate element by at least one of an adhesive attachment and a mechanical attachment.

In preferred embodiments, the multiradius element is attached to the backing plate element at a location such that, when the exterior mirror assembly is attached to a side of an automobile, at least portion, and preferably at least a substantial portion, of the plano element is disposed closer to the side of the vehicle than any portion of the multiradius element element.

In preferred embodiments, the multiradius element comprises a bent glass substrate with radii of curvature in the range of from about 4000 mm to about 50 mm, and the ratio of the width of the plano element to the width of the multiradius element is greater than 1.

In preferred embodiments, the principal axis of the rearward field of view of the auxiliary, multiradius element is different from and angled to the principal axis of the rearward field of view of the plano element when both are attached to the backing plate element of the plano-multiradius reflective element assembly and when the plano-multiradius reflective element assembly is mounted in an exterior sideview mirror assembly on an automobile. The principal axis of the rearward field of view of the plano element is directed generally parallel to the longitudinal axis of an automobile equipped with the plano-multiradius reflective element assembly and the principal axis of the rearward field of view of the multiradius element is directed generally at an angle downwards to the longitudinal axis of the vehicle.

In a preferred embodiment, the exterior sideview mirror assembly equipped with the plano-multiradius reflective element assembly comprises a fixedly attached exterior sideview mirror assembly. In another preferred embodiment, the exterior sideview mirror assembly equipped with the plano-multiradius reflective element assembly comprises a break-away exterior sideview mirror assembly. In another preferred embodiment, the exterior sideview mirror assembly equipped with the plano-multiradius reflective element assembly comprises a powerfold exterior sideview mirror assembly. In another preferred embodiment, the actuator of the exterior sideview mirror assembly to which the plano-multiradius reflective element assembly is mounted comprises an electrically operable actuator. In another preferred embodiment, the actuator of the exterior sideview mirror assembly to which the plano-multiradius reflective element assembly is mounted is controlled by a switch or by a memory controller. In another preferred embodiment, the plano element and/or the multiradius element of the plano-multiradius reflective element assembly comprises an electro-optic reflective element, preferably an electrochromic reflective element. In another preferred embodiment, the plano element of the plano-multiradius reflective element assembly comprises an electro-optic reflective element, preferably an electrochromic reflective element, and the multiradius element comprises a fixed reflectance mirror reflector, such as a fixed reflectance mirror reflector comprises a bent glass substrate coated with a metallic reflector coating.

In a preferred embodiment, the plano-auxiliary reflective element assembly is assembly is formed in an integral molding operation.

These and other advantages, features, and modifications will become more apparent when reviewed in conjunction with the drawings and the detailed description which follows.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

As illustrated in FIG. **1**, passenger automobile **10** (which may be a sedan, a station-wagon, a sports car, a convertible, a minivan, a sports utility vehicle, a pick-up truck or a similar passenger carrying non-commercial, personal transportation automobile) includes an interior rearview mirror assembly **18** positioned within interior vehicle cabin **25**. Interior vehicle cabin **25** further includes a steering wheel **16**, a driver seat **20** positioned at steering wheel **16**, a front passenger seat **21** adjacent to driver seat **20** in the front portion of cabin **25**, and a rear passenger seat **23** in the rear portion of cabin **25**. Automobile **10** further includes a driver-side exterior sideview mirror assembly **12** and a passenger-side exterior sideview mirror assembly **14**, each adapted for attachment to opposing sides of automobile body **11**, most preferably adjacent to the seating position of the driver seated in driver seat **20** for driver-side assembly **12** and adjacent to the front passenger seat **21** for passenger-side assembly **14**. Exterior sideview mirrors, mounted as shown in FIG. **1** close to the driver seating location, are commonly referred to as door-mounted exterior sideview mirror assemblies. Driver-side exterior sideview mirror assembly **12** includes, as illustrated in FIG. **2**, a plano-multiradius exterior sideview reflective element assembly **30**. Plano-multiradius reflective element assembly **30** is mounted to a reflective element positioning actuator **36**. The orientation of plano-multiradius reflective element assembly **30**, and hence its rearward field of view, is adjustable by actuator **36** in response to control **37**. Control **37** can comprise a handset control that allows the driver manually move the orientation of plano-multiradius reflective element assembly **30** within exterior mirror housing **40** (such as by a lever control or by a cable control) and hence reposition the rearward field of view of plano-multiradius reflective element assembly **30**. Alternately, when actuator **36** comprises an electrically actuated actuator that is electrically operable incorporating at least one motor, control **37** can comprise a switch (which, preferably, is operable under control of the driver seated in cabin **25**) or control **37** can comprise a memory controller, as known in the automotive mirror art, that controls actuator **36** to move the position of plano-multiradius reflective element assembly **30** to a preset orientation that suits the rearward field of view preference of an individual driver. Actuator **36** is mounted to bracket **38** which attaches to vehicle body side **11**. Plano-multiradius reflective element assembly **30** is positionable by actuator **36** within exterior mirror housing **40**.

Plano-multiradius reflective element assembly **30**, as shown in FIG. **3**, comprises a plano element **50** and a separate multiradius element **55**. Preferably, plano element **50** is adjacent to multiradius element at a joint. At their joint, plano element **50** and separate multiradius element **55** can touch leaving substantially no gap or space therebetween, or plano element **50** and separate multiradius element **55** can be spaced apart at their joint by a space or gap, as in FIG. **3**. Plano element **50** and multiradius element **55** are both mounted to surface **59** of, and are both supported by, a single backing plate element **60**. Plano element **50** and multiradius element **55** are demarcated apart by demarcation element **65**. Surface **61** of backing plate element **60** is preferably adapted to attach, such as by attachment member **64**, to actuator **36** when plano-multiradius reflective element assembly **30** is mounted in driver-side exterior sideview mirror assembly **12** (and/or in passenger-side exterior side view mirror assembly **14**) such that plano element **50** and multiradius element **55** are adjusted and positioned in tandem and simultaneously when the driver (or alternatively, when a mirror memory system, as is conventional in the rearview mirror arts) activates actuator **36** to reposition the rearward field of view of plano-multiradius reflective element assembly **30**. Thus, since elements **50**, **55** are part of plano-multiradius reflective element assembly **30**, movement of plano-multiradius reflective element assembly **30** by actuator **36** simultaneously and similarly moves plano element **50** and multiradius element **55**.

Plano element **50** preferably comprises a flat reflector-coated glass substrate having unit magnification, and comprises a reflective surface through which the angular height and width of the image of an object is equal to the angular height and width of the object when viewed at the same distance (except for flaws that do not exceed normal manufacturing tolerances). Plano element **50** may comprise a conventional fixed reflectance mirror reflector or it may comprise a variable reflectance mirror reflector whose reflectivity is electrically adjustable. For example, plano element **50** may comprise a flat glass substrate coated with a metallic reflector coating such as a chromium coating, a titanium coating, a rhodium coating, a metal alloy coating, a nickel-alloy coating, a silver coating, an aluminum coating (or any alloy or combination of these metal reflectors). The metal reflector coating of plano element **50** may be a first surface coating (such as on surface **66**) or a second surface coating (such as on surface **67**), as such terms are known in the mirror art. The reflector coating on plano element **50** may also comprise a dielectric coating, or a multilayer of dielectric coatings, or a combination of a metal layer and a dielectric layer to form automotive mirror reflectors as known in the automotive mirror art. If a variable reflectance reflector element, plano element **50** preferably comprises an electro-optic reflector element and, most preferably, an electrochromic reflector element.

When mounted into exterior side view mirror assembly **12** and/or **14**, plano-multiradius reflective element assembly **30** is preferably orientated so that at least a portion of (more preferably a substantial portion of) the reflector surface of plano element **50** is positioned closer to the vehicle body (and hence to the driver) than any portion of the reflector surface of multiradius element **55**. Thus, and referring to FIG. **3**, side A of plano element **50** of plano-multiradius reflective element assembly **30** is positioned closer to the driver than side D of multiradius element **55** when plano-multiradius reflective element assembly **30** is mounted on an automobile. Also, when mounted into exterior side view mirror assembly **12** and/or **14**, surfaces **66**, **68** of plano-multiradius reflective element assembly **30** face rearwardly in terms of the direction of vehicle travel.

Multiradius element **55** of plano-multiradius reflective element assembly **30** preferably comprises a curved/bent mirrored glass substrate. The degree of curvature preferably increases (and hence the local radius of curvature decreases) across the surface of multiradius element **55** with the least curvature (largest radius of curvature) occurring at the side of multiradius element **55** (side C in FIG. **3**) positioned adjacent its joint to plano element **50** when both are mounted on backing plate element **60**. Thus, and referring to FIG. **3**, the local radius of curvature at side C of multiradius element **55**, when mounted on backing plate element **60**, is larger than at side D. Also, the local radius of curvature preferably progressively decreases across multiradius element **55** from side C to side D. Preferably, the local radius of curvature at side C of multiradius element **55** is at least about 1000 mm; more preferably is at least about 2000 mm and most preferably is at least about 3000 mm whereas the local radius of curvature at side D of multiradius element **55** is, preferably, less than about 750 mm, more preferably less than about 350 mm; most preferably less than about 150 mm. Preferably, multiradius element **55** comprises a bent glass substrate with radii of curvature in the range of from about 4000 mm to about 50 mm. The multiradius prescription for the multiradius element to be used in a particular exterior mirror assembly can vary according to the specific field of view needs on a specific automobile model.

The total field of view rearwardly of the automobile of the plano-auxiliary reflective element assembly (which is a combination of the field of view of the plano reflective element and of the auxiliary reflective element) preferably generally subtends an angle of at least about 20 degrees (and more preferably, generally subtends an angle of at least about 25 degrees and most preferably, generally subtends an angle of at least about 30 degrees) with respect to the side of an automobile to which is attached an exterior sideview mirror assembly equipped with the plano-auxiliary reflective element assembly.

Multiradius element **55** may comprise a conventional fixed reflectance mirror reflector or it may comprise a variable reflectance mirror reflector whose reflectivity is electrically adjustable. For example, multiradius element **55** may comprise a flat glass substrate coated with a metallic reflector coating such as a chromium coating, a titanium coating, a rhodium coating, a metal alloy coating, a nickel-alloy coating, a silver coating, an aluminum coating (or any alloy or combination of these metal reflectors). The metal reflector coating of multiradius element **55** may be a first surface coating (such as on surface **68**) or a second surface coating (such as on surface **69**), as such terms are known in the mirror art. The reflector coating on multiradius element **55** may also comprise a dielectric coating, or a multilayer of dielectric coatings, or a combination of a metal layer and a dielectric layer to form automotive mirror reflectors as known in the automotive mirror art. If a variable reflectance reflector element, multiradius element **55** preferably comprises an electro-optic reflector element and, most preferably, an electrochromic reflector element.

Also, it is preferable that the thickness of plano element **50** and multiradius element **55** be substantially the same in dimension so that their respective outer surfaces, **66** and **68**, are substantially coplanar so that a driver can readily view images in either or both elements. The thickness dimension of elements **50**,**55** is determined by the thickness of the substrate (or in the case of laminate-type electrochromic reflective elements, the thickness of the two substrates between which the electrochromic medium is disposed). For example, plano element **50** and/or multiradius element **55** can comprise a reflector coated glass substrate or panel of thickness preferably equal to or less than about 2.3 mm, more preferably equal to or less than about 1.6 mm, most preferably equal to or less than about 1.1 mm. Use of a thinner substrate is beneficial in terms of improving the overall stability/vibration performance of the image seen in plano-multiradius reflective element assembly **30** when mounted to an automobile.

The reflector area of plano element **50** is preferably larger than that of multiradius element **55**. Preferably, the width dimension of plano element **50** is larger than the width dimension of multiradius element **55** (both width dimensions measured at their respective widest dimension and with the width of the respective element being gauged with the respective element oriented as it would be orientated when mounted on the automobile). Thus, and referring to FIG. **3**, the distance from side A to side B of plano element **50** is larger than the distance from side C to side D of multiradius element **55**. Thus, the ratio of the width of plano element **50** to the width of multiradius element **55** is preferably greater than 1; more preferably greater than 1.5; most preferably greater than 2.5 in order to provide a large, unit magnification plano element **50** as the principal rear viewing portion of plano-multiradius reflective element assembly **30** and providing multiradius element **55** as a smaller, auxiliary, separate, wide-angle viewing portion of plano-multiradius reflective element assembly **30**. For plano-multiradius reflective element assemblies to be mounted to the exterior sideview assemblies of passenger automobiles used non-commercially and for non-towing purpose, the width of plano element **50** (at its widest dimension) is preferably in the range of from about 50 mm to about 225 mm; more preferably in the range of from about 75 mm to about 175 mm; most preferably in the range of from about 100 mm to about 150 mm.

Backing plate element **60** is preferably a rigid polymeric substrate capable of supporting plano element **50** and multiradius element **55**. Backing plate element **60** comprises a flat portion (generally between E and F as shown in FIG. **3**) that corresponds to and is aligned with plano element **50**. Backing plate element **60** also comprises a curved portion (generally between G and H as shown in FIG. **3**) that corresponds to and is aligned with multiradius element **55**. Preferably, curved portion G–H of multiradius element **55** is fabricated with a multiradius prescription that is substantially the same as the multiradius prescription of multiradius element **55**. Backing plate element **60** is formed as a single element to which elements **50** and **55** are separately attached. Preferably, backing plate element **60** is formed by injection molding of a thermoplastic or a thermosetting polymer resin. Materials suitable to use for backing plate element **60** include unfilled or filled polymeric materials such as glass and/or mineral filled nylon or glass and/or mineral filled polypropylene, ABS, polyurethane and similar polymeric materials. For example, backing plate element **60** can be formed of ABS in an injection molding operation. Plano element **50** can be cut from a stock lite of flat chromium mirror-coated 1.6 mm thick glass. Multiradius element **55** can be cut from a stock lite of multiradiusly-bent chromium mirror-coated 1.6 mm thick glass. Plano element **50** and multiradius element **55** can then be attached (such as by an adhesive attachment such as an adhesive pad or by mechanical attachment such by clips, fasteners or the like) to the already molded backing plate element **60**. Alternatively, plano element **50** and multiradius element **55** can each by individually loaded into an injection molding tool. Once loaded, a polymeric resin (or the monomers to form a polymeric resin) can be injected into the mold in order to integrally form backing plate element **60** with elements **50, 55** integrally molded thereto. Integral molding of the backing plate element to plano element **50** and multiradius element **55** (along with any other elements such as the demarcation element **65**) in a single integral molding operation, is a preferred fabrication process for plano-multiradius reflective element assembly **30**.

Plano-multiradius reflective element assembly **30** further preferably includes demarcation element **65** that functions to delineate and demarcate the plano region of the assembly from the wide-angle, multiradius region and also preferably functions to prevent ingress of debris, dirt, water and similar contaminants (such as road splash, car wash spray, rain, snow, ice, leaves, bugs and similar items that plano-multiradius reflective element assembly **30** would be subject to when mounted and used on an automobile) into any gap between plano element **50** and multiradius element **55** when both are attached to backing plate element **60**. Optionally, at least a portion of demarcation element **65** can be disposed in any gap between plano element **50** and multiradius element **55** at their joint on backing plate element **60**. Preferably, demarcation element **65** is formed of a polymeric material that is dark colored (such as black or dark blue or dark brown or dark grey or a similar dark color) such as a dark colored polypropylene resin or a dark colored nylon resin or a dark colored polyurethane resin or a dark colored polyvinyl chloride resin or a dark colored silicone material. Most preferably demarcation element **65** is formed of an at least partially elastomeric material (such as silicone, or EPDM, or plasticized PVC or the like) in order to provide a degree of vibration dampening for elements **50, 55**. As shown in FIG. **4**, demarcation element **65** optionally includes a crown portion **70** that includes wing portions **73, 73'** and a stem portion **71**. Stem portion **71** preferably has a cross-sectional width CCC of less than about 4 mm, more preferably less than about 3 mm and, most preferably less than about 2 mm. Crown portion **70** preferably is dimensioned to not protrude substantially beyond surfaces **66, 68** of elements **50, 55** when demarcation element **65** is installed between elements **50** and **55**. Also, wings **73, 73'** are preferably dimensioned to protrude (most preferably slightly) onto surfaces **66, 68** of elements **50, 55** when demarcation element **65** is installed between elements **50** and **55** in order to provide a weather barrier seal and/or to at least partially accommodate any dimensional tolerances of elements **50, 55** that could lead to variation in the inter-element gap between sides C and B. While the demarcation element shown in FIG. **4** is one embodiment, other constructions are possible including a demarcation element that has minimal or no crown portion. Likewise, a demarcation element can have little or no stem portion, especially when the joint between plano element **50** and multiradius element **55** includes no gap to receive a stem. Also, where a gap at the plano to multiradius joint exists, any stem of the demarcation element can at least partially be disposed in such gap so as to at least partially fill the gap (or it can optionally substantially fill the gap). Optionally, demarcation element **65** is fabricated by injection molding of a polymeric resin. After plano element **50** and multiradius element **55** have been attached to backing plate element **60**, a separately formed demarcation element **65** can then be inserted (and secured such as by an adhesive or by a mechanical attachment such as by a fastener) into a space between elements **50** and **55**. Note that, optionally, side B of plano element **50** and side C of multiradius element **55** can touch (leaving substantially no gap or space therebetween). In such a situation, demarcation element **65** can comprise a dark colored strip such as of a tape or of a plastic film that covers the joint between elements **50** and **55**. Alternatively, demarcation element **65** can comprise a preferably dark-colored paint, lacquer, caulk or similar material that can be applied to, and that can preferably fill into, the joint between elements **50** and **55**. The width of the portion of demarcation element **65** that is visible to the driver is preferably less than about 4 mm, more preferably less than about 3 mm and most preferably less than about 2 mm, but is equal to or greater than about 0.5 mm, more preferably is equal to or greater than about 0.75 mm, most preferably is equal to or greater than about 1 mm in order to provide adequate demarcation of the plano region from the multiradius radius region without unduly obscuring the rearward field of view of the respective elements. Optionally, demarcation element **65** can be formed as part of backing plate element **60** such as by forming demarcation element **65** as a wall structure of the backing plate element that partitions backing plate element **60** into two regions: A first region adapted to receive plano reflective element **50** and a separate and adjacent second region adapted to receive multiradius reflective element **55**.

Thus, and referring to FIG. **6**, a second embodiment of plano-multiradius reflective element assembly **130** may include a backing plate element **160** which comprises a plate molded from a polymer resin (such as a polyolefin such as polypropylene or such as ABS or nylon) with a demarcation element **165** that is molded as a wall structure that partitions backing plate element **165** into a first region (from CC to BB) adapted to receive and accommodate plano reflective element **150** and into a second region (from BB to AA) adapted to receive and accommodate wide-angle optic multiradius reflective element **155**. Note that section AA to BB of backing plate element **160** is angled to section BB to CC. Such angling of the auxiliary reflective element relative to the plano element can be advantageous in allowing the auxiliary reflective element view a portion of the road adjacent the automobile that is in a blind spot of the plano reflective element. In this regard, it is preferable that the multiradius element be angled away from the plane of the plano element, as shown in FIG. **6** by the angling of section AA to BB to section BB to CC.

Preferably, demarcation element **65** is formed in an integral molding operation, along with formation of backing plate element **60**, and attachment of elements **50**, **55** thereto. For example, plano element **50** and multiradius element **55** can each by individually loaded into an injection molding tool. Once loaded, a polymeric resin (or the monomers to form a polymeric resin) can be injected into the mold in order to integrally form backing plate element **60** with elements **50**, **55** integrally molded thereto and, in the same molding operation and in the same tool, also form by molding the demarcation element. Integral molding of the backing plate element to plano element **50** and multiradius element **55** along with creation in the single molding operation of demarcation element **65** (along with any other elements such as attachment member **64**) in a single integral molding operation, is a preferred fabrication process for plano-multiradius reflective element assembly **30**. By loading all the sub components of plano-multiradius reflective element assembly **30** into a molding tool, and then injecting polymeric resin to form the backing plate, demarcation member and any attachment member, a substantially complete or fully complete plano-multiradius reflective element assembly can be unloaded from the tool at the completion of the integral molding operation (as known in the molding art), thus enabling economy in manufacturing and accommodation of any dimensional tolerances in the sub components. Where integral molding is so used, it is preferable to use a reactive molding operation such as reactive injection molding of a urethane as such reactive injection molding operations occur at relatively modest temperatures.

Plano element **50** and/or multiradius element **55** can comprise a heater element, as known in the automotive mirror art, that is operable to deice/demist surfaces **66**, **68**. Such heater elements are conventional and can comprise a positive temperature coefficient heater pad, a resistive heater element and/or a conductive coating. Piano element **50** and/or multiradius element **55** can also optionally comprise a scatterproofing member, as known in the automotive mirror art, such as an adhesive tape, to enhance safety in an accident.

Also, plano element **50** and/or multiradius element **55** can comprise a variable reflectance electro-optic element such as an electrochromic mirror reflector. Thus, both element **50** and element **55** can comprise an electrochromic mirror element or either of element **50** and element **55** can comprise an electrochromic mirror element and the other can comprise a fixed reflectance non-variable reflectance mirror element such as a metal reflector coated glass panel such as a chromium coated glass substrate. Also, if both plano element **50** and multiradius element **55** comprise an electro-optic element such as an electrochromic mirror element capable of electrically dimmable reflectivity, both elements **50**, **55** can dim together and in tandem under control of a common dimming control signal (typically provided by an electro-optic automatic dimming interior mirror assembly mounted in the cabin of the automobile and equipped with photosensors to detect incident glare and ambient light). Alternately, if both plano element **50** and multiradius element **55** comprise an electro-optic element such as an electrochromic mirror element capable of electrically dimmable reflectivity, element **50** can dim independently of element **55** (such as is disclosed in U.S. Pat. No. 5,550,677, the entire disclosure of which is hereby incorporated by reference herein). If either or both of elements **50**, **55** comprise an electrochromic element, preferably, the electrochromic reflective element comprises a front substrate and a rear substrate with an electrochromic medium disposed between, such as a solid polymer matrix electrochromic medium such as is disclosed in U.S. patent application Ser. No. 09/350,930, filed Jul. 12, 1999, en titled "ELECTROCHROMIC POLYMERIC SOLID FILMS, MANUFACTURING ELECTROCHROMIC DEVICES USING SUCH FILMS, AND PROCESSES FOR MAKING SUCH SOLID FILMS AND DEVICES" to Desaraju V. Varaprasad et al., now U.S. Pat. No. 6,154,306, or such as is disclosed in U.S. Pat. Nos. 5,668,663; 5,724,187; 5,910,854; and 5,239,405, the entire disclosures of which are hereby incorporated by reference herein. Most preferably, in such laminate-type electrochromic mirror reflective elements, the front substrate comprises a glass plate of thickness less than about 1.6 mm, most preferably about 1.1 mm thickness or lower, and the rear substrate comprises a glass plate of thickness equal to or greater than about 1.6 mm, more preferably greater than about 1.8 mm thickness, most preferably equal to or greater than about 2.0 mm thickness. The rearmost surface of the rear substrate (the fourth surface as known in the mirror art) is reflector coated with a high reflecting metal film such as of aluminum or silver, or an alloy of aluminum or silver. Most preferably, the front-most surface of the rear substrate (the third surface as known in the mirror art) is reflector coated with a high reflecting metal film such as of aluminum or silver, or an alloy of aluminum or silver.

Backing plate element **65** of plano-multiradius reflective element assembly **30** is optionally equipped on its rearmost surface with attachment member **64** to facilitate attachment to the reflector-positioning actuator of the exterior sideview mirror assembly that plano-multiradius reflective element assembly **30** is mounted to. Attachment of plano-multiradius reflective element assembly **30** to the actuator can be by mechanical attachment such as by a tab, clip or fastener, or may be by adhesive attachment such as by a silicone adhesive, a urethane adhesive or a similar adhesive material such as a tape coated on both surfaces with a pressure sensitive adhesive to form a "double-sticky" tape. Exterior sideview mirror assembly **12** and/or **14**, on whose mirror reflector-positioning actuator the plano-multiradius reflective element assembly is mounted, can be a fixedly attached exterior sideview mirror assembly, a break-away exterior sideview mirror assembly and a powerfold exterior sideview mirror assembly, as known in the automotive mirror art.

FIGS. **5A**–**5H** shows various arrangements of multiradius reflective element **55** relative to its adjacent plano reflective element **50** (with demarcation element **65** disposed at their joint). In FIGS. **5A**, **5B**, **5C**, **5E** and **5F**, plano element **50** is mounted wholly inboard of multiradius element **55**. Thus, in

FIGS. **5A**, **5B**, **5C**, **5E** and **5F**, plano element **50** would be disposed closer to the vehicle body (and hence to the driver) than multiradius element **55** when plano-multiradius reflective element assembly **30** was mounted in an exterior sideview mirror attached to a side of an automobile. Therefore, in FIGS. **5A**, **5B**, **5C**, **5E** and **5F**, plano element **50** would be mounted inboard relative to the side of the automobile and multiradius element **55** would be mounted outboard relative to the side of the automobile. In general, the location of the multiradius reflective element in the outboard, upper portion of the plano-multiradius reflective element assembly, as in FIGS. **5B** and **5E**, is preferred as this allows the plano portion provide a desired rearward field of view along the side of the vehicle. The configuration as shown in FIG. **5G** (where the multiradius reflective element is along the inboard side of the assembly) is also desirable as this allows the driver view the side of the vehicle (something many drivers desire in order to have a frame of reference for their rearward field of view) while facilitating having a wide field of view for the plano portion.

Unlike trucks, busses and commercial vehicles the size of an exterior sideview mirror assembly suitable for use on an automobile (and especially when the automobile is not towing a trailer or the like) is restricted. Automobiles generally are non-commercial vehicles intended for personal transportation. Automobiles typically carry 5 passengers or less, although minivans and large sports utility vehicles (which are classified herein as automobiles) can have seat accommodation for up to 10 passengers (although accommodation for 7 passengers or less is more common). The tandem mounting of a plano element of unit magnification and a separate auxiliary element onto a common, single backing plate element, and the mounting of this backing plate element onto an actuator of an exterior sideview mirror assembly so that a driver can simultaneously and similarly move the auxiliary element and the plano element so as to position their respective rearward fields of view, and to achieve this within the relatively restricted space available in a standard automobile-sized exterior sideview mirror assembly is an important element of this present invention. By utilizing a plano element of unit magnification in the plano-multiradius reflective element assembly, and by sizing the reflector area of the plano element larger than the reflector area of the multiradius element and, preferably, by sizing the reflector area of the plano element at a sufficiently large size that the rearward field of view provided by the plano element alone meets and satisfies the minimum field of view requirement mandated by an automaker specification and/or a government regulation, the need to provide a safety warning indicia such as "OBJECTS IN MIRROR ARE CLOSER THAN THEY APPEAR" in the plano element and/or in the multiradius element can be obviated. Preferably, the plano element comprises a reflector surface area of a size sufficient, when mounted as part of a plano-multiradius reflective element assembly in a driver-side exterior sideview mirror assembly on an automobile, to provide the driver of the automobile a view of a level road surface extending to the horizon from a line, perpendicular to a longitudinal plane tangent to the driver's side of the automobile at the widest point, extending 8 feet out from the tangent plane 35 feet behind the driver's eyes (at a nominal location appropriate for any 95th percentile male driver or at the driver's eye reference points established in Federal Motor Vehicle Standard No. 104), with the driver seated in the driver's seat and with the driver's seat in the rearmost position. Also, preferably, the aspect ratio of the plano-multiradius reflective element assembly (defined as the ratio of its largest vertical dimension to its largest horizontal dimension, measured with the plano-multiradius reflective element assembly oriented as it would be oriented when mounted in an exterior sideview mirror assembly on an automobile, and with "horizontal" being generally parallel with the road surface the automobile travels on and "vertical" being generally perpendicular to the road surface the automobile travels on) is preferably less than 1, more preferably less than 0.8, most preferably less than 0.6. Further, it is preferable that the multiradius element be disposed outboard (relative to the side of the vehicle and with the plano-multiradius reflective element assembly oriented as it would be when mounted in an exterior sideview mirror assembly on an automobile) on the plano-multiradius reflective element assembly so that the multiradius element is positioned to provide an auxiliary, wide-angle view of a "blind-spot" region in an adjacent sidelane while the more inboard-disposed plano element with unit magnification provides the principal sideview image to the driver.

Also, it is preferable that the principal axis of the rearward field of view of the multiradius element be different from and angled to the principal axis of the rearward field of view of the plano element when both are attached to the backing plate element of the plano-multiradius reflective element assembly and when the plano-multiradius reflective element assembly is mounted and operated in an exterior sideview mirror assembly on an automobile. Preferably, the principal axis of the rearward field of view of the plano element is directed generally parallel to the road that the automobile equipped with the plano-multiradius reflective element assembly is travelling on (i.e. generally parallel to the longitudinal axis of the automobile) so as to provide the driver with a long-distance view of approaching vehicles in the side lane that the plano element views). However, preferably the principal axis of the rearward field of view of the multiradius element of, for example, a door-mounted driver-side (or passenger-side) exterior sideview mirror assembly in which the plano-multiradius reflective element assembly is mounted is directed generally downwardly towards the road surface adjacent to the driver seating location and/or several feet (such as about 1 foot to about 24 feet; more preferably, about 1 foot to about 12 feet; most preferably about 1 foot to about 8 feet in distance) to its rear (in order to capture a field of view of a rear approaching vehicle that is approaching to overtake, or is about to overtake, or is overtaking the automobile equipped with the plano-multiradius reflective element assembly). Thus, preferably, the principal axis of the rearward field of view of the multiradius element is angled and directed generally downwardly with respect to the longitudinal axis of the automobile and thus is at an angle to the principal axis of the rearward field of view of the plano element. For example, multiradius element **155** when attached to surface **173** of backing plate **160** (see FIG. **6B**) would have its principal axis of rearward view as indicated by **180** as in FIG. **6B**, and as such would be canted towards the road surface when mounted in an exterior sideview mirror assembly attached to the side of an automobile. By contrast, plano element **150** when attached to surface **174** of backing plate **160** (see FIG. **6A**) would have a principal axis as indicated by **185** as in FIG. **6A** and, as such, would be generally parallel to the road surface when mounted in an exterior sideview mirror assembly attached to the side of an automobile. Having the multiradius element canted somewhat downwards towards the road surface assists visual detection by the driver of overtaking vehicles in the traditional "blind-spot" in the adjacent side lane. The angle that the multiradius element is angled on the backing plate element of the plano-multiradius reflective element assembly relative to the plane of the plano reflective element will vary from automobile model to model, but generally is preferred to be in the about 1 degree to about 10 degree range; about 2 degree to about 8 degree range more preferred; and about 3 degree to about 6 degree range most preferred. In order to conveniently achieve an angling of the multiradius portion with respect to the plano portion (and preferably a downward angling), the portion of the backing plate element that the multiradius reflective element is attached to can be angled relative to the adjacent portion of the backing plate element that the plano reflective portion is attached to. Thus, and referring to FIG. **6**, plano-multiradius reflective element assembly **130** includes a molded polymeric backing plate element **160** comprising a generally flat portion **162** (between BB and CC in FIG. **6**) and an adjacent curved portion **161** (between AA and BB). As indicated by **190** and **195**, portion AA to BB of backing plate element **160** is generally angled to portion BB to CC of backing plate **160**. Preferably, the portion of backing plate element **160** to which the auxiliary reflective element attaches is angled towards the front (compared to the angling of plano reflective element) of an automobile equipped with the plano-auxiliary reflective element assembly of the present invention. FIG. **6** is a view of plano-multiradius reflective element assembly **130** as it would appear from above the vehicle as it would be orientated in use (with portion **162** closer to the driver than portion **161**). The wall section, section XX in FIG. **6**, taken through section **162** of backing plate element **160** is of substantially constant dimension (as illustrated in FIG. **6**A) whereas the wall section, section YY in FIG. **6**B, taken through section **161** of backing plate element **160** is of varying dimension and is angled. Plano reflective element **150** and multiradius reflective element **155** (for example, plano element **150** can comprise an electrochromic mirror element and multiradius element **155** can comprise a chrome coated glass reflector) are attached to portions **162** and **161**, respectively. By being supported on the angled face **173** (see FIG. **6**B) of portion **161**, the principal viewing axis of multiradius reflector element **155** is angled downwards towards the road surface, as compared to the more horizontal-viewing principal viewing axis of plano element **150**, when plano-multiradius reflective element **130** is mounted in an exterior sideview mirror assembly on an automobile. Demarcation element **165** is preferably molded in the same molding tool as is used to mold backing plate element **160**, and so demarcation element **165** is formed as an integral part of backing plate element **160**, forming a wall thereof that partitions the surface of backing plate element **160** into a region for receiving the plano reflective element **150** and a region for receiving the auxiliary reflective element **155**. Also, end-caps **170** and **171** are optionally provided. Piano reflective element **150** can attach into the cavity formed between demarcation element **165** and end-cap **171**; multiradius reflective element **155** can attach into the cavity formed between demarcation element **165** and end-cap **170**. Note that the portion of the backing plate element where the wide-angle optic multiradius element attaches can have a thicker wall thickness than that of the portion of the backing plate element where the unit magnification optic element attaches in order to allow for the angling of the multiradius element downwardly relative to the angle of the plano element, as illustrated in FIGS. **6**A–B. As illustrated in FIGS. **6**A–B, the angle downwards to the longitudinal axis of the vehicle of the multiradius element can generally be set by an angling of a surface of the backing plate element in order to ensure that the principal axis of the rearward field of view of the plano element is directed generally parallel to the longitudinal axis of an automobile equipped with the plano-multiradius reflective element assembly and that the principal axis of the rearward field of view of the multiradius element is directed generally at an angle downwards to the longitudinal axis of the automobile.

Note that the provision of the plano-multiradius reflective element assembly of this invention as a unitary module has manufacturing advantages, particularly for exterior sideview mirror assembly manufacturers who can procure a plano-multiradius reflective element assembly module from a mirror reflector supplier and then mount the plano-multiradius reflective element assembly module onto an actuator.

Referring to FIG. **7**, a third embodiment **230** of a plano-multiradius reflective element assembly is illustrated. Plano-multiradius reflective element assembly **230** includes a plano reflective element **250** and a separate multiradius reflective element assembly **255**, both individually attached to a backing plate element, and with demarcation element **265** disposed at their joint. Plano-multiradius reflective element assembly **230** is about 8.5 inches wide and about 4.25 inches tall (aspect ratio of 0.5), at their largest dimension. Shown as the shaded triangle **240** in plano reflective element **250** is the image of a triangular target object set about 35 feet rearward and of width about 8 feet and of height of about 4.1 feet as would be seen were plano-multiradius reflective element assembly **230** mounted in a driver-side exterior sideview mirror assembly in an automobile such as a sports utility vehicle. In general, it is desirable that the plano reflective element be dimensioned and configured so as to have its rearward field of view capture an image (that is visible, by reflection in the plano reflective element, to a driver seated in the driver's seat in an automobile to which is attached an exterior sideview mirror assembly equipped with the plano-auxiliary reflective element assembly according to this present invention) of a triangular shaped target located about 35 feet rearward of the driver seating location, extending about 8 feet out from the plane defined by the side of the automobile and reaching a height of between about 4 feet and about 5 feet from the road surface at that location 35 feet rearward of the automobile. The total field of view rearwardly of the vehicle of plano-multiradius reflective element assembly **230** (which is a combination of the field of view of plano reflective element **250** and of the auxiliary multiradius reflective element **255**) preferably generally subtends an angle of at least about 30 degrees (and more preferably, generally subtends an angle of at least about 35 degrees and most preferably, generally subtends an angle of at least about 40 degrees) with respect to the side of an automobile to which is attached an exterior sideview mirror assembly equipped with plano-multiradius reflective element assembly **230**.

Also, although it is preferable to utilize a multiradius or compound curvature reflective element such as an aspherical element or a compound curvature element for the auxiliary mirror element adjacent the plano reflective element (as this enables least discontinuity in image at the joint between the adjacent elements of the assembly), a spherical reflective element (that has substantially only one radius of curvature and, as such, is a section from a sphere) can optionally be used adjacent the plano reflective element instead of, or in addition to, the multiradius reflective element. Also, a plano auxiliary mirror such as a flat mirrored substrate can be used, less preferably, as a substitute for a multiradius reflective element in those embodiments where the auxiliary reflective element is angled relative to the plane of the principal, plano reflective element so as to view a blind spot region of the principal plano element. Also, the plano-multiradius reflective element assembly can optionally be fixedly attached to an exterior sideview mirror assembly housing that is not movable, or, alternately, the exterior sideview mirror assembly housing to which the plano-multiradius reflective element assembly is fixedly attached can itself be actuated to move, such as by motor action, so that by moving the exterior sideview mirror assembly housing, the field of rearward view of the plano-multiradius reflective element assembly fixedly attached thereto can correspondingly move and be repositioned to suit the field of view need of a particular driver seated in the automobile cabin.

The above description is considered that of the preferred embodiments only. Modification of the invention will occur to those skilled in the art and to those who make or use the invention. Therefore, it is understood that the embodiments shown in the drawings and described above are merely for illustrative purposes and are not intended to limit the scope of the invention, which is defined in the following claims as interpreted according to the principles of patent law, including the doctrine of equivalents.

I claim:

1. An exterior sideview mirror system suitable for use on an automobile, said exterior sideview mirror system comprising:

an exterior sideview mirror assembly adapted for attachment to a side of an automobile;

said exterior sideview mirror assembly including a reflective element having a rearward field of view when attached to the side of the automobile;

said reflective element attached to an electrically-operated actuator and movable by said actuator in order to position said rearward field of view in response to a control;

wherein said reflective element comprises a plano-multiradius reflective element assembly, said plano-multiradius reflective element assembly comprising a plano reflective element having unit magnification and a separate multiradius reflective element having a multiradius curvature, said plano reflective element having a rearward field of view with a principal axis;

said plano reflective element and said multiradius reflective element of said plano-multiradius reflective element assembly mounted adjacently in said plano-multiradius reflective element assembly in a side-by-side relationship and not superimposed with one reflective element on top of the other reflective element, and supported by a backing plate element, said backing plate element mounting to said actuator such that movement of said backing plate element of said plano-multiradius reflective element assembly by said actuator simultaneously and similarly moves said plano reflective element and said multiradius reflective element, said multiradius reflective element having a rearward field of view with a principal axis, said backing plate element have a first support portion supporting said plano-reflective element and a second support portion supporting said multiradius reflective element, said second support portion tilted forward with respect to said first support portion whereby said principal axis of said rearward field of view of said multiradius reflective element is angled downwardly and outwardly with respect to said principal axis of said rearward field of view of said plano reflective element when said multiradius reflective element and said plano reflective element are supported by said backing plate element of said plano-multiradius reflective element assembly and when said plano-multiradius reflective element assembly is mounted in said exterior sideview mirror assembly on the automobile, and said principal axis of said rearward field of view of said plano reflective element being directed generally parallel to the longitudinal axis of the automobile equipped with the plano-multiradius reflective element assembly and wherein said principal axis of said rearward field of view of said multiradius reflective element is directed generally at an angle downwards to the longitudinal axis of the automobile; and

said multiradius reflective element being positioned diagonally at an outboard upper portion of said plano-multiradius reflective element assembly when said exterior sideview mirror assembly is mounted to the side of the automobile.

2. The exterior sideview mirror system of claim **1**, wherein said plano reflective element and said multiradius reflective element are adjacently attached to said backing plate element at a joint, and wherein said plano-multiradius reflective element assembly includes a demarcation element, said demarcation element disposed at said joint to form a demarcation between said plano reflective element and said multiradius reflective element, said demarcation element having a portion visible to a driver of the automobile.

3. The exterior sideview mirror system of claim **2**, wherein said demarcation element is dark colored.

4. The exterior sideview mirror system of claim **3**, wherein said demarcation element is dark colored with a color selected from the group consisting of black, grey, blue and brown.

5. The exterior sideview mirror system of claim **3**, wherein said demarcation element comprises at least one of a polymer material, a tape, a plastic film, a paint, a lacquer and a caulk.

6. The exterior sideview mirror system of claim **5**, wherein said demarcation element comprises a polymer material.

7. The exterior sideview mirror system of claim **2**, wherein said joint comprises a space between said plano reflective element and said multiradius reflective element.

8. The exterior sideview mirror system of claim **7**, wherein said demarcation element is at least partially disposed in said space between said plano reflective element and said multiradius reflective element.

9. The exterior sideview mirror system of claim **2**, wherein said demarcation element comprises a wall on said backing plate element, said wall located on said backing plate element at said joint, said wall separating said plano reflective element from said multiradius reflective element.

10. The exterior sideview mirror system of claim **2**, wherein said portion visible to a driver of the automobile has a width less than about 4 mm.

11. The exterior sideview mirror system of claim **2**, wherein said portion visible to a driver of the automobile has a width less than about 3 mm.

12. The exterior sideview mirror system of claim **2**, wherein said portion visible to a driver of the automobile has a width less than about 2 mm.

13. The exterior sideview mirror system of claim **2**, wherein said portion visible to a driver of the automobile has a width greater than about 0.5 mm.

14. The exterior sideview mirror system of claim **2**, wherein said portion visible to a driver of the automobile has a width greater than about 0.75 mm.

15. The exterior sideview mirror system of claim 2, wherein said portion visible to a driver of the automobile has a width greater than about 1 mm.

16. The exterior sideview mirror system of claim 1, wherein said plano reflective element is supported by said backing plate element by at least one of an adhesive attachment and a mechanical attachment.

17. The exterior sideview mirror system of claim 1, wherein said multiradius reflective element is supported by said backing plate element by at least one of an adhesive attachment and a mechanical attachment.

18. The exterior sideview mirror system of claim 1, wherein said multiradius reflective element is supported by said backing plate element at a location such that, when said exterior mirror assembly is attached to a side of an automobile, at least a portion of said plano reflective element is disposed closer to said side of the automobile than any portion of said multiradius reflective element.

19. The exterior sideview mirror system of claim 1, wherein said multiradius reflective element comprises a bent glass substrate with radii of curvature in the range of from about 4.000 mm to about 50 mm.

20. The exterior sideview mirror system of claim 1, wherein the ratio of the width of said plano reflective element to the width of said multiradius reflective element is greater than 1.

21. The exterior sideview mirror system of claim 1, wherein the ratio of the width of said plano reflective element to the width of said multiradius reflective element is greater than 1.5.

22. The exterior sideview mirror system of claim 1, wherein the ratio of the width of said plano reflective element to the width of said multiradius reflective element is greater than 2.5.

23. The exterior sideview mirror system of claim 1, wherein said angle downwards to the longitudinal axis of the automobile is in the range from about 1 degree to about 10 degrees.

24. The exterior sideview mirror system of claim 1, wherein said angle downwards to the longitudinal axis of the automobile is in the range from about 2 degrees to about 8 degrees.

25. The exterior sideview mirror system of claim 1, wherein said angle downwards to the longitudinal axis of the automobile is in the range from about 3 degrees to about 6 degrees.

26. The exterior sideview mirror system of claim 1, wherein said angle downwards to the longitudinal axis of the automobile is generally set by an angling of a surface of said backing plate element.

27. The exterior sideview mirror system of claim 1, wherein said exterior sideview mirror assembly comprises a door-mounted exterior sideview mirror assembly adapted for attachment to a side of the automobile adjacent a driver seating location of a driver of the automobile and wherein the principal axis of the rearward field of view of said multiradius reflective element is directed generally downwardly towards the road surface adjacent to the driver seating location at a distance in the range of about 1 foot to about 24 feet to the rear of the driver seating location.

28. The exterior sideview mirror system of claim 1, wherein said exterior sideview mirror assembly comprises a door-mounted exterior sideview mirror assembly adapted for attachment to a side of the automobile adjacent a driver seating location of a driver of the automobile and wherein the principal axis of the rearward field of view of said multiradius reflective element is directed generally downwardly towards the road surface adjacent to the driver seating location at a distance in the range of about 1 foot to about 12 feet to the rear of the driver seating location.

29. The exterior sideview mirror system of claim 1, wherein said exterior sideview mirror assembly comprises a door-mounted exterior sideview mirror assembly adapted for attachment to a side of the automobile adjacent a driver seating location of a driver of the automobile and wherein the principal axis of the rearward field of view of said multiradius reflective element is directed generally downwardly towards the road surface adjacent to the driver seating location at a distance in the range of about 1 foot to about 8 feet to the rear of the driver seating location.

30. The exterior sideview mirror system of claim 1, wherein said exterior sideview mirror assembly comprises a fixedly attached exterior sideview mirror assembly.

31. The exterior sideview mirror system of claim 1, wherein said exterior sideview mirror assembly comprises a break-away exterior sideview mirror assembly.

32. The exterior sideview mirror system of claim 1, wherein said exterior sideview mirror assembly comprises a powerfold exterior sideview mirror assembly.

33. The exterior sideview mirror system of claim 1, wherein said control comprises a memory controller.

34. The exterior sideview mirror system of claim 1, wherein at least one of said plano reflective element and said multiradius reflective element comprises an electro-optic reflective element.

35. The exterior sideview mirror system of claim 1, wherein both said plano reflective element and said multiradius reflective element comprise an electro-optic reflective element.

36. The exterior sideview mirror system of claim 1, wherein said plano reflective element comprises an electro-optical reflective element.

37. The exterior sideview mirror system of claim 36, wherein said electro-optical reflective element comprises an electrochromic reflective element.

38. The exterior sideview mirror system of claim 37, wherein said multiradius reflective element comprises a fixed reflectance mirror reflector.

39. The exterior sideview mirror system of claim 38, wherein said fixed reflectance mirror reflector comprises a bent glass substrate coated with a metallic reflector coating.

40. The exterior sideview mirror system of claim 1, wherein said plano-multiradius reflective element assembly is formed in an integral molding operation.

* * * * *

Electronic Patent Application Fee Transmittal

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First Named Inventor/Applicant Name:	Niall R. Lynam
Filer:	Timothy A. Flory/Amanda Sytsma
Attorney Docket Number:	DON09 P-1624

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Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Statutory or terminal disclaimer	1814	1	140	140
		Total in USD ($)		**140**

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First Named Inventor/Applicant Name:	Niall R. Lynam
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	TransmittalForm.pdf	81044 9ee3ef860c3f1a215aad1c1523f007c86810ac89	no	1
Warnings:					
Information:					
2	Amendment/Req. Reconsideration-After Non-Final Reject	ResponseA.pdf	1048279 0fcc22be8bb2516b2e7336f5283de7b437bb3ae3	no	18
Warnings:					
Information:					
3	Terminal Disclaimer Filed	TerminalDisclaimer.pdf	95156 06e37f8353913d1471a531c65e0f68da2d866f7f	no	1
Warnings:					
Information:					
4		DeclarationandExhibits.pdf	4808687 1a6ae3901e35606026479eb46c8f787a3c9d9402	yes	74

Multipart Description/PDF files in .zip description

Document Description	Start	End
Rule 130, 131 or 132 Affidavits	1	4
Rule 130, 131 or 132 Affidavits	5	54
Rule 130, 131 or 132 Affidavits	55	74

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
Warnings:					
Information:					
5	Fee Worksheet (PTO-875)	fee-info.pdf	29910 93c97a9cb7b564303657a33355c47cc40ab4e6b6	no	2
Warnings:					
Information:					

Total Files Size (in bytes): 6063076

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New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Electronic Acknowledgement Receipt

EFS ID:	9258662
Application Number:	12851045
International Application Number:	
Confirmation Number:	1992
Title of Invention:	EXTERIOR SIDEVIEW MIRROR SYSTEM
First Named Inventor/Applicant Name:	Niall R. Lynam
Customer Number:	28101
Filer:	Timothy A. Flory/Amanda Sytsma
Filer Authorized By:	Timothy A. Flory
Attorney Docket Number:	DON09 P-1624
Receipt Date:	19-JAN-2011
Filing Date:	05-AUG-2010
Time Stamp:	13:39:24
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$140
RAM confirmation Number	13317
Deposit Account	220190
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	TransmittalForm.pdf	81044 9ee3ef860c3f1a215aad1c1523f007c86810ac89	no	1
Warnings:					
Information:					
2	Amendment/Req. Reconsideration-After Non-Final Reject	ResponseA.pdf	1048279 0fcc22be8bb2516b2e7336f5283de7b437bb3ae3	no	18
Warnings:					
Information:					
3	Terminal Disclaimer Filed	TerminalDisclaimer.pdf	95156 06e37f8353913d1471a531c65e0f68da2d866f7f	no	1
Warnings:					
Information:					
4		DeclarationandExhibits.pdf	4808687 1a6ae3901e35606026479eb46c8f787a3c9d9402	yes	74

Multipart Description/PDF files in .zip description

Document Description	Start	End
Rule 130, 131 or 132 Affidavits	1	4
Rule 130, 131 or 132 Affidavits	5	54
Rule 130, 131 or 132 Affidavits	55	74

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
Warnings:					
Information:					
5	Fee Worksheet (PTO-875)	fee-info.pdf	29910 93c97a9cb7b564303657a33355c47cc40ab4e6b6	no	2
Warnings:					
Information:					

Total Files Size (in bytes): 6063076

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Doc Code: TRAN.LET

Document Description: Transmittal Letter

PTO/SB/21 (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Application Number	12/851,045
Filing Date	August 5, 2010
First Named Inventor	Niall R. Lynam
Art Unit	2872
Examiner Name	Alessandro V. Amari
Attorney Docket Number	DON09 P-1624
Total Number of Pages in This Submission	

ENCLOSURES *(Check all that apply)*

- ☐ Fee Transmittal Form
  - ☐ Fee Attached
- ☑ Amendment/Reply
  - ☐ After Final
  - ☐ Affidavits/declaration(s)
- ☐ Extension of Time Request
- ☐ Express Abandonment Request
- ☐ Information Disclosure Statement
- ☐ Certified Copy of Priority Document(s)
- ☐ Reply to Missing Parts/ Incomplete Application
  - ☐ Reply to Missing Parts under 37 CFR 1.52 or 1.53
- ☐ Drawing(s)
- ☐ Licensing-related Papers
- ☐ Petition
- ☐ Petition to Convert to a Provisional Application
- ☐ Power of Attorney, Revocation Change of Correspondence Address
- ☑ Terminal Disclaimer
- ☐ Request for Refund
- ☐ CD, Number of CD(s) ______
  - ☐ Landscape Table on CD
- ☐ After Allowance Communication to TC
- ☐ Appeal Communication to Board of Appeals and Interferences
- ☐ Appeal Communication to TC **(Appeal Notice, Brief, Reply Brief)**
- ☐ Proprietary Information
- ☐ Status Letter
- ☑ Other Enclosure(s) (please Identify below):

-EXHIBIT A
-EXHIBIT B
-DECLARATION UNDER RULE 131(a)

Remarks

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm Name	VAN DYKE, GARDNER, LINN & BURKHART, LLP		
Signature	Tak R Ser		
Printed name	Timothy A. Flory		
Date	January 19, 2011	Reg. No.	42540

CERTIFICATE OF TRANSMISSION/MAILING

I hereby certify that this correspondence is being facsimile transmitted to the USPTO or deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the date shown below:

Signature	Amanda R. Sytsma		
Typed or printed name	Amanda R. Sytsma	Date	January 19, 2011

This collection of information is required by 37 CFR 1.5. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and1.14. This collection is estimated to 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: **Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

PTO/SB/06 (07-06)
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 12/851,045	Filing Date 08/05/2010	☐ To be Mailed

APPLICATION AS FILED – PART I

FOR	NUMBER FILED (Column 1)	NUMBER EXTRA (Column 2)	SMALL ENTITY ☐ RATE ($)	SMALL ENTITY FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT 01/19/2011	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE ($)	SMALL ENTITY ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 39	Minus	** 92	= 0	X $ =		OR	X $52=	0
Independent (37 CFR 1.16(h))	* 1	Minus	***7	= 0	X $ =		OR	X $220=	0
☐ Application Size Fee (37 CFR 1.16(s))									
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	0

AMENDMENT	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE ($)	SMALL ENTITY ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =		OR	X $ =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =		OR	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))									
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

Legal Instrument Examiner:
/BRENDA L. TURNER/

UNITED STATES PATENT AND TRADEMARK OFFICE

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/851,045	08/05/2010	Niall R. Lynam	DON09 P-1624	1992

28101 7590 01/13/2011
VAN DYKE, GARDNER, LINN & BURKHART, LLP
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2851 CHARLEVOIX DRIVE, S.E.
GRAND RAPIDS, MI 49546

EXAMINER	
AMARI, ALESSANDRO V	
ART UNIT	**PAPER NUMBER**
2872	
MAIL DATE	**DELIVERY MODE**
01/13/2011	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

PTOL-90A (Rev. 04/07)

Office Action Summary	Application No.	Applicant(s)
	12/851,045	LYNAM, NIALL R.
	Examiner	**Art Unit**
	ALESSANDRO AMARI	2872

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *10 November 2010*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-92* is/are pending in the application.

4a) Of the above claim(s) *40-92* is/are withdrawn from consideration.

5)☐ Claim(s) ______ is/are allowed.

6)☒ Claim(s) *1-39* is/are rejected.

7)☐ Claim(s) ______ is/are objected to.

8)☐ Claim(s) ______ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *05 August 2010* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. ______.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *8/10/10*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. ______ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: ______.

DETAILED ACTION

Election/Restrictions

Applicant's election of Invention I in the reply filed on 10 November 2010 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)). Claims 40-92 are withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to nonelected Inventions, there being no allowable generic or linking claim.

Priority

Applicant's claim for the benefit of a prior-filed application under 35 U.S.C. 119(e) or under 35 U.S.C. 120, 121, or 365(c) is acknowledged. Applicant has not complied with one or more conditions for receiving the benefit of an earlier filing date under 35 U.S.C. 120 as follows:

The later-filed application must be an application for a patent for an invention which is also disclosed in the prior application (the parent or original nonprovisional application or provisional application). The disclosure of the invention in the parent application and in the later-filed application must be sufficient to comply with the requirements of the first paragraph of 35 U.S.C. 112. See *Transco Products, Inc. v. Performance Contracting, Inc.*, 38 F.3d 551, 32 USPQ2d 1077 (Fed. Cir. 1994).

The disclosure of the prior-filed applications, Application No. 60/471,872 fails to provide adequate support or enablement in the manner provided by the first paragraph of 35 U.S.C. 112 for one or more claims of this application.

The later-filed application must be an application for a patent for an invention which is also disclosed in the prior application (the parent or original nonprovisional application or provisional application). The disclosure of the invention in the parent application and in the later-filed application must be sufficient to comply with the requirements of the first paragraph of 35 U.S.C. 112. See *Transco Products, Inc. v. Performance Contracting, Inc.*, 38 F.3d 551, 32 USPQ2d 1077 (Fed. Cir. 1994).

In regard to claim 1 and claims dependent thereon, the prior Application fails to provide adequate support in the manner provided by the first paragraph of 35 U.S.C. 112 for at least the following features: electrically-operated actuator, plano-auxiliary reflective element assembly comprising a plano reflective element having unit magnification and a separate auxiliary reflective element having a curvature, a backing plate element having a first support portion supporting said plano reflective element and a second support portion supporting said auxiliary reflective element and the angling of the rearward field of view of the auxiliary reflective element relative to the rearward field of view.

Applicant states that this application is a continuation or divisional application of the prior-filed application. A continuation or divisional application cannot include new matter. Applicant is required to change the relationship (continuation or divisional application) to continuation-in-part because this application contains the following matter not disclosed in the prior-filed application:

In regard to claim 1 and claims dependent thereon, the prior Application fails to provide adequate support in the manner provided by the first paragraph of 35 U.S.C. 112 for at least the following features: electrically-operated actuator, plano-auxiliary reflective element assembly comprising a plano reflective element having unit magnification and a separate auxiliary reflective element having a curvature, a backing plate element having a first support portion supporting said plano reflective element and a second support portion supporting said auxiliary reflective element and the angling of the rearward field of view of the auxiliary reflective element relative to the rearward field of view.

Therefore, in view of the disclosure, the effective filing date for the instant application is 5 August 2010.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-23 and 27-39 are rejected under 35 U.S.C. 102(b) as being anticipated by Lynam et al (hereafter “Lynam”) US 2002/0072026.

In regard to claim 1, Lynam discloses (see for example, Figs. 1, 2, 3, 5, 6, 8) an exterior sideview mirror system suitable for use on an automobile, said exterior sideview mirror system comprising: an exterior sideview mirror assembly (12) adapted for attachment to a side of an automobile; said exterior sideview mirror assembly including a reflective element (30) having a rearward field of view when attached to the side of the automobile; said reflective element attached to an electrically-operated actuator of said exterior sideview mirror assembly and movable by said actuator in order to position said rearward field of view to a driver-desired position when said exterior sideview mirror assembly is attached to the side of the automobile as described in para. [0015] and [0019]; wherein said reflective element comprises a plano-auxiliary reflective element assembly as shown in Figure 5 and as described in para. [0083], said plano-auxiliary reflective element assembly comprising a plano reflective element having unit magnification and a separate auxiliary reflective element having a curvature as described in para. [0015]; said plano reflective element and said auxiliary reflective element of said piano-auxiliary reflective element assembly mounted adjacently at said piano-auxiliary reflective element assembly in a side-by-side relationship and not superimposed with one reflective element on top of the other reflective element as shown in Figure 5; said plano reflective element and said auxiliary reflective element supported at a backing plate element (60), said backing plate element mounting to said actuator such that movement of said backing plate element of said piano-auxiliary reflective element assembly by said actuator simultaneously and similarly moves said plano reflective element and said auxiliary reflective element as described in para.

[0042], [0056] and [0058]; said auxiliary reflective element having a wide-angle field of view encompassing a blind spot in the side lane adjacent the side of the automobile to which said exterior sideview mirror assembly is attached as described in para. [0058]; said backing plate element having a first support portion supporting said plano reflective element and a second support portion supporting said auxiliary reflective element as described in para. [0066] and [0073] and Figures 9-11; wherein said auxiliary reflective element is positioned at an outboard portion of said plano-auxiliary reflective element assembly when said exterior sideview mirror assembly is mounted to the side of the automobile as shown in Figures 5 and 9-11; wherein said backing plate element comprises a polymeric substrate that is formed as a single element by injection molding of a polymeric resin as described in para. [0050]; wherein said backing plate element is capable of supporting said plano reflective element and said auxiliary reflective element; wherein said first support portion of said backing plate element comprises a flat portion and wherein said plano reflective element is disposed at said flat portion; wherein said second support portion of said backing plate element comprises a curved portion and wherein said auxiliary reflective element is disposed at said curved portion as shown in Figure 6 and as described in para. [0059]; wherein the rearward field of view of said auxiliary reflective element is different from and angled to the rearward field of view of said plano reflective element when both are attached to said backing plate element of said piano-auxiliary reflective element assembly when said piano-auxiliary reflective element assembly is included in said exterior sideview mirror assembly and when said exterior sideview mirror assembly is attached to the side of the automobile as described in para. [0013], [0014] and [0059]; wherein angling of the rearward field of view of said auxiliary reflective element relative to the rearward field of view of said plano reflective element is achieved, at least in part, by an angling of said second support portion of said backing plate element supporting said auxiliary reflective element relative to said first support portion of said backing plate element supporting said plano reflective element as described in para. [0059]; wherein, when said exterior sideview mirror assembly is attached to the side of the automobile, the field of view of said plano reflective element generally views rearwardly of the equipped automobile and the field of view of said auxiliary reflective element generally views towards a blind spot in the side lane adjacent the side of the automobile to which said exterior sideview mirror assembly is attached, said blind spot being generally outside the rearward field of view of said plano reflective element when said plano reflective element is viewed by a driver of the equipped automobile when said exterior sideview mirror assembly is attached to the side of the automobile as described in para. [0058] and [0059]; and wherein at least one of said plano reflective element and said auxiliary reflective element comprises one of (a) a glass substrate having a surface coated with a metallic reflector coating and (b) a polymeric substrate having a thin glass element applied to a surface thereof and with an opposing surface thereof having a reflecting layer applied thereto as described in para. [0043].

Regarding claim 2, Lynam discloses that at least a portion of said auxiliary reflective element adjacent said plano reflective element has its front surface generally coplanar with the front surface of said plano reflective element as described in para. [0048] and as shown in Figure 10.

Regarding claim 3, Lynam discloses that an element of said backing plate element at least partially partitions said backing plate element into a first region where said plano reflective element is disposed and a separate and adjacent second region where said auxiliary reflective element is disposed, and wherein said first region is adapted to receive said plano reflective element and said second region is adapted to receive said auxiliary reflective element as shown in Figure 6.

Regarding claim 4, Lynam discloses (see Fig. 5, 6) that said plano reflective element and said auxiliary reflective element are adjacently supported at said backing plate element at a joint, and wherein said piano-auxiliary reflective element assembly includes a demarcation element (65, 165), said demarcation element disposed at said joint to form a demarcation between said plano reflective element and said auxiliary reflective element, said demarcation element having a portion visible to a driver of the automobile when said exterior sideview mirror assembly is attached to the side of the automobile as described in para. [0051] and as shown in Figure 5.

Regarding claim 5, Lynam discloses that said demarcation element is dark colored as described in para. [0051] and as shown in Figure 5.

Regarding claim 6, Lynam discloses that said demarcation element is dark colored with a color selected from the group consisting of black, grey, blue and brown as described in para. [0051] and as shown in Figure 5.

Regarding claim 7, Lynam discloses that said demarcation element comprises at least one of a polymer material, a tape, a plastic film, a paint, a lacquer and a caulk as described in para. [0051].

Regarding claim 8, Lynam discloses that said demarcation element comprises a polymer material as described in para. [0051].

Regarding claim 9, Lynam discloses that the rearward field of view of said auxiliary reflective element is at an angle of at least about 3 degrees relative to the rearward field of view of said plano reflective element as described in para [0013].

Regarding claim 10, Lynam discloses that said joint comprises a space between said plano reflective element and said auxiliary reflective element as described in para. [0042].

Regarding claim 11, Lynam discloses that said demarcation element is at least partially disposed at said space between said plano reflective element and said auxiliary reflective element as described in para. [0051].

Regarding claim 12, Lynam discloses that said demarcation element comprises a wall on said backing plate element, said wall located on said backing plate element at said joint, said wall disposed between said plano reflective element and said auxiliary reflective element as shown in Figure 6 and as described in para. [0051] and [0052].

Regarding claim 13, Lynam discloses that an element of said backing plate element at least partially partitions said backing plate element into a first region where said plano reflective element is disposed and a separate and adjacent second region where said auxiliary reflective element is disposed, and wherein said first region is adapted to receive said plano reflective element and said second region is adapted to receive said auxiliary reflective element as shown in Figure 6 and as described in para. [0051] and [0052].

Regarding claim 14, Lynam discloses that the rearward field of view of said auxiliary reflective element is generally directed at least one of outwardly and downwardly with respect to the longitudinal axis of the equipped automobile when said exterior sideview mirror assembly is attached to the side of the automobile as described in para. [0009], [0013], and [0074].

Regarding claim 15, Lynam discloses that the rearward field of view of said auxiliary reflective element is generally directed outwardly and downwardly with respect to the longitudinal axis of the equipped automobile when said exterior sideview mirror assembly is attached to the side of the automobile as described in para. [0009], [0013], and [0073].

Regarding claim 16, Lynam discloses that said plano reflective element is supported at said backing plate element by at least one of an adhesive attachment and a mechanical attachment, and wherein said auxiliary reflective element is supported at said backing plate element by at least one of an adhesive attachment and a mechanical attachment as described in para. [0050] and [0051].

Regarding claim 17, Lynam discloses that said plano reflective element comprises a flat glass substrate having a surface coated with a metallic reflector coating and wherein said auxiliary reflective element comprises a bent glass substrate having a surface coated with a metallic reflector coating, and wherein said bent glass substrate has a spherical curvature as described in para. [0045].

Regarding claim 18, Lynam discloses that said plano reflective dement comprises a flat glass substrate having a surface coated with a metallic reflector coating and wherein said auxiliary reflective element comprises a bent glass substrate having a surface coated with a metallic reflector coating, and wherein said bent glass substrate has a multiradius curvature as described in para. [0045].

Regarding claim 19, Lynam discloses that said plano reflective element comprises a flat glass substrate having a surface coated with a metallic reflector coating and wherein said auxiliary reflective element comprises a bent glass substrate having a surface coated with a metallic reflector coating, and wherein said bent glass substrate has an aspherical curvature as described in para. [0005] and [0083].

Regarding claim 20, Lynam discloses that said plano reflective element comprises a substrate having a surface coated with a metallic reflector coating and wherein said auxiliary reflective element comprises a substrate having a surface coated with a metallic reflector coating as described in para. [0043].

Regarding claim 21, Lynam discloses that said curved portion of said backing plate element comprises a curvature corresponding to a curvature of said auxiliary reflective element as described in para. [0083].

Regarding claim 22, Lynam discloses that said curved portion of said backing plate element has at least one of (a) a spherical curvature, (b) an aspherical curvature and (c) a multiradius curvature as described in para. [0045].

Regarding claim 23, Lynam discloses (see Fig. 5, 6) that a demarcation element (65, 165) is disposed between said plano reflective element and said auxiliary reflective element and wherein said demarcation element comprises a part of said backing plate element, and wherein said demarcation element comprises a wall structure that at least partially partitions said backing plate element into a first region where said plano reflective element is disposed and a separate and adjacent second region where said auxiliary reflective element is disposed, and wherein at least one of (a) said first region is adapted to receive said plano reflective element and (b) said second region is adapted to receive said auxiliary reflective element as described in para. [0051].

Regarding claim 27, Lynam discloses that said auxiliary reflective element comprises a heater element operable to demist/deice the outmost surface of said auxiliary reflective element when said auxiliary reflective element is disposed at said backing plate element and when said exterior sideview mirror assembly is attached and operated on the side of the automobile as described in para. [0054] and [0065] and as shown in Figure 9.

Regarding claim 28, Lynam discloses that said exterior sideview mirror assembly including said piano-auxiliary reflective element having a rearward field of view when attached to the side of the automobile comprises a driver-side exterior sideview mirror assembly, and wherein, when attached to the side of the automobile, said driver-side exterior sideview mirror assembly provides to the driver of the equipped automobile a total field of view that generally subtends an angle of at least about 25 degrees with respect to the side of the equipped automobile as described in para. [0046] and [0061].

Regarding claim 29, Lynam discloses that said exterior sideview mirror assembly including said piano-auxiliary reflective element having a rearward field of view when attached to the side of the automobile comprises a driver-side exterior sideview mirror assembly, and wherein, when attached to the side of the automobile, said driver-side exterior sideview mirror assembly provides to the driver of the equipped automobile a total field of view that generally subtends an angle of at least about 30 degrees with respect to the side of the equipped automobile as described in para. [0046] and [0061].

Regarding claim 30, Lynam discloses that said auxiliary reflective element has an aspherical curvature as described in para. [0005] and [0083].

Regarding claim 31, Lynam discloses that said auxiliary reflective element has a spherical curvature as described in para. [0083].

Regarding claim 32, Lynam discloses that the ratio of the width of said piano reflective element to the width of said auxiliary reflective element is greater than 1.5 as described in para. [0049].

Regarding claim 33, Lynam discloses that the ratio of the width of said plano reflective element to the width of said auxiliary reflective element is greater than 2.5 as described in para. [0049].

Regarding claim 34, Lynam discloses that said exterior sideview mirror assembly comprises a door-mounted exterior sideview mirror assembly adapted for attachment to a side of the automobile adjacent a driver seating location of a driver of the automobile and wherein the rearward field of view of said auxiliary reflective element generally views downwardly towards the road surface adjacent to the driver seating location at least at a distance in the range of about 1 foot to about 24 feet to the rear of the driver seating location as described in para. [0059].

Regarding claim 35, Lynam discloses that at least one of said plano reflective element and said auxiliary reflective element comprises a glass substrate having a surface coated with a metallic reflector coating, and wherein said metallic reflector coating is selected from the group consisting of (i) a chromium coating, (ii) a titanium coating, (iii) a rhodium coating, (iv) a metal-alloy coating, (v) a nickel alloy coating, (vi) an aluminum coating and (vii) a silver coating as described in para. [0047].

Regarding claim 36, Lynam discloses that at least one of said plano reflective element and said auxiliary reflective element comprises an electro-optic reflective element as described in para. [0043] and [0047].

Regarding claim 37, Lynam discloses that said plano reflective element comprises an electro-optical reflective element, and wherein said electro-optical reflective element comprises an electrochromic reflective element as described in para. [0048] and [0055].

Regarding claim 38, Lynam discloses that said auxiliary reflective element comprises a fixed reflectance mirror reflector as described in para. [0043] and [0047].

Regarding claim 39, Lynam discloses that said fixed reflectance mirror reflector comprises a spherically bent glass substrate coated with a metallic reflector coating as described in para. [0047], [0055], [0064] and [0069].

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 24-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lynam US 2002/0072026 in view of Lynam US 2004/0264011.

Regarding claims 24-26, Lynam '026 teaches the invention as set forth above but does not teach regarding claim 24, a plano reflective element comprises a substrate formed from elongated sheet of substrate material comprising a polymeric resin material, and wherein said elongated sheet has a substantially transparent functional film applied at a surface thereof, and wherein said substantially transparent functional film provides at least one of (a) an anti-abrasion function, (b) a hydrophobic function and (c) a hydrophilic function, and wherein said functional film comprises an ultrathin glass material which is sufficiently flexible to be provided in a reel or roll, and wherein said functional film is sufficiently flexible to conform to said substrate of said plano reflective element, and wherein said plano reflective element comprises a reflective film disposed at a surface of said substrate opposite said substantially transparent functional film or regarding claim 25, that said plano reflective element comprises a thin flexible glass sheet and a polymeric substrate, said thin flexible glass sheet existing as a pre-formed glass sheet that is separate from said polymeric substrate, said thin glass sheet having an attaching surface, said attaching surface being opposed to and adhered to said surface of said polymeric substrate when said thin flexible sheet is adhered to said exterior surface of said polymeric substrate, said thin flexible sheet providing an anti-abrasion function at said surface of said polymeric substrate when adhered thereto, said thin flexible glass sheet substantially conforming to said exterior surface of said polymeric substrate when adhered thereto, said thin glass sheet having a thickness of less than approximately 0.8 mm and greater than approximately 0.3 mm or regarding claim 26, that said substrate is cut from a molded or extruded or cast strip or sheet, said glass sheet being laminated to said strip or sheet and wherein said plano reflective element comprises a reflective film applied to an inner surface of said substrate opposite said exterior surface, and wherein said reflective film comprises a polymeric reflective film at least one of laminated, adhered and applied to said inner surface of said substrate.

Regarding claim 24, Lynam ‘011 teaches a plano reflective element comprises a substrate formed from elongated sheet of substrate material comprising a polymeric resin material, and wherein said elongated sheet has a substantially transparent functional film applied at a surface thereof, and wherein said substantially transparent functional film provides at least one of (a) an anti-abrasion function, (b) a hydrophobic function and (c) a hydrophilic function, and wherein said functional film comprises an ultrathin glass material which is sufficiently flexible to be provided in a reel or roll, and wherein said functional film is sufficiently flexible to conform to said substrate of said plano reflective element, and wherein said plano reflective element comprises a reflective film disposed at a surface of said substrate opposite said substantially transparent functional film as described in para. [0040]-[0043] and [0047]. Regarding claim 25, Lynam ‘011 teaches that said plano reflective element comprises a thin flexible glass sheet and a polymeric substrate, said thin flexible glass sheet existing as a pre-formed glass sheet that is separate from said polymeric substrate, said thin glass sheet having an attaching surface, said attaching surface being opposed to and adhered to said surface of said polymeric substrate when said thin flexible sheet is adhered to said exterior surface of said polymeric substrate, said thin flexible sheet providing an anti-abrasion function at said surface of said polymeric substrate when adhered thereto, said thin flexible glass sheet substantially conforming to said exterior surface of said polymeric substrate when adhered thereto, said thin glass sheet having a thickness of less than approximately 0.8 mm and greater than approximately 0.3 mm as described in para. [0032], [0040]-[0043] and [0047]. Regarding claim 26, Lynam ‘011 teaches that said substrate is cut from a molded or extruded or cast strip or sheet, said glass sheet being laminated to said strip or sheet and wherein said plano reflective element comprises a reflective film applied to an inner surface of said substrate opposite said exterior surface, and wherein said reflective film comprises a polymeric reflective film at least one of laminated, adhered and applied to said inner surface of said substrate as described in para. [0032], [0040]-[0043] and [0047]. The preceding claims are product-by-process claims and even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process. *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985)

It would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize film characteristics of Lynam '011 in the sideview mirror assembly of Lynam '026 in order to provide for a hard coat or surface for the mirror so as to provide for enhanced scratch resistance.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ALESSANDRO AMARI whose telephone number is (571)272-2306. The examiner can normally be reached on Monday-Friday 8:00 AM to 5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephone B. Allen can be reached on (571) 272-2434. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

11 January 2011

/Alessandro Amari/
Primary Examiner, Art Unit 2872

Notice of References Cited	Application/Control No. 12/851,045	Applicant(s)/Patent Under Reexamination LYNAM, NIALL R.	
	Examiner ALESSANDRO AMARI	Art Unit 2872	Page 1 of 1

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*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2002/0072026	06-2002	Lynam et al.	432/77
	B	US-			
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

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*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
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	O					
	P					
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	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
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*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
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EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	3829	(359/866,872,877,883).CCLS.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	OFF	2011/01/06 21:08
S2	42	plano-auxiliary	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	ADJ	ON	2011/01/06 21:09
S3	17	S1 and S2	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	ADJ	ON	2011/01/06 21:09
S4	814039	actuator	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	ADJ	ON	2011/01/06 21:13
S5	15	S3 and S4	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	ADJ	ON	2011/01/06 21:13
S6	22	backing plate and polymeric and angling and blind spot	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	ADJ	ON	2011/01/06 21:58
S7	3	S5 and S6	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	ADJ	ON	2011/01/06 21:59
S8	211758	glass substrate	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	ADJ	ON	2011/01/06 21:59
S9	3	S7 and S8	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	ADJ	ON	2011/01/06 21:59
S10	21770	demarcation	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	ADJ	ON	2011/01/06 22:01
S11	3	S9 and S10	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	ADJ	ON	2011/01/06 22:01

S12	137	demarcation with polymer	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	ADJ	ON	2011/01/06 22:01
S13	3	S11 and S12	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	ADJ	ON	2011/01/06 22:01
S14	3	S13 and heater	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	ADJ	ON	2011/01/06 22:06

EAST Search History (Interference)

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Receipt date: 08/10/2010

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT *(Use as many sheets as necessary)*				Application Number	12/851,045
				Filing Date	August 5, 2010
				First Named Inventor	Niall R. Lynam
				Art Unit	2872
				Examiner Name	
Sheet	1	of	12	Attorney Docket Number	DON09 P-1624

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Examiner Initials*	Cite No.[1]	Document Number / Number-Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
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Examiner Signature	/Alessandro Amari/	Date Considered	01/11/2011

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Attorney Docket Number	DON09 P-1624

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Examiner Initials*	Cite No.[1]	Document Number / Number-Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
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Application Number	12/851,045
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Sheet 4 of 12

Complete if Known	
Application Number	12/851,045
Filing Date	August 5, 2010
First Named Inventor	Niall R. Lynam
Art Unit	2872
Examiner Name	
Attorney Docket Number	DON09 P-1624

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number / Number-Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		6,005,724	1999-12-21	Todd	
		6,002,544	1999-12-14	Yatsu	
		5,980,050	1999-11-09	McCord	
		5,938,320	1999-08-17	Crandall	
		5,929,786	1999-07-27	Schofield et al.	
		5,922,176	1999-07-13	Caskey	
		5,910,854	1999-06-08	Varaprasad et al.	
		5,877,897	1999-03-02	Schofield et al.	
		5,864,434	1999-01-26	Taylor	
		5,863,116	1999-01-26	Pastrick et al.	
		5,847,889	1998-12-08	Komiyama et al.	
		5,838,505	1998-11-17	Palathingal	
		5,835,294	1998-11-10	Minegishi	
		5,825,527	1998-10-20	Forgette et al.	
		5,823,654	1998-10-20	Pastrick et al.	
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		5,796,532	1998-08-18	Kanazawa	
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		5,790,298	1998-08-04	Tonar	
		5,788,357	1998-08-04	Muth et al.	
		5,786,772	1998-07-28	Schofield et al.	
		5,784,211	1998-07-21	Mingledorff	
		5,760,962	1998-06-02	Schofield et al.	
		5,751,489	1998-05-12	Caskey et al.	
		5,724,187	1998-03-03	Varaprasad et al.	
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		5,669,704	1997-09-23	Pastrick	
		5,669,699	1997-09-23	Pastrick et al.	

Examiner Signature	/Alessandro Amari/	Date Considered	01/11/2011

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Complete if Known	
Application Number	12/851,045
Filing Date	August 5, 2010
First Named Inventor	Niall R. Lynam
Art Unit	2872
Examiner Name	
Attorney Docket Number	DON09 P-1624

U. S. PATENT DOCUMENTS

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		5,669,698	1997-09-23	Veldman et al.	
		5,668,663	1997-09-16	Varaprasad et al.	
		5,649,756	1997-07-22	Adams et al.	
		5,644,442	1997-07-01	Lemere	
		5,621,577	1997-04-15	Lang et al.	
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		5,594,593	1997-01-14	Milner	
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		5,587,699	1996-12-24	Faloon et al.	
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		5,550,677	1996-08-27	Schofield et al.	
		5,535,056	1996-07-09	Caskey et al.	
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		5,412,512	1995-05-02	Zebold et al.	
		5,406,414	1995-04-11	O'Farrell et al.	
		5,371,659	1994-12-06	Pastrick et al.	

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Complete if Known	
Application Number	12/851,045
Filing Date	August 5, 2010
First Named Inventor	Niall R. Lynam
Art Unit	2872
Examiner Name	
Attorney Docket Number	DON09 P-1624

U. S. PATENT DOCUMENTS

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		5,361,172	1994-11-01	Schissel et al.	
		5,355,245	1994-10-11	Lynam	
		5,354,965	1994-10-11	Lee	
		5,327,288	1994-07-05	Wellington et al.	
		5,313,335	1994-05-17	Gray et al.	
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		5,295,021	1994-03-15	Swanson	
		5,285,060	1994-02-08	Larson et al.	
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		5,253,109	1993-10-12	O'Farrell et al.	
		5,247,395	1993-09-21	Martinez	
		5,239,405	1993-08-24	Varaprasad et al.	
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		5,225,943	1993-07-06	Lupo	
		5,207,492	1993-05-04	Roberts	
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		5,117,346	1992-05-26	Gard	
		5,115,352	1992-05-19	do Espirito Santo	
		5,115,346	1992-05-19	Lynam	
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		5,076,673	1991-12-31	Lynam et al.	

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Substitute for form 1449/PTO	Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT *(Use as many sheets as necessary)*	Application Number	12/851,045
	Filing Date	August 5, 2010
	First Named Inventor	Niall R. Lynam
	Art Unit	2872
	Examiner Name	
Sheet 7 of 12	Attorney Docket Number	DON09 P-1624

U. S. PATENT DOCUMENTS

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		5,073,012	1991-12-17	Lynam	
		5,066,112	1991-11-19	Lynam et al.	
		5,052,792	1991-10-01	McDonough	
		5,050,977	1991-09-24	Platzer, Jr.	
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		4,948,242	1990-08-14	Desmond et al.	
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		4,932,770	1990-06-12	Caravaty	
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		4,826,289	1989-05-02	Vandenbrink et al.	
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		4,799,768	1989-01-24	Gahan	
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Examiner Signature	/Alessandro Amari/	Date Considered	01/11/2011

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Sheet 8 of 12

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Application Number	12/851,045
Filing Date	August 5, 2010
First Named Inventor	Niall R. Lynam
Art Unit	2872
Examiner Name	
Attorney Docket Number	DON09 P-1624

U. S. PATENT DOCUMENTS

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		4,679,906	1987-07-14	Brandenburg	
		4,678,294	1987-07-01	Van Nostrand	
		4,674,850	1987-06-23	Blom	
		4,674,849	1987-06-23	Stewart	
		4,666,264	1987-05-19	Yamabe	
		4,630,904	1986-12-23	Pastore	
		4,629,296	1986-12-16	White	
		4,623,222	1986-11-18	Itoh et al.	
		4,609,266	1986-09-02	Blom	
		4,588,267	1986-05-13	Pastore	
		4,575,202	1986-03-11	McGuire	
		4,555,166	1985-11-26	Enomoto	
		4,549,786	1985-10-29	Albers et al.	
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		4,306,770	1981-12-22	Marhauer	
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		4,293,191	1981-10-06	Kim	
		4,281,899	1981-08-04	Oskam	
		4,268,120	1981-05-19	Jitsumori	
		4,264,144	1981-04-28	McCord	
		4,258,979	1981-03-31	Mahin	
		4,223,983	1980-09-23	Bloom	
		4,200,359	1980-04-29	Lawson	

Examiner Signature	/Alessandro Amari/	Date Considered	01/11/2011

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Sheet 9 of 12

Complete if Known	
Application Number	12/851,045
Filing Date	August 5, 2010
First Named Inventor	Niall R. Lynam
Art Unit	2872
Examiner Name	
Attorney Docket Number	DON09 P-1624

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		4,193,668	1980-03-18	Skinner	
		3,909,117	1975-09-30	Takahashi et al.	
		3,884,606	1975-05-20	Schrenk	
		3,881,811	1975-05-06	French	
		3,826,563	1974-07-30	Davis	
		3,806,232	1974-04-23	Gray	
		3,773,882	1973-11-20	Schrenk	
		3,764,201	1973-10-09	Haile	
		3,759,647	1973-09-18	Schrenk et al.	
		3,708,222	1973-01-02	Stern	
		3,667,833	1972-06-06	Baldwin, Sr.	
		3,610,739	1971-10-05	Seashore	
		3,601,614	1971-08-24	Platzer, Jr.	
		3,563,638	1971-02-16	Panozzo	
		3,424,517	1969-01-28	Budreck	
		3,408,136	1968-10-29	Travis	
		3,404,935	1968-10-08	Creager	
		3,389,952	1968-06-25	Tobin, Jr.	
		3,375,053	1968-03-26	Ward	
		3,338,655	1967-08-29	Young	
		3,337,285	1967-08-22	Travis	
		3,280,701	1966-10-25	Donnelly et al.	
		3,267,806	1966-08-23	Azegami	
		3,266,016	1966-08-09	Maruyama et al.	
		3,175,463	1965-03-30	Seashore	
		3,170,985	1965-02-23	Katulich	
		3,146,296	1964-08-25	Fischer	
		3,131,250	1964-04-28	Ely	
		3,104,274	1963-09-17	King	
		2,911,177	1959-11-03	West	
		2,890,539	1959-06-16	Holt	
		2,778,273	1957-01-22	Fellmeth	
		2,636,419	1953-04-28	Kerr	
		2,580,014	1951-12-25	Gazda	
		2,514,989	1950-07-11	Buren	
		2,263,382	1941-11-18	Gotzinger	

Examiner Signature	/Alessandro Amari/	Date Considered	01/11/2011

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	First Named Inventor	Niall R. Lynam
	Art Unit	2872
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Sheet 10 of 12	Attorney Docket Number	DON09 P-1624

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		2,135,262	1938-11-01	Schumacher	
		1,672,559	1928-06-05	Doble	
		1,114,559	1914-10-20	Weed	
		D297,926	1988-10-04	Kesler	
		D493,394	2004-07-27	Lawlor et al.	
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		20030117731	06-26-2003	Platzer, Jr.	
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		20050232469	10-20-2005	Schofield et al.	
		20050248859	11-10-2005	Platzer, Jr.	
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		20060125919	06-15-2006	Camilleri et al.	
		20060171704	08-03-2006	Bingle et al.	
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		20060268440	11-30-2006	Platzer, Jr.	
		20070058257	03-15-2007	Lynam	
		20070285789	12-13-2007	Lindahl et al.	
		20080212189	09-04-2008	Baur et al.	
		20080225421	09-18-2008	Platzer	

Examiner Signature	/Alessandro Amari/	Date Considered	01/11/2011

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.A./

PTO/SB/08A (07-05)
Approved for use through 07/31/2006. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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Substitute for form 1449/PTO	Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT *(Use as many sheets as necessary)*	Application Number	12/851,045
	Filing Date	August 5, 2010
	First Named Inventor	Niall R. Lynam
	Art Unit	2872
	Examiner Name	
Sheet 11 of 12	Attorney Docket Number	DON09 P-1624

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		20080304170	12-11-2008	Zhao	
		20090040306	02-12-2009	Foote et al.	
		20090115631	05-07-2009	Foote et al.	
		RE17274	1929-04-16	Porter	

Examiner Signature	/Alessandro Amari/	Date Considered	01/11/2011

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation it not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.A./

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Complete if Known	
Application Number	12/851,045
Filing Date	August 5, 2010
First Named Inventor	Niall R. Lynam
Art Unit	2872
Examiner Name	
Attorney Docket Number	DON09 P-1624

Sheet 12 of 12

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T[6]
		DE 2409748	1975-09-04	Leitz		
		DE 2550095	1976-05-20	Schiff et al.		
		DE 2647592	1978-04-27	Uta		
		DE 2915521	1980-10-30	Docie		
		DE 3302735	1984-08-02	Schulze		X
		DE 3329998	1985-03-07	Horn		X
		DE 3620228	1987-12-17	Thomen		X
		DE 4026578	1992-04-30	Kramer		X
		EP 0210757	1987-02-04	Von Seidel		X
		EP 0310261	1989-04-05	Britax Wingard Limited		X
		EP 0551802	1992-01-15	Jonsson		X
		EP 0791503	1997-08-27	Gentex Corporation		X
		EP 0917987	1999-05-26	Magneti Marelli France		X
		EP 0356099	1990-02-28	Yamada et al.		X
		EP 0728618	08-28-1996	Gentex Corporation		X
		EP 0729864	09-04-1996	Gentex Corporation		X
		FR 2628042	1988-03-01	Racel		X
		GB 1279158	1972-06-28	Hacker		X
		GB 2048189	1980-12-10	Mirrocraft Inc.		X
		GB 2092534	1982-08-18	Hagiri		X
		JP 0051637	1980-04-15	Katsumata Giken KK		X
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		JP 1208245	1989-08-22	Moriwake		X
		JP 362075619	1987-04-07	Tomita		X
		JP 62105103	1987-05-15	Miyake Shinya		X
		KR 2002092059	2002-12-11	Jung		X
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		WO 2006124682	11-23-2006	Donnelly Corporation		X
		WO 2007005942	01-11-2007	Donnelly Corporation		X
		WO 2008051910	05-02-2008	Donnelly Corporation		X

Examiner Signature	/Alessandro Amari/	Date Considered	01/11/2011

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.A./

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/851,045	08/05/2010	Niall R. Lynam	DON09 P-1624

CONFIRMATION NO. 1992

PUBLICATION NOTICE

OC000000044677869

28101
VAN DYKE, GARDNER, LINN & BURKHART, LLP
SUITE 207
2851 CHARLEVOIX DRIVE, S.E.
GRAND RAPIDS, MI 49546

Title:EXTERIOR SIDEVIEW MIRROR SYSTEM

Publication No.US-2010-0296187-A1
Publication Date:11/25/2010

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Office of Public Records. The Office of Public Records can be reached by telephone at (703) 308-9726 or (800) 972-6382, by facsimile at (703) 305-8759, by mail addressed to the United States Patent and Trademark Office, Office of Public Records, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently http://pair.uspto.gov/. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Managment, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

PATENT
DON09 P-1624

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Group Art	:	2872
Examiner	:	Alessandro V. Amari
Applicant	:	Niall R. Lynam
Serial No.	:	12/851,045
Filing Date	:	August 5, 2010
For	:	EXTERIOR SIDEVIEW MIRROR SYSTEM

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

INVENTION ELECTION

This is in response to the Office Action mailed October 27, 2010. The Office Action requires that Applicants elect a single disclosed invention for prosecution on the merits. Applicants provisionally elect Invention I, which corresponds to claims 2-39 of the application. The Office Action indicated that claim 1 links Inventions I and II, and that the restriction requirement among the linked inventions is subject to the nonallowance of linking claim 1. An early and favorable action on the merits is respectfully requested.

Respectfully submitted,

NIALL R. LYNAM

By: Van Dyke, Gardner, Linn & Burkhart, LLP

Dated: November 10, 2010.

Timothy A. Flory
Registration No. 42 540
2851 Charlevoix Drive, S.E., Suite 207
P.O. Box 888695
Grand Rapids, Michigan 49588-8695
(616) 975-5500

Electronic Acknowledgement Receipt

EFS ID:	8807503
Application Number:	12851045
International Application Number:	
Confirmation Number:	1992
Title of Invention:	EXTERIOR SIDEVIEW MIRROR SYSTEM
First Named Inventor/Applicant Name:	Niall R. Lynam
Customer Number:	28101
Filer:	Timothy A. Flory/Amanda Sytsma
Filer Authorized By:	Timothy A. Flory
Attorney Docket Number:	DON09 P-1624
Receipt Date:	10-NOV-2010
Filing Date:	05-AUG-2010
Time Stamp:	14:10:49
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	TransmittalForm.pdf	79476 058a021e5e0a24b55bc258386d96ac8bae773f0b	no	1

Warnings:

Information:

2	Response to Election / Restriction Filed	InventionElection.pdf	44117 ede4e9412dc81ed89fb9b71330af665017ae58bd	no	1
Warnings:					
Information:					
			Total Files Size (in bytes):	123593	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

<u>New Applications Under 35 U.S.C. 111</u>
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

<u>National Stage of an International Application under 35 U.S.C. 371</u>
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

<u>New International Application Filed with the USPTO as a Receiving Office</u>
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Doc Code: TRAN.LET

Document Description: Transmittal Letter

PTO/SB/21 (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Application Number	12/851,045
Filing Date	August 5, 2010
First Named Inventor	Niall R. Lynam
Art Unit	2872
Examiner Name	Alessandro V. Amari
Attorney Docket Number	DON09 P-1624
Total Number of Pages in This Submission	

ENCLOSURES (*Check all that apply*)

- [ ] Fee Transmittal Form
  - [ ] Fee Attached
- [x] Amendment/Reply
  - [ ] After Final
  - [ ] Affidavits/declaration(s)
- [ ] Extension of Time Request
- [ ] Express Abandonment Request
- [ ] Information Disclosure Statement
- [ ] Certified Copy of Priority Document(s)
- [ ] Reply to Missing Parts/ Incomplete Application
  - [ ] Reply to Missing Parts under 37 CFR 1.52 or 1.53
- [ ] Drawing(s)
- [ ] Licensing-related Papers
- [ ] Petition
- [ ] Petition to Convert to a Provisional Application
- [ ] Power of Attorney, Revocation Change of Correspondence Address
- [ ] Terminal Disclaimer
- [ ] Request for Refund
- [ ] CD, Number of CD(s) ______
  - [ ] Landscape Table on CD
- [ ] After Allowance Communication to TC
- [ ] Appeal Communication to Board of Appeals and Interferences
- [ ] Appeal Communication to TC (Appeal Notice, Brief, Reply Brief)
- [ ] Proprietary Information
- [ ] Status Letter
- [ ] Other Enclosure(s) (please Identify below):

Remarks

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm Name	VAN DYKE, GARDNER, LINN & BURKHART, LLP		
Signature	[signature]		
Printed name	Timothy A. Flory		
Date	November 10, 2010	Reg. No.	42540

CERTIFICATE OF TRANSMISSION/MAILING

I hereby certify that this correspondence is being facsimile transmitted to the USPTO or deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the date shown below:

Signature	Amanda R. Sytsma		
Typed or printed name	Amanda R. Sytsma	Date	November 10, 2010

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/851,045	08/05/2010	Niall R. Lynam	DON09 P-1624	1992

28101 7590 10/27/2010
VAN DYKE, GARDNER, LINN & BURKHART, LLP
SUITE 207
2851 CHARLEVOIX DRIVE, S.E.
GRAND RAPIDS, MI 49546

EXAMINER	
AMARI, ALESSANDRO V	

ART UNIT	PAPER NUMBER
2872	

MAIL DATE	DELIVERY MODE
10/27/2010	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

PTOL-90A (Rev. 04/07)

Office Action Summary	Application No.	Applicant(s)
	12/851,045	LYNAM, NIALL R.
	Examiner	Art Unit
	ALESSANDRO AMARI	2872

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *1* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-92* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☐ Claim(s) _____ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☒ Claim(s) *1-92* are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

Restriction to one of the following inventions is required under 35 U.S.C. 121:

I. Claims 2-39, drawn to exterior sideview mirror system with rearward field of view and backing plate specifics, classified in class 359, subclass 866.

II. Claims 40-61, drawn to exterior sideview mirror system with demarcation element, joint and heater specifics, classified in class 359, subclass 872.

III. Claims 62-77, drawn to exterior sideview mirror system with adhesive element, mechanical attachment and electro-optic reflective element specifics, classified in class 359, subclass 265.

IV. Claims 78-84, drawn to exterior sideview mirror system with metallic reflector coating specifics, classified in class 359, subclass 883.

V. Claims 85-88, drawn to exterior sideview mirror system with fixed reflectance mirror and spherically bent glass specifics, classified in class 359, subclass 850.

VI. Claims 89, 90, drawn to exterior sideview mirror system with curved substrate and metallic reflector coating specifics, classified in class 359, subclass 872.

VII. Claims 91, 92, drawn to exterior sideview mirror system with spherically bent glass substrate, rearward field of view and total field of view specifics, classified in class 359, subclass 866.

The inventions are distinct, each from the other because of the following reasons:

Inventions I-VII are directed to related products. The related inventions are distinct if: (1) the inventions as claimed are either not capable of use together or can have a materially different design, mode of operation, function, or effect; (2) the inventions do not overlap in scope, i.e., are mutually exclusive; and (3) the inventions as claimed are not obvious variants. See MPEP § 806.05(j). In the instant case, claims 1-39 evidence that the combination does not rely on the details of Inventions II-VII; claims 40-61 evidence that the combination does not rely on the details of Inventions I and III-VII; claims 62-77 evidence that the combination does not rely on the details of Inventions I, II and IV-VII; claims 78-84 evidence that the combination does not rely on the details of Inventions I-III and V-VII; claims 85-88 evidence that the combination does not rely on the details of Inventions I-IV, VI and VII; claims 89 and 90 evidence that the combination does not rely on the details of Inventions I-V and VII and claims 91 and 92 evidence that the combination does not rely on the details of Inventions I-VI . Furthermore, the inventions as claimed do not encompass overlapping subject matter and there is nothing of record to show them to be obvious variants.

Claim 1 link(s) inventions I and II. The restriction requirement among the linked inventions is **subject to** the nonallowance of the linking claim(s), claim 1. Upon the indication of allowability of the linking claim(s), the restriction requirement as to the linked inventions **shall** be withdrawn and any claim(s) depending from or otherwise requiring all the limitations of the allowable linking claim(s) will be rejoined and fully examined for patentability in accordance with 37 CFR 1.104. **Claims that require all**

the limitations of an allowable linking claim will be entered as a matter of right if the amendment is presented prior to final rejection or allowance, whichever is earlier. Amendments submitted after final rejection are governed by 37 CFR 1.116; amendments submitted after allowance are governed by 37 CFR 1.312.

Restriction for examination purposes as indicated is proper because all these inventions listed in this action are independent or distinct for the reasons given above and there would be a serious search and/or examination burden if restriction were not required because at least the following reason(s) apply:

--the inventions have acquired a separate status **in** the art due to their recognized divergent subject matter
--the inventions require a different field of search (e,g., searching different classes /subclasses or electronic resources, or employing different search strategies or search queries).

Applicant is advised that the reply to this requirement to be complete <u>must</u> include (i) an election of a invention to be examined even though the requirement may be traversed (37 CFR 1.143) **and (ii) identification of the claims encompassing the elected invention**.

The election of an invention may be made with or without traverse. To reserve a right to petition, the election must be made with traverse. If the reply does not distinctly and specifically point out supposed errors in the restriction requirement, the election shall be treated as an election without traverse. Traversal must be presented at the time of election in order to be considered timely. Failure to timely traverse the requirement will result in the loss of right to petition under 37 CFR 1.144. If claims are added after the election, applicant must indicate which of these claims are readable upon the elected invention.

Should applicant traverse on the ground that the inventions are not patentably distinct, applicant should submit evidence or identify such evidence now of record showing the inventions to be obvious variants or clearly admit on the record that this is the case. In either instance, if the examiner finds one of the inventions unpatentable over the prior art, the evidence or admission may be used in a rejection under 35 U.S.C. 103(a) of the other invention.

Applicant(s) are advised that if any claim presented in a continuation or divisional application is anticipated by, or includes all the limitations of, the allowable linking claim, such claim may be subject to provisional statutory and/or nonstatutory double patenting rejections over the claims of the instant application. Where a restriction requirement is withdrawn, the provisions of 35 U.S.C. 121 are no longer applicable. *In re Ziegler*, 443 F.2d 1211, 1215, 170 USPQ 129, 131-32 (CCPA 1971). See also MPEP § 804.01.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ALESSANDRO AMARI whose telephone number is (571)272-2306. The examiner can normally be reached on Monday-Friday 8:00 AM to 5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephone B. Allen can be reached on (571) 272-2434. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

20 October 2010

/Alessandro Amari/
Primary Examiner, Art Unit 2872

Index of Claims	**Application/Control No.** 12851045	**Applicant(s)/Patent Under Reexamination** LYNAM, NIALL R.
	Examiner ALESSANDRO AMARI	**Art Unit** 2872

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
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Index of Claims	Application/Control No. 12851045	Applicant(s)/Patent Under Reexamination LYNAM, NIALL R.
	Examiner ALESSANDRO AMARI	Art Unit 2872

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CLAIM		DATE								
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Index of Claims	Application/Control No. 12851045	Applicant(s)/Patent Under Reexamination LYNAM, NIALL R.
	Examiner ALESSANDRO AMARI	Art Unit 2872

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CLAIM		DATE								
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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
12/851,045	08/05/2010	2872	5714	DON09 P-1624	92	7

CONFIRMATION NO. 1992

FILING RECEIPT

OC000000043062476

28101
VAN DYKE, GARDNER, LINN & BURKHART, LLP
SUITE 207
2851 CHARLEVOIX DRIVE, S.E.
GRAND RAPIDS, MI 49546

Date Mailed: 08/18/2010

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Applicant(s)

Niall R. Lynam, Holland, MI;

Assignment For Published Patent Application

DONNELLY CORPORATION, Holland, MI

Power of Attorney:

Daniel Van Dyke--25046	Timothy Flory--42540
Donald Gardner--25975	Karl Ondersma--55894
Frederick Burkhart--29288	
Terence Linn--30283	
Catherine Collins--37599	

Domestic Priority data as claimed by applicant

This application is a CON of 12/197,666 08/25/2008
which is a DIV of 10/709,434 05/05/2004 PAT 7,420,756
which claims benefit of 60/471,872 05/20/2003

Foreign Applications

If Required, Foreign Filing License Granted: 08/16/2010

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 12/851,045**

Projected Publication Date: 11/25/2010

Non-Publication Request: No

Early Publication Request: No

Title

EXTERIOR SIDEVIEW MIRROR SYSTEM

Preliminary Class

359

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Substitute for form 1449/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT *(Use as many sheets as necessary)*				Application Number	12/851,045
				Filing Date	August 5, 2010
				First Named Inventor	Niall R. Lynam
				Art Unit	2872
				Examiner Name	
Sheet	1	of	12	Attorney Docket Number	DON09 P-1624

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number / Number-Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		7,636,188	2009-12-22	Baur et al.	
		7,626,749	2009-12-01	Baur et al.	
		7,581,859	2009-09-01	Lynam	
		7,526,103	2009-04-28	Schofield et al.	
		7,492,281	2009-02-17	Lynam et al.	
		7,423,522	2008-09-09	O'Brien et al.	
		7,420,756	2008-09-02	Lynam	
		7,400,435	2008-07-15	Byers et al.	
		7,391,563	2008-06-24	McCabe et al.	
		7,377,675	2008-05-27	Pastrick et al.	
		7,370,983	2008-05-13	DeWind et al.	
		7,345,680	2008-03-18	David	
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		7,289,037	2007-10-30	Uken et al.	
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		7,126,456	2006-10-24	Boddy et al.	
		7,106,392	2006-09-12	You	
		7,097,312	2006-08-29	Platzer, Jr.	
		7,038,577	2006-05-02	Pawlicki et al.	
		7,005,974	2006-02-28	McMahon et al.	
		6,979,090	2005-12-27	Wnuk	
		6,932,483	2005-08-23	Strumolo et al.	
		6,919,796	2005-07-19	Boddy et al.	
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		6,831,268	2004-12-14	Bechtel et al.	
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		6,757,109	2004-06-29	Bos	
		6,742,904	2004-06-01	Bechtel et al.	

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(Use as many sheets as necessary)				Filing Date	August 5, 2010
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				Art Unit	2872
				Examiner Name	
Sheet	2	of	12	Attorney Docket Number	DON09 P-1624

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		6,737,629	2004-05-18	Nixon et al.	
		6,731,205	2004-05-04	Schofield et al.	
		6,719,215	2004-04-13	Drouillard	
		6,717,712	2004-04-06	Lynam et al.	
		6,717,610	2004-04-06	Bos et al.	
		6,709,119	2004-03-23	Gillich et al.	
		6,690,268	2004-02-10	Schofield et al.	
		6,669,109	2003-12-30	Ivanov et al.	
		6,648,477	2003-11-18	Hutzel et al.	
		6,642,851	2003-11-04	DeLine et al.	
		6,627,918	2003-09-30	Getz et al.	
		6,615,438	2003-09-09	Franco	
		6,595,649	2003-07-22	Hoekstra et al.	
		6,582,109	2003-06-24	Miller	
		6,537,138	2003-03-25	Ohmori et al.	
		6,522,451	2003-02-18	Lynam	
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		6,390,632	2002-05-21	Palathingal	
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		6,320,282	2001-11-20	Caldwell	
		6,318,870	2001-11-20	Spooner et al.	

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		6,315,419	2001-11-13	Platzer, Jr.	
		6,310,611	2001-10-30	Caldwell	
		6,294,989	2001-09-25	Schofield et al.	
		6,286,965	2001-09-11	Caskey et al.	
		6,276,821	2001-08-21	Pastrick et al.	
		6,270,225	2001-08-07	Goolsby	
		6,260,608	2001-07-17	Kim	
		6,257,746	2001-07-10	Todd et al.	
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		6,164,564	2000-12-26	Franco et al.	
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		6,128,860	2000-10-10	Varaprasad et al.	
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		6,111,684	2000-08-29	Forgette et al.	
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		6,097,023	2000-08-01	Schofield et al.	
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Examiner Signature		Date Considered	

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 4 of 12

Complete if Known	
Application Number	12/851,045
Filing Date	August 5, 2010
First Named Inventor	Niall R. Lynam
Art Unit	2872
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Attorney Docket Number	DON09 P-1624

U. S. PATENT DOCUMENTS

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		6,005,724	1999-12-21	Todd	
		6,002,544	1999-12-14	Yatsu	
		5,980,050	1999-11-09	McCord	
		5,938,320	1999-08-17	Crandall	
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		5,670,935	1997-09-23	Schofield et al.	
		5,669,705	1997-09-23	Pastrick et al.	
		5,669,704	1997-09-23	Pastrick	
		5,669,699	1997-09-23	Pastrick et al.	

Examiner Signature		Date Considered	

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Substitute for form 1449/PTO	Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT *(Use as many sheets as necessary)*	Application Number	12/851,045
	Filing Date	August 5, 2010
	First Named Inventor	Niall R. Lynam
	Art Unit	2872
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Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2 (if known)]	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		5,669,698	1997-09-23	Veldman et al.	
		5,668,663	1997-09-16	Varaprasad et al.	
		5,649,756	1997-07-22	Adams et al.	
		5,644,442	1997-07-01	Lemere	
		5,621,577	1997-04-15	Lang et al.	
		5,621,569	1997-04-15	Schlenke	
		5,610,756	1997-03-11	Lynam et al.	
		5,594,593	1997-01-14	Milner	
		5,594,222	1997-01-14	Caldwell	
		5,587,699	1996-12-24	Faloon et al.	
		5,587,236	1996-12-24	Agrawal et al.	
		5,579,133	1996-11-26	Black et al.	
		5,575,552	1996-11-19	Faloon et al.	
		5,567,360	1996-10-22	Varaprasad et al.	
		5,563,744	1996-10-08	Matsumiya	
		5,559,640	1996-09-24	Vachss et al.	
		5,557,467	1996-09-17	McColgan et al.	
		5,550,677	1996-08-27	Schofield et al.	
		5,535,056	1996-07-09	Caskey et al.	
		5,530,588	1996-06-25	Vivier	
		5,526,195	1996-06-11	Thomas	
		5,525,264	1996-06-11	Cronin et al.	
		5,523,877	1996-06-04	Lynam	
		5,517,367	1996-05-14	Kim et al.	
		5,509,606	1996-04-23	Breithaupt et al.	
		5,497,306	1996-03-05	Pastrick	
		5,497,305	1996-03-05	Pastrick et al.	
		5,483,386	1996-01-09	Carson	
		5,481,409	1996-01-02	Roberts	
		5,446,576	1995-08-29	Lynam et al.	
		5,437,931	2003-08-01	Tsai et al.	
		5,432,643	1995-07-11	Huang	
		5,424,875	1995-06-13	Davis, II	
		5,412,512	1995-05-02	Zebold et al.	
		5,406,414	1995-04-11	O'Farrell et al.	
		5,371,659	1994-12-06	Pastrick et al.	

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		5,361,172	1994-11-01	Schissel et al.	
		5,355,245	1994-10-11	Lynam	
		5,354,965	1994-10-11	Lee	
		5,327,288	1994-07-05	Wellington et al.	
		5,313,335	1994-05-17	Gray et al.	
		5,296,973	1994-03-22	Burke	
		5,295,021	1994-03-15	Swanson	
		5,285,060	1994-02-08	Larson et al.	
		5,262,894	1993-11-16	Wheatley et al.	
		5,253,109	1993-10-12	O'Farrell et al.	
		5,247,395	1993-09-21	Martinez	
		5,239,405	1993-08-24	Varaprasad et al.	
		5,237,459	1993-08-17	Strauss	
		5,237,458	1993-08-17	Polanyi et al.	
		5,233,461	1993-08-03	Dornan et al.	
		5,225,943	1993-07-06	Lupo	
		5,207,492	1993-05-04	Roberts	
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		5,189,537	1993-02-23	O'Farrell	
		5,183,099	1993-02-02	Bechu	
		5,179,471	1993-01-12	Caskey et al.	
		5,178,448	1993-01-12	Adams et al.	
		5,166,833	1992-11-24	Shyu	
		5,151,824	1992-09-29	O'Farrell	
		5,151,816	1992-09-29	Varaprasad et al.	
		5,142,407	1992-08-25	Varaprasad et al.	
		5,140,455	1992-08-18	Varaprasad et al.	
		5,118,540	1992-06-02	Hutchison	
		5,117,346	1992-05-26	Gard	
		5,115,352	1992-05-19	do Espirito Santo	
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		5,085,907	1992-02-04	Smith	
		5,080,492	1992-01-14	Platzer, Jr.	
		5,078,480	1992-01-07	Warszawski	
		5,076,673	1991-12-31	Lynam et al.	

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		5,073,012	1991-12-17	Lynam	
		5,066,112	1991-11-19	Lynam et al.	
		5,052,792	1991-10-01	McDonough	
		5,050,977	1991-09-24	Platzer, Jr.	
		5,044,739	1991-09-03	do Espirito Santo	
		5,033,835	1991-07-23	Platzer, Jr.	
		5,022,747	1991-06-11	Polanyi et al.	
		5,014,167	1991-05-07	Roberts	
		5,005,962	1991-04-09	Edelman	
		4,989,964	1991-02-05	Meise	
		4,948,242	1990-08-14	Desmond et al.	
		4,944,581	1990-07-31	Ichikawa	
		4,932,770	1990-06-12	Caravaty	
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		4,929,074	1990-05-29	Urban	
		4,917,485	1990-04-17	Baldwin, Sr.	
		4,913,542	1990-04-03	Adolfsson	
		4,906,085	1990-03-06	Sugihara et al.	
		4,906,075	1990-03-06	Majsumiya	
		4,882,565	1989-11-21	Gallmeyer	
		4,882,466	1989-11-21	Friel	
		4,859,046	1989-08-22	Traynor et al.	
		4,853,283	1989-08-01	Skolnick	
		4,828,379	1989-05-09	Parsons et al.	
		4,826,289	1989-05-02	Vandenbrink et al.	
		4,824,231	1989-04-25	Quintana	
		4,799,768	1989-01-24	Gahan	
		4,793,690	1988-12-27	Gahan et al.	
		4,773,740	1988-09-27	Kawakami et al.	
		4,770,522	1988-09-13	Alten	
		4,737,188	1988-04-12	Bahls	
		4,733,336	1988-03-22	Skogler et al.	
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		4,715,701	1987-12-29	Urban	
		4,712,879	1987-12-15	Lynam et al.	

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		4,679,906	1987-07-14	Brandenburg	
		4,678,294	1987-07-01	Van Nostrand	
		4,674,850	1987-06-23	Blom	
		4,674,849	1987-06-23	Stewart	
		4,666,264	1987-05-19	Yamabe	
		4,630,904	1986-12-23	Pastore	
		4,629,296	1986-12-16	White	
		4,623,222	1986-11-18	Itoh et al.	
		4,609,266	1986-09-02	Blom	
		4,588,267	1986-05-13	Pastore	
		4,575,202	1986-03-11	McGuire	
		4,555,166	1985-11-26	Enomoto	
		4,549,786	1985-10-29	Albers et al.	
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		4,499,451	1985-02-12	Suzuki et al.	
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		4,449,786	1984-05-22	McCord	
		4,439,013	1984-03-27	Hagn et al.	
		4,436,372	1984-03-13	Schmidt et al.	
		4,436,371	1984-03-13	Wood et al.	
		4,435,042	1984-06-03	Wood et al.	
		4,385,804	1983-05-31	Tamura et al.	
		4,350,412	1982-09-21	Steenblik et al.	
		4,331,382	1982-05-25	Graff	
		4,325,609	1982-04-20	Alford	
		4,311,363	1982-01-19	Marsalka et al.	
		4,311,362	1982-01-19	LaPorte	
		4,306,770	1981-12-22	Marhauer	
		4,303,308	1981-12-01	Kobrin	
		4,293,191	1981-10-06	Kim	
		4,281,899	1981-08-04	Oskam	
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		4,193,668	1980-03-18	Skinner	
		3,909,117	1975-09-30	Takahashi et al.	
		3,884,606	1975-05-20	Schrenk	
		3,881,811	1975-05-06	French	
		3,826,563	1974-07-30	Davis	
		3,806,232	1974-04-23	Gray	
		3,773,882	1973-11-20	Schrenk	
		3,764,201	1973-10-09	Haile	
		3,759,647	1973-09-18	Schrenk et al.	
		3,708,222	1973-01-02	Stern	
		3,667,833	1972-06-06	Baldwin, Sr.	
		3,610,739	1971-10-05	Seashore	
		3,601,614	1971-08-24	Platzer, Jr.	
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		3,408,136	1968-10-29	Travis	
		3,404,935	1968-10-08	Creager	
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		3,375,053	1968-03-26	Ward	
		3,338,655	1967-08-29	Young	
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		3,280,701	1966-10-25	Donnelly et al.	
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		3,170,985	1965-02-23	Katulich	
		3,146,296	1964-08-25	Fischer	
		3,131,250	1964-04-28	Ely	
		3,104,274	1963-09-17	King	
		2,911,177	1959-11-03	West	
		2,890,539	1959-06-16	Holt	
		2,778,273	1957-01-22	Fellmeth	
		2,636,419	1953-04-28	Kerr	
		2,580,014	1951-12-25	Gazda	
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		1,672,559	1928-06-05	Doble	
		1,114,559	1914-10-20	Weed	
		D297,926	1988-10-04	Kesler	
		D493,394	2004-07-27	Lawlor et al.	
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		2007/0032638	2004-02-19	Tonar et al.	
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		2004/0032676	2004-02-19	Drummond et al.	
		2002/0036828	2002-03-28	Wong	
		2003/0043589	2003-03-06	Blank	
		2006/0050018	2006-03-09	Hutzel et al.	
		2005/0078389	2005-04-14	Kulas et al.	
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		2002/0159270	2002-10-31	Lynam et al.	
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		2009/0237820	2009-09-24	McCabe et al.	
		2004/0264011	2004-12-30	Lynam	
		20020105741	08-08-2002	Platzer, Jr.	
		20030117731	06-26-2003	Platzer, Jr.	
		20040165291	08-26-2004	Platzer, Jr.	
		20050232469	10-20-2005	Schofield et al.	
		20050248859	11-10-2005	Platzer, Jr.	
		20060061008	03-23-2006	Karner et al.	
		20060125919	06-15-2006	Camilleri et al.	
		20060171704	08-03-2006	Bingle et al.	
		20060184297	08-17-2006	Higgins-Luthman	
		20060268440	11-30-2006	Platzer, Jr.	
		20070058257	03-15-2007	Lynam	
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		20080212189	09-04-2008	Baur et al.	
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		20080304170	12-11-2008	Zhao	
		20090040306	02-12-2009	Foote et al.	
		20090115631	05-07-2009	Foote et al.	
		RE17274	1929-04-16	Porter	

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		DE 2409748	1975-09-04	Leitz		
		DE 2550095	1976-05-20	Schiff et al.		
		DE 2647592	1978-04-27	Uta		
		DE 2915521	1980-10-30	Docie		
		DE 3302735	1984-08-02	Schulze		X
		DE 3329998	1985-03-07	Horn		X
		DE 3620228	1987-12-17	Thomen		X
		DE 4026578	1992-04-30	Kramer		X
		EP 0210757	1987-02-04	Von Seidel		X
		EP 0310261	1989-04-05	Britax Wingard Limited		X
		EP 0551802	1992-01-15	Jonsson		X
		EP 0791503	1997-08-27	Gentex Corporation		X
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Rückspiegel für Kraftfahrzeuge

Patentansprüche

1. Rückspiegel für Kraftfahrzeuge, dadurch gekennzeichnet, daß zwei Spiegelflächen durch eine horizontale Trennung übereinander angeordnet sind und eine gegenseitig unterschiedliche Winkelstellung aufweisen.

2. Rückspiegel für Kraftfahrzeuge, nach Anspruch 1, dadurch gekennzeichnet, daß die beiden Spiegelflächen durch ein Zwischenstück miteinander verbunden sind und das Zwischenstück Flanschstege aufweist, mit denen die Winkelstellung fixiert ist.

3. Rückspiegel für Kraftfahrzeuge, nach Anspruch 1, dadurch gekennzeichnet, daß die Winkelstellung der beiden Spiegelflächen veränderlich ist durch drehbare Aufhängung von mindestens einem Spiegel.

4. Rückspiegel für Kraftfahrzeuge, nach Anspruch 1 - 3, dadurch gekennzeichnet, daß die zweite Spiegelfläche (B) als Aufsatzteil auf einflächige, marktübliche, Rückspiegel angebracht wird.

Rückspiegel für Kraftfahrzeuge

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Die am Markt bekannten Rückspiegel weisen einen Mangel auf, der eine große Verunsicherung für den Kraftfahrer bedeutet: zwischen dem Sichtwinkel des Auges und dem Sichtwinkelbereich des Rückspiegels liegt ein sogenannter "toter" Sichtwinkelbereich. Dieser kann bezogen auf die Überholspur einige Wagenlängen ausmachen.

Diesen Mangel stellt weitgehend die vorliegende Erfindung ab. Sie wird gemäß der beiliegenden Zeichnung beschrieben.

Der normalerweise einflächige Spiegel wird durch zwei übereinander angeordnete Spiegel (in Abb. I) (A) und (B) ersetzt und durch das Kupplungsstück C in der horizontalen Trennungslinie miteinander gekoppelt. Gemäß Abb. II (Sicht von oben) sind beide Spiegel gegeneinander winkelversetzt. Der Spiegel (A) ist in der bisher bekannten Normalstellung angeordnet, während der Spiegel (B) den toten Winkelbereich einfängt. Gemäß Abb. III wird vorgeschlagen, durch das Zwischenstück (C) die beiden Spiegel zueinander zu fixieren, wobei der Spiegel (B) in der Führungsrille (1) fixiert ist und der Spiegel (A) in der Führungsrille (2).

Beide Spiegel können auch gegenseitig beweglich gelagert werden, auch aus dem Wageninneren bedienbar, was jedoch auf das Wesen der Erfindung keinen Einfluß hat. Das gleiche gilt auch, wenn der Spiegel (B) als Aufsatzspiegel zu einem vorhandenen Rückspiegel getrennt geliefert wird.

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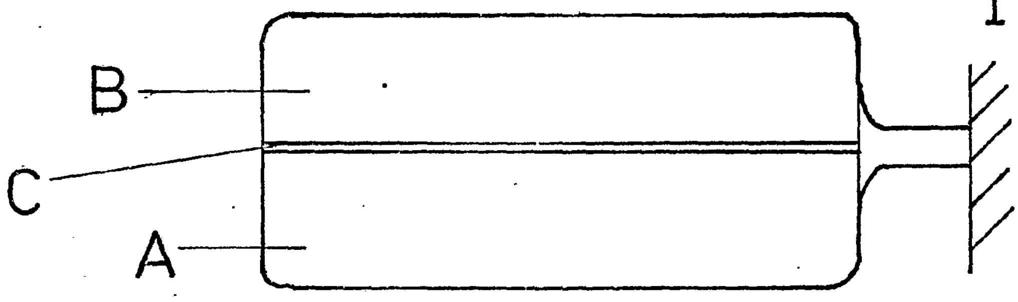
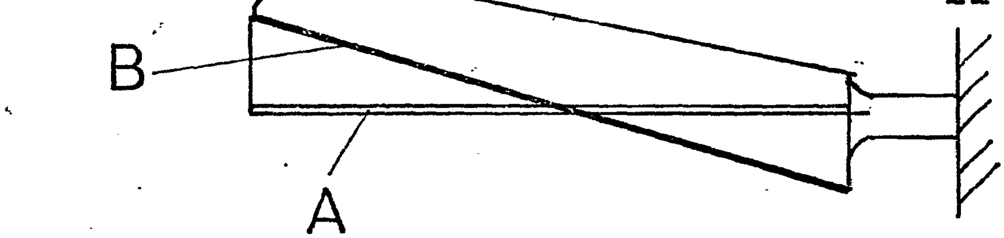
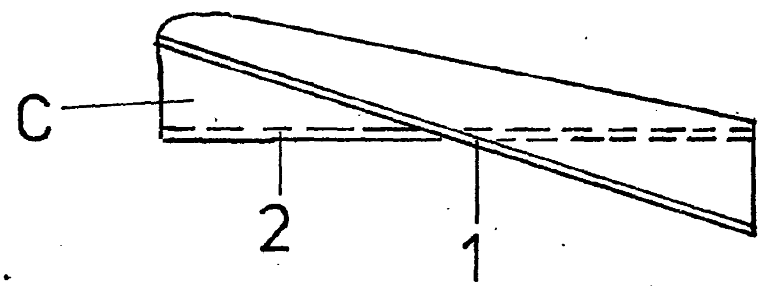
I



II



II



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Rückspiegel

Die Erfindung betrifft einen Rückspiegel, insbesondere Aussenrückspiegel für ein Fahrzeug, mit einem reflektierenden Haupt-Flächenbereich für eine direkte Sicht nach hinten und wenigstens einem an den Haupt-Flächenbereich angrenzenden zweiten Flächenbereich für eine Sicht seitlich am Fahrzeug nach hinten, Die Erfindung betrifft insbesondere einen Rückspiegel, der aussen an einem Fahrzeug, beispielsweise an einem Lastwagen oder einem Kraftfahrzeug angebracht werden kann.

Aussen-Rückspiegel für Fahrzeuge sind üblicherweise aus Glas hergestellt und eben, oder leicht konvex, um eine begrenzte Rückblick- oder Raumwirkung zu erzielen. Derartige konvexe Glasspiegel weisen jedoch den Nachteil auf, dass es in der Praxis schwierig ist, diese Spiegel mit unterschiedlichen Krümmungsradien oder mit relativ kleinen Krümmungsradien herzustellen. Daher treten zwei schwerwiegende Nachteile auf. Weil der Krümmungsradius dieser bekannten Spiegel immer relativ gross sein muss, ist es daher nur dadurch möglich, das Gesichtfeld zu vergrössern, dass die Abmessungen des Spiegels, d. h. die Spiegelhöhe und -breite vergrössertwerden.Das führt jedoch zu relativ teuren Spiegeln und ein grosser aussen angebrachter Rückspiegel kann die Sicht des Fahrers nach vorn wesentlich beeinträchtigen. Der zweite Nachteil besteht im wesentlichen darin, dass es in der Praxis relativ aufwendig und schwierig ist, einen Fahrzeugrückspiegel aus Glas herzustellen, der einen Krümmungsradius aufweist, der sich über die Breite und/oder Höhe des Spiegels hinweg ändert. Es ist in der Praxis daher aufwendig, teuer und unvorteilhaft, einen Spiegel herzustellen, der teilweise eben und teilweise konvex ist. Konvexe Spiegel führen notwendigerweise zu einer Verkleinerung des reflektierten Bildes, wodurch für den Fahrer Schwierigkeiten bei der Abschätzung der Entfernungen, der Stellungen und Geschwindigkeiten bei Fahrzeugen auftreten, die von hinten kommen.

Als Kompromiss ist es bekannt, einen Aussenspiegel für Fahrzeuge aus zwei getrennten, reflektierenden Teilen zusammenzusetzen. Der grössere Spiegelteil ist normalerweise ein ebener Spiegel und der andere Spiegelteil ist ein konvexer Spiegel, der unmittelbar an den ebenen Spiegel anschliesst, um ein vergrössertes Gesichtsfeld zu schaffen. Eine solche Anordnung ist in der GB-PS 1 133 005 beschrieben. Abgesehen von der Tatsache, dass diese zusammengesetzten Spiegel in der Herstellung teuer sind, weisen sie auch erhebliche Nachteile dadurch auf, dass das Bild unstetig, d. h. nicht kontinuierlich ist. Ein durch solche Spiegel erzeugtes Bild tritt an der Seite des ebenen Spiegels auf und erscheint nicht gleichzeitig in dem an den ebenen Spiegel anschliessenden Randbereich des konvexen Spiegels. Der Fahrer sieht daher oft gleichzeitig zwei getrennte Spiegelbilder eines von hinten kommenden Fahrzeugs, und zwar ein Spiegelbild im ebenen Spiegelteil und das andere Spiegelbild im konvexen Spiegelteil.

Der Erfindung liegt daher die Aufgabe zugrunde, einen Rückspiegel, insbesondere einen Aussenrückspiegel für Fahrzeuge zu schaffen, der relativ kostengünstig hergestellt werden kann, optimale optische Eigenschaften im Hinblick auf die Verwendungsart aufweist und keine diskontinuierlichen Spiegelbilder erzeugt. Darüberhinaus soll der Rückspiegel leichter als die üblichen Glasspiegel ähnlicher Abmessungen sein und soll wesentlich mehr komplexe optische Reflexionsflächen als die bekannten Glasspiegel aufweisen, ohne dass dadurch höhere Kosten entstehen.

Diese Aufgabe wird erfindungsgemäss dadurch gelöst, dass der erste und der zweite Flächenbereich in Form eines einzigen reflektierenden Teils ausgebildet ist, das aus einem einstückigen Kunststoff-Formstück besteht, dass die Reflexionseigenschaften des oder der zweiten Flächenbereiche den Reflexionseigenschaften eines üblichen konvexen oder azylindrischen Spiegels entsprechen und sich von den Reflexionseigenschaften des Haupt-Flächenbereiches unterscheiden, und daß die Übergänge zwischen den Flächenbereich so ausgebildet sind, dass beim Gebrauch des Rückspiegels keine Bild-Diskontinuitäten auftreten und die zweiten Flächenbereiche stetig ineinander übergehen, wenn das Formstück zwei oder mehr zweite Flächenbereiche aufweist.

Üblicherweise ist kein zweiter Spiegelflächenbereich zwischen der Fahrzeugkarrosserie und dem der Karrosserie zugewandten Rand des reflektierenden Teils angeordnet, da der reflektierende Haupt-Flächenbereich eine ausreichende Sicht nach hinten an der Seite des Fahrzeugs ermöglicht. Daher ist wenigstens eine Kante des Haupt-Flächenbereiches eine Kante des reflektierenden Teils. Der eine zweite Flächenbereich, oder mehrere dieser Flächenbereiche sind so ausgebildet, dass sie einen Blick sowohl nach hinten, als auch seitlich am Fahrzeug vorbei ermöglichen, d. h. dass sie die überholenden Fahrzeuge für den

Fahrzeugführer in seinem Gesichtsfeld erscheinen lassen. Um ein grosses Gesichtsfeld zu haben, ist es vorteilhaft, dass die Reflexionseigenschaften dieser Fläche der Reflexionseigenschaften eines üblichen konvexen oder azylindrischen Spiegels entsprechen, dessen Krümmungsradius von der Haupt-Spiegelfäche nach außen abnimmt. Normalerweise ist die zweite Spiegelfläche an der Seite der Haupt-Spiegelfläche angebracht, die bezüglich des Fahrzeuges weiter aussen liegt. Es können auch eine weitere oder mehrere weitere zweite Flächenbereiche vorgesehen werden, um eine zusätzliche Rundblickwirkung zu erzielen, d. h. um eine Sicht nach hinten und nach unten, oder eine Sicht nach hinten bei einem beladenen Lastwagen zu ermöglichen.

Die eine oder mehrere der zweiten Spiegelflächen können eine kontinuierliche, konvexe oder azylindrische Refelxionsfläche aufweisen, wobei in diesem Fall das reflektrierende Teil vorzugsweise in einem Rahmen angebracht ist und die Sichtfläche des reflektierenden Teils eine verschleißfeste Beschichtung aufweist, um Beschädigungen der Sicht- bzw. Spiegelfläche zu verhindern. Es gibt dafür verschiedene Materialien, beispielsweise "Resarit" und "Abcite". Diese Materialien sind flüssig, und werden auf die Spiegelfläche des reflektierenden Teils aufgebracht und trocknen dann. Verschleissfeste Beschichtungen können auch durch Bedampfung im Vakuum erzeugt werden. Die Dicke dieser Schichten hängt von den verwendeten Verfahren und Materialien ab. Die Dicke dieser Schichten kann beispielsweise in einem Bereich von 2×10^{-4} bis 8×10^{-3} cm liegen.

Die eine zweite Fläche, oder jede dieser zweiten Flächenkann mehrere Streifenprismen aufweisen, deren Prismenwinkel von der Hauptspiegelfläche aus nach aussen abnimmt, so dass die Reflexionseigenschaften eines üblichen konvexen oder azylindrischen Spiegels erzielt werden. In diesen Fällen ist das reflektierende Teil vorteilhafterweise in einem Rahmen angebracht und es ist eine transparente Schutzschicht, bzw. ein transparentes Schutzteil vorgesehen, das vor der Sichtfläche des reflektierenden Teils liegt.

Die für die Halterung des reflektierenden Teils vorgesehenen Rahmen sind vorteilhafterweise so ausgebildet, dass in sie das reflektierende Teil eingesetzt werden kann, wobei die Rahmen mit einem Arm oder einem Bügel am Fahrzeug befestigt sind.

Die Form der reflektierenden Spiegelflächen legt die optischen Eigenschaften des Spiegels fest. Wenn das reflektierende Teil aus Kunststoff hergestellt wird, ist es möglich, der reflektierenden Fläche eine sehr komplizierte Form zu geben (was bei Glas oder Metall völlig unmöglich ist). Die optischen Eigenschaften des erfindungsgemässen Spiegels können daher praktisch ohne Beschränkungen durch entsprechende Ausbildung des reflektierenden Teils gewählt werden. In den meisten Fällen ist es jedoch wünschenswert, dass der Spiegel einen reflektierenden Haupt-Flächenbereich aufweist, der flach oder sphärisch ist, und der wenigstens teilweise von einer oder mehreren zweiten reflektierenden Spiegelflächen umgeben ist, deren Reflexionseigenschaften einer üblichen konvexen, asphärischen oder azylindrischen Spiegelfläche entsprechen. Wenn der Haupt-Flächenbereich falsch ist, sollte der zweite Flächenbereich azylindrisch sein. Wenn der Haupt-Flächenbereich sphärisch ist, sollte der zweite Flächenbereich asphärisch sein.

Weitere vorteilhafte Ausgestaltungen der Erfindung sind in den Unteransprüchen gekennzeichnet.

Die Erfindung wird nachstehend anhand zweier Ausführungsbeispiele, die beide Aussenrückspiegel für ein Fahrzeug, beispielsweise ein Lastwagen, betreffen, beschrieben, wobei auf die Zeichnungen Bezug genommen wird. Es zeigen:

Fig. 1 einen Querschnitt durch einen erfindungsgemässen Spiegel,
Fig. 2 den in Fig. 1 dargestellten Spiegel, wie er aussen am Führerhaus eines Lastkraftwagens angebracht ist,
Fig. 3 eine Vorderansicht des in Fig. 1 dargestellten Spiegels,
Fig. 4 einen weiteren, erfindungsgemässen Spiegel in Aufsicht,
Fig. 5 einen Querschnitt des in Fig. 4 dargestellten Spiegels entlang der Schnittlinie A-A' und

Fig. 6 einen Querschnitt entlang der Schnittlinie B-B' in Fig. 4.

Wie in Fig. 1 dargestellt ist, weist der Spiegel ein reflektierendes Teil 1 auf, das aus einem einstückigen Formteil aus transparentem Kunststoffmaterial besteht und dass eine ebene Sehfläche 2 und eine reflektierende Fläche 3 aufweist. Die Fläche 3 wird in geeigneter Weise durch Aufbringen eines Metallschicht reflektierend gemacht, die mit einer Farb-Schutzschicht beschichtet ist. Die Sehfläche 2 wird durch eine transparente Schutzschicht geschützt, die, wie in den Zeichnungen dargestellt, aus einer Glasscheibe 4 besteht.

Das reflektierende Teil 1 und die Glasscheibe 4 sind an einer Halterungsplatte 5 mit einem Gummiring 6 angebracht, der zwei ringförmige Nuten aufweist, in denen die Aussenkanten der Halterungsplatte 5, der Glasplatte 4 bzw. des reflektierenden Teils 1 liegen. Der Gummiring 6 schafft eine wasserundurchlässige Dichtung. Der Halterungsarm 7, mit dem der Spiegel am Fahrzeug angebracht ist, ist an der Halterungsplatte 5 drehbar befestigt.

Das reflektierende Teil 1 besitzt einen ebenen, reflektierenden Haupt-Flächenbereich 3a auf der linken Seite in Fig. 1. Auf der rechten Seite in Fig. 1 sind auf der azylindrischen reflektierenden Fläche 3 mehrere lineare Prismenflächen 3b vorgesehen, wobei der Prismenwinkel von links nach rechts in Fig. 1 hin kleiner wird. Das vom Spiegel dargestellte Bild besteht aus einem von der reflektierenden Hauptfläche 3a erzeugten Bild und mehreren kleinen durch die Prismen 3b erzeugten Bildern, wobei das Gesichtsfeld der von den Prismen 3b erzeugten Bilder winkelmässig vom Hauptgesichtsfeld des reflektierenden Bereichs 3a in Fig. 1 nach rechts hin zunehmend versetzt sind. Die Prismenbereiche sind so klein gewählt, dass die Teilbilder der Prismenbereiche für das Auge und damit für den Benutzer des Spiegels ein einheitliches Gesatmbild erzeugen. Der Spiegel scheint daher aus einem ebenen Spiegelbereich auf der linken Seite und einem konvexen Spiegelbereich auf der rechten Seite zusammengesetzt zu sein. Der Spiegel besitzt daher ein ausgedehntes, jedoch verkleinertes Gesichtsfeld auf der rechten Seite. Der effektive Krümmungsradius des gekrümmten Spiegelbereichs kann konstant sein oder in Fig. 1 nach rechts hin grösser werden. Der effektive Krümmungsradius hängt von dem Verhältnis bzw. von dem Grad ab, mit dem der Prismenwinkel über den Spiegel hinweg zunimmt.

Wie in Fig. 3 dargestellt ist, ist der Spiegel rechteckig und die Streifenprismen verlaufen senkrecht.

In Fig. 3 ist der Spiegel am Führerhaus eines Lastwagens angebracht. Die eine Neigung aufweisenden Bereiche 3b sind auf der vom Führerhaus abgewendeten Seite des Spiegels angeordnet, so dass der Fahrer ein erweitertes Gesichtsfeld ausserhalb des Lastwagens besitzt, was ihn beispielsweise ermöglicht, überholende Fahrzeuge zu beobachten. Dieses Gesichtsfeld ist in Fig. 2 schematisch durch gestrichelte Linien dargestellt.

Der Spiegel kann auch auf der anderen Seite des Fahrzeugs angebracht sein, wobei er vor der Montage um 180° gedreht wird. Der Spiegel kann auch weitere abgeschrägte Bereiche an der Ober- und Unterseite des Spiegels aufweisen, so dass das Gesichtsfeld des Fahrers nach oben und nach unten hin vergrössert wird.
Wie in den Fig. 4 bis 6 dargestellt ist, weist der Spiegel ein reflektierendes Teil auf, das aus Kunststoff gefertigt ist, und das mit einer optisch reflektierenden Schicht 2, beispielsweise mit einer aufgebrachten Metallschicht aus Aluminium versehen ist. Die Metallschicht kann mit einer Schutzbeschichtung wetterbeständig gemacht werden. Der Spiegel weist einen ebenen Hauptbereich 3 auf, der von drei zweiten azylindrischen Flächenbereichen 4, 5 und 6 umgeben ist. Das reflektierende Teil 1 ist vorteilhafterweise in einem Rahmen angebracht. Es sind Einrichtungen vorgesehen, um den Spiegel außerhalb eines Fahrzeuges, beispiels-

weise ausserhalb eines schweren Lastwagens zu befestigen. Das reflektierende Teil 1 ist mit einer abrieb- bzw. verschleissfesten Schicht 7, beispielsweise in der zuvor beschriebenen Art beschichtet.

Wenn der Spiegel in der in Fig. 4 dargestellten Lage ausserhalb des Führerhauses eines schweren Lastkraftwagens auf der Fahrerseite angebracht ist, verschafft der Bereich 3 dem Fahrer ein unverzerrtes, jedoch eingeschränktes Gesichtsfeld nach hinten, wogegen der Bereich 5 dem Fahrer ein verkleinertes, jedoch wesentlich erweitertes Gesichtsfeld bietet.

Wenn ein Fahrzeug also den Lastkraftwagen überholt, sieht der Fahrzeugführer das überholende Fahrzeug mit dem Bereich 3 zunächst in unverzerrter Form. Wenn das überholende Fahrzeug sich während des Überholvorgangs dem zu überholenden Fahrzeug weiter nähert, bewegt sich das vom Lastwagenfahrer zu beobachtende Bild auf dem Spiegelbereich 3 nach rechts und in den Spiegelbereich 5 hinein. Als Folge davon wird das Bild immer kleiner. Obgleich der Fahrer des Lastkraftwagens jetzt nicht mehr genau die Entfernung des überholenden Fahrzeugs schätzen kann, so kann er doch die winkelmässige Lage des überholenden Fahrzeugs bezüglich des Lastkraftwagens feststellen und die Bewegung des überholenden Fahrzeugs verfolgen, wenn es den Lastkraftwagen überholt. Der Fahrer sieht praktisch nur ein reflektiertes Bild, weil die Spiegelbereiche ineinander übergehen und weil zwischen den Spiegelbereichen keine plötzliche Änderung der Krümmung auftritt. Als Folge davon kann sich das vom Fahrzeugführer wahrgenommene Bild vom Bereich 3 in den Bereich 5 des Spiegels stetig verschieben, ohne dass die Spiegelbereiche 3 und 5 gleichzeitig zwei Bilder erzeugen. Auf diese Weise wird die Sicht bzw. die Wahrnehmung des Fahrers nach hinten wesentlich verbessert, da er immer nur ein Bild in den Spiegelbereichen 3 und 5 sieht.

Die Spiegelbereiche 4 und 6 wirken in der gleichen Weise wie der Spiegelbereich 5 und erweitern das Gesichtsfeld des Spiegelbereichs 3 nach hinten, jedoch in senkrechter Richtung. In entsprechender Weise sind die Spiegelbereiche 4 und 6 so angeordnet, dass der Fahrer nur ein reflektiertes Bild sieht.

Der in den Zeichnungen dargestellte Spiegel kann auch auf der anderen Seite des Führerhauses ausserhalb desselben angebracht werden, wobei der Spiegel lediglich um 180° gedreht werden muss.

Ansprüche

1. Rückspiegel, insbesondere Aussenrückspiegel für ein Fahrzeug, mit einem reflektierenden Haupt-Flächenbereich für eine direkte Sicht nach hinten und wenigstens einem an den Haupt-Flächenbereich angrenzenden zweiten Flächenbereich für eine Sicht seitlich am Fahrzeug nach hinten, dadurch gekennzeichnet, dass der erste (3a) und der zweite (3b) Flächenbereich in Form eines einzigen reflektierenden Teils (1) ausgebildet ist, das aus einem einstückigen Kunststoff-Formstück besteht, dass die Reflexionseigenschaften des oder der zweiten Flächenbereiche (3b) den Reflexionseigenschaften eines üblichen konvexen oder azylindrischen Spiegels entsprechen und sich von den Reflexionseigenschaften des Haupt-Flächenbereiches (3a) unterscheiden, daß die Übergänge zwischen den Flächenbereichen so ausgebildet sind, daß beim Gebrauch des Rückspiegels keine Bild-Diskontinuitäten auftreten und die zweiten Flächenbereiche (3b) stetig ineinander übergehen, wenn das Formstück (1) zwei oder mehr zweite Flächenbereiche (3b) aufweist.

2. Rückspiegel nach Anspruch 1, dadurch gekennzeichnet, dass wenigstens ein Rand des Haupt-Flächenbereiches (3a) gleichzeitig ein Rand des reflektierenden Teils (1) ist.

3. Rückspiegel nach Anspruch 1 oder 2, dadurch gekennzeichnet, dass der oder die zweiten Flächenbereiche (3b) mehrere Streifenprismen aufweisen, deren Prismenwinkel vom Haupt-Flächenbereich (3a) nach aussen abnimmt, so dass die Reflexionseigenschaften eines üblichen konvexen oder azylindrischen Spiegels erhalten werden.

4. Rückspiegel nach Anspruch 3, dadurch gekennzeichnet, dass das reflektierende Teil (1) in einem Rahmen (6) befestigt

ist und ein transparentes Schutzteil (4) vor der Sichtfläche des reflektierenden Teils (1) vorgesehen ist.

5. Rückspiegel nach Anspruch 1 oder 2, dadurch gekennzeichnet, dass der oder die zweiten Flächenbereiche (3b,) eine stetige, konvexe Reflexionsfläche darstellen.

6. Rückspiegel nach Anspruch 5, dadurch gekennzeichnet, dass das reflektierende Teil (1) in einem Rahmen (6) befestigt ist und sich auf der Sichtfläche des reflektierenden Teils (1) eine verschleissfeste Schicht befindet.

7. Rückspiegel nach wenigstens einem der Ansprüche 1 bis 6, dadurch gekennzeichnet, daß der Haupt-Flächenbereich (3a) eben ist und die Reflexionseigenschaften des oder der zweiten Flächenbereiche (3b) denen eines üblichen azylindrischen Spiegels entsprechen, dessen Krümmungsradius vom Haupt-Flächenbereich (3a) nach außen hin abnimmt.

8. Rückspiegel nach wenigstens einem der Ansprüche 1 bis 6, dadurch gekennzeichnet, daß der Haupt-Flächenbereich (3a) sphärisch ist und die Reflexionseigenschaften des oder der zweiten Flächenbereiche (3b) denen eines üblichen asphärischen Spiegels entsprechen, dessen Krümmungsradius vom Haupt-Flächenbereich (3a) nach außen hin abnimmt.

9. Rückspiegel nach wenigstens einem der Ansprüche 1 bis 9, dadurch gekennzeichnet, daß dieser außen an einem Fahrzeug angebracht ist.

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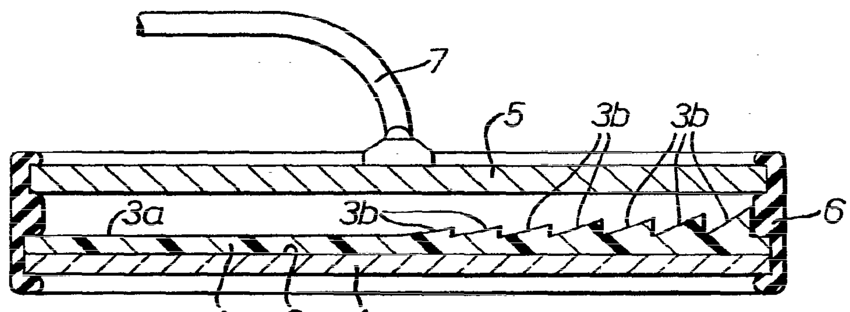

FIG.1.

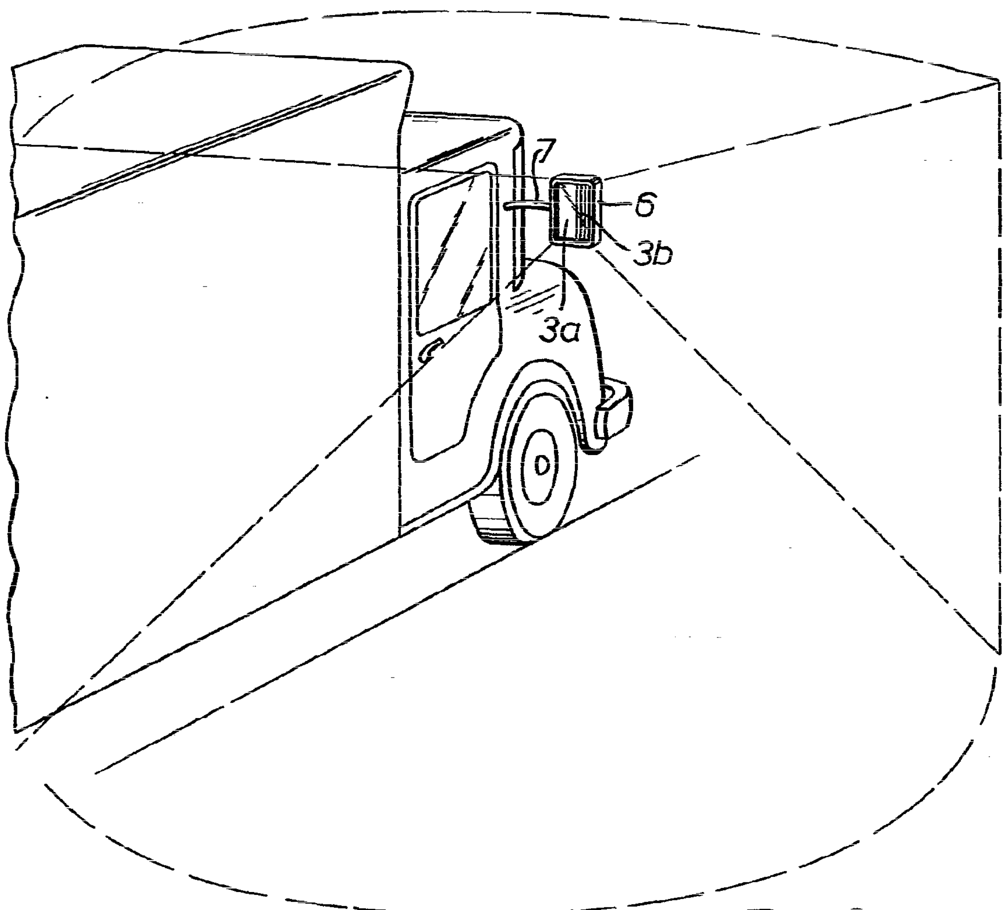

FIG.2.

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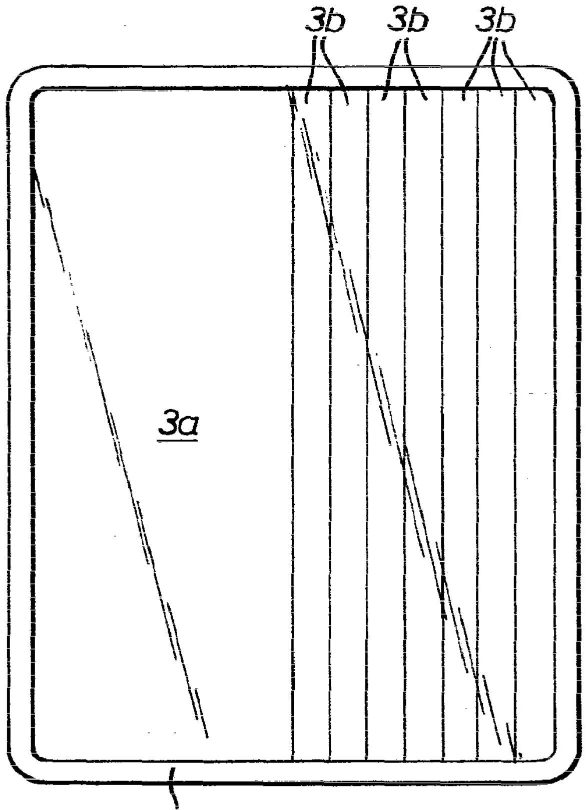

FIG.3.

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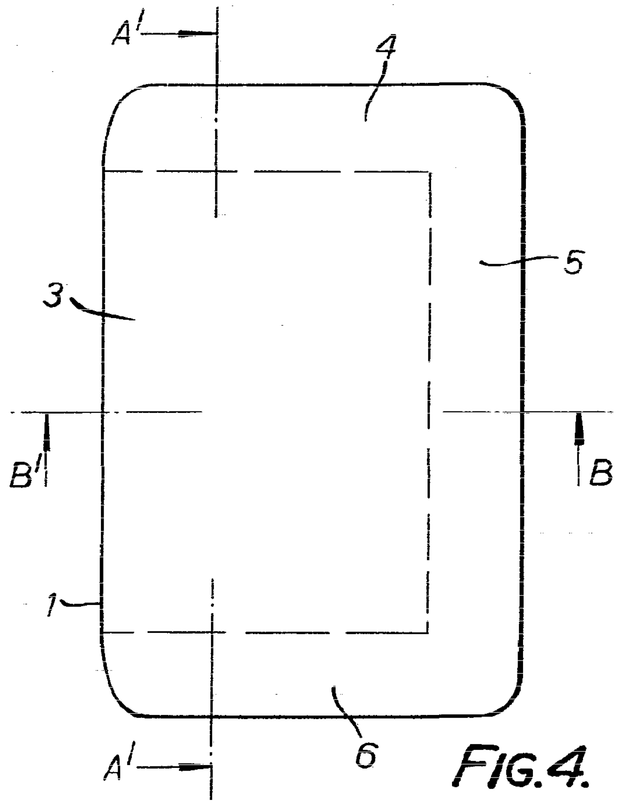

FIG.4.

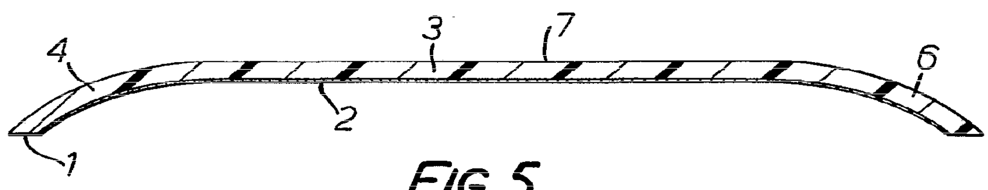

FIG.5.

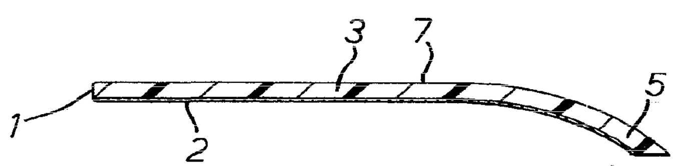

FIG.6.

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(71) Anmelder: Marhauer geb. Niederstadt, Uta, 3000 Hannover

(72) Erfinder: gleich Anmelder

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Patentansprüche

1. Rückspiegel für Fahrzeuge mit zwei im Winkel zueinander verlaufenden Spiegelflächen, dadurch gekennzeichnet, daß die Spiegelflä-che (4) für den toten Winkel des Fahrzeuges als gesonderter, zusätzlicher Spiegelkörper (3) auf keilförmig ansteigendem Untergrund ausgebildet ist, der auf einem Teil der normalen Rückspiegelfläche (2) leicht anbringbar eingerichtet ist.

2. Rückspiegel nach Anspruch 1, dadurch gekennzeichnet, daß der zusätzliche Spiegelkörper (3) aus einem keilförmig ansteigendem Untergrund besteht, der an seiner ebenen Rückfläche mit einer Haftmittelschicht (7) und einer leicht abziehbaren Deckfolie versehen ist.

3. Rückspiegel nach Anspruch 1, dadurch gekennzeichnet, daß die zusätzliche Rückspiegelfläche für den toten Winkel des Fahrzeugs kleiner als die normale Rückspiegelfläche, etwa 1/3 derselben, ausgeführt ist.

4. Rückspiegel nach Anspruch 1, dadurch gekennzeichnet, daß der zusätzliche Rückspiegelkörper (3) an der dem Fahrzeug abgewandten Seite an dem Rand der normalen Rückspiegelfläche anliegt und von diesem Rand nach dem Fahrzeug zu keilförmig ansteigt.

5. Rückspiegel nach Anspruch 1, dadurch gekennzeichnet, daß der zusätzliche Rückspiegel an seinem dem Fahrzeug abgewandten Umfangrand dem Umfangrand des normalen Rückspiegels angepaßt ist.

6. Rückspiegel nach Anspruch 1, dadurch gekennzeichnet, daß die normale Rückspiegelscheibe (2) mit dem Rückspiegelkörper (3) und dessen zusätzlicher Spiegelscheibe (4) einstückig verbunden und auf einer Grundplatte des Rückspiegelhalters (1) auswechselbar angebracht ist.

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Rückspiegel für Fahrzeuge

Die Erfindung betrifft einen Rückspiegel für Fahrzeuge mit zwei im Winkel zueinander verlaufenden Spiegelflächen, von denen die eine ein normaler Rückspiegel ist und die andere für den toten Winkel des Fahrzeuges bestimmt ist. Die Ausnutzung dieser für die Verkehrssicherheit wichtigen Anordnung scheitert bisher meist daran, daß der gewöhnlich vorhandene normale Rückspiegel nur mit hohem Kostenaufwand durch einen neuen Rückspiegel mit zwei Spiegelflächen ersetzt werden muß, was gewöhnlich unterbleibt. Versuche zur Schaffung eines Rückspiegels für den toten Winkel neben dem normalen Rückspiegel entsprechen meist den Sicherheitsvorschriften und -notwendigkeiten nicht ausreichend.

Erfindungsgemäß wird diesem Mangel dadurch abgeholfen, daß die Rückspiegelfläche für den toten Winkel am Fahrzeug als gesonderter, zusätzlicher Spiegelkörper auf keilförmig ansteigendem Untergrund ausgebildet ist, der auf der normalen Rückspiegelfläche leicht anbringbar eingerichtet ist. Der als zusätzlicher Spiegelköpper auf keilförmig ansteigendem Untergrund ausgeführte Rückspiegelteil ist auf seiner Rückfläche eben ausgeführt und mit einem Haftmittel sowie einer abziehbaren Deckfolie versehen. Der zusätzliche Rückspiegelkörper liegt ferner an der dem Fahrzeug abgewandten Seite an dem Rand des normalen Rückspiegels an und steigt keilförmig nach der gradlinig zwischen ihm und der normalen Rückspiegelfläche verlaufenden Kante an.

Weitere Einzelheiten und Vorteile der Erfindung sind in der Beschreibung im Zusammenhang mit der Zeichnung näher erläutert.

In der Zeichnung sind einige Ausführungsbeispiele des Gegenstandes der Erfindung schematisch dargestellt. Es zeigt:

Fig. 1 einen normalen Rückspiegel mit auf dessen halber Spiegelfläche angebrachtem gesondertem, zusätzlichem Spiegelkörper mit keilförmiger Rückspiegelfläche für den toten Winkel in Ansicht,

Fig. 2 einen Schnitt nach der Linie II-II der Fig. 1.

Fig. 3 eine Ausführungsform des zusätzlichen Rückspiegels mit kreisbogenförmigem Außenrand des zusätzlichen Rückspiegels,

Fig. 4 eine Ausführungsform des Außenrandes des zusätzlichen Rückspiegels mit ovalem Außenrand,

Fig. 5 eine Ausführungsform des zusätzlichen Rückspiegels mit abgerundeten Ecken des Außenrandes,

Fig. 6 eine Gesamtansicht eines Doppelrückspiegels mit im normalen Rückspiegel und im Rückspiegel für den toten Winkel angedeuteten Fahrzeugen.

In der Zeichnung ist 1 der normale Rückspiegel eines Fahrzeuges mit der Spiegelfläche 2, auf deren dem Fahrzeug abgekehrten Seite auf einem keilförmig nach dem Fahrzeug ansteigendem Untergrundkörper 3 eine zusätzliche Spiegelfläche 4 für den toten Winkel des Fahrzeuges angebracht ist. Fig.2 Der Neigungswinkel des keilförmigen Anstiegs des Untergrundkörpers beträgt etwa 4 bis 6 Grad zur Normalrückspiegelfläche 2. Es empfiehlt sich, den normalen Rückspiegel 1 mit einem Randwulst 6 zu versehen. Die Rückfläche des keilförmigen, zusätzlichen Spiegelkörpers 3 aus Kunststoff oder einem anderen Baustoff ist eben ausgeführt und mit einer Haft- oder Klebschicht 7 versehen, die bis zur Anbringung des zusätzlichen Spiegelkörpers 3 auf der normalen Rückspiegelfläche 2 mit einer nicht dargestellten abziehbaren Deckfolie abgedeckt ist. Der zusätzliche Spiegelkörper 3 ist an seinen Außenrändern den Umrissen des normalen Rückspiegelhalters angepaßt und weist auf der dem Fahrzeug zugekehrten Seite eine gerade Kante 8 auf, die von der normalen Rückspiegelfläche 2 etwas hervorsteht. Die Figuren 3 bis 5 zeigen einige vorhandenen Rückspiegeln angepaßte Umrisse des zusätzlichen Rückspiegels an. Figur 6 zeigt einen Doppelspiegel mit im normalen Rückspiegel 1 und im zusätzlichen Rückspiegel 4 angedeuteten Fahrzeugen.

In manchen Fällen der Praxis kann auch die normale Rückspiegelfläche 2 mit dem zusätzlichen Spiegelkörper 3 vereint einstückig hergestellt und mit einer rückwärtigen Haft- oder Klebschicht sowie einer Abdeckfolie versehen und auswechselbar auf einer ebenen Grundfläche eines Rückspiegelhalters angebracht werden. Dabei wird dann beim Schadhaftwerden der Rückspiegelflächen 2, 4 die Erneuerung des ganzen kombinierten Rückspiegels vermieden.

Das dargestellte und beschriebene Ausführungsbeispiel des Gegenstandes der Erfindung kann in Anpassung an die jeweiligen Fälle oder Wünsche der Praxis in den Einzelheiten zahlreiche Abänderungen erfahren, ohne daß der Bereich der Erfindung verlassen wird.

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NACHGEREICHT

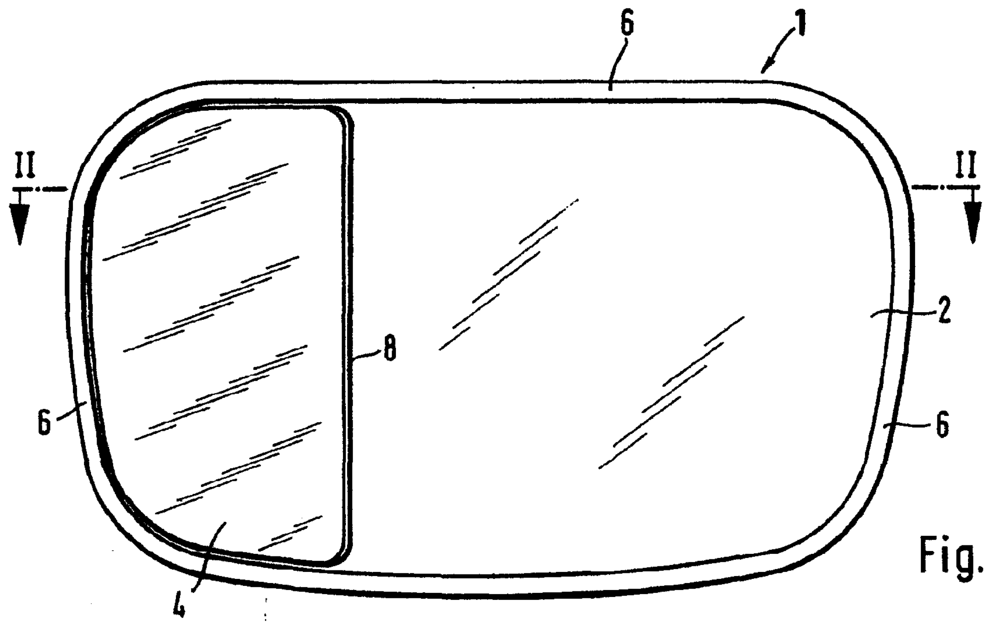

Fig. 1

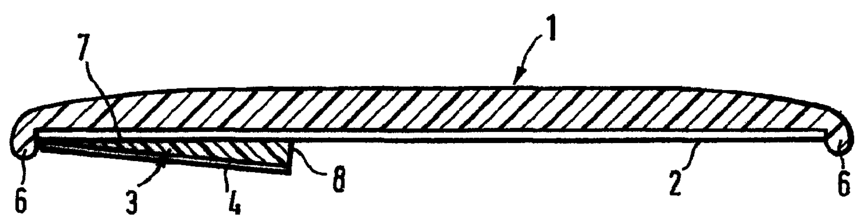

Fig. 2

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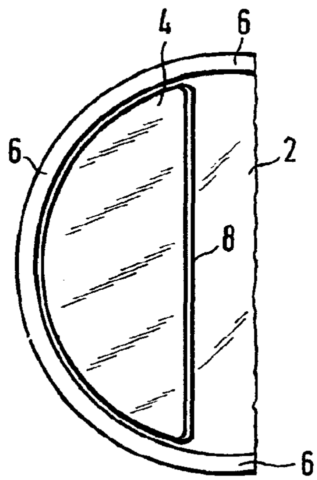

Fig. 3

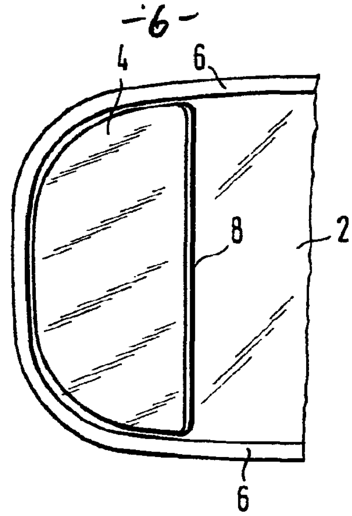

Fig.4

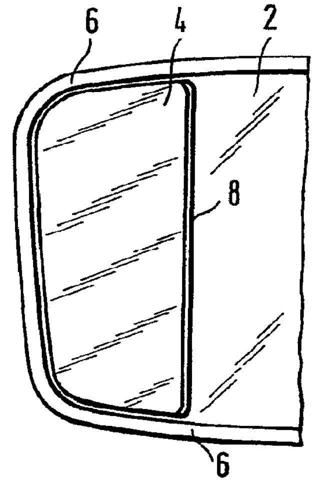

Fig. 5

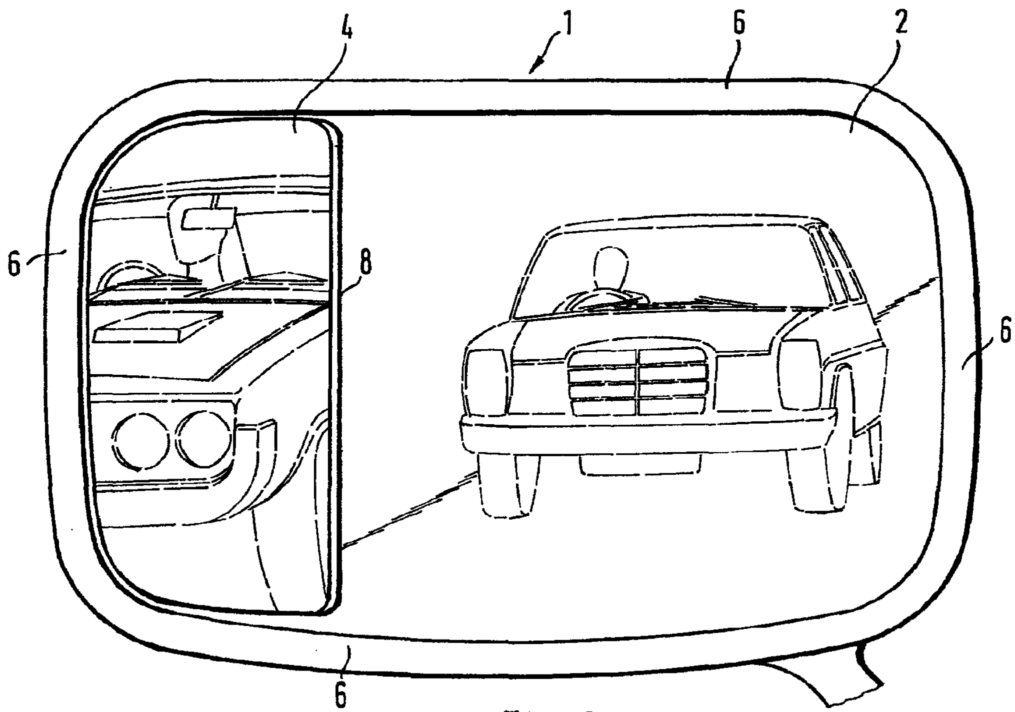

Fig. 6

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(54) Bezeichnung: Spiegelanordnung mit einem Primärspiegel

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17. April 1979 Ho/Ba

PATENTANSPRÜCHE

1. Spiegelanordnung mit einem Primärspiegel, dessen Reflexionsfläche durch eine Seitenkante begrenzt ist und welcher normalerweise aus einer seitlich versetzten Position bezüglich der Seitenkante eingesehen wird, derart, daß die Primär-Reflexionsfläche des Primärspiegels in einer ersten Ebene ein vorbestimmtes winkeliges Primärgesichtsfeld vorbestimmter Erstreckung abdeckt, wobei die erste Ebene im wesentlichen senkrecht zur Seitenkante und bezüglich der Primärreflexionsfläche verläuft, dadurch gekennzeichnet, daß der Primärspiegel (10) einen Hilfsspiegel (13) trägt, welcher beträchtlich kleinere Abmessungen als der Primärspiegel besitzt und sich nahe der Seitenkante des Primärspiegels befindet, derart, daß der Hilfsspiegel unter Abstand zu einer entgegengesetzten Seitenkante des Primärspiegels endet und ein beträchtlicher primärer Reflexionsbereich dazwischen verbleibt, daß der Hilfsspiegel (13) eine bogenförmig verlaufende Reflexionsfläche (15, 16) aufweist, welche in der ersten Ebene, im wesentlichen senkrecht bezüglich der Seitenkante und der primären Reflexionsfläche des Primärspiegels, ein Hilfsgesichtsfeld vorbestimmter

Erstreckung abdeckt, wobei das Gesichtsfeld des Hilfsspiegels beträchtlich größer ist als das winkelige primäre Gesichtsfeld der Reflexionsfläche des Primärspiegels, derart, daß sich das Gesichtsfeld (Y) des Hilfsspiegels wenigstens teilweise deckend mit dem winkeligen Gesichtsfeld (X) des Primärspiegels erstreckt und sich in von der Seitenkante abgewandter Richtung über das Gesichtsfeld des Primärspiegels als auch über die Reflexionsfläche des Primärspiegels bezüglich des Gesichtspunktes hinaus erstreckt.

2. Spiegelanordnung nach Anspruch 1, dadurch gekennzeichnet, daß die Reflexionsfläche des Hilfsspiegels bezüglich der Reflexionsfläche des Primärspiegels so angeordnet ist, daß die Ebenen der entsprechenden Winkel-Gesichtsfelder co-planar sind.

3. Spiegelanordnung nach Anspruch 2, dadurch gekennzeichnet, daß das winkelige Gesichtsfeld des Hilfsspiegels im wesentlichen das gesamte winkelige Gesichtsfeld des primären Spiegels in diesen Ebenen umfasst.

4. Spiegelanordnung nach Anspruch 3, dadurch gekennzeichnet, daß die entsprechenden Winkel-Gesichtsfelder an einer Begrenzung zusammenfallen.

5. Spiegelanordnung nach Anspruch 1, dadurch gekennzeichnet, daß die Reflexionsfläche des Hilfsspiegels bogenförmig gekrümmt ist, derart, daß ein größeres winkeliges Gesichtsfeld als das des Primärspiegels besteht, wobei dieses Gesichtsfeld in einer zweiten Ebene im wesentlichen senkrecht

zur erstgenannten Ebene verläuft.

6. Spiegelanordnung nach Anspruch 5, dadurch gekennzeichnet, daß das winkelige Gesichtsfeld des Hilfsspiegels in der zweiten Ebene das winkelige Gesichtsfeld der Reflexionsfläche des Primärspiegels abdeckt.

7. Spiegelanordnung nach Anspruch 6, dadurch gekennzeichnet, daß sich das winkelige Gesichtsfeld der Reflexionsfläche des Hilfsspiegels über das Gesichtsfeld des Primärspiegels nur in einer Richtung bezüglich der ersten Ebene hinaus erstreckt.

8. Spiegelanordnung nach Anspruch 1, dadurch gekennzeichnet, daß der Hilfsspiegel beträchtlich kleiner ist als der Primärspiegel, und daß der Hilfsspiegel nahe der Seitenkante des Primärspiegels angeordnet ist und eine Kante senkrecht zur Seitenkante verläuft.

9. Spiegelanordnung nach Anspruch 1, dadurch gekennzeichnet, daß die Reflexionsfläche des Hilfsspiegels in der ersten Ebene eine Abmessung besitzt, welche größer ist als die Abmessung innerhalb der zweiten Ebene.

10. Spiegelanordnung nach Anspruch 1, dadurch gekennzeichnet, daß der Hilfsspiegel an der Außenfläche des Primärspiegels befestigt ist.

11. Spiegelanordnung nach Anspruch 10, dadurch gekennzeichnet, daß der Hilfsspiegel ein Element mit einer Reflexionsfläche umfasst, welche in der Außenfläche befestigt ist.

12. Spiegelanordnung nach Anspruch 11, dadurch gekennzeichnet, daß das Element am Primärspiegel befestigt ist.

13. Spiegelanordnung nach Anspruch 11, dadurch gekennzeichnet, daß das Element integral mit dem Primärspiegel angeordnet ist.

14. Spiegelanordnung nach Anspruch 1, dadurch gekennzeichnet, daß die Reflexionsfläche des Hilfsspiegels integral im Primärspiegel ausgebildet ist.

15. Spiegelanordnung nach Anspruch 1, dadurch gekennzeichnet, daß die Reflexionsfläche des Hilfsspiegels an einer Innenfläche einer gleichförmig dicken Hülle angeordnet ist.

Spiegelanordnung mit einem Primär-
spiegel

Spiegel für Fahrzeuge sind herkömmlicher Weise mit einer ebenen Reflexionsfläche ausreichender Größe versehen, um dem Fahrer ein Gesichtsfeld zu vermitteln. Diese Spiegel sind entweder im Inneren des Fahrzeuges als Rückspiegel angeordnet, um durch ein an der Rückseite des Fahrzeuges befindliches Fenster sehen zu können, oder sie sind an der Seitentüre oder am Seitenrahmen einer oder beider Seiten des Fahrzeuges befestigt, um das Gesichtsfeld in seitlicher Richtung zu vergrößern. Die vorliegende Erfindung betrifft primär an der Außenseite befestigte Seitenspiegel, welche an den Türen oder Türrahmen des Fahrzeuges oder an dem vorderen Cotflügel angebracht sind. Obwohl die Aufgabe derartiger Hilfsspiegel in Form von Seitenspiegeln darin besteht, das seitliche gerichtete Sichtfeld für den Fahrer des Fahrzeuges zu erweitern, unterliegen die zur Zeit verfügbaren Spiegel dem Nachteil, daß sie unter Bezug auf das Fahrzeug selbst nicht geeignet sind, ein optimales Gesichtsfeld zu vermitteln.

Es wurden Versuche unternommen, um die Leistungsfähigkeit derartiger Spiegel zu erhöhen, indem Hilfsspiegelanordnungen entweder unabhängig von den normalen Spiegeln am Fahrzeug angeordnet wurden oder indem sie an den herkömmlichen Seitenspiegeln angebracht wurden. Derartige bisher bekannte Hilfsspiegel bestehen aus einem kreisförmigen oder bogenförmigen Abschnitt einer Kugelhülle, welche mittels Klebemittel auf der Fläche des Primärspiegels befestigbar sind, falls der Primärspiegel ausreichend groß ist, so im Falle von Lastkraftwagen. Alternativ können derartige kugelförmige

Abschnitte an der Außenseite des Fahrzeuges, also unabhängig von anderen Spiegeln, befestigt werden.

Obwohl diese kugelförmigen Spiegelanordnungen ein großes Sicht- bzw. Gesichtsfeld vermitteln, erstreckt sich dieses auf einen Winkelbereich von 360°, d.h. der Vorteil dieser Gesichtsfeldvergrößerung besteht darin, daß dem Fahrer des Fahrzeuges ein stark verzerrtes Umfangs-Feld vermittelt wird. Eine derartige Verzerrung hat zur Folge, daß die Sicherheit stark beeinträchtigt ist. Ein derartiger Spiegel erzeugt ein Sicht- oder Gesichtsfeld, welches sich über einen weiten und auch unwichtigen Seitenteil des Fahrzeugs erstreckt und welcher auch bezüglich des Fahrzeuges nach oben und nach unten gerichtete große Bereiche abdeckt. Diese Bereiche sind für den Fahrer und für die sichere Bedienung des Fahrzeuges nur von untergeordneter Bedeutung oder bedeutungslos.

Derartige kreisförmige bzw. kugelförmige Spiegel als auch andere zylindrisch-konvexe Ausführungsformen, welche geschaffen wurden, um die Nachteile des blinden Blickwinkels von herkömmlichen ebenen Reflexionsflächen zu überwinden, haben infolgedessen nicht die erwünschten Ergebnisse erbracht. Obwohl derartige Spiegel dem Wunsche entsprechen, ein vergrößertes Gesichtsfeld für den Fahrer des Fahrzeuges zu erzeugen, vermitteln sie gleichzeitig ein beträchtlich größeres Gesichtsfeld als für den nutzbringenden Einsatz erforderlich ist. Infolgedessen beeinträchtigen derartige Spiegel den Fahrer und setzen die Sicherheit herab, welche ursprünglich beabsichtigt ist.

Davon ausgehend wurde ein zusammengesetzter bzw. kombinierter Spiegel geschaffen, bei welchem der Hauptteil oder

Primärabschnitt des Spiegels den herkömmlichen Zwecken dient, d.h. der Spiegel besitzt eine ebene Reflexionsfläche, um ein verhältnismäßig schmales winkeliges Gesichtsfeld in horizontaler Ebene zu erzeugen, wobei dieses unmittelbar angrenzend am Fahrzeug sich erstreckend vorgesehen ist, wenn der Spiegel an einer Seite des Fahrzeuges besteht. Der zusammengesetzte oder kombinierte Spiegel nach der Erfindung vermittelt den Vorteil, daß der Fahrer unabhängig davon einen besonderen Bereich an der Seite des Fahrzeuges einsehen kann, welcher einen Seitenwinkel von optimal 90° bezüglich der Längsachse des Fahrzeuges abdeckt. Mit Hilfe eines derartigen Spiegels kann sich ein Fahrer der Anwesenheit eines Fahrzeuges in einem Bereich versichern, welcher bei herkömmlichen und genau eingestellten Spiegeln nicht eingesehen werden kann, da diese Spiegel ein Gesichtsfeld abdecken, welches sich nur zu einem relativ begrenzten Ausmaß seitlich und winkelig nach außen erstreckt.

Ein Segment oder Abschnitt des gekrümmten oder kurvenförmigen Spiegelabschnittes ist innerhalb eines relativ kleinen Teils der Fläche des ebenen Spiegels angebracht. Durch diese Anordnung ist der kurvenförmige und gekrümmte Abschnitt in einem Flächenbereich bezüglich des Primärspiegels placiert, derart, daß das Gesichtsfeld des Primärspiegels im wesentlichen nicht durch den Zusatz des Hilfsspiegels beeinträchtigt ist. Insbesondere befindet sich der Hilfsspiegel in der unteren rechten Ecke eines an der Fahrerseite befestigten Spiegels, während ein entsprechender Spiegel an der Mitfahrerseite den Bereich der unteren linken Ecke einnimmt.

Nachfolgend sind die verschiedenen Verfahren zur Bildung eines kombinierten bzw. zusammengesetzten Spiegels erläutert, d.h. eines Spiegelsystems, mit welchem zwei voneinander getrennte Gesichtsfelder an den Seitenbereichen eines Motor-fahrzeuges abgedeckt werden. Nach einem ersten derartigen Verfahren wird der Hilfsspiegel als separate Einheit am Primärspiegel befestigt, so daß auf diese Weise bereits bestehende Spiegel ergänzt werden und die Vorteile der Erfindung erzielt werden können. Nach einem weiteren Verfahren wird der Primärspiegel so ausgebildet, daß er bereits den Hilfsspiegel enthält. Dieser integral ausgebildete Spiegelteil kann entweder an der Außenseite bzw. der nach außen gerichteten Fläche des Primärspiegels vorgesehen sein oder er kann in er rückwärtigen Fläche ausgebildet werden. Der einzige Unterschied zwischen diesen zwei Verfahren besteht darin, daß die Silberbeschichtung zur Herstellung der Reflexionsfläche im einen Fall an der Außenfläche aufgebracht wird, während sie im anderen Fall an der Rückseite des Primärspiegels aufgebracht wird.

Die Erfindung ist nachfolgend anhand von Ausführungsbeispielen unter Bezugnahme auf die beigefügte Zeichnung erläutert.

Figur 1 ist eine Vorderansicht eines Spiegels nach der Erfindung;

Figur 2 ist eine vergrößerte vertikale Teilschnittansicht von Linie 2-2 in Figur 1;

Figur 3 ist eine vergrößerte vertikale Teilschnittansicht von Linie 3-3 in Figur 1;

Figur 4 ist eine schematische Draufsicht des Gesichtsfeldes des Spiegels;

Figur 5 ist eine der Figur 2 vergleichbare vertikale Teilschnittansicht einer weiteren Ausführungsform des Spiegels;

Figur 6 ist eine Figur 3 vergleichbare vertikale Teilschnittansicht des Spiegels;

Figur 7 ist eine Vorderansicht eines Spiegels gemäß einer weiteren Ausführungsform der Erfindung;

Figur 8 ist eine vergrößerte vertikale Teilschnittansicht von Linie 8-8 in Figur 7;

Figur 9 ist eine vergrößerte vertikale Teilschnittansicht von Linie 9-9 in Figur 7;

Figur 10 ist eine Vorderansicht einer weiteren Ausführungsform eines Spiegels nach der Erfindung;

Figur 11 ist eine vergrößerte vertikale Teilschnittansicht von Linie 11-11 in Figur 10;
und

Figur 12 ist eine vergrößerte vertikale Teilschnittansicht von Linie 12-12 in Figur 10.

In den Figuren 1, 2 und 3 der Zeichnung ist eine grundsätzliche Ausführungsform der Vorrichtung nach der Erfindung dargestellt. In Figur 1 ist ein herkömmlich geformter Seitenblickspiegel 10 ohne zusätzliche Trag- oder Haltebauteile wiedergegeben. Diese Halterungen bilden keinen Bestandteil der vorliegenden Erfindung, d.h. sie sind lediglich erforderlich, den Spiegel an der Seite des Fahrzeuges zu halten.

Da derartige Halterungen oder Befestigungsmittel bekannt sind, wird auf ihre ins einzelne gehende Beschreibung verzichtet.

Der Seitenblickspiegel, als Primärspiegel 10 bezeichnet, ist als ebener Spiegelkörper wiedergegeben, welcher eine flache Platte aus Glas oder aus einem anderen optisch durchlässigen Material aufweist. Auf der Rückseite dieser Platte ist eine Beschichtung 11 aus Silbermaterial oder dergleichen aufgebracht, wie in Figur 2 dargestellt ist. Der dargestellte Primärspiegel 10 ist von herkömmlicher rechtwinkeliger Konfiguration und kann die im allgemeinen verfügbare Größe von 7,5 X 12,5 cm besitzen, wobei die Längsachse horizontal ausgerichtet ist.

An der nach außen gerichteten Fläche 12 des Primärspiegels 10 ist der Sekundärspiegel bzw. Hilfsspiegel 13 gemäß der Erfindung befestigt. In der besonderen Ausführungsform nach der Erfindung ist der Hilfsspiegel 13 als in sich ausgebildete Einheit vorgesehen, welche insbesondere zur Befestigung an der Außenfläche 12 des Spiegels 10 dient. Gemäß Figur 2 und 3 wird der Hilfsspiegel 13 ohne weiteres mit Hilfe einer Lage von Klebematerial 14 befestigt, welches zwischen den entgegengesetzten und angrenzenden Flächen der beiden Spiegelkörper eingebracht ist.

Innerhalb des Hilfsspiegels 13 ist ein rechtwinkelig geformter Abschnitt einer bogenförmig verlaufenden bzw. kugelförmigen Hülle 15 eingesetzt. Die Hülle 15 ist vorzugsweise mit einer reflektierenden Fläche versehen und besitzt einen Krümmungsradius, der im Bereich von 12 cm liegen kann. Die Längsabmessung des Abschnittes beträgt in der dargestellten Ausführungsform etwa 18 bis 20 cm, während die beiden Abmessungen im Bereich von 1 bis 20 cm beträgt. Die bogenförmige Hülle 15 ist aus einem durchsichtigen Material gefertigt, so aus Glas und ist an der nach innen gerichteten Fläche mit einer Schicht 16 aus einem geeigneten Silbermaterial bedeckt, wobei diese Schicht die reflektierende Fläche bildet.

Die Deckfläche bzw. die Hülle 15 ist in einen oben offenen Behälter bzw. ein Gehäuse 17 eingebracht, welches einen flachen Boden 18 aufweist. Von den Umfangskanten des rechtwinkeligen Bodens 18 erstrecken sich in Längsrichtung Seitenwände 19 und in Querrichtung verlaufende Endwände 20 und 21. Die eine Endwand 21, welche sich am nächsten einer Seitenkante des Primärspiegels 10 befindet, ist beträchtlich höher als die entgegengesetzte Endwand 20. Gemäß Figur 2 befindet sich das Segment der kugelförmigen Hülle 15 innerhalb der umschließenden Wände 19, 20 und 21, so daß sich ein Ende im wesentlichen mit der kürzeren Wand 20 erstreckt, während sich das andere Ende relativ erhöht befindet und sich mit dem oberen Ende der Wand 21 erstreckt. Das kugelförmige Segment befindet sich also in winkeliger Schräglage bezüglich der Außenfläche des Primärspiegels. In der dargestellten Ausführungsform besitzt die Wand 21 eine Höhe, welche so bestimmt ist, daß das angrenzende Ende der Hülle 15 bezüglich der Fläche 12 des Primärspiegels etwa 8 mm weiter außen liegt als das entgegengesetzte Ende an der Endwand 20. Der kugelförmige Abschnitt bzw. die Hülle 15 ist innerhalb des Gehäuses 17 mit einem Klebemittel 22 befestigt, welches aushärtet und eine strukturell starre Halterung für das Segment bildet.

Wie vorstehend erwähnt wurde, ist der Hilfsspiegel 13 mittels einer Schicht 14 aus Klebemittel an der Außenfläche 12 des

Primärspiegels befestigt und nimmt die in Figur 1 dargestellte Lage bezüglich des Seitenspiegels ein, welcher an der linken Seite bzw. an der Fahrerseite eines Fahrzeuges zu befestigen ist. Diese Relativposition des Spiegels 10 an einem Fahrzeug ist schematisch in Figur 4 der Zeichnung dargestellt. In Figur 4 ist gleichfalls schematisch das normale Gesichtsfeld dargestellt, welches lediglich durch Verwendung der ebenen Reflexionsfläche des Spiegels erzielt wird. Das winkelige Gesichtsfeld bezüglich einer horizontalen Ebene ist mit X bezeichnet und umfasst einen horizontalen Winkelabstand, der sich von einer Basis- oder Bezugslinie entlang der Seite des Fahrzeuges erstreckt. Vorzugsweise ist diese begrenzende Gesichtslinie in Überlappung mit Teilen der Fahrzeugseite, so daß der Fahrer des Fahrzeuges einen besseren Bezug besitzt, um den Spiegel auf Gegenstände einzustellen, welche innerhalb dieses Gesichtsfeldes erscheinen. Das Winkelausmaß dieses Gesichtsfeldes X liegt im Bereich von etwa 35°. Es ist ersichtlich, daß dieses Gesichtsfeld für einen Fahrer nicht ausreicht, wenn sich dieser in einer Position V innerhalb des Fahrzeuges befindet und Objekte einsehen will, welche unter seitlichem Abstand oder bezüglich des Fahrzeuges weiter vorne liegen, also außerhalb des Gesichtsfeldes X.

Mit Hilfe des am Primärspiegel 10 befestigten Hilfsspiegels 13 wird das seitliche winkelige Gesichtsfeld auf das Gesichtsfeld Y gemäß Figur 4 erhöht. Dieses beträchtlich größere Winkel-Gesichtsfeld in einer Horizontalebene mit dem Spiegelaufbau erstreckt sich unter Verwendung der kugelförmigen Hülle 15 von der Basislinie A bis im wesentlichen zu einer Linie, welche um 80 bis 90° gegenüber der Seite des Fahrzeuges versetzt, also angewinkelt ist.

Einige der wesentlichen Vorteile des Aufbaues des Hilfsspiegels 13 nach der Erfindung besteht darin, daß dieser in horizontaler Ebene eines bevorzugten Bereiches ein verhältnismäßig breites Gesichtsfeld vermittelt. Dieses Gesichtsfeld ist in vertikaler Erstreckung auf ein verhältnismäßig schmales Band beschränkt; dieses Band umfasst jedoch ein nahezu 90° abdeckendes horizontales Gesichtsfeld in dem Bereich, in welchem der Fahrer des Fahrzeuges andere Fahrzeuge wahrnehmen kann. Dies geschieht in einer Position, in welcher eine größere Detailabbildung unwichtig ist. Diese begrenzte Darstellung eines Fahrzeuges im sogenannten blinden Bereich stellt einen beträchtlichen Vorteil dar, dahingehend, daß die Reflexion bzw. das Gesichtsfeld eine Fläche abdeckt, welche normalerweise erfordern würde, daß der Fahrer seinen Kopf dreht und direkt in diesen Bereich einsieht. Bei wechselnden Fahrspuren auf mehrspurigen Schnellstraßen oder Autobahnen stellt dies einen besonderen Vorteil dar. Wenn man lediglich in den ebenen Primärspiegel 10 einsieht, dann ist nur ersichtlich, ob sich ein Fahrzeug beträchtlich hinter dem Fahrzeug des Fahrers befindet. Indessen ist keine Anzeige in diesem Spiegel möglich, ob sich ein Fahrzeug unmittelbar seitlich des eigenen Fahrzeuges befindet. Ein Vorteil der erfindungsgemäßen Spiegelanordnung besteht fernerhin darin, daß der in horizontaler Ebene bestehende breite Sichtwinkel in vertikaler Richtung verhältnismäßig begrenzt ist, d.h. sowohl nach oben als auch nach unten, weshalb der Fahrer nicht mit optischen Wahrnehmungen und Informationen versorgt wird, welche keinen Einfluss auf seine Fahrentscheidungen besitzen. Es ist im wesentlichen die seitliche Position eines Fahrzeuges in dem sogenannten "blinden" Winkel oder Bereich, welche für die Sicherheit beim Lenken des eigenen Fahrzeuges erforderlich ist. Die erforderliche Einsichtnahme kann außerdem erreicht werden, ohne daß der Kopf und die Augen in bisher nachteiliger Weise bewegt werden müssen, wodurch die sichere Lenkung des Fahrzeuges beeinträchtigt werden könnte.

In den Figuren 5 und 6 ist eine weitere Ausführungsform des vorstehend in den Figuren 1, 2 und 3 dargestellten Hilfsspiegels 13 wiedergegeben. In den Figuren 5 und 6 ist ein Körper dargestellt, welcher direkt an der Fläche 12 des Spiegels befestigt ist. Dieser Körper ist als Abschnitt einer kugelförmigen Hülle wiedergegeben und trägt die Bezugszahl 23. Der kugelförmige Abschnitt 23 besteht aus einem Material, welches optisch nicht durchlässig ist und vorzugsweise aus einem geeigneten synthetischen Harzkunststoff gefertigt wird. Derartige Materialien können in geeigneten Verfahren hergestellt werden; im vorliegenden Ausführungsbeispiel ist der fragliche Körper kugelförmig geformt und weist eine Außenfläche 24 auf, welche mit einem geeigneten Silberschichtmaterial beschichtet werden kann, um die Reflexionsfläche zu bilden. Das kugelförmige Segment 23 besitzt im wesentlichen die gleichen Abmessungen wie das der erstbeschriebenen Ausführungsform und befindet sich in etwa auf der gleichen Position auf dem Primärspiegel 10. Während die Fläche 24 dieses Abschnitts mit einer versilberten Fläche versehen ist, sind die beiden Seitenwände 25 als auch die Endwand 26 vorzugsweise nicht silberbeschichtet. Auf diese Weise sollen unbeabsichtigte Reflexionen von vertikal orientierten Gegenständen verhindert werden, die sich entweder oberhalb oder unterhalb des Spiegels befinden, als auch Reflexionen des Fahrzeugteils, welches sich im Bereich der Endfläche 26 befindet. Die Befestigung dieser weiteren Ausführungsform des Hilfsspiegels 23 nach der Erfindung kann in einfacher Weise mit einer Schicht 27 aus Klebemittel geschehen. Die Klebemittelschicht befindet sich zwischen einer Bodenfläche des kugelförmigen Segments und der Außenfläche 12 des Primärspiegels 10.

In den Figuren 7, 8 und 9 ist eine weitere Ausführungsform der Vorrichtung nach der Erfindung dargestellt. In Figur 7 ist ein Primärspiegel 28 wiedergegeben, welcher einen Abschnitt mit einer kugelförmigen Fläche 29 aufweist. Dieser Abschnitt ist integral im Spiegelkörper vorgesehen. Der Primärspiegel 28 ist aus Glas oder aus einem anderen optisch durchlässigen Material gefertigt und besitzt eine Dicke, welche ausreicht, die vertikale Abmessung der Kugelfläche 29 unterzubringen. Der die kugelförmige Fläche 29 tragende Abschnitt befindet sich in der äußersten Ecke des Aufbaues, d.h., dieser Körper ist sowohl an einer Längskante als auch an einer Seitenkante des Primärspiegels 28 offen. Die Abmessungen des die kugelförmige Fläche 29 enthaltenden Abschnittes entsprechen vorzugsweise den Abschnitten der zwei weiteren, vorstehend beschriebenen Ausführungsformen. Es ist ersichtlich, daß das eine Ende angrenzend an die Unterseite 30 des Primärspiegels angepasst ist. Es ist ferner ersichtlich, daß nur eine Längs-Seitenwand 31 vorgesehen ist, welche unter einem Abstand von der unteren Längskante des Primärspiegels besteht. Das Reflexionsvermögen wird dadurch erreicht, daß die Fläche 29 mit einem geeigneten Versilberungsmaterial beschichtet ist. Dieses Versilberungs- oder Verspiegelungsmaterial ist nicht an der Seitenwandfläche 31 aufgebracht, obwohl es an der Fläche 30 des Primärspiegels vorgesehen ist.

In den Figuren 10, 11 und 12 ist eine weitere Ausführungsform nach der Erfindung dargestellt. Diese Ausführungsform umfasst eine integral ausgebildete planare oder primäre Spiegelfläche 32 als auch einen Abschnitt mit einer kugelförmigen Fläche 33. Gemäß Figur 10 ist der die kugelförmige Fläche 33 enthaltende Abschnitt in seinen Dimensionen entsprechend den voranstehend beschriebenen Spiegeln ausgebildet und befindet sich in einer Ecke des Primärspiegels. Infolgedessen vermittelt dieser Abschnitt den gleichen Vorteil der Position zum Zwecke der Einsichtnahme seitlicher Flächenbereiche, ohne daß das verhältnismäßig schmale Gesichtsfeld der Spiegelfläche 32 des Primärspiegels, welches im wesentlichen rückwärts gerichtet ist, beeinträchtigt ist. Diese besondere Ausführungsform des Spiegels ist vorzugsweise aus Kunststoff gefertigt, welcher einstückig geformt oder gegossen werden kann, wobei hierbei die verschiedenen Flächen 32 und 31 ausgebildet werden. Obwohl die gesamte Außenfläche 32 und 33 mit einem geeigneten Silber-Beschichtungsmaterial bedeckt ist, sind die Seitenkanten-Flächen vorzugsweise nicht mit einer derartigen Silberbeschichtung versehen. Insbesondere ist die innere Kantenfläche 34 (Figur 12) nicht mit einem derartigen Silberbeschichtungsmaterial belegt. Auf diese Weise werden störende Reflexionen vermieden, welche durch die angrenzenden Flächen 34 und 32 entstehen könnten.

Der vorstehend beschriebene Spiegel der verschiedenen Ausführungsformen eignet sich insbesondere zum Einsatz in Kraftfahrzeugen. Der Spiegel eignet sich dazu, ein beträchtlich vergrößertes Gesichtsfeld zu vermitteln, welches erforderlich ist, um sogenannte blinde Winkel auszuschalten, also diejenigen Sichtbereiche, welche mit herkömmlichen ebenen Spiegelflächen nicht eingesehen werden können. Mit Hilfe der Spiegelkonstruktion nach der Erfindung wird das Hilfs-Gesichtsfeld auf einen bestimmten Bereich beschränkt, welcher für den Fahrer des Fahrzeuges von besonderem Interesse ist, insbesondere wenn ein unmittelbar seitlich bezüglich des eigenen Fahrzeuges befindlicher Gegenstand oder ein Fahrzeug wahrgenommen werden soll. Der die kugelförmige Fläche enthaltende Abschnitt ist in dieser Hinsicht von besonderem Vorteil, da er ein vertikal geringfügig nach oben und nach unten sich erstreckendes Gesichtsfeld vermittelt, welches dem durch den Primärspiegel erzeugten Bild besser angepasst und durch den Fahrer einsehbar ist. Die Winkellage des vertikalen Abschnittes bezüglich der ebenen Fläche des Primärspiegels hat zur Folge, daß dieser Abschnitt insbesondere das extrem seitliche Gesichtsfeld einsieht als auch eine Sicht-Bezugslinie an der Seite des Fahrzeuges schafft. Der Spiegelaufbau kann als separate Einheit geschaffen werden, welche leicht an bereits bestehenden Spiegeln befestigbar ist; der Aufbau kann auch in einem integral geformten System eingeordnet werden, um das äußere Erscheinungsbild eines Hilfs-Spiegelaufbaues zu vermeiden. Der Spiegel nach der Erfindung kann auch an beiden Seiten eines Fahrzeuges angeordnet werden und kann die Vorteile des erweiterten Gesichtsfeldes vermitteln.

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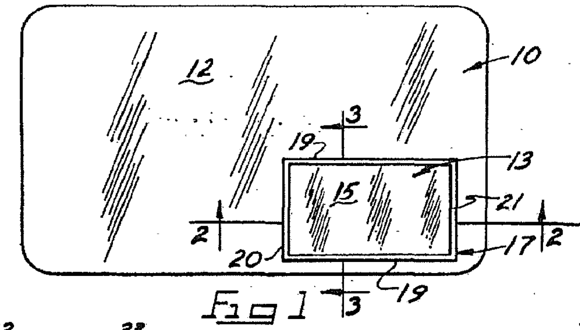
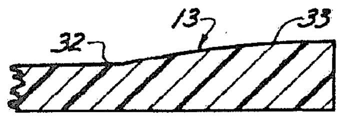


Fig 1



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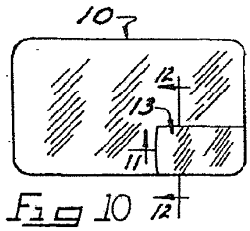

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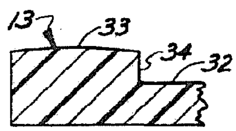

Fig 12

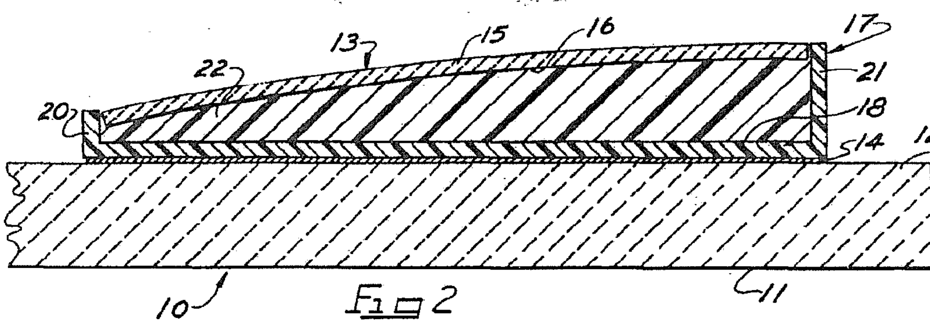

Fig 2

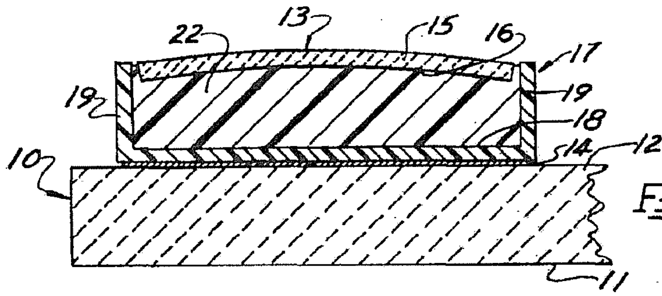

Fig 3

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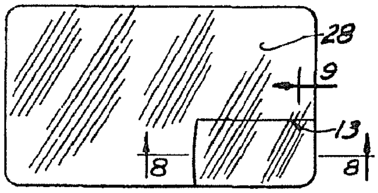

Fig 7

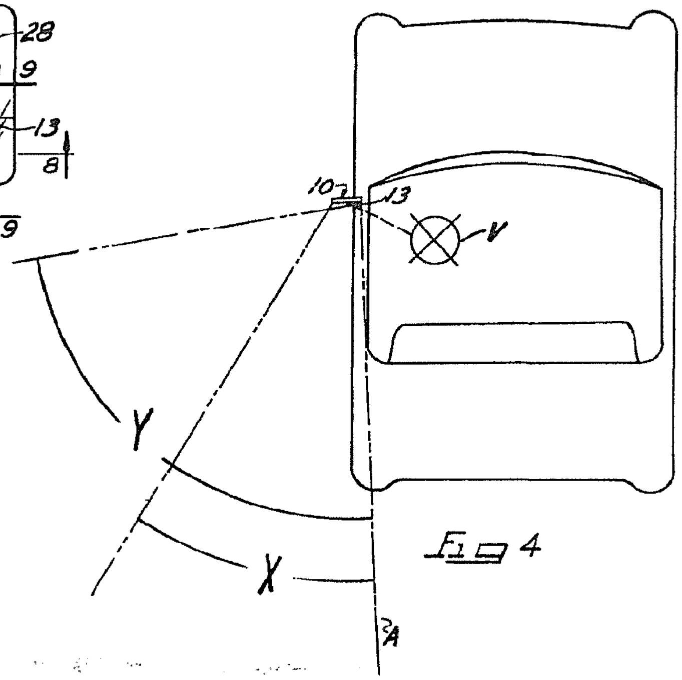

Fig 4

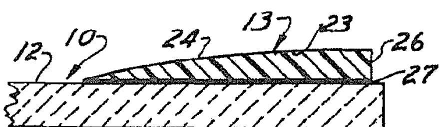

Fig 5

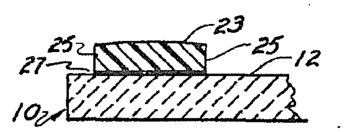

Fig 6

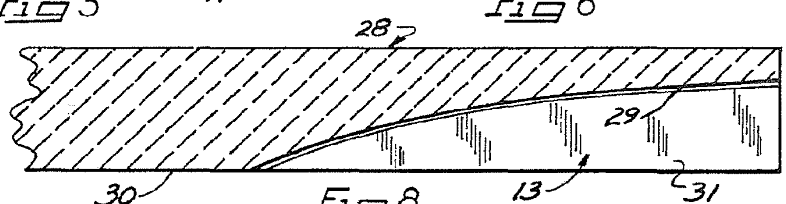

Fig 8

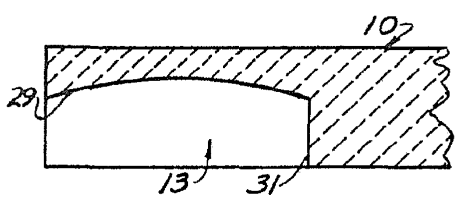

Fig 9

Exterior rearview mirror for motor vehicles

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Inventor(s): SCHULZE GEB HARTWIG [DE] +
Applicant(s): SCHULZE GEB HARTWIG JOHANNE +
Classification:
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- European: B60R1/08D2
Application number: DE19833302735 19830127
Priority number(s): DE19833302735 19830127

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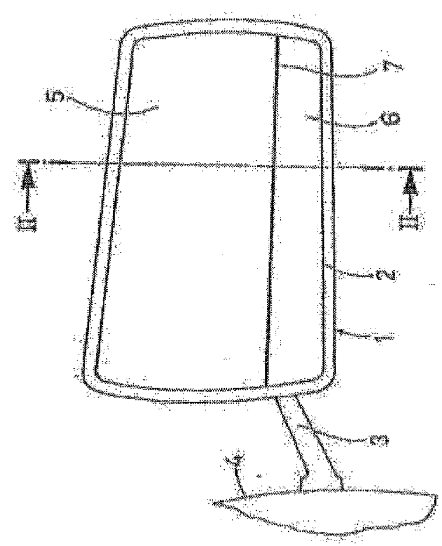
Abstract of **DE 3302735 (A1)**

The exterior rearview mirror has an upper mirror surface (5) as a main mirror surface for viewing behind and a lower mirror surface (6) which is bent at an angle along a horizontal line (7) relative to said upper mirror surface (5) in the direction of the rear of the mirror and by means of which the surface of the road or the edge of the pavement in the region directly next to the vehicle can be viewed from the driver's seat.



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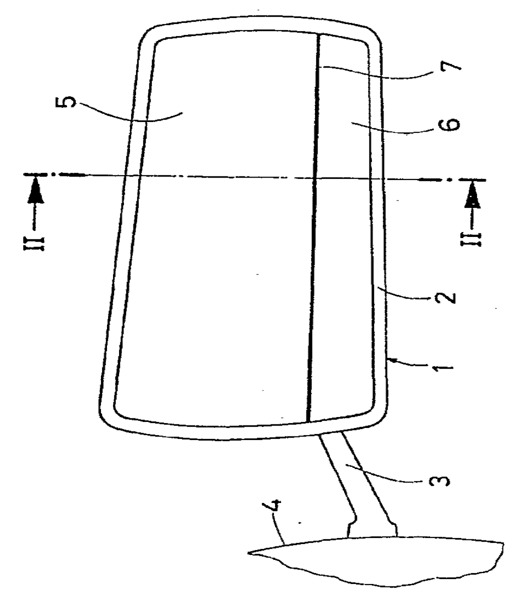
US	22 79 751

(54) Aussenrückspiegel für Kraftfahrzeuge

Der Außenrückspiegel weist eine obere Spiegelfläche (5) als Hauptspiegelfläche zur Rückwärtsbeobachtung und eine relativ dazu um eine horizontale Linie (7) in Richtung auf die Spiegelrückseite abgewinkelte untere Spiegelfläche (6) auf, mittels welcher die Straßenoberfläche bzw. eine Bordsteinkante im Bereich unmittelbar neben dem Fahrzeug vom Fahrersitz aus zu beobachten ist.



DE 3302735 A1

PATENTANSPRUECHE

1. Aussenrückspiegel für Kraftfahrzeuge, dadurch gekennzeichnet, dass er eine obere Spiegelfläche (5) zur üblichen Rückwärtsbeobachtung und eine gegenüber dieser oberen Spiegelfläche (5) um eine wenigstens näherungsweise horizontal verlaufende Linie (7) in Richtung auf die Spiegelrückseite abgewinkelte, untere Spiegelfläche (6) zur Beobachtung der Strassenoberfläche unmittelbar neben dem Kraftfahrzeug, insbesondere des Bordsteins, aufweist.

2. Aussenrückspiegel nach Anspruch 1, dadurch gekennzeichnet, dass die untere Spiegelfläche (6) nur 20% bis 30% der gesamten Fläche des Spiegels beträgt.

3. Aussenrückspiegel nach Anspruch 1 oder 2, dadurch gekennzeichnet, dass die Breite des Rückspiegels in an sich bekannter Weise grösser als seine Höhe, insbesondere etwa doppelt so gross wie seine Höhe ist.

4. Aussenrückspiegel nach einem der Ansprüche 1 bis 3, dadurch gekennzeichnet, dass der Neigungswinkel (α) der unteren Spiegelfläche (6) gegenüber der oberen Spiegelfläche (5) zwischen etwa 15° und 25°, vorzugsweise ungefähr 20°, beträgt.

5. Aussenrückspiegel nach einem der Ansprüche 1 bis 4, dadurch gekennzeichnet, dass die oberen und unteren Spiegelflächen (5,6) durch getrennte, in das Spiegelgehäuse (2) eingesetzte Spiegelgläser (8,9) gebildet sind.

6. Aussenrückspiegel nach einem der Ansprüche 1 bis 5, dadurch gekennzeichnet, dass die untere Spiegelfläche konvex, insbesondere zylindrisch-konvex, ausgebildet ist.

7. Aussenrückspiegel nach einem der Ansprüche 1 bis 6, dadurch gekennzeichnet, dass die untere Spiegelfläche (11) ausserdem gegenüber der oberen Spiegelfläche (5) um eine im wesentlichen vertikal verlaufende Achse seitlich zum Fahrzeug hin um einen Winkel gedreht ist.

8. Aussenrückspiegel nach einem der Ansprüche 1 bis 7, dadurch gekennzeichnet, dass er dreiteilig ausgebildet ist und ausser den erwähnten oberen und unteren Spiegelflächen (12,13) an einer Seite eine gegenüber der oberen Spiegelfläche (12) um eine im wesentlichen vertikale Linie (15) abgewinkelte dritte Spiegelfläche (14) zur Vermeidung des toten Winkels aufweist.

9. Aussenrückspiegel nach einem der Ansprüche 1 bis 8, dadurch gekennzeichnet, dass die untere Spiegelfläche (6,11,13) unabhängig von der oberen Spiegelfläche (5,12) verstellbar ist.

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Aussenrückspiegel für Kraftfahrzeuge

Die Erfindung bezieht sich auf einen Aussenrückspiegel für Kraftfahrzeuge.

Es sind bereits zweiteilige Aussenrückspiegel bekannt, die ausser der für die Rückwärtsbeobachtung bestimmten Hauptspiegelfläche an einer Seite eine kleine, um eine etwa vertikale Achse abgewinkelte zweite Spiegelfläche haben, um für den Fahrer den Einfalls- und Reflektionswinkel zu vergrössern, so dass der sonst tote Winkel und damit ein gerade überholendes Fahrzeug beobachtet werden kann.

Bisher besteht jedoch noch keine Möglichkeit, vom Fahrersitz aus in einfacher und bequemer Weise die Strassenoberfläche unmittelbar neben dem Kraftfahrzeug, insbesondere den Bordstein beobachten zu können, was vor allem beim Parken das Manövrieren wesentlich erleichtern würde. Die bisher bekannten, unten am Fahrzeug montierten und seitlich abstehenden, drahtförmigen Metallfühler, welche durch das beim Berühren der Bordsteinkante erzeugte kratzende Geräusch dem Fahrer das korrekte dichte Heranfahren an die Bordsteinkante erleichtern sollen, stellen offensichtlich keine befriedigende Lösung dar und haben sich in der Praxis, wie die Erfahrung zeigt, nicht durchgesetzt.

Der Erfindung liegt die Aufgabe zugrunde, einen Aussenrückspiegel zu schaffen, welcher ausser der üblichen Rückwärtsbeobachtung auch auf einfache Weise die Beobachtung der Strassenoberfläche unmittelbar neben dem Fahrzeug, insbesondere einer Bordsteinkante, erlaubt.

Zur Lösung dieser Aufgabe ist der Aussenrückspiegel erfindungsgemäss dadurch gekennzeichnet, dass er eine obere Spiegelfläche zur üblichen Rückwärtsbeobachtung und eine gegenüber dieser oberen Spiegelfläche um eine wenigstens näherungsweise horizontal verlaufende Linie in Richtung auf die Spiegelrückseite abgewinkelte, untere Spiegelfläche zur Beobachtung der Strassenoberfläche unmittelbar neben dem Kraftfahrzeug, insbesondere des Bordsteins, aufweist.

Auf diese Weise erleichtert der Aussenrückspiegel nach der Erfindung insbesondere das korrekte Parken dicht neben einem niedrigen, sonst nicht ohne weiteres zu erkennenden Hindernis, vor allem dicht an einer Bordsteinkante, ohne Gefahr zu laufen, dass Reifen und/oder Radkappen durch Schleifen am Bordstein beschädigt werden, wie das bisher häufig vorkommt. In Ländern mit Rechtsverkehr wird der Rückspiegel nach der Erfindung natürlich vorzugsweise auf der rechten Fahrzeugseite angebracht.

Zweckmässigerweise ist die Breite des Rückspiegels, im montierten Zustand also seine Horizontalabmessung, grösser als seine Höhe, insbesondere etwa doppelt so gross wie seine Höhe, und der Bereich der unteren Spiegelfläche beträgt nur etwa 20 bis 30% der Gesamtfläche des Spiegels und hat daher die Gestalt eines nur vergleichsweise schmalen, horizontalen Streifens. Der Neigungswinkel der unteren Spiegelfläche zur oberen Spiegelfläche, welcher bei korrekter Einstellung des Rückspiegels den Bordstein zu beobachten erlaubt, hängt zwar etwas vom Ort des Rückspiegels am Fahrzeug, das heisst von der Höhe des Rückspiegels über der Strassendecke und von seinem Abstand zum Hinterrad, ab, liegt jedoch in den meisten Fällen, zumindest für die meisten Personenkraftwagen, zwischen etwa 15° und 25°; in der Regel erfüllt ein Rückspiegel nach der Erfindung mit einem Neigungswinkel von etwa 20° gut seine Funktion, wenn er in der üblichen Rückspiegelstellung seitlich an der Aussentür, etwa einen Meter über der Strassendecke, installiert ist.

Um bei einem normal für die rückwärtige Beobachtung eingestellten Rückspiegel nach der Erfindung, in welchem der Fahrer in der unteren Spiegelfläche die Strassenoberfläche im Bereich der hinteren Fahrzeughälfte, insbesondere des betreffenden Hinterrades, beobachten kann, das Spiegelblickfeld dieser unteren Spiegelfläche zu erweitern, vor allem nach vorn zum mittleren Fahrzeugbereich hin, kann gemäss einer besonderen Ausführungsform die untere Spiegelfläche konvex, insbesondere zylindrisch-konvex, gekrümmt sein. Um gegebenenfalls das Spiegelblickfeld weiter nach vorn, bis wenigstens zum Bereich des betreffenden Vorderrades, zu erweitern bzw. zu verschieben, kann ausserdem die untere Spiegelfläche noch gegenüber der oberen Spiegelfläche um eine im wesentlichen vertikale Achse zum Fahrzeug hin, das heisst bei einem an der rechten Fahrzeugseite befestigten Spiegel in der Draufsicht im Uhrzeigersinne, gedreht sein.

Auch im Falle einer ebenen unteren Spiegelfläche kann diese etwas gegenüber der oberen Spiegelfläche um eine vertikale Achse gedreht sein, um das Spiegelblickfeld weiter nach vorn zu verschieben.

Da der Rückspiegel nach der Erfindung vor allem auf derjenigen Fahrzeugseite sinnvoll ist, auf der normalerweise geparkt wird, also bei Rechtsverkehr auf der rechten Seite und bei Linksverkehr auf der linken Seite, besteht kein grosses Interesse, bei diesem Rückspiegel dafür zu sorgen, dass man auf dieser Seite auch noch den toten Winkel, also den Bereich unmittelbar neben dem Fahrzeug, beobachten kann, da ja eine Ueberholung auf der anderen Fahrzeugseite stattfindet und der Fahrer auf dieser Seite ohne weiteres einen bekannten zweiteiligen Spiegel für Rückwärtsbeobachtung und Beobachtung des toten Winkels montieren lassen kann. Jedoch schliesst der Rückspiegel nach der Erfindung grundsätzlich auch einen dreiteiligen Spiegel ein, welcher ausser den beiden bisher erörterten Spiegelflächen an einer Seite auch noch - in an sich bekannter Weise - eine gegenüber der für die Rückwärtsbeobachtung bestimmten Hauptspiegelfläche um eine etwa vertikale Achse abgewinkelte Spiegelfläche zur Beobachtung des toten Winkels aufweist, wobei diese dritte Spiegelfläche vorzugsweise kleiner als die Hauptspiegelfläche ist und sich entweder über die Gesamthöhe des Spiegels erstreckt, wobei dann untere Spiegelfläche und obere Hauptspiegelfläche die gleiche Breite haben, oder aber nur die Höhe der oberen Hauptspiegelfläche oder gegebenenfalls nur die Höhe der unteren Spiegelfläche einnimmt.

Zweckmässige Ausgestaltungen der Erfindung ergeben sich aus den abhängigen Ansprüchen.

Die Erfindung wird anhand der Zeichnungen an Ausführungsbeispielen näher erläutert. Es zeigen:

Figur 1 eine erste Ausführungsform eines Rückspiegels nach der Erfindung, und zwar die Vorderansicht eines an der rechten Fahrzeugseite angebrachten Rückspiegels,

Figur 2 einen Schnitt längs der Linie II-II nach Figur 1,

Figur 3 einen der Figur 2 entsprechenden Schnitt durch eine zweite Ausführungsform eines Aussenrückspiegels und

Figur 4 die Vorderansicht einer dritten Ausführungsform mit drei Spiegelflächen.

Figur 1 zeigt einen Aussenrückspiegel 1, dessen Gehäuse 2 mittels eines Arms 3 in bekannter Weise einstellbar an der rechten Seite eines nur durch eine Begrenzungslinie angedeuteten Kraftfahrzeugs 4 befestigt ist. Der Rückspiegel 1 hat eine übliche, näherungsweise rechteckförmige Gestalt mit abgerundeten Ecken und ist ungefähr doppelt so breit wie hoch. Er hat eine obere Spiegelfläche 5, welche die Hauptspiegelfläche zur üblichen Rückwärtsbeobachtung bildet, und eine untere Spiegelfläche 6, welche gegenüber der oberen Spiegelfläche 5 um eine etwa parallel zu den Spiegelbreitseiten verlaufende, im montierten Zustand des Spiegels also im wesentlichen horizontal orientierte Linie 7 in Richtung auf die Spiegelrückseite abgewinkelt ist, wie es Figur 2 zeigt. Im betrachteten Beispiel werden beide Spiegelflächen 5 und 6 durch getrennte, in das Spiegelgehäuse 2 eingesetzte ebene Spiegelgläser 8 und 9 gebildet, wobei die Fuge zwischen diesen beiden Planspiegeln längs der Linie 7 durch eine Befestigungsmasse bzw. einen Befestigungsstreifen, beispielsweise aus Gummi, ausgefüllt ist.

Der Neigungswinkel α (Figur 2) der unteren Spiegelfläche 6 gegenüber der oberen Spiegelfläche 5 ist so gewählt, dass bei der normalen Einstellung des Rückspiegels 1, in welcher der Fahrer mittels der oberen Spiegelfläche 5 nach rückwärts blicken kann, vom Fahrersitz gleichzeitig auch die Strassenoberfläche unmittelbar neben dem Fahrzeug beobachtet werden kann, wie durch den gewinkelten Pfeil 10 in Figur 2 angedeutet. Dadurch kann der Fahrer insbesondere bei einem Parkmanöver den rechten Bordstein beobachten, was ein dichtes Heranfahren an den Bordstein erleichtert, ohne diesen mit Reifen oder Radkappen zu berühren. Die zweckmässige Grösse des Neigungswinkels α liegt im allgemeinen zwischen etwa 15° und etwa 25°; in den meisten Fällen erfüllt der Rückspiegel, sofern er an seiner üblichen Stelle an einer Autotür montiert ist, seinen erfindungsgemässen Zweck, wenn der Neigungswinkel α etwa 20° beträgt.

Bei der Ausführungsform nach den Figuren 1 und 2 wird der Fahrer mittels der unteren Spiegelfläche 6 im wesentlichen den Bereich der Strassenoberfläche unmittelbar neben der hinteren Fahrzeughälfte beobachten. Wenn es wünschenswert ist, das Spiegelblickfeld zu erweitern, insbesondere weiter nach vorn, kann die untere Spiegelfläche 6 auch konvex, insbesondere zylindrisch-konvex gekrümmt ausgebildet sein. Wenn das Spiegelblickfeld auch noch wenigstens teilweise den Strassenbereich neben der vorderen Fahrzeughälfte umfassen soll, kann die untere Spiegelfläche 6 auch noch in Bezug auf die obere Spiegelfläche 5 um eine etwa vertikale Achse in Richtung auf das Fahrzeug, also in Richtung auf den Befestigungsarm 3, um einen bestimmten Winkel gedreht sein. Auf diese Weise lässt sich gegebenenfalls erreichen, dass der Fahrer in der unteren Spiegelfläche 6 einen vergleichsweise grossen Abschnitt der Strassenoberfläche bzw. des Bordsteins unter Einschluss der betreffenden Hinter- und Vorderräder bzw. der neben diesen liegenden Bereiche beobachten kann. Durch die erwähnte Massnahme kann das Spiegelblickfeld, wenn gewünscht, auch einfach weiter nach vorn verschoben werden.

Auch im Falle einer ebenen unteren Spiegelfläche lässt sich das Spiegelblickfeld für den Fahrer nach vorn in den Strassenbereich neben der Fahrzeugmitte hin verschieben, indem, wie im Ausführungsbeispiel nach Figur 3 gezeigt, die ebene untere Spiegelfläche 11 in Bezug auf die obere Spiegelfläche 5 um eine im wesentlichen vertikale Achse in Richtung auf das Fahrzeug 4 bzw. den Befestigungsarm 3 gedreht in das Spiegelgehäuse 2 eingesetzt wird, so dass sich für den Fahrer Einfalls- und Reflektionswinkel entsprechend verkleinern. Natürlich ist die Grösse dieser möglichen Drehung und damit das Ausmass, das Spiegelblickfeld weiter nach vorn zu verlegen, dadurch eingeschränkt, dass der für den Fahrer massgebende Einfallswinkel bei schräg von vorn kommendem Einfallsstrahl nicht zu gross und daher die für den Fahrer sichtbare scheinbare Grösse der unteren Spiegelfläche 11 nicht zu klein sein darf.

Wenn der Rückspiegel nach der Erfindung in Ländern mit Rechtsverkehr nur auf der rechten und in Ländern mit Linksverkehr nur auf der linken Fahrzeugseite montiert wird, um die Parkmanöver auf der rechten bzw. auf der linken Strassenseite zu erleichtern, dann besteht im allgemeinen kein Interesse, den Rückspiegel auch noch so auszubilden, dass der tote Winkel auf dieser Seite, wo nicht überholt werden darf, vermieden wird. Wenn es trotzdem auch noch gewünscht wird, den normalerweise toten Winkel in einem Aussenrückspiegel nach der Erfindung zu erfassen, dann kann ein solcher Rückspiegel gemäss einer weiteren Ausführungsform, die in Figur 4 gezeigt ist, dreiteilig ausgebildet sein. Ausser der oberen Spiegelfläche 12, die wiederum die Hauptspiegelfläche für die Rückwärtsbeobachtung darstellt, und der kleineren unteren Spiegelfläche 13 weist dieser Rückspiegel an einer Seite der oberen Spiegelfläche 12 eine dritte Spiegelfläche 14 auf, die zur Vermeidung des toten Winkels in Bezug auf die die Hauptspiegelfläche bildende obere Spiegelfläche 12 um eine im wesentlichen vertikale Achse entsprechend abgewinkelt ist. Diese dritte Spiegelfläche 14, deren Breite vorzugsweise wesentlich kleiner als die der Hauptspiegelfläche ist, kann sich auch über die gesamte Höhe des Spiegels erstrecken, wodurch die untere Spiegelfläche 13 entsprechend kürzer ausfällt, oder aber gegebenenfalls auch nur an einer Seite der unteren Spiegelfläche 13 angeordnet sein, so dass die obere Spiegelfläche 12 als Hauptspiegelfläche nicht verkleinert zu werden braucht.

Natürlich kann gegebenenfalls zur Vermeidung eines toten Winkels bei einem zweiteiligen Rückspiegel nach der Erfindung, wie er im Prinzip in den Figuren 1 und 2 gezeigt ist, die obere Spiegelfläche als Hauptspiegelfläche in bekannter Weise auch konvex ausgebildet sein. Gegebenenfalls können obere und untere Spiegelflächen 5 und 6 nach Figur 1 beide konvex gekrümmt sein.

Es ist auch möglich, das die untere Spiegelfläche bildende Spiegelglas unabhängig von der oberen Spiegelfläche einstellbar im Spiegelgehäuse 2 zu lagern.

Der Rückspiegel nach der Erfindung ist nicht auf die beschriebenen Ausführungsformen beschränkt, sondern lässt hinsichtlich der Form und Gestalt des Spiegels manigfache Varianten zu.

– Leerseite –

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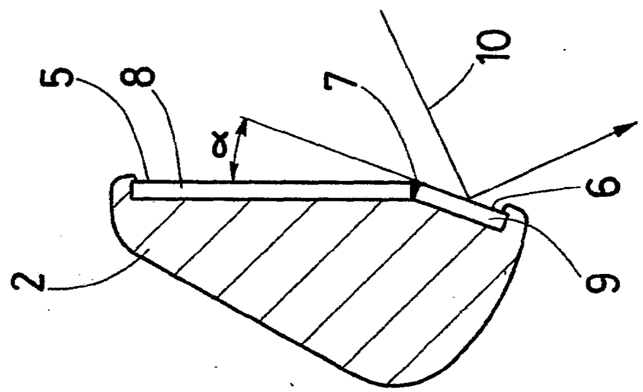


Fig. 2

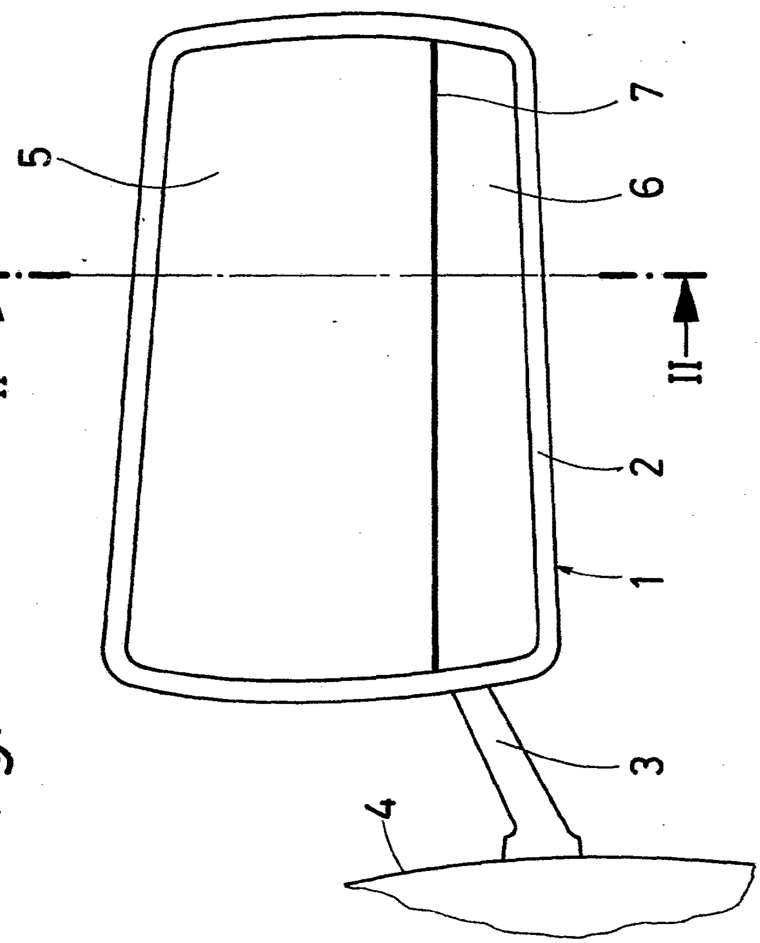


Fig. 1

Fig. 3

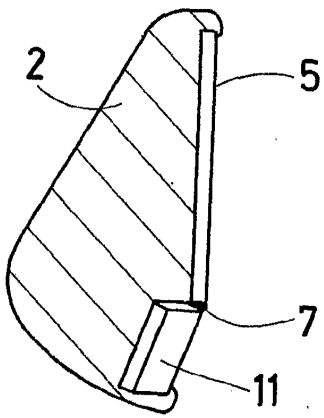
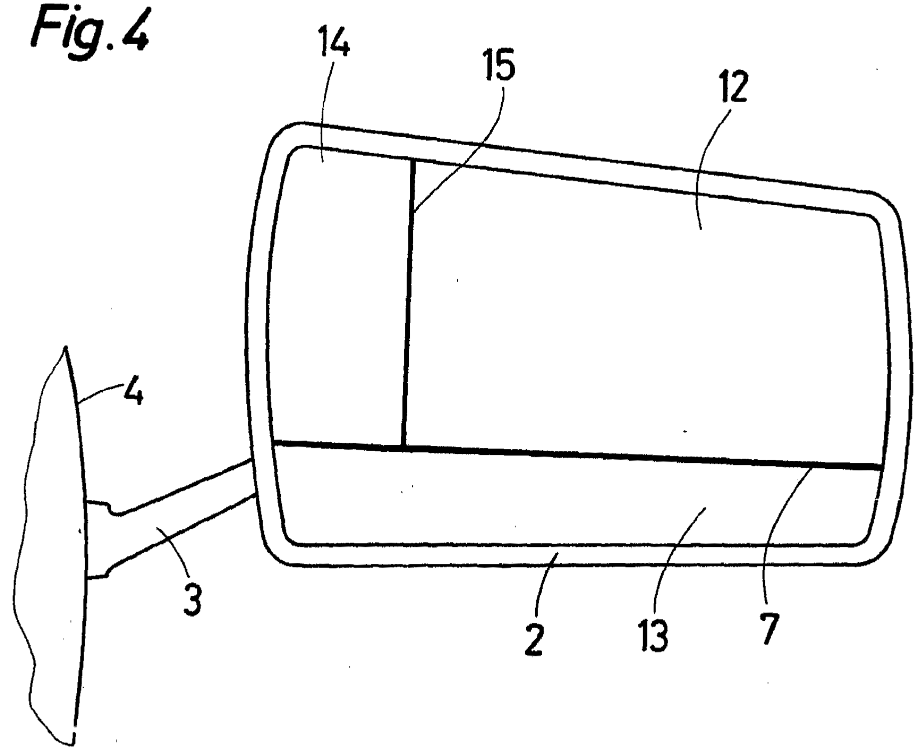


Fig. 4



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3302735

Rearview mirror for a motor vehicle

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Publication date: 1985-03-07
Inventor(s): HORN KARL-HEINZ [DE]
Applicant(s): HORN KARL HEINZ
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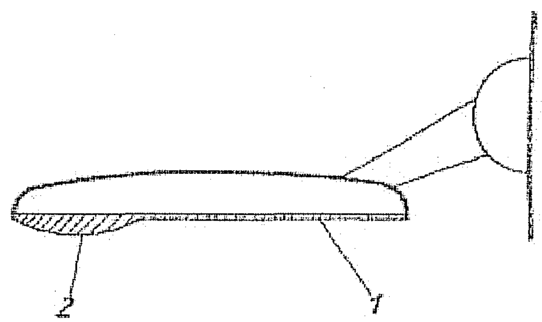
- European: B60R1/08D2
Application number: DE19833329998 19830819
Priority number(s): DE19833329998 19830819

Abstract of **DE 3329998 (A1)**
Rearview mirror for a motor vehicle with a plane mirror surface, part of the plane mirror surface being constructed as a raised mirror surface.



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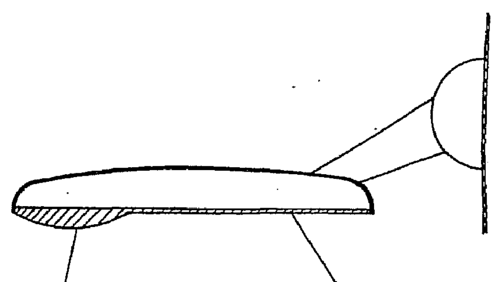
(54) Rückspiegel für ein Kraftfahrzeug

Rückspiegel für ein Kraftfahrzeug mit einer ebenen Spiegelfläche, wobei ein Teil der ebenen Spiegelfläche als erhabene Spiegelfläche ausgebildet ist.



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A n s p r ü c h e

1. Rückspiegel für ein Kraftfahrzeug mit einer ebenen Spiegelfläche
d a d u r c h g e k e n n z e i c h n e t , daß ein Teil der ebenen Spiegelfläche als erhabene Spiegelfläche ausgebildet ist.

2. Rückspiegel nach Anspruch 1
d a d u r c h g e k e n n z e i c h n e t , daß auf die ebene Spiegelfläche eine erhabene Spiegelfläche aufgesetzt ist.

3. Rückspiegel nach Anspruch 1
d a d u r c h g e k e n n z e i c h n e t , daß die erhabene Spiegelfläche an der äußeren Seite der ebenen Spiegelfläche aufgesetzt ist.

Dipl.-Ing. HORST WALTHER

Zugelassener Vertreter beim Europäischen Patentamt

PATENTANWALT

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Tag: 9.8.1983 W/H

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Rückspiegel für ein Kraftfahrzeug

Die Erfindung betrifft einen Rückspiegel für ein Kraftfahrzeug mit einer ebenen Spiegelfläche.

Rückspiegel für Kraftfahrzeuge sind an sich bekannt. Sie besitzen im allgemeinen eine ebene Spiegelfläche. Bekanntlich kann damit ein nachfolgendes Fahrzeug dann nicht mehr gesehen werden, wenn es im toten Winkel sich befindet.

Bekannt sind an sich auch Rückspiegel mit erhabener Spiegelfläche. Dabei ist allerdings nachteilig, daß die nachfolgenden Fahrzeuge verzerrt auf der Spiegelfläche erscheinen, so daß man den Abstand des

Fahrzeuges nicht abschätzen kann.

Der Erfindung liegt daher die Aufgabe zugrunde, einen Rückspiegel für Kraftfahrzeuge zu schaffen, der einerseits die Spiegelbilder unverzerrt wiedergibt, andererseits mit Sicherheit die im toten Winkel befindlichen Fahrzeuge erkennbar macht.

Nach der Erfindung wird das dadurch erreicht, daß ein Teil der ebenen Spiegelfläche als erhabene Spiegelfläche ausgebildet ist. Dadurch besteht der Rückspiegel aus zwei Spiegelflächen, nämlich einer ebenen- und einer erhabenen Spiegelfläche. Zweckmäßig ist die erhabene Spiegelfläche auf der ebenen Spiegelfläche und an der äußeren Seite der ebenen Spiegelfläche angebracht.

Die Ausbildung hat den Vorteil, daß mit Hilfe der üblichen ebenen Spiegelfläche die nachfolgenden Fahrzeuge unverzerrt erkennbar sind, so daß der Abstand dieser Fahrzeuge nach wie vor sicher abgeschätzt werden kann. Gleichzeitig ist aber erreicht, daß ein im toten Winkel befindliches Fahrzeug in der erhabenen Spiegelfläche erkennbar ist. Die verzerrte Abbildung des im toten Winkel befindlichen Fahrzeuges kann zu keinen Abstandsirrtümern führen, da bekannt ist, daß das im toten Winkel sichtbare Fahrzeug in unmittelbarer Nähe des eigenen Fahrzeuges ist.

In der Zeichnung ist eine beispielsweise Ausführungsform dargestellt.

Fig. 1 zeigt den erfindungsgemäßen Rückspiegel von vorn;

Fig. 2 ist ein Schnitt gemäß der Linie II-II.

Mit 1 ist die übliche ebene Spiegelfläche bezeichnet. An der äußeren Seite dieser ebenen Spiegelfläche ist die mit 2 bezeichnete erhabene Spiegelfläche als Teil der ebenen Spiegelfläche angebracht und stellt mit dem gesamten Spiegel einen integrierenden Bestandteil dar.

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Fig. 1

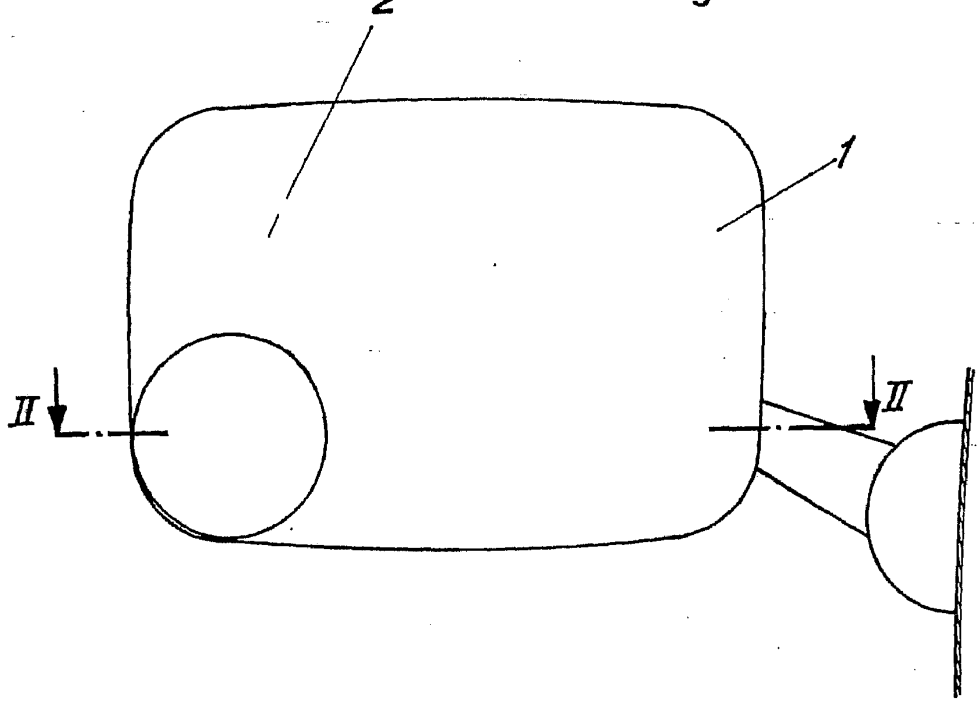
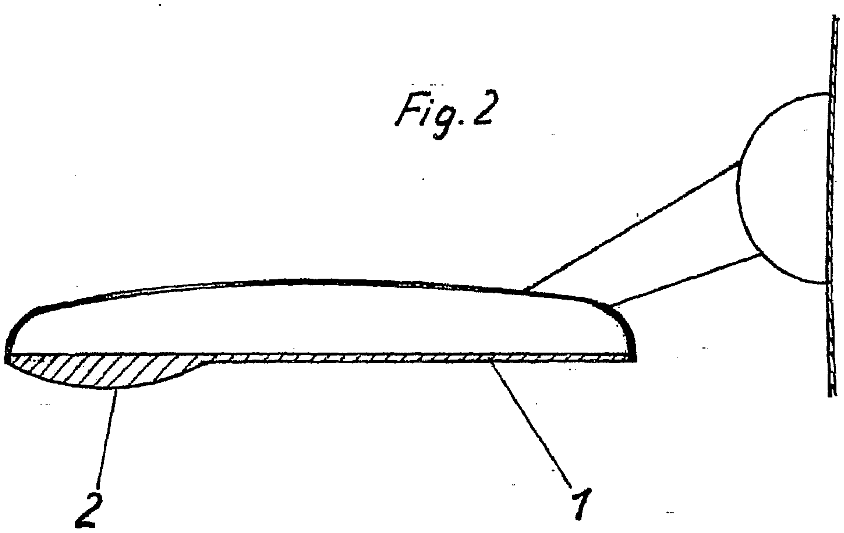


Fig. 2



Rearview mirror for motor vehicles

Publication number:	DE3620228
Publication date:	1987-12-17
Inventor:	MARHAUER FRIEDRICH (DE)
Applicant:	MARHAUER UTA (DE)
Classification:	
- International:	***B60R1/08;*** **B60R1/08;** (IPC1-7): B60R1/08
- European:	B60R1/08D2
Application number:	DE19863620228 19860616
Priority number(s):	DE19863620228 19860616

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Abstract of **DE3620228**

In order to include the blind angle, known rearview mirrors are convex and/or aspherical. This results in the disadvantage that the driver can only estimate the distances and speeds of approaching vehicles with great difficulty, which can lead to dangerous situations. The entire surface of the new rearview mirror is divided up horizontally. The upper mirror (16) is planar, and two adjacent mirrors are situated below the upper mirror. One (12) of the lower mirrors is convex and the other (14) is aspherical. The convex mirror (12) covers the same field of vision as the upper mirror (16).

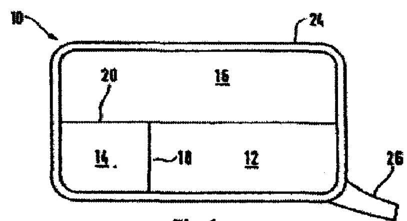

Fig.1

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DEUTSCHES PATENTAMT

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(51) Int. Cl. 4: B60R 1/08

(21) Aktenzeichen: P 36 20 228.2
(22) Anmeldetag: 16. 6. 86
(43) Offenlegungstag: 17. 12. 87

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Prüfungsantrag gem. § 44 PatG ist gestellt

(54) Rückspiegel für Kraftfahrzeuge

Um den toten Winkel zu erfassen, sind die bekannten Rückspiegel konvex bzw. asphärisch ausgebildet. Hierbei besteht der Nachteil, daß der Fahrer Entfernungen und Geschwindigkeiten der herannahenden Fahrzeuge nur sehr schwer abschätzen kann, was zu gefährlichen Situationen führen kann.
Der neue Rückspiegel besitzt eine horizontale Aufteilung der gesamten Spiegelfläche. Der obere Spiegel (16) ist plan ausgebildet, und unterhalb des oberen Spiegels befinden sich zwei nebeneinander angeordnete Spiegel. Davon ist der eine Spiegel (12) konvex und der andere Spiegel (14) asphärisch ausgebildet. Der konvexe Spiegel (12) erfaßt das gleiche Sichtfeld wie der obere Spiegel (16).

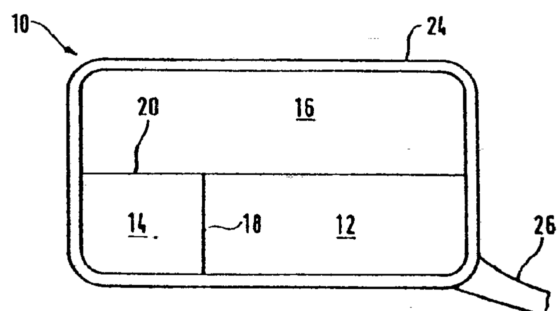

Fig.1

DE 3620228 A1

Patentansprüche

1. Rückspiegel für Kraftfahrzeuge, mit einem ersten konvex ausgebildeten Spiegel und einem an der dem Kraftfahrzeug abgewandten Seite des ersten Spiegels seitlich daneben angeordneten zweiten und stärker konvex ausgebildeten Spiegel, wobei der erste Spiegel der Hauptspiegel für das normale Sichtfeld ist und der zweite Spiegel den toten Winkel erfaßt, **dadurch gekennzeichnet,** daß horizontal über dem ersten (12) und zweiten Spiegel (14) ein plan ausgebildeter dritter Spiegel (16) winkelig angeordnet ist, der — in der Breite — das gleiche Sichtfeld wie der erste Spiegel erfaßt.

2. Rückspiegel nach Anspruch 1, dadurch gekennzeichnet, daß der erste (12) und der zweite Spiegel (14) durch eine senkrechte Trennlinie (18) voneinander getrennt sind, und daß der dritte Spiegel (16) durch eine waagerechte Trennlinie (20) von dem ersten (12) und zweiten Spiegel (14) getrennt ist.

3. Rückspiegel nach Anspruch 1 und/oder 2, dadurch gekennzeichnet, daß der erste (12), der zweite (14) und der dritte Spiegel (16) auf einer gemeinsamen Grundplatte (22) angeordnet sind, die in einem Spiegelgehäuse (24) gehalten ist.

4. Rückspiegel nach Anspruch 2 und/oder 3, dadurch gekennzeichnet, daß die waagerechte Trennlinie (18) etwa mittig innerhalb des Spiegelgehäuses (24) verläuft.

5. Rückspiegel nach Anspruch 1 und/oder 2, dadurch gekennzeichnet, daß der erste (12), der zweite (14) und der dritte Spiegel (16) auf einer gemeinsamen Grundplatte (22) angeordnet sind, und daß die Grundplatte (22) auf ihrer Rückseite mit einer Klebeschicht versehen ist.

Beschreibung

Die Erfindung betrifft einen Rückspiegel für Kraftfahrzeuge, mit einem ersten konvex ausgebildeten Spiegel und einem an der dem Kraftfahrzeug abgewandten Seite des ersten Spiegels seitlich angeordneten zweiten und stärker konvex ausgebildeten Spiegel, wobei der erste Spiegel der Hauptspiegel für das normale Sichtfeld ist und der zweite Spiegel den toten Winkel erfaßt.

Bei einem normalen Rückspiegel für Kraftfahrzeuge ist bekanntlich das generelle Problem zu beobachten, daß der tote Winkel von dem in den Spiegel blickenden Fahrer nicht erfaßt werden kann. Dies hat zur Folge, daß ein von hinten herannahendes überholendes Fahrzeug, daß sich in diesem toten Winkel befindet in dem normalen Rückspiegel nicht sichtbar ist und somit von dem Fahrer auch nicht wahrgenommen werden kann.

Der geschilderte Umstand kann im Straßenverkehr zu gefährlichen Situationen führen, wenn der Fahrer, der aufgrund eines Blickes in seinen Rückspiegel das im toten Winkel befindliche überholende Fahrzeug nicht sieht, seinerseits zum Überholen eines anderen vor ihm befindlichen Fahrzeuges ausscheren will. Auch beim Einfädeln in den fließenden Verkehr auf Autobahnen und Autostraßen sowie beim Ausparken können sich derartige gefahrvolle Situationen einstellen.

Zur Beseitigung der geschilderten gravierenden Nachteile der normalen Rückspiegel sind schon mehrere Wege beschritten worden, die aber in der Praxis allesamt nicht vollständig befriedigen können.

Durch die Zeitschrift "ADAC-Motorwelt" 1978, Heft 7, Seite 15, rechte Spalte, dritter Spiegel von oben ist es schon bekannt geworden, den Rückspiegel nicht plan, sondern konvex auszubilden, um mit einem einzigen Spiegel sowohl den normalen Sichtbereich als auch den toten Winkel erfassen zu können. Dabei ist der eine, dem Fahrzeug zugewandte größere Teil des Spiegels gleichmäßig konvex mit einem konstanten Krümmungsradius ausgebildet, während der sich nach außen hin anschließende zweite Spiegelbereich mit sich änderndem Krümmungsradius konvex (asphärisch) verläuft.

Insgesamt ist dieser bekannte Rückspiegel also mit Bereichen mit unterschiedlichen Krümmungsradien versehen. Dadurch ergeben sich Verzerrungen des Spiegelbildes, die störend auf den Fahrer wirken.

Ein weiterer gravierender Nachteil besteht darin, daß dem in den bekannten Rückspiegel blickenden Fahrer wegen der Verzerrungen die Orientierung erschwert wird und daß er vor allen Dingen Entfernungen und die Geschwindigkeit herannahender Fahrzeuge nur sehr schlecht abschätzen kann.

Es ist nämlich zu berücksichtigen, daß in den Kraftfahrzeugen üblicherweise neben dem Rückspiegel auch noch ein Innenspiegel vorhanden ist, dessen Spiegelfläche plan ausgebildet ist. Anhand dieses das Sichtfeld nicht verzerrenden Innenspiegels ist es der Fahrer gewöhnt, die Entfernungen zu einem in dem unverzerrten Spiegelbild sichtbaren Fahrzeug richtig einzuschätzen. Deshalb wird der Fahrer verunsichert, wenn er in den konvexen Rückspiegel schaut und es besteht hier die große Gefahr, daß die Entfernung eines im konvexen Rückspiegel erscheinenden Fahrzeuges falsch eingeschätzt wird. Obwohl also der tote Winkel mit dem bekannten asphärischen Spiegel mit erfaßt wird, können sich dennoch wegen des verzerrten Spiegelbildes und wegen der Gefahr der falschen Einschätzung von Entfernungen und Geschwindigkeiten gefährliche Situationen im Straßenverkehr ergeben.

Hier greift die Erfindung ein, der die Aufgabe zugrunde liegt, zur Vermeidung der beschriebenen Nachteile einen Rückspiegel zu schaffen, der neben dem normalen Sichtbereich auch den toten Winkel umfaßt, und der gleichwohl die dem Fahrer geläufige Einschätzung von Entfernungen ermöglicht.

Dieses Ziel erreicht die Erfindung bei dem im Oberbegriff des Schutzanspruches 1 genannten Rückspiegel dadurch, daß horizontal über dem ersten und zweiten Spiegel ein plan ausgebildeter dritter Spiegel winkelig angeordnet ist, der — in der Breite — das gleiche Sichtfeld wie der erste Spiegel erfaßt.

Die Erfindung behält also den asphärischen Spiegel mit dem verzerrten Spiegelbild und mit der Möglichkeit der Erfassung des toten Winkels bei. Zusätzlich beinhaltet der komplette neue Spiegel aber im oberen Bereich noch einen dritten plan ausgebildeten Spiegel, der so angeordnet ist, daß er dem Fahrer das Sichtfeld des ersten Spiegels — allerdings unverzerrt — wiedergibt. Die unverzerrte Wiedergabe in dem zusätzlichen dritten Spiegel ermöglicht es dem Fahrer, in der ihm geläufigen Weise Entfernungen zu herannahenden Fahrzeugen richtig einzuschätzen, d.h. der neue Rückspiegel vereinigt in vorteilhafter Weise die Möglichkeit des Erfassens des toten Winkels und die Möglichkeit der richtigen Abschätzung von Entfernungen und Geschwindigkeiten. Dies war bisher bei den bekannten Rückspiegeln nicht möglich.

Durch die DE-US 24 09 748 ist zwar schon ein Rückspiegel bekannt, der durch eine horizontale Trennung in zwei übereinander angeordnete Spiegel aufgeteilt ist, allerdings sind hier beide Spiegel plan ausgebildet. Einer der beiden Spiegel soll den toten Winkel erfassen, und deshalb ist dieser Spiegel in einem Winkel zum anderen Spiegel angeordnet.

Bei diesem bekannten Rückspiegel ist es nachteilig, daß der sonst den kompletten Spiegel bildende Sichtbereich in Folge der Aufteilung in zwei winkelig zueinander angeordneten Spiegel zur Folge hat, daß in jedem der Spiegel nur die Hälfte des üblichen Bildes erscheint. Abgesehen von diesem den Fahrer verwirrenden Effekt wird ein in den Sichtbereich der Spiegel erscheinender Gegenstand auch noch horizontal verschoben dargestellt. Ein herannahendes Kraftfahrzeug, das in dem einen Spiegel beispielsweise in der Mitte gesehen wird, erscheint wegen der winkligen Anordnung in dem anderen Spiegel verschoben an dessen Rand.

Schließlich ist durch das deutsche Gebrauchsmuster 80 25 168.9 ebenfalls ein Spiegel mit einer horizontalen Trennlinie bekannt, wobei der obere Spiegel plan und der untere Spiegel konvex ausgebildet und bezüglich der Spiegelebene des ersten Spiegels entgegengesetzt zur Fahrtrichtung geneigt ist, so daß er neben dem toten Winkel auch das Sichtfeld des ersten Spiegels erfaßt. In der Praxis hat sich allerdings gezeigt, daß das menschliche Auge die beiden unterschiedlich großen Bilder kaum koordinieren kann, und außerdem besitzt der untere Spiegel mit dem Konvexglas eine zu geringe Höhe. Im übrigen wird hier der tote Winkel zwar verringert, aber nicht vollständig beseitigt. Schließlich ist hier — im Gegensatz zur Erfindung — der obere plan ausgebildete Spiegel als normaler Rückspiegel vorgesehen, während dieser bei der Erfindung im unteren Bereich angeordnet ist und zudem auch noch den toten Winkel erfaßt. Der obere Spiegel bildet bei der Erfindung nicht den normalen Rückspiegel, sondern er dient dazu, dem Fahrer die Möglichkeit zu geben, in gewohnter Weise Entfernungen und Geschwindigkeiten richtig abschätzen zu können.

Gemäß einer zweckmäßigen Ausgestaltung der Erfindung sind die drei Spiegel auf einer gemeinsamen Grundplatte angeordnet, welche auf ihrer Rückseite mit einer Klebeschicht versehen ist. Dadurch wird in vorteilhafter Weise die Möglichkeit geschaffen, den neuen Rückspiegel im nachhinein auf einen bereits vorhandenen herkömmlichen Spiegel aufzukleben, so daß bereits im Verkehr befindliche Kraftfahrzeuge nachträglich mit dem neuen Rückspiegel bestückt werden können.

Andere zweckmäßige Ausgestaltungen der Erfindung sind in den Unteransprüchen angegeben und der Zeichnung zu entnehmen.

Nachfolgend wird die Erfindung anhand des in der Zeichnung dargestellten Ausführungsbeispiels näher erläutert. Es zeigen:

Fig. 1 eine Vorderansicht eines Rückspiegels,

Fig. 2 eine Draufsicht des Rückspiegels gemäß **Fig.** 1, jedoch ohne Gehäuse, und

Fig. 3 eine Querschnittsansicht des Rückspiegels gemäß **Fig.** 1, ebenfalls ohne Gehäuse.

Der Rückspiegel **10** umfaßt insgesamt drei Spiegelbereiche, nämlich einen ersten Spiegel 12, einen zweiten Spiegel **14** und einen dritten Spiegel **16**.

Der erste Spiegel 12 ist der normale Rückspiegel für das Hauptsichtfeld. Er ist konvex mit einem gleichbleibenden Krümmungsradius ausgebildet.

Durch eine Trennlinie **18** abgesetzt schließt sich seitlich an den ersten Spiegel **12** der zweite Spiegel **14** zur Erfassung des toten Winkels an. Der zweite Spiegel **14** ist stärker konvex gekrümmt, wobei der Krümmungsradius hier nicht konstant ist.

Über die gesamte Breite der beiden Spiegel **12** und **14** zusammen erstreckt sich oberhalb einer waagerechten Trennlinie **20** der dritte Spiegel **16**, der nicht konvex, sondern plan ausgebildet ist. Dieser Spiegel **16** wird winkelig so angeordnet, daß er in seiner Breite das gleiche Sichtfeld wie der normale erste Spiegel **12** wiedergibt.

Alle drei Spiegel **12**, **14** und **16** sind auf einer gemeinsamen Grundplatte **22** befestigt und bilden somit eine Spiegeleinheit. Die Grundplatte **22** ist zusammen mit den drei Spiegeln **12**, **14** und **16** innerhalb eines Spiegelgehäuses **24** angeordnet, welches über einen Arm **26** mit einem hier nicht näher dargestellten Kraftfahrzeug verbunden ist.

Die waagerechte Trennlinie **20** verläuft etwa in der Mitte des Gehäuses **24**, so daß der erste Spiegel **12** und der zweite Spiegel **14** die gleiche Höhe besitzen wie der dritte Spiegel **16**.

Der neue Rückspiegel **10** eignet sich vorzüglich auch zum nachträglichen Einbau. Es ist nämlich möglich, die Rückseite der gemeinsamen Grundplatte **22** mit einer Klebeschicht zu versehen, die durch eine Schutzfolie abgedeckt wird. Auf ein Spiegelgehäuse **24** kann in diesem Fall verzichtet werden.

Der Käufer braucht dann lediglich die Schutzfolie abzuziehen, und die Grundplatte auf den bereits vorhandenen Spiegel bzw. auf die Spiegeloberfläche aufzukleben.

Für den Fall, daß die Grundplatte **22** größer als der Spiegelrahmen des bereits vorhandenen herkömmlichen Spiegels ist, kann auf der Rückseite der Grundplatte **22** ein kleineres Distanzstück angeordnet werden, welches dann auf die Spiegelfläche des herkömmlichen Spiegels aufgeklebt wird.

Nummer:	**36 20 228**
Int. Cl.^{4}:	**B 60 R 1/08**
Anmeldetag:	16. Juni 1986
Offenlegungstag:	17. Dezember 1987

3620228

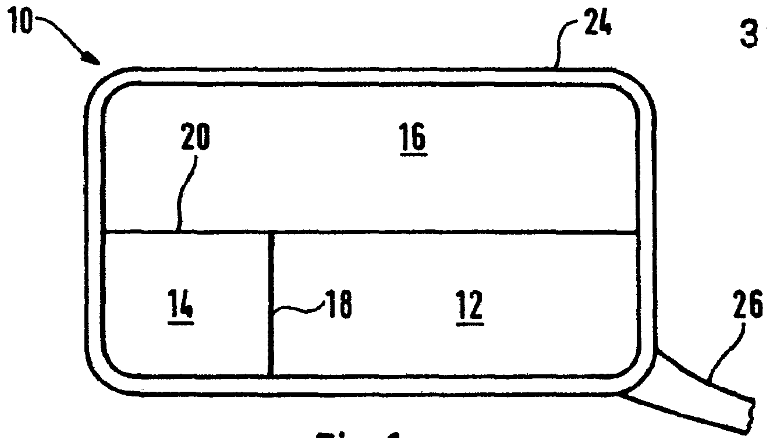

Fig.1

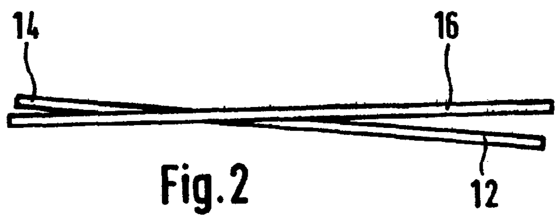

Fig.2

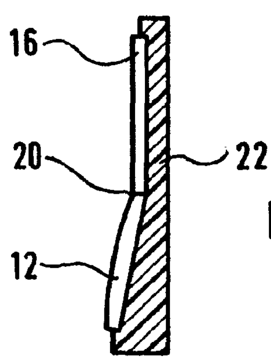

Fig.3

External rear view mirror for car - uses two-section mirror surface with curved area

Publication number:	DE4026578
Publication date:	1992-04-30
Inventor:	KRAEMER HORST (DE)
Applicant:	KRAEMER HORST (DE)
Classification:	
- international:	***B60R1/08;*** **B60R1/08;** (IPC1-7): B60R1/08
- European:	B60R1/08D2
Application number:	DE19904026578 19900820
Priority number(s):	DE19904026578 19900820

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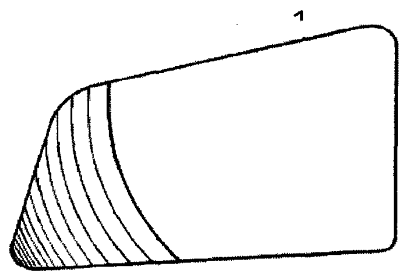
Abstract of **DE4026578**

Rear view external mirror for a passenger car having a mirror surface divided into a vehicle-side larger main mirror surface and an adjacent additional surface with progressive curvature. The progressive curvature is spherical and runs not only horizontally outwards but also slopingly downwards. ADVANTAGE - Mirror having an additional surface which provides an enlargement of the field of view.



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(51) Int. Cl.[5]: B 60 R 1/08

(21) Aktenzeichen: P 40 26 578.1
(22) Anmeldetag: 20. 8. 90
(43) Offenlegungstag: 30. 4. 92

DE 40 26 578 A 1

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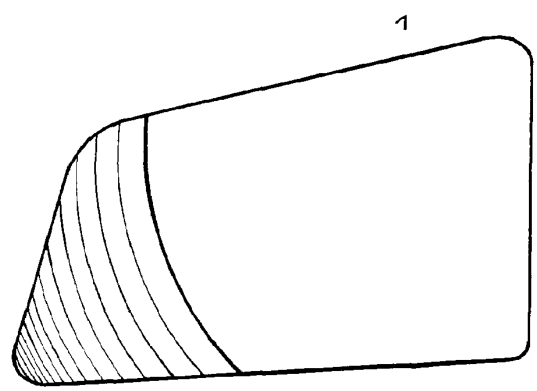
(72) Erfinder:
gleich Anmelder

Prüfungsantrag gem. § 44 PatG ist gestellt

(54) Vollsicht-Außenrückspiegel für Fahrzeuge

(57) Die Gesamt-Spiegelfläche des einteilig verstellbaren Spiegelglases hat eine einheitliche gleichförmige Ausgangs-Optik, entweder plan oder konvex mit gleichförmiger Krümmung. Sie ist unterteilt in eine fahrzeugseitige größere Haupt-Spiegelfläche mit Beibehaltung der Ausgangs-Optik, sowie in eine anschließende kleinere Zusatz-Spiegelfläche mit progressiver sphärischer Abkrümmung, die sowohl nach auswärts waagerecht wie auch nach auswärts abfallend verläuft.
Durch die sich daraus ergebende fächerförmig raumraffende Sicht-Erweiterung wird der Bereich des toten Winkels voll von waagerecht bis zur Fahrbahn erfaßt.



DE 40 26 578 A 1

Beschreibung

Gegenstand der Erfindung ist ein einteilig verstellbares Spiegelglas, das nicht nur den normalen Sehbereich erfaßt, sondern auch den vollen Bereich des toten Winkels, und zwar von waagerechter Ausdehnung bis schräg zur Fahrbahn. Der tote Winkel ist ein Nah-Bereich, und je mehr sich ein Objekt auf der Fahrbahn dem Beobachter nähert, umso mehr muß der Blick auch tiefer gehen.

Stand der Technik in bezug auf die Erfindung ist ein Spiegelglas nach dem Oberbegriff des Anspruchs. Dabei ist die Gesamt-Spiegelfläche unterteilt in eine fahrzeugseitige größere Haupt-Spiegelfläche von gleichförmiger optischer Beschaffenheit für den normalen Rückblick, sowie in eine anschließende kleinere Zusatz-Spiegelfläche für den Blick in den toten Winkel. Diese Zusatz-Spiegelfläche ist progressiv asphärisch abgekrümmt mit nach auswärts waagerechtem Verlauf. Daraus ergibt sich eine raumraffende waagerechte Sicht-Erweiterung.

Diese nur waagerechte Sicht-Erweiterung ist der Mangel dieses Spiegelglases. In einem Teil-Bereich des toten Winkels wird damit selbst bei Verwendung von konvexen Flächen mit Sicherheit nur erfaßt, was über PKW-Höhe hinausreicht. PKW-Fronthauben, die ja zuerst in den toten Winkel einfahren, werden in diesem Teil-Bereich so überhaupt nicht erfaßt.

Aufgabe der Erfindung ist es, ein Spiegelglas so zu konstruieren, daß mit einer Zusatz-Spiegelfläche eine raumraffende Sicht-Erweiterung nach auswärts waagerecht und gleichzeitig nach auswärts abfallend zustandekommt.

Diese Aufgabe wird erfindungsgemäß gelöst durch die kennzeichnenden Merkmale des Anspruchs. Die Zusatz-Spiegelfläche ist progressiv sphärisch abgekrümmt, wobei die Krümmung gleichzeitig nach auswärts waagerecht und nach auswärts abfallend verläuft. Durch die sich daraus ergebende fächerförmig raumraffende Sicht-Erweiterung wird der Bereich des toten Winkels voll von waagerecht bis zur Fahrbahn erfaßt. Es erleichtert auch das schnelle Beurteilen der jeweiligen Situation, wenn man die zu beobachtenden Objekte nicht nur über der Fahrbahn sieht, sondern auch auf der Fahrbahn.

Die beiden Zeichnungen zeigen vergleichsweise den Stand der Technik (2) für einen PKW-Spiegel und eine Darstellung des erfindungsgemäßen Spiegelglases (1) für einen PKW-Spiegel.

Ausführungsbeispiel in Verbindung mit der erfindungsgemäßen Zeichnung

Die Gesamt-Spiegelfläche hat eine mittlere verwendungsübliche Größe von etwa 170 Quadratzentimetern. Das Design entspricht einem praxisgerechten PKW-Spiegel, wobei die Unterkante leicht nach außen abfällt, damit sich für den Fahrer eine echte waagerechte Basis-Sicht ergibt. Flächengröße und Design ermöglichen es, daß die Ausgangs-Optik plan ist. Nach EURO TÜV muß sich auf Planglas für einen PKW-Außenspiegel die folgende geometrische Figur beschreiben lassen: Basis 13 cm, Außenhöhe 4 cm, Innenhöhe 7 cm. Diese Figur läßt sich bei der erfindungsgemäßen Darstellung bequem im oberen Teil der Haupt-Spiegelfläche einzeichnen und beläßt noch zusätzlichen Freiraum. Auch die Zusatz-Spiegelfläche wird mehr als nur knapp den Anforderungen gerecht.

Ein Spiegelglas mit konvexer Ausgangs-Optik kann

für die Praxis und darf nach EURO TÜV entsprechend kleiner sein, wobei die bezeichnete geometrische Figur nach einer vorgegebenen Formel berechnet wird, die den Krümmungsradius berücksichtigt.

Für die rechte Fahrzeugseite, die ja weiter vom Fahrer entfernt ist, empfiehlt sich aber ein Konvex-Spiegel mit den Abmessungen des hier dargestellten Plan-Spiegels.

Das erfindungsgemäße Spiegelglas eignet sich für die Erstausrüstung ebenso wie für die Zurüstung. Es kann zugerüstet werden entweder mit der Gesamt-Spiegelfläche als Voll-Aufsatzstück oder mit der Zusatz-Spiegelfläche als Teil-Aufsatzstück.

Patentanspruch

Fahrzeug-Außenrückspiegel mit einteilig verstellbarem Spiegelglas. Die Gesamt-Spiegelfläche hat eine einheitliche gleichförmige Ausgangs-Optik, entweder plan oder konvex mit gleichförmiger Krümmung. Sie ist unterteilt in eine fahrzeugseitige größere Haupt-Spiegelfläche mit Beibehaltung der Ausgangs-Optik, sowie in eine anschließende kleinere Zusatz-Spiegelfläche mit progressiver Abkrümmung, **dadurch gekennzeichnet,** daß die progressive Abkrümmung nicht asphärisch (2) sondern erfindungsgemäß sphärisch (1) ist, und daß sie nicht nur nach auswärts waagerecht (2) sondern erfindungsgemäß sowohl nach auswärts waagerecht wie auch nach auswärts abfallend (1) verläuft.

Hierzu 1 Seite(n) Zeichnungen

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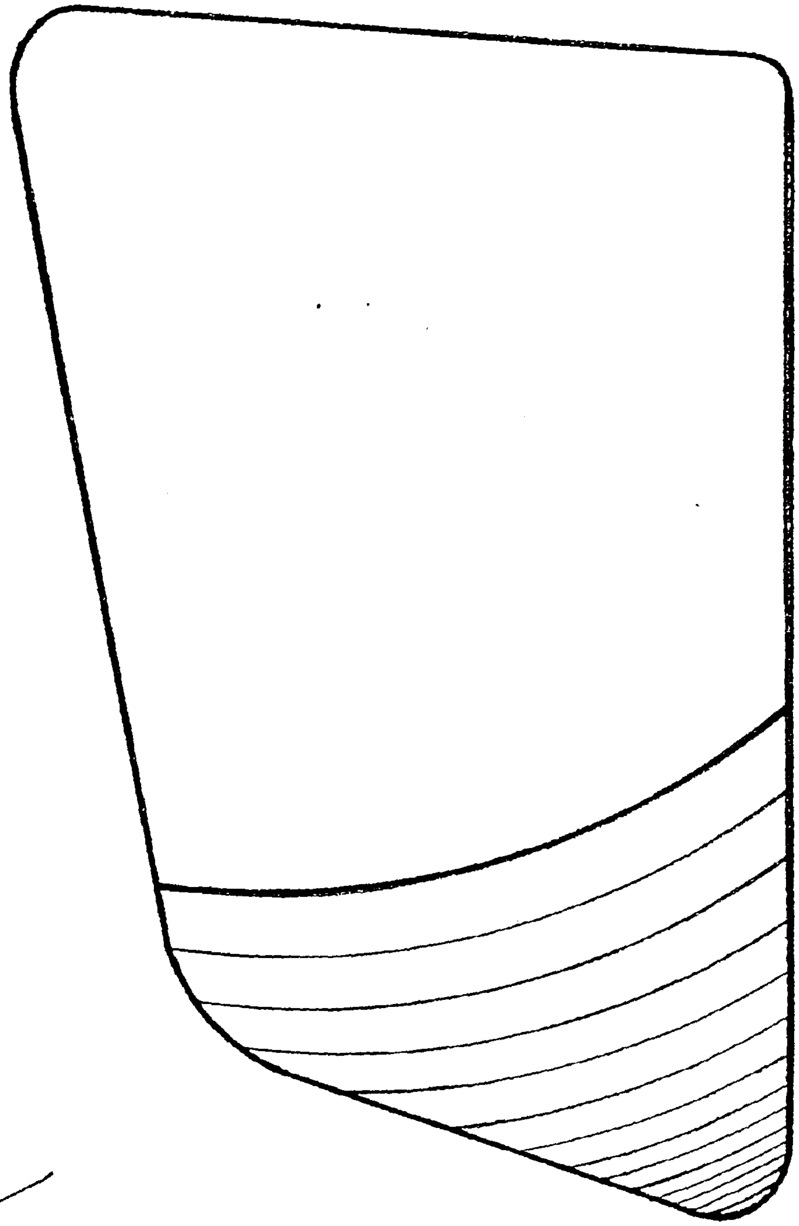
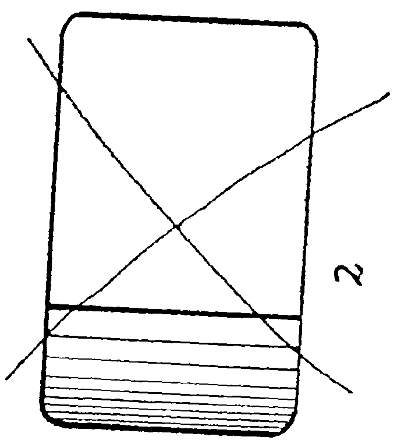
Offenlegungstag: 30. April 1992





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A2

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(54) **A mirror.**

(57) A mirror (1) generally in the form of a rear view or wing mirror with increased field of view but with perspective being substantially retained is provided. The mirror comprises two integral and continuous mirror sections (5,6), one (5) of which is flat to provide for recognition of distance and the other (6) of which laterally adjoins and merges with the flat mirror in tangential manner whilst being of convex shape to increase the lateral field of view whilst maintaining perspective of image to some extent at least. The mirror is generally held in a body or frame (2) having a mounting foot (4) or arm (3) attached thereto.

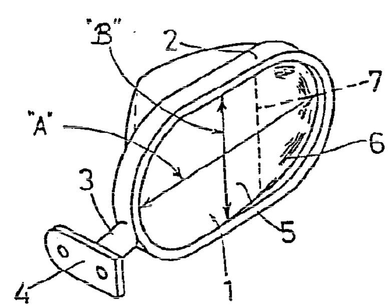

FIG.1

EP 0 210 757 A2

Croydon Printing Company Ltd

FIELD OF THE INVENTION

THIS INVENTION relates to a mirror such a rear view mirror of the general type employed for enabling an operator to view in a rearward direction particularly a driver of a motor vehicle or other land or water vehicle. Still more particularly, although not exclusively, the invention relates to what are widely termed "wing mirrors" and which are employed on the outside of a motor vehicle either on a door adjacent a front seat thereof and, particularly, but not exclusively, adjacent a driver's seat, or on a front fender of a vehicle.

BACKGROUND TO THE INVENTION

Wing mirrors, particularly those used on the door of a motor vehicle, suffer from the disadvantage that ordinary flat mirrors, which provide a realistic size of image (and thus correctly indicate distance)

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have insufficient field of view to enable a driver to see, in the mirror, a vehicle positioned in the well known "blind-spot" immediately adjacent the vehicle and somewhat to the rear of the driver. In an effort to overcome this disadvantage, it is well known to make such wing mirrors to a convex (part spherical) shape so that a very much increased field of vision is obtained. However, the disadvantage of this course of action is that a reduced size of image is presented in the mirror which, in turn, leads to a distorted impression as to the distance from the mirror of an object reflected therein.

In a further effort to avoid this disadvantage, there has been made available a flat mirror having a small convex mirror in the centre, or to one side, thereof. The distance mentioned above can therefore be estimated from the flat mirror whilst the convex mirror covers the required additional field of vision This arrangement has the disadvantage that a zone of flat mirror is rendered substantially inoperative by the convex mirror and any reduced size image appearing therein will have the same disadvantage regarding its distance from the mirror as indicated above. Also, only part, and possibly none,

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of any required image will appear in the flat region of the mirror. Also the eyes of an observer must refocus over a very short distance between the two totally different mirror surfaces.

Further efforts to overcome the problem include a number of different arrangements in which a flat mirror is either bent into two or more sections or has a lateral zone curved to a part cylindrical shape to provide an increased field of view. However, bending a flat mirror to provide a part cylindrical surface in this manner generally results in a change of mirror character which takes place over too short a distance and also a total loss of proportion in the curved part of the mirror. The images of objects are simply too narrow and tall and in fact become extremely difficult to recognise. Proposals of this general nature form the subject matter of granted United States Patent Numbers :-

4,331.382 to Graff
3,028,794 to Kinkella
2,857,810 to Troedle
3,501,227 to Landen, and,
3,628,851 to Robertson.

/...

It is the object of this invention to provide a rear view mirror which will alleviate, at least to some extent, the above disadvantages and which may, in addition, provide the advantage that it will be simple for an observer to detect when an object is in the usual "blind-spot" in relation to a motor vehicle.

SUMMARY OF THE INVENTION

In accordance with this invention there is provided a mirror having in the plane of the mirror a first dimension and a second dimension at right angles to the first dimension and wherein the mirror comprises a flat mirror section made integral with, and merging into, a convex mirror section which lies in the path of the second dimension, the flat mirror section communicating substantially tangentially with the convex mirror section such that the mirror, in the direction of the second dimension, has a cross-section comprising a straight portion communicating tangentially with a curved portion, the convex section having a cross-sectional shape in a direction parallel to said first dimension which increases in convexity with increasing distance from the flat mirror section.

/...

A further feature of the invention provides for the convex mirror section to also increase in convexity in the direction of the second dimension with increasing distance from the flat mirror section. A section through the mirror in this direction therefore may follow the path of a spiral or volute.

The cross-section of the convex section of the mirror in a direction parallel to the first dimension is conveniently part-circular with the radius of curvature decreasing with increasing distance from the flat mirror section.

The cross-section of the mirror in the direction parallel to the second dimension may be a straight line merging tangentially with a curved line which may be part-circular (ie. of fixed radius of curvature) but is preferably one which increases in convexity with increasing distance from the flat mirror section. In the latter case the curved line may be considered to have an "instantaneous" radius of curvature in the direction of the second dimension which will decrease either stepwise or continuously. A stepwise decrease facilitates physically generating

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the surface on a pattern. Most preferably such "instantaneous" radius of curvature is substantially equal to the radius of curvature in a direction parallel to the first dimension at all points on the convex mirror section.

It is to be understood that in this specification the terms "increasing and decreasing convexity" correspond to "decreasing and increasing instantaneous radii of curvature" respectively.

It will be understood that the radii of curvature and dimensions of the mirror will be chosen, in each case, to provide the required field of view. It should be noted that an image in the convex mirror section will be somewhat distorted and it is part of the advantage of the present invention that when a distorted image is viewed, a driver will know that the object being reflected is within the usual "blind-spot" area. However, such an image will not be so distorted as to be unrecognisable. It is also within the scope of this invention that the convex section of the mirror could be slightly tinted with any suitable colour to indicate that an object being reflected is located within such "blind-spot" area.

/...

In order that the invention may be more fully understood, various embodiments of the invention, in the form of a rear view wing mirror, will now be described.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings :

FIG. 1 is an isometric view of a wing mirror according to this invention;

FIG. 2 is a diagrammatic cross-section taken along the second dimension of the mirror indicated by line "A" in Fig. 1 illustrating the optical view lines achieved by a mirror of the invention itself (without the body, frame or the like);

FIG. 3 is an isometric view of a mirror surface according to the invention which can be generated on a lathe for pattern making purposes;

/...

FIG. 4 is an isometric view of a mirror alone in which the convex mirror section conforms to an alternative and preferred shape;

FIG. 5 is a sectional view taken in the direction of the second dimension of the mirror (ie. along line V - V in Fig. 4 and in the direction of line "A" in Fig. 1; and,

FIGS. 6a to 6d illustrate some cross-sections taken at lines VIa to VIa; VIb to VIb; VIc to VIc; and VId to VId respectively in Fig. 5 in directions parallel to the first dimension of the mirror as indicated by line "B" in Fig. 1.

DETAILED DESCRIPTION WITH REFERENCE TO THE DRAWINGS

In all the illustrated embodiments of the invention a wing mirror (1) is carried in a body or frame (2) mounted on an arm (3) having a mounting foot (4). The mirror itself has two integral sections (5)

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and (6), the one (5) of which is a flat mirror section and the other (6) of which is of a convex shape. The "break away" line of join between these two sections (5) and (6) of the mirror is indicated by dotted line (7) as being a straight line but it may also be an arcuate line as in the case of the mirror shown in Fig. 3.

In the case of the embodiment illustrated in Fig. 3 the convex section is formed by turning a pattern for the mirror on a lathe and moving the tool to form the radius of curvature in the direction parallel to the second dimension. The "break away" line (7) is, therefore, of part circular shape in this case.

In the case of the embodiment illustrated in Figs. 4 to 6 the "break away" line (7) is straight and the mirror surface assumes its preferred shape. The mirror surface thus deviates from a straight section as it enters the convex mirror section in the direction of the second dimension (ie. line "A" in Fig. 1). The convex section may have a constant radius of curvature in this direction but, in order to provide for the least distortion, preferably has a

/...

decreasing radius of curvature. Such radius of curvature preferably decreases constantly but for the purpose of facilitating development of a pattern surface, it may decrease in a step-wise manner so long as the surfaces are tangential to each other at the positions where the radius decreases by a stepped amount (ie. increasing convexity). The radius of curvature of the convex section of the mirror in cross-section in directions parallel to the first dimension of the miror (ie. parallel to line "B" in Fig. 1) at any particular point is preferably equal to the radius of curvature of the mirror at that same point in the direction parallel to the second dimension (ie. line "A" in Fig. 1).

In such preferred form therefore, the radius of curvature will decrease as the distance increases from the "break away" line (7). Thus, as shown clearly in Fig. 5, r_1 is greater than r_2 which is greater than r_3 which is greater than r_4. The radius of curvature in cross-section (in directions parallel to the dimension) is illustrated in Figs. 6a to 6d respectively as being equal to the radius of curvature in the direction of the second dimension at any particular point along its length.

/...

Referring now more particularly to Fig. 2, it will be seen that the flat section (2) of the mirror has extremities of vision, relative to a pair of hypothetical eyes given by lines of vision indicated by numerals (10) and (11). That indicated by numeral (10) constitutes the innermost limit of vision whilst that indicated by numeral (11) indicates the outermost line of vision. Thus, there is, as usual, a substantial "blind-spot" in the general area indicated by numeral (12).

The convex section (6) of the mirror according to this invention, as indicated by extremity line of vision indicated by numeral (13), embraces this general area and, in fact, can, depending on the size of the mirror, and the radii of curvature thereof, be made to bring the field of vision up to substantially that of a driver looking roughly forwardly and what is seen out of the corner of his eye..

As indicated above, it will be appreciated, that the radius of curvature should not be too small otherwise the image of an object will be excessively distorted and possibly be unrecognisable. The preferred idea is to render the object recognisable

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but in somewhat distorted image so that a driver will then be aware of the fact that the object is in what is usually considered to be the "blind-spot".

It will be understood that numerous variations may be made to the above described embodiments of the invention without departing from the scope hereof.

The invention therefore provides an extremely simple yet highly effective rear view mirror which will, it is considered, do away with the general difficulties outlined above and which are associated with presently available mirrors or mirror assemblies.

Also, the invention is not to be interpreted as being confined in scope to a convex section being only on one side of a flat mirror section and, in fact, an arcuate mirror section could be provided at two opposite sides of a flat mirror section or around the entire periphery of the flat mirror section, if required. In the latter case, the flat mirror section could be circular, thus providing a convex type of mirror but with a central flat section.

/...

The mirrors of this invention can be made by any suitable methods of manufacture such as moulding of a mirror backing following by silvering and the application of any protective coatings or the like as may be required. In particular, it is envisaged that mass production will be most easily carried out by injection or press moulding a backing or even vacuum forming such backing. In any event, all conventional techniques can be employed as only the contour of the reflective surface is different from mirrors currently being manufactured.

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Claims

1. A mirror (1) having in the plane of the mirror a first dimension ("B") and a second dimension ("A") at right angles to the first dimension and wherein the mirror comprises a flat mirror section (5) made integral with, and merging into, a convex section (6) which lies in the path of the second dimension, the flat mirror section communicating substantially tangentially with the convex mirror section such that the mirror, in the direction of the second dimension, has a cross-section comprising a straight portion communicating tangentially with a curved portion, the convex section having a cross-sectional shape in a direction parallel to said first dimension which increases in convexity with increasing distance from the flat mirror section.

/...

2. A mirror as claimed in claim 1 in which the convex mirror section (6) increases in convexity in the direction of the second dimension ("A") of the mirror with increasing distance from the flat mirror section (5).

3. A mirror as claimed in claim 2 in which the convexity of the convex mirror section (6) is substantially the same in the direction of the first dimension ("B") as it is in the direction of the second dimension ("A") at all positions on the convex mirror section (6).

4. A mirror as claimed in claim 1 in which the cross-section of the convex mirror section (6) is in the direction of the first dimension ("B"), substantially part-circular in shape at all positions thereon.

5. A mirror as claimed in claim 1 in which the break-away line (7) where the flat (5) and convex (6) mirror sections meet tangentially is a straight line.

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6. A mirror as claimed in claim 1 in which the break-away line (7) where the flat (5) and convex mirror sections meet tangentially is a curved line.

7. A mirror as claimed in claim 2 in which the convexity of the convex mirror section (6) increases in a stepwise manner with increasing distance from the flat mirror section (5).

8. A mirror (1) as claimed in claim 2 in which the convexity of the convex mirror section increases continuously with increasing distance from the flat mirror section (5).

9. A mirror as claimed in claim 1 in which the mirror (1) is a rear view mirror held in a suitable body or frame (2) therefor.

10. A mirror as claimed in claim 9 in which the body or frame (2) is carried by a mounting foot (4) or arm (3).

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11. A mirror as claimed in claim 1 in which the convex mirror section (6) is of a different colour tint from that of the flat mirror section (5).

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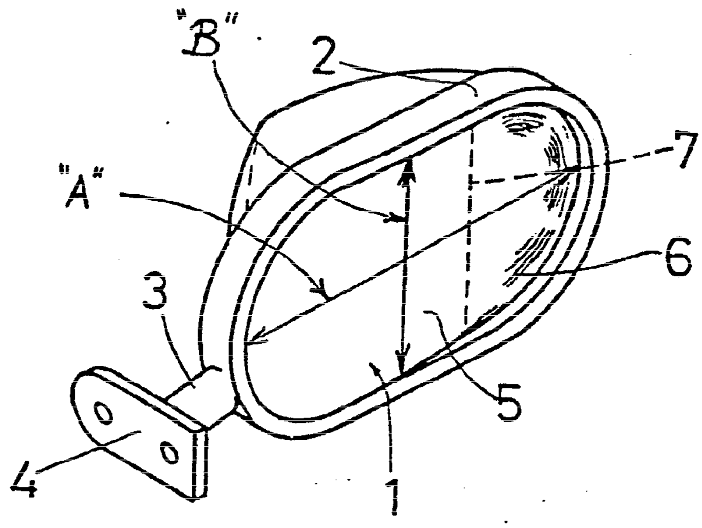

FIG. 1

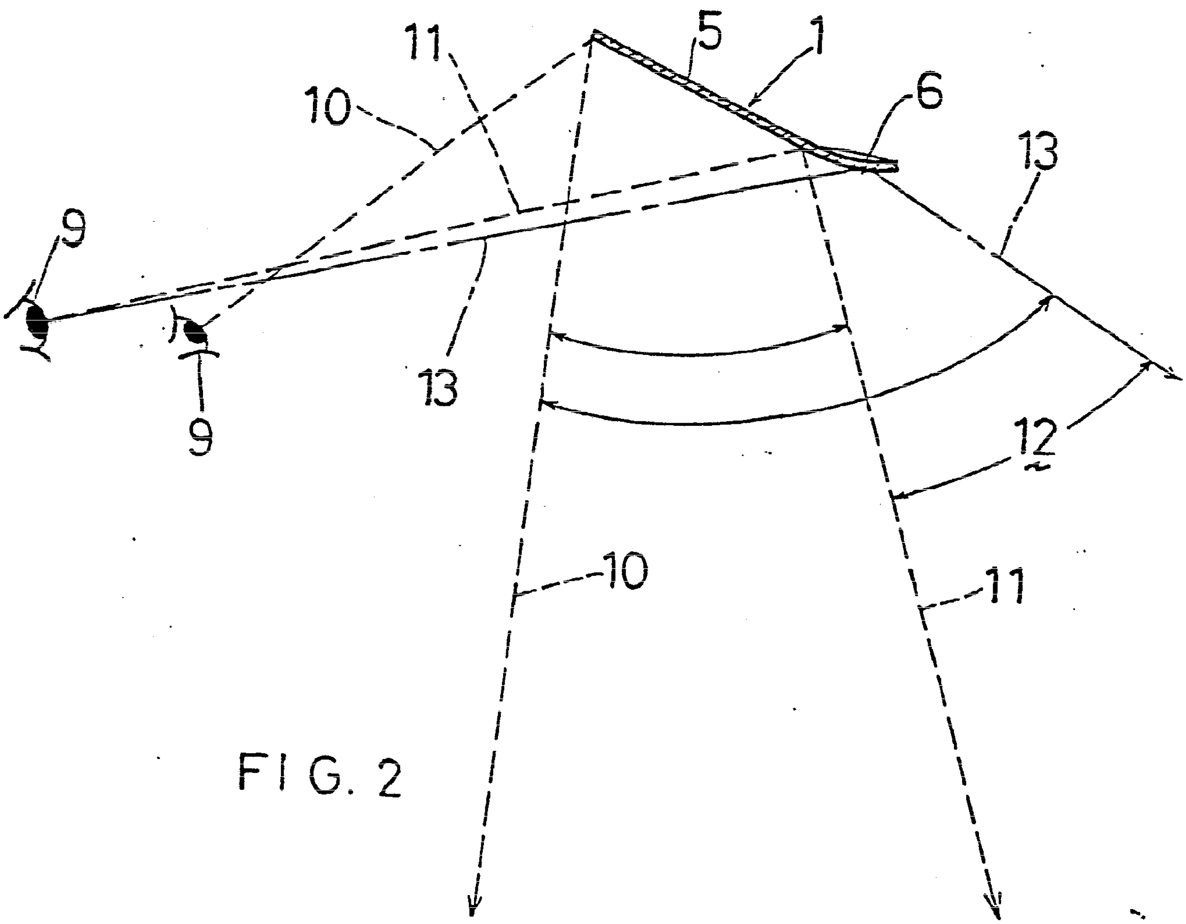

FIG. 2

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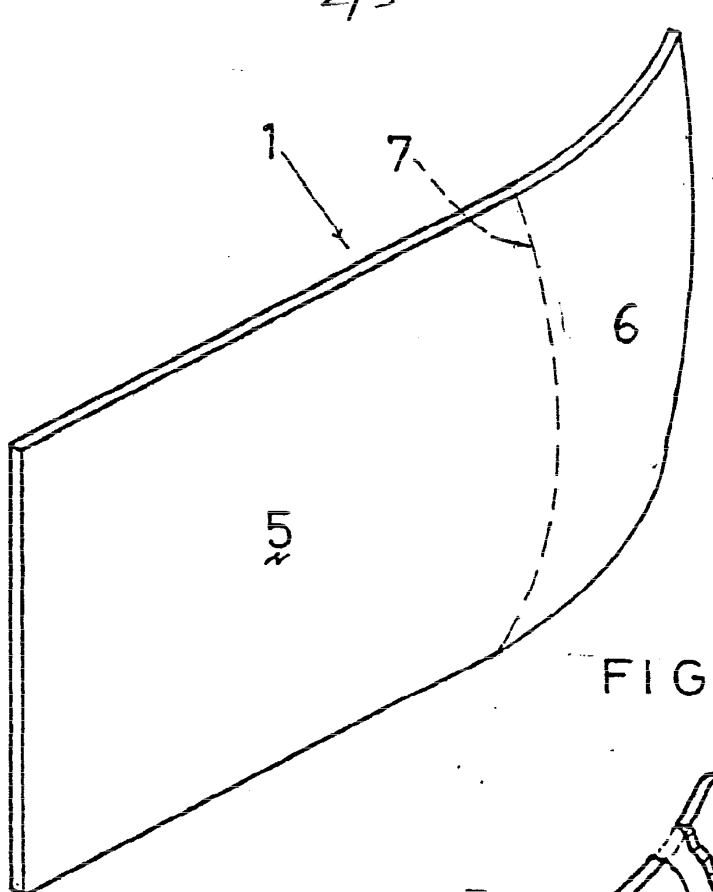

FIG. 3

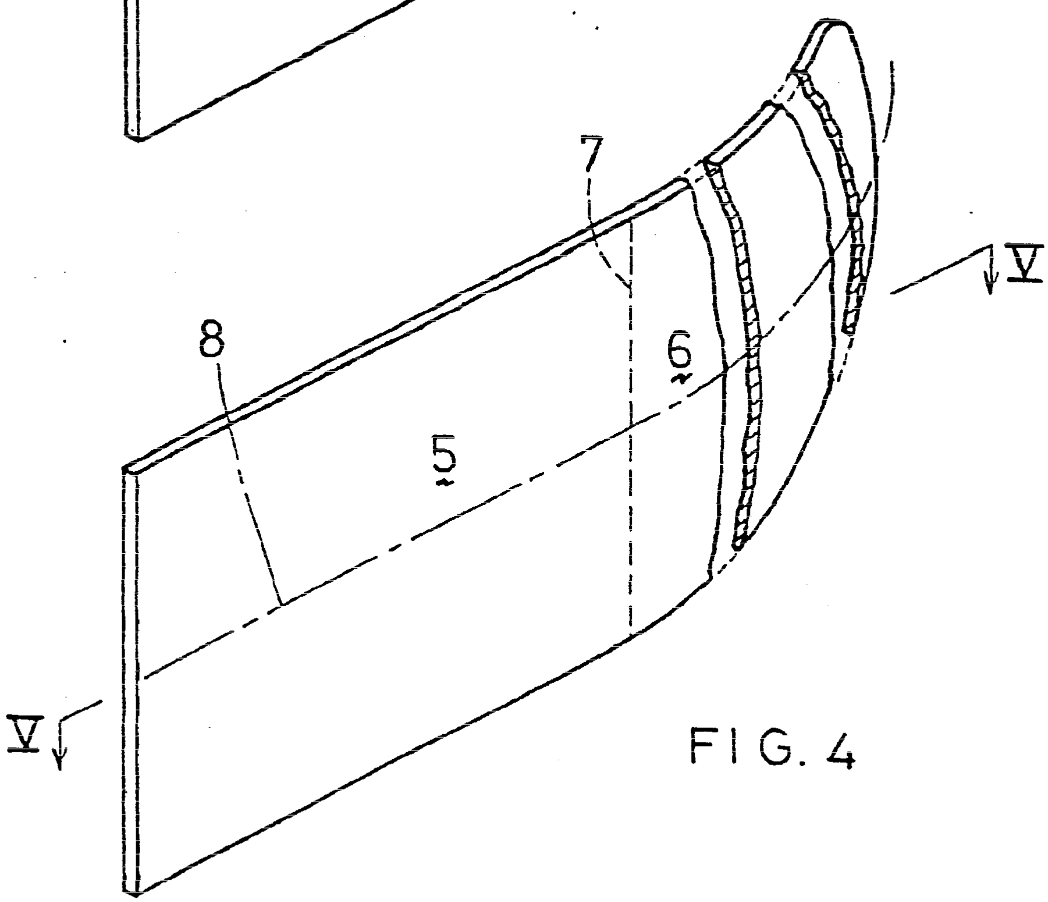

FIG. 4

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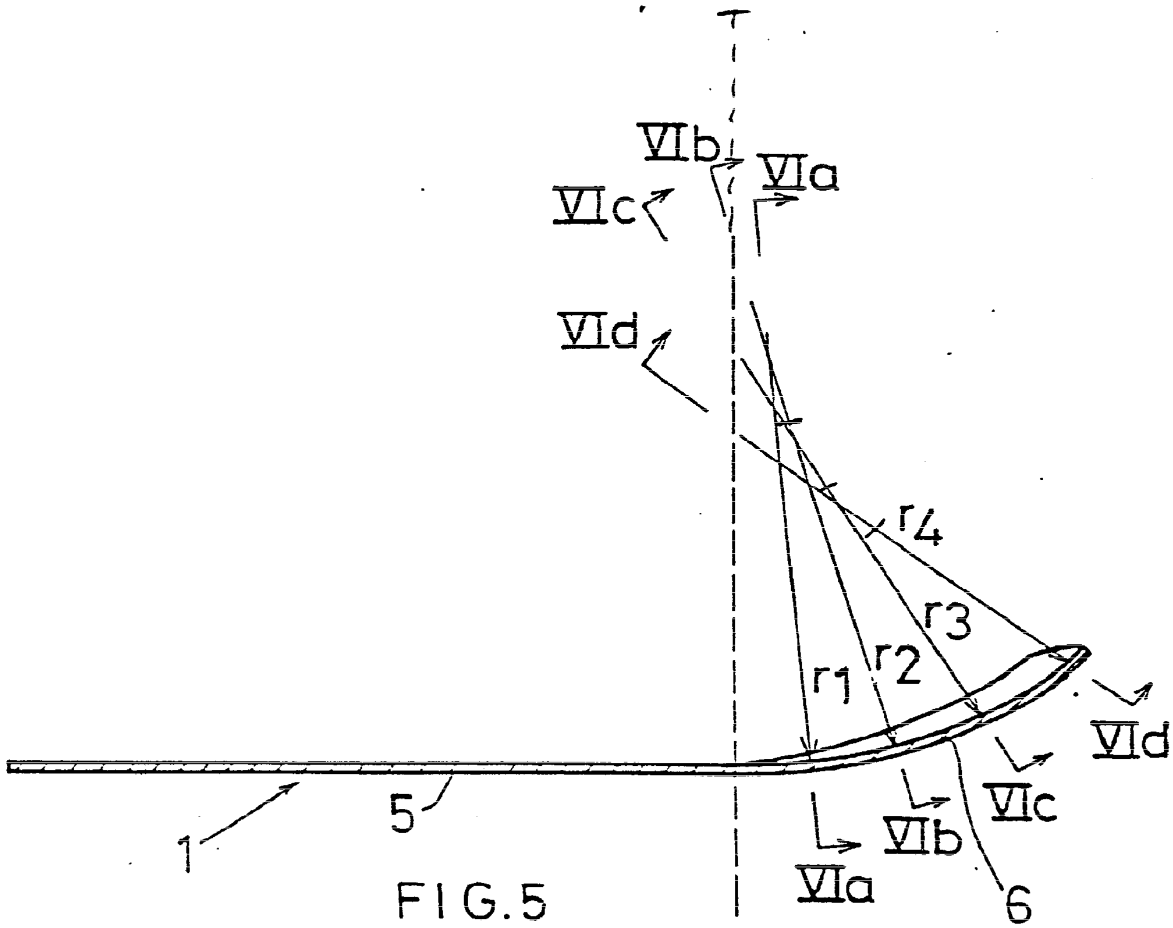

FIG.5

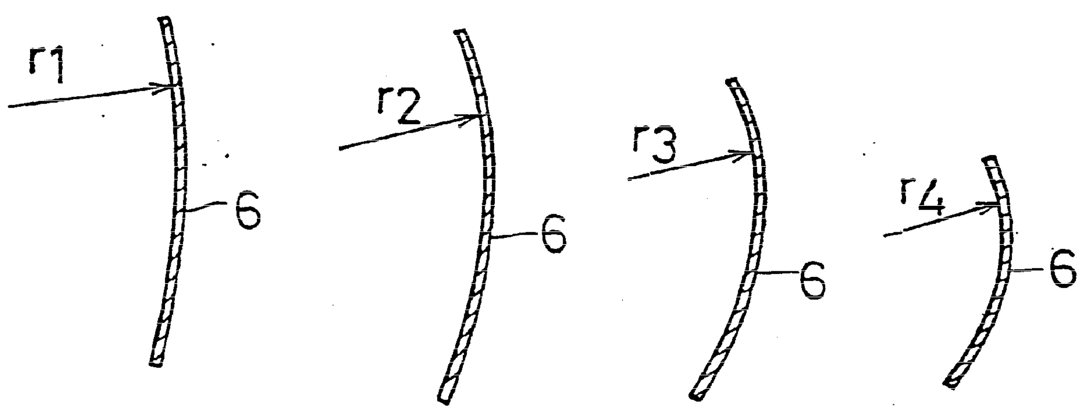

FIG.6a FIG.6b FIG.6c FIG.6d

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(54) Exterior rear-view mirror assembly for a vehicle.

(57) An exterior rear-view mirror assembly for a vehicle has a housing (10) arranged to be mounted at a predetermined orientation on a vehicle body and a mirror (30) mounted in the housing (10) on means (28) permitting its orientation to be adjusted relative to the housing (10). A second mirror (36), which is convex and of smaller radius of curvature than the first mirror (30), is mounted in the housing (10) either above or below the first mirror (30) so that no part thereof is further from the vehicle than the outboard edge of the first mirror (30).

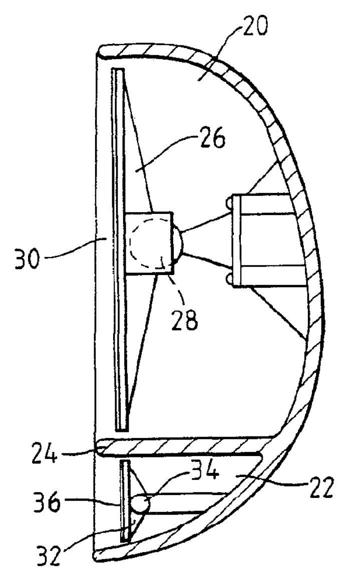


Fig.2

EP 0 310 261 A1

EXTERIOR REAR-VIEW MIRROR ASSEMBLY FOR A VEHICLE

This invention relates to an exterior rear-view mirror assembly for a vehicle of the type in which a housing is arranged to be mounted at a predetermined orientation on a vehicle body and a mirror is mounted in the housing on means permitting its orientation to be adjusted relative to the housing.

The mirrors of such mirror assemblies are commonly either plane mirrors or convex mirrors having a relatively large radius of curvature. Consequently, although a driver using such a mirror is able to form a relatively accurate impression of the distance between his vehicle and a following vehicle, it is probable that such a mirror will leave a so-called "blind spot" in which another vehicle passing the vehicle to which the mirror is fitted moves out of the driver's field of view in the mirror before it enters the periphery of the driver's field of view by direct vision. The present invention aims to provide a mirror assembly which is not subject to this disadvantage.

According to the invention, a mirror assembly of the foregoing type has a second convex mirror of smaller radius of curvature than the first mirror mounted in the housing either above or below the first mirror so that no part thereof is further from the vehicle than the outboard edge of the first mirror.

An embodiment of the invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is an elevational view of a rear view mirror in accordance with the invention from the side from which the mirror is viewed;

Figure 2 is a cross-sectional view taken on the line 2-2 in Figure 1;

Figure 3 is a partially broken away plan view of the mirror shown inFigure 2.

Referring to Figure 1, a rear view mirror assembly comprises a housing 10 mounted at one side on a base member 12, the surface 14 of which is adapted to abut against and be secured to the body of a motor vehicle (not shown). The connection between the housing 10 and the base member 12 comprises mechanism allowing the housing 10 to be displaced forwardly or rearwardly in the event that the housing is subjected to impact. This mechanism which, in Figure 1 is covered by a sleeve 16 of flexible material, is of known type and will therefore not be described in detail.

As can be seen from Figures 1 and 2, the housing 10 comprises an upper chamber 20 and a lower chamber 22 which are separated by a partitition wall 24. A first mirror carrier 26 is mounted on a ball-and-socket joint 28 which is secured to the interior of the chamber 20. A plane mirror 30 is mounted on the mirror carrier 26.

Similarly, a mirror carrier 32 is mounted on a ball-and-socket joint 34 which is secured to the interior of the lower chamber 22. The mirror carrier 32 carries a convex mirror 36. The relative curvatures of the mirrors 30 and 36 can best be seen from Figure 3.

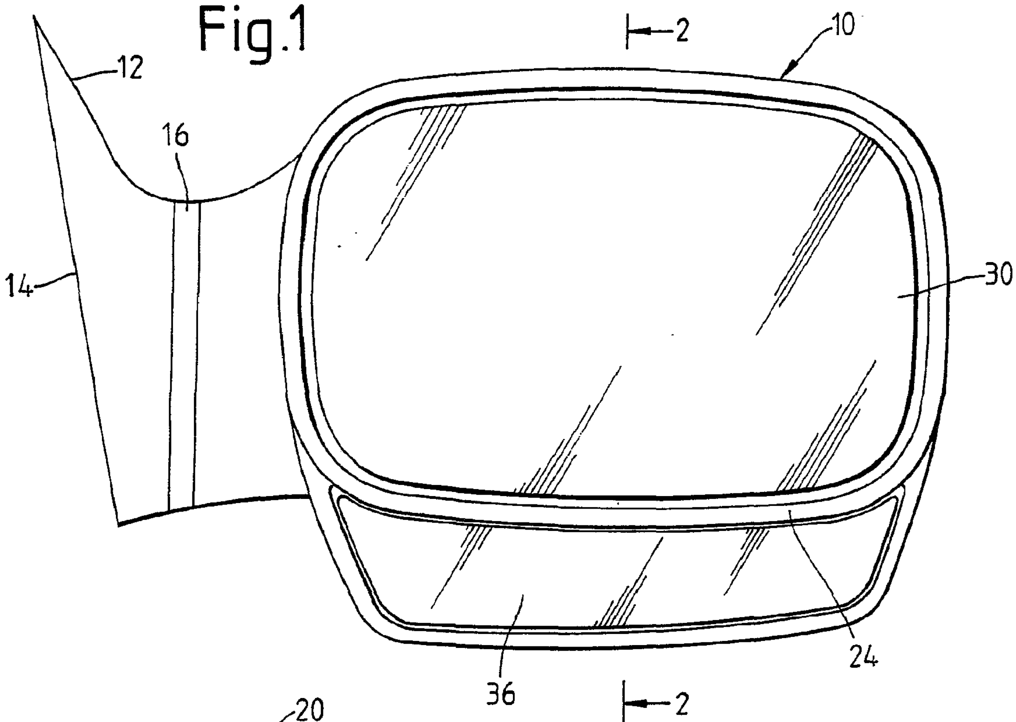
As is well known, it will be necessary for different drivers to adjust the orientation of the plane mirror 30 to suit their requirements. If desired, mechanism of known type may be provided for making this adjustment remotely from the interior of the vehicle. It will usually be unnecessary for the orientation of the convex mirror 36 to be altered, only two settings being necessary depending on whether the vehicle with which it is to be used has left hand drive or right hand drive. Consequently, the ball-and-socket joint 34 may be replaced by a mounting which can be set to either of two predetermined positions at the time when the mirror is fitted to a vehicle.

Claims

1. An exterior rear-view mirror assembly for a vehicle having a housing (10) arranged to be mounted at a predetermined orientation on a vehicle body and a mirror (30) mounted in the housing (10) on means (28) permitting its orientation to be adjusted relative to the housing (10), characterised by a second mirror (36) which is convex and of smaller radius of curvature than the first mirror (30) mounted in the housing (10) either above or below the first mirror (30) so that no part thereof is further from the vehicle than the outboard edge of the first mirror (30).

2. An exterior rear-view mirror assembly according to claim 1, wherein the second mirror (36) is mounted on means (34) permitting its orientation to be adjusted relative to the housing (10).

Fig.1



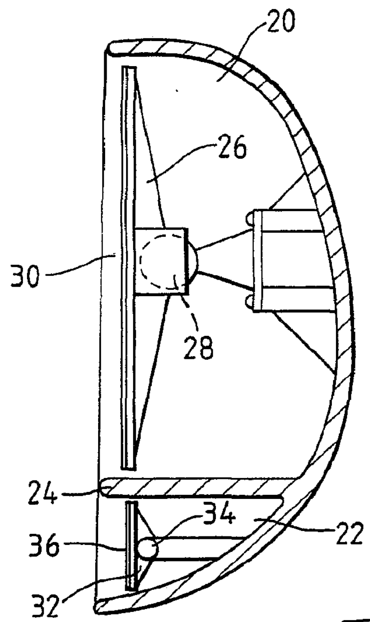
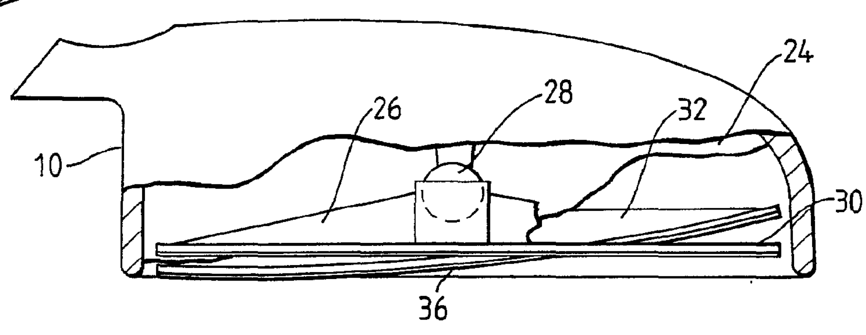


Fig.2

Fig.3



European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 88 30 8482

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. 4)
X	DE-A-2 537 876 (REITTER & SCHEFENACKER KG) * Claim 1; figures 1,2 * ---	1,2	B 60 R 1/08
X	US-A-3 408 136 (TRAVIS) * Page 1, lines 20-29; figures 1-4 * ---	1	
X	US-A-3 175 463 (SEASHORE) * Column 1, line 62 - column 2, lines 1-40; figures 1-7 * -----	1	
			TECHNICAL FIELDS SEARCHED (Int. Cl.4)
			B 60 R

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	02-01-1989	MAUSSER,T.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P0401)

Blind spot viewing device for a rearview-mirror.

Publication number: EP0551802 (A1)
Publication date: 1993-07-21

Inventor(s): JONSSON TORN RUBEN [SE] +
Applicant(s): JONSSON TORN RUBEN [SE] +

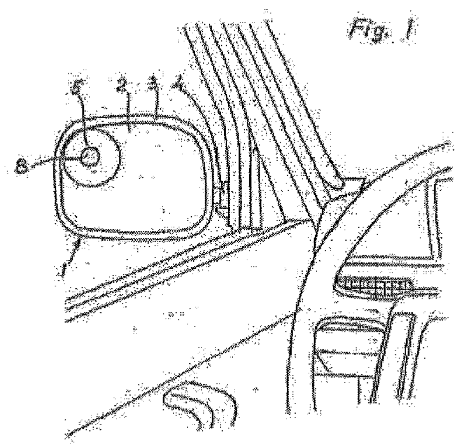
Classification:
- international: ***B60R1/08;*** **B60R1/08;** (IPC1-7): B60R1/08
- European: B60R1/08D2
Application number: EP19920850006 19920115
Priority number(s): EP19920850006 19920115

Cited documents:

US2778273 (A)
NL9000884 (A)
US2911177 (A)
US3104274 (A)
NL7908257 (A)

Abstract of **EP 0551802 (A1)**

In order to improve the viewing field in the blind spot of a car driver using a rear view mirror (1), a convex mirror surface shaped like a spherical cap (5) with a central planar surface (8) is mounted on the planar or slightly convex mirror glass surface (2) of the rear view mirror, preferably near one corner of the mirror glass. The cap (5) has a radius of curvature of about 0.1 m and its size is such that the cap encloses an angle alpha of between about 2 and about 6 DEG at the intended viewing distance.



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(11) Veröffentlichungsnummer: **0 551 802 A1**

(12) EUROPÄISCHE PATENTANMELDUNG

(21) Anmeldenummer: **92850006.5**

(51) Int. Cl.^{5}: **B60R 1/08**

(22) Anmeldetag: **15.01.92**

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21.07.93 Patentblatt 93/29

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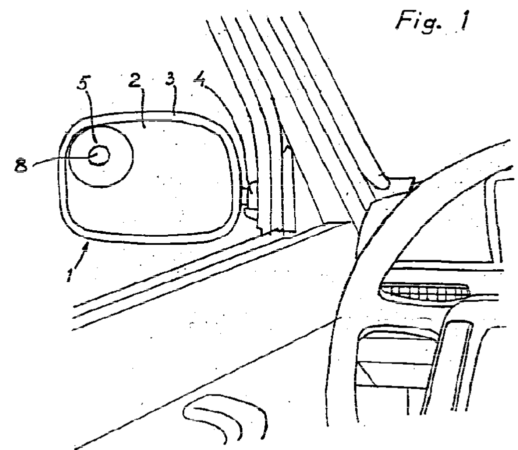
(54) Toterwinkelerfassungsvorrichtung für Rückspiegel.

(57) Zwecks Verbesserung des Sichtfeldes im toten Winkel eines Wagenführers mit Hilfe eines Rückspiegels (1) ist eine konvexe Spiegelfläche in Form einer sfärischen Kalotte (5) mit einer zentralen planen Fläche (8) auf der planen oder schwach konvexen Spiegelglassfläche (2) des Rückspiegels angebracht und vorzugsweise in der Nähe einer Ecke des Spiegelglasses. Die Kalotte (5) hat einen Krümmungsradius von etwa 0,1 m und eine solche Grösse, dass die Kalotte bei beabsichtigtem Betrachtungsabstand einen Winkel α von zwischen etwa 2 bis etwa 6° umfasst.

Fig. 1



EP 0 551 802 A1

Die vorliegende Erfindung bezieht sich auf eine Vorrichtung für Rückspiegel für Fahrzeuge um den toten Winkel zwischen dem Sichtfeld des üblichen Aussenrückspiegels und dem direkten Sichtfeld des Wagenführers auszuschalten.

Derartige Vorrichtungen an Rückspiegeln mit welchem man durch besondere optische Ausbildungen versucht hat den s.g. toten Winkel zu vermindern sind vorbekannt. Übliche äussere Rückspiegel sind meistenteils mit einer planen oder schwach konvexen Fläche ausgebildet. Zwecks Erhalt einer grösseren Sichtfläche sind s.g. Panoramarückspiegel verwendet worden, die durch eine konvexe Ausbildung und einer beträchtlich grösseren horisontalen Länge als gewöhnliche Rückspiegel eine gewisse Verbesserung des Sichtfeldes gegeben haben. Hierdurch besteht jedoch der Nachteil dass der Autofahrer rückwärtigen Verkehr nicht länger in natürlicher Grösse erfassen kann, wodurch eine Beurteilung des Abstandes zu rückwärtigen Fahrzeugen und deren Geschwindigkeit schwierig zu beurteilen ist. Man hat auch schon versucht das Sichtfeld durch Aufteilung des Spiegelglasses in einer äusseren Hälfte und einer inneren Hälfte zu vergrössern. Eine derartige Ausbildung führt jedoch zu ungewünschten Verzerrungen.

Zur Lösung des vorliegenden Problemes ist auch schon die Befestigung eines kleineren Spiegels auf dem normalen äusseren Rückspiegel vorgeschlagen worden, wobei die Spiegelfläche des kleineren Spiegels konvex ausgebildet ist und durch den hierdurch erhaltenen Weitwinkeleffekt den Totenwinkel abdeckt - vgl hierzu beispielsweise DE OS 2 139 431 insbesondere Fig. 3 c. Diese hier verwendete gänzlich konvex gewölbte Spiegelfläche ergibt jedoch ein unproportional verzerrtes Bild und resultiert damit leicht zu einer falschen Beurteilung des Abstandes zu einem im toten Winkel beobachteten Fahrzeug.

Zweck vorliegender Erfindung ist die Schaffung einer Vorrichtung an derartigen Rückspiegeln, die den toten Winkel abdeckt ohne zu Verzerrungen der Sichtfläche zu führen.

Zur Lösung dieses Problemes wird erfindungsgemäss eine Vorrichtung vorgeschlagen die eine Wölbung hat, die im Vergleich zu einem planen oder schwach konvexen Rückspiegel einen ausgesprochenen Weitwinkeleffekt ergibt und welche gegenüber ihrem Betrachtungsabstand ausreichend gross ist um eine sichere und korrekte Beobachtung eines im diesem Abstand befindlichen Fahrzeuges zu ergeben. Hierdurch wird der gewöhnlicherweise tote Winkel gut abgedeckt und der ausgesprochene Weitwinkeleffekt ergibt, dass besonders naheliegende im Totenwinkel befindliche Fahrzeuge gut observiert werden können während die Spiegelfläche des üblichen Rückspiegels für Betrachtungen auf längeren Abständen verwendet werden kann.

Erfindungsgemäss ist die spiegelnde konvexe Fläche als eine hauptsächlich sfärisch gewölbte Kalotte ausgebildet, deren zentrale Zentrumpartie aus einer planen Fläche besteht, wobei die zentrale plane Fläche etwa 5 - 17 %, vorzugsweise 7-10 % der totalen Spiegelfläche ausmacht. Hierdurch ist die Möglichkeit zu einer einfachen und billigen Herstellung gegeben und gleichzeitig überwindet man auch in bestmöglicherweise eine Bildverzerrung und auch ignorierbare optische Kanteneffekte an der Periferie der Kalotte.

Zweckmässig soll der Krümmungsradius der spiegelnden konvexen Fläche eine Grössenordnung von 0,1 m aufweisen und soll die Kalotte bei einem Betrachtungsabstand einen Winkel von zwischen 2 bis 6° aufnehmen. Mit "Grössenordnung" ist in diesem Zusammenhang der Intervall zwischen der Messzahl dividiert mit $\sqrt{3}$ und der Messzahl multipliziert mit $\sqrt{3}$ gemeint. Der Krümmungsradius R ist somit in einer Grössenordnung 0,1 m falls $0{,}1/\sqrt{3} \leqq R$ och $\leqq 0{,}1 \cdot \sqrt{3}$ oder mit anderen Worten R sollte zwischen etwa 0,05 m und zirka 0,16 m betragen. Weiterhin kann die obere Winkelgrenze von 6° zweckmässig für heutzutage verwendete Personenkraftwagen gelten bei welchen die Grösse der Rückspiegel meistens einen grösseren Winkel erlaubt ohne dass die gewöhliche Spiegelfläche des Rückspiegels allzu klein wird. Bei Lastkraftwagen und Omnibussen kann deshalb, falls gewünchst, die obere Winkelgrenze um einige Grade höher sein.

Bei einer ersten vorgezogenen Ausführungsform der Erfindung besteht die Vorrichtung aus einem Körper in Form einer hauptsächlich sfärisch gewölbten Kalotte mit einer zentralen planen Fläche, wobei die Vorrichtung auf einem planen oder schwach konvexen Spiegelglass eines üblichen Rückspiegels befestigt werden kann.

Hierbei ist zweckmässig dass der Körper eine Hinterseite hat, die wenigstens teilweise mit einer Klebmasseschicht bedeckt ist um hiermit in gewünschter Lage auf dem Spiegelglass eines üblichen Rückspiegels befestigt werden zu können und dass diese Klebmittelschicht in an sich bekannter Weise vor Werwendung durch eine abreissbare Schutzschicht abgedecht ist.

Alternativ kann die erfindungsgemässe Vorrichtung natürlich initial auf einem üblichen Rückspiegel befestigt sein. Durch eine derartige Befestigung, die im Zuge der Herstellung des Rückspiegel geschehen kann, ist natürlich eine bessere Haftung gewährleistet.

In beiden diesen Fällen besteht die mit einer zentralen planen Fläche versehene, sfärisch kalottförmige Vorrichtung zweckmässig aus einem blankpolierten Metall oder einer Metallschicht auf einem Träger aus beispielsweise Kunststoff oder Glass, wobei das Metall, falls gewünscht gegen chemische oder physikalische Einflüsse geschützt ist beispielsweise durch eine klare, permanente Schutzschicht.

In einer weiter alternativen Ausführungsform ist die mit einer zentralen planen Fläche versehene, sfärisch kalottförmige Vorrichtung einstückig mit einem planen oder schwachkonvexen Spiegelglass zu einem üblichen Rückspiegel geformt. Diese Ausführungsform erscheint als zweckmässig bei einer normalen Ausrüstung von neuen Fahrzeugen vor dem Verkauf.

Die Erfindung wird nachstehend an Hand der beiliegenden Zeichnungen näher veranschaulicht,

- Fig. 1 ist eine Perspektivansicht vom Fahrerplatz eines Personenwagens und zeigt eine vorgezogene Ausführungsform der Erfindung an einem äusseren Rück-spiegel
- Fig. 2 ist eine Seitenansicht der Vorrichtung in Form einer sfärischen Kalotte die am Spigelglass eines Rückspiegels befestigt ist
- Fig. 3 ist eine weitere Seitenansicht, die eine sfärische Kalotte zeigt, die auf der Hinterseite mit einer Klebstoffschicht und einer Schutzschicht versehen ist,
- Fig. 4 ist ein Querschnitt einer zweiten vorgezogenen Ausführungsform, bei welcher eine hauptsächlich sfärische Kalotte einstückig mit dem planen oder schwach gewölbten Spiegelglass eines üblichen Rückspiegels ausgebildet ist,
- Fig. 5 ist eine perspektivische Ansicht einer erfindungsgemässen Vorrichtung von oben, wobei die Vorrichtung als solche gezeigt wird,
- Fig. 6 ist eine untere Ansicht der in Fig. 5 gezeigten Vorrichtung und
- Fig.7 ist ein Querschnitt durch die Vorrichtung nach Fig. 5.

Der in Fig. 1 gezeigte Rückspiegel 1 ist ein äusserer Rückspiegel der am Türpfosten eines Personenwagens angeordnet ist. Der Rückspiegel 1 besteht aus einem planen oder schwach konvexen Spiegelglass 2 und einer Halterung 3, welche durch eine Befestingungsvorrichtung 4 am Bilpfosten in an sich bekannter Weise befestigt ist. Zwecks Verbesserung des Sichtfeldes nach hinten ist ein spiegelreflektierender Körper 5 an der oberen äusseren Ecke der Spiegelglasses 2 befestigt, wobei die spiegelnde Fläche des Körpers hauptsächlich die Form einer sfärischen Kalotte mit einer zentralen planen Fläche 8 hat, wobei diese zentrale plane Fläche 5 - 17 %, vorzugsweise 7 - 10 % der totalen Spiegelfläche ausmacht.

Der Wölbungsradius R (Fig. 2) der Kalottfläche ist von einer Grössenordnung von etwa 0,1 m und kann normalerweise zwischen etwa 0,05 m und etwa 0,16 m variieren.

Ein vorgezogener Wert liegt zwischen 0,09 bis 0,1. Bei Rückspiegeln für Personenkraftwagen hat die Kalotte 5 zweckmässig eine solche Grösse, dass diese beim beabsichtigten Betrachtungsabstand einen Winkel α von etwa 2° bis etwa 6° aufnimmt. Die obere Zahl ist zweckmässig für eine Kalotte die für einen Aussenrückspiegel vorgesehen ist und die untere Grenze zweckmässig für eine Kalotte die auf einem Innenrückspiegel angeordnet ist.

Aus Fig. 2 geht auch hervor dass die Kalotte oder der Körper 5 am Spiegelglass 2 mittels einer zwischenliegenden Schicht 6 eines Klebstoffes angeordnet ist und dass das Spiegelglass 2 aus einer planparallelen Glasscheibe 2 a besteht, deren Hinterseite mit einer Metallschicht 2 b bezogen ist, beispielsweise einer Silberschicht, die durch eine Schutzschicht 2 c abgedeckt ist.

Wie aus Fig. 3 hervorgeht kann die Klebstoffschicht 6, die wenigstens einen Teil der Hinterseite der Kalotte abdeckt bis zur Aufklebung der Kalotte am Spiegelglass 2 durch eine abreissbare Schutzschicht 7 abgedeckt sein.

Bei der Ausführungsform der Erfindung, die in den Fig. 1 - 4 beschrieben ist besteht die Kalotte 5 zweckmässig aus blankpoliertem Metall oder aus einer Metallschicht auf einem Träger aus beispielsweise Kunststoff oder Glass. Das Metall ist gegebenenfalls gegen chemische oder physikalische Einflüsse einschliesslich nechanischer Beanspruchungen durch eine klare und nicht gezeigte permanent angebrachte Schutzschicht abgedeckt. Die Hinterseite der Kalotte ist zweckmässig plan ausgebildet wenn sie zu Befestigung gegen eine plane Spiegelglassfläche 2 vorgesehen ist bzw schwach konkav ausgebildet wenn sie zu Befestigung gegen eine schwach konvexe Spiegelglassfläche 2 vorgesehen ist.

In Fig. 4 ist eine Ausführungsform gezeigt, bei welcher der mit einer zentralen planen Fläche 8 versehene Kalotteil, der hier mit 15 bezeichnet ist, einstückig mit dem Spiegelglass ausgebildet ist, welches hier mit 12 bezeichet ist. Die spiegelnde Fläche des Kalotteiles 15 wird hierbei somit aus eine sfärischen kalottförmigen Partie der spiegelnden Metallschicht 12 b des Spiegelglasses 2 gebildet, die die Glassscheibe 12 a trägt und durch die Schutzschicht 12 c abgedeckt ist.

Die oben beschriebene erfindungsgemässe Vorrichtung kann natürlich auch für Rückspiegeln im Innern des Fahrzeuges vorgesehen werden.

Patentansprüche

1. Vorrichtung an Rückspiegeln für Fahrzeuge bestehend aus einer spiegelnden konvexen Fläche (5) mit einer Wölbung (R) die - verglichen mit einem üblichen planen oder schwach konvex ausgebildeten Rückspiegel - einen ausgesprochenen Weitwinkeleffekt ergibt und die eine gegenüber ihrem vorgesehenen Betrachtungsabstand ausreichende Grösse aufweist um eine sichere und korrekte Beobachtung von im toten Winkel befindlichen Fahrzeugen zu erzielen, dadurch **gekennzeichnet**, dass an spiegelnde konvexe Fläche (5) aus einer hauptsächlich sfärisch gewölbten Kalotte (5) mit einer zentralen planen Fläche (8) besteht, wobei die zentrale plane Fläche (8) etwa 5 - 17%, vorzugsweise 7 - 10 % der totalen Spiegelfläche umfasst.

2. Vorrichtung nach Anspruch 1, dadurch **gekennzeichnet**, dass der Wölbungsradius (R) der spiegelnden konvexen Fläche eine Grössenordnung von etwa 0,1 m hat.

3. Vorrichtung nach Anspruch 1 oder 2, dadurch **gekennzeichnet**, dass die Kalotte (5) bei einem vorgesehenen Betrachtungsabstand einen Winkelα von etwa 2° - 6° aufnimmt.

4. Vorrichtung nach den Ansprüchen 1 - 3, dadurch **gekennzeichnet**, dass die Kalotte (5) zur Befestigung an einem planen oder schwach gewölbten Spiegelglass (2) eines üblichen Rückspiegels (1) vorgesehen ist.

5. Vorrichtung nach Anspruch 4, dadurch **gekennzeichnet**, dass der Körper (5) eine Hinterseite aufweist, die wenigstens teilweise von einer Klebstoffschicht (6) und eine diese schützende abreissbare Schutzschicht (7) besteht.

6. Vorrichtung nach den Ansprüchen 1-5, dadurch **gekennzeichnet**, dass der Körper (5) aus blankpolierten Metall oder einer Metallschicht auf einem Träger aus beispielsweise Kunststoff oder Glass besteht, wobei das Metall gegebenenfalls gegen chemische und physikalische Beanspruchung durch eine klare permanente Schutzschicht abgedeckt ist.

7. Vorrichtung nach den Ansprüchen 1-3, dadurch **gekennzeichnet**, dass der Kalotteil (15) einstückig mit einem planen oder schwach konvexen Spiegelglass (12) eines üblichen Rückspiegels ausgeführt ist.

Fig. 1

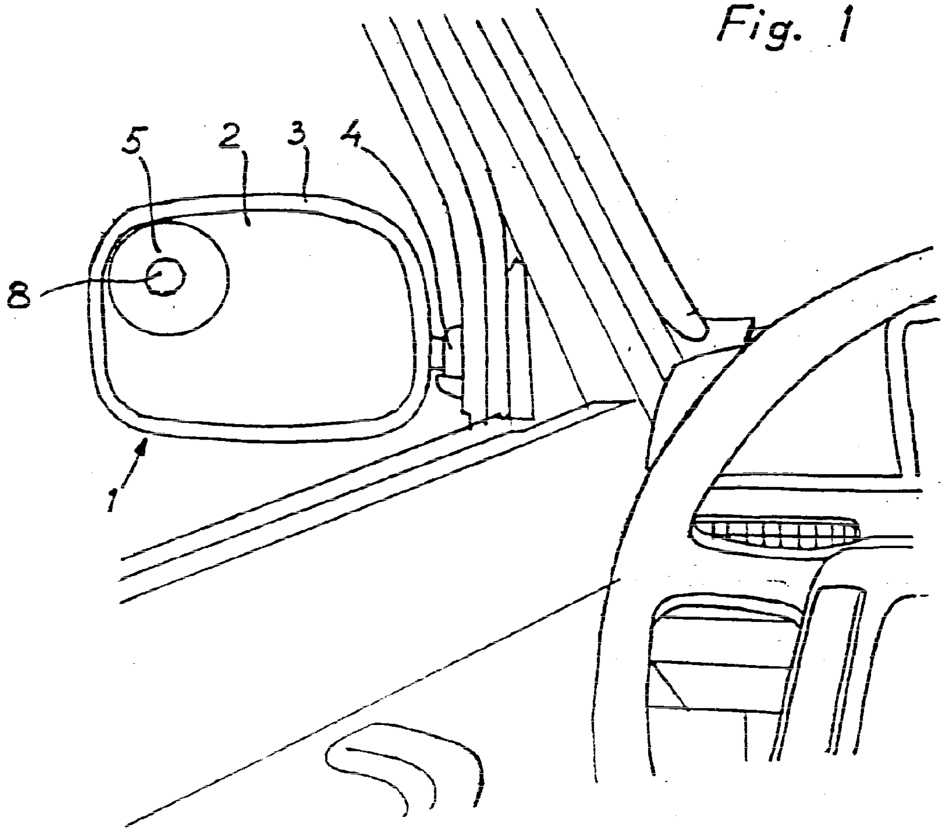
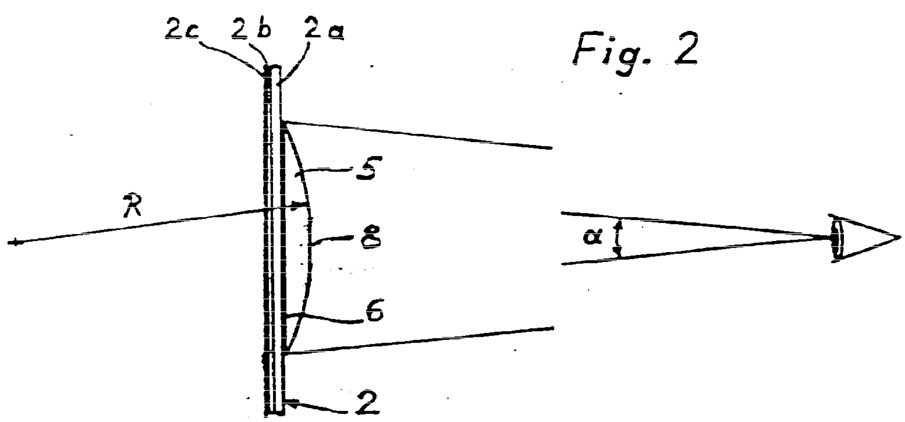


Fig. 2



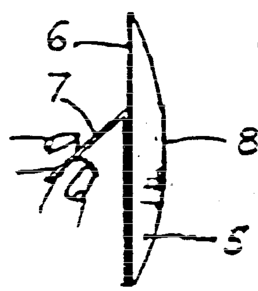


Fig. 3

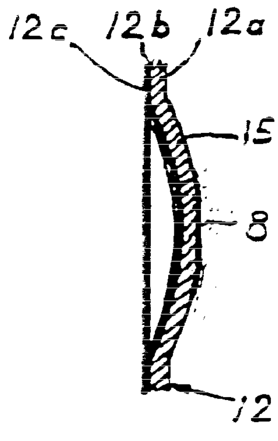


Fig. 4

Fig 5

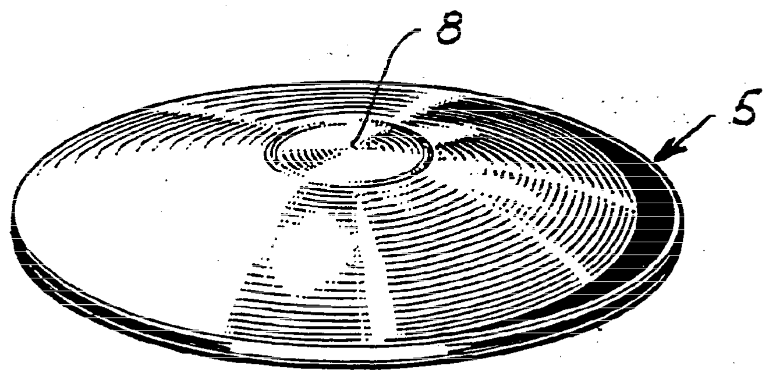


Fig 6

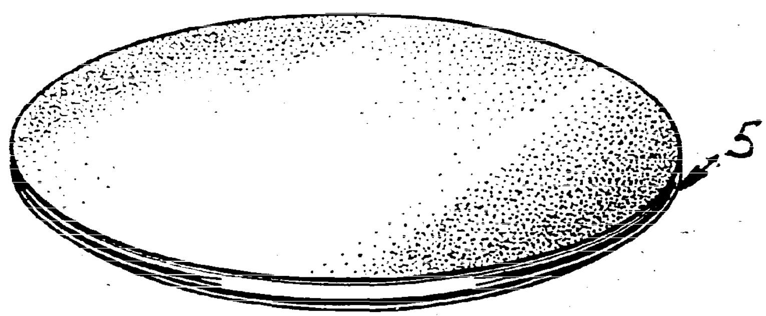


Fig 7

Europäisches Patentamt

EUROPÄISCHER RECHERCHENBERICHT

Nummer der Anmeldung

EP 92 85 0006

EINSCHLÄGIGE DOKUMENTE

Kategorie	Kennzeichnung des Dokuments mit Angabe, soweit erforderlich, der maßgeblichen Teile	Betrifft Anspruch	KLASSIFIKATION DER ANMELDUNG (Int. Cl.5)
X Y	US-A-2 778 273 (R.E. FELLMETH) * Spalte 1, Zeile 38 - Zeile 57; Figuren 1-4 * ---	1 2	B 60 R 1/08
Y	NL-A-9 000 884 (CORNELIS-JAN VAN KEMPEN) * Ansprüche 1,2; Figur 2 * ---	2	
A	US-A-2 911 177 (C.G. WEST) * das ganze Dokument * ---	1,6,7	
A	US-A-3 104 274 (G.W. KING) * Spalte 2, Zeile 61 - Spalte 3, Zeile 56; Figuren 1-5; Spalte 4, Zeile 73 - Spalte 5, Zeile 14; Figuren 8-11 * ---	1,2,4-6	
A	NL-A-7 908 257 (NICOLAAS BARTHOLOMEUS DE JONGH) * Seite 3, Zeile 36 - Seite 4, Zeile 30; Figuren 1-3 * -----	1,4-7	RECHERCHIERTE SACHGEBIETE (Int. Cl.5) B 60 R

Der vorliegende Recherchenbericht wurde für alle Patentansprüche erstellt

Recherchenort	Abschlußdatum der Recherche	Prüfer
DEN HAAG	23-09-1992	DUBOIS B.F.J.

KATEGORIE DER GENANNTEN DOKUMENTE

X : von besonderer Bedeutung allein betrachtet
Y : von besonderer Bedeutung in Verbindung mit einer anderen Veröffentlichung derselben Kategorie
A : technologischer Hintergrund
O : nichtschriftliche Offenbarung
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This application was filed on 30 - 04 - 1997 as a divisional application to the application mentioned under INID code 62.

(54) **Improved rearview mirror for motor vehicles**

(57) An improved low cost automatic rearview mirror for automotive vehicles is provided, the mirror being capable of operating in harsh environments over wide variations in temperature, humidity, vibration, atmospheric corrosion, salt spray, electronic disturbances and sand and grit abrasion. In one embodiment of the invention, an improved automatically partially dimming aspheric outside rearview mirror is provided which increases the safety of night driving and in which an inboard portion of the mirror automatically transfers from a full reflective mode to a partial reflective mode for glare protection purposes while an outboard portion of the mirror remains in the full reflectance mode at all times so as to provide a danger signal. Another embodiment of the invention provides improved signaling means.

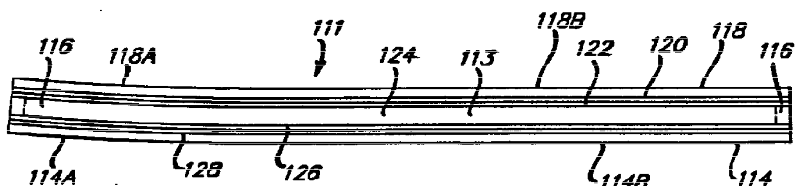

FIG. 9

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Description

BRIEF SUMMARY OF THE INVENTION

This invention relates to rearview mirrors for motor vehicles and, more particularly, to improved exterior rear view mirrors for motor vehicles.

Heretofore, various automatic rearview mirrors for motor vehicles have been devised which automatically change from the full reflectance mode (day) to the partial reflectance mode (night) for glare protection purposes from light emanating from the headlights of vehicles approaching from the rear. The electrochromic mirrors disclosed in U.S. Patent No. 4,902,108, issued February 20, 1990, for Single-Compartment, Self-Erasing, Solution-Phase Electrochromic Devices, Solutions for Use Therein, and Uses Thereof; U.S. Patent No. 4,917,477, issued April 17, 1990, for Automatic Rearview Mirror System for Automotive Vehicles; U.S. Patent No. 5,128,799, issued July 7, 1992, for Variable Reflectance Motor Vehicle Mirror; U.S. Patent No. 5,202,787, issued April 13, 1993, for Electro-Optic Device; U.S. Patent No. 5,280,380, issued January 18, 1994, for UV-Stabilized Compositions and Methods; and U.S. Patent No. 5,282,077, issued January 25, 1994, for Variable Reflectance Mirror, each of which patents is assigned to the assignee of the present invention, are typical of modern day automatic rearview mirrors for motor vehicles. Such electrochromic mirrors may be utilized in a fully integrated inside/outside rearview mirror system or as an inside or an outside rearview mirror system. In general, in automatic rearview mirrors of the types disclosed in U.S. Patent Nos. 4,902,108; 4,917,477; 5,128,799; 5,202,787, 5,280,380 and 5,282,077, both the inside and the outside rearview mirrors are comprised of a relatively thin electro-optic medium sandwiched and sealed between two glass elements. In most cases when the electro-optic medium is electrically energized, it darkens and begins to absorb light, and the higher the voltage, the darker the mirror becomes. When the electrical voltage is decreased to zero or removed, the mirror returns to its clear state. Also, in general, the electro-optic medium sandwiched and sealed between the two glass elements is preferably comprised of solutions of electrochromic compounds which function as the media of variable transmittance in the mirrors, although it should be understood that other electro-optic media may be utilized, including an approach wherein a tungsten oxide electrochromic layer is coated on one electrode with a solution containing at least another compound to provide counter electrode reaction. When operated automatically, the rearview mirrors of the indicated character generally incorporate light-sensing electronic circuitry which is effective to change the mirrors to the dimmed reflectance modes when glare is detected, the sandwiched electro-optic medium being activated and the mirror being dimmed in proportion to the amount of glare that is detected. As glare subsides, the mirror automatically returns to its normal high reflectance state without any action being required on the part of the driver of the vehicle. The electro-optic medium is disposed in a sealed chamber defined by a transparent front glass element, a peripheral edge seal, and a rear mirror element having a reflective layer, the electro-optic medium filling the chamber. Conductive layers are provided on the inside of the front and rear glass elements, the conductive layer on the front glass element being transparent while the conductive layer on the rear glass element may be either transparent or opaque, i.e., the conductive layer on the rear glass element may also function as the reflective layer for the rear glass element, and the conductive layers on both the front glass element and the rear glass element are connected to electronic circuitry which is effective to electrically energize the electro-optic medium to switch the mirror to nighttime, decreased reflectance modes when glare is detected and thereafter allow the mirror to return to the daytime, high reflectance mode when the glare subsides as described in detail in the aforementioned U.S. Patents. For clarity of description of such a structure, the front surface of the front glass element is sometimes referred to hereinafter as the first surface, and the inside surface of the front glass element is sometimes referred to as the second surface. The inside surface of the rear glass element is sometimes referred to as the third surface, and the back surface of the rear glass element is sometimes referred to as the fourth surface.

If desired, and as described in detail in the applicants' copending application entitled "Dimmable Rearview Mirror for Motor Vehicles", which application is assigned to the assignee of the present invention, and the entire disclosure of which is hereby incorporated by reference, a reflective layer may be provided on the inside (third surface) of the back glass of a dimming portion of the rearview mirror, which layer is comprised of a series of coatings, hereafter called the multilayer combination reflector/electrode, which also forms an integral electrode in contact with the electrochromic media. The other electrode on the inside (second) surface of the front glass is a transparent electrode which also contacts the electrochromic media inside the mirror element. The series of coatings of the multilayer combination reflector/ electrode is comprised of at least a base coating which bonds to the glass surface tenaciously and resists the corrosive action of the materials in the electrochromic media, and a reflective over coating which directly contacts the electrochromic media and which is chosen primarily for its high reflectance, stable behavior as an electrode, resistance to corrosion by the materials of the electrochromic media, resistance to atmospheric corrosion, resistance to electrical contact corrosion, the ability to adhere to the base coating, and ease of cleaning to an uncontaminated, high quality electrode surface. The series of coatings of the multilayer combination reflector/electrode has one or more base coatings and one or more high reflectance over coatings. The transparent coating is preferably fluorine doped tin oxide, tin doped indium oxide (ITO) or a series of metal oxide coatings with base coatings to suppress color and reflection followed by an electrically conductive, transparent coating which contacts the electrochromic media directly. Where a series of transparent coatings is used, the materials are chosen for good bonding, resistance to corrosion by the materials of the electrochromic media, resistance to corrosion by the atmosphere, minimal reflectance, high light transmission, neutral coloration and high electrical conductance. Also, to a considerable extent, it is possible to make the reflective electrode very high in electrical conductance to compensate in a synergistic fashion with a transparent electrode that is lower in electrical conductance so the net result is an electrochromic mirror which darkens and clears acceptably fast and uniformly with excellent optical properties.

This synergistic structure is applicable for both inside and outside rearview mirrors for motor vehicles. When the multilayer combination reflector/electrode is used in any mirror, it has the inherent advantage of reducing double images, distortion, and multiple images from raindrops, dust, etc., while providing excellent speed of reflectance change, good high end reflectance, good uniformity of reflectance change across the surface area of the mirror, neutral color, continually variable reflectance and a low end reflectance low enough to relieve strong glare. The reduction in double images and distortion is particularly useful in the case of dimmable mirrors which use glass that is bent but may have slight variations in radius of curvature or slight ripple or warp that result in slight imperfections in matching two pieces of bent glass required to make, for example, a convex electrochromic mirror.

Heretofore, non-automatically dimming aspheric exterior rearview mirrors have been provided which increase the field of view of the driver of a vehicle and virtually eliminate the well-known blind spots of conventional flat glass and/or curved glass exterior mirrors. In general, aspheric mirrors are made by using multiple radii of curvature or by combining several types of curvature, i.e., a man flat area (infinite radius of curvature) or a main curved area with a constant radius of curvature similar to the convex mirrors that are currently in common use on passenger side exterior mirrors in the United States, together with an aspheric area which is disposed on the outboard portion of the mirror. It is the high curvature in the aspheric area that yields a greatly expanded field of view which, in general, may be nearly double that of convex mirrors and nearly triple that of flat-surface mirrors. Aspheric mirrors thus tend to eliminate the conventional so-called blind spots, thereby enabling the drivers of the vehicles to see adjacent lanes in the road and to change lanes without failing to observe other vehicles, such as automobiles, motorcycles and bicycles, traveling in adjacent lanes. However, serious cost and technical problems arise when efforts are made to construct an automatically dimming aspheric outside rearview mirror with a reflective layer on the back (fourth) surface of the rear glass element, because it is generally necessary to very closely match the curvature of two glass elements of complex curvature, sometimes referred to as "matched-twins" in the industry. Mismatched glass elements can cause double images, and at the present time, it is questionable whether automatically dimming, double image-free aspherical mirrors having a reflective layer on the fourth surface of the mirror element can be commercially manufactured from a practical and/or economical standpoint. However, unexpected and surprisingly good results are obtained when a multilayer combination reflector/electrode is utilized on the inside (third surface) of an aspheric portion of a dimmable rearview mirror constructed in accordance with the present invention.

Heretofore, the benefits of including a turn signal or other signal, such as a brake signal, in each of the outside mirrors of an automotive vehicle have been recognized. U.S. Patent No. 5,014,167, issued May 7, 1991, for Visual Signaling Apparatus, and U.S. Patent No. 5,207,492, issued May 4, 1993, for Mirror Assembly describe such mirrors where signal indicators are located behind the mirror surface. Through the use of dichroic reflectors, special light sources, and directional louver means these signals, such as turn signals, can be hidden from the view of the vehicle operator so that the signals do not cause a vision nuisance while still being visible to following vehicles or to the passing vehicles on either side. The benefit is that vehicles located in the blind spots, yet too far forward to see conventional rear turn signals, receive forewarnings that a vehicle is about to turn. These mirrors have come to be known as "signal mirrors" in the industry. Heretofore, signal mirrors have not been particularly successful commercially due to cost, technical problems, and the inherent difficulty of combining this feature with automatic dimming mirrors.

An aim of the present invention is to overcome the serious cost and technical problems encountered in efforts to very closely match the complex curvatures of multiple glass plates for use in an automatically dimming aspheric outside rearview mirror of the indicated character, and to provide an improved automatically partially dimming aspheric outside rearview mirror incorporating improved means which enables the mirror to be commercially and economically manufactured and assembled from a practical standpoint.

Another aim of the present invention is to provide an improved dimmable rearview mirror which increases the safety of night driving.

Another aim of the present invention is to provide an improved aspheric outside rearview mirror for motor vehicles in which an inboard portion of the mirror can be varied from its high reflectance mode to partial or lower reflectance modes for glare protection purposes while an outboard portion of the mirror remains in the high reflectance mode at all times so as to provide a potential danger/warning signal if another vehicle is nearby in adjacent lanes even under glare-producing conditions.

Another aim of the present invention is to provide an improved dimmable rearview mirror for motor vehicles which provides a greater field of view than conventional flat or convex dimming outside rearview mirrors.

Another aim of the present invention is to provide an improved electro-optic, dimmable rearview mirror for motor vehicles, which mirror is relatively economical to manufacture and assemble, durable, efficient and reliable in operation.

Another aim of the present invention is to provide improved signaling means in conjunction with an improved outside rearview mirror for motor vehicles.

Still another aim of the present invention is to provide improved signaling means at the outboard section of a partially dimming mirror whereby technical difficulties are eliminated and costs are reduced.

Yet another aim of the present invention is to provide an improved dimmable rearview mirror for motor vehicles in which double images, distortion and multiple images from raindrops are reduced and wherein excellent speed of reflectance change, good high end reflectance, good uniformity of reflectance change across the surface area of the mirror, neutral color, continually variable reflectance and good low end reflectance are obtained.

The above features and advantages of the present invention will be further described hereinafter in the following description of exemplary embodiments and the accompanying drawings, in which:

FIG. 1 is a front elevational view schematically illustrating an inside/outside rearview mirror system for motor vehicles, the system including a dimmable inside rearview mirror together with two dimmable outside rearview mirrors which embody the present invention and all of which are adapted to be installed on a motor vehicle in a conventional manner whereby the mirrors face the rear of the vehicle and can be viewed by the driver of the vehicle to provide a rearward view to the driver;

FIG. 2 is an enlarged simplified sectional view of the inside rearview mirror illustrated in FIG. 1, taken on the line 2-2 thereof;

FIG. 3 is an exploded view of the left electro-optic, aspheric, partially dimmable outside rearview mirror illustrated in FIG. 1;

FIG. 4 is a front elevational view of the mirror illustrated in FIG. 3;

FIG. 5 is a simplified top plan view of the mirror illustrated in FIG. 4;

FIG. 6 is a simplified side elevational view of the right side of the mirror as viewed in FIG. 4, showing the electro-optic structure.

FIG. 7 is a schematic simplified side elevational view of another embodiment of the invention;

FIG. 8 is a schematic simplified side elevational view of still another embodiment of the invention; and

FIG. 9 is a schematic simplified top plan view of yet another embodiment of the invention.

DETAILED DESCRIPTION

In general, in outside rearview mirrors embodying the present invention, at least a portion of the rearview mirror assembly may be comprised of a relatively thin layer of an electro-optic medium sealed between two glass elements. When the electro-optic medium is electrically energized, it darkens and begins to absorb light, and the higher the voltage, the darker the mirror becomes. When the electrical voltage is decreased to zero or is removed, the electro-optic medium returns to its clear state. Rearview mirrors embodying the present invention may, for example, incorporate light-sensing electronic circuitry of the type illustrated and described in the aforementioned U.S. Patent No. 4,917,477. Also, the components of mirrors embodying the present invention may be of the types disclosed in the aforementioned U.S. Patent Nos. 4,902,108; 5,128,799; 5,202,787; 5,280,380 and 5,282,077, as well as in U.S. Patent No. 5,014,167, issued May 7, 1991, for Visual Signaling Apparatus, and U.S. Patent No. 5,207,492, issued May 4, 1993, for Mirror Assembly. It should be understood, however, that other type of electronic circuitry and other types of electro-optic media and other components may be utilized in minors embodying the present invention.

In one embodiment of the present invention, an aspheric outside rearview mirror is provided wherein a large flat area and/or a large radius of curvature convex area of the mirror automatically dims, but the aspheric portion of the mirror does not. A key aspect of such embodiment of the invention resides in the fact that the front glass element is formed in one continuous piece that includes an inboard main body portion that is substantially flat, or slightly curved, and an outboard aspherical portion which is formed integrally with the main body portion and projects laterally outwardly therefrom. In its most practical form, the outside mirror has a large radius of curvature, spherical, convex inboard portion, integrally joined to an outboard aspherical portion, it being understood, however, that the dimming inboard portion could be of flat or other configuration, and that the aspherical portion could be of cylindrical or spherical configuration or could be formed with multiple radii of curvature or other configurations.

Referring to the drawings, an electro-optic inside/outside mirror assembly, generally designated 9, embodying the present invention is depicted in FIGS. 1

through 6. Since some of the layers of each of the mirrors in the assembly 9 are very thin, the scale has been distorted for pictorial clarity. As shown in the drawings, the mirror assembly 9 includes a inside mirror 10 and outside mirrors 11 and 12. For clarity, in the drawings, like numbers identify components of the inside and outside minors which may be slightly different in configuration but which function in substantially the same manner and obtain the same results as similarly numbered components. For example, the shape of the front glass element of the left outside mirror is the reverse of the shape of the right outside mirror, and the front glass element of the inside mirror is generally longer and narrower than the front glass elements of the outside mirrors. In the embodiment of the illustrated, each of the mirrors 10, 11 and 12 includes a sealed chamber 13, defined by a front glass element 14, an edge seal 16, and a rear glass element 18, having reflective and electrically conductive metal layers 20 and 22, respectively. An electro-optic medium 24 having the desired electro-optic properties fills the chamber 13, and a transparent electrically conductive layer such as a fluorine-doped tin oxide conductive layer 26 is carried by the front element 14. The electrically conductive layers are connected to an electrical circuit as will be described hereinafter in greater detail. If desired, a color suppression coating or coatings, such as 28, may be disposed between the conductive layer 26 and the adjacent rear surface of the front element 14. Light rays enter through the front glass element 14, the color suppression coating(s) 28, the transparent conductive layer 26 and the electro-optic medium 24 before being reflected from the electrically conductive and reflective layer 22 (or layers 20 and 22 if layer 22 is extremely thin) provided on the rear glass element 18. The reflected rays exit by the same general path traversed in the reverse direction. In electrochromic media both the entering rays and the reflected rays are attenuated in proportion to the degree to which the electro-optic medium 24 is light-absorbing while in other electro-optic media the light rays may, in some cases, only be attenuated in one direction. When the electro-optic medium 24 is electrochromic and highly light absorbing, the intensity of the exiting rays is diminished, the dim image remaining mainly being from light rays which are reflected off of the front surface of the front glass element 14 and the interface between the front glass element 14 and the coatings 28 and/or 26. Thus, the basic structural elements of the electro-optic portion of each of the mirrors includes two electrode-bearing sides or walls 14 and 18, a spacing or separating seal 16, which spaces apart and holds the walls in substantially parallel relationship in an assembled device, and which surrounds a volume which in an assembled device is defined by the inside surfaces of electrode layers on the electrode-bearing walls as well as the circumferential inside walls 30 of the sealing member 16. The volume of the chamber 13 is preferably filled through a sealable fill port 32 with any of the electro-optic media disclosed in this or the aforementioned patents which have reversibly variable transmittance in the operation of the device, the medium in the chamber 13 being in contact with both electrode layers 22 and 26 during operation of the mirror. It will be understood that the electro-optic medium for achieving variable reflectance could be other solution-phase electrochromics, solid electrochromics, a combination of the two in the form of a hybrid, or any of the above in a polymerized matrix. A liquid crystal, dipolar suspension or other electro-optic medium could also be utilized in mirrors embodying the present invention.

In the embodiment of the invention illustrated, the reflective surface on the inside of the rear glass 18 may be comprised of a series of coatings, hereinafter termed the multilayer combination reflector/electrode, which serves as a mirror reflectance layer and also forms an integral electrode in contact with the electrochromic media. The other electrode on the inside surface of the front glass 14 is the transparent electrode 26 which also contacts the electrochromic media inside the mirror element. The series of multilayer combination reflector/electrode coatings is comprised first of a base coating which bonds to the glass surface tenaciously and resists the corrosive action of the materials in the electrochromic media. The base coating is preferably chromium, but alternatively may be stainless steel, nickel-chromium, titanium, gold, silver, or any material or series of coatings which accomplish the objectives above stated. The thickness of the base coating is typically 100 to 1500 angstroms and is more typically 200 to 800 angstroms. The final reflective coating which directly contacts the electrochromic media is chosen primarily for its high reflectance, resistance to attack by the electrochromic media, resistance to atmospheric corrosion, resistance to electrical contact corrosion, and the ability to adhere to the base coating. The preferred material for the reflective coating is rhodium which has excellent hardness, excellent reflectance and excellent conductance, but it should be understood that it is alternatively possible to choose from a group of metals and their alloys such as, but not limited to, platinum, ruthenium, iridium, and stainless steel or multiple layers including combinations thereof. The thickness of the reflective over coating is typically 100 to 1000 angstroms and is more typically 100 to 600 angstroms. The series of coatings of this multilayer combination reflector/electrode has one or more base coating(s) which generally provide high conductance and one or more over coatings which provide additional conductance and high reflectance. By way of example the sheet resistance of the multilayer combination reflector/electrode may be approximately 1 to 10 ohms per square.

The transparent coating 26 is preferably made of fluorine doped tin oxide or ITO or alternately a series of coatings with a base coating(s) to suppress color and reflection followed by a conductive transparent coating which contacts the electrochromic media directly. Where a series of transparent coatings is used, the materials are chosen for good bonding, good resistance to corrosion by the materials in the electrochromic media, good resistance to corrosion by the atmosphere, minimal reflectance, high light transmission, neutral coloration and high electrical conductance. Suitable types of low cost transparent electrode coated glass substrates are "TEK 20" or "TEK 15" coated glass manufactured by Libbey Owens-Ford of Toledo, Ohio, but other suitable coatings are ITO or extremely thin metal layers which may alternatively function as the transparent electrode.

Transparent electrode materials are inherently limited in the balance of properties and cost. Low sheet resistance transparent coatings with a sheet resistance below approximately 10 ohms per square tend to have low transmission and other attendant shortcomings including possible haziness, coloration, non-uniformity of coating thickness and high cost. This makes a low sheet resistance transparent coating less practical for electrochromic mirrors. To a considerable extent, it is possible to make the multilayer combination reflector/electrode low in electrical resistance to compensate in a synergistic fashion with a transparent electrode that is higher in electrical resistance so the net result is an electrochromic mirror which darkens and clears acceptably fast and uniformly over its surface area, with excellent optical properties.

To demonstrate the surprising nature of the synergy, electrochromic mirrors have been constructed with a multilayer combination reflector/electrode of about 3 and of about 7 ohms per square sheet resistance with a front transparent electrode of about 18 to 22 ohms per square or higher which show remarkably good results for speed and uniformity of coloration and clearing. Electrochromic mirrors with reflectors on the front surface of the rear element have been previously described, but the use of multilayer coatings that combine to provide high reflectance, good adhesion to glass, low sheet resistance and ease of cleaning for electrochromic mirrors, especially in combination with a low cost high resistance transparent coating, is preferred. Thus, if desired, mirrors embodying the present invention may use a high electrical conductance multilayer combination reflector/electrode on the third surface, with a lower electrical conductance transparent front electrode on the second surface to achieve a cost effective, high performance, electrochromic mirror. This synergistic structure has the inherent advantage of reducing double images, distortion, and multiple images from raindrops, (particularly with convex or spherically curved mirrors), while providing excellent speed of reflectance change, good high end reflectance, good uniformity of reflectance change over the area of the device, neutral color and a low end reflectance, low enough to relieve strong glare.

The following are examples of components that have been found to be suitable for use in rearview mirrors embodying the present invention, it being understood that other components may also be used in rearview mirrors embodying the present invention.

EXAMPLE 1

A multilayer combination reflector/electrode was prepared by sequentially depositing approximately 300 angstroms of titanium, approximately 200 angstroms of gold and approximately 200 angstroms of platinum on the 6.6 cm by 14.4 cm surface of a 0.2 cm thick sheet of soda lime float glass. The deposition was accomplished by rotating the glass sheet past three separate metal targets in a magnetron sputtering system with a base pressure of a 3×10^{-6} tort and an argon pressure of 2×10^{-3} torr. The first surface, CIE curve white light reflectance from the multilayer combination reflector/electrode with the platinum surface in contact with air, measured according to the procedure of SAE J964, was 71.9 percent and the sheet resistance of the metal layer stack was 3.2 ohms per square.

This multilayer combination reflector/electrode coated glass was used as the rear element of an electrochromic mirror device. The front element was a sheet of TEK 20 transparent conductor coated glass of the same size as the rear element. The sheet resistance of the transparent conductor was approximately 20 ohms per square. The two elements were bonded together by an epoxy perimeter seal with the transparent conductor electrode and multilayer combination reflector/electrode offset from, substantially parallel to and facing each other as shown in Figure 2. The spacing between the electrodes was about 0.014 cm. The device was vacuum filled through a small gap left in the perimeter seal with a solution made up of:

0.034 molar 5,10-dihydro-5,10-dimethylphenazine
0.034 molar 1,1'-di(phenyl propyl)-4,4'-bipyridinium difluoroborate
0.5 molar ethyl-2-cyano-3,3-diphenylacrylate
in a solution of 3 wt% Elvacite™ 2041 polymethylmethacrylate resin dissolved in propylene carbonate.

The small gap was plugged with a UV cure adhesive which was cured by exposure to UV light.

The reflectance of the device, (measured as before for the rear element), with no voltage applied was 56 percent and with 1.2 volts applied the reflectance decreased over a period of 5 seconds to 10 percent and within 10 seconds to 7.5 percent. On short circuiting the device, the reflectance increased over a period of 15 seconds back to 56 percent.

EXAMPLE 2

Other than as specifically mentioned, the conditions of Example 1 were used in this example. A multilayer combination reflector/electrode was prepared by sequentially depositing approximately 300 angstroms of chromium, approximately 500 angstroms of silver and approximately 300 angstroms of platinum at a base pressure of 3.7×10^{-6} torr and an argon pressure of 8 x

10^{-3} torr. The first surface reflectance was 73.3 percent and the sheet resistance was 0.1 ohms per square.

When an electrochromic mirror device was fabricated with this multilayer combination reflector/electrode, the device had a high end reflectance of 57.0 percent, a low end reflectance of 6.5 percent and changed from 57.0 percent to 10.0 percent reflectance in 2.0 seconds with the application of 1.2 volts.

EXAMPLE 3

Other than as specifically mentioned, the conditions of Example 1 were used in this example. A multilayer combination reflector/electrode was prepared by sequentially depositing approximately 600 angstroms of chromium and approximately 300 angstroms of platinum. The base pressure of 2.1×10^{-6} torr and the argon pressure of 8×10^{-3} torr. The first surface reflectance was 73.8 percent and the sheet resistance was 3.2 ohms per square.

When an electrochromic mirror device was fabricated with this multilayer combination reflector/electrode, the device had a high end reflectance of 58.0 percent, a low end reflectance of 7.0 percent and changed from 58.0 percent to 10.0 percent reflectance in 2.7 seconds with the application of 1.2 volts.

EXAMPLE 4

A multilayer combination reflector/electrode was prepared by the sequential deposition of approximately 600 angstroms of chromium and approximately 100 angstroms of 316 stainless steel on the 19 cm by 66 cm surface of a 0.2 cm thick sheet of flat soda lime float glass and on the convex side of a 22 cm diameter circle of glass which had been press bent to a uniform spherical curvature with a radius of curvature of 140 cm. The glass which was bent was TEK 20 tin oxide coated glass manufactured by Libbey Owens-Ford of Toledo, Ohio, and the tin oxide coating was on the concave side after the glass was bent. The deposition was accomplished in a large in-line sputtering system. The first surface reflectance from the multilayer combination reflector/electrode coatings was about 58 percent and the sheet resistance was about 7 ohms per square.

The fat and the bent glass sheets were cut into mirror shapes which were approximately 10 cm high and 16 cm wide. These were used as the rear elements of dimmable mirrors for the outside of an automobile as described below. As compared to glass coated only with chromium metal, these pieces of the multilayer combination reflector/electrode coated glass were dramatically easier to clean to a condition in which they behaved as uniform high quality electrodes without poorly coloring spots and blemishes in the final electrochromic dimmable minor devices.

The flat and convex pieces of multilayer combination reflector/electrode coated glass were matched with mirror-shaped pieces of TEK 20 coated pieces of flat and convex coated glass respectively. The front element convex mirror glass was also bent such that the tin oxide coating was on the concave side. Mirror devices were made by sealing nearly all the way around the perimeter of the glass pieces with an epoxy seal containing glass bead spacers which provided for a 0.015 cm spacing between the TEK 20 transparent, tin oxide electrode and the multilayer combination reflector/electrode. The spacing between the electrode surfaces was filled with a solution made up of:

0.028 molar 5,10-dihydro-5,10-dimethylphenazine
0.034 molar 1,1'-di(phenylpropyl)-4,4'-bipyridinium difluoroborate
0.030 molar 2-(2'-hydroxy-5'-methylphenyl)-benzotriazole
in a solution of 3 wt% Elvacite™ 2041 polymethylmethacrylate resin dissolved in propylene carbonate.

The small gap in the perimeter seal was plugged with a UV cure adhesive which was cured by exposure to UV light.

The high end reflectance of the mirrors was approximately 45 percent and the low end reflectance was approximately 7 percent. The mirrors changed reflectance from 45 percent to 15 percent reflectance in about 5 seconds and provided excellent glare relief when dimmed to the appropriate reflectance level during nighttime driving.

EXAMPLE 5

Every aspect of Example 4 was repeated with the exception that the multilayer combination reflector/electrode was prepared by the sequential deposition of approximately 400 angstroms of chromium and approximately 200 angstroms of rhodium. The first surface reflectance from the multilayer combination reflector/electrode was about 70 percent and the sheet resistance was about 7 ohms per square.

The flat and convex dimmable minor devices prepared with this multilayer combination reflector/electrode according to the procedure of Example 4 had a high end reflectance of about 55 percent and a low end reflectance of about 7 percent with a speed of reflectance change similar to the mirrors of Example 4.

An automobile equipped with an automatic inside electrochromic mirror, one of the above flat mirrors as the driver's side outside mirror and one of the above convex mirrors as the passenger side outside mirror allowed the automobile operator to drive at night with essentially complete protection from glare from the headlamps of following vehicles.

It has been observed that chromium coatings alone can be difficult to clean during assembly of the entire mirror, resulting in a finished minor that may exhibit contamination spots and areas of slower darkening and clearing. The use of a high reflectance material, such as rhodium alone, can be very costly at thicknesses that provide low sheet resistance, but coated over the above-mentioned base coating(s) such as chromium results in a rear glass element which is easily cleaned prior to assembly, resulting in a finished mirror that is more optically perfect and free of contamination and darkening defects. Chromium or stainless steel alone also have the problem that the high end reflectance of the finished mirror is too low considering the attendant losses of light from the transparent coated front substrate and electrochromic media. A problem with stainless alone and to a lesser extent chromium alone is poor electrical contact stability to the conventional spring clip type buss bars or other electrical contact means.

The use of an inert high reflectance coating also makes attachment of spring clip type buss bars or other contact attachments more stable and trouble free, since non-conductive compounds and oxides do not form as readily under pressure contact areas. The result of low stability electrical contact is a mirror which loses its uniformity of coloration and its range and speed of coloration and clearing over the long life required in the motor vehicle industry.

There is thus provided a robust, low cost, dimmable rearview mirror for automotive vehicles, which mirror is capable of operating in harsh environments over wide variations in temperature, humidity, vibration, atmospheric corrosion, salt spray, electronic disturbances and sand and grit abrasion, and which mirror is resistant to damage from vehicle crashes and owner abuse. An additional benefit from sealing the main area of the mirror reflector inside the dimmable mirror element is long life of the reflector in the motor vehicle environment.

It is common with outside dimmable mirrors to adhere a resistance heater to the fourth surface reflective structure at the back of the rear glass substrate. This heater and its associated adhesive can cause incompatibility and field problems if conventional reflective material, such as silver, is on the back side of the back glass substrate. It is also common practice to adhesively bond the electrochromic mirror assembly to a plastic backing plate often called the glass case. Normal temperature variations experienced by this assembly can cause large forces to be exerted on a reflector structure on the back or fourth surface due to the thermal expansion mismatch of the materials involved. The adhesives used can also lead to chemical attack and degradation of the fourth surface reflector. Such problems are avoided when the reflector is located inside the device, and the heater is adhered directly to the glass (fourth surface) of the rear glass element or to the tin oxide coating such as TEK 20 or TEK 15 layer which may optionally be on the fourth surface.

Heretofore, problems have been encountered with a conventional silver reflector on the back surface of the rear glass, such problems being known as silver spoilage and silver lift, and are avoided with the multilayer combination reflector/ electrode inside the mirror element and protected by the rear glass. With the multilayer combination reflector/electrode located inside the mirror element, the environmental factors are limited to those that result from contact with the materials of the electrochromic media and the offset area where electrical contact is made, whereas with the reflector on the back of the rear glass surface, a number of other difficult environmental factors must be dealt with for the reflector to survive during the life of the mirror especially on the exterior of a motor vehicle.

Speed of coloring, good high end reflectance (typically greater than 50% for exterior mirrors and greater than 60% for interior mirrors) and low cost - important requirements for dimmable mirrors, and the above described construction provides a mirror meeting such requirements. Thus, it is possible to use comparatively low cost practical electrode coatings to make a surprisingly high performance mirror. Highly conducting transparent coatings are either nondurable, low in transmissivity and/or very high in cost. For this reason it is desirable to use comparatively low cost durable transparent coatings which have the inherent disadvantage that their conductance is lower than that of expensive coatings. Metals, on the other hand, have high conductance which can be used to great advantage. Electrochromic mirrors with reflector/electrodes involving a single metal layer on the front surface of the rear element have been previously described. However, the concept of creating a dimmable mirror where the electrical conductance of the transparent electrode at the second surface of the mirror element is purposely made much lower than the multilayer combination reflector/electrode conductance at the third surface of the mirror element is preferred. This intentional mismatch of conductance in a symbiotic relationship using practical low cost coatings provides a structure of significant commercial potential, i.e. the conductance of the transparent electrode is substantially lower than that of the multilayer combination reflector/electrode, and the multilayer combination reflector/electrode is comprised of two or more coatings. The first coating on the rear glass is preferably the low cost, high conductance base metal such as chromium. The final coating on the multilayer combination reflector/electrode is the thin, high reflectance metal such as rhodium for the purpose of providing high reflectance and high stability in use as an electrode for the electrochromic device. The coating(s) on the back surface of the front element may include one or more color suppression coatings followed by fluorine doped tin oxide, but it must be understood that any transparent coating having the required properties which is substantially lower in conductance than the coatings on the front surface of the rear element would be suitable. This concept may be incorporated in both inside and outside electrochromic mirrors which may incorporate ambient and glare light sensors, the glare light sensor being positioned either behind the mirror glass and looking through a section of the mirror with the reflective material removed, or partially removed, or the glare light sensor can be positioned outside the reflective surfaces. In the alternative, areas of the electrode and reflector, such as 45 and 46, respectively, may be removed, or partially removed in, for example, a dot pattern, to permit a vacuum fluorescent display, such as a compass or clock, to show through to the driver of the vehicle. Such concept is also applicable to a mirror which uses only one video chip light sensor to measure both glare and ambient light and which is further capable of determining the direction of glare. An automatic mirror on the inside of a vehicle can also control one or both outside mirrors as slaves in an automatic mirror system.

The foregoing also has application in the construction of elements for mirrors where high maximum reflectance is desired, and the electrochromic materials may be solution phase containing liquids, gels, rigid gels and/or polymers. It may also be a hybrid design where some or all of the electrochromic materials are not in solution and may be confined on the surfaces of the electrodes, and also particularly applies to electro-optic mirrors which draw more than 10 milliamps in operation at any point in their process of dimming.

The above described structure is particularly effective when used with selected low cost transparent coatings, as for example, "TEK 20", marketed by Libbey Owens-Ford Co. of Toledo, Ohio. The benefits over the most commonly used automatic mirrors in use today are as follows: mirrors embodying the multilayer combination reflector/electrode change reflectance faster, have a clearer image, have better coloration of image in the nondimmed state, eliminate the need and inconvenience of putting silver reflective coatings on the fourth surface of the mirror element, have fewer handling steps thereby creating fewer chances for scratching in the glass during processing and providing a final product with better optical quality, and having fewer surfaces through which the light must travel, and the first surface and third surface reflections are closer together with the result that there are less multiple images and less distortion in the mirror for the driver. Moreover, when used as an outside mirror, there are less reflections from raindrops and dust on the front surface of the front glass, and the reflector at the front surface of the rear glass element is protected from aging, exposure to airborne contaminants and physical abuse that often affect reflectors placed at the back surface of the rear glass element.

In the embodiment of the invention illustrated in Figures 1 through 6, the front glass element 14 of each outside mirror is formed in one continuous piece that includes an inboard main body portion 14B that may be substantially flat with an infinite radius of curvature, or slightly curved with a relatively large radius of curvature. This curvature is generally spherical with a radius of curvature in the range of 1200 to 3000 mm and more typically in the range of 1400 to 2600 mm. The main body portion 14B is integrally joined to an outboard aspherical portion 14A having a radius of curvature substantially less than the radius of curvature of the main body portion 14B. Thus, the aspherical portion 14A contributes a predetermined field of view which, when combined with the field of view of the main body portion 14B, is substantially greater than the field of view of the main body portion 14B alone. The rear glass element 18 of each outside mirror of this embodiment of the invention is substantially the same size as the main body portion 14B of the front glass element so that the aspherical portion 14A projects laterally outwardly, i.e., outboard of both the main body portion 14B and the rear glass element 18. Since the aspheric portion 14A of the front glass element 18 projects outwardly beyond the adjacent edge of the rear glass element 18, the aspheric portion 14A of the front glass element does not dim when the electro-optic inboard portion 14B of the mirror dims. It should also be understood that a bezel structure 34, shown in dashed lines for clarity of illustration, is preferably utilized which extends around the entire periphery of the front glass element and conceals the peripheral edge portions thereof.

In this embodiment of the invention, the rear surface 36 of the front glass element 14 of each outside mirror is preferably coated with a reflective layer 38 only in the area of the outboard aspherical portion 14A. This reflective material also preferably covers the outboard section 40 of the seal 16 so that the outboard section 40 of the seal 16 is not visible to the driver of the vehicle, although, if desired, a portion of the seal may be purposely allowed to be visible to the driver to provide a demarcation to apprise the driver that there is a difference in the minor configuration. As previously mentioned, the outboard area 14A of each outside mirror can be either aspheric, cylindrical, spherical, formed with multiple radii of curvature formed of any combination of the preceding, or be of other desired configuration. It should also be understood that the reflective layer could be on the front surface of the aspherical portion 14A.

The above described construction overcomes serious cost and technical problems which are encountered when efforts are made to perfectly match two glass shapes of complex curvature. Since the rear glass element 18 and the electro-optic portion 14B of the front glass element 14 are either flat or only slightly curved, matching of the overlying portions thereof is more readily achieved, and serious mismatching, which can cause double imaging, is obviated or at least minimized. Moreover, since the aspheric portion 14A of the front element 14 projects outwardly beyond the outboard edge of the rear glass element 18, no matching whatsoever is required because there is only one layer of glass in the aspherical portion 14A of each outside mirror.

It will be understood that if a reflective layer 38, such as chromium or rhodium, is deposited on the rear surface 36 in the aspherical portion 14A of the front glass element 14, and a reflective layer such as 22 is also used as a reflector on the inner surface of the rear glass element 18, behind the electro-optic material 24, then there will be a minimum discontinuity in the reflected image since the electro-optic media layer is very thin (typically 150 microns or less). In that connection it should be understood that light from reflection in the clear state of the electrochromic portion of the device may 10-20% less than the first surface reflectance of the layer 22 when measured with the layer 22 in contact with air.

It should also be understood that, by way of example, it is also possible to utilize indium tin oxide (ITO) as the transparent conductors on the confronting surfaces of the front and rear glass elements and a reflective layer such as silver on the back of the rear glass element. For matching purposes, it is also possible to provide a silver reflector on the back surface of the aspherical portion 14A of the front glass. In the preferred embodiment of the invention, a layer of chromium or a layer of rhodium makes up the reflective layer 38 provided on the back surface 36 of the aspherical portion 14A of the front glass element, limited to the aspheric area as illustrated in the drawings. For example, a rhodium layer 22 can be used on the front surface of the back glass element 18, deposited over a thick highly conductive chromium layer 20. By way of example, the rhodium layer may have a thickness of about 100-700 Angstroms, while the chromium layer may have a thickness of about 300 to 1500 Angstroms. In the alternative, instead of a dual layer of rhodium and chromium, a single layer of chromium may be utilized together with a single layer of chromium on surface 38. A single layer of smooth, high transmission ITO is preferred for application to the surface 36 in both areas 14A and 14B to simplify the ITO coating process and to maximize reflection of 38 and minimize haze of reflector 38. When the reflector of the outboard portion is placed on the front side of element 14 then the smoothness of the transparent conductor 36 is not critical, and it is possible to use the low cost but somewhat rough or hazy coating sold by Libbey Owens-Ford as "TEK 20" tin oxide coated glass or the Libbey Owens-Ford "TEK 15" glass or a similar type low cost tin oxide coated glass, or it is possible to remove the tin oxide transparent conductive layer prior to applying the reflector to the area 14A. Thus, if desired, the transparent conductive coating 26 on the front element 14 may be uniformly applied, selectively applied or removed from a portion of surface 36 prior to the application of the reflective layer 38 so that in the latter case the reflective layer 38 is applied directly onto the rear surface 36 of element 14. This latter configuration of the front element reflector is especially desirable if the transparent conductive coating has significant haze. It may also be desirable to lower the reflectivity at the area 14A to a value as bright as, or lower than, the reflectance range of the dimming portion by choice of reflector material or transmission properties of the layer 26, if present, in the area 14A.

From the foregoing description, it will be understood that much of the uniqueness of this embodiment of the invention resides in the fact that only the inboard main body portion 14B of the front element 14 will be dimmed utilizing electro-optic principles. This permits protection from glare and yet preserves safety, since the aspheric portion 14A is not allowed to dim and the driver can still see nearby vehicles in adjacent lanes. Moreover, the unitary front face of the front glass element 14 can still be easily cleaned and scraped of ice in the winter. In addition, the one-piece face of the front glass element is cosmetically stylish. Also, the layers of reflective material can be made so close to the same plane that their discontinuity will not be objectionable to the driver of the vehicle. It should also be understood that for defrosting purposes, a conventional heater (not shown) can be utilized to cover either the entire back of each outside mirror assembly including both the aspherical outboard portion and the automatically dimming inboard portion of the mirror, or only the automatic dimming portion with the heat eventually spreading through thermal conduction to the outboard portion 14A.

From the foregoing description, it will be appreciated that the aspheric outboard portion of the mirror provides a greatly increased field of view, thereby virtually eliminating blind spots, and mirrors embodying the present invention can replace conventional driver's side exterior mirrors or both the driver's side and the passenger's side exterior mirrors. The outside mirrors embodying the present invention combine two types of curvature, i.e., a convex main area with a large radius of curvature or a flat main area with an infinite radius of curvature, the latter being similar to conventional United States driver side exterior mirrors, together with an aspheric section on the outboard portion of the mirror. The relatively high curvature in the aspheric area yields a greatly expanded field of view, and at the same time, since the aspheric portion does not dim, the bright outboard portion provides a danger signal in the event another vehicle is positioned immediately adjacent to the vehicle quips with mirrors embodying the present invention. It should also be understood that if desired, the aspheric portion of the mirror assembly could be tinted or provided with less reflective capability than the undimmed electro-optic portion of the mirror.

With reference to FIG. 6, a preferred arrangement for connecting the electronic conductive layers to a power source is illustrated. In this arrangement, the two electrode-bearing front and rear glass elements 14 and 18 are displaced in opposite directions, laterally from, but parallel to, the chamber 13 in order to provide exposed areas on the front and rear glass elements. Electrically conductive spring clips 42 and 44 are provided which are placed on the coated glass sheets to make electrical contact with the exposed areas of the electrically conductive layers. Suitable electrical conductors (not shown) may be soldered or otherwise connected to the spring clips 42 and 44 so that desired voltage may be applied to the device from a suitable power source. It is preferred but not essential that the combination reflector/electrode, which may or may not be multilayer, function as and be maintained as the cathode in the circuitry.

Rearview mirrors embodying the present invention preferably include a bezel 34 which extends around the entire periphery of the assembly. The bezel 34 conceals and protects the spring clips 42 and 44 and the peripheral edge portions of both of the front and the rear elements 14 and 18. By way of example, the bezel 34 may be of the type disclosed in the co-pending Continuation Application of William L. Tonar, Serial No. 08/142,875, filed October 29, 1993, which issued as US-5,448,397 on 5th September 1995.

The assembly may also include a conventional heater and a plastic mirror back or glass case which is adapted to snap into an outside mirror housing (not shown) that may be of any desired configuration including with and without a motor pack for remote adjustment of mirror position. The outside mirror housing is supported on the outside of an automotive vehicle in any desired or conventional manner, and the inside mirror is supported inside the vehicle in any desired or conventional manner, whereby the field of view of each mirror may be adjusted by the driver of the vehicle in a conventional manner, as for example, through manual adjustment or by mechanical or electrical means of the types conventionally provided on modem day automobiles.

Another embodiment of the invention is illustrated in Figure 7 which enables each outside mirror to implement a signaling function, and in which the reflector on the outboard section 14A is constructed to reflect most of the spectra while transmitting only a selected spectra of a cooperative signal light source located behind the mirror. In an alternate approach, the reflector can be made generally reflective, but partially light transmissive over a broad spectral range, thus requiring a signal light of sufficient intensity to be seen by passing vehicles after attenuation through the partially reflecting layer. In order to direct the light away from the driver's eyes either louvers or a sheet of plastic light directing film is placed behind the mirror surface between the signal light source and the reflector. The ambient light sensor in the automatic interior mirror can be used along with a conventional control circuit (not shown) to progressively reduce the signal light output under progressively darker night driving conditions. Areas behind the outboard portion of each outside mirror where the signal light is not expected to shine through can optionally be covered with black or dark paint to make the interior behind the mirror reflector less visible cosmetically in the daytime. In this embodiment of the invention, a dichroic reflector in area 14A may be utilized, along with a light source that is compatible with the dichroic reflector, e.g., a red light emitting diode, emitting in specific spectral wavelengths of the band pass region of the dichroic reflector. Another possibility for a light source for use with a dichroic reflector is a neon gas tube, power supplies (not shown) for the light emitting diodes or neon tube being well known in the art.

With a partially reflecting mirror, any wide band light source is acceptable provided it has sufficient light output and life to withstand the automotive environment, and provided the color is acceptable for an automotive safety signal. Where a white or broad spectrum light source is preferably used, either a tinted lamp enclosure or separate colored filter between the light source and the reflector is sufficient to provide the proper orange or red light output. The preferred color of the light output with the partial reflector approach is orange. The most practical low cost light source is of the incandescent type with possible variations to include halogen, xenon or other life-extending, high efficiency technology. It is desired to produce the most light with the least cost using a practical, affordable light source for which replacement bulbs are readily available for service.

Whatever light source is used, it is preferred to use either a lamp reflector, lens or both for the purpose of increasing light output efficiency in the desired direction. The lamp reflector referred to in this case is distinctively separate from the mirror reflector on the outboard portion of the partially dimming aspheric mirror. As an alternate approach, this signal light concept and partial dimming concept can also be useful with a substantially uniformly curved mirror, such as a convex mirror, where only a portion of the mirror is automatically dimming and the outboard portion is non-dimming with a signal light feature behind the outboard reflector.

In order to direct light, emitting from the signal light source, away from the driver's view, a laser can be used to cut (burn) a precise controllable louver pattern in a plastic louver member effective to direct light out of the mirror so it can be seen by other vehicles on the side of the vehicle equipped with the signaling mirror, but not seen by the driver of the vehicle so equipped. The plastic louver sheet can be either extruded flat or molded flat or it can be molded in a curved shape to fit the mirror curve.

It will be understood that a laser or other suitable means can be utilized to burn slots at an angle through the plastic sheet, and that the slots can be arranged in a manner to provide the greatest practical ratio of open area with the laser cut slots being stopped at certain points to allow sufficient structural retention and support. Referring to Figure 7, a schematic simplified side elevational view of this embodiment of the invention is illustrated therein. In this embodiment of the invention, a front reflector 138 is provided on the aspherical portion 114A of the glass 114, the reflector 138 preferably being a very highly reflective but partially transparent metal coating.

It should be understood, however, that in this embodiment of the invention it is not necessary that the outboard portion of the mirror be aspheric, and that if desired the outboard portion can be flat or curved. If desired, protective coatings may also be provided upon the condition that the reflective coating be substantially transmissive thereby allowing light from behind the mirror to pass through. The higher the natural reflectance of the front layers the greater will be the ability to sacrifice reflectance to transmittance and still fall within an acceptable mirror reflectance range of about 40% to 60%. Suitable reflectors are rhodium, coated aluminum, coated silver, or other suitable different metal. The key aspect is that the natural reflectance be high enough to allow a thin controlled thickness to transmit approximately 10 to 30% or greater of the signal light and still allow approximately 40 to 60% reflectance. The glass itself is designated 114 in Figure 7, but clear plastic may be useful as an alternate.

The layer designated 115 is the louvered layer which incorporates an appropriate signal pattern which can be recognized as a turn or other signal, which when lighted is visible to vehicles on the side, but not to driver of the vehicle quipped with outside mirrors embodying the present invention.

In the embodiment of the invention illustrated in Figure 7, an optional lens 117 is provided to direct light for efficiency. A signal light source 119 is provided which may be in the form of an LED array, a filament lamp or lamps, or a gas filled lamp such as neon or xenon, and a reflector or reflector array 121 is provided to direct light emanating from the light source 119 toward the lens 117 and/or the louvers 115. If desired, a clear transparent electrode heater and black mask could be positioned between the louvers 115 and the glass 114. The louvers 115 would then be glued to the substrate with adhesive.

In the operation of this embodiment of the invention, when the signal light source is energized, the turn or other signal is thus visible only to the drivers of other vehicles. At the same time, the reflective surfaces of the mirror function in a conventional manner.

In accordance with the present invention, the signaling concept described hereinabove can be extended to include electro-optic dimming mirrors as shown in Figure 8. Referring to Figure 8, an electro-optic assembly generally designated 210 is provided which includes a sealed chamber 213 defined by a front glass element 214, an edge seal 216, and a rear glass element 218 having reflective but partially light transmitting and electrically conducting chromium and rhodium layers 220 and 222, respectively, on the front face thereof. An electro-optic medium 224 having the desired electro-optic properties fills the chamber 213, and a transparent electrically conductive layer or layers 226, such as ITO, is carried on the back face of the front glass 214. A louvered layer 215 is provided which is secured to the back surface of the rear glass 218, the louvered layer having an appropriate signal pattern, such as an arrow, which can be recognized as a turn or other signal, visible to vehicles on the side, but not to the driver of the vehicle equipped with outside mirrors embodying the invention. This embodiment of the invention includes an optional lens 217 to direct light for efficiency. A signal light source 219 is provided which may be in the form of an LED array, a filament lamp or lamps, or a gas-filled lamp such as a neon lamp or a xenon lamp, and a reflector or reflector array 221 is provided to direct light emanating from the light source 219 toward the lens 217 and/or the louvers 215. If desired, a clear transparent electrode heater can be positioned between the louvers 215 and the rear glass 218, the louvers being fixed to the heater substrate, as with an adhesive. Thus, in the operation of this embodiment or the invention, when the signal light source is energized, the signal is visible only to drivers of other vehicles, while the electro-optic dimming features of the mirrors are visible to the driver of the vehicle equipped with the mirrors embodying the invention.

Another embodiment of the invention is illustrated in Figure 9. In this embodiment of the invention, the rear glass element is substantially the same size as the front glass element including the aspherical portion thereof so that the entire mirror including the aspheric portion thereof has the reversibly variable transmittance capabilities. Referring to Figure 9, an outside mirror, generally designated 111, is illustrated which includes a sealed chamber 113 defined by a front glass element 114, an edge seal 116, and a rear glass element 118 having reflective and electrically conductive metal layer 122 and optionally also a metal under coating 120. An electro-optic medium 124 having the desired electro-optic properties fills the chamber 113, and a transparent electrically conductive layer, such as a fluorine-doped tin oxide conductive layer 126 is carried by the front element 114. The electrically conductive layers are connected to a electrical circuit in the manner previously described, and, if desired, a color suppression coating or coatings, such as 128 may be disposed between the conductive layer 126 and the adjacent rear surface of the front element 114.

In this embodiment of the invention, the front glass element 114 is formed in one continuous piece that includes an inboard main body portion 114B that may be substantially flat with an infinite radius of curvature, or slightly curved with a relatively large radius of curvature. The main body portion 114B is integrally joined to an outboard aspherical portion 114A having a radius of curvature substantially less than the radius of curvature of the main body portion 114B. Thus, the aspherical portion 114A contributes a predetermined field of view which, when combined with the field of view of the main body portion 114B is substantially greater than the field of view of the main body portion 114B alone. The rear glass element 118 of the mirror of this embodiment of the invention is substantially the same size as the front glass element 114 and includes a main body portion 118B that is substantially the same size as the main body portion 114B of the front glass element, and an aspherical portion 118A that is substantially the same size as the aspherical portion 114A of the front glass element.

In this embodiment of the invention the reflective surface on the inside of the rear glass 118 is comprised of a single metal layer combination reflector/electrode or a series of coatings which may be the same as the multilayer combination reflector/electrode types previously described which serve as a mirror reflective layer and also form an integral electrode in contact with the electrochromic media. The other electrode on the inside surface of the front glass 114 may be the same as the transparent electrode 26 previously described which contacts the electrochromic media inside the mirror element. The multilayer combination reflector/electrode in this embodiment of the invention thus functions in the same manner and obtains the same results as the multilayer combination reflector/electrode previously described, and the transparent electrode on the inside surface of the front glass 114 also functions in the manner and obtains the same results as the transparent electrodes previously described, the difference in this embodiment of the invention being that the multilayer combination reflector/electrode and the transparent electrode include the aspheric portion of the mirror, it being understood that the seal 116 encompasses the entire chamber 113 which extends to the left end of the mirror structure, as illustrated in Figure 9, including the aspheric portion of the mirror. Thus, the entire mirror 111 including the aspheric portion of the mirror has the reversibly variable transmittance capabilities, and the entire mirror functions in the same manner as the inboard main body portion 14B of the embodiment of the invention illustrated in Figures 1 through 6.

While preferred embodiments of the invention have been illustrated and described, it will be understood that various changes and modifications may be made without departing from the scope of the invention which is defined by the appended claims.

Claims

1. An electro-optically dimming exterior rearview mirror (111) for automotive vehicles, said mirror comprising, in combination, front and rear spaced elements (114, 118), said front element (114) being optically transparent and including an inboard portion (140) and an outboard portion (114A) projecting laterally outwardly of said inboard portion, at least one of said inboard and outboard portions (114A, B) of said front element being of curved configuration, said front element and said rear element defining a chamber therebetween, the confronting sides of said front element and said rear element each including at least one layer of electrically conductive material (22, 26) said chamber containing an electro-optic reversibly variable transmittance medium (124) in contact with each of said electrically conductive layers, said rear element including light reflecting means (20, 22), said light reflecting means of said rear element being effective to reflect light through said medium and through said front element when said light reaches said rear element reflecting means after passing through said medium and through said front element, and means for applying electrical potential to said layers of electrically conductive material to cause variation in the light transmittance of said electro-optic medium.

2. A mirror according to claim 1, wherein said outboard portion of said front element is of aspheric configuration.

3. A mirror according to claim 1, wherein said inboard portion (114B) and said outboard portion (114A) of said front element have curved surfaces each with a radius of curvature, the radius of curvature of said curved surface of said inboard portion being greater than the radius of curvature of said curved surface of said outboard portion.

4. A mirror according to claim 1, 2 or 3, wherein said light reflecting means (20, 22) of said rear element is also electrically conductive and located on the side of said rear element (118) confronting said front element (114).

5. A mirror according to claim 4, wherein said light reflecting means of said rear element is formed of multiple layers of electrically conductive material.

6. A mirror according to claim 5, wherein said light reflecting means of said rear element includes a layer of rhodium and a layer of chromium, said layer of rhodium being on the side of said layer of chromium confronting said front element.

7. A combination as set forth in claim 6, wherein said layer of chromium is greater in thickness than said layer of rhodium.

8. An electro-optically dimming exterior rearview mirror (11, 12) for automotive vehicles, said mirror comprising, in combination, an optically transparent front element (14) having an inboard portion (14B) and an outboard portion (14A) projecting laterally outwardly from said inboard portion, a rear element (18), said rear element having a reflective surface (20, 22) thereon, said front clement (14) and said rear element (18) each having front and rear surfaces and defining a space between said rear surface of said front element and said front surface of said rear element, an electro-optic medium (24) confined in said space whereby light transmittance of said medium is variable upon the application of an electrical potential thereto, said front surface of said inboard portion (14B) of said front element having a predetermined radius of curvature, said front surface of said outboard portion (14A) of said front element being of aspheric configuration.

9. A mirror according to claim 8, wherein said front surface of said outboard portion (14B) of said front element has a radius of curvature less than said radius of curvature of said front surface of said inboard portion of said front element.

10. A mirror according to any of the preceding claims,

wherein said inboard portion (14B; 114B) and said outboard portion (14A; 114A) of said front element each have a predetermined field of view, the field of view of the combination of said inboard portion and said outboard portion being greater than the field of view of said inboard portion alone.

11. A mirror according to any of the preceding claims, including means (28; 128) disposed between said front element (14; 114) and said rear element (18; 118) for suppressing colour.

12. A mirror according to any of the preceding claims, wherein said inboard portion (14B; 114B) and said outboard portion (14A; 114A) of said front element are formed of one continuous piece of glass.

13. A mirror according to any of the preceding claims, wherein said front element (14; 114) and said rear element (18; 118) have confronting surface portions of curved configuration.

14. A mirror according to any of claims 1 to 12, wherein said front element (14; 114) and said rear element (18; 118) have confronting surface portions of substantially flat configuration.

15. A mirror according to any of the preceding claims, wherein said reflective surface (20, 22; 120, 122) on said rear side of said rear element.

16. A mirror according to any of claims 1 to 14, wherein said reflective surface (20, 22; 120, 122) on said rear element (18; 118) is located on the side of said rear clement confronting said front element (14; 114).

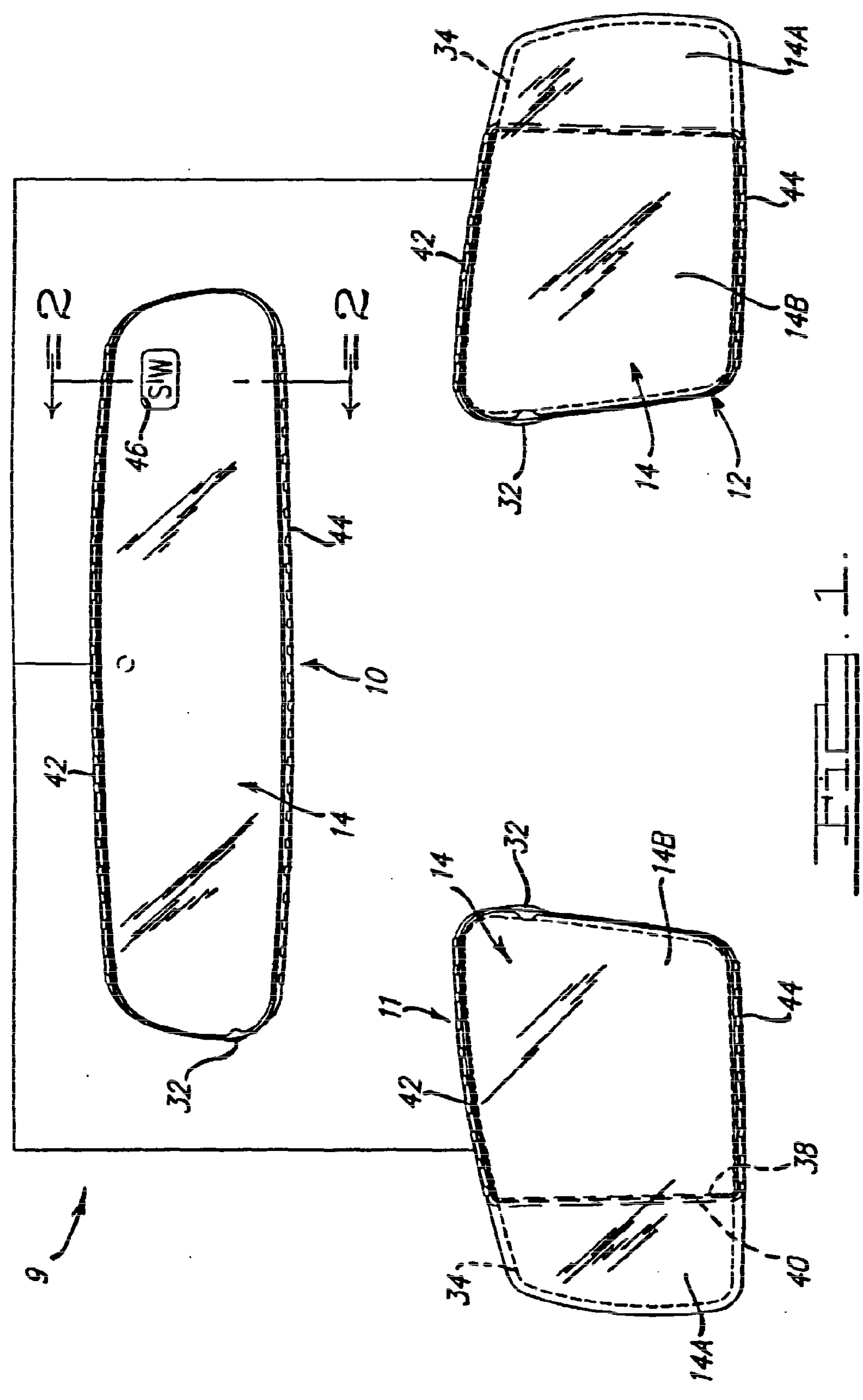

FIG. 1

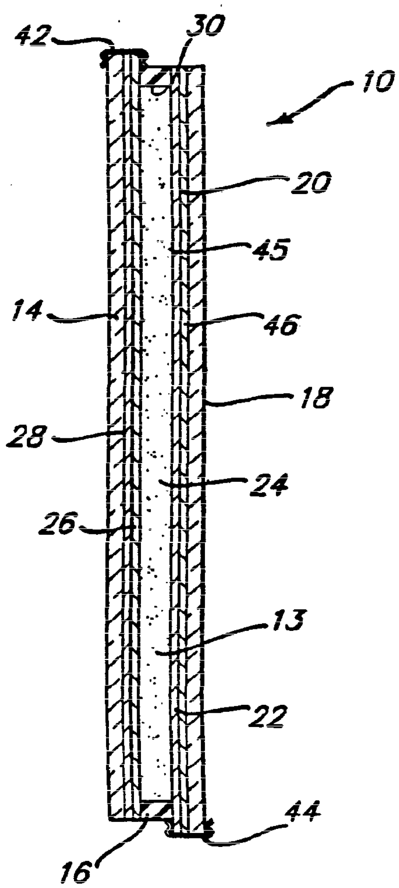
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FIG. 2.

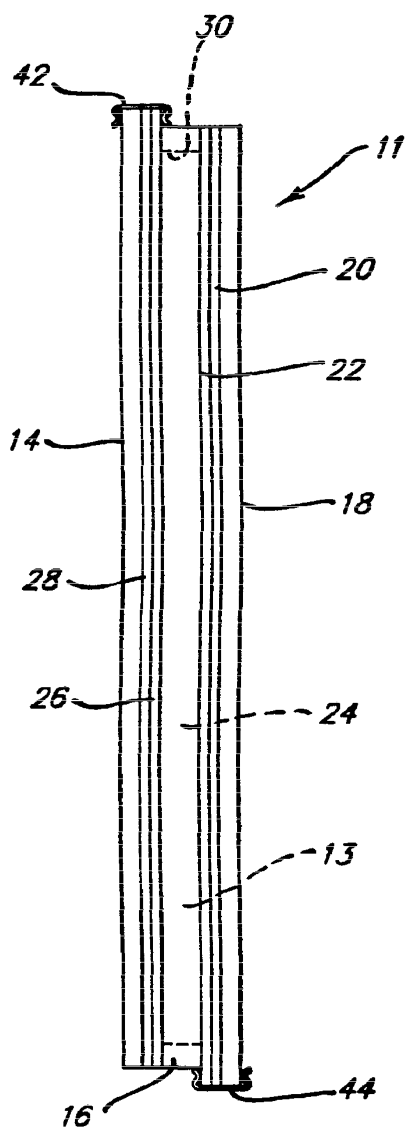
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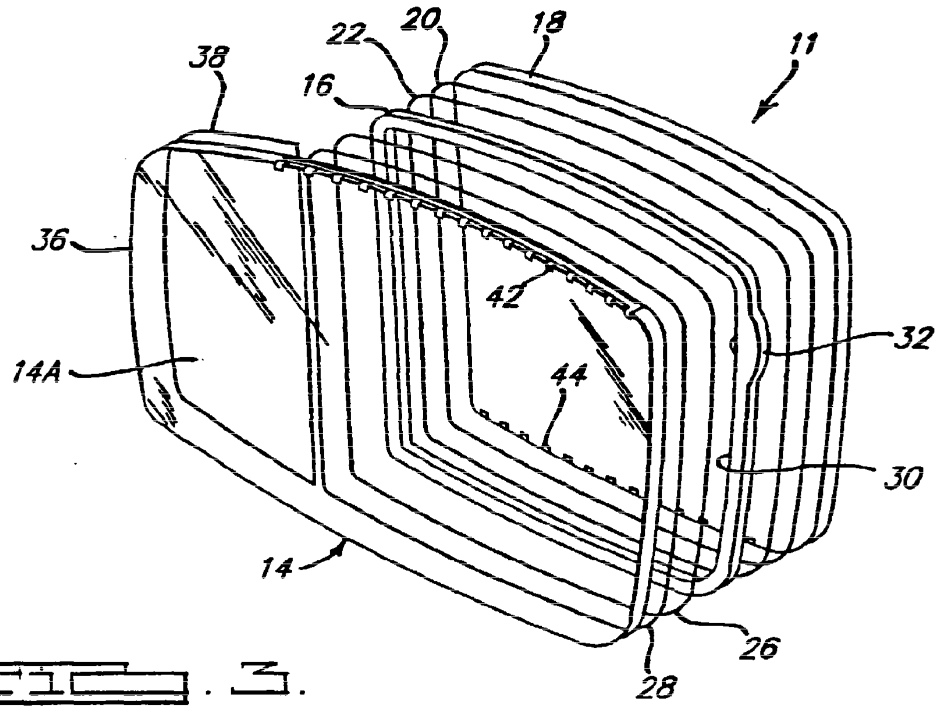
FIG. 6.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14A
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26
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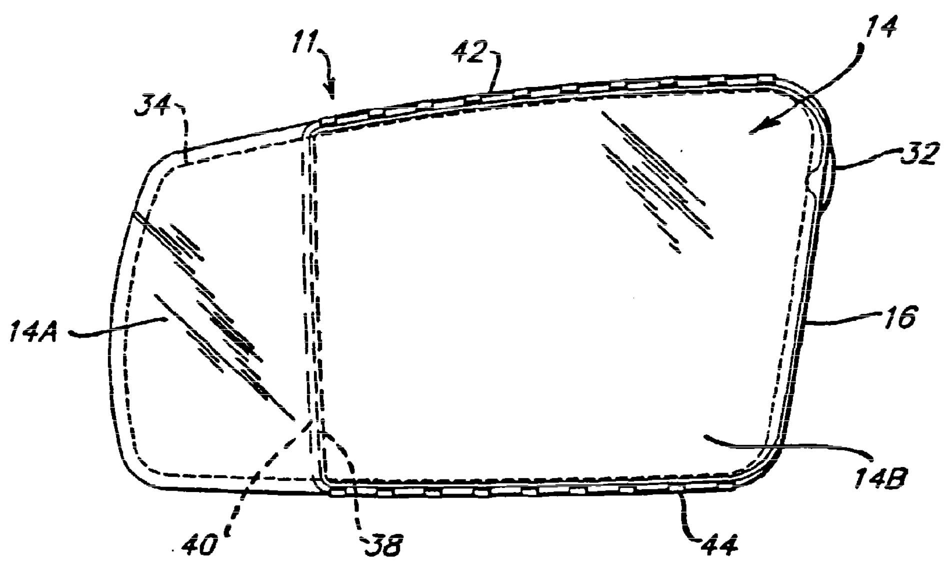
FIG. 3.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14A
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14B
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FIG. 4.

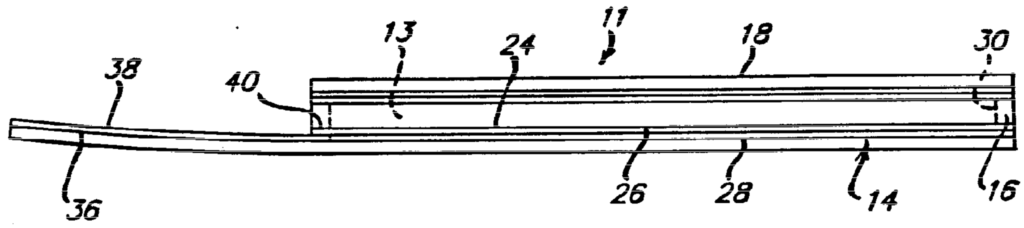

FIG. 5.

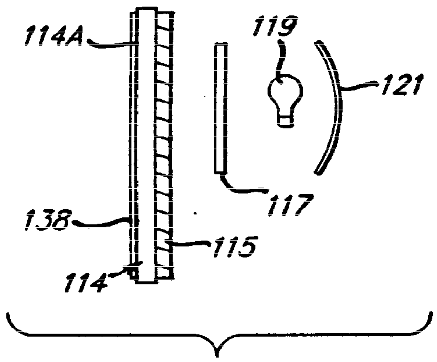

FIG. 7.

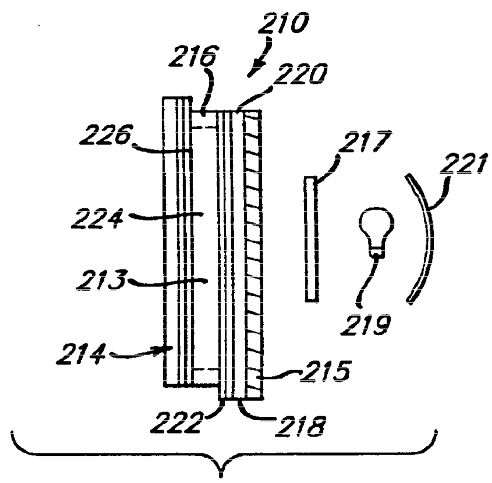

FIG. 8.

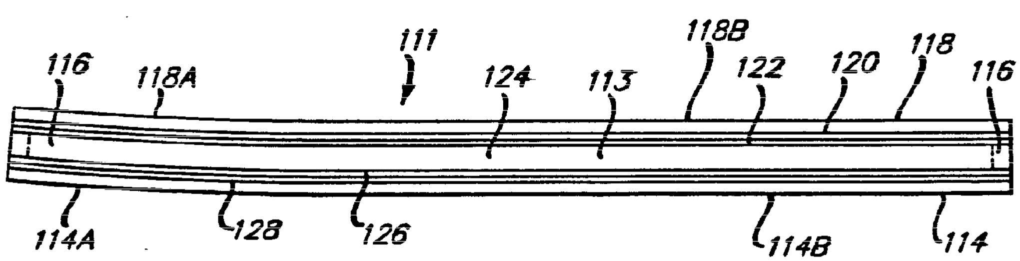

FIG. 9.

Mirror support with divergent reflective area

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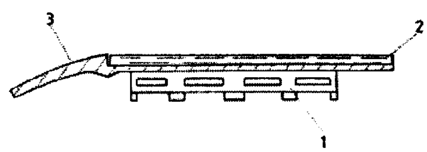
Abstract of **EP0917987**

The mirror holder (1), designed to be mounted in a rear view mirror housing and pivotable by direct pressure or remote operation, incorporates a divergent reflective zone (3) extending to one side of the main mirror surface (2). The divergent zone is produced by a chrome or varnish reflective coating applied directly to the mirror holder itself, and it can be a flat or curved spherical or aspherical surface. The mirror can also be equipped with a de-icer.



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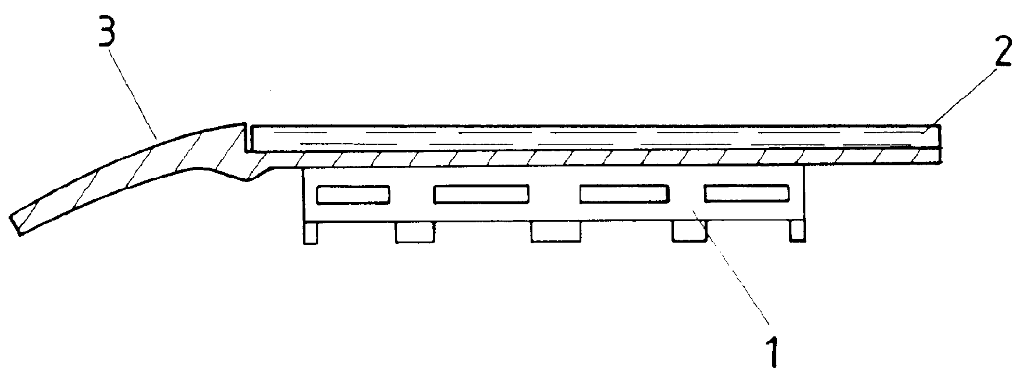
(54) Porte-miroir comportant une zone réfléchissante divergente

(57) La présente invention concerne un porte-miroir (1) destiné à être monté dans un boîtier de rétroviseur extérieur par l'intermédiaire d'un dispositif de montage pivotable à commande directe par appui sur le miroir (2) équipant ledit porte-miroir (1) ou à commande à distance au moyen d'un dispositif à actionnement manuel ou motorisé.

Porte-miroir caractérisé en ce qu'il comporte une zone réfléchissante (3) divergente par rapport au miroir (2), s'étendant latéralement en prolongement de la surface de réception du miroir (2), en position de service du rétroviseur, et dont le revêtement réfléchissant est une couche réfléchissante chromée ou vernie appliquée directement sur la matière du porte-miroir (1) formant ladite zone réfléchissante (3).

L'invention est plus particulièrement applicable dans le domaine de la réalisation de dispositifs de rétrovision pour véhicules automobiles.



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Description

[0001] La présente invention concerne le domaine des véhicules automobiles, en particulier de leurs accessoires, et notamment leurs moyens de rétrovision et a pour objet un porte-miroir comportant une zone réfléchissante divergente.

[0002] Actuellement, pour permettre aux automobilistes de surveiller la circulation à l'arrière et sur les côtés de leur véhicule, en particulier lors des manoeuvres de dépassement ou garage, les véhicules automobiles sont généralement équipés d'un rétroviseur intérieur central et de deux rétroviseurs extérieurs fixés chacun sur une portière avant.

[0003] Ainsi, le miroir intérieur central permet essentiellement la surveillance de la zone située à l'arrière du véhicule, notamment pour apprécier l'approche ou l'éloignement d'autres véhicules, alors que les rétroviseurs extérieurs latéraux sont destinés à permettre le contrôle des zones latérales dudit véhicule, immédiatement lors des manoeuvres de dépassement ou de changement de file, ainsi que pour les manoeuvres de stationnement.

[0004] Un tel montage des rétroviseurs est généralement satisfaisant, en permettant, par installation d'un miroir central intérieur panoramique et de miroirs extérieurs orientables à distance, la couverture d'un vaste champ de vision latéral et arrière.

[0005] Cependant, du fait même de la disposition des rétroviseurs, il subsiste des zones périphériques du véhicule qui restent invisibles au conducteur et qui sont appelées angles morts. Ces angles morts obligent le conducteur à tourner plus ou moins la tête pendant les manoeuvres de dépassement de manière à s'assurer qu'aucun véhicule n'effectue de manoeuvre dans l'espace constituant l'angle mort, ce qui pourrait être dangereux et entraîner éventuellement une collision, risque augmenté par le fait que pendant cette vérification la surveillance vers l'avant du véhicule n'est plus assurée.

[0006] Pour obvier à ces inconvénients, il a été proposé des rétroviseurs extérieurs présentant des moyens destinés à supprimer plus ou moins l'angle mort de chaque rétroviseur extérieur. A cet effet, le miroir de rétroviseur peut, soit être muni d'un élément rapporté réfléchissant plan ou courbe, en saillie par rapport à lui, soit être sous forme d'un miroir sphérique ou asphérique.

[0007] Les miroirs comportant deux éléments réfléchissants sont généralement formés par un élément de plus grande surface destiné à la vue arrière latérale et par un élément de plus petite surface servant à couvrir partiellement l'angle mort correspondant.

[0008] De tels miroirs de rétroviseur extérieur nécessitent, cependant, des investissements de fabrication importants, du fait que chaque modèle de rétroviseur, pour tenir compte des normes en matière de surface de vision latérale arrière minimale, sera équipé de miroirs différents.

[0009] Les miroirs sphériques ou asphériques sont réalisés à partir d'une ébauche plane, par déformation à chaud sur un gabarit. De tels miroirs nécessitent des coûts de fabrication importants entraînant des prix de revient élevés des rétroviseurs obtenus. En outre, ces miroirs ne permettent pas l'obtention d'une image non déformée.

[0010] On connaît, par ailleurs, par GB-A-2 126 548, un rétroviseur extérieur comportant un premier miroir plan et un second miroir convexe contigu au premier, ces miroirs étant montés sur un porte miroir commun et déterminant une surface réfléchissante continue.

[0011] De même, le document GB-A-2 261 861 a pour objet un rétroviseur extérieur comportant deux miroirs adjacents formant une surface réfléchissante convexe. Ces deux miroirs peuvent être, soit adjacents, soit d'un seul tenant et reliés par une partie incurvée.

[0012] Les miroirs ainsi réalisés présentent, cependant, tous l'inconvénient de ne pas être adaptés à une mise en oeuvre sur des modèles de rétroviseurs différents, de sorte que chaque modèle nécessite, au moins pour la partie de miroir destinée à couvrir partiellement l'angle mort, un miroir spécifique, ce qui entraîne des frais de fabrication correspondants.

[0013] La présente invention a pour but de pallier les inconvénients des rétroviseurs extérieurs connus en proposant un porte-miroir permettant, tout en maintenant un confort de vision optimal, d'améliorer sensiblement le champ de vision vers l'arrière, ce à un faible prix de revient.

[0014] A cet effet, l'invention a pour objet un parle-miroir, destiné à être monté dans un boîtier de rétroviseur extérieur par l'intermédiaire d'un dispositif de montage pivotable à commande directe par appui sur le miroir équipant ledit porte-miroir ou à commande à distance au moyen d'un dispositif à actionnement manuel ou motorisé, caractérisé en ce qu'il comporte une zone réfléchissante divergente par rapport au miroir, s'étendant latéralement en prolongement de la surface de réception du miroir, en position de service du rétroviseur, et dont le revêtement réfléchissant est une couche réfléchissante chromée ou vernie appliquée directement sur la matière du porte-miroir formant ladite zone réfléchissante.

[0015] L'invention sera mieux comprise, grâce à la description ci-après, qui se rapporte à un mode de réalisation préféré, donné à titre d'exemple non limitatif, et expliqué avec référence au dessin schématique annexé, dont la figure unique est une vue en élévation et en coupe du porte-miroir conforme à l'invention.

[0016] La figure unique du dessin annexé représente un porte-miroir 1 destiné à être monté dans un boîtier de rétroviseur extérieur par l'intermédiaire d'un dispositif de montage pivotable à commande directe par appui sur le miroir 2 équipant ledit porte-miroir 1 ou à commande à distance au moyen d'un dispositif à actionnement manuel ou motorisé.

[0017] Conformément à l'invention, le porte-miroir 1 comporte une zone réfléchissante 3 divergente par rapport au miroir 2, s'étendant en prolongement de la surface de réception du miroir 2, de préférence latéralement par rapport cette surface, en position de service du rétroviseur, et dont le revêtement réfléchissant est avantageusement une couche réfléchissante chromée ou vernie appliquée directement sur la matière du porte-miroir 1 formant ladite zone réfléchissante 3.

[0018] Ainsi, le rétroviseur extérieur muni d'un tel porte-miroir 1 permet une vision habituelle de la partie arrière latérale correspondante du véhicule et une détection complémentaire dans l'espace correspondant à l'angle mort du miroir 2, grâce à la zone réfléchissante 3. La disposition de la zone réfléchissante divergente 3 est particulièrement avantageuse, du fait qu'elle permet un prolongement naturel du miroir 2 par la zone réfléchissante divergente 3 et donc un réglage simultané de cette dernière avec ledit miroir 2.

[0019] La zone réfléchissante divergente 3 peut se présenter, soit sous forme d'une surface plane, soit sous forme d'une surface sphérique ou asphérique. Dans le premier cas, l'image réfléchie par la zone 3 sera une image comparable à celle réfléchie par le miroir 2, tandis que dans le deuxième cas, cette image sera plus ou moins déformée du fait de la convexité de la surface.

[0020] Le miroir 2 peut être un miroir en verre ou en matière synthétique muni ou non d'un dispositif de dégivrage et collé sur le porte-miroir 1. Dans le mode de réalisation représenté au dessin annexé, la surface de réception du miroir 2 est une surface plane, cependant, cette surface pourrait également se présenter comme une surface convexe destinée à la réception d'un miroir 2 asphérique ou sphérique. Dans un tel cas, la réalisation du miroir 2 en matière synthétique pourrait permettre une conformation directe à la convexité du support ou porte-miroir 1, lors de son montage sur ce dernier par collage, ce qui entraînerait un coût de fabrication réduit en conséquence.

[0021] Conformément à une autre caractéristique de l'invention, non représentée au dessin annexé, la zone réfléchissante divergente 3 peut avantageusement être pourvue, sous sa surface de réception du revêtement réfléchissant, d'une plaquette de dégivrage. Une telle plaquette de dégivrage peut être intégrée directement dans la matière constitutive du porte-miroir 1 lors du moulage de ce dernier, par surmoulage, et présenter des moyens de branchement électrique débouchant derrière ledit porte-miroir 1 et coopérant avec des moyens correspondants prévus dans le boîtier du rétroviseur.

[0022] Ainsi, l'ensemble du miroir de rétroviseur à surfaces réfléchissantes multiples peut être maintenu dans un état de réflexion parfait permettant au conducteur du véhicule ainsi équipé de toujours disposer d'un angle de vision latéral arrière maximal.

[0023] Grâce à l'invention, il est possible de réaliser un porte-miroir, permettant, du fait de la prévision d'une zone réfléchissante divergente, l'obtention d'un champ de vision latéral arrière considérablement élargi, de sorte que le conducteur du véhicule ainsi équipé peut voir simultanément une image normale du champ latéral arrière et une image partielle de l'espace se trouvant dans l'angle mort correspondant. Cette deuxième image sera, selon le cas, avec ou sans déformation, suivant que la zone réfléchissante sera convexe, c'est-à-dire sphérique ou asphérique, ou plane.

[0024] En outre, l'invention permet une création de rétroviseurs plus étendue, du fait qu'elle rend parfaitement envisageable l'utilisation d'un même miroir plan sur des modèles de porte-miroirs différents dans leur forme et dans leurs dimensions, le miroir plan pouvant très bien être intégré avec une dimension figée sur des porte-miroirs, dont la surface de la zone réfléchissante divergente est variable d'un modèle de rétroviseur à un autre.

[0025] Le porte-miroir ainsi obtenu est d'un prix de revient relativement faible comparativement à celui de porte-miroirs et de miroirs permettant une rétrovision latérale optimisée et sa mise en oeuvre, ainsi que son réglage sont particulièrement simples.

[0026] La présente invention est plus particulièrement applicable dans le domaine de la réalisation de dispositifs de rétrovision pour véhicules automobiles.

[0027] Bien entendu, l'invention n'est pas limitée au mode de réalisation décrit et représenté au dessin annexé. Des modifications restent possibles, notamment du point de vue de la constitution des divers éléments ou par substitution d'équivalents techniques, sans sortir pour autant du domaine de protection de l'invention.

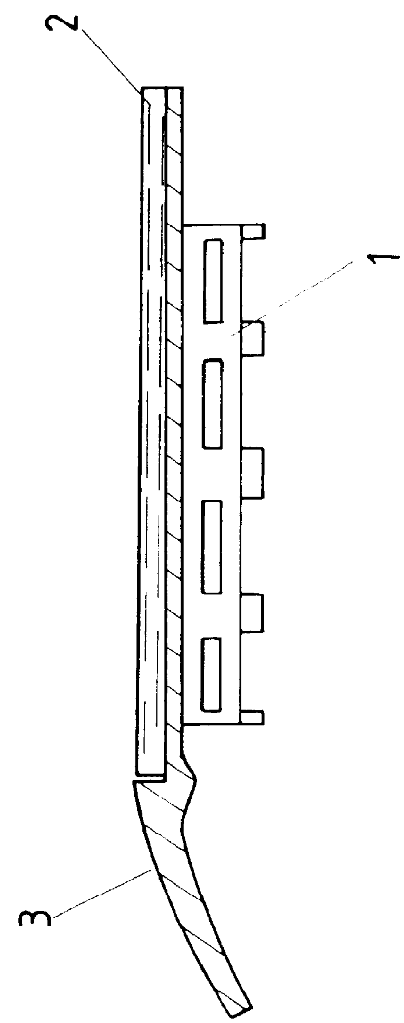
Revendications

1. Porte-miroir (1), destiné à être monté dans un boîtier de rétroviseur extérieur par l'intermédiaire d'un dispositif de montage pivotable à commande directe par appui sur le miroir (2) équipant ledit porte-miroir (1) ou à commande à distance au moyen d'un dispositif à actionnement manuel ou motorisé, caractérisé en ce qu'il comporte une zone réfléchissante (3) divergente par rapport au miroir (2), s'étendant latéralement en prolongement de la surface de réception du miroir (2), en position de service du rétroviseur, et dont le revêtement réfléchissant est une couche réfléchissante chromée ou vernie appliquée directement sur la matière du porte-miroir (1) formant ladite zone réfléchissante (3).

2. Porte-miroir, suivant la revendication 1, caractérisé en ce que la zone réfléchissante divergente (3) se présente sous forme d'une surface plane.

3. Porte-miroir, suivant la revendication 1, caractérisé en ce que la zone réfléchissante divergente (3) se présente sous forme d'une surface sphérique ou asphérique.

4. Porte-miroir, suivant la revendication 1, caractérisé en ce que le miroir en verre ou en matière synthétique formant la zone réfléchissante divergente (3) est pourvue sur sa face arrière d'une plaquette de dégivrage.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RAPPORT DE RECHERCHE EUROPEENNE

Numéro de la demande
EP 98 44 0260

DOCUMENTS CONSIDERES COMME PERTINENTS

Catégorie	Citation du document avec indication, en cas de besoin, des parties pertinentes	Revendication concernée	CLASSEMENT DE LA DEMANDE (Int.Cl.6)
P,X	EP 0 864 465 A (BRITAX) 16 septembre 1998 * revendications 4,5; figure 6 * ---	1,3,4	B60R1/08
A	GB 2 126 548 A (KERR) 28 mars 1984 ---		
A	GB 2 261 861 A (WHITTLE) 2 juin 1993 -----		

DOMAINES TECHNIQUES RECHERCHES (Int.Cl.6)
B60R

Le présent rapport a été établi pour toutes les revendications

Lieu de la recherche	Date d'achèvement de la recherche	Examinateur
LA HAYE	4 février 1999	Knops, J

CATEGORIE DES DOCUMENTS CITES

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Document brevet cité au rapport de recherche		Date de publication	Membre(s) de la famille de brevet(s)	Date de publication
EP 864465	A	16-09-1998	AUCUN	
GB 2126548	A	28-03-1984	AUCUN	
GB 2261861	A	02-06-1993	AUCUN	

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⑪ Publication number: 0 356 099 A2

⑫ # EUROPEAN PATENT APPLICATION

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㉒ Date of filing: 14.08.89

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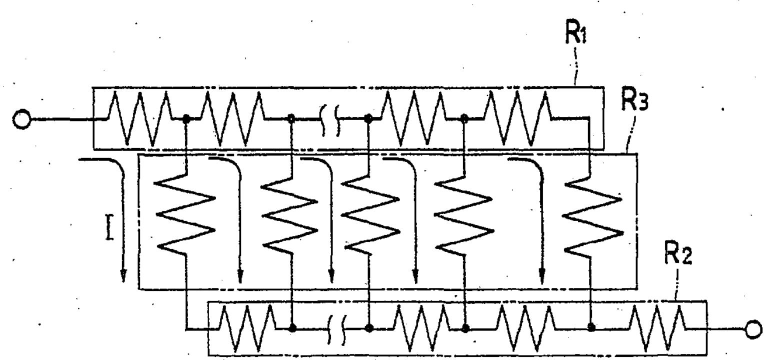
⑤④ **Electrochromic device.**

⑤⑦ The present invention relates to an electrochromic device which comprises a first electrode layer, an intermediate layer including an electrochromic layer, a second electrode layer; said first electrode layer, said intermediate layer and said second electrode layer being laminated in succession, and an electrode member connected to one of said first and second electrode layers and extending in a predetermined direction perpendicular to the direction of lamination of said first electrode layer, said intermediate layer and said second electrode layer.

The resistance R_1, R_2 respectively of said first and second electrode layers and the internal resistance R_3 of said intermediate layer satisfy the predetermined condition.

FIG. 2



Electrochromic Device

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to an electrochromic device capable of uniform coloring.

Related Background Art

A phenomenon of reversible coloration by reversible electrolytic oxidation or reduction under voltage application is called electrochromism.

Various attempts have been made, since more than 20 years ago, to prepare electrochromic devices (ECD) utilizing an electrochromic material showing such electrochromic phenomenon and capable of coloration and color erasure by voltage application, and to utilize such ECD for a light control device such as an anti-glare mirror, or a 7-segment numeric display unit.

For example, the U.S. Patent No. 3,829,196 discloses a totally solid-state ECD composed of a transparent electrode film (cathode), a tungsten trioxide film, an insulating film for example of silicon dioxide, and an electrode film (anode) laminated in succession on a glass substrate.

The tungsten trioxide (WO_3) film is colored blue when a voltage is applied to said ECD, and returns to the colorless state when an inverse voltage is applied. The mechanism of the coloration and color erasure is not fully clarified, but it is estimated that the coloration and color erasure of WO_3 is governed by a small amount of water present in the WO_3 film and the insulating film (ion conductive layer).

The reaction formulae are estimated as follows:

$H_2O \rightarrow H^+ + OH^-$

(WO_3 film: cathode) $WO_3 + nH^+ + ne^- \rightarrow H_nWO_3$

colorless, transparent colored

(insulating film: anode) $OH^- \rightarrow \frac{1}{2}H_2O + \frac{1}{4}O_2\uparrow + \frac{1}{2}e^-$

Also there is already known an ECD composed of an electrochromic layer capable of coloration by reduction (for example WO_3), an ion conductive layer, and a layer capable of reversible electrolytic oxidation (for example iridium oxide or iridium hydroxide) laminated in succession between an upper electrode and a lower electrode for applying a pre-determined voltage.

At least one of the electrode layers directly or indirectly sandwiching the electrochromic layer has to be transparent in order to show the coloration and color erasure to the exterior, and both electrode layers have to be transparent in case of a transmissive ECD.

It is already known that a transparent electrode can be prepared for example from SnO_2, In_2O_3 ITO (SnO_2 - In_2O_3 mixture) or ZnO, but these materials are of relatively low transparency and have to be made thin. Because of this fact, and also because of other reasons, the ECD is usually formed on a substrate such as a glass plate or a plastic plate.

Also for certain applications, a sealing substrate, for protecting the device, is positioned opposite to the substrate of the device, and the device is sealed for example with epoxy resin.

However, the conventional ECD'S have been associated with a drawback that the coloration is very slow and is not uniform, and said uneven coloration has been particularly marked in a large-sized ECD.

SUMMARY OF THE INVENTION

The object of the present invention is to provide an ECD capable of showing uniform coloration even in a large size.

The above-mentioned object can be attained, according to the present invention, by a certain relationship of the resistances of the intermediate layer including the electrochromic layer, and the upper and lower electrodes sandwiching said intermediate layer.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic view showing the current flow in an ECD , for explaining the principle of the present invention;

Fig. 2 is a schematic view showing the current flow in an ECD embodying the present invention;

Fig. 3 is a schematic cross-sectional view of an ECD embodying the present invention; and

Fig. 4 is a plan view of an ECD for explaining the definition of conditions of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the following there will be explained the principle of the present invention.

At first explained is the relationship of the resistances of the intermediate layer, including the electrochromic layer, and the upper and lower electrodes sandwiching said intermediate layer, in a conventional ECD.

In the conventional ECD, the resistance R_1 of the upper electrode layer, the resistance R_2 of the lower electrode layer and the internal resistance R_3 of the intermediate layer sandwiched between said electrode layers satisfy following relation (1):

$$\frac{R_1 + R_2}{100} > R_3 \qquad (1)$$

The resistance R_1 or R_2 of the upper or lower electrode is measured in a direction substantially perpendicular to the extending direction of a connection electrode provided in at least one of said upper and lower electrodes, and the resistance R_3 of the intermediate layer is measured in the direction of thickness thereof.

The resistances R_1, R_2 and R_3 are defined as follows:

$$R_1 = \frac{\rho_1 \cdot S}{d_1 \cdot \ell^2} \qquad (2)$$

$$R_2 = \frac{\rho_2 \cdot S}{d_2 \cdot \ell^2} \qquad (3)$$

$$R_3 = \frac{\rho_3 \cdot d_3}{S} \qquad (4)$$

wherein:

ρ_1: resistivity of upper electrode layer:

ρ_2: resistivity of lower electrode layer:

ρ_3: ion resistivity of intermediate layer;

d_1: thickness of upper electrode layer;

d_2: thickness of lower electrode layer;

d_3: thickness of intermediate layer;

ℓ: shortest length, in the extending direction of connection electrode, of the upper or lower electrode layer not connected to said connection electrode, the connection electrode and the intermediate layer; and

S : superposed area of the upper electrode layer, the intermediate layer and the lower electrode layer, when seen from the direction of lamination thereof.

It is also assumed that the resistance of the connection electrode is approximately zero, which means following conditions:

$$\frac{\rho_4}{d_4} < \frac{\rho_1}{d_1}, \frac{\rho_4}{d_4} < \frac{\rho_2}{d_2}$$

wherein
ρ_4 : resistivity of connection electrode; and
d_4: thickness of connection electrode.

Fig. 1 schematically shows the state of flow of current I when a voltage is applied to an ECD of the above-explained resistance relationship. Since the vertical resistance of the intermediate layer is smaller than the horizontal resistance of the upper electrode layer, most of the current I flows into the intermediate layer from an end of the upper electrode layer close to the connection electrode. Consequently, in a portion of the ECD close to the connection electrode, the aforementioned reaction proceeds to show faster and denser coloration, but in the central portion and in a portion opposite to said connection electrode, the coloration is much slower and paler due to much lower current density.

This phenomenon results in uneven coloration, which is more marked in the large-sized ECD.

Also the erasure of coloration proceeds unevenly for the same reason, though the extent of unevenness is less marked than in the coloration.

According to the present invention, the aforementioned object is attained, in an electrochromic device composed of a laminate structure at least of an upper electrode, an electrochromic layer, and a lower electrode, by selecting the resistances R_1, R_2 of the upper and lower electrodes and the internal resistance R_3 of the electrochromic device so as to satisfy relations: $R_1 < R_3$ (5) and
$R_2 < R_3$ (6).

In the following there will be explained the principle of the present invention.

Fig. 2 shows the state of flow of the current I in the ECD of the present invention, when a voltage is applied across the upper electrode layer (positive side) and the lower electrode layer (negative side).

According to the present invention, since the resistances of two electrode layers and the internal resistance of the intermediate layer are so selected as to satisfy the above-mentioned relations:
$R_1 < R_3$ (5) and
$R_2 < R_3$ (6),
the current supplied from the connection electrode of the upper electrode layer (in the structure shown in Fig. 2), at first flows sufficiently in the upper electrode layer without voltage slope therein, and uniformly flows into the intermediate layer toward the lower electrode layer. Consequently the voltage across the upper and lower electrode layers is substantially constant in any part of the electrode layers in the horizontal direction.

For promoting the coloration and erasure of coloration the following condition:

$$\frac{R_1 + R_2}{10} < R_3 \qquad (7)$$

is experimentally found preferable.

For achieving more uniform coloration, R_3 should be made as large as possible in comparison with R_1 and R_2, and experimentally preferred is a condition:
$(R_1 + R_2) < R_3$ (8),
or more particularly:
$4(R_1 + R_2) < R_3$ (9).

In the present invention, the relationship of magnitude of the resistances R_1, R_2 of the electrode layers is not important. If both layers are transparent electrodes, the resistance of the uppermost electrode layer tends to become larger, in practical film formation, than that of the electrode layer formed directly on the substrate.

The laminate structure of the ECD of the present invention is only required to have an upper electrode layer, an electrochromic layer and a lower electrode layer and there may be employed, for example, a structure employing a liquid electrochromic layer, an intermediate layer containing liquid electrolyte, a structure employing an organic electrochromic material or a structure utilizing metal ions such as lithium ions instead protons. However there is preferred a totally solid thin film structure composed of four layers such as electrode layer/electrochromic layer/ion conductive layer/electrode layer or five layers such as electrode layer/reduction coloring electrochromic layer/ion conductive layer/reversible electrolytic oxidation layer/electrode layer.

The transparent electrode can be formed, for example, of SnO_2, In_2O_3, or ITO. Such electrode layer can be generally formed by a vacuum thin film deposition technology such as vacuum evaporation, ion plating or sputtering.

The reduction coloring electrochromic layer can be generally composed of WO_3 or MoO_3.

The ion conductive layer can be composed, for example, of silicon oxide, tantalum oxide, titanium oxide, aluminum oxide, niobium oxide, zirconium oxide, hafnium oxide, lanthanum oxide or magnesium fluoride. The thin film of such materials is insulating to electrons depending on the method of film preparation, but is conductive to protons (H^+) and hydroxyl ions (OH^-).

The coloring and color erasing reactions of the electrochromic layer require cations, so that H^+ ions or Li^+ ions have to be incorporated in the electrochromic or other layer. The H^+ ions need not necessarily be present from the beginning but can be generated under the voltage application, and water may be added instead of H^+ ions. The amount of water can be very small, and the coloring and color erasing reactions may take place even by the moisture spontaneously entering from the air.

It is possible to place either of the electrochromic layer and the ion conductive layer above the other. Furthermore there may be provided a reversible electrolytic oxidation layer (eventually constituting an oxidation coloring electrochromic layer) or a catalytic layer in opposed relation to the electrochromic layer across the ion conductive layer.

Such layer may be composed, for example, of oxide or hydroxide of iridium, nickel, chromium, vanadium, rutenium or rhodium. Such materials may be dispersed in the ion conductive layer or in the transparent electrode, or may be used for dispensing the material of said layers. The opaque electrode layer may also serve as a reflective layer, and can be composed of a metal such as gold, silver, aluminum, chromium, tin, zinc, nickel, rutenium, rhodium or stainless steel.

The upper and lower electrode layers have to be connected to external wirings for charge (current) supply. However, in the use of a transparent electrode which is higher in resistance than the external wirings, a connection electrode of low resistance is superposed, in an area as large as possible, with (in contact with) the transparent electrode. Normally, the connection electrode of low resistance is formed as a belt in the peripheral area of the transparent electrode layer. Said electrode of low resistance can be composed of the materials for the above-mentioned opaque electrode layer, for example aluminum.

In the use of opaque electrode which is generally of low resistance, a part of said electrode can be used as the connection electrode.

Fig. 3 is a schematic cross-sectional view of an embodiment of the ECD of the present invention, wherein z-direction corresponds to the direction of thickness of the ECD.

At first on the entire surface of a rectangular or parallelogram glass substrate 10 (25 x 15 cm; area $S = 375\ cm^2$; length ℓ of connection electrodes for the upper and lower electrode layers = 25 cm) there was formed an ITO electrode layer of a thickness $d_2 = 2 \times 10^{-5}$ cm (resistivity $\rho_2 = 2 \times 10^{-4}\ \Omega$ cm).

Then said ITO electrode layer was split into two portions, at an end part thereof by forming a narrow groove with etching or laser beam cutting, thereby forming a connection part 7 for the upper electrode, and a lower electrode layer 2.

Said connection part 7 and lower electrode layer 2 may be formed directly by masked evaporation of ITO.

On said lower electrode layer 2, there were formed, in succession, a reversible electrolytic oxidation layer 5 consisting of a mixture of iridium oxide and tin oxide, an ion conductive layer consisting of tantalum oxide, and a reduction coloring electrochromic layer 3 consisting of tungsten oxide.

The intermediate layer, consisting of the above-mentioned three layers 3, 4 and 5, has a thickness $d_2 = 1.5 \times 10^{-4}$ cm, and an ion resistivity $\rho_3 = 2 \times 10^8\ \Omega \cdot$cm.

On the electrochromic layer 3, there was formed, by evaporation, an ITO electrode layer of a thickness $d_1 = 2 \times 10^{-5}$ cm (resistivity $\rho_1 = 4 \times 10^{-4}\ \Omega \cdot$cm) as an upper electrode layer 1. Said ITO layer was formed so as to contact, at an end thereof, with the connection part 7 formed on the substrate 10.

The resistivity and ion resistivity of the layers can be varied by suitably selecting the conditions of film formation, such as Ar/O_2 ratio. degree of vacuum, film forming rate, substrate temperature, high-frequency power applied etc.

The resistances R_1, R_2 and R_3 of the layers are calculated as follows:

$\rho_1/d_1 = 20\ \Omega$

$\rho_2/d_2 = 10\ \Omega$

$\rho_3 \cdot d_3 = 3 \times 10^4\ \Omega cm^2$

$\ell = 25$ cm, $S = 375\ cm^2$

Consequently:

$R_1 = \rho_1 \cdot S/d_1 \ell^2 = 12\ \Omega$

$R_2 = \rho_2 \cdot S/d_2 \ell^2 = 6\ \Omega$
$R_3 = \rho_3 \cdot d_3/S = 80\ \Omega$

Thus the condition $4(R_1 + R_2) < R_3 < 5(R_1 + R_2)$ is satisfied.

Then external wirings 11a, 11b were connected, by soldering or with conductive adhesive, to two phosphor bronze clips of square-C section of a length of 25 cm (connection electrodes) 8a, 8b, which were then mounted on end portions of the substrate 10 in such a manner that the clip 8a is in contact with the connection part 7 of the upper electrode while the clip 8b is in contact with a part of the lower electrode layer 2. In this case, the clips 8a, 8b constituting the connection electrodes are regarded as substantially zero resistance (constant potential in any part).

The shape and dimension of said clips 8a, 8b are so selected as to be capable of defining the position of a sealing substrate 6 to be explained later and masking the non-display portion in the peripheral part of the ECD.

Finally a sealing glass substrate 6, coated with epoxy sealing resin, was superposed on an area between the clips 8a, 8b and the sealing resin was hardened to complete the ECD of the present embodiment. A coloring voltage (+3 V) was applied, by a power source 12, across the upper and lower electrode layers 1, 2 of thus prepared ECD, whereby the ECD showed rapid and uniform coloration over the entire surface, reducing the transmittance of the light of 633 nm to 10 % after 20 seconds.

The transmittance remained in this state for a while even after the termination of voltage application, and was elevated to 70 % after application or an erasing voltage (-3 V) for 20 seconds.

For referecne, another ECD of same dimensions and thicknesses was prepared with modified resistivity ρ_1, ρ_2 and ion resistivity ρ_3 of the layers. Resistances were $R_1 = 12\ \Omega$, $R_2 = 6\ \Omega$, and $R_3 = 0.15\ \Omega$, so that:

$$\frac{R_1 + R_2}{100} > R_3.$$

In the same test as in the foregoing embodiment, this ECD showed uneven coloration and color erasure.

Now reference is made to Fig. 4 for explaining the definition of S and ℓ.

Fig. 4 is a plan view of a part of the ECD shown in Fig. 3, seen along Z-axis from above the upper electrode layer 1. For explaining the definition of S and ℓ, the structure shown in Fig. 4 is partly different from what is shown in Fig. 3.

S corresponds to the superposed area, when seen along z-axis, of the upper electrode 1, the intermediate layers 3, 4, 5 and the lower electrode 2. In the structure shown in Fig. 4, the area 21 of the lower electrode 2 is smallest among these. Consequently the area S corresponds to the area 21 of the lower electrode 2. On the other hand, if the area of the intermediate layers 3, 4, 5 is smallest among the upper electrode 1, said intermediate layers 3, 4, 5 and the lower electrode 2, the area S corresponds to the area of said intermediate layers. In Fig. 4, an area 22 indicates the remaining part of the lower electrode 2, excluding the area 21.

ℓ corresponds to the length ℓ_1 of the connection electrode 7 in the x-direction in Fig. 4, but it corresponds to the length ℓ_3 of the lower electrode 2 in the x-direction if it is shorter than said length ℓ_1. Also ℓ corresponds to the length ℓ_2 of the intermediate layers 3, 4, 5 if it shorter than the length ℓ_1 of the connection electrode 7 and the length ℓ_3 of the lower electrode 2.

In the structures shown in Figs. 3 and 4, the upper electrode 1 is provided with the connection electrode 7 but the lower electrode 2 is not provided with the connection electrode, because the lower electrode 2 is composed of a material same as that of the connection electrode 7 and is in itself suitable as the connection electrode. If the material of the lower electrode 2 is not suitable as the connection electrode 2, a connection electrode has to be connected also to the lower electrode 2. In such case ℓ_3 is the length, in x-direction of the connection electrode connected to the lower electrode 2.

Claims

1. An electrochromic device comprising:
a first electrode layer;
an intermediate layer including an electrochromic layer;

a second electrode layer; said first electrode layer, said intermediate layer and said second electrode layer being laminated in succession; and
an electrode member connected to one of said first and second electrode layers and extending in a predetermined direction perpendicular to the direction of lamination of said first electrode layer, said intermediate layer and said second electrode layer;
wherein the resistances R_1, R_2 respectively of said first and second electrode layers and the internal resistance R_3 of said intermediate layer satisfy following condition:

$$\frac{R_1 + R_2}{10} < R_3$$

said resistances R_1, R_2 and R_3 being defined as follows:

$$R_1 = \frac{\rho_1 \cdot S}{d_1 \cdot \ell^2}$$

$$R_2 = \frac{\rho_2 \cdot S}{d_2 \cdot \ell^2}$$

$$R_3 = \frac{\rho_3 \cdot d_3}{S}$$

wherein
ρ_1 : resistivity of upper electrode layer:
ρ_2 : resistivity of lower electrode layer:
ρ_3 : ion resistivity of intermediate layer:
d_1: thickness of upper electrode layer:
d_2: thickness of lower electrode layer;
d3: thickness of intermediate layer;
ℓ: shortest length, in the extending direction of connection electrode, among the upper or lower electrode layer not connected to said connection electrode, the connection electrode and the intermediate layer; and
S : superposed area of the upper electrode layer, the intermediate layer and the lower electrode layer, when seen from the direction of lamination thereof.

2. An electrochromic device according to claim 1, wherein the resistances R_1 and R_2 respectively of said first and second electrode layers and the internal resistance R_3 of the second electrode layer satisfy following condition:
$(R_1 + R_2) < R_3$.

3. An electrochromic device according to claim 2, wherein the resistances R_1 and R_2 respectively of said first and second electrode layers and the internal resistance R_3 of said intermediate layer satisfy following condition:
$4(R_1 + R_2) < R_3$.

4. An electrochromic device according to claim 3, further comprising means for applying a voltage between an electrode provided in said first electrode layer and an electrode provided in said second electrode layer.

5. An electrochromic device comprising:
a first electrode layer;
an intermediate layer including an electrochromic layer;
a second electrode layer; said first electrode layer, said intermediate layer and said second electrode layer being laminated in succession; and
an electrode member connected to one of said first and second electrode layers and extending in a

predetermined direction intersecting to the direction of lamination of said first electrode layer, said intermediate layer and said second electrode layer;
wherein the resistances R_1 and R_2 respectively of said first and second electrode layers and the internal resistance R_3 of said intermediate layers satisfy following conditions:
$R_1 < R_3$ and
$R_2 < R_3$
said resistances R_1, R_2 and R_3 being defined as follows:

$$R_1 = \frac{\rho_1 \cdot S}{d_1 \cdot \ell^2}$$

$$R_2 = \frac{\rho_2 \cdot S}{d_2 \cdot \ell^2}$$

$$R_3 = \frac{\rho_3 \cdot d_3}{S}$$

wherein
ρ_1: resistivity of upper electrode layer;
ρ_2: resistivity of lower electrode layer:
ρ_3: ion resistivity of intermediate layer;
d_1: thickness of upper electrode layer;
d_2: thickness of lower electrode layer;
d_3: thickness of intermediate layer;
ℓ: shortest length, in said predetermined direction, among the first or second electrode layer not connected to the electrode member, the electrode member and the intermediate layer; and S: superposed area of the upper electrode layer, the intermediate layer and the lower electrode layer, when seen from the direction of lamination thereof.

6. An electrochromic device comprising an electrochromic layer disposed between first and second electrode layers which are coupled, respectively, to first and second electrical connection means, the resistivities of the layers being such that current flowing between the first and second connection means is distributed substantially uniformly over the area of the elctrochromic layer.

FIG. 1
PRIOR ART

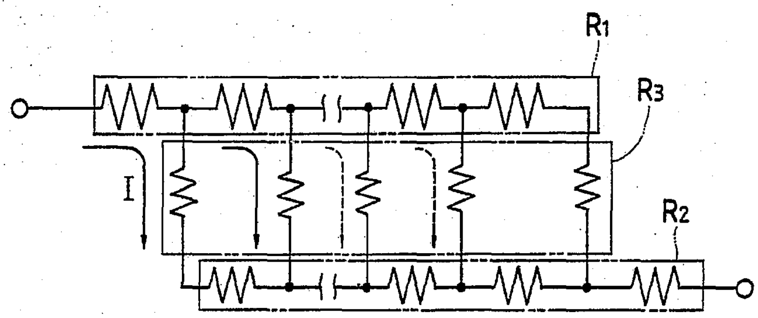


FIG. 2

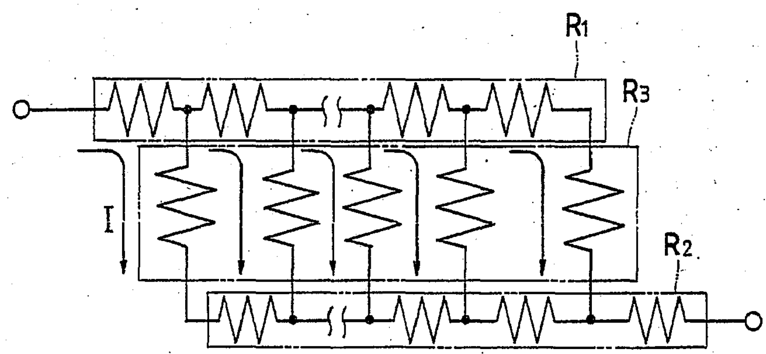


FIG. 3

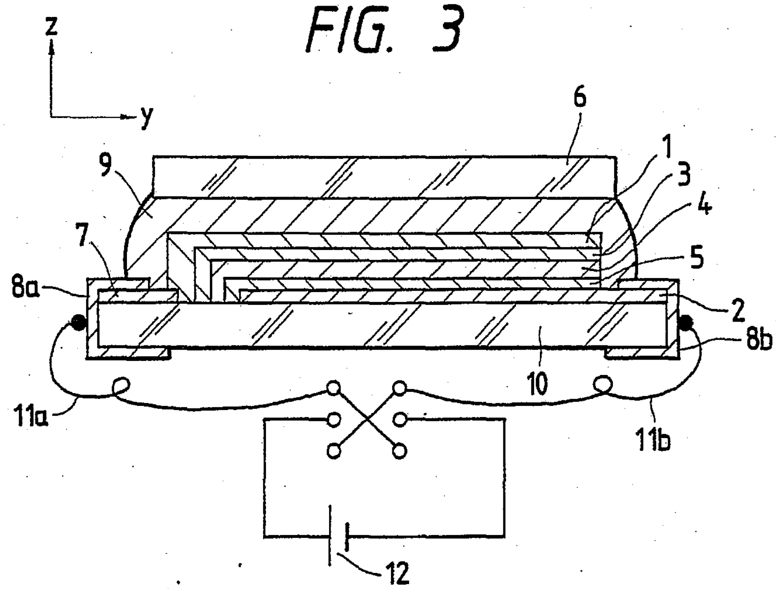
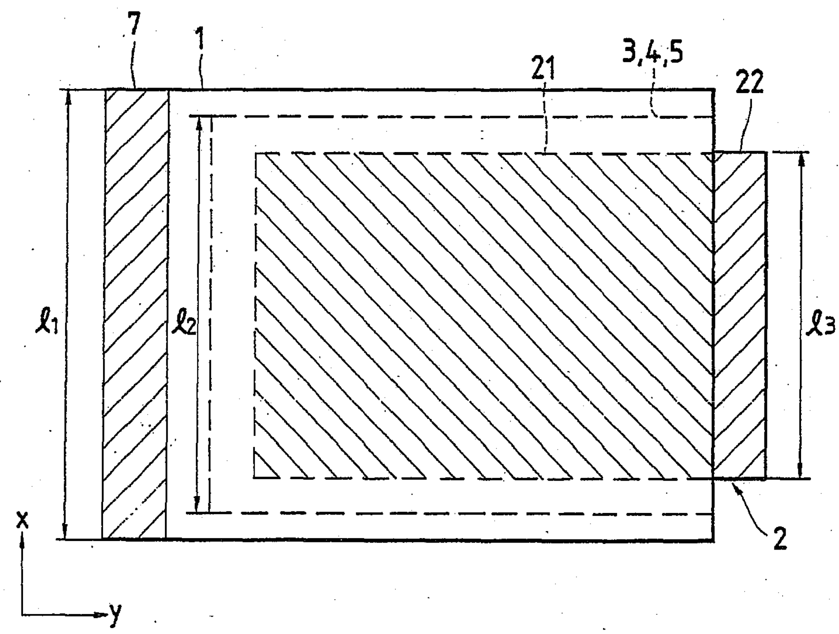


FIG. 4



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Electrochromic device.

Abstract:

Abstract of EP0356099

The present invention relates to an electrochromic device which comprises a first electrode layer, an intermediate layer including an electrochromic layer, a second electrode layer; said first electrode layer, said intermediate layer and said second ele 109a ctrode layer being laminated in succession, and an electrode member connected to one of said first and second electrode layers and extending in a predetermined direction perpendicular to the direction of lamination of said first electrode layer, said intermediate layer and said second electrode layer. The resistance R1, R2 respectively of said first and second electrode layers and the internal resistance R3 of said intermediate layer satisfy the predetermined condition.

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(54) **Dimmable rearview mirror for motor vehicles**

(57) An improved dimmable electro-optical rearview mirror for motor vehicles is provided, the mirror including a multilayer combination reflector/electrode that is low in electrical sheet resistance per unit area, and a transparent electrode that is higher in electrical sheet resistance per unit area than the multilayer combination reflector/electrode whereby such components operate in a synergistic fashion resulting in an electro-optic mirror having improved speed of reflectance change, improved high end reflectance, good uniformity of reflectance change across the surface area of the mirror, neutral colour and continuously variable reflectance, and a low end reflectance low enough to relieve strong glare.

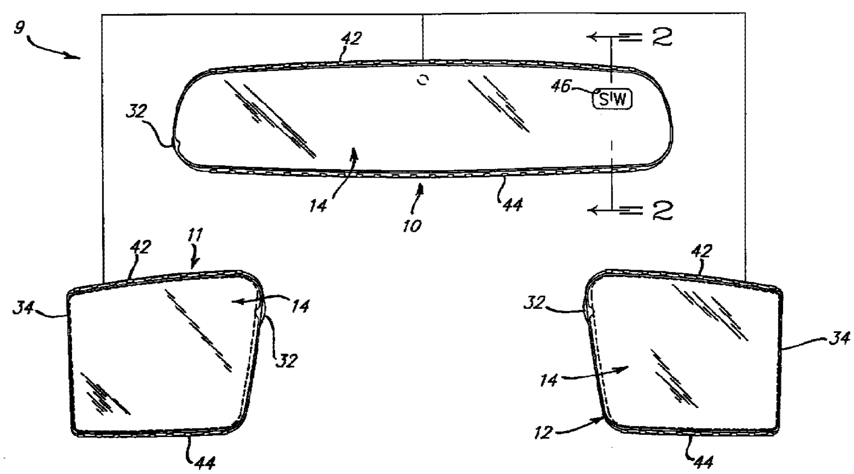

FIG. 1.

EP 0 728 618 A2

Description

BRIEF SUMMARY OF THE INVENTION

This invention relates to rearview mirrors for motor vehicles and, more particularly, to improved interior and/or exterior rearview mirrors for motor vehicles.

Heretofore, various automatic rearview mirrors for motor vehicles have been devised which automatically change from the full reflectance mode (day) to the partial reflectance mode (night) for glare protection purposes from light emanating from the headlights of vehicles approaching from the rear. The electrochromic mirrors disclosed in U.S. Patent No. 4,902,108, issued February 20, 1990, for Single-Compartment, Self-Erasing, Solution-Phase Electrochromic Devices, Solutions for Use Therein, and Uses Thereof; U.S. Patent No. 4,917,477, issued April 17, 1990, for Automatic Rearview Mirror System for Automotive Vehicles; U.S. Patent No. 5,128,799, issued July 7, 1992, for Variable Reflectance Motor Vehicle Mirror; U.S. Patent No. 5,202,787, issued April 13, 1993, for Electro-Optic Device; U.S. Patent No. 5,280,380, issued January 18, 1994, for UV-Stabilized Compositions and Methods; and U.S. Patent No. 5,282,077, issued January 25, 1994, for Variable Reflectance Mirror, each of which patents is assigned to the assignee of the present invention and the disclosures of each of which are hereby incorporated herein by reference, are typical of modern day automatic rearview mirrors for motor vehicles. Such electrochromic mirrors may be utilized in a fully integrated inside/outside rearview mirror system or as an inside or an outside rearview mirror system. In general, in automatic rearview mirrors of the types disclosed in U.S. Patent Nos. 4,902,108; 4,917,477; 5,128,799; 5,202,787, 5,280,380 and 5,282,077, both the inside and the outside rearview mirrors are comprised of a relatively thin electro-optic medium sandwiched and sealed between two glass elements. In most cases, when the electro-optic medium is electrically energized, it darkens and begins to absorb light, and the higher the voltage, the darker the mirror becomes. When the electrical voltage is decreased to zero or removed, the mirror returns to its clear state. Also, in general, the electro-optic medium sandwiched and sealed between the two glass elements is preferably comprised of solutions of electrochromic compounds which function as the media of variable transmittance in the mirrors, although it should be understood that other electro-optic media may be utilized, including an approach wherein a tungsten oxide electrochromic layer is coated on one electrode with a solution containing at least another compound to provide counter electrode reaction. When operated automatically, the rearview mirrors of the indicated character generally incorporate light-sensing electronic circuitry which is effective to change the mirrors to the dimmed reflectance modes when glare is detected, the sandwiched electro-optic medium being activated and the mirror being dimmed in proportion to the amount of glare that is detected. As glare subsides, the mirror automatically returns to its normal high reflectance state without any action being required on the part of the driver of the vehicle. The electro-optic medium is disposed in a sealed chamber defined by a transparent front glass element, a peripheral edge seal, and a rear mirror element having a reflective layer, the electro-optic medium filling the chamber. Conductive layers are provided on the inside of the front and rear glass elements, the conductive layer on the front glass element being transparent while the conductive layer on the rear glass element may be either transparent or opaque, i.e., the conductive layer on the rear glass element may also function as the reflective layer for the rear glass element, and the conductive layers on both the front glass element and the rear glass element are connected to electronic circuitry which is effective to electrically energize the electro-optic medium to switch the mirror to nighttime, decreased reflectance modes when glare is detected and thereafter allow the mirror to return to the daytime, high reflectance mode when the glare subsides as described in detail in the aforementioned U.S. Patents. For clarity of description of such a structure, the front surface of the front glass element is sometimes referred to hereinafter as the first surface, and the inside surface of the front glass element is sometimes referred to as the second surface. The inside surface of the rear glass element is sometimes referred to as the third surface, and the back surface of the rear glass element is sometimes referred to as the fourth surface.

In accordance with one aspect of the present invention, a reflective layer is provided on the inside (third surface) of the back glass of a dimming portion of the rearview mirror, which layer is comprised of a series of coatings, hereafter called the multilayer combination reflector/electrode, which also forms an integral electrode in contact with the electrochromic media. The other electrode on the inside (second) surface of the front glass is a transparent electrode which also contacts the electrochromic media inside the mirror element. The series of coatings of the reflector/electrode is comprised of at least a base coating which bonds to the glass surface tenaciously and resists the corrosive action of the materials in the electrochromic media, and a reflective over coating which directly contacts the electrochromic media and which is chosen primarily for its high reflectance, stable behavior as an electrode, resistance to corrosion by the materials of the electrochromic media, resistance to atmospheric corrosion, resistance to electrical contact corrosion, the ability to adhere to the base coating, and ease of cleaning to an uncontaminated, high quality electrode surface. The series of coatings of the multilayer combination reflector/electrode has one or more base coatings and one or more high reflectance over coatings.

In accordance with the present invention, the transparent coating is preferably fluorine doped tin oxide, tin doped indium oxide (ITO) or a series of metal oxide coatings with base coatings to suppress color and reflection followed by an electrically conductive, transparent coating which contacts the electrochromic media directly. Where a series of transparent coatings is used, the materials are chosen for good bonding, resistance to corrosion by the materials of the electrochromic media, resistance to corrosion by the atmosphere, minimal reflectance, high light transmission, neutral coloration and high electrical conductance. Also in accordance with the present invention, to a considerable extent, it is possible to make the reflective electrode very high in electrical conductance to compensate in a synergistic fashion with a transparent electrode that is lower in electrical conductance so the net result is an electrochromic mirror which darkens and clears acceptably fast and uniformly with excellent optical properties.

This synergistic structure is applicable for both inside and outside rearview mirrors for motor vehicles. When the multilayer combination reflector/electrode is used in any mirror, it has the inherent advantage of reducing double images, distortion, and multiple images from raindrops, dust, etc., while providing excellent speed of reflectance change, good high end reflectance, good uniformity of reflectance change across the surface area of the mirror, neutral color, continually variable reflectance and a low end reflectance low enough to relieve strong glare. The reduction in double images and distortion is particularly useful in the case of dimmable convex mirrors which use glass that is bent but may have slight variations in radius of curvature or slight ripple or warp that result in slight imperfections in matching two pieces of bent glass required to make a convex, solution based electrochromic mirror.

The present invention can overcome disadvantages in prior rearview mirrors of the indicated character and provide an improved, robust, low cost dimmable rearview mirror for motor vehicles, which mirror is capable of operating in harsh environments over wide variations in temperature, humidity, vibration, atmospheric corrosion, salt spray, electronic disturbances, and sand and grit abrasion,and which is resistant to damage from vehicle crashes and owner abuse.

The present invention can also provide an improved dimmable rearview mirror which increases the safety of night driving.

The present invention can further provide an improved electro-optic, dimmable rearview mirror for motor vehicles, which mirror is relatively economical to manufacture and assemble, durable, efficient and reliable in operation.

The present invention can still further provide an improved dimmable rearview mirror for motor vehicles wherein excellent speed of reflectance change, good high end reflectance, good uniformity of reflectance change across the surface area of the mirror, neutral colour, continually variable reflectance and good low end reflectance are obtained.

The above features and advantages of the present invention will be further described hereinafter with reference to the following description of exemplary embodiments, and the accompanying drawings, in which:-

Figure 1 is a front elevational view schematically illustrating an inside/outside rearview mirror system for motor vehicles, the system including a dimmable inside rearview mirror together with two dimmable outside rearview mirrors all of which embody the present invention and all of which are adapted to be installed on a motor vehicle in a conventional manner whereby the mirrors face the rear of the vehicle and can be viewed by the driver of the vehicle to provide a rearward view to the driver;

FIG. 2 is an enlarged simplified sectional view of the inside rearview mirror illustrated in FIG. 1, taken on the line 2-2 thereof;

FIG. 3 is an exploded view of the left electro-optic, dimmable outside rearview mirror illustrated in FIG. 1;

FIG. 4 is a front elevational view of the mirror illustrated in FIG. 3;

FIG. 5 is a simplified top plan view of the mirror illustrated in FIG. 4; and

FIG. 6 is a simplified side elevational view of the right side of the mirror as viewed in FIG. 4, showing the electro-optic structure.

DETAILED DESCRIPTION

In general, in inside and outside rearview mirrors embodying the present invention, the rearview mirror assembly is comprised of a relatively thin layer of an electro-optic medium sealed between two glass elements. When the electro-optic medium is electrically energized, it darkens and begins to absorb light, and the higher the voltage, the darker the mirror becomes. When the electrical voltage is decreased to zero or is removed, the electro-optic medium returns to its clear state. Rearview mirrors embodying the present invention may, for example, incorporate light-sensing electronic circuitry of the type illustrated and described in the aforementioned U.S. Patent No. 4,917,477. Also, the components of mirrors embodying the present invention may be of the types disclosed in the aforementioned U.S. Patent Nos. 4,902,108; 5,128,799; 5,202,787; 5,280,380 and 5,282,077. It should be understood, however, that other types of electronic circuitry and other types of electro-optic media and other components may be utilized in mirrors embodying the present invention.

Referring to the drawings, an electro-optic inside/outside mirror assembly, generally designated 9, embodying the present invention is depicted in FIGS. 1 through 6. Since some of the layers of each of the mirrors in the assembly 9 are very thin, the scale has been distorted for pictorial clarity. As shown in the drawings, the mirror assembly 9 includes an inside mirror 10 and outside mirrors 11 and 12. For clarity, in the drawings, like numbers identify components of the inside and outside mirrors which may be slightly different in configuration but which function in substantially the same manner and obtain the same results as similarly numbered components. For example, the shape of the front glass element of the left outside mirror is the reverse of the shape of the right outside mirror, and the front glass element of the inside mirror is generally longer and narrower than the front glass elements of the outside mirrors. Each of the mirrors 10, 11 and 12 includes a sealed chamber 13, defined by a front glass element 14, an edge seal 16, and a rear glass element 18, having reflective and electrically conductive metal layers 20 and 22, respectively. An electro-optic medium 24 having the desired electro-optic properties fills the chamber 13, and a transparent electrically conductive layer such as a fluorine-doped tin oxide conductive layer 26 is carried by the front element 14. The electrically conductive layers are connected to an electrical circuit as will be described hereinafter in greater detail. If desired, a color suppression coating or coatings, such as 28, may be disposed between the conductive layer 26 and the adjacent rear surface of the front element 14. Light rays enter through the front glass element 14, the color suppression coating(s) 28, the transparent conductive layer 26 and the electro-optic medium 24 before being reflected from the electrically conductive and reflective layer 22 (or layers 20 and 22 if layer 22 is extremely thin) provided on the rear glass element 18. The reflected rays exit by the same general path traversed in the reverse direction. In electrochromic media both the entering rays and the reflected rays are attenuated in proportion to the degree to which the electro-optic medium 24 is light-absorbing while in other electro-optic media the light rays may, in some cases, only be attenuated in one direction. When the electro-optic medium 24 is electrochromic and highly light absorbing, the intensity of the exiting rays is diminished, the dim image remaining mainly being from light rays which are reflected off of the front surface of the front glass element 14 and the interface between the front glass element 14 and the coatings 28 and/or 26. Thus, the basic structural elements of the electro-optic portion of each of the mirrors includes two electrode-bearing sides or walls 14 and 18, a spacing or separating seal 16, which spaces apart and holds the walls in substantially parallel relationship in an assembled device, and which surrounds a volume which in an assembled device is defined by the inside surfaces of electrode layers on the electrode-bearing walls as well as the circumferential inside walls 30 of the sealing member 16. The volume of the chamber 13 is preferably filled through a sealable fill port 32 with any of the electro-optic media disclosed in this or the aforementioned patents which have reversibly variable transmittance in the operation of the device, the media in the chamber 13 being in contact with both electrode layers 22 and 26 during operation of the mirror. It will be understood that the electro-optic medium for achieving variable reflectance could be other solution-phase electrochromics, solid electrochromics, a combination of the two in the form of a hybrid, or any of the above in a polymerized matrix. A liquid crystal, dipolar suspension or other electro-optic medium could also be utilized in mirrors embodying the present invention.

In accordance with the present invention, the reflective surface on the inside of the rear glass 18 is comprised of a series of coatings, hereinafter termed the multilayer combination reflector/electrode, which serves as a mirror reflectance layer and also forms an integral electrode in contact with the electrochromic media. The other electrode on the inside surface of the front glass 14 is the transparent electrode 26 which also contacts the electrochromic media inside the mirror element. The series of multilayer combination reflector/electrode coatings is comprised first of a base coating which bonds to the glass surface tenaciously and resists the corrosive action of the materials in the electrochromic media. The base coating is preferably chromium, but alternatively may be stainless steel, nickel-chromium, titanium, gold, silver, or any material or series of coatings which accomplish the objectives above stated. The thickness of the base coating is typically 100 to 1500 angstroms and is more typically 200 to 800 angstroms. The final reflective coating which directly contacts the electrochromic media is chosen primarily for its high reflectance, resistance to attack by the electrochromic media, resistance to atmospheric corrosion, resistance to electrical contact corrosion, and the ability to adhere to the base coating. The preferred material for the reflective coating is rhodium which has excellent hardness, excellent reflectance and excellent conductance, but it should be understood that it is alternatively possible to choose from a group of metals and their alloys such as, but not limited to, platinum, ruthenium, iridium and stainless steel or multiple layers including combinations thereof. The thickness of the reflective over coating is typically 100 to 1000 angstroms and is more typically 100 to 600 angstroms. The series of coatings of this multilayer combination reflector/electrode has one or more base coating(s) which generally provide high conductance and one or more over coatings which provide additional conductance and high reflectance. By way of example the sheet resistance of the multilayer combination reflector/electrode may be approximately 1 to 10 ohms per square.

The transparent coating 26 is preferably made of fluorine doped tin oxide or ITO or alternately a series of coatings with a base coating(s) to suppress color and reflection followed by a conductive transparent coating which contacts the electrochromic media directly. Where a series of transparent coatings is used, the materials are chosen for good bonding, good resistance to corrosion by the materials in the electrochromic media, good resistance to corrosion by the atmosphere, minimal reflectance, high light transmission, neutral coloration and high electrical conductance. Types of low cost transparent electrode substrates include "TEK 20" or "TEK 15" coated glass manufactured by Libbey Owens-Ford of Toledo, Ohio, but other suitable coatings are ITO or extremely thin metal layers which may alternatively function as the transparent electrode of the invention.

Transparent electrode materials are inherently limited in the balance of properties and cost. Low sheet resistance transparent coatings with a sheet resistance below approximately 10 ohms per square tend to have low transmission and other attendant shortcomings including possible haziness, coloration, non-uniformity of coating thickness and high cost. This makes a low sheet resistance transparent coating less practical for electrochromic mirrors. To a considerable extent, it is possible to make the multilayer combination reflector/electrode low in electrical resistance to compensate in a synergistic fashion with a transparent electrode that is higher in electrical resistance so the net result is an electrochromic mirror which darkens and clears acceptably fast and uniformly over its surface area, with excellent optical properties.

To demonstrate the surprising nature of the synergy, electrochromic mirrors have been constructed with a multilayer combination reflector/electrode of about 3 and of about 7 ohms per square sheet resistance with a front transparent electrode of about 18 to 22 ohms per square or higher which show remarkably good results for speed and uniformity of coloration and clearing. Electrochromic mirrors with reflectors on the front surface of the rear element have been previously described, but the use of multilayer coatings that combine to provide high reflectance, good adhesion to glass, low sheet resistance, and ease of cleaning for electrochromic mirrors, especially in combination with a low cost high sheet resistance transparent coating, is a major improvement. Thus the present invention provides a synergistic mismatch using a high electrical conductance multilayer combination reflector/electrode on the third surface with a lower electrical conductance transparent front electrode on the second surface to achieve a cost effective, high performance, electrochromic mirror. This concept is also applicable to any technology where the electrical current requirement of the electro-optic medium sandwiched between two coated glass substrates is comparatively high or where the area is comparatively large. This new synergistic structure is equally applicable to dimmable inside rearview mirrors for motor vehicles. When used in any mirror, it has the inherent advantage of reducing double images, distortion, and multiple images from raindrops, (particularly with convex or spherically curved mirrors), while providing excellent speed of reflectance change, good high end reflectance, good uniformity of reflectance change over the area of the device, neutral color and a low end reflectance, low enough to relieve strong glare.

The invention is illustrated in more detail in the following examples:

EXAMPLE 1

A multilayer combination reflector/electrode was prepared by sequentially depositing approximately 300 angstroms of titanium, approximately 200 angstroms of gold and approximately 200 angstroms of platinum on the 6.6 cm by 14.4 cm surface of a 0.2 cm thick sheet of soda lime float glass. The deposition was accomplished by rotating the glass sheet past three separate metal targets in a magnetron sputtering system with a base pressure of a 3×10^{-6} torr and an argon pressure of 2×10^{-3} torr. The first surface, CIE curve white light reflectance from the multilayer combination reflector/electrode with the platinum surface in contact with air, measured according to the procedure of SAE J964, was 71.9 percent and the sheet resistance of the metal layer stack was 3.2 ohms per square.

This multilayer combination reflector/electrode coated glass was used as the rear element of an electrochromic mirror device. The front element was a sheet of TEK 20 transparent conductor coated glass of the same size as the rear element. The sheet resistance of the transparent conductor was approximately 20 ohms per square. The two elements were bonded together by an epoxy perimeter seal with the transparent conductor electrode and multilayer combination reflector/electrode offset from, substantially parallel to and facing each other as shown in Figure 2. The spacing between the electrodes was about 0.014 cm. The device was vacuum filled through a small gap left in the perimeter seal with a solution made up of:

0.034 molar 5,10-dihydro-5,10-dimethylphenazine

0.034 molar 1,1'-di(phenyl propyl)-4,4'-bipyridinium difluoroborate

0.5 molar ethyl-2-cyano-3,3-diphenylacrylate

in a solution of 3 wt% Elvacite™ 2041 polymethylmethacrylate resin dissolved in propylene carbonate.

The small gap was plugged with a UV cure adhesive which was cured by exposure to UV light.

The reflectance of the device, (measured as before for the rear element), with no voltage applied was 56 percent and with 1.2 volts applied the reflectance decreased over a period of 5 seconds to 10 percent and within 10 seconds to 7.5 percent. On short circuiting the device, the reflectance increased over a period of 15 seconds back to 56 percent.

EXAMPLE 2

Other than as specifically mentioned, the conditions of Example 1 were used in this example. A multilayer combination reflector/electrode was prepared by sequentially depositing approximately 300 angstroms of chromium, approximately 500 angstroms of silver and approximately 300 angstroms of platinum at a base pressure of 3.7×10^{-6} torr and an argon pressure of 8×10^{-3} torr. The first surface reflectance was 73.3 percent and the sheet resistance was 0.1 ohms per square.

When an electrochromic mirror device was fabricated with this multilayer combination reflector/electrode, the device had a high end reflectance of 57.0 percent, a low end reflectance of 6.5 percent and changed from 57.0 percent to 10.0 percent reflectance in 2.0 seconds with the application of 1.2 volts.

EXAMPLE 3

Other than as specifically mentioned, the conditions of Example 1 were used in this example. A multilayer combination reflector/electrode was prepared by sequentially depositing approximately 600 angstroms of chromium and approximately 300 angstroms of platinum. The base pressure of 2.1×10^{-6} torr and the argon pressure of 8×10^{-3} torr. The first surface reflectance was 73.8 percent and the sheet resistance was 3.2 ohms per square.

When an electrochromic mirror device was fabricated with this multilayer combination reflector/electrode, the device had a high end reflectance of 58.0 percent, a low end reflectance of 7.0 percent and changed from 58.0 percent to 10.0 percent reflectance in 2.7 seconds with the application of 1.2 volts.

EXAMPLE 4

A multilayer combination reflector/electrode was prepared by the sequential deposition of approximately 600 angstroms of chromium and approximately 100 angstroms of 316 stainless steel on the 19 cm by 66 cm surface of a 0.2 cm thick sheet of flat soda lime float glass and on the convex side of a 22 cm diameter circle of glass which had been press bent to a uniform spherical curvature with a radius of curvature of 140 cm. The glass which was bent was TEK 20 tin oxide coated glass manufactured by Libbey Owens-Ford of Toledo, Ohio, and the tin oxide coating was on the concave side after the glass was bent. The deposition was accomplished in a large in-line sputtering system. The first surface reflectance from the multilayer combination reflector/electrode coatings was about 58 percent and the sheet resistance was about 7 ohms per square.

The flat and the bent glass sheets were cut into mirror shapes which were approximately 10 cm high and 16 cm wide. These were used as the rear elements of dimmable mirrors for the outside of an automobile as described below. As compared to glass coated only with chromium metal, these pieces of multilayer combination reflector/electrode coated glass were dramatically easier to clean to a condition in which they behaved as uniform high quality electrodes without poorly coloring spots and blemishes in the final electrochromic dimmable mirror devices.

The flat and convex pieces of multilayer combination reflector/electrode coated glass were matched with mirror-shaped pieces of TEK 20 coated pieces of flat and convex coated glass respectively. The front element convex mirror glass was also bent such that the tin oxide coating was on the concave side. Mirror devices were made by sealing nearly all the way around the perimeter of the glass pieces with an epoxy seal containing glass bead spacers which provided for a 0.015 cm spacing between the TEK 20 transparent, tin oxide electrode and the multilayer combination reflector/electrode. The spacing between the electrode surfaces was filled with a solution made up of:

0.028 molar 5,10-dihydro-5,10-dimethylphenazine

0.034 molar 1,1'-di(phenylpropyl)-4,4'-bipyridinium difluoroborate

0.030 molar 2-(2'-hydroxy-5'-methylphenyl)-benzotriazole

in a solution of 3 wt% Elvacite™ 2041 polymethylmethacrylate resin

dissolved in propylene carbonate.

The small gap in the perimeter seal was plugged with a UV cure adhesive which was cured by exposure to UV light.

The high end reflectance of the mirrors was approximately 45 percent and the low end reflectance was approximately 7 percent. The mirrors changed reflectance from 45 percent to 15 percent reflectance in about 5 seconds and provided excellent glare relief when dimmed to the appropriate reflectance level during nighttime driving.

EXAMPLE 5

Every aspect of Example 4 was repeated with the exception that the multilayer combination reflector/electrode was prepared by the sequential deposition of approximately 400 angstroms of chromium and approximately 200 angstroms of rhodium. The first surface reflectance from the multilayer combination reflector/electrode was about 70 percent and the sheet resistance was about 7 ohms per square.

The flat and convex dimmable mirror devices prepared with this multilayer combination reflector/electrode according to the procedure of Example 4 had a high end reflectance of about 55 percent and a low end reflectance of about 7 percent with a speed of reflectance change similar to the mirrors of Example 4.

With such a construction in which there is a transparent tin oxide conductive coating on the second surface of the front convex element and a transparent tin oxide conductive coating 48 on the fourth surface of the rear convex element, the tin oxide coatings assist in the bending operation because the front and rear glass elements and their associated tin oxide coatings have the same heating and cooling characteristics during the bending operation thereby effecting a close match in the curvature of the front and rear elements as compared with trying to match the bending of tin oxide coated glass with that of uncoated glass. Moreover, with a multilayer combination reflector/electrode on the third surface of either a flat or a convex rear element, the tin oxide coating 48 on the fourth surface of either a flat or a convex rear element may be utilized as a heater. In the alternative, a conventional heater 50 may be bonded directly to the tin oxide coating 48 on the fourth surface of the rear glass element.

An automobile equipped with an automatic inside electrochromic mirror, one of the above flat mirrors as the driver's side outside mirror and one of the above convex mirrors as the passenger side outside mirror allowed the automobile operator to drive at night with essentially complete protection from glare from the headlamps of following vehicles.

It has been observed that chromium coatings alone can be difficult to clean during assembly of the entire mirror, resulting in a finished mirror that may exhibit contamination spots and areas of slower darkening and clearing. The use of a high reflectance material, such as rhodium alone, can be very costly at thicknesses that provide low sheet resistance, but coated over the above-mentioned base coating(s) such as chromium results in a rear glass element which is easily cleaned prior to assembly, resulting in a finished mirror that is more optically perfect and free of contamination and darkening defects. Chromium or stainless steel alone also have the problem that the high end reflectance of the finished mirror is low considering the attendant losses of light from the transparent coated front substrate and electrochromic media. A problem with stainless alone and to a lesser extent chromium alone is poor electrical contact stability to the conventional spring clip type buss bars or other electrical contact means.

The use of an inert high reflectance coating also makes attachment of spring clip type buss bars or other contact attachments more stable and trouble free, since non-conductive compounds and oxides do not form as readily under pressure contact areas. The result of low stability electrical contact is a mirror which loses its uniformity, coloration and clearing speed over the long life required in the motor vehicle industry.

The present invention thus provides a robust, low cost, dimmable rearview mirror for automotive vehicles, which mirror is capable of operating in harsh environments over wide variations in temperature, humidity, vibration, atmospheric corrosion, salt spray, electronic disturbances and sand and grit abrasion, and which mirror is resistant to damage from vehicle crashes and owner abuse. An additional benefit from sealing the main area of the mirror reflector inside the dimmable mirror element is long life of the reflector in the motor vehicle environment.

It is common with outside dimmable mirrors to adhere a resistance heater to the reflective structure at the back of the rear glass substrate. This heater and its associated adhesive can cause incompatibility and field problems if conventional reflective material, such as silver, is on the back side of the back glass substrate. It is also common practice to adhesively bond the electrochromic mirror assembly to a plastic backing plate often called the glass case. Normal temperature variations experienced by this assembly can cause large forces to be exerted on a reflector structure on the back or fourth surface due to the thermal expansion mismatch of the materials involved. The adhesives used can also lead to chemical attack and degradation of a fourth surface reflector. Such problems are avoided by the present invention when the reflector is located inside the device, and the heater is adhered directly to the glass (fourth surface) of the rear glass element or to the tin oxide coating of the TEK 20 layer which may optionally be on the fourth surface.

Heretofore, problems have been encountered with a conventional silver reflector on the back surface of the rear glass, such problems being known as silver spoilage and silver lift, and are avoided with the multilayer combination reflector/electrode located inside the mirror element and protected by the rear glass. With the multilayer combination reflector/electrode inside the mirror element, the environmental factors are limited to those that result from contact with the materials of the electrochromic media and the offset area where electrical contact is made, whereas with the reflector on the back of the rear glass surface, a number of other difficult environmental factors must be dealt with for the reflector to survive during the life of the mirror especially on the exterior of a motor vehicle.

Speed of coloring, good high end reflectance (typically greater than 50% for exterior mirrors and greater than 60% for interior mirrors) and low cost are important requirements for dimmable mirrors, and the present invention provides a mirror meeting such requirements. The present invention also makes it possible to use comparatively low cost practical electrode coatings to make a surprisingly high performance mirror. Highly conducting transparent coatings are either nondurable, low in transmissivity and/or very high in cost. For this reason it is desirable to use comparatively low cost durable transparent coatings which have the inherent disadvantage that their conductance is lower than that of expensive coatings. Metals, on the other hand, have high conductance which can provide great advantage when used in accordance with the present invention. Electrochromic mirrors with reflector/electrodes involving a single metal layer on the front surface of the rear element have been previously described. However, the concept of creating a dimmable mirror where the electrical conductance of the transparent electrode at the back surface of the front element is purposely made much lower than the multilayer combination reflector/electrode conductance at the front surface of the rear element provides a major improvement. This intentional mismatch of conductance in a symbiotic relationship using practical low cost coatings provides a breakthrough of significant commercial potential. In accordance with the present invention the conductance of the transparent electrode is substantially lower than that of the multilayer combination reflector/electrode, and the multilayer combination reflector/electrode is comprised of two or more coatings. The first coating on the rear glass is preferably the low cost, high conductance base metal such as chromium. The final coating on the multilayer combination reflector/electrode is the thin, high reflectance metal such as rhodium for the purpose of providing high reflectance and high stability in use as an electrode for the electrochromic device. The coating(s) on the back surface of the front element may include one or more color suppression coatings followed by fluorine doped tin oxide, but it must be understood that any transparent coating having the required properties which is substantially lower in conductance than the coatings on the front surface of the rear element would be suitable. The invention may be incorporated in both inside and outside electrochromic mirrors which may incorporate ambient and glare light sensors, the glare light sensor being positioned either behind the mirror glass and looking through a section of the mirror with the reflective material removed or partially removed, or the glare light sensor can be positioned outside the reflective surfaces. In the alternative, areas of the electrode and reflector, such as 45 and 46, respectively, may be removed, or partially removed in, for example, a dot pattern, to permit a vacuum fluorescent display, such as a compass or clock, to show through to the driver of the vehicle. The present invention is also applicable to a mirror which uses only one video chip light sensor to measure both glare and ambient light and which is further capable of determining the direction of glare. An automatic mirror on the inside of a vehicle, constructed according to this invention, can also control one or both outside mirrors as slaves in an automatic mirror system.

The present invention also has application in the construction of elements for mirrors where high maximum reflectance is desired, and the electrochromic materials may be solution phase containing liquids, gels, rigid gels and/or polymers. It may also be a hybrid design where some or all of the electrochromic materials are not in solution and may be confined on the surfaces of the electrodes. The present invention also particularly applies to electro-optic mirrors which draw more than 10 milliamps in operation at any point in their process of dimming.

The invention is particularly effective when used with selected low cost transparent coatings, as for example, "TEK 20", marketed by Libbey Owens-Ford Co. of Toledo, Ohio. The benefits over the most commonly used automatic mirrors in use today are as follows: mirrors embodying the present invention change reflectance faster, have a clearer image, have better coloration of image in the nondimmed state, eliminate the need and inconvenience of putting silver reflective coatings on the back surface of the rear glass, have fewer handling steps thereby creating fewer chances for scratching in the glass during processing and providing a final product with better optical quality, and having fewer surfaces through which the light must travel, and the first surface and third surface reflections are closer together with the result that there are less multiple images and less distortion in the mirror for the driver. Moreover, when used as an outside mirror, there are less reflections from raindrops and dust on the front surface of the front glass, and the reflector at the front surface of the rear glass element is protected from aging, exposure to airborne contaminants and physical abuse that often affect reflectors placed at the back surface of the rear glass element.

With reference to Figures 2 and 6, a preferred arrangement for connecting the electronic conductive layers to a power source is illustrated. In this arrangement, the two electrode-bearing front and rear glass elements 14 and 18 are displaced in opposite directions, laterally from, but parallel to, the chamber 13 in order to provide exposed areas on the front and rear glass elements. Electrically conductive spring clips 42 and 44 are provided which are placed on the coated glass sheets to make electrical contact with the exposed areas of the electrically conductive layers. Suitable electrical conductors (not shown) may be soldered or otherwise connected to the spring clips 42 and 44 so that desired voltage may be applied to the device from a suitable power source. It is preferred but not essential that the multilayer combination reflector/electrode function and be maintained as the cathode in the circuitry.

Rearview mirrors embodying the present invention preferably include a bezel 34 which extends around the entire periphery of the assembly. The bezel 34 conceals and protects the spring clips 42 and 44 and the peripheral edge portions of both of the front and the rear elements 14 and 18. By way of example, the bezel 34 may be of the type disclosed in the co-pending Continuation Application of William L. Tonar, Serial No. 08/142,875, filed October 29, 1993, which is a continuation of Application Serial No. 07/907,055, filed July 1, 1992, both of which applications are assigned to the assignee of the present invention and both of which applications are hereby incorporated herein by reference. The assembly may also include a conventional heater and a plastic mirror back or glass case which is adapted to snap into an outside mirror housing (not shown) that may be of any desired configuration, the outside mirror housing being supported on the outside of an automotive vehicle in any desired or conventional manner, and the inside mirror being supported inside the vehicle in any desired or conventional manner, whereby the field of view of each mirror may be adjusted by the driver of the vehicle in a conventional manner, as for example, through manual adjustment or by mechanical or electrical means of the types conventionally provided on modern day automobiles.

While preferred embodiments of the invention have been illustrated and described, it will be understood that various changes and modifications may be made without departing from the scope of the invention which is defined by the appended claims.

Claims

1. An electro-optically dimming rearview mirror for motor vehicles, said mirror comprising, in combination, front and rear spaced elements, said front element and said rear element defining a chamber therebetween, said front element being transparent, the side of said front element confronting said rear element including transparent electrically conductive means, including combined electrically conductive light reflecting means, said chamber containing an electro-optic reversible variable transmittance medium in contact with said transparent electrically conductive material on said front element and said combined electrically conductive light reflecting means on said rear element, said combined electrically conductive light reflecting means on said rear element being effective to reflect light through said medium and through said front element when said light reaches said combined electrically conductive light reflecting means after passing through said medium and through said front element, said combined electrically conductive light reflecting means on said rear element having a lower electrical resistance per unit area than said transparent electrically conductive means on said front element.

2. A mirror according to claim 1, wherein said transparent electrically conductive means on said front element comprises indium tin oxide.

3. A mirror according to claim 1 or 2, wherein said combined electrically conductive light reflecting means on said rear element comprises chromium and rhodium.

4. A mirror according to claim 1, 2 or 3, including indicia means visible through said front element.

5. A mirror according to claim 1, 2, 3 or 4, wherein said transparent electrically conductive means on said front element includes colour suppressing means and a doped tin oxide in contact with said electro-optic medium.

6. A mirror according to any one of the preceding claims, wherein said combined electrically conductive light reflecting means on said rear element includes at least one high conductance base coating over which is deposited at least one high reflectance coating.

7. A mirror according to any one of the preceding claims, wherein said combined electrically conductive light reflecting means on said rear element includes separate layers of chromium and rhodium.

8. A mirror according to claim 7, wherein said layer of rhodium is on the side of said layer of chromium confronting said front element.

9. A mirror according to claim 8, wherein said layer of chromium is greater in thickness than said layer of rhodium.

10. A mirror according to any one of the preceding claims, wherein said combined electrically conductive light reflecting means has an opening, and further comprising vacuum fluorescent display means visible through said front element and through the opening in said combined electrically conductive light reflecting means.

11. A mirror according to any one of the preceding claims, including bezel means extending around the periphery of said front element.

12. A mirror according to any one of the preceding claims, further comprising means for applying electrical potential to said transparent electrically conductive means on said front element and said combined electrically conductive light reflecting means on said rear element to cause variations in the light transmittance of said electro-optic medium.

13. A mirror according to claim 12,wherein said means for applying electrical potential to said transparent electrically conductive means is automatic.

14. A mirror according to any one of the preceding claims, wherein said front and rear spaced elements are made of glass.

15. A mirror according to any one of the preceding claims, wherein said combined electrically conductive light reflecting means has a plurality of layers.

16. A mirror according to any one of the preceding claims, wherein said reversibly variable transmittance medium is an electrochromic medium.

17. A mirror according to any one of the preceding claims, wherein said combined electrically conductive light reflectance means functions as a cathode.

18. A mirror according to any one of the preceding claims, wherein said transparent electrically conductive means on said front element includes multiple coatings, one of said coatings comprising indium tin oxide.

19. A mirror according to any one of the preceding claims, wherein said combined electrically conductive light reflecting means on said rear element includes coatings selected from the group consisting of rhodium, platinum, ruthenium, iridium, gold,

stainless steel, silver, titanium, nickel-chromium and chromium.

20. A mirror according to any one of the preceding claims, including resistance heater means adhered to the side of said rear element remote from said front element.

21. A mirror according to any one of the preceding claims, wherein said transparent electrically conductive means on said front element includes a coating selected from the group consisting of fluorine doped tin oxide and indium tin oxide.

22. A mirror according to any one of the preceding claims, wherein said combined electrically conductive light reflecting means is disposed on the side of said rear element confronting said front element.

23. A mirror according to claim 23, wherein said rear element also includes a conductive transparent coating on the other side than that confronting the front element.

24. A mirror according to any one of the preceding claims, wherein said combined electrically conductive light reflecting means on said rear element includes a first high conductance coating selected from the group consisting of chromium, stainless steel, nickel-chromium, gold, silver and titanium, and alloys thereof, and a second high reflectance coating selected from the group consisting of rhodium, ruthenium, iridium, platinum, chromium and stainless steel and alloys thereof.

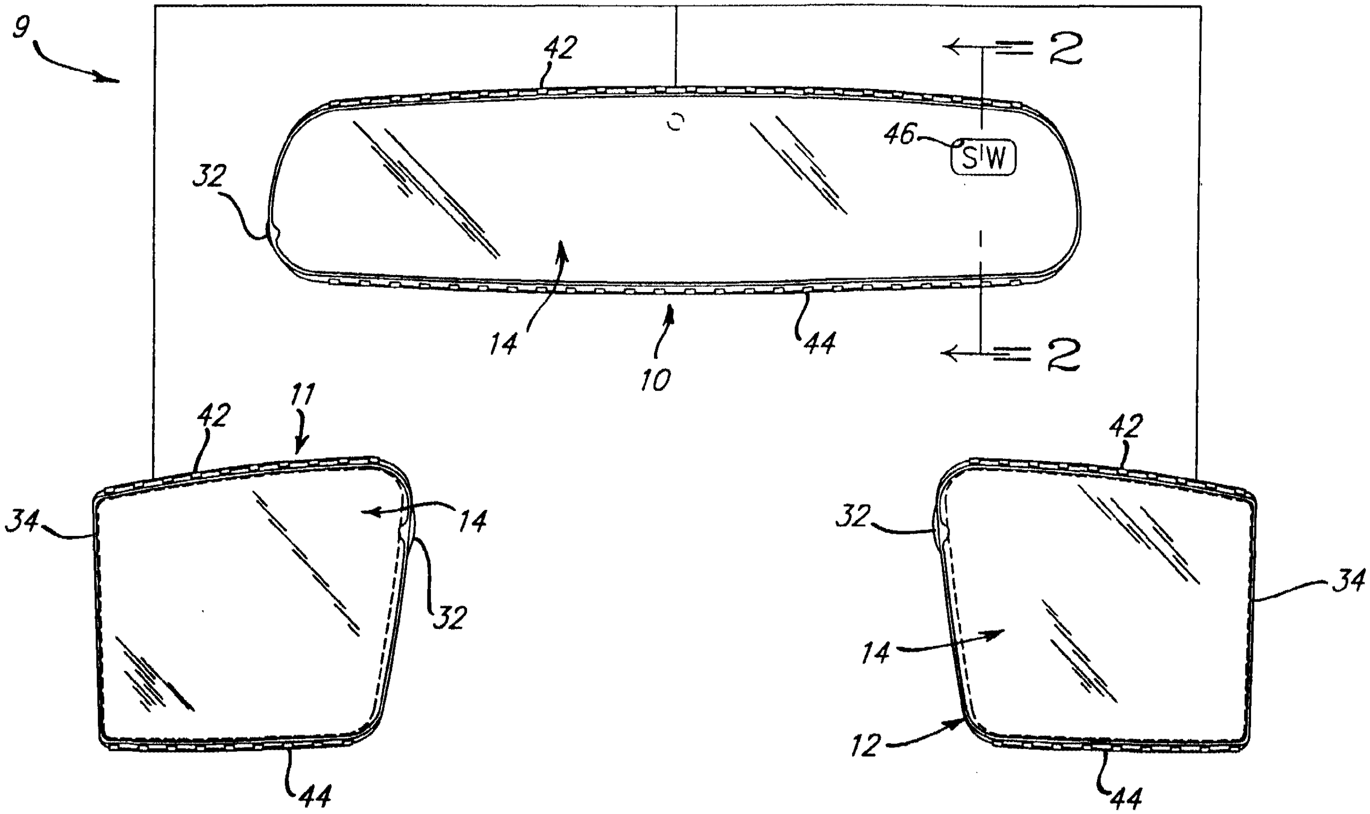

FIG. 1.

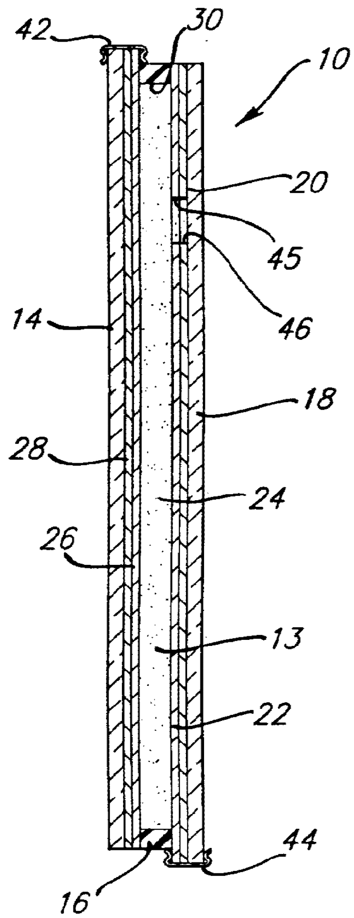

FIG. 2.

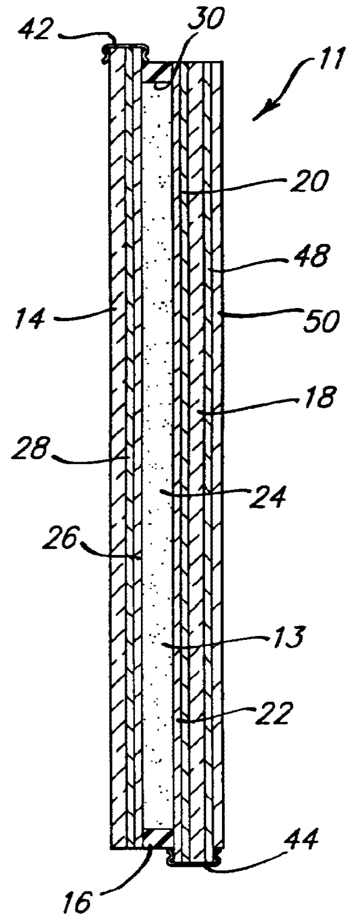

FIG. 6.

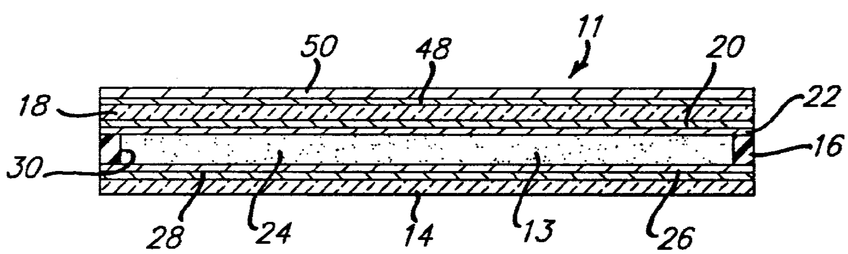

FIG. 5.

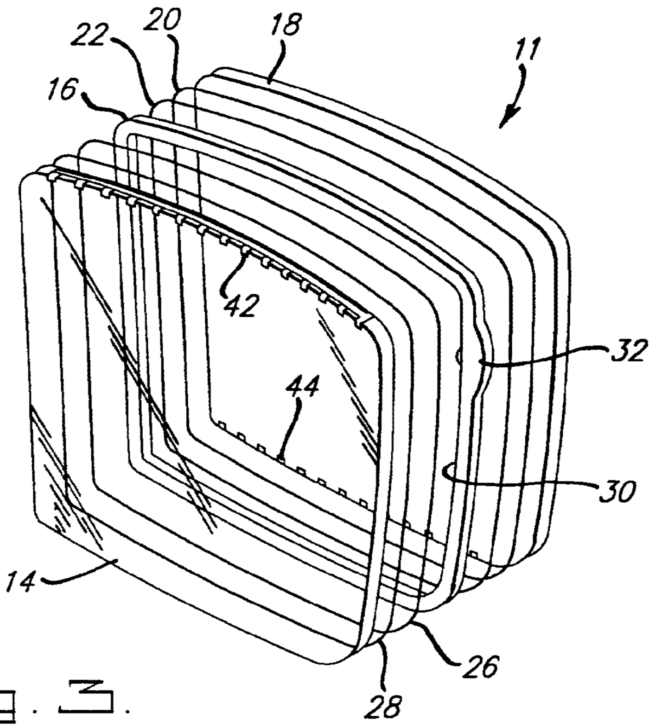

FIG. 3.

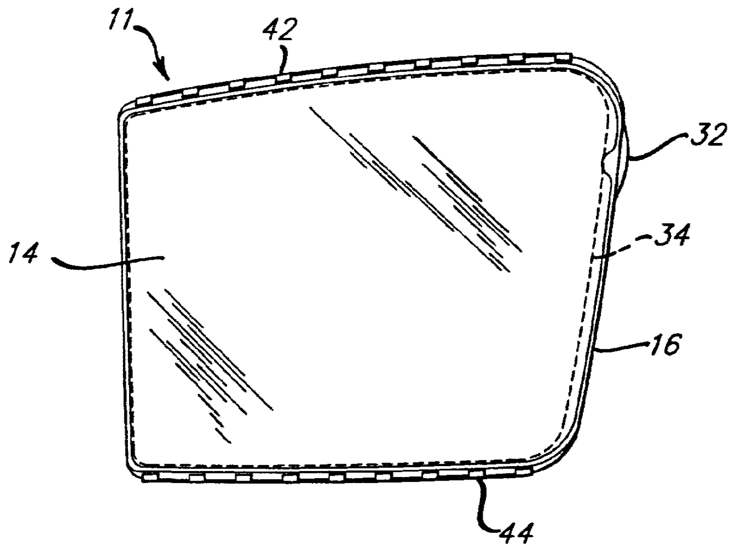

FIG. 4.

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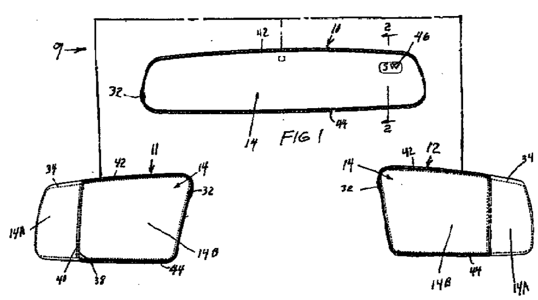
(54) **Improved rearview mirror for motor vehicles**

(57) An improved low cost automatic rearview mirror for automotive vehicles is provided, the mirror being capable of operating in harsh environments over wide variations in temperature, humidity, vibration, atmospheric corrosion, salt spray, electronic disturbances and sand and grit abrasion. In one embodiment of the invention, an electro-optically dimming exterior rearview mirror for automotive vehicles, said mirror comprising, in combination, a front element (14) having an optically transparent inboard portion (14B) and an outboard portion (14A) projecting laterally outwardly from said inboard portion, a rear element (18), said outboard portion of said front element (14) and said rear element (18) each having reflective surfaces thereon, said inboard portion (14B) of said front element and said rear element each having front and rear surfaces and defining a space (13) between said rear surface of said inboard portion and said front surface of said rear element, and electro-optic medium (24) confined in said space (13) whereby light transmittance of said medium is variable upon the application of an electrical potential thereto, said front surface of said inboard portion (14B) of said front element having a predetermined radius of curvature, said outboard portion (14A) of said front element having a front surface projecting laterally outwardly beyond said front surface of said rear element. Another embodiment of the invention provides improved signaling means.



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Description

BRIEF SUMMARY OF THE INVENTION

This invention relates to rearview mirrors for motor vehicles and, more particularly, to improved interior and/or exterior rearview mirrors for motor vehicles.

Heretofore, various automatic rearview mirrors for motor vehicles have been devised which automatically change from the full reflectance mode (day) to the partial reflectance mode (night) for glare protection purposes from light emanating from the headlights of vehicles approaching from the rear. The electrochromic mirrors disclosed in U.S. Patent No. 4,902,108, issued February 20, 1990, for Single-Compartment, Self-Erasing, Solution-Phase Electrochromic Devices, Solutions for Use Therein, and Uses Thereof; U.S. Patent No. 4,917,477, issued April 17, 1990, for Automatic Rearview Mirror System for Automotive Vehicles; U.S. Patent No. 5,128,799, issued July 7, 1992, for Variable Reflectance Motor Vehicle Mirror; U.S. Patent No. 5,202,787, issued April 13, 1993, for Electro-Optic Device; U.S. Patent No. 5,280,380, issued January 18, 1994, for UV-Stabilized Compositions and Methods; and U.S. Patent No. 5,282,077, issued January 25, 1994, for Variable Reflectance Mirror, each of which patents is assigned to the assignee of the present invention and the disclosures of each of which are hereby incorporated herein by reference, are typical of modem day automatic rearview mirrors for motor vehicles. Such electrochromic mirrors may be utilized in a fully integrated inside/outside rearview mirror system or as an inside or an outside rearview mirror system. In general, in automatic rearview mirrors of the types disclosed in U.S. Patent Nos. 4,902,108; 4,917,477; 5,128,799; 5,202,787, 5,280,380 and 5,282,077, both the inside and the outside rearview mirrors are comprised of a relatively thin electro-optic medium sandwiched and sealed between two glass elements. In most cases when the electro-optic medium is electrically energized, it darkens and begins to absorb light, and the higher the voltage, the darker the mirror becomes. When the electrical voltage is decreased to zero or removed, the mirror returns to its clear state. Also, in general, the electro-optic medium sandwiched and sealed between the two glass elements is preferably comprised of solutions of electrochromic compounds which function as the media of variable transmittance in the mirrors, although it should be understood that other electro-optic media may be utilized, including an approach wherein a tungsten oxide electrochromic layer is coated on one electrode with a solution containing at least another compound to provide counter electrode reaction. When operated automatically, the rearview mirrors of the indicated character generally incorporate light-sensing electronic circuitry which is effective to change the mirrors to the dimmed reflectance modes when glare is detected, the sandwiched electro-optic medium being activated and the mirror being dimmed in proportion to the amount of glare that is detected. As glare subsides, the mirror automatically returns to its normal high reflectance state without any action being required on the part of the driver of the vehicle. The electro-optic medium is disposed in a sealed chamber defined by a transparent front glass element, a peripheral edge seal, and a rear mirror element having a reflective layer, the electro-optic medium filling the chamber. Conductive layers are provided on the inside of the front and rear glass elements, the conductive layer on the front glass element being transparent while the conductive layer on the rear glass element may be either transparent or opaque, i.e., the conductive layer on the rear glass element may also function as the reflective layer for the rear glass element, and the conductive layers on both the front glass element and the rear glass element are connected to electronic circuitry which is effective to electrically energize the electro-optic medium to switch the mirror to nighttime, decreased reflectance modes when glare is detected and thereafter allow the mirror to return to the daytime, high reflectance mode when the glare subsides as described in detail in the aforementioned U.S. Patents. For clarity of description of such a structure, the front surface of the front glass element is sometimes referred to hereinafter as the first surface, and the inside surface of the front glass element is sometimes referred to as the second surface. The inside surface of the rear glass element is sometimes referred to as the third surface, and the back surface of the rear glass element is sometimes referred to as the fourth surface.

If desired, and as described in detail in the applicants' copending application entitled "Dimmable Rearview Mirror for Motor Vehicles", which application is assigned to the assignee of the present invention, and the entire disclosure of which is hereby incorporated by reference, a reflective layer may be provided on the inside (third surface) of the back glass of a dimming portion of the rearview mirror, which layer is comprised of a series of coatings, hereafter called the multilayer combination reflector/electrode, which also forms an integral electrode in contact with the electrochromic media. The other electrode on the inside (second) surface of the front glass is a transparent electrode which also contacts the electrochromic media inside the mirror element. The series of coatings of the multilayer combination reflector/ electrode is comprised of at least a base coating which bonds to the glass surface tenaciously and resists the corrosive action of the materials in the electrochromic media, and a reflective over coating which directly contacts the electrochromic media and which is chosen primarily for its high reflectance, stable behavior as an electrode, resistance to corrosion by the materials of the electrochromic media, resistance to atmospheric corrosion, resistance to electrical contact corrosion, the ability to adhere to the base coating, and ease of cleaning to an uncontaminated, high quality electrode surface. The series of coatings of the multilayer combination reflector/electrode has one or more base coatings and one or more high reflectance over coatings. The transparent coating is preferably fluorine doped tin oxide, tin doped indium oxide (ITO) or a series of metal oxide coatings with base coatings to suppress color and reflection followed by an electrically conductive, transparent coating which contacts the electrochromic media directly. Where a series of transparent coatings is used, the materials are chosen for good bonding, resistance to corrosion by the materials of the electrochromic media, resistance to corrosion by the atmosphere, minimal reflectance, high light transmission, neutral coloration and high electrical conductance. Also, to a considerable extent, it is possible to make the reflective electrode very high in electrical conductance to compensate in a synergistic fashion with a transparent electrode that is lower in electrical conductance so the net result is an electrochromic mirror which darkens and clears acceptably fast and uniformly with excellent optical properties.

This synergistic structure is applicable for both inside and outside rearview mirrors for motor vehicles. When the multilayer combination reflector/electrode is used in any mirror, it has the inherent advantage of reducing double images, distortion, and multiple images from raindrops, dust, etc., while providing excellent speed of reflectance change, good high end reflectance, good uniformity of reflectance change across the surface area of the mirror, neutral color, continually variable reflectance and a low end reflectance low enough to relieve strong glare. The reduction in double images and distortion is particularly useful in the case of dimmable mirrors which use glass that is bent but may have slight variations in radius of curvature or slight ripple or warp that result in slight imperfections in matching two pieces of bent glass required to make, for example, a convex electrochromic mirror.

Heretofore, non-automatically dimming aspheric exterior rearview mirrors have been provided which increase the field of view of the driver of a vehicle and virtually eliminate the well-known blind spots of conventional flat glass and/or curved glass exterior mirrors. In general, aspheric mirrors are made by using multiple radii of curvature or by combining several types of curvature, i.e., a main flat area (infinite radius of curvature) or a main curved area with a constant radius of curvature similar to the convex mirrors that are currently in common use on passenger side exterior mirrors in the United States, together with an aspheric area which is disposed on the outboard portion of the mirror. It is the high curvature in the aspheric area that yields a greatly expanded field of view which, in general, may be nearly double that of convex mirrors and nearly triple that of flat-surface mirrors. Aspheric mirrors thus tend to eliminate the conventional so-called blind spots, thereby enabling the drivers of the vehicles to see adjacent lanes in the road and to change lanes without failing to observe other vehicles, such as automobiles, motorcycles and bicycles, traveling in adjacent lanes. However, serious cost and technical problems arise when efforts are made to construct an automatically dimming aspheric outside rearview mirror with a reflective layer on the back (fourth) surface of the rear glass element, because it is generally necessary to very closely match the curvature of two glass elements of complex curvature, sometimes referred to as "matched-twins" in the industry. Mismatched glass elements can cause double images, and at the present time, it is questionable whether automatically dimming, double image-free aspherical mirrors having a reflective layer on the fourth surface of the mirror element can be commercially manufactured from a practical and/or economical standpoint. However, unexpected and surprisingly good results are obtained when a multilayer combination reflector/electrode is utilized on the inside (third surface) of an aspheric portion of a dimmable rearview mirror constructed in accordance with the present invention.

Heretofore, the benefits of including a turn signal or other signal, such as a brake signal, in each of the outside mirrors of an automotive vehicle have been recognized. U.S. Patent No. 5,014,167, issued May 7, 1991, for Visual Signaling Apparatus, and U.S. Patent No. 5,207,492, issued May 4, 1993, for Mirror Assembly describe such mirrors where signal indicators are located behind the mirror surface. Through the use of dichroic reflectors, special light sources, and directional louver means these signals, such as turn signals, can be hidden from the view of the vehicle operator so that the signals do not cause a vision nuisance while still being visible to following vehicles or to the passing vehicles on either side. The benefit is that vehicles located in the blind spots, yet too far forward to see conventional rear turn signals, receive forewarnings that a vehicle is about to turn. These mirrors have come to be known as "signal mirrors" in the industry. Heretofore, signal mirrors have not been particularly successful commercially due to cost, technical problems, and the inherent difficulty of combining this feature with automatic dimming mirrors.

An aim of the present invention is to overcome the serious cost and technical problems encountered in efforts to very closely match the complex curvatures of multiple glass plates for use in an automatically dimming aspheric outside rearview mirror of the indicated character, and to provide an improved automatically partially dimming aspheric outside rearview mirror incorporating improved means which enables the mirror to be commercially and economically manufactured and assembled from a practical standpoint.

Another aim of the present invention is to provide an improved dimmable rearview mirror which increases the safety of night driving.

Another aim of the present invention is to provide an improved aspheric outside rearview mirror for motor vehicles in which an inboard portion of the mirror can be varied from its high reflectance mode to partial or lower reflectance modes for glare protection purposes while an outboard portion of the mirror remains in the high reflectance mode at all times so as to provide a potential danger/warning signal if another vehicle is nearby in adjacent lanes even under glare-producing conditions.

Another aim of the present invention is to provide an improved dimmable rearview mirror for motor vehicles which provides a greater field of view than conventional flat or convex dimming outside rearview mirrors.

Another aim of the present invention is to provide an improved electro-optic, dimmable rearview mirror for motor vehicles, which mirror is relatively economical to manufacture and assemble, durable, efficient and reliable in operation.

Another aim of the present invention is to provide improved signaling means in conjunction with an improved outside rearview mirror for motor vehicles.

Still another aim of the present invention is to provide improved signaling means at the outboard section of a partially dimming mirror whereby technical difficulties are eliminated and costs are reduced.

Yet another aim of the present invention is to provide an improved dimmable rearview mirror for motor vehicles in which double images, distortion and multiple images from raindrops are reduced and wherein excellent speed of reflectance change, good high end reflectance, good uniformity of reflectance change across the surface area of the mirror, neutral color, continually variable reflectance and good low end reflectance are obtained.

The above features and advantages of the present invention will be further described hereinafter in the following description of exemplary embodiments and the accompanying drawings, in which:

FIG. 1 is a front elevational view schematically illustrating an inside/outside rearview mirror system for motor vehicles, the system including a dimmable inside rearview mirror together with two dimmable outside rearview mirrors which embody the present invention and all of which are adapted to be installed on a motor vehicle in a conventional manner whereby the mirrors face the rear of the vehicle and can be viewed by the driver of the vehicle to provide a rearward view to the driver;

FIG. 2 is an enlarged simplified sectional view of the inside rearview mirror illustrated in FIG. 1, taken on the line 2-2 thereof;

FIG. 3 is an exploded view of the left electro-optic, aspheric, partially dimmable outside rearview mirror illustrated in FIG. 1;

FIG. 4 is a front elevational view of the mirror illustrated in FIG. 3;

FIG. 5 is a simplified top plan view of the mirror illustrated in FIG. 4;

FIG. 6 is a simplified side elevational view of the right side of the mirror as viewed in FIG. 4, showing the electro-optic structure.

FIG. 7 is a schematic simplified side elevational view of another embodiment of the invention;

FIG. 8 is a schematic simplified side elevational view of still another embodiment of the invention; and

FIG. 9 is a schematic simplified top plan view of yet another embodiment of the invention.

DETAILED DESCRIPTION

In general, in inside and outside rearview mirrors embodying the present invention, at least a portion of the rearview mirror assembly may be comprised of a relatively thin layer of an electro-optic medium sealed between two glass elements. When the electro-optic medium is electrically energized, it darkens and begins to absorb light, and the higher the voltage, the darker the mirror becomes. When the electrical voltage is decreased to zero or is removed, the electro-optic medium returns to its clear state. Rearview mirrors embodying the present invention may, for example, incorporate light-sensing electronic circuitry of the type illustrated and described in the aforementioned U.S. Patent No. 4,917,477. Also, the components of mirrors embodying the present invention may be of the types disclosed in the aforementioned U.S. Patent Nos. 4,902,108; 5,128,799; 5,202,787; 5,280,380 and 5,282,077, as well as in U.S. Patent No. 5,014,167, issued May 7, 1991, for Visual Signaling Apparatus, and U.S. Patent No. 5,207,492, issued May 4, 1993, for Mirror Assembly. It should be understood, however, that other types of electronic circuitry and other types of electro-optic media and other components may be utilized in mirrors embodying the present invention.

In one embodiment of the present invention, an aspheric outside rearview mirror is provided wherein a large flat area and/or a large radius of curvature convex area of the mirror automatically dims, but the aspheric portion of the mirror does not. A key aspect of such embodiment of the invention resides in the fact that the front glass element is formed in one continuous piece that includes an inboard main body portion that is substantially flat, or slightly curved, and an outboard aspherical portion which is formed integrally with the main body portion and projects laterally outwardly therefrom. In its most practical form, the outside mirror has a large radius of curvature, spherical, convex inboard portion, integrally joined to an outboard aspherical portion, it being understood, however, that the dimming inboard portion could be of flat or other configuration, and that the aspherical portion could be of cylindrical or spherical configuration or could be formed with multiple radii of curvature or other configurations.

Referring to the drawings, an electro-optic inside/outside mirror assembly, generally designated 9, embodying the present invention is depicted in FIGS. 1 through 6. Since some of the layers of each of the mirrors in the assembly 9 are very thin, the scale has been distorted for pictorial clarity. As shown in the drawings, the mirror assembly 9 includes an inside mirror 10 and outside mirrors 11 and 12. For clarity, in the drawings, like numbers identify components of the inside and outside mirrors which may be slightly different in configuration but which function in substantially the same manner and obtain the same results as similarly numbered components. For example, the shape of the front glass element of the left outside mirror is the reverse of the shape of the right outside mirror, and the front glass element of the inside mirror is generally longer and narrower than the front glass elements of the outside mirrors. In the embodiment of the illustrated, each of the mirrors 10, 11 and 12 includes a sealed chamber 13, defined by a front glass element 14, an edge seal 16, and a rear glass element 18, having reflective and electrically conductive metal layers 20 and 22, respectively. An electro-optic medium 24 having the desired electro-optic properties fills the chamber 13, and a transparent electrically conductive layer such as a fluorine-doped tin oxide conductive layer 26 is carried by the front element 14. The electrically conductive layers are connected to an electrical circuit as will be described hereinafter in greater detail. If desired, a color suppression coating or coatings, such as 28, may be disposed between the conductive layer 26 and the adjacent rear surface of the front element 14. Light rays enter through the front glass element 14, the color suppression coating(s) 28, the transparent conductive layer 26 and the electro-optic medium 24 before being reflected from the electrically conductive and reflective layer 22 (or layers 20 and 22 if layer 22 is extremely thin) provided on the rear glass element 18. The reflected rays exit by the same general path traversed in the reverse direction. In electrochromic media both the entering rays and the reflected rays are attenuated in proportion to the degree to which the electro-optic medium 24 is light-absorbing while in other electro-optic media the light rays may, in some cases, only be attenuated in one direction. When the electro-optic medium 24 is electrochromic and highly light absorbing, the intensity of the exiting rays is diminished, the dim image remaining mainly being from light rays which are reflected off of the front surface of the front glass element 14 and the interface between the front glass element 14 and the coatings 28 and/or 26. Thus, the basic structural elements of the electro-optic portion of each of the mirrors includes two electrode-bearing sides or walls 14 and 18, a spacing or separating seal 16, which spaces apart and holds the walls in substantially parallel relationship in an assembled device, and which surrounds a volume which in an assembled device is defined by the inside surfaces of electrode layers on the electrode-bearing walls as well as the circumferential inside walls 30 of the sealing member 16. The volume of the chamber 13 is preferably filled through a sealable fill port 32 with any of the electro-optic media disclosed in this or the aforementioned patents which have reversibly variable transmittance in the operation of the device, the medium in the chamber 13 being in contact with both electrode layers 22 and 26 during operation of the mirror. It will be understood that the electro-optic medium for achieving variable reflectance could be other solution-phase electrochromics, solid electrochromics, a combination of the two in the form of a hybrid, or any of the above in a polymerized matrix. A liquid crystal, dipolar suspension or other electro-optic medium could also be utilized in mirrors embodying the present invention.

In the embodiment of the invention illustrated, the reflective surface on the inside of the rear glass 18 may be comprised of a series of coatings, hereinafter termed the multilayer combination reflector/electrode, which serves as a mirror reflectance layer and also forms an integral electrode in contact with the electrochromic media. The other electrode on the inside surface of the front glass 14 is the transparent electrode 26 which also contacts the electrochromic media inside the mirror element. The series of multilayer combination reflector/electrode coatings is comprised first of a base coating which bonds to the glass surface tenaciously and resists the corrosive action of the materials in the electrochromic media. The base coating is preferably chromium, but alternatively may be stainless steel, nickel-chromium, titanium, gold, silver, or any material or series of coatings which accomplish the objectives above stated. The thickness of the base coating is typically 100 to 1500 angstroms and is more typically 200 to 800 angstroms. The final reflective coating which directly contacts the electrochromic media is chosen primarily for its high reflectance, resistance to attack by the electrochromic media, resistance to atmospheric corrosion, resistance to electrical contact corrosion, and the ability to adhere to the base coating. The preferred material for the reflective coating is rhodium which has excellent hardness, excellent reflectance and excellent conductance, but it should be understood that it is alternatively possible to choose from a group of metals and their alloys such as, but not limited to, platinum, ruthenium, iridium, and stainless steel or multiple layers including combinations thereof. The thickness of the reflective over coating is typically 100 to 1000 angstroms and is more typically 100 to 600 angstroms. The series of coatings of this multilayer combination reflector/electrode has one or more base coating(s) which generally provide high conductance and one or more over coatings which provide additional conductance and high reflectance. By way of example the sheet resistance of the multilayer combination reflector/electrode may be approximately 1 to 10 ohms per square.

The transparent coating 26 is preferably made of fluorine doped tin oxide or ITO or alternately a series of coatings with a base coating(s) to suppress color and reflection followed by a conductive transparent coating which contacts the electrochromic media directly. Where a series of transparent coatings is used, the materials are chosen for good bonding, good resistance to corrosion by the materials in the electrochromic media, good resistance to corrosion by the atmosphere, minimal reflectance, high light transmission, neutral coloration and high electrical conductance. Suitable types of low cost transparent electrode coated glass substrates are "TEK 20" or "TEK 15" coated glass manufactured by Libbey Owens-Ford of Toledo, Ohio, but other suitable coatings are ITO or extremely thin metal layers which may alternatively function as the transparent electrode.

Transparent electrode materials are inherently limited in the balance of properties and cost. Low sheet resistance transparent coatings with a sheet resistance below approximately 10 ohms per square tend to have low transmission and other attendant shortcomings including possible haziness, coloration, non-uniformity of coating thickness and high cost. This makes a low sheet resistance transparent coating less practical for electrochromic mirrors. To a considerable extent, it is possible to make the multilayer combination reflector/electrode low in electrical resistance to compensate in a synergistic fashion with a transparent electrode that is higher in electrical resistance so the net result is an electrochromic mirror which darkens and clears acceptably fast and uniformly over its surface area, with excellent optical properties.

To demonstrate the surprising nature of the synergy, electrochromic mirrors have been constructed with a multilayer combination reflector/electrode of about 3 and of about 7 ohms per square sheet resistance with a front transparent electrode of about 18 to 22 ohms per square or higher which show remarkably good results for speed and uniformity of coloration and clearing. Electrochromic mirrors with reflectors on the front surface of the rear element have been previously described, but the use of multilayer coatings that combine to provide high reflectance, good adhesion to glass, low sheet resistance and ease of cleaning for electrochromic mirrors, especially in combination with a low cost high resistance transparent coating, is preferred. Thus, if desired, mirrors embodying the present invention may use a high electrical conductance multilayer combination reflector/electrode on the third surface, with a lower electrical conductance transparent front electrode on the second surface to achieve a cost effective, high performance, electrochromic mirror. This synergistic structure has the inherent advantage of reducing double images, distortion, and multiple images from raindrops, (particularly with convex or spherically curved mirrors), while providing excellent speed of reflectance change, good high end reflectance, good uniformity of reflectance change over the area of the device, neutral color and a low end reflectance, low enough to relieve strong glare.

The following are examples of components that have been found to be suitable for use in rearview mirrors embodying the present invention, it being understood that other components may also be used in rearview mirrors embodying the present invention.

EXAMPLE 1

A multilayer combination reflector/electrode was prepared by sequentially depositing approximately 300 angstroms of titanium, approximately 200 angstroms of gold and approximately 200 angstroms of platinum on the 6.6 cm by 14.4 cm surface of a 0.2 cm thick sheet of soda lime float glass. The deposition was accomplished by rotating the glass sheet past three separate metal targets in a magnetron sputtering system with a base pressure of a 3 x 10^{-6} ton and an argon pressure of 2 x 10^{-3} torr. The first surface, CIE curve white light reflectance from the multilayer combination reflector/electrode with the platinum surface in contact with air, measured according to the procedure of SAE J964, was 71.9 percent and the sheet resistance of the metal layer stack was 3.2 ohms per square.

This multilayer combination reflector/electrode coated glass was used as the rear element of an electrochromic mirror device. The front element was a sheet of TEK 20 transparent conductor coated glass of the same size as the rear element. The sheet resistance of the transparent conductor was approximately 20 ohms per square. The two elements were bonded together by an epoxy perimeter seal with the transparent conductor electrode and multilayer combination reflector/electrode offset from, substantially parcel to and facing each other as shown in Figure 2. The spacing between the electrodes was about 0.014 cm. The device was vacuum filled through a small gap left in the perimeter seal with a solution made up of:

0.034 molar 5,10-dihydro-5,10-dimethylphenazine

0.034 molar 1,1'-di(phenyl propyl)-4,4'-bipyridinium difluoroborate

0.5 molar ethyl-2-cyano-3,3-diphenylacrylate

in a solution of 3 wt% Elvacite™ 2041 polymethylmethacrylate resin dissolved in propylene carbonate.

The small gap was plugged with a UV cure adhesive which was cured by exposure to UV light.

The reflectance of the device, (measured as before for the rear element), with no voltage applied was 56 percent and with 1.2 volts applied the reflectance decreased over a period of 5 seconds to 10 percent and within 10 seconds to 7.5 percent. On short circuiting the device, the reflectance increased over a period of 15 seconds back to 56 percent.

EXAMPLE 2

Other than as specifically mentioned, the conditions of Example 1 were used in this example. A multilayer combination reflector/electrode was prepared by sequentially depositing approximately 300 angstroms of chromium, approximately 500 angstroms of silver and approximately 300 angstroms of platinum at a base pressure of 3.7 x 10^{-6} torr and an argon pressure of 8 x 10^{-3} torr. The first surface reflectance was 73.3 percent and the sheet resistance was 0.1 ohms per square.

When an electrochromic mirror device was fabricated with this multilayer combination reflector/electrode, the device had a high end reflectance of 57.0 percent, a low end reflectance of 6.5 percent and changed from 57.0 percent to 10.0 percent reflectance in 2.0 seconds with the application of 1.2 volts.

EXAMPLE 3

Other than as specifically mentioned, the conditions of Example 1 were used in this example. A multilayer combination reflector/electrode was prepared by sequentially depositing approximately 600 angstroms of chromium and approximately 300 angstroms of platinum. The base pressure of 2.1 x 10^{-6} torr and the argon pressure of 8 x 10^{-3} torr. The first surface reflectance was 73.8 percent and the sheet resistance was 3.2 ohms per square.

When an electrochromic mirror device was fabricated with this multilayer combination reflector/electrode, the device had a high end reflectance of 58.0 percent, a low end reflectance of 7.0 percent and changed from 58.0 percent to 10.0 percent reflectance in 2.7 seconds with the application of 1.2 volts.

EXAMPLE 4

A multilayer combination reflector/electrode was prepared by the sequential deposition of approximately 600 angstroms of chromium and approximately 100 angstroms of 316 stainless steel on the 19 cm by 66 cm surface of a 0.2 cm thick sheet of flat soda lime float glass and on the convex side of a 22 cm diameter circle of glass which had been press bent to a uniform spherical curvature with a radius of curvature of 140 cm. The glass which was bent was TEK 20 tin oxide coated glass manufactured by Libbey Owens-Ford of Toledo, Ohio, and the tin oxide coating was on the concave side after the glass was bent. The deposition was accomplished in a large in-line sputtering system. The first surface reflectance from the multilayer combination reflector/electrode coatings was about 58 percent and the sheet resistance was about 7 ohms per square.

The flat and the bent glass sheets were cut into mirror shapes which were approximately 10 cm high and 16 cm wide. These were used as the rear elements of dimmable mirrors for the outside of an automobile as described below. As compared to glass coated only with chromium metal, these pieces of the multilayer combination reflector/electrode coated glass were dramatically easier to clean to a condition in which they behaved as uniform high quality electrodes without poorly coloring spots and blemishes in the final electrochromic dimmable mirror devices.

The flat and convex pieces of multilayer combination reflector/electrode coated glass were matched with mirror-shaped pieces of TEK 20 coated pieces of flat and convex coated glass respectively. The front element convex mirror glass was also bent such that the tin oxide coating was on the concave side. Mirror devices were made by sealing nearly all the way around the perimeter of the glass pieces with an epoxy seal containing glass bead spacers which provided for a 0.015 cm spacing between the TEK 20 transparent, tin oxide electrode and the multilayer combination reflector/electrode. The spacing between the electrode surfaces was filled with a solution made up of:

0.028 molar 5,10-dihydro-5,10-dimethylphenazine

0.034 molar 1,1'-di(phenylpropyl)-4,4'-bipyridinium difluoroborate

0.030 molar 2-(2'-hydroxy-5'-methylphenyl)-benzotriazole

in a solution of 3 wt % Elvacite™ 2041 polymethylmethacrylate resin dissolved in propylene carbonate.

The small gap in the perimeter seal was plugged with a UV cure adhesive which was cured by exposure to UV light.

The high end reflectance of the mirrors was approximately 45 percent and the low end reflectance was approximately 7 percent. The mirrors changed reflectance from 45 percent to 15 percent reflectance in about 5 seconds and provided excellent glare relief when dimmed to the appropriate reflectance level during nighttime driving.

EXAMPLE 5

Every aspect of Example 4 was repeated with the exception that the multilayer combination reflector/electrode was prepared by the sequential deposition of approximately 400 angstroms of chromium and approximately 200 angstroms of rhodium. The first surface reflectance from the multilayer combination reflector/electrode was about 70 percent and the sheet resistance was about 7 ohms per square.

The flat and convex dimmable mirror devices prepared with this multilayer combination reflector/electrode according to the procedure of Example 4 had a high end reflectance of about 55 percent and a low end reflectance of about 7 percent with a speed of reflectance change similar to the mirrors of Example 4.

An automobile equipped with an automatic inside electrochromic mirror, one of the above flat mirrors as the driver's side outside mirror and one of the above convex mirrors as the passenger side outside mirror allowed the automobile operator to drive at night with essentially complete protection from glare from the headlamps of following vehicles.

It has been observed that chromium coatings alone can be difficult to clean during assembly of the entire mirror, resulting in a finished mirror that may exhibit contamination spots and areas of slower darkening and clearing. The use of a high reflectance material, such as rhodium alone, can be very costly at thicknesses that provide low sheet resistance, but coated over the above-mentioned base coating(s) such as chromium results in a rear glass element which is easily cleaned prior to assembly, resulting in a finished mirror that is more optically perfect and free of contamination and darkening defects. Chromium or stainless steel alone also have the problem that the high end reflectance of the finished mirror is too low considering the attendant losses of light from the transparent coated front substrate and electrochromic media. A problem with stainless alone and to a lesser extent chromium alone is poor electrical contact stability to the conventional spring clip type buss bars or other electrical contact means.

The use of an inert high reflectance coating also makes attachment of spring clip type buss bars or other contact attachments more stable and trouble free, since non-conductive compounds and oxides do not form as readily under pressure contact areas. The result of low stability electrical contact is a mirror which loses its uniformity of coloration and its range and speed of coloration and clearing over the long life required in the motor vehicle industry.

There is thus provided a robust, low cost, dimmable rearview mirror for automotive vehicles, which mirror is capable of operating in harsh environments over wide variations in temperature, humidity, vibration, atmospheric corrosion, salt spray, electronic disturbances and sand and grit abrasion, and which mirror is resistant to damage from vehicle crashes and owner abuse. An additional benefit from sealing the main area of the mirror reflector inside the dimmable mirror element is long life of the reflector in the motor vehicle environment.

It is common with outside dimmable mirrors to adhere a resistance heater to the fourth surface reflective structure at the back of the rear glass substrate. This heater and its associated adhesive can cause incompatibility and field problems if conventional reflective material, such as silver, is on the back side of the back glass substrate. It is also common practice to adhesively bond the electrochromic mirror assembly to a plastic backing plate often called the glass case. Normal temperature variations experienced by this assembly can cause large forces to be exerted on a reflector structure on the back or fourth surface due to the thermal expansion mismatch of the materials involved. The adhesives used can also lead to chemical attack and degradation of the fourth surface reflector. Such problems are avoided when the reflector is located inside the device, and the heater is adhered directly to the glass (fourth surface) of the rear glass element or to the tin oxide coating such as TEK 20 or TEK 15 layer which may optionally be on the fourth surface.

Heretofore, problems have been encountered with a conventional silver reflector on the back surface of the rear glass, such problems being known as silver spoilage and silver lift, and are avoided with the multilayer combination reflector/ electrode inside the mirror element and protected by the rear glass. With the multilayer combination reflector/electrode located inside the mirror element, the environmental factors are limited to those that result from contact with the materials of the electrochromic media and the offset area where electrical contact is made, whereas with the reflector on the back of the rear glass surface, a number of other difficult environmental factors must be dealt with for the reflector to survive during the life of the minor especially on the exterior of a motor vehicle.

Speed of coloring, good high end reflectance (typically greater than 50% for exterior mirrors and greater than 60% for interior minors) and low cost are important requirements for dimmable minors, and the above described construction provides a minor meeting such requirements. Thus, it is possible to use comparatively low cost practical electrode coatings to make a surprisingly high performance mirror. Highly conducting transparent coatings are either nondurable, low in transmissivity and/or very high in cost. For this reason it is desirable to use comparatively low cost durable transparent coatings which have the inherent disadvantage that their conductance is lower than that of expensive coatings. Metals, on the other hand, have high conductance which can be used to great advantage. Electrochromic minors with reflector/electrodes involving a single metal layer on the front surface of the rear element have been previously described. However, the concept of creating a dimmable minor where the electrical conductance of tile transparent electrode at the second surface of the mirror element is purposely made much lower than the multilayer combination reflector/electrode conductance at the third surface of the mirror element is preferred. This intentional mismatch of conductance in a symbiotic relationship using practical low cost coatings provides a structure of significant commercial potential, i.e. the conductance of the transparent electrode is substantially lower than that of the multilayer combination reflector/electrode, and the multilayer combination reflector/electrode is comprised of two or more coatings. The first coating on the rear glass is preferably the low cost, high conductance base metal such as chromium. The final coating on the multilayer combination reflector/electrode is the thin, high reflectance metal such as rhodium for the purpose of providing high reflectance and high stability in use as an electrode for the electrochromic device. The coating(s) on the back surface of the front element may include one or more color suppression coatings followed by fluorine doped tin oxide, but it must be understood that any transparent coating having the required properties which is substantially lower in conductance than the coatings on the front surface of the rear element would be suitable. This concept may be incorporated in both inside and outside electrochromic mirrors which may incorporate ambient and glare light sensors, the glare light sensor being positioned either behind the mirror glass and looking through a section of the mirror with the reflective material removed, or partially removed, or the glare light sensor can be positioned outside the reflective surfaces. In the alternative, areas of the electrode and reflector, such as 45 and 46, respectively, may be removed, or partially removed in, for example, a