AO 120 (Rev. 08/10)

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

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 for the Northern District of Georgia on the following

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

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
1:22-cv-02774-TCB	7/14/2022	for the Northern District of Georgia

PLAINTIFF	DEFENDANT
Hisense USA Corporation	Brightplus Ventures LLC

	PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1	See Attachment A		
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
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In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE
KEVIN P. WEIMER	s/ A. Edwards	7/15/2022

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

Print Save As... Reset

Attachment A to Form AO 120

Patent No.	Date of Patent	Holder of Patent
7,690,812	4/6/2010	Brightplus Ventures LLC
7,872,705	1/18/2011	Brightplus Ventures LLC
8,177,382	5/15/2012	Brightplus Ventures LLC
8,294,075	10/23/2012	Brightplus Ventures LLC
8,330,710	12/11/2012	Brightplus Ventures LLC
8,941,331	1/27/2015	Brightplus Ventures LLC
9,605,835	5/28/2017	Brightplus Ventures LLC
RE42,598	8/9/2011	Brightplus Ventures LLC
RE45,796	11/10/2015	Brightplus Ventures LLC

AO 120 (Rev. 08/10)

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

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 Eastern District of Texas - Marshall Divison on the following

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

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
2:22-cv-00194	6/7/2022	Eastern District of Texas - Marshall Divison

PLAINTIFF	DEFENDANT
BRIGHTPLUS VENTURES LLC	TCL ELECTRONICS HOLDINGS LTD. et al.

	PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1	7,960,812	4/6/2010	Brightplus Ventures LLC
2	8,941,331	1/27/2015	Brightplus Ventures LLC
3	8,177,382	5/15/2012	Brightplus Ventures LLC
4	8,294,075	10/23/2012	Brightplus Ventures LLC
5	8,330,710	12/11/2012	Brightplus Ventures LLC

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
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DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE

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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 Eastern District of Texas - Marshall Divison on the following

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

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
2:22-cv-00194	6/7/2022	Eastern District of Texas - Marshall Divison

PLAINTIFF	DEFENDANT
BRIGHTPLUS VENTURES LLC	TCL ELECTRONICS HOLDINGS LTD. et al.

	PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1	9,605,835	3/28/2017	Brightplus Ventures LLC
2	RE45,796	11/10/2015	Brightplus Ventures LLC
3	RE42,598	8/9/2011	Brightplus Ventures LLC
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
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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 Eastern District of Texas - Marshall Divison on the following

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

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
2:22-cv-00170	5/24/2022	Eastern District of Texas - Marshall Divison

PLAINTIFF	DEFENDANT
BRIGHTPLUS VENTURES LLC	LG ELECTRONICS, INC. and LG ELECTRONICS U.S.A., INC.

	PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1	7,960,812	4/6/2010	Brightplus Ventures LLC
2	7,872,705	1/18/2011	Brightplus Ventures LLC
3	8,177,382	5/15/2012	Brightplus Ventures LLC
4	8,294,075	10/23/2012	Brightplus Ventures LLC
5	8,330,710	12/11/2012	Brightplus Ventures LLC

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
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DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE

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Copy 2—Upon filing document adding patent(s), mail this copy to Director Copy 4—Case file copy

AO 120 (Rev. 08/10)

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

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
2:22-cv-00170	5/24/2022	Eastern District of Texas - Marshall Divison

PLAINTIFF	DEFENDANT
BRIGHTPLUS VENTURES LLC	LG ELECTRONICS, INC. and LG ELECTRONICS U.S.A., INC.

	PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1	8,941,331	1/27/2015	Brightplus Ventures LLC
2	9,605,835	3/28/2017	Brightplus Ventures LLC
3	RE42,598	8/9/2011	Brightplus Ventures LLC
4	RE45,796	11/10/2015	Brightplus Ventures LLC
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In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
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DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE

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Copy 2—Upon filing document adding patent(s), mail this copy to Director Copy 4—Case file copy

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 NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/045,729	03/11/2008	John Roberts	4308-824

CONFIRMATION NO. 9825

158862
MYERS BIGEL, P.A.
P.O. BOX 37428
RALEIGH, NC 27627

POA ACCEPTANCE LETTER

OC000000113199929

Date Mailed: 12/09/2019

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 12/05/2019.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/qnguyen/

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 7 of 836

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 NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/045,729	03/11/2008	John Roberts	4308-824

CONFIRMATION NO. 9825

146366
Sage Patent Group/Cree
PO BOX 30789
RALEIGH, NC 27622-0789

POWER OF ATTORNEY NOTICE

OC000000113199888

Date Mailed: 12/09/2019

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 12/05/2019.

- The Power of Attorney to you in this application has been revoked by the assignee who has intervened as provided by 37 CFR 3.71. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/qnguyen/

Doc Code: PA..
Document Description: Power of Attorney

PTO/AIA/82B (07-13)
Approved for use through 03/31/2021. OMB 0651-0035
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

POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

Application Number	Filing Date

(Note: The boxes above may be left blank if information is provided on form PTO/AIA/82A.)

☑ I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above: 158862

OR

☐ I hereby appoint Practitioner(s) named in the attached list (form PTO/AIA/82C) as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the patent application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above. (Note: Complete form PTO/AIA/82C.)

Please recognize or change the correspondence address for the application identified in the attached transmittal letter or the boxes above to:

☑ The address associated with the above-mentioned Customer Number

OR

☐ The address associated with Customer Number:

OR

☐ Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Email			

I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

IDEAL INDUSTRIES LIGHTING LLC

☐ Inventor or Joint Inventor (title not required below)

☐ Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)

☑ Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)

☐ Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document) (provide signer's title if applicant is a juristic entity)

SIGNATURE of Applicant for Patent

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

Signature		Date (Optional)	September 19, 2019
Name	Craig K. Atwater		
Title	Senior Vice President and General Manager		

NOTE: Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. If more than one applicant, use multiple forms.

☑ Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. 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 and 1.14. This collection is estimated to take 3 minutes 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.

Electronic Acknowledgement Receipt

EFS ID:	37941246
Application Number:	12045729
International Application Number:	
Confirmation Number:	9825
Title of Invention:	APPARATUS AND METHODS FOR MULTIPLANAR OPTICAL DIFFUSERS AND DISPLAY PANELS FOR USING THE SAME
First Named Inventor/Applicant Name:	John Roberts
Customer Number:	146366
Filer:	Dennis J. Williamson/Meredith DeRosa
Filer Authorized By:	Dennis J. Williamson
Attorney Docket Number:	4308-824
Receipt Date:	05-DEC-2019
Filing Date:	11-MAR-2008
Time Stamp:	14:44:18
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		1535-824.pdf	160493 ef3ff5b4800455ed328872b18c7b711c970fd7b9	yes	3

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Assignee showing of ownership per 37 CFR 3.73	1	2
	Power of Attorney	3	3
Warnings:			
Information:			
	Total Files Size (in bytes):	160493	

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.

1535-824

PTO/AIA/96 (08-12)
Approved for use through 01/31/2013. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: Ideal Industries Lighting LLC

Application No./Patent No.: 12/045,729 Filed/Issue Date: 03-11-2008

Titled: APPARATUS AND METHODS FOR MULTIPLANAR OPTICAL DIFFUSERS AND DISPLAY PANELS FOR USING THE SAME

Ideal Industries Lighting LLC, a corporation

(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that, for the patent application/patent identified above, it is (choose **one** of options 1, 2, 3 or 4 below):

1. ☑ The assignee of the entire right, title, and interest.

2. ☐ An assignee of less than the entire right, title, and interest (check applicable box):

   ☐ The extent (by percentage) of its ownership interest is _____%. Additional Statement(s) by the owners holding the balance of the interest must be submitted to account for 100% of the ownership interest.

   ☐ There are unspecified percentages of ownership. The other parties, including inventors, who together own the entire right, title and interest are:

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

3. ☐ The assignee of an undivided interest in the entirety (a complete assignment from one of the joint inventors was made). The other parties, including inventors, who together own the entire right, title, and interest are:

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

4. ☐ The recipient, via a court proceeding or the like (*e.g.*, bankruptcy, probate), of an undivided interest in the entirety (a complete transfer of ownership interest was made). The certified document(s) showing the transfer is attached.

The interest identified in option 1, 2 or 3 above (not option 4) is evidenced by either (choose **one** of options A or B below):

A. ☐ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel _____, Frame _____, or for which a copy thereof is attached.

B. ☑ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: John Roberts, Chenhua You To: Cree, Inc.

   The document was recorded in the United States Patent and Trademark Office at

   Reel 020711, Frame 0056, or for which a copy thereof is attached.

2. From: Cree, Inc. To: Ideal Industries Lighting LLC

   The document was recorded in the United States Patent and Trademark Office at

   Reel 049902, Frame 0679, or for which a copy thereof is attached.

This collection of information is required by 37 CFR 3.73(b). 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 and 1.14. This collection is estimated to take 12 minutes 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/AIA/96 (08-12)
Approved for use through 01/31/2013. 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.

STATEMENT UNDER 37 CFR 3.73(c)

3. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

4. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

5. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

6. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☐ As required by 37 CFR 3.73(c)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

Signature	Date: 12/5/2019
Dennis J. Williamson	32,338
Printed or Typed Name	Title or Registration Number

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 NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/045,729	03/11/2008	John Roberts	5308-824

CONFIRMATION NO. 9825

146366
Sage Patent Group/Cree
PO BOX 30789
RALEIGH, NC 27622-0789

POA ACCEPTANCE LETTER

OC000000089443889

Date Mailed: 02/24/2017

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 02/20/2017.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/mbeyene/

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 14 of 836

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 NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/045,729	03/11/2008	John Roberts	5308-824

CONFIRMATION NO. 9825

65106
MYERS BIGEL, P.A.
P.O. BOX 37428
RALEIGH, NC 27627

POWER OF ATTORNEY NOTICE

OC000000089443819

Date Mailed: 02/24/2017

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 02/20/2017.

- The Power of Attorney to you in this application has been revoked by the assignee who has intervened as provided by 37 CFR 3.71. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/mbeyene/

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 15 of 836

PTO/AIA/80 (07-12)
Approved for use through 11/30/2014. OMB 0651-0035
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.

POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(c).

I hereby appoint:

■ Practitioners associated with Customer Number: 146366

OR

☐ Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number	Name	Registration Number

As attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignments documents attached to this form in accordance with 37 CFR 3.73(c).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(c) to:

■ The address associated with Customer Number: 146366

OR

☐	Firm or Individual Name		
	Address		
	City	State	Zip
	Country		
	Telephone	Email	

Assignee Name and Address: Cree, Inc.
4600 Silicon Drive
Durham, NC 27703

A copy of this form, together with a statement under 37 CFR 3.73(c) (Form PTO/AIA/96 or equivalent) is required to be Filed in each application in which this form is used. The statement under 37 CFR 3.73(c) may be completed by one of The practitioners appointed in this form, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee

Signature	Julio Garceran	Date	2/13/17
Name	Julio Garceran	Telephone	919-407-5343
Title	Chief Intellectual Property Counsel - Cree, inc.		

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. 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 and 1.14. This collection is estimated to take 3 minutes 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/AIA/96 (08-12)
Approved for use through 01/31/2013. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: Cree, Inc.

Application No./Patent No.: 12/045,729 Filed/Issue Date: 3/27/2008

Titled: APPARATUS AND METHODS FOR MULTIPLANAR OPTICAL DIFFUSERS AND DISPLAY PANELS FOR USING THE SAME

Cree, Inc., a Corporation

(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that, for the patent application/patent identified above, it is (choose **one** of options 1, 2, 3 or 4 below):

1. ☑ The assignee of the entire right, title, and interest.

2. ☐ An assignee of less than the entire right, title, and interest (check applicable box):

   ☐ The extent (by percentage) of its ownership interest is _____%. Additional Statement(s) by the owners holding the balance of the interest must be submitted to account for 100% of the ownership interest.

   ☐ There are unspecified percentages of ownership. The other parties, including inventors, who together own the entire right, title and interest are:

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

3. ☐ The assignee of an undivided interest in the entirety (a complete assignment from one of the joint inventors was made). The other parties, including inventors, who together own the entire right, title, and interest are:

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

4. ☐ The recipient, via a court proceeding or the like (*e.g.*, bankruptcy, probate), of an undivided interest in the entirety (a complete transfer of ownership interest was made). The certified document(s) showing the transfer is attached.

The interest identified in option 1, 2 or 3 above (not option 4) is evidenced by either (choose **one** of options A or B below):

A. ☑ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel 020711, Frame 0056, or for which a copy thereof is attached.

B. ☐ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

   1. From: _____ To: _____

      The document was recorded in the United States Patent and Trademark Office at

      Reel _____, Frame _____, or for which a copy thereof is attached.

   2. From: _____ To: _____

      The document was recorded in the United States Patent and Trademark Office at

      Reel _____, Frame _____, or for which a copy thereof is attached.

This collection of information is required by 37 CFR 3.73(b). 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 and 1.14. This collection is estimated to take 12 minutes 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/AIA/96 (08-12)
Approved for use through 01/31/2013. 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.

STATEMENT UNDER 37 CFR 3.73(c)

3. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

4. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

5. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

6. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☑ As required by 37 CFR 3.73(c)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

/Timothy J. Wall/	2/20/2017
Signature	Date
Timothy J. Wall	50,743
Printed or Typed Name	Title or Registration Number

Electronic Acknowledgement Receipt

EFS ID:	28405029
Application Number:	12045729
International Application Number:	
Confirmation Number:	9825
Title of Invention:	APPARATUS AND METHODS FOR MULTIPLANAR OPTICAL DIFFUSERS AND DISPLAY PANELS FOR USING THE SAME
First Named Inventor/Applicant Name:	John Roberts
Customer Number:	65106
Filer:	Timothy Jennings Wall/Cheryl Ramey
Filer Authorized By:	Timothy Jennings Wall
Attorney Docket Number:	5308-824
Receipt Date:	20-FEB-2017
Filing Date:	11-MAR-2008
Time Stamp:	16:13:21
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		5308_000824_373_Statement_and_POA.pdf	439215 2e86e29cfed3f272dd532df1cb760a9656e6aa50	yes	3

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Power of Attorney	3	3
	Assignee showing of ownership per 37 CFR 3.73	1	2
Warnings:			
Information:			
	Total Files Size (in bytes):	439215	

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.

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.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/045,729	05/15/2012	8177382	5308-824	9825

65106 7590 04/25/2012

MYERS BIGEL SIBLEY & SAJOVEC, P.A.
P.O. BOX 37428
RALEIGH, NC 27627

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 278 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):

John Roberts, Grand Rapids, MI;
Chenhua You, Cary, NC;

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 21 of 836

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12045729	ROBERTS ET AL.
	Examiner	**Art Unit**
	JULIE SHALLENBERGER	2885

ORIGINAL		INTERNATIONAL CLASSIFICATION										
CLASS	SUBCLASS	CLAIMED					NON-CLAIMED					
362	97.4	G	0	9	F	13 / 08 (2006.01.01)						

CROSS REFERENCE(S)

CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)				
362	616				

Change(s) applied to document,
/A.E.M./
2/23/2012

☐ 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	1	16	17												
2	2		18												
3	3		19												
4	4	17	20												
5	5	~~18~~ 20	21												
6	6	19	22												
7	7	~~20~~ 18	23												
8	8														
9	9														
10	10														
	11														
11	12														
12	13														
13	14														
14	15														
15	16														

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	20	
/JULIE SHALLENBERGER/ Primary Examiner.Art Unit 2885	1/11/12	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	3

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 22 of 836

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)

65106 7590 01/23/2012
MYERS BIGEL SIBLEY & SAJOVEC, P.A.
P.O. BOX 37428
RALEIGH, NC 27627

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.
12/045,729	03/11/2008	John Roberts	5308-824	9825

TITLE OF INVENTION: APPARATUS AND METHODS FOR MULTIPLANAR OPTICAL DIFFUSERS AND DISPLAY PANELS FOR USING THE SAME

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1740	$300	$0	$2040	04/23/2012

EXAMINER	ART UNIT	CLASS-SUBCLASS
SHALLENBERGER, JULIE A	2885	362-097400

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 Myers Bigel Sibley & Sajovec
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: Cree, Inc.

(B) RESIDENCE: (CITY and STATE OR COUNTRY): Durham, NC

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 50-0220 (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 April 11, 2012

Typed or printed name Timothy J. Wall Registration No. 50,743

This collection of information is required by 37 CFR 1.311. 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 12 minutes 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, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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Petitioner Hisense USA Corporation
Exhibit 1002 - Page 23 of 836

Electronic Patent Application Fee Transmittal

Application Number:	12045729
Filing Date:	11-Mar-2008
Title of Invention:	APPARATUS AND METHODS FOR MULTIPLANAR OPTICAL DIFFUSERS AND DISPLAY PANELS FOR USING THE SAME
First Named Inventor/Applicant Name:	John Roberts
Filer:	Timothy Jennings Wall/Michele McMahan
Attorney Docket Number:	5308-824

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	1740	1740
Publ. Fee- early, voluntary, or normal	1504	1	300	300

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**2040**

Electronic Acknowledgement Receipt

EFS ID:	12525912
Application Number:	12045729
International Application Number:	
Confirmation Number:	9825
Title of Invention:	APPARATUS AND METHODS FOR MULTIPLANAR OPTICAL DIFFUSERS AND DISPLAY PANELS FOR USING THE SAME
First Named Inventor/Applicant Name:	John Roberts
Customer Number:	65106
Filer:	Timothy Jennings Wall/Michele McMahan
Filer Authorized By:	Timothy Jennings Wall
Attorney Docket Number:	5308-824
Receipt Date:	12-APR-2012
Filing Date:	11-MAR-2008
Time Stamp:	13:12:29
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$2040
RAM confirmation Number	15287
Deposit Account	500220
Authorized User	

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)	5308-824-IssueFee.pdf	159414 5ff4cab55d5cdbe13c671fe3ea8f361edf88f383	no	1
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	32059 abaa5396e60102162e9e3f7ef8516aec446b97a8	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	191473		

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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.

UNITED STATES PATENT AND TRADEMARK OFFICE

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

NOTICE OF ALLOWANCE AND FEE(S) DUE

65106 7590 01/23/2012
MYERS BIGEL SIBLEY & SAJOVEC, P.A.
P.O. BOX 37428
RALEIGH, NC 27627

EXAMINER	
SHALLENBERGER, JULIE A	
ART UNIT	PAPER NUMBER
2885	

DATE MAILED: 01/23/2012

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/045,729	03/11/2008	John Roberts	5308-824	9825

TITLE OF INVENTION: APPARATUS AND METHODS FOR MULTIPLANAR OPTICAL DIFFUSERS AND DISPLAY PANELS FOR USING THE SAME

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1740	$300	$0	$2040	04/23/2012

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.

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 28 of 836

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)

65106 7590 01/23/2012
MYERS BIGEL SIBLEY & SAJOVEC, P.A.
P.O. BOX 37428
RALEIGH, NC 27627

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.
12/045,729	03/11/2008	John Roberts	5308-824	9825

TITLE OF INVENTION: APPARATUS AND METHODS FOR MULTIPLANAR OPTICAL DIFFUSERS AND DISPLAY PANELS FOR USING THE SAME

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1740	$300	$0	$2040	04/23/2012

EXAMINER	ART UNIT	CLASS-SUBCLASS
SHALLENBERGER, JULIE A	2885	362-097400

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. _____

This collection of information is required by 37 CFR 1.311. 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 12 minutes 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, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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.

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 29 of 836

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www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/045,729	03/11/2008	John Roberts	5308-824	9825

65106 7590 01/23/2012

MYERS BIGEL SIBLEY & SAJOVEC, P.A.
P.O. BOX 37428
RALEIGH, NC 27627

EXAMINER	
SHALLENBERGER, JULIE A	

ART UNIT	PAPER NUMBER
2885	

DATE MAILED: 01/23/2012

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 278 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 278 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.

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Exhibit 1002 - Page 30 of 836

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.	Applicant(s)	
	12/045,729	ROBERTS ET AL.	
	Examiner	Art Unit	
	JULIE SHALLENBERGER	2885	

-- 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 *12/16/11*.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☒ The allowed claim(s) is/are *1-10,12-17 and 20-23*.

4. ☐ 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.

5. ☐ 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.

6. ☐ 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).

7. ☐ 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 4/7/11 & 9/21/11
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 _____.

/Julie A Shallenberger/
Primary Examiner, Art Unit 2885

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 32 of 836

EXAMINER'S AMENDMENT

An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Timothy Wall on 1/10/12.

The specification is amended as follows:

Claim 14

A method of providing diffused light comprising:

emitting light from a plurality of solid state light emitters arranged in a planar configuration;

receiving the emitted light at a first side of a first diffusion plane that is a first distance from the plurality of solid state light emitters;

transmitting first diffused light from a structured refractive diffuser plate at a second side of the first diffusion plane;

receiving the first diffused light from the first diffusion plane at a first side of a second diffusion plane that is a second distance from the plurality of solid state light emitters; and

transmitting second diffused light from a second side of the second diffusion plane,

wherein the plurality of solid state light emitters comprise a third distance between adjacent ones of the plurality of solid state light emitters, wherein the first distance is a function of the third distance ~~wherein the first distance~~

~~comprises approximately one half of the third distance, and wherein the second distance comprises a value in a range between substantially the third distance value and substantially 1.5 times the third distance value~~.

Claim 20

A display comprising:

a backlighting panel comprising

a plurality of solid state light emitters arranged in a substantially planar configuration including a third distance between adjacent ones of the plurality of solid state light emitters,

a first diffusion plane that is configured to receive light from the plurality of solid state light emitters and to transmit first diffused light, the first diffusion plane including a diffuser plate that is positioned a first distance from the plurality of solid state light;

a second diffusion plane that is configured to receive the first diffused light and to transmit second diffused light

a plurality of diffuser supports configured to support a first diffuser plane structure at a first distance from the plurality of solid state light emitters and to support a second diffuser plane structure at a second distance from the plurality of solid state light emitters, wherein the second distance is greater than the first distance; and

a LCD display panel that is configured to receive the second diffused light and selectively transmit received light as display content,

wherein the first distance is a function of the third distance.

Allowance

Claims 1-10, 12-17, 20-23 are allowed.

Reasons for Allowance

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

The prior art fails to show or teach the lighting device as recited in claims 1, 14, and 20 wherein a display includes a plurality of light sources and a multiplane diffuser, wherein the distance from the light sources to the first diffuser is a first distance and the distance between the light sources is a third distance wherein the first distance is a function of the third distance.

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."

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JULIE SHALLENBERGER whose telephone number is (571)272-7131. The examiner can normally be reached on Monday - Friday 830-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jong-Suk (James) Lee can be reached on 571-272-7044. 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.

/Julie A Shallenberger/
Primary Examiner, Art Unit 2885

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (use as many sheets as necessary)				Complete if Known	
				Application Number	12/045,729
				Filing Date	March 11, 2008
				First Named Inventor	John Roberts
				Art Unit	2885
				Examiner Name	Julie A. Shallenberger
Sheet	D1	of	D1	Attorney Docket Number	5308-824

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.	Document Number Number-Kind Code (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
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.	Foreign Patent Document Country Code, Number, Kind Code (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
	1.	JP 2008-034342 A	02-14-2008	Sony Corp.		A
	2.	JP 2007-076666 A	03-29-2007	Fujifilm Corp.		A

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published	T

Examiner Signature	/Julie Shallenberger/	Date Considered	1/11/12

*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.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /J.S./

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12045729	ROBERTS ET AL.
	Examiner	Art Unit
	JULIE A SHALLENBERGER	2885

SEARCHED			
Class	Subclass	Date	Examiner
362	612,616-622,624-629,634,97.1-97.4	3/12/10	JAS
	updated	8/2/10	JAS
	updated	12/2/10	JAS
	updated	4/20/11	JAS
	updated	1/10/12	JAS

SEARCH NOTES		
Search Notes	Date	Examiner
Consulted Sharon Payne	3/12/10	JAS
inventor search	3/12/10	JAS
fwd/bwd search	3/12/10	JAS
Consulted Isma Negron	8/2/10	JAS

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner
	see EAST	1/10/12	JAS

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (use as many sheets as necessary)				Complete if Known	
				Application Number	12/045,729
				Filing Date	March 11, 2008
				First Named Inventor	John Roberts et al.
				Art Unit	2871
				Examiner Name	David C. Nelms
Sheet	C1	of	C1	Attorney Docket Number	5308-824

U.S. PATENT DOCUMENTS AND APPLICATIONS					
Examiner Initials*	Cite No.	Document Number Number-Kind Code (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
	1.	US- 2006/152931	07-13-2006	Holman, Robert L.	
	2.				
	3.				
		US-			
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FOREIGN PATENT DOCUMENTS						
Examiner Initials*	Cite No.	Foreign Patent Document Country Code, Number, Kind Code (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
	4.					Abstract
	5.					Abstract
	6.					Abstract

NON PATENT LITERATURE DOCUMENTS			
Examiner Initials*	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published	T
	7.	Second Examination Report (7 pages) corresponding to European Application No. 09154919.6; Dated: February 4, 2011.	

iDoc# 786113

Examiner Signature	/Julie Shallenberger/	Date Considered	1/11/12

*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.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /J.S./

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S44	630	362/612,616-622,634,97.1-97.4.ccls. &@pd>"20110420"	US-PGPUB; USPAT; DERWENT	OR	OFF	2012/01/10 11:40

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L2	43	(backlight and diffus$3 same (leds or diodes)).clm.	USPAT; UPAD	OR	OFF	2012/01/11 12:07

1/11/2012 12:08:40 PM
C:\Users\jshallenberger\Documents\EAST\Workspaces\12045729_BL_diffusers.wsp

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Exhibit 1002 - Page 40 of 836

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BIB DATA SHEET

CONFIRMATION NO. 9825

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
12/045,729	03/11/2008 RULE	362	2885	5308-824

APPLICANTS

John Roberts, Grand Rapids, MI;
Chenhua You, Cary, NC;

** CONTINUING DATA **********

** FOREIGN APPLICATIONS **********

** IF REQUIRED, FOREIGN FILING LICENSE GRANTED **
03/19/2008

Foreign Priority claimed ☐ Yes ☑ No 35 USC 119(a-d) conditions met ☐ Yes ☑ No Verified and Acknowledged /JULIE A SHALLENBERGER/ Examiner's Signature	☐ Met after Allowance Initials	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
		MI	5	20	3

ADDRESS

MYERS BIGEL SIBLEY & SAJOVEC, P.A.
P.O. BOX 37428
RALEIGH, NC 27627
UNITED STATES

TITLE

Apparatus and Methods for Multiplanar Optical Diffusers and Display Panels for Using the Same

FILING FEE RECEIVED	FEES: Authority has been given in Paper	
1160	No._____ to charge/credit DEPOSIT ACCOUNT No._____ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12045729	ROBERTS ET AL.
	Examiner	Art Unit
	JULIE SHALLENBERGER	2885

ORIGINAL		INTERNATIONAL CLASSIFICATION														
CLASS	SUBCLASS	CLAIMED					NON-CLAIMED									
362	97.4	G	0	9	F	13 / 08 (2006.01.01)										

CROSS REFERENCE(S)					
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)				
362	616				

☐ 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	1	16	17												
2	2		18												
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11	12														
12	13														
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14	15														
15	16														

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	20	
/JULIE SHALLENBERGER/ Primary Examiner.Art Unit 2885	1/11/12	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	3

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 42 of 836

Attorney Docket No.: 5308-824 **PATENT**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re: John Roberts *et al.* Confirmation No.: 9825
Serial No.: 12/045,729 Group Art Unit: 2885
Filed: March 11, 2008 Examiner: Julie A. Shallenberger
For: APPARATUS AND METHODS FOR MULTIPLANAR OPTICAL DIFFUSERS AND DISPLAY PANELS FOR USING THE SAME

Date: December 16, 2011

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

APPELLANTS' AMENDED BRIEF ON APPEAL UNDER 37 C.F.R. §1.192

This Amended Appeal Brief is filed pursuant to the "Notification of Non-Compliant Appeal Brief" mailed on November 21, 2011, to the to the "Notice of Panel decision from Pre-Appeal Brief Review" mailed on October 12, 2011 and to the "Notice of Appeal to the Board of Patent Appeals and Interferences" mailed July 25, 2011. This Appellants' Amended Brief includes all text from the Appellants' Brief on Appeal of November 11, 2011. In addition, this Appellants' Amended Brief on Appeal includes a revised Summary of the Claimed Subject Matter to include references to page and line numbers in the specification as filed. Accordingly, all objections noted in the Notification of Non-Compliant Appeal Brief have been overcome.

Real Party In Interest

The real party in interest is assignee Cree Inc., Durham, North Carolina.

Related Appeals and Interferences

Appellants are not aware of any appeals or interferences that would be affected by the present appeal.

Status of Claims

Appellants appeal the final rejection of Claims 1-10, 12-17, and 20-23 as set forth in the Final Office Action of April 25, 2011 (hereinafter "Final Office Action"), which stand rejected at least twice. The attached Appendix A presents the claims (Claims 1-10, 12-17, and 20-23) as they currently stand.

Appellants note that Claim 23 appears to be allowable based on the lack of statement of rejection thereof.

Status of Amendments

No claim amendment has been entered in the present case in response to the Final Office Action. All amendments have been entered.

Summary of the Claimed Subject Matter

The present application is directed to a solid state lighting device (Specification, page 1, lines 24-26, Figure 2, 110) that includes a plurality of solid state light emitters (Specification, page 1, lines 25-27, Figure 2, 112) that are configured to emit light The device includes a multiplane light diffuser (Specification, page 1, lines 26-28, Figure 3, 120) having a first diffusion plane (Specification, page 1, lines 26-28, Figure 2, 122) that is a first distance (Specification, page 1, line 31 – page 2, line 1) from the plurality of solid state emitters and a second diffusion plane (Specification, page 1, lines 26-29, Figure 2, 124) that is a second distance (Specification, page 2, lines 2-4) from the plurality of solid state emitters that is different from the first distance. The multiplane light diffuser includes a first side (Specification, page 1, lines 27-30, Figure 3, 141) that corresponds to the first plane and that is configured to receive the light emitted from the plurality of solid state light emitters and a second side (Specification, page 1, lines 29-31, Figure 3, 143) that corresponds to the second plane and that is configured to transmit diffused light.

The multiplane light diffuser includes a diffuser plate (Specification, page 1, lines 29-33, Figure 3, 140) that includes the first side of the multiplane light, the diffuser plate configured to define the first diffusion plane. The solid state emitters comprise a third distance (Specification, page 2, lines 21-22) between adjacent ones of the plurality of solid state light emitters, and wherein the first distance is a function of the third distance (Specification, page 3, lines 23-27).

The present application is further directed to a method of providing diffused light, the method comprising emitting light from a plurality of solid state light emitters arranged in a planar configuration (Specification, page 3, lines 4-6, Figure 7, 300). The emitted light is received at a first side of a first diffusion plane that is a first distance from the plurality of solid state light emitters (Specification, page 3, lines 5-7, Figure 7, 310), first diffused light is

transmitted from a structured refractive diffuser plate at a second side of the first diffusion plane (Specification, page 3, lines 21-22, Figure 7, 320), the first diffused light is received from the first diffusion plane at a first side of a second diffusion plane that is a second distance from the plurality of solid state light emitters (Specification, page 3, lines 8-11, Figure 7, 330), and second diffused light is transmitted from a second side of the second diffusion plane (Specification, page 3, lines 11-12, Figure 7, 340). The plurality of solid state light emitters comprise a third distance between adjacent ones of the plurality of solid state light emitters, wherein the first distance comprises approximately one half of the third distance (Specification, page 3, lines 23-25), and wherein the second distance comprises a value in a range between substantially the third distance value and substantially 1.5 times the third distance value (Specification, page 3, lines 25-27).

The present application is further directed to a display (Specification, page 3, line 28, Figure 2, 100) comprising a backlighting panel (Specification, page 3, line 29, Figure 2, 110). The backlighting panel includes a plurality of solid state light emitters (Specification, page 3, lines 27-28, Figure 2, 112) arranged in a substantially planar configuration, a first diffusion plane (Specification, page 3, lines 31-32, Figure 2, 122) that is configured to receive light from the plurality of solid state light emitters and to transmit first diffused light, the first diffusion plane including a diffuser plate that is positioned a first distance from the plurality of solid state light, and a second diffusion plane (Specification, page 3, lines 32-33, Figure 2, 124) that is configured to receive the first diffused light and to transmit second diffused light. A plurality of diffuser supports (Specification, page 4, lines 1-3, Figures 5B-5D, 164) are configured to support a first diffuser plane structure at a first distance from the plurality of solid state light emitters and to support a second diffuser plane structure at a second distance from the plurality of solid state light emitters, wherein the second distance is greater than the first distance. An LCD display panel (Specification, page 4, lines 4-6, Figure 2, 102) is configured to receive the second diffused light and selectively transmit received light as display content.

Grounds of Rejection to be Reviewed on Appeal

1. Are Claims 1, 2, 4-6, 8, 9, 12, 14, 19 and 20-22 properly rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 7,036,956 to Chou ("Chou") in

view of U.S. Patent Publication No. 2004/0105251 to Yu. ("Yu")? (Final Office Action, page 2.)

2. Are Claims 3, 7, 13, 15 and 16 properly rejected under 35 U.S.C. §103(a) as being unpatentable over Chou, Yu and further in view of U.S. Patent Publication No. 2007/0019419 to Hafuka ("Hafuka")? (Final Office Action, page 7.)

3. Are Claims 10 and 17 properly rejected under 35 U.S.C. §103(a) as being unpatentable over Chou, Yu and further in view of U.S. Patent Publication No. 2004/0136172 to Boyd ("Boyd")? (Final Office Action, page 9.)

Arguments

The Section 103 Rejections

Claims 1-10, 12-17, and 20-22 stand rejected as allegedly being obvious under 35 U.S.C. §103. A determination under §103 that an invention would have been obvious to someone of ordinary skill in the art is a conclusion of law based on fact. *Panduit Corp. v. Dennison Mfg. Co.* 810 F.2d 1593, 1 U.S.P.Q.2d 1593 (Fed. Cir. 1987), *cert. denied*, 107 S.Ct. 2187. After the involved facts are determined, the decision maker must then make the legal determination of whether the claimed invention as a whole would have been obvious to a person having ordinary skill in the art at the time the invention was unknown, and just before it was made. *Id.* at 1596. The United States Patent and Trademark Office (USPTO) has the initial burden under §103 to establish a *prima facie* case of obviousness. *In re Fine*, 837 F.2d 1071, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988).

To establish a *prima facie* case of obviousness under 35 U.S.C. § 103, the prior art reference or references, when combined, must teach or suggest all the recitations of the claims, and there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. A patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art. *KSR Int'l Co. v. Teleflex Inc.,* 550 U. S. 1, 15 (2007). A corollary principle is that, when the prior art teaches away from combining certain known elements, discovery of a successful means of combining them is more likely to be unobvious. *Id.* at 12. If a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill. *Id.* at 13. A Court must ask whether the improvement is more than the predictable use of prior art elements according to their established functions. *Id.* at 13. When it is necessary for a Court to look at interrelated teachings of multiple patents, the Court must determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue. *Id.* at 14.

Claims 1, 14 and 20 are Patentable

Independent Claim 1 stands rejected under 35 U.S.C. §103(a) as unpatentable over Chou in view of Yu. (Final Office Action, page 2.) Appellants respectfully traverse the

rejection on the basis that Chou and Yu, alone or in combination, do not disclose or suggest all of the recitations of Claim 1. For example, Claim 1 recites:

> A solid state lighting device, comprising:
> a plurality of solid state light emitters that are configured to emit light; and
> a multiplane light diffuser including a first diffusion plane that is a first distance from the plurality of solid state emitters and a second diffusion plane that is a second distance from the plurality of solid state emitters that is different from the first distance, the multiplane light diffuser including first side that corresponds to the first plane and that is configured to receive the light emitted from the plurality of solid state light emitters and a second side that corresponds to the second plane and that is configured to transmit diffused light,
> wherein the multiplane light diffuser comprises a diffuser plate that includes the first side of the multiplane light, the diffuser plate configured to define the first diffusion plane, and
> wherein the plurality of solid state emitters comprise a third distance between adjacent ones of the plurality of solid state light emitters, and wherein the first distance is a function of the third distance.

As Claim 1 was amended to include general recitations that correspond to specific recitations of Claim 8, the rejection of which will be addressed as applied to Claim 1. Regarding Claim 8, the Office Action states that Chou teaches "the second distance being about the same as the third distance (see fig. 3 and 4)." (Final Office Action, page 4.) Appellants respectfully disagree. The Final Office Action appears to rely on illustrated dimensions in the cited figures of Chou as providing the alleged teachings. Such reliance is improper. It is well established that absent any written description in the specification of quantitative values, arguments based on the measurement of a drawing are of little value. (*See, e.g., Application of Wright*, 569 F.2d 1124, 193 U.S.P.Q. 332, 335 (C.C.P.A. 1977). Additionally, patent drawings do not define the precise proportions of the elements and may not be relied upon to show particular sizes if the specification is completely silent on the issue. (*See, e.g., Nystrom v. TREX Co., Inc.*, 424 F.3d 1136, 76 U.S.P.Q.2d 1481, 1490 (Fed. Cir. 2005). As further evidence that the Final Office Action is relying on the figures for dimensional recitations, the Final Office Action concedes that Chou "lacks explicit (i.e. written) teaching of ...a third distance between adjacent ones of the plurality of solid state light emitters wherein the first distance comprises approximately one half the third distance." (Final Office Action, page 4.) As such, Chou does not disclose of suggest what is alleged by

the Final Office Action. As Chou does not disclose dimensional values, then Chou necessarily does not disclose or suggest relationships between various ones of the dimensions, as disclosed in Claim 1. Accordingly, Chou necessarily lacks the teachings that "the first distance is a function of the third distance," as recited in Claim 1. The Final Office Action alleges that it would have been obvious to add more light emitters such that the first distance comprises approximately one half the third distance in order to increase the light output while providing enough air gap for refraction through diffusing mediums and that spacing light sources together is considered well within the level of one of ordinary skill in the art in order to obtain a desired level of light output. (Office Action, pages 4-5.) This statement is erroneous. The above recitations of Claim 1 are directed to the relative distances between components of the device and are not directed to adding light emitters, as the Final Office Action appears to contort. Moreover, using the logic asserted by the Final Office Action, there is no motivation to limit the number of light emitters (or the spacing therebetween) corresponding to any other property of the device. For example, if one of skill in the art would be motivated to add light emitters, there is no suggestion other than hindsight based reasoning provided by the teachings of Appellants' specification as to a practical limit of this approach.

Further, the Final Office Action states that one would have been motivated to make the first distance approximately one half the third distance to optimize the light efficiency and size of the display device. Appellants respectfully submit that, absent the roadmap provided by Appellants' specification, there is no suggestion to one of ordinary skill in the art that the relative dimensions as recited in Claim 1 would achieve the alleged motivation of light efficiency. In this regard, the alleged motivation does not provide a reason for altering the prior art. As is well-established law, the standard for patentability does not depend on a showing of advantages or improvements, but rather obviousness. In this regard, as the Final Office Action has not provided a sufficient reason for finding the alteration from a ratio employed in the prior art in the direction and manner claimed, the rejection is untenable. (*See, e.g., Ex Parte Parthasarathy and Ciapetta*, 174 U.S.P.Q. 63, 1972 WL 17748 (Pat. & Trademark Office Bd. App. 1972). Appellants respectfully note that as the alleged reason for altering a ratio employed in the prior art is untenable, the obviousness allegation is improper.

Additionally, the Final Office Action does not allege and Yu does not provide the teachings that are missing from Chou. Accordingly, Claim 1 is patentable over Chou and Yu.

Additionally, Claim 14 includes recitations that are patentable over Chou and Yu for at least similar reasons. For example, Claim 14 recites, in part, "wherein the first distance comprises approximately one half of the third distance, and wherein the second distance comprises a value in a range between substantially the third distance value and substantially 1.5 times the third distance value." As discussed above, reading non-disclosed dimensional properties into the references is impermissible. Claim 20 includes similar recitations and is thus patentable over Chou and Yu for at least the same reasons.

In view of the above, the rejection of independent Claims 1, 14 and 20 under 35 U.S.C. §103 based on Chou and Yu is clearly erroneous. As such, Appellants respectfully submit that Claims 1, 14 and 20 are patentable over Chou and Yu for at least these reasons and respectfully request reversal of the rejection of Claims 1, 14 and 20.

In addition, Appellants respectfully submit that dependent Claims 2, 4-6, 8, 9, 12, 19, 21 and 22 are patentable over Chou and Yu at least by virtue of the patentability of independent Claims 1, 14 and 20, from which they depend and respectfully requests reversal of the rejections of Claims 2, 4-6, 8, 9, 12, 19, 21 and 22.

Claims 3, 7, 13, 15 and 16 are patentable

Claims 3, 7, 13, 15 and 16 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Chou, Yu and in further view of Hafuka. Claims 3, 7 and 13 depend from independent Claim 1. Independent Claim 1 is patentable for at least the reasons discussed above. Accordingly, Claims 3, 7 and 13 are patentable based on the failure of the Examiner to establish a prima facie case of obviousness for Claim 1 under 35 U.S.C. §103 as set forth above. Moreover, the additional secondary reference, Hafuka, fails to rectify the deficiencies of Chou and Yu with respect to independent Claim 1. In view of the above, Appellants respectfully request reversal of the rejections of Claims 3, 7 and 13.

Claims 15 and 16 depend from independent Claim 14. Independent Claim 14 is patentable for at least the reasons discussed above. Accordingly, Claims 15 and 16 are patentable based on the failure of the Examiner to establish a prima facie case of obviousness for Claim 14 under 35 U.S.C. §103 as set forth above. Moreover, the additional secondary

reference, Hafuka, fails to rectify the deficiencies of Chou and Yu with respect to independent Claim 1. In view of the above, Appellants respectfully request reversal of the rejections of Claims 15 and 16.

Claims 3, 7, 13, 15 and 16 are patentable

Claims 10 and 17 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Chou, Yu and in further view of Boyd. Claim 10 depends from independent Claim 1. Independent Claim 1 is patentable for at least the reasons discussed above. Accordingly, Claim 10 is patentable based on the failure of the Examiner to establish a prima facie case of obviousness for Claim 1 under 35 U.S.C. §103 as set forth above. Moreover, the additional secondary reference, Boyd, fails to rectify the deficiencies of Chou and Yu with respect to independent Claim 1. In view of the above, Appellants respectfully request reversal of the rejection of Claim 10.

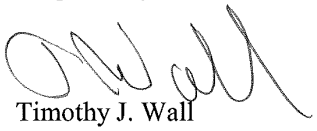
Claim 17 depends from independent Claim 14. Independent Claim 14 is patentable for at least the reasons discussed above. Accordingly, Claim 17 is patentable based on the failure of the Examiner to establish a prima facie case of obviousness for Claim 14 under 35 U.S.C. §103 as set forth above. Moreover, the additional secondary reference, Boyd, fails to rectify the deficiencies of Chou and Yu with respect to independent Claim 14. In view of the above, Appellants respectfully request reversal of the rejection of Claim 17.

Conclusion

In light of the above discussion, Appellants submit that pending Claims 46-51 and 53-57 are patentable over the cited references and, therefore, request reversal of the rejections of those claims and passing of the application to issue.

Any additional fees believed to be due in connection with this paper may be charged to Deposit Account No. 50-0220.

Respectfully submitted,

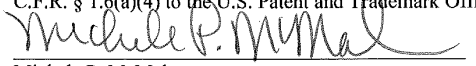


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CERTIFICATION OF TRANSMISSION

I hereby certify that this correspondence is being transmitted via the Office electronic filing system in accordance with 37 C.F.R. § 1.6(a)(4) to the U.S. Patent and Trademark Office on December 16, 2011.



Michele P. McMahan

APPENDIX A – CLAIMS

1. (Previously presented) A solid state lighting device, comprising:

a plurality of solid state light emitters that are configured to emit light; and

a multiplane light diffuser including a first diffusion plane that is a first distance from the plurality of solid state emitters and a second diffusion plane that is a second distance from the plurality of solid state emitters that is different from the first distance, the multiplane light diffuser including first side that corresponds to the first plane and that is configured to receive the light emitted from the plurality of solid state light emitters and a second side that corresponds to the second plane and that is configured to transmit diffused light,

wherein the multiplane light diffuser comprises a diffuser plate that includes the first side of the multiplane light, the diffuser plate configured to define the first diffusion plane, and

wherein the plurality of solid state emitters comprise a third distance between adjacent ones of the plurality of solid state light emitters, and wherein the first distance is a function of the third distance.

2. (Previously presented) The device of Claim 1, wherein the multiplane light diffuser comprises:

a diffuser sheet that includes the second side of the multiplane light diffuser and is positioned ~~a~~the second distance from the plurality of solid state light emitters, the diffuser sheet configured to define the second diffusion plane.

3. (Original) The device of Claim 2, wherein the diffuser sheet comprises:

a substantially transparent plate; and

a diffuser film supported by the substantially transparent plate.

4. (Original) The device of Claim 2, comprising a plurality of diffuser supports, wherein the diffuser supports comprise:

a proximal end that is configured to be positioned proximate the plurality of solid state light emitters; and

a distal end that is configured to support the diffuser sheet.

5. (Original) The device of Claim 4, wherein the diffuser plate comprises a plurality of diffuser plate holes that are configured to receive the plurality of diffuser supports.

6. (Original) The device of Claim 4, wherein the plurality of diffuser supports comprise steps for supporting, at the first distance from the plurality of solid state light emitters, the diffuser plate via the plurality of holes.

7. (Original) The device of Claim 2, wherein the diffuser sheet comprises a diffuser film, a brightness enhancing film, a polarizing film and a substantially clear plate configured to support the diffuser film, the brightness enhancing film, the polarizing film.

8. (Original) The device of Claim 2, wherein the plurality of solid state emitters comprise a third distance between adjacent ones of the plurality of solid state light emitters, and wherein the first distance comprises approximately one half the third distance.

9. (Previously presented) The device of Claim 2, wherein the second distance comprises a distance in a range between the third distance and 1.5 times the third distance.

10. (Previously presented) The device of Claim 1, wherein the diffuser plate comprises a plate including a light filter color.

11. (Canceled)

12. (Original) The device of Claim 1, further comprising means for transmitting first diffused light from the first diffusion plane to the second diffusion plane.

13. (Previously presented) The device of Claim 1, wherein the multiplane light diffuser comprises:

the first diffuser plate positioned at a first distance from the plurality of solid state emitters;

a second diffuser plate positioned at a second distance from the plurality of solid state emitters; and

a diffuser sheet supported by the second diffuser plate,

wherein the first distance is less than the second distance.

14. (Previously presented) A method of providing diffused light comprising:

emitting light from a plurality of solid state light emitters arranged in a planar configuration;

receiving the emitted light at a first side of a first diffusion plane that is a first distance from the plurality of solid state light emitters;

transmitting first diffused light from a structured refractive diffuser plate at a second side of the first diffusion plane;

receiving the first diffused light from the first diffusion plane at a first side of a second diffusion plane that is a second distance from the plurality of solid state light emitters; and

transmitting second diffused light from a second side of the second diffusion plane,

wherein the plurality of solid state light emitters comprise a third distance between adjacent ones of the plurality of solid state light emitters, wherein the first distance comprises approximately one half of the third distance, and wherein the second distance comprises a value in a range between substantially the third distance value and substantially 1.5 times the third distance value.

15. (Original) The method of Claim 14, wherein transmitting the first diffused light comprises transmitting the first diffused light from a diffuser plate and wherein transmitting the second diffused light comprises transmitting the second diffused light from a diffuser sheet that is supported by a substantially transparent sheet.

16. (Original) The method of Claim 14, wherein transmitting the first diffused light comprises transmitting light from a first diffuser plate and wherein transmitting the

second diffused light comprises transmitting light from a diffuser sheet that is supported by a second diffuser plate.

17. (Previously presented) The method of Claim 14, wherein transmitting the first diffused light comprises transmitting scattered diffusion light from a plate including a light filter color.

18-19. (Canceled)

20. (Previously presented) A display comprising:

a backlighting panel comprising

a plurality of solid state light emitters arranged in a substantially planar configuration,

a first diffusion plane that is configured to receive light from the plurality of solid state light emitters and to transmit first diffused light, the first diffusion plane including a diffuser plate that is positioned a first distance from the plurality of solid state light;

a second diffusion plane that is configured to receive the first diffused light and to transmit second diffused light

a plurality of diffuser supports configured to support a first diffuser plane structure at a first distance from the plurality of solid state light emitters and to support a second diffuser plane structure at a second distance from the plurality of solid state light emitters, wherein the second distance is greater than the first distance; and

a LCD display panel that is configured to receive the second diffused light and selectively transmit received light as display content.

21. (Previously presented) The device of Claim 23, wherein ones of the plurality of extrusion peaks include a peak angle in a range of about 120 degrees to 170 degrees.

22. (Previously presented) The device of Claim 23, wherein the structured refractive diffuser comprises a plurality of crossed linear prismatic lenselets.

23. (Previously presented) The device of Claim 1, wherein the diffuser plate comprises a structured refractive diffuser that includes a plurality of extrusion peaks that are divided by a plurality of extrusion grooves.

APPENDIX B – EVIDENCE APPENDIX

(NONE)

APPENDIX C – RELATED PROCEEDINGS

(NONE)

Electronic Acknowledgement Receipt

EFS ID:	11638409
Application Number:	12045729
International Application Number:	
Confirmation Number:	9825
Title of Invention:	Apparatus and Methods for Multiplanar Optical Diffusers and Display Panels for Using the Same
First Named Inventor/Applicant Name:	John Roberts
Customer Number:	65106
Filer:	Timothy Jennings Wall/Michele McMahan
Filer Authorized By:	Timothy Jennings Wall
Attorney Docket Number:	5308-824
Receipt Date:	16-DEC-2011
Filing Date:	11-MAR-2008
Time Stamp:	13:29:53
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	Supplemental Appeal Brief	5308-824-Amended-AppealBrief.pdf	1354083 5e7b2df14e74c567c4cc03142bd1d0a982fad4f1	no	17
Warnings:					
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New International Application Filed with the USPTO as a Receiving Office
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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/045,729	03/11/2008	John Roberts	5308-824

CONFIRMATION NO. 9825

65106
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POA ACCEPTANCE LETTER

OC000000051367640

Date Mailed: 12/13/2011

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 12/03/2011.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

/gbien-aime/

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Application Number	12/045,729
Filing Date	March 11, 2008
First Named Inventor	John Roberts
Title	Apparatus and Methods for Multiplanar ...
Art Unit	2885
Examiner Name	SHALLENBERGER, JULIE A
Attorney Docket Number	5308-824

I hereby revoke all previous powers of attorney given in the above-identified application.

☒ A Power of Attorney is submitted herewith.

OR

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I am the:

☐ Applicant/inventor.

OR

☒ Assignee of record of the entire interest. See 37 CFR 3.71.
Statement under 37 CFR 3.73(b) (Form PTO/SB/96) submitted herewith or filed on _____

SIGNATURE of Applicant or Assignee of Record

Signature		Date	11/30/11
Name	Julio Garceran	Telephone	
Title and Company	Chief Intellectual Property Counsel - Cree, Inc.		

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below*.

☐ *Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. 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 and 1.14. This collection is estimated to take 3 minutes 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.**

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STATEMENT UNDER 37 CFR 3.73(b)

Applicant/Patent Owner: John Roberts et al.

Application No./Patent No.: 12/045,729 Filed/Issue Date: March 11, 2008

Titled:
Apparatus and Methods for Multiplanar Optical Diffusers and Display Panels for Using the Same

Cree, Inc., a Corporation
(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.

states that it is:

1. [X] the assignee of the entire right, title, and interest in;

2. [ ] an assignee of less than the entire right, title, and interest in
(The extent (by percentage) of its ownership interest is _____ %); or

3. [ ] the assignee of an undivided interest in the entirety of (a complete assignment from one of the joint inventors was made)

the patent application/patent identified above, by virtue of either:

A. [X] An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel 020711, Frame 0056, or for which a copy therefore is attached.

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[X] As required by 37 CFR 3.73(b)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (*i.e.*, a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

Signature — Date: 11/30/11

Julio Garceran — Printed or Typed Name

Chief IP Counsel — Title

This collection of information is required by 37 CFR 3.73(b). 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 and 1.14. This collection is estimated to take 12 minutes 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.**

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Electronic Acknowledgement Receipt

EFS ID:	11537755
Application Number:	12045729
International Application Number:	
Confirmation Number:	9825
Title of Invention:	Apparatus and Methods for Multiplanar Optical Diffusers and Display Panels for Using the Same
First Named Inventor/Applicant Name:	John Roberts
Customer Number:	65106
Filer:	David C. Hall/Jessica Blischok
Filer Authorized By:	David C. Hall
Attorney Docket Number:	5308-824
Receipt Date:	03-DEC-2011
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Application Type:	Utility under 35 USC 111(a)

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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		5308-824_POA_and_CFR_373.pdf	641506 d6ec5741e9e3fb8efb97435369052848c3f069dc	yes	2

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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.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/045,729	03/11/2008	John Roberts	5308-824	9825

65106 7590 11/21/2011

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EXAMINER	
ART UNIT	PAPER NUMBER

DATE MAILED: 11/21/2011

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

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 67 of 836

Notification of Non-Compliant Appeal Brief (37 CFR 41.37)	Application No. 12/045,729	Applicant(s) Roberts et al	
	Examiner Shallenberger, Julie	Art Unit 2885	

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

The Appeal Brief filed on *11 November 2011* is defective for failure to comply with one or more provisions of 37 CFR 41.37.

To avoid dismissal of the appeal, applicant must file anamended brief or other appropriate correction (see MPEP 1205.03) within **ONE MONTH or THIRTY DAYS** from the mailing date of this Notification, whichever is longer. **EXTENSIONS OF THIS TIME PERIOD MAY BE GRANTED UNDER 37 CFR 1.136.**

1. ☐ The brief does not contain the items required under 37 CFR 41.37(c), or the items are not under the proper heading or in the proper order.

2. ☐ The brief does not contain a statement of the status of all claims, (e.g., rejected, allowed, withdrawn, objected to, canceled), or does not identify the appealed claims (37 CFR 41.37(c)(1)(iii)).

3. ☐ At least one amendment has been filed subsequent to the final rejection, and the brief does not contain a statement of the status of each such amendment (37 CFR 41.37(c)(1)(iv)).

4. ☒ (a) The brief does not contain a concise explanation of the subject matter defined in each of the independent claims involved in the appeal, referring to the specification by page and line number and to the drawings, if any, by reference characters; and/or (b) the brief fails to: (1) identify, for each independent claim involved in the appeal and for each dependent claim argued separately, every means plus function and step plus function under 35 U.S.C. 112, sixth paragraph, and/or (2) set forth the structure, material, or acts described in the specification as corresponding to each claimed function with reference to the specification by page and line number, and to the drawings, if any, by reference characters (37 CFR 41.37(c)(1)(v)).

5. ☐ The brief does not contain a concise statement of each ground of rejection presented for review (37 CFR 41.37(c)(1)(vi))

6. ☐ The brief does not present an argument under a separate heading for each ground of rejection on appeal (37 CFR 41.37(c)(1)(vii)).

7. ☐ The brief does not contain a correct copy of the appealed claims as an appendix thereto (37 CFR 41.37(c)(1)(viii)).

8. ☐ The brief does not contain copies of the evidence submitted under 37 CFR 1.130, 1.131, or 1.132 or of any other evidence entered by the examiner **and relied upon by appellant in the appeal**, along with a statement setting forth where in the record that evidence was entered by the examiner, as an appendix thereto (37 CFR 41.37(c)(1)(ix)).

9. ☐ The brief does not contain copies of the decisions rendered by a court or the Board in the proceeding identified in the Related Appeals and Interferences section of the brief as an appendix thereto (37 CFR 41.37(c)(1)(x)).

10. ☒ Other (including any explanation in support of the above items):

The summary claim subject matter (each independent claim) should be mapped to the Specification seperately by page and line number the entire brief is not required..

J. Gunter-Riley, Paralegal
571-272-7929
Supervisory Paralegal: Quita Gould
571-272-9797

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 68 of 836

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 69 of 836

Attorney Docket No.: 5308-824 **PATENT**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re: John Roberts *et al.* Confirmation No.: 9825
Serial No.: 12/045,729 Group Art Unit: 2885
Filed: March 11, 2008 Examiner: Julie A. Shallenberger
For: APPARATUS AND METHODS FOR MULTIPLANAR OPTICAL DIFFUSERS AND DISPLAY PANELS FOR USING THE SAME

Date: November 11, 2011

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APPELLANTS' BRIEF ON APPEAL UNDER 37 C.F.R. §1.192

This Appeal Brief is filed pursuant to the "Notice of Panel decision from Pre-Appeal Brief Review" mailed on October 12, 2011 and to the "Notice of Appeal to the Board of Patent Appeals and Interferences" mailed July 25, 2011.

Real Party In Interest

The real party in interest is assignee Cree Inc., Durham, North Carolina.

Related Appeals and Interferences

Appellants are not aware of any appeals or interferences that would be affected by the present appeal.

Status of Claims

Appellants appeal the final rejection of Claims 1-10, 12-17, and 20-23 as set forth in the Final Office Action of April 25, 2011 (hereinafter "Final Office Action"), which stand rejected at least twice. The attached Appendix A presents the claims (Claims 1-10, 12-17, and 20-23) as they currently stand.

Appellants note that Claim 23 appears to be allowable based on the lack of statement of rejection thereof.

Status of Amendments

No claim amendment has been entered in the present case in response to the Final Office Action. All amendments have been entered.

Summary of the Claimed Subject Matter

The present application is directed to a solid state lighting device (Specification, ¶ 0003, Figure 2, 110) that includes a plurality of solid state light emitters (Specification, ¶ 0003, Figure 2, 112) that are configured to emit light The device includes a multiplane light diffuser (Specification, ¶ 0003, Figure 3, 120) having a first diffusion plane (Specification, ¶ 0003, Figure 2, 122) that is a first distance (Specification, ¶ 0004) from the plurality of solid state emitters and a second diffusion plane (Specification, ¶ 0003, Figure 2, 124) that is a second distance (Specification, ¶ 0004) from the plurality of solid state emitters that is different from the first distance. The multiplane light diffuser includes a first side (Specification, ¶ 0003, Figure 3, 141) that corresponds to the first plane and that is configured to receive the light emitted from the plurality of solid state light emitters and a second side (Specification, ¶ 0003, Figure 3, 143) that corresponds to the second plane and that is configured to transmit diffused light.

The multiplane light diffuser includes a diffuser plate (Specification, ¶ 0004, Figure 3, 140) that includes the first side of the multiplane light, the diffuser plate configured to define the first diffusion plane. The solid state emitters comprise a third distance (Specification, ¶ 0007) between adjacent ones of the plurality of solid state light emitters, and wherein the first distance is a function of the third distance (Specification, ¶ 0013).

The present application is further directed to a method of providing diffused light, the method comprising emitting light from a plurality of solid state light emitters arranged in a planar configuration (Specification, ¶ 0010, Figure 7, 300). The emitted light is received at a first side of a first diffusion plane that is a first distance from the plurality of solid state light emitters (Specification, ¶ 0010, Figure 7, 310), first diffused light is transmitted from a structured refractive diffuser plate at a second side of the first diffusion plane (Specification, ¶ 0010, Figure 7, 320), the first diffused light is received from the first diffusion plane at a first side of a second diffusion plane that is a second distance from the plurality of solid state light emitters (Specification, ¶ 0010, Figure 7, 330), and second diffused light is transmitted from a second side of the second diffusion plane (Specification, ¶ 0010, Figure 7, 340). The plurality of solid state light emitters comprise a third distance between adjacent ones of the plurality of solid state light emitters, wherein the first distance comprises approximately one

half of the third distance (Specification, ¶ 0013), and wherein the second distance comprises a value in a range between substantially the third distance value and substantially 1.5 times the third distance value (Specification, ¶ 0013).

The present application is further directed to a display (Specification, ¶ 0014, Figure 2, 100) comprising a backlighting panel (Specification, ¶ 0014, Figure 2, 110). The backlighting panel includes a plurality of solid state light emitters (Specification, ¶ 0014, Figure 2, 112) arranged in a substantially planar configuration, a first diffusion plane (Specification, ¶ 0014, Figure 2, 122) that is configured to receive light from the plurality of solid state light emitters and to transmit first diffused light, the first diffusion plane including a diffuser plate that is positioned a first distance from the plurality of solid state light, and a second diffusion plane (Specification, ¶ 0014, Figure 2, 124) that is configured to receive the first diffused light and to transmit second diffused light. A plurality of diffuser supports (Specification, ¶ 0014, Figures 5B-5D, 164) are configured to support a first diffuser plane structure at a first distance from the plurality of solid state light emitters and to support a second diffuser plane structure at a second distance from the plurality of solid state light emitters, wherein the second distance is greater than the first distance. An LCD display panel (Specification, ¶ 0014, Figure 2, 102) is configured to receive the second diffused light and selectively transmit received light as display content.

Grounds of Rejection to be Reviewed on Appeal

1. Are Claims 1, 2, 4-6, 8, 9, 12, 14, 19 and 20-22 properly rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 7,036,956 to Chou ("Chou") in view of U.S. Patent Publication No. 2004/0105251 to Yu. ("Yu")? (Final Office Action, page 2.)

2. Are Claims 3, 7, 13, 15 and 16 properly rejected under 35 U.S.C. §103(a) as being unpatentable over Chou, Yu and further in view of U.S. Patent Publication No. 2007/0019419 to Hafuka ("Hafuka")? (Final Office Action, page 7.)

3. Are Claims 10 and 17 properly rejected under 35 U.S.C. §103(a) as being unpatentable over Chou, Yu and further in view of U.S. Patent Publication No. 2004/0136172 to Boyd ("Boyd")? (Final Office Action, page 9.)

Arguments

The Section 103 Rejections

Claims 1-10, 12-17, and 20-22 stand rejected as allegedly being obvious under 35 U.S.C. §103. A determination under §103 that an invention would have been obvious to someone of ordinary skill in the art is a conclusion of law based on fact. *Panduit Corp. v. Dennison Mfg. Co.* 810 F.2d 1593, 1 U.S.P.Q.2d 1593 (Fed. Cir. 1987), *cert. denied*, 107 S.Ct. 2187. After the involved facts are determined, the decision maker must then make the legal determination of whether the claimed invention as a whole would have been obvious to a person having ordinary skill in the art at the time the invention was unknown, and just before it was made. *Id.* at 1596. The United States Patent and Trademark Office (USPTO) has the initial burden under §103 to establish a *prima facie* case of obviousness. *In re Fine*, 837 F.2d 1071, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988).

To establish a *prima facie* case of obviousness under 35 U.S.C. § 103, the prior art reference or references, when combined, must teach or suggest all the recitations of the claims, and there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. A patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art. *KSR Int'l Co. v. Teleflex Inc.,* 550 U. S. 1, 15 (2007). A corollary principle is that, when the prior art teaches away from combining certain known elements, discovery of a successful means of combining them is more likely to be unobvious. *Id.* at 12. If a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill. *Id.* at 13. A Court must ask whether the improvement is more than the predictable use of prior art elements according to their established functions. *Id.* at 13. When it is necessary for a Court to look at interrelated teachings of multiple patents, the Court must determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue. *Id.* at 14.

Claims 1, 14 and 20 are Patentable

Independent Claim 1 stands rejected under 35 U.S.C. §103(a) as unpatentable over Chou in view of Yu. (Final Office Action, page 2.) Appellants respectfully traverse the

rejection on the basis that Chou and Yu, alone or in combination, do not disclose or suggest all of the recitations of Claim 1. For example, Claim 1 recites:

> A solid state lighting device, comprising:
> a plurality of solid state light emitters that are configured to emit light; and
> a multiplane light diffuser including a first diffusion plane that is a first distance from the plurality of solid state emitters and a second diffusion plane that is a second distance from the plurality of solid state emitters that is different from the first distance, the multiplane light diffuser including first side that corresponds to the first plane and that is configured to receive the light emitted from the plurality of solid state light emitters and a second side that corresponds to the second plane and that is configured to transmit diffused light,
> wherein the multiplane light diffuser comprises a diffuser plate that includes the first side of the multiplane light, the diffuser plate configured to define the first diffusion plane, and
> wherein the plurality of solid state emitters comprise a third distance between adjacent ones of the plurality of solid state light emitters, and wherein the first distance is a function of the third distance.

As Claim 1 was amended to include general recitations that correspond to specific recitations of Claim 8, the rejection of which will be addressed as applied to Claim 1. Regarding Claim 8, the Office Action states that Chou teaches "the second distance being about the same as the third distance (see fig. 3 and 4)." (Final Office Action, page 4.) Appellants respectfully disagree. The Final Office Action appears to rely on illustrated dimensions in the cited figures of Chou as providing the alleged teachings. Such reliance is improper. It is well established that absent any written description in the specification of quantitative values, arguments based on the measurement of a drawing are of little value. (*See, e.g., Application of Wright*, 569 F.2d 1124, 193 U.S.P.Q. 332, 335 (C.C.P.A. 1977). Additionally, patent drawings do not define the precise proportions of the elements and may not be relied upon to show particular sizes if the specification is completely silent on the issue. (*See, e.g., Nystrom v. TREX Co., Inc.*, 424 F.3d 1136, 76 U.S.P.Q.2d 1481, 1490 (Fed. Cir. 2005). As further evidence that the Final Office Action is relying on the figures for dimensional recitations, the Final Office Action concedes that Chou "lacks explicit (i.e. written) teaching of ...a third distance between adjacent ones of the plurality of solid state light emitters wherein the first distance comprises approximately one half the third distance." (Final Office Action, page 4.) As such, Chou does not disclose of suggest what is alleged by

the Final Office Action. As Chou does not disclose dimensional values, then Chou necessarily does not disclose or suggest relationships between various ones of the dimensions, as disclosed in Claim 1. Accordingly, Chou necessarily lacks the teachings that "the first distance is a function of the third distance," as recited in Claim 1. The Final Office Action alleges that it would have been obvious to add more light emitters such that the first distance comprises approximately one half the third distance in order to increase the light output while providing enough air gap for refraction through diffusing mediums and that spacing light sources together is considered well within the level of one of ordinary skill in the art in order to obtain a desired level of light output. (Office Action, pages 4-5.) This statement is erroneous. The above recitations of Claim 1 are directed to the relative distances between components of the device and are not directed to adding light emitters, as the Final Office Action appears to contort. Moreover, using the logic asserted by the Final Office Action, there is no motivation to limit the number of light emitters (or the spacing therebetween) corresponding to any other property of the device. For example, if one of skill in the art would be motivated to add light emitters, there is no suggestion other than hindsight based reasoning provided by the teachings of Appellants' specification as to a practical limit of this approach.

Further, the Final Office Action states that one would have been motivated to make the first distance approximately one half the third distance to optimize the light efficiency and size of the display device. Appellants respectfully submit that, absent the roadmap provided by Appellants' specification, there is no suggestion to one of ordinary skill in the art that the relative dimensions as recited in Claim 1 would achieve the alleged motivation of light efficiency. In this regard, the alleged motivation does not provide a reason for altering the prior art. As is well-established law, the standard for patentability does not depend on a showing of advantages or improvements, but rather obviousness. In this regard, as the Final Office Action has not provided a sufficient reason for finding the alteration from a ratio employed in the prior art in the direction and manner claimed, the rejection is untenable. (*See, e.g., Ex Parte Parthasarathy and Ciapetta*, 174 U.S.P.Q. 63, 1972 WL 17748 (Pat. & Trademark Office Bd. App. 1972). Appellants respectfully note that as the alleged reason for altering a ratio employed in the prior art is untenable, the obviousness allegation is improper.

Additionally, the Final Office Action does not allege and Yu does not provide the teachings that are missing from Chou. Accordingly, Claim 1 is patentable over Chou and Yu.

Additionally, Claim 14 includes recitations that are patentable over Chou and Yu for at least similar reasons. For example, Claim 14 recites, in part, "wherein the first distance comprises approximately one half of the third distance, and wherein the second distance comprises a value in a range between substantially the third distance value and substantially 1.5 times the third distance value." As discussed above, reading non-disclosed dimensional properties into the references is impermissible. Claim 20 includes similar recitations and is thus patentable over Chou and Yu for at least the same reasons.

In view of the above, the rejection of independent Claims 1, 14 and 20 under 35 U.S.C. §103 based on Chou and Yu is clearly erroneous. As such, Appellants respectfully submit that Claims 1, 14 and 20 are patentable over Chou and Yu for at least these reasons and respectfully request reversal of the rejection of Claims 1, 14 and 20.

In addition, Appellants respectfully submit that dependent Claims 2, 4-6, 8, 9, 12, 19, 21 and 22 are patentable over Chou and Yu at least by virtue of the patentability of independent Claims 1, 14 and 20, from which they depend and respectfully requests reversal of the rejections of Claims 2, 4-6, 8, 9, 12, 19, 21 and 22.

Claims 3, 7, 13, 15 and 16 are patentable

Claims 3, 7, 13, 15 and 16 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Chou, Yu and in further view of Hafuka. Claims 3, 7 and 13 depend from independent Claim 1. Independent Claim 1 is patentable for at least the reasons discussed above. Accordingly, Claims 3, 7 and 13 are patentable based on the failure of the Examiner to establish a prima facie case of obviousness for Claim 1 under 35 U.S.C. §103 as set forth above. Moreover, the additional secondary reference, Hafuka, fails to rectify the deficiencies of Chou and Yu with respect to independent Claim 1. In view of the above, Appellants respectfully request reversal of the rejections of Claims 3, 7 and 13.

Claims 15 and 16 depend from independent Claim 14. Independent Claim 14 is patentable for at least the reasons discussed above. Accordingly, Claims 15 and 16 are patentable based on the failure of the Examiner to establish a prima facie case of obviousness for Claim 14 under 35 U.S.C. §103 as set forth above. Moreover, the additional secondary

reference, Hafuka, fails to rectify the deficiencies of Chou and Yu with respect to independent Claim 1. In view of the above, Appellants respectfully request reversal of the rejections of Claims 15 and 16.

Claims 3, 7, 13, 15 and 16 are patentable

Claims 10 and 17 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Chou, Yu and in further view of Boyd. Claim 10 depends from independent Claim 1. Independent Claim 1 is patentable for at least the reasons discussed above. Accordingly, Claim 10 is patentable based on the failure of the Examiner to establish a prima facie case of obviousness for Claim 1 under 35 U.S.C. §103 as set forth above. Moreover, the additional secondary reference, Boyd, fails to rectify the deficiencies of Chou and Yu with respect to independent Claim 1. In view of the above, Appellants respectfully request reversal of the rejection of Claim 10.

Claim 17 depends from independent Claim 14. Independent Claim 14 is patentable for at least the reasons discussed above. Accordingly, Claim 17 is patentable based on the failure of the Examiner to establish a prima facie case of obviousness for Claim 14 under 35 U.S.C. §103 as set forth above. Moreover, the additional secondary reference, Boyd, fails to rectify the deficiencies of Chou and Yu with respect to independent Claim 14. In view of the above, Appellants respectfully request reversal of the rejection of Claim 17.

Conclusion

In light of the above discussion, Appellants submit that pending Claims 46-51 and 53-57 are patentable over the cited references and, therefore, request reversal of the rejections of those claims and passing of the application to issue.

Any additional fees believed to be due in connection with this paper may be charged to Deposit Account No. 50-0220.

Respectfully submitted,

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CERTIFICATION OF TRANSMISSION

I hereby certify that this correspondence is being transmitted via the Office electronic filing system in accordance with 37 C.F.R. § 1.6(a)(4) to the U.S. Patent and Trademark Office on November 11, 2011.

Kirsten S. Carlos

APPENDIX A – CLAIMS

1. (Previously presented) A solid state lighting device, comprising:

a plurality of solid state light emitters that are configured to emit light; and

a multiplane light diffuser including a first diffusion plane that is a first distance from the plurality of solid state emitters and a second diffusion plane that is a second distance from the plurality of solid state emitters that is different from the first distance, the multiplane light diffuser including first side that corresponds to the first plane and that is configured to receive the light emitted from the plurality of solid state light emitters and a second side that corresponds to the second plane and that is configured to transmit diffused light,

wherein the multiplane light diffuser comprises a diffuser plate that includes the first side of the multiplane light, the diffuser plate configured to define the first diffusion plane, and

wherein the plurality of solid state emitters comprise a third distance between adjacent ones of the plurality of solid state light emitters, and wherein the first distance is a function of the third distance.

2. (Previously presented) The device of Claim 1, wherein the multiplane light diffuser comprises:

a diffuser sheet that includes the second side of the multiplane light diffuser and is positioned athe second distance from the plurality of solid state light emitters, the diffuser sheet configured to define the second diffusion plane.

3. (Original) The device of Claim 2, wherein the diffuser sheet comprises:

a substantially transparent plate; and

a diffuser film supported by the substantially transparent plate.

4. (Original) The device of Claim 2, comprising a plurality of diffuser supports, wherein the diffuser supports comprise:

a proximal end that is configured to be positioned proximate the plurality of solid state light emitters; and

a distal end that is configured to support the diffuser sheet.

5. (Original) The device of Claim 4, wherein the diffuser plate comprises a plurality of diffuser plate holes that are configured to receive the plurality of diffuser supports.

6. (Original) The device of Claim 4, wherein the plurality of diffuser supports comprise steps for supporting, at the first distance from the plurality of solid state light emitters, the diffuser plate via the plurality of holes.

7. (Original) The device of Claim 2, wherein the diffuser sheet comprises a diffuser film, a brightness enhancing film, a polarizing film and a substantially clear plate configured to support the diffuser film, the brightness enhancing film, the polarizing film.

8. (Original) The device of Claim 2, wherein the plurality of solid state emitters comprise a third distance between adjacent ones of the plurality of solid state light emitters, and wherein the first distance comprises approximately one half the third distance.

9. (Previously presented) The device of Claim 2, wherein the second distance comprises a distance in a range between the third distance and 1.5 times the third distance.

10. (Previously presented) The device of Claim 1, wherein the diffuser plate comprises a plate including a light filter color.

11. (Canceled)

12. (Original) The device of Claim 1, further comprising means for transmitting first diffused light from the first diffusion plane to the second diffusion plane.

13. (Previously presented) The device of Claim 1, wherein the multiplane light diffuser comprises:

the first diffuser plate positioned at a first distance from the plurality of solid state emitters;

a second diffuser plate positioned at a second distance from the plurality of solid state emitters; and

a diffuser sheet supported by the second diffuser plate,

wherein the first distance is less than the second distance.

14. (Previously presented) A method of providing diffused light comprising:

emitting light from a plurality of solid state light emitters arranged in a planar configuration;

receiving the emitted light at a first side of a first diffusion plane that is a first distance from the plurality of solid state light emitters;

transmitting first diffused light from a structured refractive diffuser plate at a second side of the first diffusion plane;

receiving the first diffused light from the first diffusion plane at a first side of a second diffusion plane that is a second distance from the plurality of solid state light emitters; and

transmitting second diffused light from a second side of the second diffusion plane,

wherein the plurality of solid state light emitters comprise a third distance between adjacent ones of the plurality of solid state light emitters, wherein the first distance comprises approximately one half of the third distance, and wherein the second distance comprises a value in a range between substantially the third distance value and substantially 1.5 times the third distance value.

15. (Original) The method of Claim 14, wherein transmitting the first diffused light comprises transmitting the first diffused light from a diffuser plate and wherein transmitting the second diffused light comprises transmitting the second diffused light from a diffuser sheet that is supported by a substantially transparent sheet.

16. (Original) The method of Claim 14, wherein transmitting the first diffused light comprises transmitting light from a first diffuser plate and wherein transmitting the

second diffused light comprises transmitting light from a diffuser sheet that is supported by a second diffuser plate.

17. (Previously presented) The method of Claim 14, wherein transmitting the first diffused light comprises transmitting scattered diffusion light from a plate including a light filter color.

18-19. (Canceled)

20. (Previously presented) A display comprising:

a backlighting panel comprising

a plurality of solid state light emitters arranged in a substantially planar configuration,

a first diffusion plane that is configured to receive light from the plurality of solid state light emitters and to transmit first diffused light, the first diffusion plane including a diffuser plate that is positioned a first distance from the plurality of solid state light;

a second diffusion plane that is configured to receive the first diffused light and to transmit second diffused light

a plurality of diffuser supports configured to support a first diffuser plane structure at a first distance from the plurality of solid state light emitters and to support a second diffuser plane structure at a second distance from the plurality of solid state light emitters, wherein the second distance is greater than the first distance; and

a LCD display panel that is configured to receive the second diffused light and selectively transmit received light as display content.

21. (Previously presented) The device of Claim 23, wherein ones of the plurality of extrusion peaks include a peak angle in a range of about 120 degrees to 170 degrees.

22. (Previously presented) The device of Claim 23, wherein the structured refractive diffuser comprises a plurality of crossed linear prismatic lenselets.

23. (Previously presented) The device of Claim 1, wherein the diffuser plate comprises a structured refractive diffuser that includes a plurality of extrusion peaks that are divided by a plurality of extrusion grooves.

APPENDIX B – EVIDENCE APPENDIX

(NONE)

APPENDIX C – RELATED PROCEEDINGS

(NONE)

Electronic Patent Application Fee Transmittal

Application Number:	12045729
Filing Date:	11-Mar-2008
Title of Invention:	Apparatus and Methods for Multiplanar Optical Diffusers and Display Panels for Using the Same
First Named Inventor/Applicant Name:	John Roberts
Filer:	Timothy Jennings Wall/Kirsten Carlos
Attorney Docket Number:	5308-824

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:				
Filing a brief in support of an appeal	1402	1	620	620
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
		Total in USD ($)		**620**

Electronic Acknowledgement Receipt	
EFS ID:	11386003
Application Number:	12045729
International Application Number:	
Confirmation Number:	9825
Title of Invention:	Apparatus and Methods for Multiplanar Optical Diffusers and Display Panels for Using the Same
First Named Inventor/Applicant Name:	John Roberts
Customer Number:	65106
Filer:	Timothy Jennings Wall/Kirsten Carlos
Filer Authorized By:	Timothy Jennings Wall
Attorney Docket Number:	5308-824
Receipt Date:	11-NOV-2011
Filing Date:	11-MAR-2008
Time Stamp:	10:03:21
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$620
RAM confirmation Number	7293
Deposit Account	500220
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 1.17 (Patent application and reexamination processing fees)	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Appeal Brief Filed	5308_824AppealBrief.pdf	1287451 161e310ce1bfcd00d27b45763d45304c819770d1	no	16
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30407 574e7db4af7673e14671493a73515c7e61b05328	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	1317858		

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.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/045,729	03/11/2008	John Roberts	5308-824	9825

65106 7590 10/12/2011
MYERS BIGEL SIBLEY & SAJOVEC, P.A.
P.O. BOX 37428
RALEIGH, NC 27627

EXAMINER	
SHALLENBERGER, JULIE A	
ART UNIT	PAPER NUMBER
2885	
MAIL DATE	DELIVERY MODE
10/12/2011	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.

Notice of Panel Decision from Pre-Appeal Brief Review	Application/Control No.	Applicant(s)/Patent under Reexamination
	12/045,729	ROBERTS ET AL.
	JULIE SHALLENBERGER	Art Unit: 2885

This is in response to the Pre-Appeal Brief Request for Review filed 25 July 2011.

1. ☐ **Improper Request** – The Request is improper and a conference will not be held for the following reason(s):

☐ The Notice of Appeal has not been filed concurrent with the Pre-Appeal Brief Request.
☐ The request does not include reasons why a review is appropriate.
☐ A proposed amendment is included with the Pre-Appeal Brief request.
☐ Other: .

The time period for filing a response continues to run from the receipt date of the Notice of Appeal or from the mail date of the last Office communication, if no Notice of Appeal has been received.

2. ☒ **Proceed to Board of Patent Appeals and Interferences** – A Pre-Appeal Brief conference has been held. The application remains under appeal because there is at least one actual issue for appeal. Applicant is required to submit an appeal brief in accordance with 37 CFR 41.37. The time period for filing an appeal brief will be reset to be one month from mailing this decision, or the balance of the two-month time period running from the receipt of the notice of appeal, whichever is greater. Further, the time period for filing of the appeal brief is extendible under 37 CFR 1.136 based upon the mail date of this decision or the receipt date of the notice of appeal, as applicable.

☒ The panel has determined the status of the claim(s) is as follows:
Claim(s) allowed: _____.
Claim(s) objected to: _____.
Claim(s) rejected: *1-10,12-17,20-23*.
Claim(s) withdrawn from consideration: _____.

3. ☐ **Allowable application** – A conference has been held. The rejection is withdrawn and a Notice of Allowance will be mailed. Prosecution on the merits remains closed. No further action is required by applicant at this time.

4. ☐ **Reopen Prosecution** – A conference has been held. The rejection is withdrawn and a new Office action will be mailed. No further action is required by applicant at this time.

All participants:

(1) *JULIE SHALLENBERGER*. (3) *MICHAEL DAY*.

(2) *JONG-SUK(JAMES) LEE*. (4)_____.

/Julie A Shallenberger/
Primary Examiner, Art Unit 2885

/Jong-Suk (James) Lee/
Supervisory Patent Examiner, Art Unit 2885

/Michael Day/
Supervisory Patent Examiner, Art Unit 2800

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 91 of 836

INFORMATION DISCLOSURE STATEMENT BY APPLICANT *(use as many sheets as necessary)* Sheet D1 of D1	*Complete if Known*	
	Application Number	12/045,729
	Filing Date	March 11, 2008
	First Named Inventor	John Roberts
	Art Unit	2885
	Examiner Name	Julie A. Shallenberger
	Attorney Docket Number	5308-824

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.	Document Number Number-Kind Code (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
		US-			
		US-			
		US-			
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		US-			
		US-			

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.	Foreign Patent Document Country Code, Number, Kind Code (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
	1.	JP 2008-034342 A	02-14-2008	Sony Corp.		A
	2.	JP 2007-076666 A	03-29-2007	Fujifilm Corp.		A

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published	T

Examiner Signature		Date Considered	

*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.

Espacenet

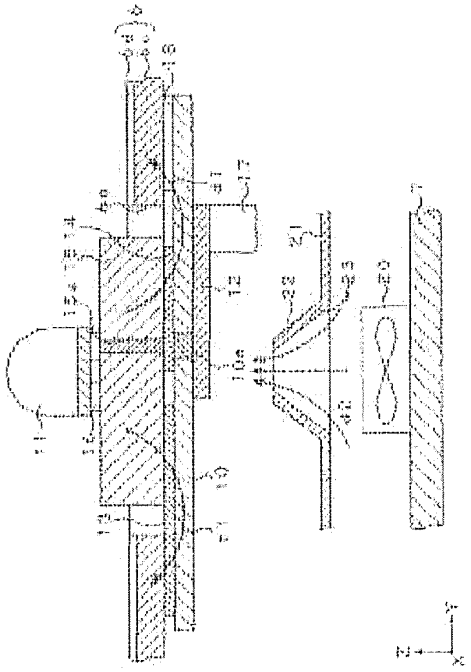
Bibliographic data: JP 2008034342 (A)

BACKLIGHT DEVICE, LIQUID CRYSTAL DISPLAY DEVICE, AND ELECTRONIC APPARATUS

Publication date:	2008-02-14
Inventor(s):	SHIBATA HIROICHI; OIDE TATSUYA +
Applicant(s):	SONY CORP +
Classification:	- **international:** ***F21S2/00; F21S8/04; F21V29/00; G02F1/13357; H01L33/60; F21Y101/02***
	- **European:** G02F1/13357B1; G02F1/13357B4
Application number:	JP20070013149 20070123
Priority number(s):	JP20060182029 20060630; JP20070013149 20070123
Also published as:	• US 2008111949 (A1)

Abstract of JP 2008034342 (A)

PROBLEM TO BE SOLVED: To provide a backlight device simplifying its structure, capable of reducing the number of components and weight, to provide a liquid crystal display device equipped with the above backlight device, and to provide an electronic apparatus. ; SOLUTION: A reflective sheet 6 is formed by joining a base material 6c having mechanical stiffness and a reflective material 6d having high-reflectivity characteristics. A plurality of light source substrates 10 mounted with a plurality of LEDs 11 illuminating illumination light is attached on a surface of the base material 6c side of the reflective sheet 6, each LED 11 is exposed from a surface of the reflective material 6d side through an opening part 6e penetrating the base material 6c and the reflective material 6d. With this, the reflective sheet 6 can be used as a base structure body of a backlight unit 3, and illumination light illuminated from each LED 11 can be reflected. ; COPYRIGHT: (C)2008,JPO&INPIT



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審査請求 未請求　請求項の数 13　ＯＬ　（全 18 頁）　最終頁に続く

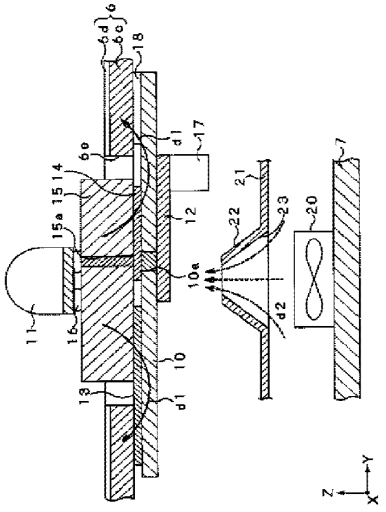
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最終頁に続く

(54)【発明の名称】バックライト装置、液晶表示装置及び電子機器

(57)【要約】　（修正有）
【課題】構造を簡素化し、部品点数の削減が図れ、軽量化を図ることができるバックライト装置、このバックライト装置を備える液晶表示装置及び電子機器を提供すること。
【解決手段】反射シート６は、機械的剛性を有する基材６ｃと、高反射率特性を有する反射材６ｄを接合して形成される。反射シート６の基材６ｃ側の面には、照明光を照明する複数のＬＥＤ１１が実装された複数の光源基板１０が取り付けられ、各ＬＥＤ１１は、基材６ｃと反射材６ｄとを貫通する開口部６ｅを介して反射材６ｄ側の面から露出している。これにより、反射シート６をバックライトユニット３の基本構造体として用いることができるとともに各ＬＥＤ１１から照射された照明光を反射させることができる。
【選択図】図４



Petitioner Hisense USA Corporation
Exhibit 1002 - Page 94 of 836

【特許請求の範囲】
【請求項1】
透過型の液晶パネルを背面側から照明するバックライト装置において、
照明光を照射する複数の発光素子が実装された複数の光源基板と、
上記光源基板が一方の面に複数取り付けられ、上記光源基板に実装された上記発光素子に対応する位置にそれぞれ形成された開口部から上記発光素子を他方の面に露出させ、上記発光素子から照射された照明光を他方の面で反射する反射シートと、
上記反射シートの他方の面側に上記反射シートと所定の対向間隔を介して対向され、上記反射シートから入射された上記照明光を層内において拡散する拡散導光プレートと、
上記拡散導光プレートに組み合わされ、複数の光学機能シートを積層してなり、上記透過型の液晶パネルに上記照明光を導光する光学機能シート積層体と
を備えることを特徴とするバックライト装置。
【請求項2】
上記光源基板は、ガラスエポキシ基板であることを特徴とする請求項１記載のバックライト装置。
【請求項3】
上記光源基板は、一方の面に配線用のパターンが形成され、他方の面に放熱用のパターンが形成され、
上記配線用のパターンは、他方の面のランドとスルーホールを介して接続されていることを特徴とする請求項１記載のバックライト装置。
【請求項4】
上記光源基板は、一方の面に、コネクタ又はハーネスが実装されていることを特徴とする請求項３記載のバックライト装置。
【請求項5】
更に、上記光源基板の一方の面側には、冷却手段が配設されることを特徴とする請求項１記載のバックライト装置。
【請求項6】
透過型の液晶パネルに照明光を供給するバックライト装置において、
前記照明光を照射する複数の発光素子が実装された複数の光源基板と、
前記各光源基板が設けられる第１の面と、前記第１の面に対向し、前記各発光素子から照射された照明光を反射する第２の面と、前記第１の面と第２の面とを連通し、前記各発光素子を前記第２の面から露出させるように前記各発光素子に対応してそれぞれ形成された複数の開口部とを有する反射シートと、
前記反射シートの第２の面と所定の間隔を介して直接的に対向して設けられ、前記各発光素子から照射された前記照明光及び前記反射シートの第２の面から入射された前記照明光を内部で拡散する拡散導光プレートと、
前記拡散導光プレートに組み合わされ、複数の光学機能シートを積層してなり、前記液晶パネルに前記照明光を導光する光学機能シート積層体と
を具備することを特徴とするバックライト装置。
【請求項7】
透過型の液晶パネルと、
上記透過型の液晶パネルを背面側から照明するバックライト装置を備え、
上記バックライト装置は、照明光を照射する複数の発光素子が実装された複数の光源基板と、上記光源基板が一方の面に複数取り付けられ、上記光源基板に実装された上記発光素子に対応する位置にそれぞれ形成された開口部から上記発光素子を他方の面に露出させ、上記発光素子から照射された照明光を他方の面で反射する反射シートと、上記反射シートの他方の面側に上記反射シートと所定の対向間隔を介して対向され、上記反射シートから入射された上記照明光を層内において拡散する拡散導光プレートと、上記拡散導光プレートに組み合わされ、複数の光学機能シートを積層してなり、上記透過型の液晶パネルに

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 95 of 836

上記照明光を導光する光学機能シート積層体とを備えることを特徴とする液晶表示装置。
【請求項8】
上記光源基板は、ガラスエポキシ基板であることを特徴とする請求項７記載の液晶表示装置。
【請求項9】
上記光源基板は、一方の面に配線用のパターンが形成され、他方の面に放熱用のパターンが形成され、
上記配線用のパターンは、他方の面のランドとスルーホールを介して接続されていることを特徴とする請求項７記載の液晶表示装置。
【請求項10】
上記光源基板は、一方の面に、コネクタ又はハーネスが実装されていることを特徴とする請求項９記載の液晶表示装置。
【請求項11】
更に、上記光源基板の一方の面側には、冷却手段が配設されることを特徴とする請求項７記載の液晶表示装置。
【請求項12】
透過型の液晶パネルと、
前記液晶パネルに前記照明光を供給するバックライト装置とを備え、
前記バックライト装置は、
前記照明光を照射する複数の発光素子が実装された複数の光源基板と、
前記各光源基板が設けられる第１の面と、前記第１の面に対向し、前記各発光素子から照射された照明光を反射する第２の面と、前記第１の面と第２の面とを連通し前記各発光素子を前記第２の面から露出させるように前記各発光素子に対応してそれぞれ形成された複数の開口部とを有する反射シートと、
前記反射シートの第２の面と所定の間隔を介して直接的に対向して設けられ、前記各発光素子から照射された前記照明光及び前記反射シートから入射された前記照明光を内部で拡散する拡散導光プレートと、
前記拡散導光プレートに組み合わされ、複数の光学機能シートを積層してなり、前記液晶パネルに前記照明光を導光する光学機能シート積層体とを有する
ことを特徴とする液晶表示装置。
【請求項13】
透過型の液晶パネルと、
前記液晶パネルに供給するための照明光を照射する複数の発光素子が実装された複数の光源基板と、前記各光源基板が設けられる第１の面と、前記第１の面に対向し、前記各発光素子から照射された照明光を反射する第２の面と、前記第１の面と第２の面とを連通し前記各発光素子を前記第２の面から露出させるように前記各発光素子に対応してそれぞれ形成された複数の開口部とを有する反射シートと、前記反射シートの第２の面と所定の間隔を介して直接的に対向して設けられ、前記各発光素子から照射された前記照明光及び前記反射シートから入射された前記照明光を内部で拡散する拡散導光プレートと、前記拡散導光プレートに組み合わされ、複数の光学機能シートを積層してなり、前記液晶パネルに前記照明光を導光する光学機能シート積層体とを有するバックライト装置と、
前記光源基板を冷却するための冷却手段と
を具備することを特徴とする電子機器。
【発明の詳細な説明】
【技術分野】
【0001】
本発明は、透過型の液晶パネルを照明するバックライト装置、このバックライト装置を備える液晶表示装置及び電子機器に関する。
【背景技術】
【0002】
液晶表示装置は、２枚の透明基板の間に液晶が封入され、電圧が印加されることにより

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 96 of 836

液晶分子の向きが変えられ光透過率を変化させることで所定の映像等が光学的に表示される。この液晶表示装置には、液晶自体が発光体ではないため、例えば液晶パネルの背面側に冷陰極蛍光ランプ（CCFL:Cold Cathode Fluorescent Lamp）や発光ダイオード（LED:Light Emitting Diode ）を光源とした照明光を照射するバックライト装置が備えられる。

【0003】

バックライト装置においては、液晶パネルを背面側から、複数のＬＥＤが実装された光源から照明光が照射され、この照明光に対して、各光学シートによって拡散、反射及び導光等の光学処理が施されることで、液晶パネルに対して照明光が全面に亘って均一かつ安定な状態で照射される。

【0004】

例えば、特許文献１のバックライト装置は、バックライト装置の基本構造体であるバックシャーシの一方の面に光源基板を取り付け、このバックシャーシと対向間隔を介して、反射シートを設ける構造を備えている。このため、特許文献１のバックライト装置は、バックシャーシと反射シートとの２重底構造を有するため構造が複雑化しかつ重量の増加も招いている。

【0005】

また、特許文献１のバックライト装置においては、各光源基板の一方の面側の直上に反射シートが存在し、各光源基板の他方の面にヒートプレートが取り付けられているので、各光源基板の一方の面と直上にある反射シートとの狭い対向間隔内の限られたスペースで各光源基板の一方の面に複数のＬＥＤやこれらＬＥＤをシリーズで配線する配線パターンや光源用のハーネス、コネクタ等の配線部品を実装させる必要があり、設計の自由度が制約されてしまう。

【0006】

更に、特許文献１のバックライト装置においては、光源基板の冷却手段に関して、ＬＥＤより発生した発生熱を光源基板に取り付けられているヒートプレートによってヒートパイプを介してヒートシンクに移動させ、この発生熱を空冷ファン等で冷却している。しかしながら、この冷却手段では、ヒートプレート等を介した熱伝導に依存するため冷却効率が光源基板の取付方法などに依存してしまう。また、光源基板、ヒートプレート、ヒートパイプ及びヒートシンク等は、アルミニウム部材から設けられているので、重量が重く、加工が困難であり、コストが高くなってしまう。

【特許文献1】特開２００５－３５２４２７号公報

【発明の開示】

【発明が解決しようとする課題】

【0007】

本発明は、このような従来の事情に鑑みて提案されたものであり、構造を簡素化し、部品点数の削減が図れ、軽量化を図ることができるバックライト装置、このバックライト装置を備える液晶表示装置及び電子機器を提供することを目的とする。

【0008】

また、本発明は、ＬＥＤから発生した発生熱を簡単な構成で効率よく冷却することができるバックライト装置及びこのバックライト装置を備える液晶表示装置を提供することを目的とする。

【課題を解決するための手段】

【0009】

上述した目的を達成するために本発明に係るバックライト装置は、透過型の液晶パネルを背面側から照明し、照明光を照射する複数の発光素子が実装された複数の光源基板と、上記光源基板が一方の面に複数取り付けられ、上記光源基板に実装された上記発光素子に対応する位置にそれぞれ形成された開口部から上記発光素子を他方の面に露出させ、上記発光素子から照射された照明光を他方の面で反射する反射シートと、上記反射シートの他方の面側に上記反射シートと所定の対向間隔を介して対向され、上記反射シートから入射された上記照明光を層内において拡散する拡散導光プレートと、上記拡散導光プレートに

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 97 of 836

組み合わされ、複数の光学機能シートを積層してなり、上記透過型の液晶パネルに上記照明光を導光する光学機能シート積層体とを備える。

【0010】

また、上述した目的を達成するために本発明に係る液晶表示装置は、透過型の液晶パネルと、上記透過型の液晶パネルを背面側から照明するバックライト装置とを備えるものである。

【0011】

本発明の他の観点に係るバックライト装置は、透過型の液晶パネルに照明光を供給するバックライト装置であって、前記照明光を照射する複数の発光素子が実装された複数の光源基板と、前記各光源基板が設けられる第１の面と、前記第１の面に対向し、前記各発光素子から照射された照明光を反射する第２の面と、前記第１の面と第２の面とを連通し、前記各発光素子を前記第２の面から露出させるように前記各発光素子に対応してそれぞれ形成された複数の開口部とを有する反射シートと、前記反射シートの第２の面と所定の間隔を介して直接的に対向して設けられ、前記各発光素子から照射された前記照明光及び前記反射シートの第２の面から入射された前記照明光を内部で拡散する拡散導光プレートと、前記拡散導光プレートに組み合わされ、複数の光学機能シートを積層してなり、前記液晶パネルに前記照明光を導光する光学機能シート積層体とを具備する。

【0012】

ここで「直接的に対向して」とは、反射シートと拡散導光プレートとの間に、両者を隔てるような他の部材が存在しないことを意味する。この構成により、反射シートの第１の面に各光源基板が設けられ、第２の面から各発光素子が露出するようになっているため、従来のバックライト装置において必要であった各光源基板を保持するための部材が不要となり、バックライト装置の薄型化、軽量化及びコスト低減を図ることができる。また、反射シートと拡散導光プレートとが直接的に対向しており、両者の間に例えば拡散プレート等の他の部材を設ける必要がないため、上述の薄型化、軽量化及びコスト低減の効果が更に高まることとなる。

【0013】

本発明の他の観点に係る液晶表示装置は、透過型の液晶パネルと、前記液晶パネルに前記照明光を供給するバックライト装置とを備え、前記バックライト装置は、前記照明光を照射する複数の発光素子が実装された複数の光源基板と、前記各光源基板が設けられる第１の面と、前記第１の面に対向し、前記各発光素子から照射された照明光を反射する第２の面と、前記第１の面と第２の面とを連通し前記各発光素子を前記第２の面から露出させるように前記各発光素子に対応してそれぞれ形成された複数の開口部とを有する反射シートと、前記反射シートの第２の面と所定の間隔を介して直接的に対向して設けられ、前記各発光素子から照射された前記照明光及び前記反射シートから入射された前記照明光を内部で拡散する拡散導光プレートと、前記拡散導光プレートに組み合わされ、複数の光学機能シートを積層してなり、前記液晶パネルに前記照明光を導光する光学機能シート積層体とを有している。

【0014】

本発明の他の観点に係る電子機器は、透過型の液晶パネルと、前記液晶パネルに供給するための照明光を照射する複数の発光素子が実装された複数の光源基板と、前記各光源基板が設けられる第１の面と、前記第１の面に対向し、前記各発光素子から照射された照明光を反射する第２の面と、前記第１の面と第２の面とを連通し前記各発光素子を前記第２の面から露出させるように前記各発光素子に対応してそれぞれ形成された複数の開口部とを有する反射シートと、前記反射シートの第２の面と所定の間隔を介して直接的に対向して設けられ、前記各発光素子から照射された前記照明光及び前記反射シートから入射された前記照明光を内部で拡散する拡散導光プレートと、前記拡散導光プレートに組み合わされ、複数の光学機能シートを積層してなり、前記液晶パネルに前記照明光を導光する光学機能シート積層体とを有するバックライト装置と、前記光源基板を冷却するための冷却手段とを具備する。

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 98 of 836

【0015】
ここで電子機器とは、例えばテレビジョン受像機やＰＣ（Personal Computer）等である。また冷却手段としては、冷却ファン、ヒートパイプ、ヒートシンク等、様々なものを用いることができる。またこの冷却手段は、光源基板側に設けられていてもよいし、液晶パネル及びバックライト装置とを保持する外筐の内面に設けられていてもよい。
【発明の効果】
【0016】
本発明によれば、バックライトユニットの基本構造体として用いることができるとともに各ＬＥＤから照射された照明光を反射させることができる反射シートの一方の面に、照明光を照射するＬＥＤが実装された光源基板を複数取り付けることで、構造が簡素化し、部品点数の削減が図れ、軽量化を図ることができる。
【発明を実施するための最良の形態】
【0017】
以下、本発明を適用したバックライト装置、液晶表示装置及び電子機器について、図面を参照して説明する。
【0018】
（第１実施形態）
まず、本発明の第１の実施形態について説明する。
本実施形態における液晶表示装置１は、例えば４０インチ以上の大型表示画面を有するテレビジョン受像機の表示パネルに用いられる。この液晶表示装置１は、図１及び図２に示すように、透過型の液晶パネル４を有する液晶パネルユニット２と、この液晶パネルユニット２の背面側に組み合わされ液晶パネルユニット２に対して照明光を照射する本発明が適用されたバックライトユニット３とを備える。
【0019】
バックライトユニット３により背面側から照明光が照射される液晶パネルユニット２は、略矩形状の液晶パネル４と、この液晶パネル４を保持する前面フレーム部材５ａと背面フレーム部材５ｂとを有する。
【0020】
前面フレーム部材５ａ及び背面フレーム部材５ｂに保持される液晶パネル４は、図２に示すように、スペーサビーズ等によって対向間隔が保持された第１のガラス基板４ａと第２のガラス基板４ｂとの間に液晶（図示せず）が封入されてなる。第１のガラス基板４ａの内面には、例えば、ストライプ状の透明電極と、絶縁膜と、液晶分子を一定方向に配列させる配向膜とが設けられる。また、第２のガラス基板４ｂの内面には、例えば、光の三原色のカラーフィルタと、このカラーフィルタを保護するオーバコート層と、ストライプ状の透明電極と、液晶分子を一定方向に配列させる配向膜とが設けられる。更に、第１のガラス基板４ａと第２のガラス基板４ｂの表面には、それぞれ偏向フィルムと位相差フィルム等からなる光学フィルム層４ｃが設けられている。
【0021】
以上のような構成からなる液晶パネル４においては、スペーサビーズ等によって対向間隔が保持された第１のガラス基板４ａと第２のガラス基板４ｂとの間に液晶が封入され、透明電極に電圧が印加されると、ポリイミドからなる配向膜によって液晶分子が界面に対して水平方向に配列されて液晶分子の向きを変えることで光透過率が変化される。そして、液晶パネル４は、光学フィルム層４ｃによってバックライトユニット３から照射された照明光の波長特性を無彩色化、白色化し、カラーフィルタによってフルカラー化を図り所定の映像等をカラー表示する。
【0022】
なお、液晶パネル４は、上述した構成に限定されるものではなく、従来提供されている種々の構成を備える液晶パネルであってもよい。
【0023】
液晶パネル４を保持する前面フレーム部材５ａ及び背面フレーム部材５ｂは、枠状に形

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 99 of 836

成され、図２に示すように、スペーサ２ａ，２ｂ及びガイド部材２ｃを介して液晶パネル４の外周縁部を前面フレーム部材５ａと背面フレーム部材５ｂとで液晶パネル４を挟み込み保持する。

【0024】

以上のように構成された液晶パネルユニット２においては、背面側にバックライトユニット３が組み合わされ、液晶パネルユニット２に対して照明光が照射されることで所定の映像等がカラー表示される。また、液晶表示装置１においては、次に説明するバックライトユニット３がその背面側に備えられることで、バックライトユニット３から液晶パネルユニット２に対して照明光が全面に亘って均一かつ安定な状態で照射されるため、輝度むらや色むら等が少なくなり画質等の向上が図られる。

【0025】

液晶パネルユニット２の背面側に組み合わされ照明光を照射するバックライトユニット３は、図２に示すように、液晶パネルユニット２の背面と略同じ大きさの外形寸法を有しており、背面フレーム部材５ｂに組み合わされる反射シート６と、反射シート６に取り付けられ、照明光を照明するための光源として複数の発光ダイオード（以下、ＬＥＤという。）が実装された複数の光源基板１０と、反射シート６と対向間隔を介して取り付けられ、光源基板１０から照射された照明光に光学処理を施す光学シートブロック３０とを有する。

【0026】

光源基板１０が取り付けられた反射シート６は、図２に示すように、液晶パネル４の外形よりもやや大型の略矩形薄板状の主面部６ａと、この主面部６ａの周囲に背面フレーム部材５ｂと外周部で組み合わされる外周壁部６ｂとを有する。また、反射シート６は、機械的剛性を有するアルミニウムプレートからなる基材６ｃ（図４参照）と、蛍光剤を含有し高反射率特性を有する発泡性ＰＥＴ（Polyethylene Terephthalate）等からなる反射材６ｄ（図４参照）とを接合して形成される。反射材６ｄは、基材６ｃの両主面のうち、光源基板１０が取り付けられる一方の面とは反対側の他方の面に接合される。更に、反射シート６には、図３に示すように、主面部６ａに後述する光源基板１０に実装されたＬＥＤ１１に対応する位置にそれぞれ形成された開口部６ｅが設けられている。

【0027】

なお、反射シート６は、アルミニウムプレートに限定されるものではなく、例えば鏡面を有するステンレスプレートを用いるようにしてもよい。また、反射シート６は、比較的小サイズの液晶表示装置に用いられる場合、例えば蛍光剤を含有した発泡性ＰＥＴ等からなる反射材６ｄで形成されるようにしてよい。

【0028】

反射シート６に取り付けられている光源基板１０は、図４に示すように、導電層が両面に形成されたガラスエポキシ基板であり、反射シート６の開口部６ｅより大型の略矩形薄板状に形成されている。また、光源基板１０の一方の面には、導電材料からなる配線用パターン１２が設けられ、他方の面には、放熱用パターン１３と、この放熱用パターン１３と電気的に絶縁された複数のランド１４とが長手方向の略同一軸線上に設けられている。

【0029】

更に、光源基板１０には、他方の面の各ランド１４と一方の面の配線用パターン１２とを電気的に接続させる複数のスルーホール１０ａが設けられている。このスルーホール１０ａは、スルーホール１０ａ内に金や銅等の金属メッキ処理を施すスルーホール接続やスルーホール１０ａ内に導電性ペーストを詰めること等によって、他方の面に設けられたランド１４と一方の面に設けられた配線用パターン１２とを電気的に接続させる。

【0030】

また、光源基板１０の他方の面に設けられたランド１４及び放熱用パターン１３上には、セラミック基板１５が熱伝導性に優れた接着材等で接着され実装されている。なお、セラミック基板１５は、ランド１４及び放熱用パターン１３上に半田付けによって実装されてもよい。

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 100 of 836

【0031】
このセラミック基板１５は、図４に示すように、熱伝導性を有するセラミック材からなり、略円形板状又は略矩形板状に形成されている。更に、セラミック基板１５の上面には、各ランド１４の配置位置に対応されたスルーホール１５ａが設けられている。また、セラミック基板１５の上面には、このスルーホール１５ａの配置位置に対応された照明光を照明するＬＥＤ１１が半田バンプ１６によって実装されている。このスルーホール１５ａは、スルーホール１５ａ内を金や銅等の金属メッキ処理を施すスルーホール接続やスルーホール１５ａ内に導電性ペーストを詰めること等によって、セラミック基板１５の上面に実装されたＬＥＤ１１と光源基板１０のランド１４とを電気的に接続させる。
【0032】
半田バンプ１６によってセラミック基板１５の上面に実装されたＬＥＤ１１は、図３に示すように、ランド１４及びスルーホール１５ａと同様に、光源基板１０の長手方向に略同一軸線上に、赤色ＬＥＤと緑色ＬＥＤと青色ＬＥＤとを組み合わせ複数実装されている。なお、ランド１４、スルーホール１５ａ及びＬＥＤ１１は、光源基板１０の長手方向に略同一軸線上に実装されることに限定されない。
【0033】
光源基板１０の一方の面に設けられ、スルーホール１０ａを介してランド１４と電気的に接続されている配線用パターン１２には、図４に示すように、例えばＬＥＤ１１の制御信号用リード線を接続するコネクタ１７が実装されている。
【0034】
また、光源基板１０は、その他方の面が、熱伝導性に優れた熱伝導性両面テープ１８によって反射シート６の一方の面に接着されることで反射シート６に取り付けられている。反射シート６には、光源基板１０の他方の面に実装されたＬＥＤ１１に対応する位置にそれぞれ開口部６ｅが形成されており、この開口部６ｅからＬＥＤ１１が反射シート６の他方の面に露出される。また、光源基板１０の他方の面には、反射シート６の一方の面に当接されるように放熱用パターン１３が設けられている。なお、光源基板１０を反射シート６に取り付ける方法としては、ネジによる締め付け、スナップフィット等でもよい。
【0035】
以上のような構成からなる光源基板１０は、他方の面側に設けられたＬＥＤ１１がセラミック基板１５のスルーホール１５ａ及び光源基板１０のスルーホール１０ａを介して、一方の面に設けられた配線用パターン１２と電気的に接続される。
【0036】
また、ＬＥＤ１１が半田バンプ１６によってセラミック基板１５に実装され、セラミック基板１５が放熱用パターン１３上に熱伝導性に優れた接着材によって接着され、熱伝導性に優れた熱伝導性両面テープ１８によって放熱用パターン１３が反射シート６の一方の面と当接されるように接着されていることで、図４中の矢印ｄ１方向のように、ＬＥＤ１１より発生した発生熱が熱伝導性を有するセラミック基板１５に伝導され、セラミック基板１５から放熱用パターン１３又は熱伝導性両面テープ１８を介して反射シート６へと伝導されるようになっている。
【0037】
なお、光源基板１０には、他方の面側に、ＬＥＤ１１とセラミック基板１５を覆い、ＬＥＤ１１より照射される照明光を拡散させるレンズを設けてもよい。また、光源基板１０は、ガラスエポキシ基板に限定されるものではなく、アルミニウム等のメタルコア基板でもよい。
【0038】
以上のような構成を有する光源基板１０は、図５に示すように、反射シート６の一方の面に、例えば、マトリックス状に３行６列で複数配列されている。この光源基板１０は、行方向、すなわち図５中の矢印Ｘ方向に近接して配列され、列方向、すなわち図５中の矢印Ｙ方向に離間して配列されている。また、行方向に配列された光源基板１０は、図示しないリード線によって電気的に接続されている。

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 101 of 836

【0039】
更に、反射シート６には、図５に示すように、各光源基板１０が列方向に離間して配列されることによって、２つの光源基板１０間に配置部６ｆが設けられる。この配置部６ｆには、後述する光学スタッド部材３４が挿入され立設される挿入孔６ｇが複数形成されている。配置部６ｆには、後述する光学スタッド部材３４が行方向に５個、列方向に３個、合計１５個配置されるため、この挿入孔６ｇは、各光学スタッド部材３４の配置位置に対応してそれぞれ行方向に５個、列方向に３個、合計１５個形成されている。
【0040】
また、本実施形態のバックライトユニット３を備える液晶表示装置１を組み込む電子機器５０（例えばテレビジョン受像機など）には、図４に示すように、バックライトユニット３の光源基板１０の一方の面側に、液晶表示装置１を覆う外筐７と、光源基板１０の冷却機能を促進する冷却ファン２０とが配設されている。また、この電子機器５０においては、バックライトユニット３の光源基板１０と、電子機器５０の外筐７との間に、電子機器５０の冷却ファン２０により送り込まれた空気を光源基板１０に吹き付ける風向制御板２１が配置されている。
【0041】
風向制御板２１は、反射シート６の主面部６ａよりやや大形の略矩形薄板状に形成される。この風向制御板２１のうち、光源基板１０に対向する面には、各光源基板１０に実装された各ＬＥＤ１１の実装位置に対応させた複数の突出部２２がプレス加工で形成されている。各突出部２２の頂面には、光源基板１０に対向する面に向かって小径となる貫通孔２３が形成されている。なお、風向制御板２１を、機械的強度を有する熱可塑性樹脂等で成形等により形成してもよい。
【0042】
この構成により、冷却ファン２０によって空気が外筐７内に送り込まれたとき、図４中の矢印ｄ２方向のように、送り込まれた空気が貫通孔２３によってガイドされ光源基板１０のＬＥＤ１１が実装されている領域及びこの近傍に集中的に直接吹き付けられる。これにより、バックライトユニット３は、各ＬＥＤ１１から発生した発生熱を効率よく冷却することができる。
【0043】
なお、上述したような冷却ファン２０に限定されず、如何なる冷却手段を配置させてもよい。また、冷却ファン２０及び風向制御板２１等の冷却手段を設けず、反射シート６による放熱だけで冷却してもよい。また、他の部品の配置等に応じて、電子機器５０の外筐７側ではなく、バックライトユニット３側（例えば、光源基板１０の、各ＬＥＤ１１が実装されていない方の面や、反射シート６の、光源基板１０が取り付けられている方の面）に冷却手段を設けてもよい。
【0044】
反射シート６に取り付けられた光学シートブロック３０は、図２に示すように、液晶パネル４の背面側に対向して設けられている。また、光学シートブロック３０は、拡散プレート３１、拡散導光プレート３２と、光学機能シート積層体３３と、複数の光学スタッド部材３４とを有する。
【0045】
拡散プレート３１は、一方の面に複数の光源基板１０が取り付けられた反射シート６の他方の面と所定の対向間隔を介して対向され、照明光の一部を透過するとともに一部を反射する。拡散プレート３１は、図２に示すように、透明な合成樹脂材料、例えば、アクリル樹脂等によって液晶パネル４よりやや大形の略矩形薄板状に成形されている。また、拡散プレート３１には、後述する光学スタッド部材３４が挿入される複数の拡散プレート貫通孔３１ａが形成されている。
【0046】
拡散プレート貫通孔３１ａは、図５に示すように、各光学スタッド部材３４の配置位置に対応してそれぞれ行方向に５個、列方向に３個、合計１５個形成されている。

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 102 of 836

【0047】
拡散プレート３１には、図２に示すように、光源基板１０と対向する一方の面に、反射シート６にマトリックス状に配置された複数の光源基板１０の複数のＬＥＤ１１にそれぞれ対向する複数の調光ドット３１ｂが形成されている。
【0048】
照明光を反射する調光ドット３１ｂは、例えば酸化チタン、硫化バリウム等の遮光剤やガラス粉末、酸化ケイ素等の拡散剤を混合した反射性インクを用いてスクリーン印刷等によって形成される。また、調光ドット３１ｂは、対向するＬＥＤ１１の外径と略同径又はやや大径の略円形パターンからなる。拡散プレート３１は、光源基板１０から出射される照明光を調光ドット３１ｂによって反射シート６側に反射させる。また、拡散プレート３１は、調光ドット３１ｂの非形成領域で各ＬＥＤ１１から照射された照明光の入射角が拡散プレート３１の一方の面に対して臨界角を満たす場合に照明光を入射させる。すなわち、拡散プレート３１は、調光ドット３１ｂの非形成領域であっても、各ＬＥＤ１１から照射された照明光の入射角が拡散プレート３１の一方の面に対して臨界角を超えて入射される場合、照明光を反射する。これにより、拡散プレート３１は、調光ドット３１ｂによって、拡散導光プレート３２へ入射される照明光の入射光量を規制する。更に、拡散プレート３１は、調光ドット３１ｂによって、反射シート６との間で照明光を反復反射させることによって、照明光を全面に亘って均一な状態で拡散導光プレート３２へ入射させる。
【0049】
なお、拡散プレート３１は、１つのＬＥＤ１１に複数の調光ドット３１ｂが対向するようにドットパターンを形成してもよい。また、拡散プレート３１は、ＬＥＤ１１の照明光分布によって十分拡散される場合、省略してもよい。
【0050】
拡散導光プレート３２は、拡散プレート３１と所定の対向間隔を介して反射シート６と反対側に対向され、入射された照明光を内部で拡散する。拡散導光プレート３２は、図２に示すように、導光性を有する乳白色の合成樹脂材、例えば、アクリル樹脂やポリカーボネート樹脂等によって拡散プレート３１と略同形の略矩形薄板状に成形されている。また、拡散導光プレート３２は、反射シート６側の一方の面から入射された照明光を内部において屈折、反射させて拡散させることで、他方の面に組み合わされた光学機能シート積層体３３へ、照明光を全面に亘って均一な状態で導光させる。更に、拡散導光プレート３２は、ブラケット部材３２ａによって外周部が保持されて反射シート６の外周壁部６ｂに取り付けられる。
【0051】
光学機能シート積層体３３は、拡散導光プレート３２に組み合わされ、複数の光学機能シートが積層されてなる。光学機能シート積層体３３は、図２に示すように、拡散導光プレート３２と略同形の略矩形状に形成される。複数の光学機能シートとは、例えば、光源基板１０の光源から照射されて液晶パネル４に導光される照明光を直交する偏光成分に分解する機能を有する偏光フィルム、光波の位相差を補償して広角視野角化及び着色防止を図る機能を有する位相差フィルム、照明光を拡散する機能を有する拡散フィルム等である。
【0052】
なお、光学機能シート積層体３３は、上述した光学機能シートに限定されるものではなく、例えば輝度向上を図る輝度向上フィルム、位相差フィルムやプリズムシートを挟む上下２枚の拡散シート等を用いてもよい。
【0053】
光学スタッド３４は、反射シート６と拡散プレート３１との対向間隔と、拡散プレート３１と拡散導光プレート３２との対向間隔とをそれぞれ規定する。また、光学スタッド部材３４は、図５に示すように、２つの光源基板１０間の配置部６ｆに配置され、行方向、すなわち図５中の矢印Ｘ方向に５個、列方向、すなわち図５中の矢印Ｙ方向に３個、合計１５個備えられている。光学スタッド部材３４は、図２に示すように、例えば、ポリカー

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 103 of 836

ボ樹脂等の導光性と機械的剛性及びある程度の弾性を有する乳白色、透明等の光高反射部材によって一体に形成される。また、光学スタッド部材３４は、先端部が拡散導光プレート３２の一方の面に突き当てられ拡散導光プレート３２と反射シート６との対向間隔を規定する本体部３４ａと、この本体部３４ａの基端に連続して形成された取付部３４ｂとを有する。

【0054】

図２に示すように、本体部３４ａの先端側は、拡散導光プレート３２側に向かって次第に小径となるような円錐形状に形成されており、この円錐形状の基端に、拡散プレート貫通孔３１ａよりも大径である拡散プレート規定部３４ｃが突出形成されている。この拡散プレート規定部３４ｃの一方の面が拡散プレート３１の他方の面と当接される。更に、本体部３４ａの基端側には、反射シート６の挿入孔６ｇよりも大径である反射シート規定部３４ｄが突出形成されている。この反射シート規定部３４ｄの一方の面が反射シート６の他方の面と当接される。

【0055】

本体部３４ａの基端に連続して形成された取付部３４ｂは、図２に示すように、支軸部３４ｅと支持体３４ｆとからなる。支軸部３４ｅは、本体部３４ａと一体に形成され、反射シート６に形成された挿入孔６ｇに挿入されている。支持体３４ｆは、この支軸部３４ｅから基端の外周部に突出形成される。支持体３４ｆの先端は挿入孔６ｇよりも大径であり、先端面は挿入孔６ｇの一方の面側の周囲に支持される。この支持体３４ｆは、弾性特性を有し、挿入孔６ｇよりも大径である先端が径方向に押圧されると挿入孔６ｇよりも一時的に小径となり、反射シート６に脱着することが可能となる。

【0056】

ここで、バックライトユニット３の組立方法を説明する。

【0057】

先ず、既に一方の面に配線用パターン１２が設けられ、他方の面に放熱用パターン１３及びランド１４が設けられた光源基板１０の放熱用パターン１３及びランド１４上に、セラミック基板１５を熱伝導性に優れた接着剤等で接着させ実装させる。そして、セラミック基板１５の上面に複数のＬＥＤ１１を半田バンプ１６によって実装させる。そして、反射シート６の一方の面にこれら複数のＬＥＤ１１が実装された光源基板１０をマトリックス状に３行６列に配列させて熱伝導性に優れた熱伝導性両面テープ１８によって取り付ける。

【0058】

次に、図２に示すように、拡散プレート３１を、反射シート６の周囲に設けられた図示しない拡散プレート支持部上に配置させる。そして、反射シート６の各挿入孔６ｇと、各挿入孔６ｇの配置位置に対応して形成された拡散プレート貫通孔３１ａとを対向させる。

【0059】

次に、光学スタッド部材３４の取付部３４ｂを、反射シート６の他方の面側から拡散プレート３１の拡散プレート貫通孔３１ａを介して、挿入孔６ｇ内に押し込む。そして、光学スタッド部材３４の取付部３４ｂが挿入孔６ｇ内を通過する際に支持体３４ｆが小径となり、通過後弾性特性により挿入孔６ｇより大径に復帰するように押し込むことで、支持体３４ｆの先端面を挿入孔６ｇの一方の面側の周囲に支持させる。

【0060】

このとき、各光学スタッド部材３４は、支持体３４ｆの先端面が反射シート６の挿入孔６ｇの一方の面側の周囲に支持されるとともに、反射シート規定部３４ｄが反射シート６の他方の面と当接されることで反射シート６に取り付けられる。また、各光学スタッド部材３４は、反射シート６の周囲に設けられた図示しない拡散プレート支持部と拡散プレート規定部３４ｃとで拡散プレート３１を厚み方向（Ｚ方向）に挟持することで、反射シート６と拡散プレート３１との対向間隔を規定し、これら対向する主面間の平行度を全面に亘って高精度に位置決めする。

【0061】

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 104 of 836

次に、拡散導光プレート３２の一方の面を各光学スタッド部材３４の先端部に突き当てるようにして、拡散導光プレート３２をブラケット部材３２ａを用いて反射シート６の外周壁部６ｂに取り付ける。

【0062】

このとき、各光学スタッド部材３４は、その先端部が拡散導光プレート３２の一方の面に点又は狭い面積で接触され突き当てられるとともに、拡散プレート規定部３４ｃが拡散プレート３１の他方の面で当接されることで、拡散導光プレート３２と拡散プレート３１との対向間隔を規定し、これら対向する主面間の平行度を全面に亘って高精度に位置決めする。

【0063】

以上のように構成されたバックライトユニット３においては、反射シート６が、機械的剛性を有するアルミニウムプレートの基材６ｃの他方の面に蛍光剤を含有した高反射率特性を有する反射材６ｄを接合して形成されている。したがって、反射シート６は、その機械的剛性によりバックライトユニット３の基本構造体として機能するとともに、他方の面の高反射率特性を有する反射材６ｄによって各ＬＥＤ１１から照射された照明光及び拡散プレート３１で反射された照明光を拡散プレート３１側に反射させることができる。すなわち、上記特許文献１で備えられていたバックライト装置のバックシャーシと反射シートの組み合わせを、本発明では反射シート６の一部品に置き換えることができる。したがって、反射シート６の一方の面に、ＬＥＤ１１が実装された光源基板１０を複数取り付けることで、バックライトユニット３の構造を簡素化でき、部品点数の削減が図れ、軽量化を図ることができる。

【0064】

また、バックライトユニット３においては、光源基板１０の他方の面側にありセラミック基板１５の上面に実装されているＬＥＤ１１が、セラミック基板１５のスルーホール１５ａ及び光源基板１０のスルーホール１０ａを介して、光源基板１０の一方の面に設けられた配線用パターン１２と電気的に接続されているので、配線用パターン１２、コネクタ１７及びハーネス等の配線部品を光源基板１０の一方の面に実装させることができ、配線の設計の自由度の向上を図ることができる。

【0065】

更に、バックライトユニット３においては、図４中の矢印ｄ１方向のように、ＬＥＤ１１より発生した発生熱がセラミック基板１５に伝導され、セラミック基板１５から放熱用パターン１３及び熱伝導性両面テープ１８を介して反射シート６に伝導され、反射シート６によって放熱されることで、光源基板１０を冷却することができる。

【0066】

また、バックライトユニット３においては、反射シート６の一方の面にＬＥＤ１１が実装された光源基板１０が複数取り付けられているので、光源基板１０の一方の面に冷却手段を配置することができる。更に、光源基板１０の一方の面側に配置された冷却手段によって光源基板１０の一方の面を直接冷却することができる。このため、バックライトユニット３は、各ＬＥＤ１１から発生した発生熱を反射シート６により放熱するとともに、光源基板１０の一方の面を冷却手段によって直接冷却することで、各ＬＥＤ１１から発生した発生熱を簡単な構成で効率よく冷却することができる。

【0067】

更に、バックライトユニット３においては、光源基板１０が、反射シート６による放熱及び冷却ファン２０によって冷却されるので、光源基板１０に汎用性のあるガラスエポキシ基板を用いることができ、生産性の向上を図るとともにコストの削減を図ることができる。

【0068】

（第２実施形態）

次に、本発明の第２の実施形態について説明する。本実施形態において、上記第１の実施形態と同様の構成となる部分については同一の符号を付し、説明を省略または簡略化す

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 105 of 836

る。

【0069】

図６は、本実施形態における液晶表示装置１００の要部縦断面図であり、図７は、本実施形態における反射シート６と光源基板１０の要部切り欠き平面図であり、図８は、図７で示した反射シートの開口部６ｅと光源基板のＡ－Ａ´縦断面図である。

【0070】

図６に示すように、本実施形態の液晶表示装置１００は、上記第１の実施形態における図２等に示した液晶表示装置１と比較して、拡散プレート３１を設けていない点が異なる。すなわち、反射シート６と拡散導光プレート３２とは直接的に対向するように構成されている。したがって、光学スタッド部材３４においては、図２に示したような拡散プレート規定部３４ｃは設けられておらず、その本体部３４ａは、拡散導光プレート３２に当接する先端から反射シート規定部３４ｄにかけて略円錐状に形成されている。拡散プレート３１を廃することで、液晶表示装置１００の更なる薄型化、軽量化及びコストダウンを図ることができる。

【0071】

また、上記第１の実施形態において、図３に示したように各ＬＥＤ１１が光源基板１０上に直線状に実装されているのと異なり、本実施形態においては、図６～図８に示すように、ＬＥＤ１１は、非線状（十字状）に実装されている。

【0072】

具体的には、図７に示すように、各光源基板１０上には、４つのＬＥＤ１１がＸＹ方向に沿って十字状に近接して構成されたＬＥＤユニット１９が、各光源基板１０の長手方向（Ｘ方向）に所定間隔（例えば６０ｍｍ）を置いて複数（例えば６ユニット）設けられている。ただし、左端及び右端のＬＥＤユニット１９については、ＸＹ方向における十字状ではなく斜め方向にずれて配置され、また左右のＬＥＤユニット１９でその配置は対称的となっている。また、Ｙ方向において隣接する各光源基板１０は、互いに１８０度反転した状態となるように配置される。

【0073】

各ＬＥＤユニット１９は、例えばＸ方向に並んだそれぞれ一つの赤色ＬＥＤ１１ａ及び青色ＬＥＤ１１ｂと、Ｙ方向に並んだ２つの緑色ＬＥＤ１１ｃ及び１１ｄとで構成される。したがって、本実施形態においては、ＬＥＤユニット１９は６×４×１２＝２８８ユニット設けられ、ＬＥＤ１１は４×２８８＝１１５２個設けられることとなる。なお、ＬＥＤユニット１９及びＬＥＤ１１の数や配置間隔は、上述したものに限られるものではなく、液晶パネル４のサイズやＬＥＤ１１の発光能力等によって適宜変更可能である。

【0074】

また、本実施形態においては、各ＬＥＤ１１は非線状に設けられるため、反射シート６に設けられる開口部６ｅは、上記図３で示したような直線状ではなく、図７に示すように１つのＬＥＤ１１毎に例えば円柱状に形成され、各開口部６ｅは、各ＬＥＤ１１を反射シート６の反射材６ｄが設けられた方の面から露出させている。

【0075】

なお、図７に示すように、各光源基板１０の上記２つの緑色ＬＥＤ１１ｃ（Ｇ１）及び１１ｄ（Ｇ２）は、互いに色度が異なり、両者の平均色度が所定の色度となるように構成されている。すなわち、平均色度が所定の色度になりさえすれば、どのような色度の緑色ＬＥＤでも組み合わせることができる。このように構成することで、各色ＬＥＤの中でも特に大きい緑色ＬＥＤのばらつきを吸収することができる。

【0076】

そして、各緑色ＬＥＤ１１ｃ及び１１ｄ（Ｇ１及びＧ２）は、それぞれＸ方向に沿ってジグザグ状となるように配置されている。すなわち、各ＬＥＤユニット１９において各緑色ＬＥＤ１１ｃ及び１１ｄは上下の位置がＸ方向に行くにしたがって交互に入れ替わっている。

【0077】

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 106 of 836

また、上述したように、Ｙ方向において隣接する各光源基板１０は、互いに１８０度反転した状態となるように配置されるため、色度の異なる各緑色ＬＥＤ１１ｃ及び１１ｄをそれぞれＸ方向に沿って直線状に配置すると、Ｙ方向において隣接する光源基板１０間で、同一の色度を有する緑色ＬＥＤ１１ｃ同士及び１１ｄ同士（Ｇ１同士及びＧ２同士）が近接してしまい、これにより色むら及び輝度むらが生じてしまう。しかしながら、本実施形態のように緑色ＬＥＤ１１ｃ及び１１ｄをそれぞれジグザグ状に配置することで、Ｙ方向で隣接する光源装置２０間でＧ１同士及びＧ２同士の距離が近接することなく均一に配置されることとなるため、色むら及び輝度むら発生を抑えることができる。

【0078】

なお、上記緑色ＬＥＤ１１ｃ及び１１ｄには、色度のみならず輝度も異なるものを採用しても構わない。この場合、緑色ＬＥＤ１１ｃ及び１１ｄの平均輝度が所定の輝度となりさえすればどのような輝度の緑色ＬＥＤでも組み合わせることができる。

【0079】

また、ＬＥＤユニット１９に、緑色ＬＥＤ１１ｃ及び１１ｄのみならず、赤色ＬＥＤ１１ａまたは青色ＬＥＤ１１ｂも複数実装して、その複数の赤色ＬＥＤ１１ａまたは青色ＬＥＤ１１ｂの平均色度（または平均色度）が所定の色度（または輝度）となるようにしても構わない。

【0080】

図８に示すように、本実施形態においても、第１の実施形態と同様、各ＬＥＤ１１はスルーホール１５ａを有するセラミック基板１５上に半田バンプ１６を介して設けられている。しかし、上述のように本実施形態においては各ＬＥＤ１１が非線状に設けられているため、ランド１４、放熱用パターン１３及び配線用パターン１２は、直線状ではなく、各ＬＥＤ１１の配置に対応して非線状に設けられている。例えば、ＬＥＤ１１ｃとＬＥＤ１１ｄとの間に設けられた放熱用パターン１３は、当該２つのＬＥＤ１１ｃ及び１１ｄの放熱を兼ねるように形成されている。しかし、同図Ｘ方向に存在するＬＥＤ１１ａまたは１１ｂ（図７参照）が実装される各セラミック基板１５の下部においては、放熱用パターン１３は、各ＬＥＤ１１ａまたは１１ｂの放熱専用となるように形成されている。このような構成によっても、各ＬＥＤ１１からの発生する熱を、例えば同図矢印ｄ１に示すような経路で反射シート６から効率よく放熱することができる。また、各光源基板１０にも、各ＬＥＤ１１に対応してそれぞれスルーホール１０ａが設けられている。これにより、各ＬＥＤ１１のランド１４と、各ＬＥＤ１１の配置に応じて形成された配線用パターン１２とが電気的に接続されている。

【0081】

そして、本実施形態においては、上記第１の実施形態において設けられていた冷却ファン２０及び風向制御板２１を廃している。これにより、液晶表示装置１００の更なる薄型化、軽量化及びコスト低減を図ることができる。ただし、本発明はこの構成に限定されず、製品仕様に応じ、電子機器側またはバックライトユニット側に第１の実施形態と同様の冷却手段を設けてもよい。

【0082】

以上説明した上記第１及び第２の実施形態によれば、光源基板に汎用性のあるプリント配線基板を用いることで、生産性の向上を図るとともに、コストの削減を図ることができる。

【0083】

また、反射シートの一方の面に光源を有する光源基板を複数取り付けることで、反射シートとは反対側の光源基板の一方の面にコネクタやハーネス等の配線部品を実装させることができ、設計の自由度の向上を図ることができる。

【0084】

本発明は上述の実施形態にのみ限定されるものではなく、本発明の要旨を逸脱しない範囲内において種々変更を加え得ることは勿論である。

【0085】

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 107 of 836

上述の実施形態においては、各光源基板１０を、反射シート６の一方の面に取り付けており、この一方の面から各光源基板１０がそのＺ方向の厚み分及びコネクタ１７の厚み分だけ突出するような構成となっていた。しかし、例えば、反射シート６の一方の面に、各光源基板６の形状及び厚みに適合した凹部を設けて、この凹部に各光源基板６を埋設するようにしてもよい。また、この場合、コネクタ１７も反射シート６の一方の面から突出しないように当該一方の面に埋設してもよい。更に光学スタッド部材３４の支持体３４ｆも反射シート６の一方の面に埋設してもよい。これにより、液晶表示装置の更なる薄型化が可能となる。

【0086】

上述の各実施形態においては、液晶表示装置をテレビジョン受像機に適用した例を示したが、例えばＰＣや屋外用の大型ディスプレイ装置等の他の電子機器に適用することも勿論可能である。

【図面の簡単な説明】

【0087】

【図1】本発明の第１の実施形態における透過型の液晶表示装置の要部分解斜視図である。

【図2】本発明の第１の実施形態における透過型の液晶表示装置の要部縦断面図である。

【図3】本発明の第１の実施形態における反射シートの開口部と光源基板の要部斜視図である。

【図4】本発明の第１の実施形態における反射シートの開口部と光源基板の要部縦断面図である。

【図5】本発明の第１の実施形態における反射シートと光源基板の組立体の背面図である。

【図6】本発明の第２の実施形態における液晶表示装置の要部縦断面図である。

【図7】本発明の第２の実施形態における反射シートと光源基板の要部切り欠き平面図である。

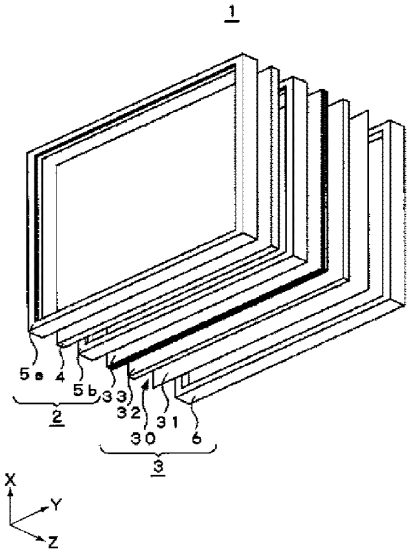
【図8】図７で示した反射シートの開口部と光源基板のＡ－Ａ´縦断面図である。

【符号の説明】

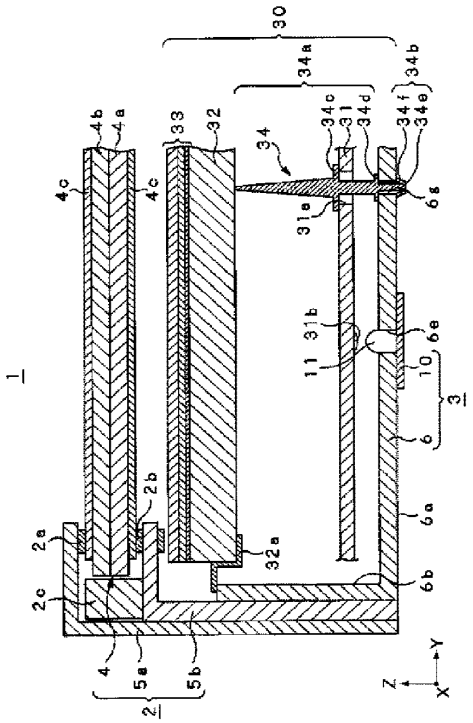
【0088】

１、１００…透過型の液晶表示装置
２…液晶パネルユニット
３…バックライトユニット
４…液晶パネル
６…反射シート
１０…光源基板
１１…発光ダイオード（ＬＥＤ）
１９…ＬＥＤユニット
３０…光学シートブロック
３１…拡散プレート
３２…拡散導光プレート
３３…光学機能シート積層体
３４…光学スタッド部材
５０…電子機器

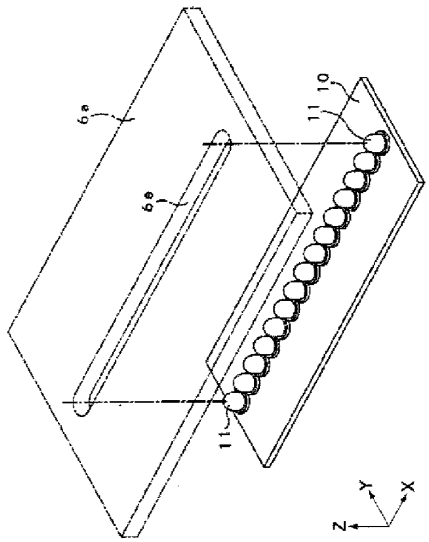
【図1】


1
5a
4
5b
33
32
31
30
6
2
3
X
Y
Z

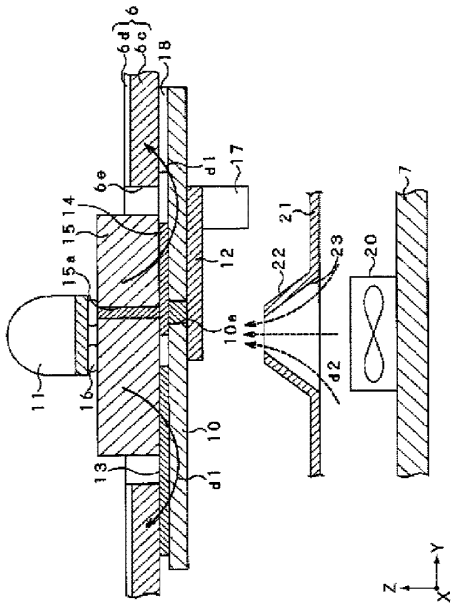
【図2】


30
34a
34b
4b
4a
33
32
34
34c
31
34d
34f
34e
4c
4c
6g
31a
31b
6e
11
10
3
6
2b
6a
2a
32a
6b
2c
4
5a
5b
2
Z
Y
X

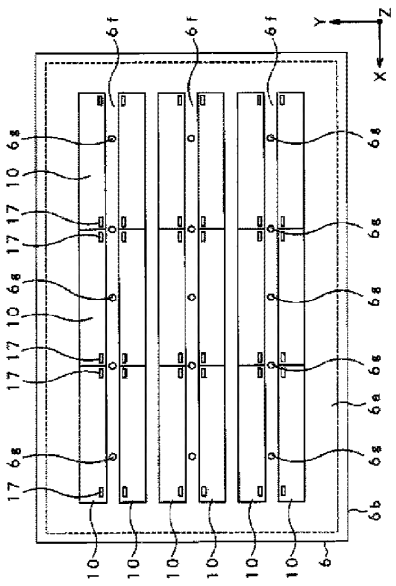
【図3】


6e
11
10
6e
11
Z
Y
X

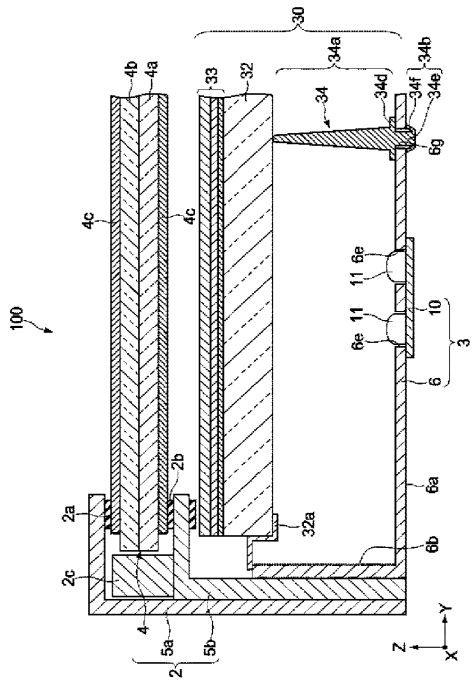
【図4】


6d
6c
6
18
d1
17
6e
14
15
15a
12
21
22
23
20
7
10a
d2
11
16
10
13
d1
Z
Y
X

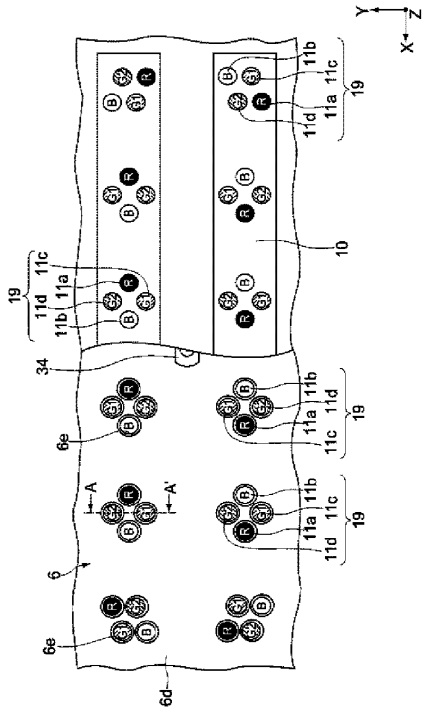
【図5】



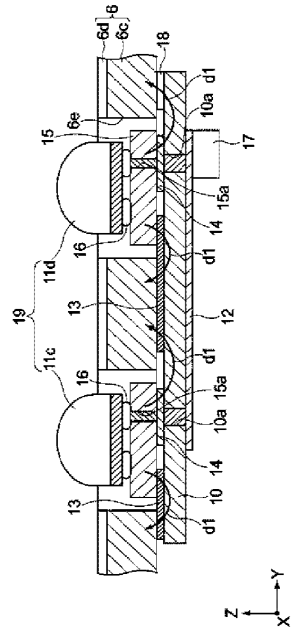
【図6】



【図7】



【図8】



Petitioner Hisense USA Corporation
Exhibit 1002 - Page 110 of 836

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3K243 MA01
5F041 AA33 DC07 DC23 EE23 FF11

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 111 of 836

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PACKAGE OF DISPLAY OPTICAL SHEET AND METHOD FOR PACKAGING SAME

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Applicant(s):	FUJIFILM CORP +
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	- European:
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Abstract of JP 2007076666 (A)

PROBLEM TO BE SOLVED: To provide a package of display optical sheets for packaging sheet-like articles used for a display such as a liquid crystal display element easily at a low cost, in comparison to those conventionally used, and to provide a method for packaging the same. ; SOLUTION: A layer 100 of two or more kinds of optical sheets (a first prism sheet 12, a first diffusion sheet 14, a second diffusion sheet 16, and a second prism sheet 18) arranged in the order of loading in a back light unit is inserted into a packaging bag 104 one end of which is sealed in advance. Pressure in the packaging bag 104 is reduced by an air suction nozzle 108 inserted in the opening 110 of the other end. The air suction nozzle 108 is retracted when the layer 100 and the packaging bag 104 are in close contact with each other, and then the opening 110 is sealed. ; COPYRIGHT: (C)2007,JPO&INPIT

Last updated: 26.04.2011 Worldwide Database 5.7.23.1; 92p

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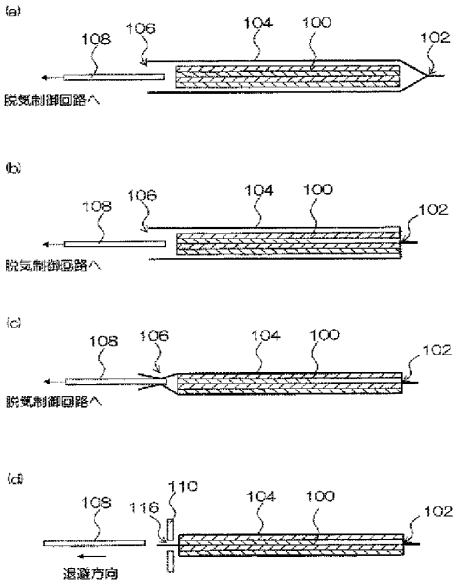
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(54)【発明の名称】ディスプレイ用光学シートの包装体及びその包装方法

(57)【要約】
【課題】液晶表示素子等のディスプレイ用途に使用されるシート状物を、従来に比べて簡易且つ低コストに包装するディスプレイ用光学シートの包装体及びその包装方法を提供する。
【解決手段】２種類以上の光学シート（第１のプリズムシート１２、第１の拡散シート１４、第２の拡散シート１６、第２のプリズムシート１８）がバックライトユニットに装填する順に並べられた冊１００は、予め片側が封緘された包装袋１０４に挿入され、他方の開口部１１０に差し込まれたエア吸引ノズル１０８によって包装袋１０４の内部を減圧し、冊１００と包装袋１０４が適度に密着した状態でエア吸引ノズル１０８を退避させ、開口部１１０が封止される。
【選択図】　図１５



Petitioner Hisense USA Corporation
Exhibit 1002 - Page 113 of 836

【特許請求の範囲】
【請求項1】
２種類以上の光学シートを所定の順序に積層した製品サイズの積層体が包装部材中に包装され、前記包装部材が前記積層体と密着するように前記包装材料を減圧した状態で封止されることを特徴とするディスプレイ用光学シートの包装体。
【請求項2】
２種類以上の光学シートを所定の順序に積層し前記光学シートの周縁部の少なくとも１箇所において接合した製品サイズの積層体が包装材料中に包装され、前記包装部材が前記積層体と密着するように前記包装材料を減圧した状態で封止されることを特徴とするディスプレイ用光学シートの包装体。
【請求項3】
前記光学シートはレンズシート及び拡散シートを含むことを特徴とする請求項１又は２記載のディスプレイ用光学シートの包装体。
【請求項4】
前記光学シートは複数のレンズシートが積層された積層レンズシート及び拡散シートを含むことを特徴とする請求項１、２又は３記載のディスプレイ用光学シートの包装体。
【請求項5】
前記積層体は、前記光学シートがバックライトユニットに装填する順序に積層されることを特徴とする請求項１乃至４のうち何れか１項に記載のディスプレイ用光学シートの包装体。
【請求項6】
前記包装部材は、少なくとも前記積層体と接触する部分に所定の弾性を有することを特徴とする請求項１乃至５のうち何れか１項に記載のディスプレイ用光学シートの包装体。
【請求項7】
２種類以上の光学シートを所定の順序に積層した製品サイズの積層体を包装部材中に包装する仮包装工程と、
前記包装部材が前記積層体と密着するように前記包装部材の内部を減圧する減圧工程と、
前記包装部材が前記積層体と密着する状態で前記包装部材を封止する封止工程と、
を含むことを特徴とするディスプレイ用光学シートの包装方法。
【請求項8】
２種類以上の光学シートを所定の順序に積層した製品サイズの積層体を前記光学シートの周縁部の少なくとも１箇所において接合する接合工程と、
前記接合工程によりその周縁部の少なくとも１箇所において接合された積層体を包装部材中に包装する仮包装工程と、
前記包装部材が前記積層体と密着するように前記包装部材の内部を減圧する減圧工程と、
前記包装部材が前記積層体と密着する状態で前記包装部材を封止する封止工程と、
を含むことを特徴とするディスプレイ用光学シートの包装方法。

【発明の詳細な説明】
【技術分野】
【0001】
本発明は、ディスプレイ用光学シートの包装体及びその包装方法に係り、特に、液晶表示素子等に使用されるシート状物を、従来に比べて簡易な工程且つ低コストで包装するのに好適な包装技術に関する。
【背景技術】
【0002】
近年、液晶表示素子や有機ＥＬ等の電子ディスプレイの用途に、導光板等の光源からの光を拡散させるフィルムや、正面方向に光を集光するレンズフィルム等が用いられている。

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 114 of 836

【0003】
この場合、各種の光学フィルム（シート）を積層して使用する例が多い。たとえば、特許文献１においては、反射型偏光フィルムと位相差フィルムと半透過半反射層とが任意の順番で積層され、更に、これら３層の外側に吸収型偏光フィルムが積層されてなる半透過半反射性偏光フィルムが提供されている。そして、光源装置と液晶セルとの間に５層ものフィルムが介在しており、この構成により、画面輝度が高められ、又は消費電力が抑えられるとされている。
【0004】
また、特許文献２～４においては、１枚の光拡散フィルムとレンズフィルムの機能を一体化したフィルムが開示されている。
【特許文献1】特開２００４－１８４５７５号公報
【特許文献2】特開平７－２３０００１号公報
【特許文献3】特許第３１２３００６号公報
【特許文献4】特開平５－３４１１３２号公報
【発明の開示】
【発明が解決しようとする課題】
【0005】
しかしながら、上記の従来の構成において、上記のフィルムを一枚ずつ包装すると、大変手間がかかり、コストアップは避けられない。
【0006】
また、包装材は、剥離された後には、廃却されるのみであり、資源として無駄であるのみならず、コストアップの要因ともなり、好ましくない。また、包装材をフィルムから剥離する作業が必要であり、その分だけ生産性を落すこととともなる。更に、輸送中に起こる擦れ等の原因でフィルムに傷を生じさせ易い。
【0007】
本発明は、このような事情に鑑みてなされたもので、液晶表示素子等のディスプレイ用途に使用されるシート状物を、従来に比べて簡易且つ低コストに包装するディスプレイ用光学シートの包装体及びその包装方法を提供することを目的とする。
【課題を解決するための手段】
【0008】
上記目的を達成するために、本発明に係るディスプレイ用光学シートの包装体は、２種類以上の光学シートを所定の順序に積層した製品サイズの積層体が包装部材中に包装され、前記包装部材が前記積層体と密着するように前記包装材料を減圧した状態で封止されることを特徴とする。
【0009】
本発明によれば、所定の順序に積層した複数種類の光学シートからなる積層体を包装部材と密着させた状態で包装部材が封止されるので、被包装物（積層体）の損傷を防止するとともに、該光学シートの積層体を組み付ける際の作業数を削減でき、製造コストの低減に寄与する。
【0010】
即ち、製品サイズの光学シートを用いることで、何枚ものシート（フィルム）をそれぞれ製品サイズに裁断する工程が省け、何層ものシートを位置決めしながら積層する工程も省ける。また、保護シートを用いることなく被包装体の損傷を回避でき、保護シートによる問題も生じず、コスト面及び品質面でも有利である。更に、何層ものフィルムを積層する際の問題点や、複数のフィルム間の熱膨張・熱収縮による問題点も生じない。
【0011】
ここでいう「光学シート」には、光学的機能を備える各種シートの総称であり、拡散シート、偏光板（偏光フィルム）、各種レンズシート（レンチキュラーレンズ、フライアイレンズ（蛇の目レンズ）、プリズムシート等）が代表的なものである。
【0012】

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 115 of 836

また、「製品サイズの積層体」は、製品サイズよりも大きなサイズの光学シートを積層した後に製品サイズに裁断する態様が好ましい。

【0013】

積層体を包装部材に包装（仮包装）する際に、該積層体の１箇所以上をクリップして搬送することが好ましい。

【0014】

「包装部材」には、袋状の包装部材１つの端辺（端部）に開口部を有し、該開口部から被包装物（積層体）を該袋状の包装材料の内部に挿入する態様がある。

【0015】

「前記包装部材を減圧した状態」には、積層体を包装した包装部材を所定の真空度で真空状態にする態様が好ましい。

【0016】

また、上記目的を達成するために、請求項２に記載の発明に係るディスプレイ用光学シートの包装体は、２種類以上の光学シートを所定の順序に積層し前記光学シートの周縁部の少なくとも１箇所において接合した製品サイズの積層体が包装材料中に包装され、前記包装部材が前記積層体と密着するように前記包装材料を減圧した状態で封止されることを特徴とする。

【0017】

本発明によれば、周縁部の少なくとも１箇所において積層体が接合されるので、該積層体を搬送する際に、積層体を構成する光学シート間の擦れによる損傷が防止される。なお、該積層体の４辺を接合する態様がより好ましい。このように、積層体の周縁の４辺において接合がなされれば、積層体の固定がより強固になり、また、ごみ等の汚染の混入も、より効果的に防止できる。

【0018】

積層体を構成する光学シートの接合には、接着材や両面接着テープ等の接合部材を用いてもよいし、溶着による接合を適用してもよい。積層体を構成する光学シートを溶着させる手段としては、超音波による加熱や、レーザ光の照射による加熱等が採用できる。溶着を用いる態様では、製品サイズよりも大きな光学シートからなる積層体を製品サイズに切断する工程と、積層体を構成する光学シートを接合する工程を共通化することができる。

【0019】

請求項３に記載の発明は、請求項１又は２記載のディスプレイ用光学シートの包装体の一態様に係り、前記光学シートはレンズシート及び拡散シートを含むことを特徴とする。

【0020】

請求項３に記載の発明によれば、傷がつき易く汚れやすいレンズシートと傷か目立たない拡散シートとを組み合わせることで（即ち、積層体の少なくとも一方の面に拡散シートを用いることで）、レンズシートの損傷や汚れを防ぐことが可能になる。なお、レンズシートの表裏両面に拡散シートを積層する態様がより好ましい。

【0021】

レンズシートには、「１軸方向に形成された凸状レンズが隣接して略全面に配列されたレンズシート」がある。「１軸方向に形成された凸状レンズが隣接して略全面に配列されたレンズシート」とは、レンチキュラーレンズやプリズムシートが代表的であり、他に回折格子等も含まれる。

【0022】

請求項４に記載の発明は、請求項１、２又は３記載のディスプレイ用光学シートの包装体の一態様に係り、前記光学シートは複数のレンズシートが積層された積層レンズシート及び拡散シートを含むことを特徴とする。

【0023】

複数のレンズシートが積層された積層レンズシートには、各レンズシートのレンズの軸が略直交する向きに積層する態様や、モアレ縞等の防止のために角度を若干量調整する態様がある。

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 116 of 836

【0024】
請求項５に記載の発明は、請求項１乃至４のうち何れか１項に記載のディスプレイ用光学シートの包装体の一態様に係り、前記積層体は、前記光学シートがバックライトユニットに装填する順序に積層されることを特徴とする。
【0025】
バックライトユニット（ＢＬＵ）に装着する順序に光学シートを積層することで、ＢＬＵの組立工程を簡素化することが可能である。
【0026】
請求項６に記載の発明は、請求項１乃至５のうち何れか１項に記載のディスプレイ用光学シートの包装体の一態様に係り、前記包装部材は、少なくとも前記積層体と接触する部分に所定の弾性を有することを特徴とする。
【0027】
請求項６に記載の発明によれば、包装部材と積層体との密着性を確保することができ、包装部材と積層体の擦れによる傷つきや粉塵の発生を防止することができる。更に、該包装部材に熱収縮性樹脂フィルムを適用する態様では、シュリンク包装を併用することで包装部材と積層体との密着性及び気密性をより向上させることができる。
【0028】
また、上記目的を達成するために、請求項７に記載の発明に係るディスプレイ用光学シートの包装方法は、２種類以上の光学シートを所定の順序に積層した製品サイズの積層体を包装部材中に包装する仮包装工程と、前記包装部材が前記積層体と密着するように前記包装部材の内部を減圧する減圧工程と、前記包装部材が前記積層体と密着する状態で前記包装部材を封止する封止工程と、
を含むことを特徴とする。
【0029】
製品サイズよりも大きな光学シートを用いる態様では、製品サイズよりも大きな光学シートからなる積層体を製品サイズに裁断する裁断工程が含まれる。
【0030】
包装部材に熱収縮性を有する材料を用いる場合、減圧工程（或いは、封止工程）に積層体が仮包装された包装部材を加熱する加熱工程を含むことが好ましい。
【0031】
また、上記目的を達成するために、請求項８に記載の発明に係るディスプレイ用光学シートの包装方法は、２種類以上の光学シートを所定の順序に積層した製品サイズの積層体を前記光学シートの周縁部の少なくとも１箇所において接合する接合工程と、前記接合工程によりその周縁部の少なくとも１箇所において接合された積層体を包装部材中に包装する仮包装工程と、前記包装部材が前記積層体と密着するように前記包装部材の内部を減圧する減圧工程と、前記包装部材が前記積層体と密着する状態で前記包装部材を封止する封止工程と、を含むことを特徴とする。
【0032】
該積層体の少なくとも１箇所を固定する態様によれば、包装時（特に、ハンドリング時）における光学シートの位置ズレや、該位置ズレによるシート間の擦れを防止することができる。
【発明の効果】
【0033】
本発明によれば、被包装物（複数種類の光学シートからなる積層体）に対して高い密着性で包装することが可能であり、被包装物の損傷を防止することができる。また、バックライトユニットの組み立てに必要な部材の組み込み作業数が減り、製造コストの削減に寄与する
【発明を実施するための最良の形態】
【0034】
以下、添付図面に基づいて、本発明の実施態様について説明する。先ず、本発明に係る

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 117 of 836

ディスプレイ用光学シートの製造方法により製造されたディスプレイ用光学シートの例（第１～第６実施形態）の構成を説明し、次いでこれらのディスプレイ用光学シートの製造方法（第１～第６の製造方法）について説明する。

【0035】

〔ディスプレイ用光学シートの説明〕

図１は、本発明に係るディスプレイ用光学シートの製造方法により製造されたディスプレイ用光学シートの例（第１実施形態）の構成を示す断面図である。

【0036】

このディスプレイ用光学シート１０は、下から順に、第１の拡散シート１２、第１のプリズムシート１４、第２のプリズムシート１６、及び第２の拡散シート１８が積層されてなる光学シートのモジュールである。

【0037】

第１の拡散シート１２及び第２の拡散シート１８は、透明なフィルム（支持体）の表面（片面）にビーズをバインダーで固定したシートであり、所定の光拡散性能を有するものである。第１の拡散シート１２と第２の拡散シート１８とはビーズの径（平均粒径）が異なっており、光拡散性能も異なっている。

【0038】

第１の拡散シート１２及び第２の拡散シート１８に使用される透明なフィルム（支持体）には、樹脂フィルムを使用できる。樹脂フィルの材質としては、ポリエチレン、ポリプロピレン、ポリ塩化ビニル、ポリ塩化ビニリデン、ポリ酢酸ビニル、ポリエステル、ポリオレフィン、アクリル、ポリスチレン、ポリカーボネート、ポリアミド、ＰＥＴ（ポリエチレンテレフタレート）、二軸延伸を行ったポリエチレンテレフタレート、ポリエチレンナフタレート、ポリアミドイミド、ポリイミド、芳香族ポリアミド、セルロースアシレート、セルロースストリアセテート、セルロースアセテートプロピオネート、セルロースダイアセテート等の公知のものが使用できる。これらのうち、特に、ポリエステル、セルロースアシレート、アクリル、ポリカーボネート、ポリオレフィンが好ましく使用できる。

【0039】

第１の拡散シート１２及び第２の拡散シート１８のビーズの径は、１００μｍ以下であることが必要であり、２５μｍ以下であることが好ましい。たとえば所定の分布７～３８μｍの範囲で、平均粒径が１７μｍとできる。

【0040】

第１のプリズムシート１４及び第２のプリズムシート１６は、１軸方向に形成された凸状レンズが隣接して略全面に配列されたレンズシートであり、たとえば、ピッチを５０μｍと、凹凸高さを２５μｍと、凸部の頂角を９０度（直角）とできる。

【0041】

この第１のプリズムシート１４と第２のプリズムシート１６とは、凸状レンズ（プリズム）の軸が略直交する向きに配されている。すなわち、図１において、第１のプリズムシート１４の凸状レンズの軸は紙面に垂直方向に配されており、第２のプリズムシート１６の凸状レンズの軸は紙面に平行方向に配されている。なお、図１においては、第２のプリズムシート１６の断面が凸状のレンズである旨が理解できるように、実際とは異なった向きに示されている。

【0042】

第１のプリズムシート１４と第２のプリズムシート１６の材質及び製法は、公知の各種態様が採り得る。たとえば、ダイより押し出したシート状の樹脂材料を、この樹脂材料の押し出し速度と略同速度で回転する転写ローラ（プリズムシートの反転型が表面に形成されている）と、この転写ローラに対向配置され同速度で回転するニップローラ板とで挟圧し、転写ローラ表面の凹凸形状を樹脂材料に転写する樹脂シートの製造方法が採用できる。

【0043】

また、ホットプレスにより、プリズムシートの反転型が表面に形成されている転写型板

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 118 of 836

（スタンパー）と樹脂板とを積層し、熱転写によりプレス成形する樹脂シートの製造方法が採用できる。

【0044】

このような製造方法に使用される樹脂材料としては、熱可塑性樹脂を用いることができ、たとえば、ポリメチルメタクリレート樹脂（ＰＭＭＡ）、ポリカーボネート樹脂、ポリスチレン樹脂、ＭＳ樹脂、ＡＳ樹脂、ポリプロピレン樹脂、ポリエチレン樹脂、ポリエチレンテレフタレート樹脂、ポリ塩化ビニル樹脂（ＰＶＣ）、熱可塑性エラストマー、又はこれらの共重合体、シクロオレフィンポリマー等が挙げられる。

【0045】

また、他の製造方法として、第１の拡散シート１２及び第２の拡散シート１８に使用されるのと同様の透明なフィルム（ポリエステル、セルロースアシレート、アクリル、ポリカーボネート、ポリオレフィン等）の表面に、凹凸ローラ（プリズムシートの反転型が表面に形成されている）表面の凹凸を転写形成する樹脂シートの製造方法が採用できる。

【0046】

より具体的には、表面に接着剤と樹脂とが順次塗布されることにより、接着剤層と樹脂層（たとえばＵＶ硬化性樹脂）とが２層以上に形成されている透明なフィルムを連続走行させ、この透明なフィルムを回転する凹凸ローラに巻き掛け、樹脂層に凹凸ローラ表面の凹凸を転写し、透明なフィルムが凹凸ローラに巻き掛けられている状態で樹脂層を硬化させる（たとえばＵＶ照射する）凹凸状シートの製造方法が採用できる。なお、接着剤はなくてもよい。

【0047】

なお、第１のプリズムシート１４及び第２のプリズムシート１６の製法は、上記の例に限定される訳ではなく、表面に所望の凹凸形状が形成できる方法であれば、他の製法も採用できる。

【0048】

図１に示されるように、ディスプレイ用光学シート１０の左右の端部は、接合部１０Ａにより各層が一体化されている。この接合部１０Ａの形成は、接合工程における炭酸ガスレーザ加工等によりなされている。

【0049】

以上に説明したディスプレイ用光学シート１０は、たとえば光源装置と液晶セルとの間に配され、全体で液晶表示素子を形成するように使用される。この場合、既述した各種のメリット（ディスプレイ用光学シートを従来より簡易な工程で低コストで、かつ高品質に製造できる）に加え、液晶表示素子のアセンブル作業も非常に容易となるというメリットが得られる。

【0050】

次に、本発明に係るディスプレイ用光学シートの製造方法により製造されたディスプレイ用光学シートの他の例（第２実施形態）について説明する。図２は、ディスプレイ用光学シート２０の構成を示す断面図である。なお、図１（第１実施形態）と同一、類似の部材については、同様の符号を付し、その詳細な説明は省略する。

このディスプレイ用光学シート２０は、下から順に、拡散シート１２、第１のプリズムシート１４、及び第２のプリズムシート１６が積層されてなる光学シートである。既述のディスプレイ用光学シート１０のような広い拡散性能が求められない場合に第２の拡散シート１８が省略されている。

【0051】

以上に説明したディスプレイ用光学シート２０は、第１実施形態と同様に、たとえば光源装置と液晶セルとの間に配され、全体で液晶表示素子を形成するように使用される。

【0052】

次に、本発明に係るディスプレイ用光学シートの製造方法により製造されたディスプレイ用光学シートの更に他の例（第３実施形態）について説明する。図３は、ディスプレイ用光学シート３０の構成を示す断面図である。なお、図１（第１実施形態）及び図２（第

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 119 of 836

１実施形態）と同一、類似の部材については、同様の符号を付し、その詳細な説明は省略する。

【0053】

このディスプレイ用光学シート３０は、下から順に、第１の拡散シート１２、プリズムシート１４、及び第２の拡散シート１８が積層されてなる光学シートである。

【0054】

このディスプレイ用光学シート３０は、既述のディスプレイ用光学シート１０のような紙面に垂直方向の拡散性能が求められない場合に、第２のプリズムシート１６が省略されているものである。

【0055】

以上に説明したディスプレイ用光学シート３０は、第１実施形態と同様に、たとえば光源装置と液晶セルとの間に配され、全体で液晶表示素子を形成するように使用される。

【0056】

次に、本発明に係るディスプレイ用光学シートの製造方法により製造されたディスプレイ用光学シートの更に他の例（第４実施形態）について説明する。図４は、ディスプレイ用光学シート４０の構成を示す断面図である。なお、図１（第１実施形態）、図２（第２実施形態）等と同一、類似の部材については、同様の符号を付し、その詳細な説明は省略する。

【0057】

このディスプレイ用光学シート４０は、下から順に、拡散シート１２、及びプリズムシート１４が積層されてなる光学シートである。既述のディスプレイ用光学シート１０のような広い拡散性能が求められない場合に第２の拡散シート１８が省略され、既述のディスプレイ用光学シート１０のような紙面に垂直方向の拡散性能が求められない場合に、第２のプリズムシート１６が省略されている。

【0058】

以上に説明したディスプレイ用光学シート４０は、第１実施形態と同様に、たとえば光源装置と液晶セルとの間に配され、全体で液晶表示素子を形成するように使用される。

【0059】

次に、本発明に係るディスプレイ用光学シートの製造方法により製造されたディスプレイ用光学シートの他の例（第５実施形態）について説明する。図５は、ディスプレイ用光学シート５０の構成を示す断面図である。なお、図１（第１実施形態）、図２（第２実施形態）等と同一、類似の部材については、同様の符号を付し、その詳細な説明は省略する。

【0060】

このディスプレイ用光学シート５０は、下から順に、第１のプリズムシート１４、第２のプリズムシート１６、及び拡散シート１８が積層されてなる光学シートである。既述のディスプレイ用光学シート１０のような広い拡散性能が求められない場合に第１の拡散シート１２が省略されている。

【0061】

以上に説明したディスプレイ用光学シート５０は、第１実施形態と同様に、たとえば光源装置と液晶セルとの間に配され、全体で液晶表示素子を形成するように使用される。

【0062】

次に、本発明に係るディスプレイ用光学シートの製造方法により製造されたディスプレイ用光学シートの他の例（第６実施形態）について説明する。図６は、ディスプレイ用光学シート５０の構成を示す断面図である。なお、図１（第１実施形態）、図２（第２実施形態）等と同一、類似の部材については、同様の符号を付し、その詳細な説明は省略する。

【0063】

このディスプレイ用光学シート６０は、下から順に、第１のプリズムシート１４、及び拡散シート１８が積層されてなる光学シートである。既述のディスプレイ用光学シート１

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 120 of 836

０のような広い拡散性能が求められない場合に第１の拡散シート１２が省略され、既述のディスプレイ用光学シート１０のような紙面に垂直方向の拡散性能が求められない場合に、第２のプリズムシート１６が省略されている。

【0064】

以上に説明したディスプレイ用光学シート６０は、第１実施形態と同様に、たとえば光源装置と液晶セルとの間に配され、全体で液晶表示素子を形成するように使用される。

【0065】

〔ディスプレイ用光学シートの製造方法の説明〕

次に、ディスプレイ用光学シートの製造方法（第１～第６の製造方法）について説明する。この製造方法は、既述のディスプレイ用光学シート１０～６０に共通して適用できるものであるが、説明の便宜より４層構成のディスプレイ用光学シート（第１実施形態）に適用した場合について説明する。

【0066】

図７は、第１の製造方法に適用されるディスプレイ用光学シート製造ライン１１の構成図である。図の左端部に設けられているロール１２Ｂ、１４Ｂ、１６Ｂ、及び１８Ｂは、それぞれ、既述の図１に示される第１の拡散シート１２、第１のプリズムシート１４、第２のプリズムシート１６、及び第２の拡散シート１８が巻回されたロールである。

【0067】

このロール１２Ｂ、１４Ｂ、１６Ｂ、及び１８Ｂは、図示しない繰り出し手段の回転軸にそれぞれ軸支されており、ロール１２Ｂ、１４Ｂ、１６Ｂ、及び１８Ｂより第１の拡散シート１２、第１のプリズムシート１４、第２のプリズムシート１６、及び第２の拡散シート１８がそれぞれ略同一速度で繰り出し可能となっている。

【0068】

繰り出された第１の拡散シート１２、第１のプリズムシート１４、第２のプリズムシート１６、及び第２の拡散シート１８は、それぞれガイドローラＧ、Ｇ…に支持され、最終的には、後述するレーザヘッド２４の上流側において積層されるようになっている（積層工程）。

【0069】

レーザヘッド２４を含むレーザ光照射装置としては、波長が３５５～１０６４ｎｍのＹＡＧレーザ照射装置、半導体レーザ照射装置、波長が９～１１μｍの炭酸ガスレーザ照射装置等が採用できる。発振方式は連続発振でもパルス発振でもよいが、裁断と略同時に溶着を行うにはパルス発振による点付けが、外見上の仕上がりもよく好適である。

【0070】

裁断（裁断工程）と略同時に溶着（接合工程）を行うのに必要な出力及び周波数は、素材の送り速度、レーザ光のスキャン速度、素材の厚さ等により異なるが、概ね、出力は２～５０Ｗが、周波数は１００ｋＨｚ以下の条件で良好な溶着結果が得られる。

【0071】

レーザヘッド２４は、Ｘ方向（シート幅方向）又はＸＹ方向に移動できるＸ駆動ロボット軸又はＸＹ駆動ロボット軸に取り付けられており、任意の位置への位置決めや任意の軌跡移動を行うことができる。レーザ光の照射パターンに応じてレーザヘッド２４ごと移動させてもよいが、レーザヘッド２４を別置き（固定）にして、レーザ光のみを光ファイバーにより導波することでＸＹ方向の移動機構を簡素化することもできる。

【0072】

なお、レーザヘッド２４による裁断時及び溶着時に発生する煙を吸引する公知の機構（吸引装置等）を設けることもできる。

【0073】

このレーザヘッド２４よりレーザ光を積層体周縁の被裁断・接合箇所に照射し、照射スポット一定の速度で移動させながら、積層体の周縁を製品サイズに裁断するとともに溶融させて接合する。

【0074】

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 121 of 836

以上の工程を経ることにより、ディスプレイ用光学シート１０（図１参照）が形成される。裁断及び接合されたディスプレイ用光学シート１０は、コンベア２６上に搬送されて停止する。コンベア２６上のディスプレイ用光学シート１０は吸着横移載装置２８により集積装置３２上に順次重ねられる。

【0075】

一方、レーザヘッド２４によりディスプレイ用光学シート１０が打ち抜かれたシートの積層体３４は、巻き取り装置（詳細は不図示）の巻き取りロール３６に巻き取られる。

【0076】

以上のディスプレイ用光学シートの製造方法（第１の製造方法）によれば、以下の１）～３）の効果が得られる。

【0077】

１）傷故障削減効果

レンズシート（第１のプリズムシート１４、第２のプリズムシート１６）の上面、下面に傷がつくとレンズ効果もあることより、傷が目立ってしまう。一方、拡散シート（第１の拡散シート１２、第２の拡散シート１８）の下面に傷がついた場合は、光が拡散されるので傷は目立たない。このようなことからレンズシートへの傷付きを防止することが傷故障削減に繋がる。傷は、シート加工後の取扱時に付くことが多いが、レンズシートを拡散シートと複合化することにより、拡散シートが保護シートの役割を果たすため、傷付きによる故障が削減できる。特に、レンズシートが表面に出ない、第１実施形態のディスプレイ用光学シート１０（図１参照）、及び第２実施形態のディスプレイ用光学シート３０（図３参照）においてその効果が大きい。

【0078】

２）組立工数削減効果

たとえば、液晶表示素子の組み立てにおいて、第１実施形態のディスプレイ用光学シート１０（図１参照）を使用した場合には、組立工数はディスプレイ用光学シート１０を組み込む１工程だけなのに対し、従来品を使用した場合には、第１の拡散シートの組み込み⇒第１のレンズシートの裏面保護シート剥し⇒第１のレンズシートの表面保護シート剥し⇒第１のレンズシートの組み込み⇒第２のレンズシートの裏面保護シート剥し⇒第２のレンズシートの表面保護シート剥し⇒第２のレンズシートの組み込み⇒第２の拡散シートの組み込み、と８工程必要となる。このように、第１の製造方法によれば、大幅な組立工数削減を達成でき、製品コストの低減ができる。

【0079】

３）保護シートの削減効果

レンズシートには、傷付き防止のために保護シートを表裏に貼着することが多い。この保護シートは、レンズシートを組み込んだ後は廃却するものであり、非常に無駄である。本発明品は、拡散シートを保護シートの役割とすることで、この保護シートを節約することができる。

【0080】

具体的には、第４実施形態のディスプレイ用光学シート４０（図４参照）、及び第６実施形態のディスプレイ用光学シート６０（図６参照）において保護シートを１枚削減でき、第３実施形態のディスプレイ用光学シート３０（図３参照）において保護シートを２枚削減でき、第２実施形態のディスプレイ用光学シート２０（図２参照）、及び第５実施形態のディスプレイ用光学シート５０（図５参照）において保護シートを３枚削減でき、第１実施形態のディスプレイ用光学シート１０（図１参照）において保護シートを４枚削減できる。

【0081】

次に、ディスプレイ用光学シートの他の製造方法（第２の製造方法）について説明する。図８は、第２の製造方法に適用されるディスプレイ用光学シート製造ライン２１の構成図である。なお、図７（第１の製造方法）のディスプレイ用光学シート製造ライン１１と同一、類似の部材については、同様の符号を付し、その詳細な説明を省略する。

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 122 of 836

【0082】
このディスプレイ用光学シート製造ライン２１においては、ディスプレイ用光学シート製造ライン１１のレーザヘッド２４に代えて、ディスペンサ４２、４４、４６及び打ち抜きプレス装置４８が採用されている。
【0083】
このディスペンサ４２、４４及び４６は、それぞれ接着剤を先端より吐出する供給装置である。ディスペンサ４２は、第１の拡散シート１２と第１のプリズムシート１４とを接着するために、第１の拡散シート１２の表面に接着剤を供給するものであり、ディスペンサ４４は、第１のプリズムシート１４と第２のプリズムシート１６とを接着するために、第１のプリズムシート１４の表面に接着剤を供給するものであり、ディスペンサ４６は、第２のプリズムシート１６と第２の拡散シート１８とを接着するために、第２のプリズムシート１６の表面に接着剤を供給するものである。
【0084】
ディスペンサ４２、４４及び４６より供給される接着剤は、熱又は触媒の助けにより接着される接着剤であることが好ましい。具体的には、シリコン系接着剤、ポリウレタン系接着剤、ポリエステル系接着剤、エポキシ系接着剤、シアノアクリレート系接着剤、アクリル系接着剤など一般的な接着剤を用いることができる。
【0085】
ディスプレイ用光学シート１０～６０は、高温で使用する可能性があるため、常温～１２０°Ｃでも安定な接着剤が好ましい。これらの中で、エポキシ系接着剤は強度、耐熱性に優れているため、好適に利用できる。シアノアクリレート系接着剤は、即効性と強度に優れているため、効率的なディスプレイ用光学シートの作製に利用できる。ポリエステル系接着剤は、強度、加工性に優れているため、特に好適である。
【0086】
これらの接着剤は、接着方法によって熱硬化型、ホットメルト型、２液混合型に大別されるが、好ましくは連続生産が可能な熱硬化型又はホットメルト型が使用される。どの接着剤を使用した場合でも、その塗布厚さは、０．５μｍ～５０μｍが好ましい。
【0087】
また、下流のプレスローラ（ガイドローラＧ）までの間に、接着剤を乾燥させる乾燥手段を設けるのが好ましい。この乾燥手段としては、特に制限はなく、公知の乾燥方法、たとえば、温風や熱風による乾燥、脱湿風による乾燥、等が挙げられる。
【0088】
ディスペンサ４２、４４及び４６はＸ方向（シート幅方向）又はＸＹ方向に移動できるＸ駆動ロボット軸又はＸＹ駆動ロボット軸に取り付けられ、任意の位置への位置決めや任意の軌跡移動を行うことができるようになっている。
【0089】
これらのディスペンサ４２、４４及び４６より接着剤を積層体周縁の被接合箇所に供給し、積層体を搬送しながら下流のプレスローラ（ガイドローラＧ）により積層体の周縁を接合する。
【0090】
ディスペンサ４２、４４及び４６の下流の打ち抜きプレス装置４８は、積層体の周縁を製品サイズに裁断する装置である。この打ち抜きプレス装置４８では、接着された部分の中心部分に刃物が入るようにすることにより、打抜かれたシート（ディスプレイ用光学シート１０～６０）の全片又は任意の片の端部分だけが接着された複合シートを得ることができる。
【0091】
次に、ディスプレイ用光学シートの更に他の製造方法（第３の製造方法）について説明する。図９は、第３の製造方法に適用されるディスプレイ用光学シート製造ライン３１の構成図である。なお、図７（第１の製造方法）のディスプレイ用光学シート製造ライン１１及び図８（第２の製造方法）のディスプレイ用光学シート製造ライン２１と同一、類似

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 123 of 836

の部材については、同様の符号を付し、その詳細な説明を省略する。

【0092】

このディスプレイ用光学シート製造ライン２１においては、ディスプレイ用光学シート製造ライン２１のディスペンサ４２、４４、４６に代えてテープ供給装置５２、５４、５６が採用されている。このテープ供給装置５２、５４及び５６は、それぞれ両面テープを先端より供給する供給装置である。

【0093】

テープ供給装置５２は、第１の拡散シート１２と第１のプリズムシート１４とを接着するために、第１の拡散シート１２の表面に両面テープを供給するものであり、テープ供給装置５４は、第１のプリズムシート１４と第２のプリズムシート１６とを接着するために、第１のプリズムシート１４の表面に両面テープを供給するものであり、テープ供給装置５６は、第２のプリズムシート１６と第２の拡散シート１８とを接着するために、第２のプリズムシート１６の表面に両面テープを供給するものである。

【0094】

テープ供給装置５２、５４及び５６より供給される両面テープは、両面に粘着剤が塗布されたものである。この両面テープの粘着剤としては、高粘着性アクリル共重合樹脂が使用できるが、それ以外にはたとえば、シリコン系、天然ゴム系、合成ゴム系等の粘着剤が使用でき、耐熱性、耐クリープ性等の物理強度、価格等を総合的に考慮すればアクリル系粘着剤を用いるのが好ましい。

【0095】

両面テープを供給するテープ供給装置５２、５４及び５６は、市販されている汎用のテープディスペンサーを使うことで対応可能である。テープ供給装置５２、５４及び５６はＸ方向（シート幅方向）の任意の位置に移動可能な１軸の移動機構に取り付けられており、打抜きパターンに応じて両面テープ貼りの位置を可変させることができる。

【0096】

また、テープ供給装置５２、５４及び５６の固定部分にはピボット機構があり、シートの送り速度に同期させてテープ供給装置５２、５４及び５６の位置をかえることで、斜め方向へのテープ貼りパターンにも対応可能な機構となっている。

【0097】

テープ供給装置５２、５４及び５６の下流の打ち抜きプレス装置４８では、接着されたテープ幅部分の中心部分に刃物が入るようにすることで、打抜かれたシート（ディスプレイ用光学シート１０～６０）の全片又は任意の片の端部分だけが接着された複合シートを得ることができる

次に、ディスプレイ用光学シートの更に他の製造方法（第４の製造方法）について説明する。図１０は、第４の製造方法に適用されるディスプレイ用光学シート製造ライン４１の構成図である。なお、図７（第１の製造方法）のディスプレイ用光学シート製造ライン１１、図８（第２の製造方法）のディスプレイ用光学シート製造ライン２１、及び図９（第３の製造方法）のディスプレイ用光学シート製造ライン３１と同一、類似の部材については、同様の符号を付し、その詳細な説明を省略する。

【0098】

このディスプレイ用光学シート製造ライン２１においては、ディスプレイ用光学シート製造ライン２１のディスペンサ４２、４４、４６に代えて超音波ホーン６２、６４、６６が採用されている。この超音波ホーン６２、６４及び６６は、それぞれプレスローラ（ガイドローラＧ）の下流側に配されている。

【0099】

この超音波ホーン６２、６４及び６６は、２枚以上の積層されたシートを融着させる装置である。すなわち、超音波ホーン６２は、第１の拡散シート１２と第１のプリズムシート１４とを融着させるものであり、超音波ホーン６４は、第１のプリズムシート１４と第２のプリズムシート１６とを融着させるものであり、超音波ホーン６６は、第２のプリズムシート１６と第２の拡散シート１８とを融着させるものである。

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 124 of 836

【0100】
超音波ホーン６２、６４及び６６（超音波溶着装置）としては、従来より公知であり、エアシリンダでホーンを昇降させる形式のものや、サーボモータによりホーンを昇降させる型式のものが知られているが、シートに荷重を加えながら超音波振動を付与してシート同士を溶着できるものであれば、どのような型式の超音波溶着装置でも適用可能である。
【0101】
超音波ホーン６２、６４及び６６の位置制御は、打抜きパターンがシートの送り方向に対して水平の場合は、シートの幅方向への位置切替だけでよいが、斜めに打抜くようなパターンに対応する場合には、超音波ホーン６２、６４及び６６の走行方向が任意の向きに可変できるような首振り機構を設け、シートの移動量と同期させて幅方向へ移動させることで対応可能である。
【0102】
超音波ホーン６２、６４及び６６の設定条件は、融着部分が熱により溶け切れたりしない範囲で定めればよく、必要に応じて接着（融着）後にエア吹き付けなどの空冷機構により接着部分を冷却してもよい。
【0103】
超音波ホーン６２、６４及び６６の下流の打ち抜きプレス装置４８では、接着された融着部分の中心部分に刃物が入るようにすることで、打抜かれたシート（ディスプレイ用光学シート１０～６０）の全片又は任意の片の端部分だけが接着された複合シートを得ることができる。
【0104】
次に、ディスプレイ用光学シートの更に他の製造方法（第５の製造方法）について説明する。図１１は、第５の製造方法に適用されるディスプレイ用光学シート製造ライン５１の構成図である。なお、図７（第１の製造方法）のディスプレイ用光学シート製造ライン１１、図８（第２の製造方法）のディスプレイ用光学シート製造ライン２１、及び図９（第３の製造方法）のディスプレイ用光学シート製造ライン３１等と同一、類似の部材については、同様の符号を付し、その詳細な説明を省略する。
【0105】
このディスプレイ用光学シート製造ライン２１においては、ディスプレイ用光学シート製造ライン４１の超音波ホーン６２、６４及び６６に代えてレーザヘッド７２、７４、７６が採用されている。このレーザヘッド７２、７４、７６は、超音波ホーン６２、６４及び６６と同様に、それぞれプレスローラ（ガイドローラＧ）の下流側に配されている。
【0106】
このレーザヘッド７２、７４、７６は、超音波ホーン６２、６４及び６６と同様に、２枚以上の積層されたシートを融着させる装置である。すなわち、レーザヘッド７２は、第１の拡散シート１２と第１のプリズムシート１４とを融着させるものであり、レーザヘッド７４は、第１のプリズムシート１４と第２のプリズムシート１６とを融着させるものであり、レーザヘッド７６は、第２のプリズムシート１６と第２の拡散シート１８とを融着させるものである。
【0107】
なお、レーザヘッド７２、７４、７６は、図７（第１の製造方法）のディスプレイ用光学シート製造ライン１１におけるレーザヘッド２４と異なり、接合工程にのみ使用され、裁断工程は打ち抜きプレス装置４８により行われる。ただし、レーザヘッド７２、７４、７６の基本的な仕様や周辺の構成は、第１の製造方法と略同様である。
【0108】
レーザヘッド７２、７４及び７６の設定条件は、融着部分が熱により溶け切れたりしない範囲で定めればよく、必要に応じて接着（融着）後にエア吹き付けなどの空冷機構により接着部分を冷却してもよい。
【0109】
レーザヘッド７２、７４及び７６の下流の打ち抜きプレス装置４８では、接着された融

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 125 of 836

着部分の中心部分に刃物が入るようにすることで、打抜かれたシート（ディスプレイ用光学シート１０～６０）の全片又は任意の片の端部分だけが接着された複合シートを得ることができる。

【0110】

次に、ディスプレイ用光学シートの更に他の製造方法（第６の製造方法）について説明する。図１２は、第６の製造方法に適用されるディスプレイ用光学シート製造ライン６１の構成図である。なお、図７（第１の製造方法）のディスプレイ用光学シート製造ライン１１、図８（第２の製造方法）のディスプレイ用光学シート製造ライン２１、及び図９（第３の製造方法）のディスプレイ用光学シート製造ライン３１等と同一、類似の部材については、同様の符号を付し、その詳細な説明を省略する。

【0111】

このディスプレイ用光学シート製造ライン２１においては、ディスプレイ用光学シート製造ライン５１の３台のレーザヘッド７２、７４及び７６に代えて１台のレーザヘッド７８が採用されている。このレーザヘッド７８は、プレスローラ（ガイドローラＧ）の下流側に配されている。

【0112】

このレーザヘッド７８は、２枚以上の積層されたシートを融着させる装置である。すなわち、レーザヘッド７８は、第１の拡散シート１２と第１のプリズムシート１４と第２のプリズムシート１６と第２の拡散シート１８との積層体を融着させるものである。

【0113】

なお、レーザヘッド７８は、図７（第１の製造方法）のディスプレイ用光学シート製造ライン１１におけるレーザヘッド２４と異なり、接合工程にのみ使用され、裁断工程は打ち抜きプレス装置４８により行われる。ただし、レーザヘッド７８の基本的な仕様や周辺の構成は、第１の製造方法と略同様である。

【0114】

レーザヘッド７８の設定条件は、融着部分が熱により溶け切れたりしない範囲で定めればよく、必要に応じて接着（融着）後にエア吹き付けなどの空冷機構により接着部分を冷却してもよい。

【0115】

レーザヘッド７８の下流の打ち抜きプレス装置４８では、接着された融着部分の中心部分に刃物が入るようにすることで、打抜かれたシート（ディスプレイ用光学シート１０～６０）の全片又は任意の片の端部分だけが接着された複合シートを得ることができる。

【0116】

次に、第１の拡散シート１２、第１のプリズムシート１４、第２のプリズムシート１６、及び第２の拡散シート１８の積層体より打抜かれるシート（ディスプレイ用光学シート１０～６０）の平面配置について説明する。

【0117】

図１３は、第１の製造方法において、積層体より打抜かれるシート（ディスプレイ用光学シート１０～６０）の平面配置を説明する図であり、図１４は、第２～第６の製造方法において、積層体より打抜かれるシート（ディスプレイ用光学シート１０～６０）の平面配置を説明する図である。

【0118】

図１３において、（Ａ）は、積層体の搬送方向に対して平行な融着（接合工程）及び打ち抜き（裁断工程）を行う状態を示し、（Ｂ）は、積層体の搬送方向に対して斜め方向に融着（接合工程）及び打ち抜き（裁断工程）を行う状態を示す。図において、積層体より打抜かれるシートの周縁部の点は、融着箇所を示す。

【0119】

図１４において、（Ａ）は、積層体の搬送方向に対して平行方向に融着又は接着（接合工程）を行う状態を示し、（Ｂ）は、積層体の搬送方向に対して斜め方向に融着又は接着（接合工程）を行う状態を示す。図において、積層体より打抜かれるシートの周縁部の点

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 126 of 836

は、融着箇所又は接着箇所を示す。

【0120】

以上、説明したように、本発明によれば、ディスプレイ用光学シートを従来より簡易な工程で低コストで、かつ高品質に製造することができる。

【0121】

また、本発明によれば、以下の効果も得られる。

【0122】

１）コストの削減、薄型化による製品価値の向上

大型液晶テレビに用いられる光学シートは剛性が必要なため、支持体の厚さをそれぞれ従来より２倍程度に厚くしたものが用いられている。しかしながら、本発明による光学シートは、シートを複合化したものであるため、それぞれの厚さを厚くせずとも充分に剛性を持たせることができ、各層の厚さを減らすことができる。

【0123】

２）集光効果の低減防止による性能の向上

レンズシートの傷付き防止(傷を目立たなくする目的)のために、裏面をマット処理している製品もある。本発明による光学シートではその必要がなく、生産コストが削減できるのみならず、マット処理による集光効果低減防止が可能であり、性能が向上する。

【0124】

以上、本発明に係るディスプレイ用光学シートの製造方法の実施形態の各例について説明したが、本発明は上記実施形態の例に限定されるものではなく、各種の態様が採り得る。

【0125】

たとえば、本実施形態の例では、いずれの場合においても第１のプリズムシート１４及び第２のプリズムシート１６のプリズムが上向きになっているが、このプリズムを下向きにして積層することもできる。

【0126】

また、ディスプレイ用光学シートの層構成も実施形態の例に限定されるものではなく、たとえば、保護シートを上下面に積層することもできる。

【0127】

以上のような構成であっても、本実施形態と同様に作用し、同様の効果が得られるからである。

【0128】

〔包装方法の説明〕

次に、図１５を用いて、上述したディスプレイ用光学シートの包装方法について説明する。図１５には、所定の包装枚数にそろえられたディスプレイ用光学シート（以下、「冊」と呼ぶ。）を脱気（減圧）しながら包装する脱気包装方法の手順を示す。なお、ここでいう冊には、図１～図６に示すような少なくとも１点を接合したディスプレイ用光学シートだけでなく、バックライトユニットの装填する順序に並べられた未接着の光拡散シート及びプリズムシートの組み合わせが含まれる。

【0129】

即ち、本例に示す包装方法が好適に用いられる光拡散シート及びプリズムシートの構成は、（１）第２の光拡散シート１８と第１のプリズムシート１４の組み合わせ（図６のディスプレイ用光学シート６０）、（２）第２の光拡散シート１８、第２のプリズムシート１６及び第１のプリズムシート１４の組み合わせ（図５のディスプレイ用光学シート５０）、（３）第２の拡散シート１８、第１のプリズムシート１４及び第１の拡散シート１２の組み合わせ（図３のディスプレイ用光学シート３０）、（４）第２の拡散シート１８、第２のプリズムシート１６、第１のプリズムシート１４及び第１の拡散シート１２の組み合わせ（図１のディスプレイ用光学シート１０）、（５）第１のプリズムシート１４及び第１の拡散シート１２の組み合わせ（図４のディスプレイ用光学シート４０）、（６）第２のプリズムシート１６、第１のプリズムシート１４及び第１の拡散シート１２の組み合

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 127 of 836

わせ（図２のディスプレイ用光学シート２０）がある。

【0130】

なお、上記（１）～（６）の光拡散シート及びプリズムシートの組み合わせにおいて、第１の拡散シート１４と第２の拡散シート１８とを適宜入れ替えてもよいし、第１のプリズムシート１４と第２のプリズムシート１６とを適宜入れ替えてもよい。例えば、（１）に示す光拡散シート及びプリズムシートの組み合わせにおいて、第１のプリズムシート１４に代わり第２のプリズムシートを第２の拡散シート１８に組み合わせてもよい。

【0131】

第１のプリズムシート１４及び第２のプリズムシート１６を用いる態様では、各プリズムシートは、各プリズムシートが有する凸状レンズの軸が略直交する向き（各プリズムシートが有する凸状レンズの稜線方向が互いに略直交する向き）に配されている。

【0132】

図１５(a)に示す仮包装工程では、予め、片側（第１の端部１０２）が封緘された包装袋１０４（包装部材）に冊１００（積層体）が挿入され、他方の開口部（第２の端部１０６）には包装袋１０４内の空気を排出するためのエア吸引ノズル１０８（脱気手段）が差し込まれる。また、このエア吸着ノズル１０８の上下には包装袋１０４の幅より広い長さを有するヒートシール機構（図１５(a)中不図示、図１５(d)に符号１１０で図示）が配置されている。なお、図１５(a)に示す冊１００及び包装袋１０４は、図１５(a)における下側から支持されている。

【0133】

バックライトユニットの装填する順序に並べられた未接着の光拡散シート及びプリズムシートの組み合わせを仮包装する場合、該シートの組み合わせはその一端（本例では、図１５(a)における左側の端部）をクリップした状態でハンドリングされる。

【0134】

図１５(b)に示す脱気工程では、エア吸引ノズル１０８に接続される不図示の排出ポンプを脱気制御回路（不図示）によって動作させて包装袋１０４内の空気を排出し（減圧し）、包装袋１０４を収縮させる。図１５(c)には、包装袋１０４の収縮が進行した状態を示す。なお、包装袋１０４の内部を減圧すると、包装袋１０４内の空気及び異物（ほこり等）が外部に排出される。更に、包装袋１０４に冊１００が適度に固定されるので、冊を構成するシート同士や冊と包装袋１０４と擦れによる発塵、傷付き、静電気の発生などが防止される。

【0135】

脱気工程では、冊１００が仮包装された包装袋１０４内を所定の真空度の真空状態としてもよい。

【0136】

図１５(d)に示す封止工程では、包装袋１００が収縮しきった状態で（即ち、冊１００と包装袋１０４が適度に密着して冊１００が包装袋１０４に固定された状態で）、エア吸引ノズル１０８を退避方法（矢印線で図示）に退避させるとともに、図１５(a)～(c)に示す第２の端部１０６にヒートシール１１０によってヒートシール処理が施され、封止部１１６が形成される。

【0137】

本例に用いられる包装袋１０４は、冊１００との密着性を確保するために、少なくとも冊１００と接触する部分は所定の弾性を有していることが好ましい。所定の弾性を有する部材の一例を挙げると、ＰＶＣ（ポリ塩化ビニル）、ＰＰ（ポリプロピレン）、ＰＥ（ポリエチレン）、ＰＳ（ポリスチレン）、ＰＯ（ポリオレフィン）、ＰＥＴ（ポリエチレンテレフタレート）などがある。なお、上記部材は熱収縮性を有しており、封止する際に熱をかけることで（シュリンク包装を併用することで）、包装袋１０４と冊１００との密着性（包装袋１０４の気密性）が向上する。

【0138】

上述した包装方法によれば、傷や異物の付着による冊の欠陥を低減し、組立工程及び検

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 128 of 836

査工程が削減される。また、保護シート等の削減による製品コストの削減に寄与する。

【図面の簡単な説明】

【0139】

【図1】本発明に係るディスプレイ用光学シートの製造方法により製造されたディスプレイ用光学シートの実施形態の断面図

【図2】ディスプレイ用光学シートの他の実施形態の断面図

【図3】ディスプレイ用光学シートの更に他の実施形態の断面図

【図4】ディスプレイ用光学シートの更に他の実施形態の断面図

【図5】ディスプレイ用光学シートの更に他の実施形態の断面図

【図6】ディスプレイ用光学シートの更に他の実施形態の断面図

【図7】第１の製造方法に適用されるディスプレイ用光学シート製造ラインの構成図

【図8】第２の製造方法に適用されるディスプレイ用光学シート製造ラインの構成図

【図9】第３の製造方法に適用されるディスプレイ用光学シート製造ラインの構成図

【図10】第４の製造方法に適用されるディスプレイ用光学シート製造ラインの構成図

【図11】第５の製造方法に適用されるディスプレイ用光学シート製造ラインの構成図

【図12】第６の製造方法に適用されるディスプレイ用光学シート製造ラインの構成図

【図13】第１の製造方法において、積層体より打抜かれるシートの平面配置を説明する図

【図14】第２～第６の製造方法において、積層体より打抜かれるシートの平面配置を説明する図

【図15】図１～図６に示すディスプレイ用光学シートの包装方法を説明する図

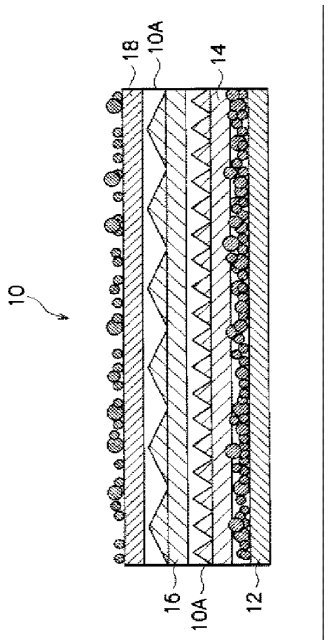
【符号の説明】

【0140】

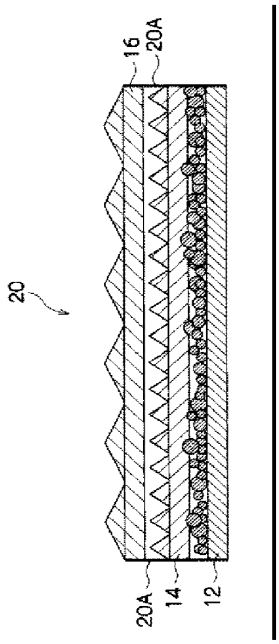
１０，２０，３０，４０，１００…ディスプレイ用光学シート、１２…第１の拡散シート、１４…第１のプリズムシート、１６…第２のプリズムシート、１８…第２の拡散シート、１００…冊、１０４…包装材料、１０８…エア吸着ノズル、１１０…ヒートシール機構

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 129 of 836

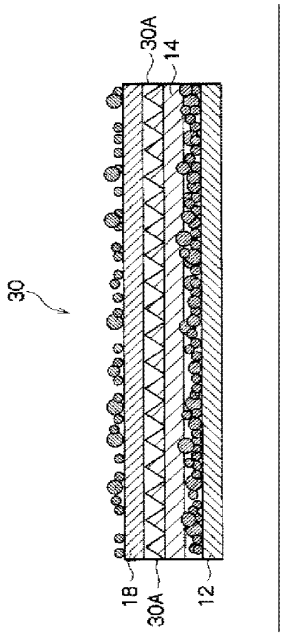
【図1】


10
18
10A
14
16
10A
12

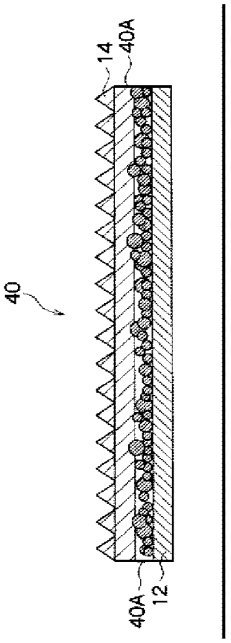
【図2】


20
16
20A
20A
14
12

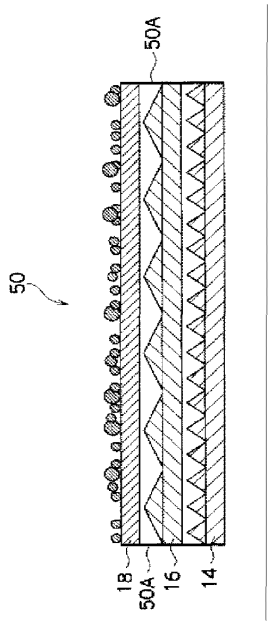
【図3】


30
30A
14
18
30A
12

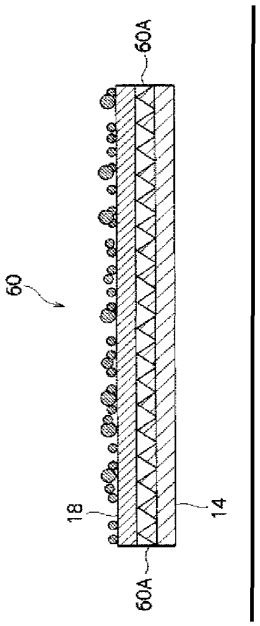
【図4】


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14
40A
40A
12

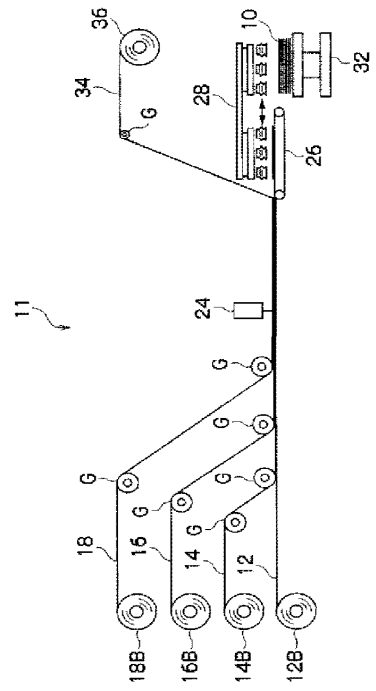
【図5】



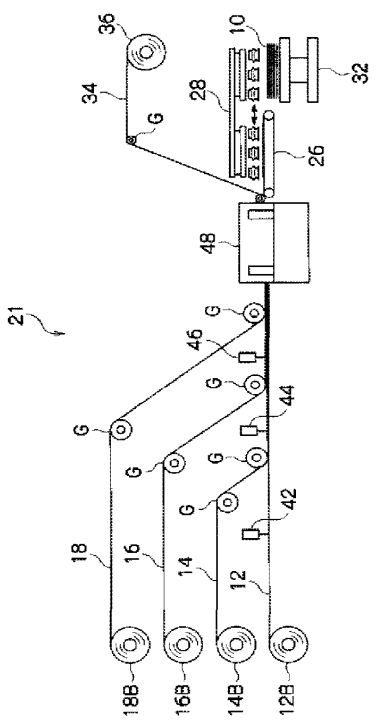
【図6】



【図7】

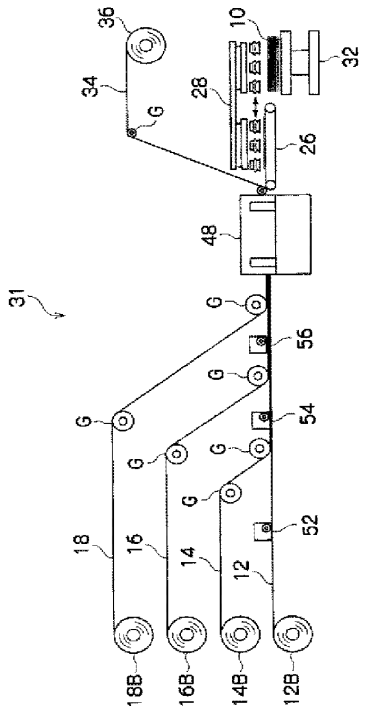


【図8】

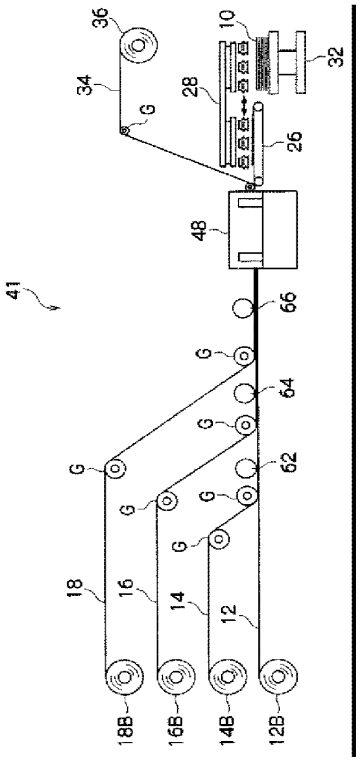


Petitioner Hisense USA Corporation
Exhibit 1002 - Page 131 of 836

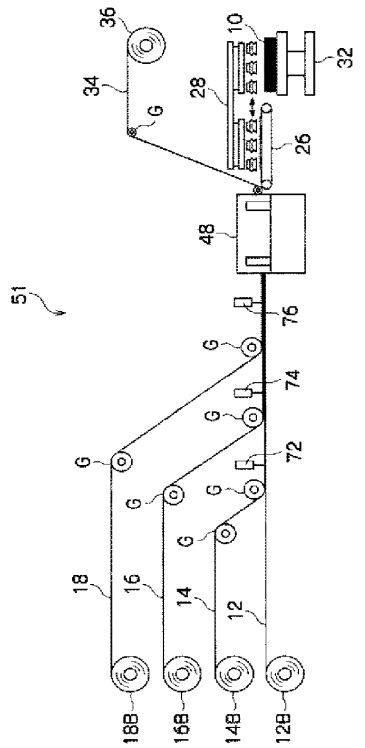
【図9】



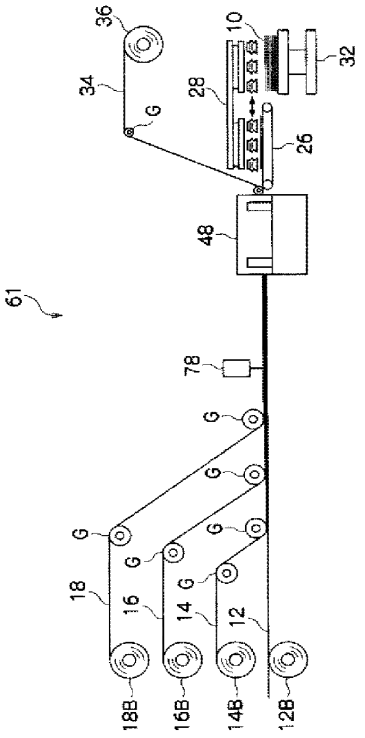
【図10】



【図11】

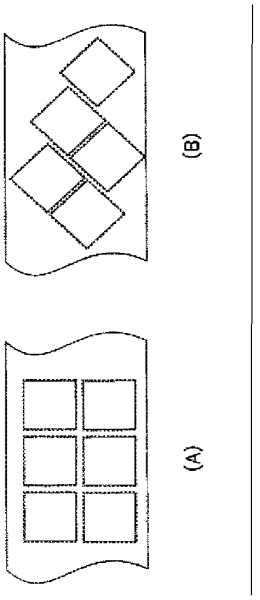


【図12】

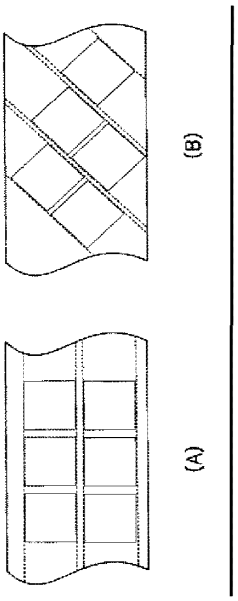


Petitioner Hisense USA Corporation
Exhibit 1002 - Page 132 of 836

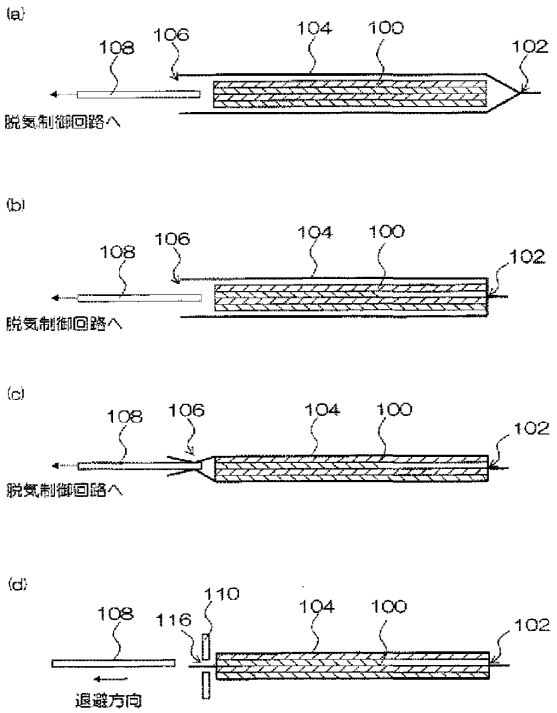
【図13】



【図14】



【図15】



Petitioner Hisense USA Corporation
Exhibit 1002 - Page 133 of 836

Electronic Patent Application Fee Transmittal

Application Number:	12045729
Filing Date:	11-Mar-2008
Title of Invention:	Apparatus and Methods for Multiplanar Optical Diffusers and Display Panels for Using the Same
First Named Inventor/Applicant Name:	John Roberts
Filer:	Timothy Jennings Wall/Greg Journigan
Attorney Docket Number:	5308-824

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:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
		Total in USD ($)		**180**

Electronic Acknowledgement Receipt

EFS ID:	10996496
Application Number:	12045729
International Application Number:	
Confirmation Number:	9825
Title of Invention:	Apparatus and Methods for Multiplanar Optical Diffusers and Display Panels for Using the Same
First Named Inventor/Applicant Name:	John Roberts
Customer Number:	65106
Filer:	Timothy Jennings Wall/Greg Journigan
Filer Authorized By:	Timothy Jennings Wall
Attorney Docket Number:	5308-824
Receipt Date:	21-SEP-2011
Filing Date:	11-MAR-2008
Time Stamp:	09:40:11
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$180
RAM confirmation Number	14549
Deposit Account	500220
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)

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<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.

Attorney Docket No. 5308-824 PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re: Roberts et al. Confirmation No. 9825
Application No.: 12/045,729 Examiner: Julie A. Shallenberger
Filing Date: March 11, 2008 Group Art Unit: 2885
For: APPARATUS AND METHODS FOR MULTIPLANAR OPTICAL DIFFUSERS AND DISPLAY PANELS FOR USING THE SAME

Date: September 21, 2011

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

INFORMATION DISCLOSURE STATEMENT TRANSMITTAL

Sir:

Attached is an Information Disclosure Statement listing of documents, together with a copy of any listed foreign patent document and/or non-patent literature. A copy of any listed U.S. patent and/or U.S. patent application publication is not provided herewith in accordance with 37 C.F.R. § 1.98(a)(2)(ii).

☐ In accordance with **37 CFR 1.97(b)**, the information disclosure statement is being filed:

☐ (1) within three months of the filing date of a national application other than a continued prosecution application under §1.53(d);

☐ (2) within three months of the date of entry of the national stage as set forth in §1.491 in an international application;

☐ (3) before the mailing of a first Office Action on the merits; or

☐ (4) before the mailing of a first Office Action after the filing of a request for continued examination under §1.114.

☐ In accordance with **37 CFR 1.97(c)**, the information disclosure statement is being filed after the period specified in 37 CFR 1.97(b) above, but before the mailing date of any of a final action under §1.113, a notice of allowance under §1.311, or an action that otherwise closes prosecution in the application, and is accompanied by **one** of the following:

☐ (1) The statement specified under **37 CFR 1.97(e)**, as follows:

☐ Each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement; **or**

☐ No item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in §1.56(c) more than three months prior to the filing of the information disclosure statement; **or**

☐ (2) The fee set forth in §1.17(p);

☒ In accordance with **37 CFR 1.97(d)**, the information disclosure statement is being filed after the period specified in 37 CFR 1.97(c) above, but on or before payment of the issue fee, and is accompanied by **both** of the following:

☒ (1) The statement specified under **37 CFR 1.97(e)**, as follows:

☒ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement; **or**

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in §1.56(c) more than three months prior to the filing of the information disclosure statement; **and**

☒ (2) The fee set forth in §1.17(p);

In accordance with **37 CFR 1.97(g)**, the information disclosure statement shall not be construed as a representation that a search has been made.

In accordance with **37 CFR 1.97(h)**, the information disclosure statement shall not be construed to be an admission that the information cited in the statement is, or is considered to be, material to patentability as defined in §1.56(b).

☒ The Director is hereby authorized to charge the fee specified in 37 C.F.R. § 1.17(p), and any fee deficiency or credit any overpayment, to Deposit Account No. 50-0220; or

☐ No fee is believed due. However, the Director is hereby authorized to charge any deficiency or credit any overpayment to Deposit Account No. 50-0220.

Respectfully submitted,

Timothy J. Wall
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CERTIFICATION OF TRANSMISSION

I hereby certify that this correspondence is being transmitted via the Office electronic filing system in accordance with 37 CFR § 1.6(a)(4) to the U.S. Patent and Trademark Office on September 21, 2011.

Name: Greg Journigan

Doc Code: AP.PRE.REQ

PTO/SB/33 (07-09)
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PRE-APPEAL BRIEF REQUEST FOR REVIEW

Docket Number (Optional): 5308-824

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on _____

Signature _____

Typed or printed name _____

Application Number	Filed
12/045,729	03/11/2008

First Named Inventor: John Roberts et al.

Art Unit	Examiner
9825	Julie A. Shallenberger

Applicant requests review of the final rejection in the above-identified application. No amendments are being filed with this request.

This request is being filed with a notice of appeal.

The review is requested for the reason(s) stated on the attached sheet(s).
Note: No more than five (5) pages may be provided.

I am the

- ☐ applicant/inventor.
- ☐ assignee of record of the entire interest. See 37 CFR 3.71. Statement under 37 CFR 3.73(b) is enclosed. (Form PTO/SB/96)
- ☑ attorney or agent of record. Registration number 50,743.
- ☐ attorney or agent acting under 37 CFR 1.34. Registration number if acting under 37 CFR 1.34 _____

Signature

Timothy J. Wall
Typed or printed name

919-854-1400
Telephone number

July 25, 2011
Date

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below*.

☑ *Total of 1 forms are submitted.

This collection of information is required by 35 U.S.C. 132. 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, 1.14 and 41.6. This collection is estimated to take 12 minutes 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: Mail Stop AF, 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.

Attorney's Docket No. 5308-824 PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re: John Roberts *et al.*
Serial No.: 12/045,729
Filed: March 11, 2008
For: APPARATUS AND METHODS FOR MULTIPLANAR OPTICAL DIFFUSERS AND DISPLAY PANELS FOR USING THE SAME

Confirmation No.: 9825
Group Art Unit: 2885
Examiner: Julie A. Shallenberger

July 25, 2011

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

REASONS IN SUPPORT OF APPELLANTS' PRE-APPEAL BRIEF REQUEST FOR REVIEW

Sir:

This document is submitted in support of the Pre-Appeal Brief Request for Review (hereinafter "Request") filed concurrently with a Notice of Appeal in compliance with 37 CFR § 41.31, and in accordance with the rules set out in the Official Gazette of July 12, 2005, for the New Appeal Brief Conference Pilot Program, which have been extended indefinitely. No fee or extension of time is believed due for this Request beyond those that may otherwise be provided for in documents accompanying this paper. However, if any fee or extension of time for this Request is required, Appellants request that this be considered a petition therefor. The Commissioner is hereby authorized to charge any additional fee, which may be required, or credit any refund, to our Deposit Account No. 50-0220.

REMARKS

Appellants hereby request a Pre-Appeal Brief Review of the rejections of pending Claims 1-10, 12-17 and 20-23, which were finally rejected in the final Office Action mailed April 25, 2011 ("Office Action").

Appellants will show below that the rejections of these claims are clearly improper based on errors in fact and law, and that the Office Action has failed to establish a *prima facie* case of obviousness. In the interest of brevity and without waiving the right to argue

additional grounds should this Request be denied, Appellants limit the substantive discussion herein to clear errors in the rejections of independent Claim 1, which stands rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 7,036,956 to Chou ("Chou") in view of U.S. Patent Publication No. 2004/0105251 to Yu ("Yu"). (Office Action, page 2.) However, as provided below, the errors in the rejection of Claim 1 also apply to the rejections of Claims 14 and 20. Claim 1, for example, recites, in part "wherein the plurality of solid state emitters comprise a third distance between adjacent ones of the plurality of solid state light emitters, and wherein the first distance is a function of the third distance."

Regarding the above recitation, the Office Action states that Chou shows "the first distance appears to be in a range between substantially approximately one half of the third distance" and that "the second distance comprises a value in a range between substantially the third distance value and substantially 1.5 times the third distance value." (Office Action, page 3.) Appellants respectfully submit that the Office Action allegations are both improper and factually incorrect. The Office Action appears to rely on illustrated dimensions in the cited figures of Chou as providing the alleged teachings. Such reliance is improper because it is well established that absent any written description in the specification of quantitative values, arguments based on the measurement of a drawing are of little value. (*See, e.g., Application of Wright*, 569 F.2d 1124, 193 U.S.P.Q. 332, 335 (C.C.P.A. 1977). Additionally, patent drawings do not define the precise proportions of the elements and may not be relied upon to show particular sizes if the specification is completely silent on the issue. (*See, e.g., Nystrom v. TREX Co., Inc.*, 424 F.3d 1136, 76 U.S.P.Q.2d 1481, 1490 (Fed. Cir. 2005). The Office Action does not allege and the specification of Chou does not describe the dimensional values corresponding to the distances as recited in Claim 1. As such, the Office Action conclusions regarding dimensions based on the figures in Chou are improper.

Additionally, even if the Office Action allegations are proper, which they are not, the allegations are factually false. For example, estimated measurements taken of a printout of Figures 3 and 4 of Chou, which are cited by the Office Action, provide that the alleged first distance is approximately 9mm, the alleged second distance is approximately 33mm and the alleged third distance is approximately 55mm. As such, the Office Action allegation that

Chou shows "the first distance [9mm] appears to be in a range between substantially approximately one half of the third distance [55mm]" is factually incorrect. Additionally the Office Action allegation that Chou shows "the second distance [33mm] comprises a value in a range between substantially the third distance value [55mm] and substantially 1.5 times the third distance value [82.5mm]" is also factually incorrect.

Further, even if the Office Action allegations were proper and factually correct, which they are not, such allegations do not address the recitations of Claim 1 that "the first distance is a **function of the third distance**," as recited in Claim 1. Chou is wholly silent regarding any relationships between the first and third distances and the Office Action provides no reference to such teachings therein. For at least the above reasons, Chou does not disclose or suggest what is alleged by the Office Action.

The Office Action further alleges that it would have been obvious to add more light emitters such that the first distance comprises approximately one half the third distance in order to increase the light output while providing enough air gap for refraction through diffusing mediums and that spacing light sources together is considered well within the level of one of ordinary skill in the art in order to obtain a desired level of light output. (Office Action, pages 4-5.) This statement is erroneous. The above recitations of Claim 1 are directed to relationships between structures of the device and not about adding light emitters. Moreover, using the logic asserted by the Office Action, there is no motivation to limit the number of light emitters (or the spacing therebetween) corresponding to any other property of the device. For example, if one of skill in the art would be motivated to add light emitters, there is no suggestion other than hindsight based reasoning provided by the teachings of Appellants' specification as to a practical limit of this approach.

Further, the Office Action states that one would have been motivated to make the first distance approximately one half the third distance to optimize the light efficiency and size of the display device. Appellants respectfully submit that, absent the roadmap provided by Appellants' specification, there is no suggestion to one of ordinary skill in the art that the relative dimensions as recited in Claim 1 would achieve the alleged motivation of light efficiency. In this regard, the alleged motivation does not provide a reason for altering the

prior art. As is well-established law, the standard for patentability does not depend on a showing of advantages or improvements, but rather obviousness. In this regard, as the Office Action has not provided a sufficient reason for finding the alteration from a ratio employed in the prior art in the direction and manner claimed, the rejection is untenable. (*See, e.g., Ex Parte Parthasarathy and Ciapetta*, 174 U.S.P.Q. 63, 1972 WL 17748 (Pat. & Trademark Office Bd. App. 1972). Appellants respectfully note that as the alleged reason for altering a ratio employed in the prior art is untenable, the obviousness allegation is improper.

Additionally, the Office Action states that it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. (*See, e.g.*, Office Action, page 10.) Appellants respectfully note that the Office Action improperly characterizes recitations of Claim 1 as optimum values. In fact, the recitations of Claim 1 include recognition of structural relationships that are unconsidered by the art of record and in fact are not "values" at all. For example, the recitations of Claim 1 do not include an optimal value corresponding to any "variable" described in Chou. As such, Application of the legal concept that is relied upon by the Office Action is misplaced.

Additionally, the Office Action does not allege and Yu does not provide the teachings that are missing from Chou. Accordingly, Claim 1 is patentable over Chou and Yu, the allowance of which is respectfully requested.

Additionally, Claim 14 includes recitations that are patentable over Chou and Yu for at least similar reasons. For example, Claim 14 recites, in part, "wherein the first distance comprises approximately one half of the third distance, and wherein the second distance comprises a value in a range between substantially the third distance value and substantially 1.5 times the third distance value." As discussed above, reading non-disclosed and factually incorrect dimensional properties into the references is impermissible. Claim 20 includes similar recitations and is thus patentable over Chou and Yu for at least the same reasons.

Appellants therefore respectfully request that the present application be reviewed and the rejections of the pending claims be reversed by the appeal conference prior to the filing of an Appeal Brief for at least these reasons.

Respectfully submitted,

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CERTIFICATION OF TRANSMISSION

I hereby certify that this correspondence is being transmitted via the Office electronic filing system in accordance with § 1.6(a)(4) to the U.S. Patent and Trademark Office on July 25, 2011.

Michele P. McMahan

Electronic Patent Application Fee Transmittal

Application Number:	12045729
Filing Date:	11-Mar-2008
Title of Invention:	Apparatus and Methods for Multiplanar Optical Diffusers and Display Panels for Using the Same
First Named Inventor/Applicant Name:	John Roberts
Filer:	Timothy Jennings Wall/Michele McMahan
Attorney Docket Number:	5308-824

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:				
Notice of appeal	1401	1	540	540
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
		Total in USD ($)		**540**

Electronic Acknowledgement Receipt

EFS ID:	10588825
Application Number:	12045729
International Application Number:	
Confirmation Number:	9825
Title of Invention:	Apparatus and Methods for Multiplanar Optical Diffusers and Display Panels for Using the Same
First Named Inventor/Applicant Name:	John Roberts
Customer Number:	65106
Filer:	Timothy Jennings Wall/Michele McMahan
Filer Authorized By:	Timothy Jennings Wall
Attorney Docket Number:	5308-824
Receipt Date:	25-JUL-2011
Filing Date:	11-MAR-2008
Time Stamp:	15:07:52
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$540
RAM confirmation Number	1465
Deposit Account	500220
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)

1	Notice of Appeal Filed	5308-824-Notice-Appeal.pdf	121239 3c71c7338e5cde81e38c918590cb0a3215956ee2	no	1
Warnings:					
Information:					
2	Pre-Brief Conference request	5308-824-PreAppealRequest.pdf	626083 60cc0847fd0b2c2483cecd6f46b49d92cdd3e866	no	6
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	30119 81fd263b4c74cba416a40d4f185409c44756cf5e	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	777441		

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.

PTO/SB/31 (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.

NOTICE OF APPEAL FROM THE EXAMINER TO THE BOARD OF PATENT APPEALS AND INTERFERENCES

Docket Number (Optional): 5308-824

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" [37 CFR 1.8(a)]
on _____

Signature _____

Typed or printed name _____

In re Application of: John Roberts et al.

Application Number	Filed
12/045,729	03-11-2008

For: Apparatus and Methods for Multiplanar.....

Art Unit	Examiner
2885	Julie A. Shallenberger

Applicant hereby **appeals** to the Board of Patent Appeals and Interferences from the last decision of the examiner.

The fee for this Notice of Appeal is (37 CFR 41.20(b)(1)) $ 540.00

☐ Applicant claims small entity status. See 37 CFR 1.27. Therefore, the fee shown above is reduced by half, and the resulting fee is: $ _____

☐ A check in the amount of the fee is enclosed.

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

☐ The Director has already been authorized to charge fees in this application to a Deposit Account.

☑ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. 50-0220 .

☐ A petition for an extension of time under 37 CFR 1.136(a) (PTO/SB/22) is enclosed.

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.

I am the

☐ applicant/inventor.

☐ assignee of record of the entire interest.
See 37 CFR 3.71. Statement under 37 CFR 3.73(b) is enclosed.
(Form PTO/SB/96)

☑ attorney or agent of record. Registration number 50,743.

☐ attorney or agent acting under 37 CFR 1.34.
Registration number if acting under 37 CFR 1.34. _____

Signature

Timothy J. Wall
Typed or printed name

919-854-1400
Telephone number

07-25-2011
Date

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below*.

☑ *Total of 1 forms are submitted.

This collection of information is required by 37 CFR 41.31. 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, 1.14 and 41.6. This collection is estimated to take 12 minutes 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.**

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/045,729	03/11/2008	John Roberts	5308-824	9825

65106 7590 04/25/2011

MYERS BIGEL SIBLEY & SAJOVEC, P.A.
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EXAMINER	
SHALLENBERGER, JULIE A	
ART UNIT	PAPER NUMBER
2885	
MAIL DATE	DELIVERY MODE
04/25/2011	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.

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 152 of 836

Office Action Summary	Application No.	Applicant(s)	
	12/045,729	ROBERTS ET AL.	
	Examiner	Art Unit	
	JULIE A. SHALLENBERGER	2885	

-- 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 *07 April 2011*.

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) *1-10,12-17 and 20-23* 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) _____ 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

The amendments submitted 4/7/11 have been entered.

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 1, 2, 4-6, 8, 9, 12, 14, 19 and 20-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chou (7,036,956) in view of Yu (2004/0105251).

In regard to claims 1 and 2, Chou teaches a solid state lighting device, comprising a plurality of solid state light emitters 37 that are configured to emit light; and a multiplane light diffuser including a first diffusion plane (corresponding to 34) and a second diffusion plane (corresponding to 36) that are separated by a gap (figures 3 and 4), the multiplane light diffuser including first side that is configured to receive the light emitted from the plurality of solid state light emitters and a second side that is configured to transmit diffused light the multiplane light diffuser comprises a diffuser plate 34 that includes the first side of the multiplane light diffuser and is positioned a first distance from the plurality of solid state light emitters, the diffuser plate configured to define the first diffusion plane, (col. 3 line 15-col. 4 line 49) as recited in claim 1, and Chou teaches a diffuser sheet 36 that includes the second side of the multiplane light diffuser and is positioned a second distance from the plurality of solid state light emitters, the diffuser sheet configured to define the second diffusion plane, wherein the

first distance is less than the second distance (figures 3 and 4, col. 3 line 15- col.4 line 38) as recited in claim 2, but lacks the teaching of the diffuser plate being a structured refractive diffuser.

Yu teaches a structured refractive diffuser 3025 (fig. 4) [0028].

It would have been obvious to one of ordinary skill in the art at the time the invention was made to been obvious to make the diffusion sheet of Chou have a refractive structure in order to enhance the diffusivity of the element. One would have been motivated to modify the diffusion sheet of Chou as taught by Yu in order to improve the uniformity of the display output.

With regard to the limitations in claims 1 and 14 which recite: “the solid state emitters comprise a third distance between adjacent ones of the plurality of solid state emitters, and wherein the first distance is a function of the third distance” as recited in claim 1 and "wherein the first distance comprises a value in a range between substantially approximately one half of the third distance, and wherein the second distance comprises a value in a range between substantially the third distance value and substantially 1.5 times the third distance value", Chou shows the first distance appears to be in a range between substantially approximately one half of the third distance, and wherein the second distance comprises a value in a range between substantially the third distance value and substantially 1.5 times the third distance value. Furthermore, the applicant is advised that it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only ordinary skill in the art. *In re Aller*, 105 USPQ 233.

In regard to claim 14, the method(s) recited in this claim are considered obvious in view of the structure of Chou and Yu as described in claims 1 and 2 above.

In regard to claim 4, Chou teaches a plurality of diffuser supports, wherein the diffuser supports 35, 55 comprise a proximal end that is configured to be positioned proximate the plurality of solid state light emitters; and a distal end that is configured to support the diffuser sheet (figures 3 and 4, col. 3 line 15-col. 4 line 49).

In regard to claim 5, Chou teaches the diffuser plate comprises a plurality of diffuser plate holes that are configured to receive the plurality of diffuser supports (col. 3 lines 30-38).

In regard to claim 6, Chou teaches the plurality of diffuser supports comprise steps for supporting, at the first distance from the plurality of solid state light emitters, the diffuser plate via the plurality of holes (col. 3 lines 30-38).

In regard to claims 8 and 9, Chou teaches the invention described above, including the second distance being about the same as the third distance (see fig. 3 and 4), and appears to show the first distance being approximately one half the third distance, but lacks the *explicit* (i.e. written) teaching of the plurality of solid state emitters comprise a third distance between adjacent ones of the plurality of solid state light emitters wherein the first distance comprises approximately one half the third distance as recited in claim 8.

However, it would have been obvious to one of ordinary skill in the art at the time the invention was made to add more light emitters such that the first distance comprises

approximately one half the third distance in order increase the light output while providing enough of an air gap for refraction through diffusing mediums and maintaining a slim display. One would have been motivated to make the first distance comprises approximately one half the third distance in order to optimize the light efficiency and size of the display device. The applicant is also advised that it has been held that discovering an *optimum value of a result effective variable involves only routine skill in the art. In re Boesch*, 617 F.2nd 272, 205 USPQ 215 (CCPA 1980). Spacing light sources closer together is considered will within the level of ordinary skill in the art in order to obtain a desired level of light output. It is also noted that moving the diffuser plate slightly away from the light emitters such that the first distance is half the third distance is also considered within the level of ordinary skill in order to obtain the desired amount of light refraction for particular applications of the lighting device.

In regard to claim 12, Chou teaches a means for transmitting first diffused light from the first diffusion plane to the second diffusion plane (via air space - see figure 3, col. 3 lines 30-38).

In regard to claim 19, the method(s) recited in this claim are considered obvious in view of the structure of Chou as described in claim 9 above.

In regard to claims 20-22, Chou teaches a backlighting panel comprising a plurality of solid state light emitters 37 arranged in a substantially planar configuration, a first diffusion plane 34 that is configured to receive light from the plurality of solid state light emitters and to transmit first diffused light; a second diffusion plane 36 that is configured to receive the first diffused light and to transmit second diffused light a

plurality of diffuser supports 35,55 configured to support a first diffuser plane structure at a first distance from the plurality of solid state light emitters and to support a second diffuser plane structure at a second distance from the plurality of solid state light emitters, wherein the second distance is greater than the first distance; and a LCD display panel (col. 3 lines 51-53) that is configured to receive the second diffused light and selectively transmit received light as display content (figures 3 and 4, col. 3 line 15-col. 4 line 49), but lacks the teaching of the diffuser plate being a structured refractive diffuser including extrusion peaks divided by extrusion grooves or crossed linear prismatic lenslets as recited in claims 20-22.

Yu teaches a diffuser plate with structured refractive with extrusion peaks divided by extrusion groove and crossed linear prismatic lenslets (fig. 3,4)[0028]. It is noted that the peak angles of Yu's extrusion peaks appear to be substantially the same as the applicant's fig. 6A,B and therefore they are considered to be within a range of 120-170 degrees as recited in claim 21. The applicant is also advised that it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only ordinary skill in the art. *In re Aller*, 105 USPQ 233.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the diffusion member of Chou to have refractive extrusions peaks and grooves with crossed prismatic lenslets in order to achieve a desired light output for various applications of the display device. One would have been

motivated to modify Chou's diffusion member to have crossed prismatic lenslets in order to optimize the quality of the display output.

Claims 3, 7, 13, 15, and 16, are rejected under 35 U.S.C. 103(a) as being unpatentable over Chou in view of Yu and further in view of Hafuka (2007/0019419).

In regard to claims 3 and 7 Chou and Yu teach the invention described above, (as well as Yu's teaching of a diffuser sheet 4025 with a polarizer, and BEF [0029] which are all well known optical sheets in the art), but Chou lacks the specific teaching of the diffuser sheet comprising a substantially transparent plate; and a diffuser film supported by the substantially transparent plate as recited in claim 3 or the diffuser sheet comprising a diffuser film, a brightness enhancing film, a polarizing film and a substantially clear plate configured to support the diffuser film, the BEF and polarizing film.

Hafuka teaches a diffuser film 13 supported by the substantially transparent plate 14 and the diffuser sheet comprises a diffuser film, a brightness enhancing film, a polarizing film and a substantially clear plate configured to support the diffuser film, the BEF, the polarizing film [0037].

It would have been obvious to one of ordinary skill in the art at the time the invention was made to make the diffusion sheet of Chou include a diffuser film, a brightness enhancing film, a polarizing film and a substantially clear plate configured to support the diffuser film in order to enhance the diffusivity of the element. One would

have been motivated to modify include these well known optical sheets in order to improve the uniformity of the display output.

In regard to claim 13, Chou and Yu teach the invention described above including Chou's multiplane light diffuser comprising a first diffuser plate positioned at a first distance from the plurality of solid state emitters; a second diffuser plate positioned at a second distance from the plurality of solid state emitters wherein the first distance is less than the second distance; but lacks the specific teaching of the second diffuser plate comprising a diffuser sheet supported by the second diffuser plate, as recited in claim 13.

Hafuka teaches a diffuser sheet supported by a diffuser plate 14 [0038].

It would have been obvious to one of ordinary skill in the art at the time the invention was made to been obvious to make the second diffuser of Chou comprise a diffuser sheet supported by the diffuser plate as taught by Hafuka in order to enhance optical properties via incorporating functional sheets therein as taught by Hafuka). One would have been motivated to make Chou's second diffusion plate include a diffusion sheet (as well as other optical sheets as desired) for improving the light output as necessitated by particular applications.

In regard to claims 15 and 16, the method(s) recited in this claim are considered obvious in view of the structure of Chou, Yu and Hafuka, as described in claims 3 and 13 above.

Claims 10 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chou in view of Yu and further in view of Boyd (2004/0136172).

In regard to claim 10, Chou teaches the invention described above, including a diffuser plate, but lacks the specific teaching of the diffuser comprising a light filter color.

Boyd teaches a diffuser including a light filter color [0036]

It would have been obvious to one of ordinary skill in the art at the time the invention was made to make the diffuser of Chou colored as taught by Boyd in order to filter out unwanted wavelengths. One would have been motivated to use a color filter in order to emit desired color(s) from the display as necessitated by particular applications of the backlight device.

In regard to claim 17, the method(s) recited in this claim are considered obvious in view of the structure of Chou, Yu and Boyd as described in claim 10 above.

Response to Arguments

Applicant's arguments filed have been fully considered but they are not persuasive.

With regard to the argument that Chou does not teach “the solid state emitters comprise a third distance between adjacent ones of the plurality of solid state emitters, and wherein the first distance is a function of the third distance” as recited in claim 1 and "wherein the first distance comprises a value in a range between substantially approximately one half of the third distance, and wherein the second distance comprises a value in a range between substantially the third distance value and

substantially 1.5 times the third distance value", Chou shows the first distance appears to be in a range between substantially approximately one half of the third distance, and wherein the second distance comprises a value in a range between substantially the third distance value and substantially 1.5 times the third distance value. Furthermore, the applicant is advised that it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only ordinary skill in the art. *In re Aller*, 105 USPQ 233.

With regard to the argument that it would not have been obvious to make the first distance one half the third distance, it is noted that Chou fig. 3-4 shows the first distance appears to be about one half of the third distance. Furthermore, the applicant is respectfully advised that it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 F.2nd 272, 205 USPQ 215 (CCPA 1980).

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JULIE A. SHALLENBERGER whose telephone number is (571)272-7131. The examiner can normally be reached on Monday - Friday 830-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jon-Suk (James) Lee can be reached on 571-272-7044. 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.

JAS
AU 2885
/Julie A Shallenberger/
Primary Examiner, Art Unit 2885

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12045729	ROBERTS ET AL.
	Examiner	Art Unit
	JULIE A SHALLENBERGER	2885

SEARCHED			
Class	Subclass	Date	Examiner
362	612,616-622,624-629,634,97.1-97.4	3/12/10	JAS
	updated	8/2/10	JAS
	updated	12/2/10	JAS
	updated	4/20/11	JAS

SEARCH NOTES		
Search Notes	Date	Examiner
Consulted Sharon Payne	3/12/10	JAS
inventor search	3/12/10	JAS
fwd/bwd search	3/12/10	JAS
Consulted Isma Negron	8/2/10	JAS

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	333	362/612,616-622,634,97.1-97.4.ccls. &@pd>"20101202"	US-PGPUB; USPAT; DERWENT	OR	OFF	2011/04/20 11:57

EAST Search History (Interference)

< This search history is empty>

4/20/2011 12:01:30 PM
C:\Documents and Settings\jshallenberger\My Documents\EAST\Workspaces\12045729_BL_diffusers.wsp

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 165 of 836

Attorney's Docket No. 5308-824 PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re: John Roberts *et al.* Confirmation No.: 9825
Serial No.: 12/045,729 Group Art Unit: 2885
Filed: March 11, 2008 Examiner: Julie A. Shallenberger
For: APPARATUS AND METHODS FOR MULTIPLANAR OPTICAL DIFFUSERS AND DISPLAY PANELS FOR USING THE SAME

April 7, 2011

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

AMENDMENT AND RESPONSE

Sir:

The present Amendment and response is provided to address the issues raised in the Office Action mailed December 7, 2010.

It is not believed that an extension of time and/or additional fee(s)-including fees for net addition of claims-are required, beyond those that may otherwise be provided for in documents accompanying this paper. In the event, however, that an extension of time is necessary to allow consideration of this paper, such an extension is hereby petitioned under 37 C.F.R. §1.136(a). Any additional fees believed to be due in connection with this paper may be charged to our Deposit Account No. 50-0220.

Claim Amendments are included in a listing of the claims, which is provided beginning on page 2 of this paper.

Remarks begin on page 7 of this paper.

Amendments to the Claims:

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

Listing of the Claims:

1. (Currently amended) A solid state lighting device, comprising:

a plurality of solid state light emitters that are configured to emit light; and

a multiplane light diffuser including a first diffusion plane that is a first distance from the plurality of solid state emitters and a second diffusion plane that is a second distance from the plurality of solid state emitters that is different from the first distance ~~that are separated by a gap~~, the multiplane light diffuser including first side that corresponds to the first plane and that is configured to receive the light emitted from the plurality of solid state light emitters and a second side that corresponds to the second plane and that is configured to transmit diffused light,

wherein the multiplane light diffuser comprises a diffuser plate that includes the first side of the multiplane light ~~diffuser and is positioned a first distance from the plurality of solid state light emitters~~, the diffuser plate configured to define the first diffusion plane, and

~~wherein the diffuser plate comprises a structured refractive diffuser that includes a plurality of extrusion peaks that are divided by a plurality of extrusion grooves~~wherein the plurality of solid state emitters comprise a third distance between adjacent ones of the plurality of solid state light emitters, and wherein the first distance is a function of the third distance.

2. (Currently amended) The device of Claim 1, wherein the multiplane light diffuser comprises:

a diffuser sheet that includes the second side of the multiplane light diffuser and is positioned ~~a~~the second distance from the plurality of solid state light emitters, the diffuser sheet configured to define the second diffusion plane~~,~~

~~wherein the first distance is less than the second distance~~.

3. (Original) The device of Claim 2, wherein the diffuser sheet comprises:

a substantially transparent plate; and

a diffuser film supported by the substantially transparent plate.

4. (Original) The device of Claim 2, comprising a plurality of diffuser supports, wherein the diffuser supports comprise:

a proximal end that is configured to be positioned proximate the plurality of solid state light emitters; and

a distal end that is configured to support the diffuser sheet.

5. (Original) The device of Claim 4, wherein the diffuser plate comprises a plurality of diffuser plate holes that are configured to receive the plurality of diffuser supports.

6. (Original) The device of Claim 4, wherein the plurality of diffuser supports comprise steps for supporting, at the first distance from the plurality of solid state light emitters, the diffuser plate via the plurality of holes.

7. (Original) The device of Claim 2, wherein the diffuser sheet comprises a diffuser film, a brightness enhancing film, a polarizing film and a substantially clear plate configured to support the diffuser film, the brightness enhancing film, the polarizing film.

8. (Original) The device of Claim 2, wherein the plurality of solid state emitters comprise a third distance between adjacent ones of the plurality of solid state light emitters, and wherein the first distance comprises approximately one half the third distance.

9. (Currently amended) The device of Claim 2, ~~wherein the plurality of solid state emitters comprise a third distance between adjacent ones of the plurality of solid state~~

~~light emitters, and~~ wherein the second distance comprises a distance in a range between the third distance and 1.5 times the third distance.

10. (Previously presented) The device of Claim 1, wherein the diffuser plate comprises a plate including a light filter color.

11. (Canceled)

12. (Original) The device of Claim 1, further comprising means for transmitting first diffused light from the first diffusion plane to the second diffusion plane.

13. (Previously presented) The device of Claim 1, wherein the multiplane light diffuser comprises:

the first diffuser plate positioned at a first distance from the plurality of solid state emitters;

a second diffuser plate positioned at a second distance from the plurality of solid state emitters; and

a diffuser sheet supported by the second diffuser plate,

wherein the first distance is less than the second distance.

14. (Currently amended) A method of providing diffused light comprising:

emitting light from a plurality of solid state light emitters arranged in a planar configuration;

receiving the emitted light at a first side of a first diffusion plane that is a first distance from the plurality of solid state light emitters;

transmitting first diffused light from a structured refractive diffuser plate at a second side of the first diffusion plane;

receiving the first diffused light from the first diffusion plane at a first side of a second diffusion plane that is a second distance from the plurality of solid state light emitters; and

transmitting second diffused light from a second side of the second diffusion plane,

wherein the plurality of solid state light emitters comprise a third distance between adjacent ones of the plurality of solid state light emitters, wherein the first distance comprises approximately one half of the third distance, and wherein the second distance comprises a value in a range between substantially the third distance value and substantially 1.5 times the third distance value.

15. (Original) The method of Claim 14, wherein transmitting the first diffused light comprises transmitting the first diffused light from a diffuser plate and wherein transmitting the second diffused light comprises transmitting the second diffused light from a diffuser sheet that is supported by a substantially transparent sheet.

16. (Original) The method of Claim 14, wherein transmitting the first diffused light comprises transmitting light from a first diffuser plate and wherein transmitting the second diffused light comprises transmitting light from a diffuser sheet that is supported by a second diffuser plate.

17. (Previously presented) The method of Claim 14, wherein transmitting the first diffused light comprises transmitting scattered diffusion light from a plate including a light filter color.

18-19. (Canceled)

20. (Currently amended) A display comprising:

a backlighting panel comprising

a plurality of solid state light emitters arranged in a substantially planar configuration,

a first diffusion plane that is configured to receive light from the plurality of solid state light emitters and to transmit first diffused light, the first diffusion plane

including a diffuser plate that is positioned a first distance from the plurality of solid state light ~~emitters and that includes a structured refractive diffuser that includes a plurality of extrusion peaks that are divided by a plurality of extrusion grooves~~;

a second diffusion plane that is configured to receive the first diffused light and to transmit second diffused light

a plurality of diffuser supports configured to support a first diffuser plane structure at a first distance from the plurality of solid state light emitters and to support a second diffuser plane structure at a second distance from the plurality of solid state light emitters, wherein the second distance is greater than the first distance; and

a LCD display panel that is configured to receive the second diffused light and selectively transmit received light as display content.

21. (Currently amended) The device of Claim 23[[1]], wherein ones of the plurality of extrusion peaks include a peak angle in a range of about 120 degrees to 170 degrees.

22. (Currently amended) The device of Claim 23[[1]], wherein the structured refractive diffuser comprises a plurality of crossed linear prismatic lenselets.

23. (New) The device of Claim 1, wherein the diffuser plate comprises a structured refractive diffuser that includes a plurality of extrusion peaks that are divided by a plurality of extrusion grooves.

REMARKS

Applicants appreciate the detailed examination evidenced by the Office Action mailed December 7, 2010 ("Office Action"). Applicants have amended the claims as set out above and respectfully submit that the pending claims are in condition for allowance for at least the reasons discussed herein.

Claims 1, 14 and 20 are Patentable

Claims 1, 2, 4-6, 8, 9, 12, 14, 19 and 20-22 stand rejected under 35 U.S.C. §103(a) as unpatentable over U. S. Patent No. 7,036,956 to Chou ("Chou") in view of U.S. Patent Publication No. 2004/0105251 to Yu ("Yu"). (Office Action, page 2.) Applicants respectfully traverse the rejection on the basis that Chou and Yu, alone or in combination, do not disclose or suggest all of the recitations of Claims 1, 14 and 20. Claim 1 is amended to recite, in part:

> a multiplane light diffuser including a first diffusion plane that is a first distance from the plurality of solid state emitters and a second diffusion plane that is a second distance from the plurality of solid state emitters...
>
> wherein the plurality of solid state emitters comprise a third distance between adjacent ones of the plurality of solid state light emitters, and wherein the first distance is a function of the third distance.

As Claim 1 is amended to include general recitations that corresponding to specific recitations of Claim 8, the rejection of which will be addressed as applied to Claim 1. Regarding Claim 8, the Office Action states that Chou teaches "the second distance being about the same as the third distance (see fig. 3 and 4)." (Office Action, page 4.) Applicants respectfully disagree. The Office Action appears to rely on illustrated dimensions in the cited figures of Chou as providing the alleged teachings. Such reliance is improper. It is well established that absent any written description in the specification of quantitative values, arguments based on the measurement of a drawing are of little value. (*See, e.g., Application of Wright*, 569 F.2d 1124, 193 U.S.P.Q. 332, 335 (C.C.P.A. 1977). Additionally, patent drawings do not define the precise proportions of the elements and may not be relied upon to show particular sizes if the specification is completely silent on the issue. (*See, e.g., Nystrom*

v. TREX Co., Inc., 424 F.3d 1136, 76 U.S.P.Q.2d 1481, 1490 (Fed. Cir. 2005). The Office Action does not allege and the specification of Chou does not describe the dimensional values corresponding to the distances as recited in Claim 1, as amended. As such, Chou does not disclose of suggest what is alleged by the Office Action. As Chou does not disclose dimensional values, then Chou necessarily does not disclose or suggest relationships between various ones of the dimensions, as disclosed in Claim 1, as amended.

Additionally, the Office Action concedes that Chou lacks the teachings regarding "a third distance between adjacent ones of the plurality of solid state light emitters, and wherein the first distance comprises approximately one half the third distance," as recited in Claim 8. (Office Action, page 4.) Accordingly, Chou necessarily lacks the teachings that "the first distance is a function of the third distance," as recited in Claim 1, as amended. The Office Action alleges that it would have been obvious to add more light emitters such that the first distance comprises approximately one half the third distance in order to increase the light output while providing enough air gap for refraction through diffusing mediums and that spacing light sources together is considered well within the level of one of ordinary skill in the art in order to obtain a desired level of light output. (Office Action, page 4.) This statement is erroneous. The above recitations of Claim 1, as amended, are directed to the relative distances between components of the device and not about adding light emitters. Moreover, using the logic asserted by the Office Action, there is no motivation to limit the number of light emitters (or the spacing therebetween) corresponding to any other property of the device. For example, if one of skill in the art would be motivated to add light emitters, there is no suggestion other than hindsight based reasoning provided by the teachings of Applicants' specification as to a practical limit of this approach.

Further, the Office Action states that one would have been motivated to make the first distance approximately one half the third distance to optimize the light efficiency and size of the display device. Applicants respectfully submit that, absent the roadmap provided by Applicants' specification, there is no suggestion to one of ordinary skill in the art that the relative dimensions as recited in Claim 1 would achieve the alleged motivation of light efficiency. In this regard, the alleged motivation does not provide a reason for altering the

prior art. As is well-established law, the standard for patentability does not depend on a showing of advantages or improvements, but rather obviousness. In this regard, as the Office Action has not provided a sufficient reason for finding the alteration from a ratio employed in the prior art in the direction and manner claimed, the rejection is untenable. (*See, e.g., Ex Parte Parthasarathy and Ciapetta*, 174 U.S.P.Q. 63, 1972 WL 17748 (Pat. & Trademark Office Bd. App. 1972). Applicants respectfully note that as the alleged reason for altering a ratio employed in the prior art is untenable, the obviousness allegation is improper.

Additionally, the Office Action does not allege and Yu does not provide the teachings that are missing from Chou. Accordingly, Claim 1 is patentable over Chou and Yu, the allowance of which is respectfully requested.

Additionally, Claim 14 includes recitations that are patentable over Chou and Yu for at least similar reasons. For example, Claim 14 recites, in part, "wherein the first distance comprises approximately one half of the third distance, and wherein the second distance comprises a value in a range between substantially the third distance value and substantially 1.5 times the third distance value." As discussed above, reading non-disclosed dimensional properties into the references is impermissible. Claim 20 includes similar recitations and is thus patentable over Chou and Yu for at least the same reasons.

Dependent Claims Are Allowable

Applicants traverse the rejection of the remaining dependent claims. However, as each of these claims depends from a base claim that is believed to be in condition for allowance, Applicants do not believe that it is necessary to argue the allowability of each dependent claim individually. Applicants do not necessarily concur with the interpretation of these claims, nor with the bases for rejection set forth in the Office Action. Applicants therefore reserve the right to address the patentability of these claims individually as necessary in the future.

CONCLUSION

As all of the claims are now in condition for allowance, Applicants respectfully request allowance of the claims and passing of the application to issue in due course. Applicants urge the Examiner to contact Applicants' undersigned representative at (919) 854-1400 to resolve any remaining formal issues.

Respectfully submitted,

Timothy J. Wall
Registration No. 50,743

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CERTIFICATION OF TRANSMISSION

I hereby certify that this correspondence is being transmitted via the Office electronic filing system in accordance with § 1.6(a)(4) to the U.S. Patent and Trademark Office on April 7, 2011.

Michele P. McMahan

PTO/SB/22 (07-09)
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PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a) **FY 2009** ***(Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).)***	Docket Number (Optional) 5308-824
Application Number 12/045,729	Filed March 11, 2008
For APPARATUS AND METHODS FOR MULTIPLANAR OPTICAL DIFFUSERS AND DISPLAY.....	
Art Unit 2885	Examiner Julie A. Shallenberger

This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a reply in the above identified application.

The requested extension and fee are as follows (check time period desired and enter the appropriate fee below):

		Fee	Small Entity Fee	
☑	One month (37 CFR 1.17(a)(1))	$130	$65	$ 130.00
☐	Two months (37 CFR 1.17(a)(2))	$490	$245	$
☐	Three months (37 CFR 1.17(a)(3))	$1110	$555	$
☐	Four months (37 CFR 1.17(a)(4))	$1730	$865	$
☐	Five months (37 CFR 1.17(a)(5))	$2350	$1175	$

☐ Applicant claims small entity status. See 37 CFR 1.27.

☐ A check in the amount of the fee is enclosed.

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

☐ The Director has already been authorized to charge fees in this application to a Deposit Account.

☑ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment, to Deposit Account Number 50-0220.

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.

I am the

☐ applicant/inventor.

☐ assignee of record of the entire interest. See 37 CFR 3.71.
Statement under 37 CFR 3.73(b) is enclosed (Form PTO/SB/96).

☑ attorney or agent of record. Registration Number 50,743

☐ attorney or agent under 37 CFR 1.34.
Registration number if acting under 37 CFR 1.34 _____

Signature	April 7, 2011 Date
Timothy J. Wall Typed or printed name	919-854-1400 Telephone Number

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below.

☐ Total of _____ forms are submitted.

This collection of information is required by 37 CFR 1.136(a). 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 and 1.14. This collection is estimated to take 6 minutes 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.

Attorney Docket No. 5308-824 PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re: John Roberts et al. Confirmation No. 9825
Application No.: 12/045,729 Examiner: David C. Nelms
Filing Date: March 11, 2008 Group Art Unit: 2871
For: Apparatus and Methods for Multiplanar Optical Diffusers and Display Panels for Using the Same

Date: April 7, 2011

Mail Stop: Amendment
Commissioner for Patents
Box 1450
Alexandria, VA 22313-1450

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT TRANSMITTAL

Sir:

Attached is an Information Disclosure Statement listing of documents, together with a copy of any listed foreign patent document and/or non-patent literature. A copy of any listed U.S. patent and/or U.S. patent application publication is not provided herewith in accordance with 37 C.F.R. § 1.98(a)(2)(ii).

☐ In accordance with **37 CFR 1.97(b)**, the information disclosure statement is being filed:

- ☐ (1) within three months of the filing date of a national application other than a continued prosecution application under §1.53(d);
- ☐ (2) within three months of the date of entry of the national stage as set forth in §1.491 in an international application;
- ☐ (3) before the mailing of a first Office Action on the merits; or
- ☐ (4) before the mailing of a first Office Action after the filing of a request for continued examination under §1.114.

☒ In accordance with **37 CFR 1.97(c)**, the information disclosure statement is being filed after the period specified in 37 CFR 1.97(b) above, but before the mailing date of any of a final action under §1.113, a notice of allowance under §1.311, or an action that otherwise closes prosecution in the application, and is accompanied by **one** of the following:

☒ (1) The statement specified under **37 CFR 1.97(e)**, as follows:

☒ Each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement; **or**

☐ No item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in §1.56(c) more than three months prior to the filing of the information disclosure statement; **or**

☐ (2) The fee set forth in §1.17(p);

☐ In accordance with **37 CFR 1.97(d)**, the information disclosure statement is being filed after the period specified in 37 CFR 1.97(c) above, but on or before payment of the issue fee, and is accompanied by **both** of the following:

☐ (1) The statement specified under **37 CFR 1.97(e)**, as follows:

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement; **or**

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in §1.56(c) more than three months prior to the filing of the information disclosure statement; **and**

☐ (2) The fee set forth in §1.17(p);

In accordance with **37 CFR 1.97(g)**, the information disclosure statement shall not be construed as a representation that a search has been made.

In accordance with **37 CFR 1.97(h)**, the information disclosure statement shall not be construed to be an admission that the information cited in the statement is, or is considered to be, material to patentability as defined in §1.56(b).

☐ The Director is hereby authorized to charge the fee specified in 37 C.F.R. § 1.17(p), and any fee deficiency or credit any overpayment, to Deposit Account No. 50-0220; or

☒ No fee is believed due. However, the Director is hereby authorized to charge any deficiency or credit any overpayment to Deposit Account No. 50-0220.

Respectfully submitted,

Timothy J. Wall
Registration No. 50,743
Attorney for Applicant(s)

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919-854-1401 (Fax)

CERTIFICATION OF TRANSMISSION

I hereby certify that this correspondence is being transmitted via the Office electronic filing system in accordance with § 1.6(a)(4) to the U.S. Patent and Trademark Office on April 7, 2011

Michele P. McMahan

Name: Michele P. McMahan

INFORMATION DISCLOSURE STATEMENT BY APPLICANT *(use as many sheets as necessary)* Sheet C1 of C1	*Complete if Known*	
	Application Number	12/045,729
	Filing Date	March 11, 2008
	First Named Inventor	John Roberts et al.
	Art Unit	2871
	Examiner Name	David C. Nelms
	Attorney Docket Number	5308-824

U.S. PATENT DOCUMENTS AND APPLICATIONS					
Examiner Initials*	Cite No.	Document Number Number-Kind Code (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
	1.	US- 2006/152931	07-13-2006	Holman, Robert L.	
	2.				
	3.				
		US-			
		US-			
		US-			
		US-			
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		US-			

FOREIGN PATENT DOCUMENTS						
Examiner Initials*	Cite No.	Foreign Patent Document Country Code, Number, Kind Code (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
	4.					Abstract
	5.					Abstract
	6.					Abstract

NON PATENT LITERATURE DOCUMENTS			
Examiner Initials*	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published	T
	7.	Second Examination Report (7 pages) corresponding to European Application No. 09154919.6; Dated: February 4, 2011.	

iDoc# 786113

Examiner Signature		Date Considered	

*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.

Electronic Patent Application Fee Transmittal

Application Number:	12045729
Filing Date:	11-Mar-2008
Title of Invention:	Apparatus and Methods for Multiplanar Optical Diffusers and Display Panels for Using the Same
First Named Inventor/Applicant Name:	John Roberts
Filer:	Timothy Jennings Wall/Michele McMahan
Attorney Docket Number:	5308-824

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:				
Extension-of-Time:				
Extension - 1 month with $0 paid	1251	1	130	130

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
		Total in USD ($)		**130**

Electronic Acknowledgement Receipt

EFS ID:	9829469
Application Number:	12045729
International Application Number:	
Confirmation Number:	9825
Title of Invention:	Apparatus and Methods for Multiplanar Optical Diffusers and Display Panels for Using the Same
First Named Inventor/Applicant Name:	John Roberts
Customer Number:	65106
Filer:	Timothy Jennings Wall/Michele McMahan
Filer Authorized By:	Timothy Jennings Wall
Attorney Docket Number:	5308-824
Receipt Date:	07-APR-2011
Filing Date:	11-MAR-2008
Time Stamp:	12:42:14
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$130
RAM confirmation Number	9355
Deposit Account	500220
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)

1		5308-824-Amendment.pdf	821668 de7a8c61dfa4944d0e54abe322229d89fca72f86	yes	10

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
	Claims	2	6
	Applicant Arguments/Remarks Made in an Amendment	7	10

Warnings:

Information:

2	Extension of Time	5308-824-Extension.pdf	124517 9d28a0dcef0f100383602535045a079e41bef799	no	1

Warnings:

Information:

3		5308-824-IDS.pdf	320805 2e454efd0b6a5b8c93ba46687ac507562c24f12d	yes	3

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Transmittal Letter	1	2
	Information Disclosure Statement (IDS) Filed (SB/08)	3	3

Warnings:

Information:

4	Foreign Reference	5308-824-Ref2.pdf	610882 fa18a2abd2c6fcb7bdda6204233ac46031616086	no	7

Warnings:

Information:

5	Fee Worksheet (PTO-875)	fee-info.pdf	30273 1ff2429fe766ebf10721e6e931a5dcb11c5b7a3b	no	2

Warnings:

Information:

Total Files Size (in bytes):	1908145

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.

PTO/SB/06 (07-06)
Approved for use through 1/31/2007. OMB 0651-0032
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.

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number	Filing Date	☐ To be Mailed
12/045,729	03/11/2008	

APPLICATION AS FILED – PART I

	(Column 1)	(Column 2)	SMALL ENTITY ☐		OR	OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE ($)	FEE ($)		RATE ($)	FEE ($)
☐ 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 04/07/2011	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 20	Minus	** 20	= 0	X $ =		OR	X $52=	0
Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 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	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)	OR	RATE ($)	ADDITIONAL FEE ($)
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:
/DIANA BATES/

This collection of information is required by 37 CFR 1.16. 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 12 minutes 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.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/045,729	03/11/2008	John Roberts	5308-824	9825

65106 7590 12/07/2010

MYERS BIGEL SIBLEY & SAJOVEC, P.A.
P.O. BOX 37428
RALEIGH, NC 27627

EXAMINER	
SHALLENBERGER, JULIE A	
ART UNIT	PAPER NUMBER
2885	
MAIL DATE	DELIVERY MODE
12/07/2010	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.

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 186 of 836

Office Action Summary	Application No.	Applicant(s)	
	12/045,729	ROBERTS ET AL.	
	Examiner	Art Unit	
	JULIE A. SHALLENBERGER	2885	

-- 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 *16 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) *1-10,12-17 and 19-22* 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) *1-10,12-17 and 19-22* 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 _____ 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

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 11/16/10 has been entered.

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 1, 2, 4-6, 8, 9, 12, 14, 19 and 20-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chou (7,036,956) in view of Yu (2004/0105251).

In regard to claim 1, Chou teaches a solid state lighting device, comprising a plurality of solid state light emitters 37 that are configured to emit light; and a multiplane light diffuser including a first diffusion plane (corresponding to 34) and a second diffusion plane (corresponding to 36) that are separated by a gap (figures 3 and 4), the multiplane light diffuser including first side that is configured to receive the light emitted from the plurality of solid state light emitters and a second side that is configured to

transmit diffused light the multiplane light diffuser comprises a diffuser plate 34 that includes the first side of the multiplane light diffuser and is positioned a first distance from the plurality of solid state light emitters, the diffuser plate configured to define the first diffusion plane, (col. 3 line 15-col. 4 line 49), but lacks the teaching of the diffuser plate being a structured refractive diffuser.

Yu teaches a structured refractive diffuser 3025 (fig. 4) [0028].

It would have been obvious to one of ordinary skill in the art at the time the invention was made to been obvious to make the diffusion sheet of Chou have a refractive structure in order to enhance the diffusivity of the element. One would have been motivated to modify the diffusion sheet of Chou as taught by Yu in order to improve the uniformity of the display output.

In regard to claim 2, Chou teaches a diffuser sheet 36 that includes the second side of the multiplane light diffuser and is positioned a second distance from the plurality of solid state light emitters, the diffuser sheet configured to define the second diffusion plane, wherein the first distance is less than the second distance (figures 3 and 4, col. 3 line 15-

In regard to claim 4, Chou teaches a plurality of diffuser supports, wherein the diffuser supports 35, 55 comprise a proximal end that is configured to be positioned proximate the plurality of solid state light emitters; and a distal end that is configured to support the diffuser sheet (figures 3 and 4, col. 3 line 15-col. 4 line 49).

In regard to claim 5, Chou teaches the diffuser plate comprises a plurality of diffuser plate holes that are configured to receive the plurality of diffuser supports (col. 3 lines 30-38).

In regard to claim 6, Chou teaches the plurality of diffuser supports comprise steps for supporting, at the first distance from the plurality of solid state light emitters, the diffuser plate via the plurality of holes (col. 3 lines 30-38).

In regard to claims 8 and 9, Chou teaches the invention described above, including the second distance being about the same as the third distance (see fig. 3 and 4), but lacks the explicit teaching of the plurality of solid state emitters comprise a third distance between adjacent ones of the plurality of solid state light emitters wherein the first distance comprises approximately one half the third distance as recited in claim 8.

However, it would have been obvious to one of ordinary skill in the art at the time the invention was made to add more light emitters such that the first distance comprises approximately one half the third distance in order increase the light output while providing enough of an air gap for refraction through diffusing mediums and maintaining a slim display. One would have been motivated to make the first distance comprises approximately one half the third distance in order to optimize the light efficiency and size of the display device. The applicant is also advised that it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 F.2nd 272, 205 USPQ 215 (CCPA 1980). Spacing light sources closer together is considered will within the level of ordinary skill in the art in order to obtain a desired level of light output. It is also noted that moving

the diffuser plate slightly away from the light emitters such that the first distance is half the third distance is also considered within the level of ordinary skill in order to obtain the desired amount of light refraction for particular applications of the lighting device.

In regard to claim 12, Chou teaches a means for transmitting first diffused light from the first diffusion plane to the second diffusion plane (via air space - see figure 3, col. 3 lines 30-38).

In regard to claim 14, the method(s) recited in this claim are considered obvious in view of the structure of Chou and Yu as described in claims 1 and 2 above.

In regard to claim 19, the method(s) recited in this claim are considered obvious in view of the structure of Chou as described in claim 9 above.

In regard to claims 20-22, Chou teaches a backlighting panel comprising a plurality of solid state light emitters 37 arranged in a substantially planar configuration, a first diffusion plane 34 that is configured to receive light from the plurality of solid state light emitters and to transmit first diffused light; a second diffusion plane 36 that is configured to receive the first diffused light and to transmit second diffused light a plurality of diffuser supports 35,55 configured to support a first diffuser plane structure at a first distance from the plurality of solid state light emitters and to support a second diffuser plane structure at a second distance from the plurality of solid state light emitters, wherein the second distance is greater than the first distance; and a LCD display panel (col. 3 lines 51-53) that is configured to receive the second diffused light and selectively transmit received light as display content (figures 3 and 4, col. 3 line 15-col. 4 line 49), but lacks the teaching of the diffuser plate being a structured refractive

diffuser including extrusion peaks divided by extrusion grooves or crossed linear prismatic lenslets as recited in claims 20-22.

Yu teaches a diffuser plate with structured refractive with extrusion peaks divided by extrusion groove and crossed linear prismatic lenslets (fig. 3,4)[0028]. It is noted that the peak angles of Yu's extrusion peaks appear to be substantially the same as the applicant's fig. 6A,B and therefore they are considered to be within a range of 120-170 degrees as recited in claim 21. The applicant is also advised that it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only ordinary skill in the art. *In re Aller*, 105 USPQ 233.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the diffusion member of Chou to have refractive extrusions peaks and grooves with crossed prismatic lenslets in order to achieve a desired light output for various applications of the display device. One would have been motivated to modify Chou's diffusion member to have crossed prismatic lenslets in order to optimize the quality of the display output.

Claims 3, 7, 13, 15, and 16, are rejected under 35 U.S.C. 103(a) as being unpatentable over Chou in view of Yu and further in view of Hafuka (2007/0019419).

In regard to claims 3 and 7 Chou and Yu teach the invention described above, (as well as Yu's teaching of a diffuser sheet 4025 with a polarizer, and BEF [0029] which are all well known optical sheets in the art), but Chou lacks the specific teaching

of the diffuser sheet comprising a substantially transparent plate; and a diffuser film supported by the substantially transparent plate as recited in claim 3 or the diffuser sheet comprising a diffuser film, a brightness enhancing film, a polarizing film and a substantially clear plate configured to support the diffuser film, the BEF and polarizing film.

Hafuka teaches a diffuser film 13 supported by the substantially transparent plate 14 and the diffuser sheet comprises a diffuser film, a brightness enhancing film, a polarizing film and a substantially clear plate configured to support the diffuser film, the BEF, the polarizing film [0037].

It would have been obvious to one of ordinary skill in the art at the time the invention was made to make the diffusion sheet of Chou include a diffuser film, a brightness enhancing film, a polarizing film and a substantially clear plate configured to support the diffuser film in order to enhance the diffusivity of the element. One would have been motivated to modify include these well known optical sheets in order to improve the uniformity of the display output.

In regard to claim 13, Chou and Yu teach the invention described above including Chou's multiplane light diffuser comprising a first diffuser plate positioned at a first distance from the plurality of solid state emitters; a second diffuser plate positioned at a second distance from the plurality of solid state emitters wherein the first distance is less than the second distance; but lacks the specific teaching of the second diffuser plate comprising a diffuser sheet supported by the second diffuser plate, as recited in claim 13.

Hafuka teaches a diffuser sheet supported by a diffuser plate 14 [0038].

It would have been obvious to one of ordinary skill in the art at the time the invention was made to been obvious to make the second diffuser of Chou comprise a diffuser sheet supported by the diffuser plate as taught by Hafuka in order to enhance optical properties via incorporating functional sheets therein as taught by Hafuka). One would have been motivated to make Chou's second diffusion plate include a diffusion sheet (as well as other optical sheets as desired) for improving the light output as necessitated by particular applications.

In regard to claims 15 and 16, the method(s) recited in this claim are considered obvious in view of the structure of Chou, Yu and Hafuka, as described in claims 3 and 13 above.

Claims 10 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chou in view of Yu and further in view of Boyd (2004/0136172).

In regard to claim 10, Chou teaches the invention described above, including a diffuser plate, but lacks the specific teaching of the diffuser comprising a light filter color.

Boyd teaches a diffuser including a light filter color [0036]

It would have been obvious to one of ordinary skill in the art at the time the invention was made to make the diffuser of Chou colored as taught by Boyd in order to filter out unwanted wavelengths. One would have been motivated to use a color filter in order to emit desired color(s) from the display as necessitated by particular applications of the backlight device.

In regard to claim 17, the method(s) recited in this claim are considered obvious in view of the structure of Chou, Yu and Boyd as described in claim 10 above.

Response to Arguments

Applicant's arguments filed have been fully considered but they are not persuasive.

It is noted that several of the applicant's arguments are moot upon considering the new grounds of rejection.

In regard to the applicant's arguments over the rejection of claim 8, figures 3 and 4 of Chou show the second distance being about the same as the third distance. In regard to the applicant's arguments over the rejection of claim 9, it would have been obvious to one of ordinary skill in the art at the time the invention was made to add more light emitters such that the first distance comprises approximately one half the third distance in order increase the light output while providing enough of an air gap for refraction through diffusing mediums and maintaining a slim display. One would have been motivated to make the first distance comprises approximately one half the third distance in order to optimize the light efficiency and size of the display device. The applicant is also advised that it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 F.2nd 272, 205 USPQ 215 (CCPA 1980). Spacing light sources closer together is considered will within the level of ordinary skill in the art in order to obtain a desired level of light output. It is also noted that moving the diffuser plate slightly away from the light emitters such that the first distance is half the third distance is also considered within the level of

ordinary skill in order to obtain the desired amount of light refraction for particular applications of the lighting device.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JULIE A. SHALLENBERGER whose telephone number is (571)272-7131. The examiner can normally be reached on Monday - Friday 830-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jon-Suk (James) Lee can be reached on 571-272-7044. 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.

JAS
AU 2885
/Julie A Shallenberger/
Examiner, Art Unit 2885

Notice of References Cited	Application/Control No. 12/045,729	Applicant(s)/Patent Under Reexamination ROBERTS ET AL.	
	Examiner JULIE A. SHALLENBERGER	Art Unit 2885	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2004/0105251	06-2004	Yu et al.	362/031
	B	US-			
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

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

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 197 of 836

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12045729	ROBERTS ET AL.
	Examiner	Art Unit
	JULIE A SHALLENBERGER	2885

SEARCHED			
Class	Subclass	Date	Examiner
362	612,616-622,624-629,634,97.1-97.4	3/12/10	JAS
	updated	8/2/10	JAS
	updated	12/2/10	JAS

SEARCH NOTES		
Search Notes	Date	Examiner
Consulted Sharon Payne	3/12/10	JAS
inventor search	3/12/10	JAS
fwd/bwd search	3/12/10	JAS
Consulted Isma Negron	8/2/10	JAS

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S35	359	diffus$3 near5 (peaks or prisms) and "362".clas.	US-PGPUB; USPAT; DERWENT	OR	OFF	2010/11/30 15:48
S36	184	S35 and backlight	US-PGPUB; USPAT; DERWENT	OR	OFF	2010/11/30 15:49
S37	7	"7036956"	USPAT	OR	OFF	2010/11/30 16:20
S39	8	diffus$3 near5 (peaks or prisms) same trans$5 and "362".clas.	US-PGPUB; USPAT; DERWENT	OR	OFF	2010/11/30 16:23
S38	0	diffus$3 near5 (peaks or prisms) same transp$4 and "362".clas.	US-PGPUB; USPAT; DERWENT	OR	OFF	2010/11/30 16:23
S41	57	diffus$3 near5 transp$5 same prisms and "362".clas.	US-PGPUB; USPAT; DERWENT	OR	OFF	2010/11/30 16:24
S40	2010	diffus$3 near5 transp$5 and "362".clas.	US-PGPUB; USPAT; DERWENT	OR	OFF	2010/11/30 16:24
L2	349	362/612,616-622,634,97.1-97.4.ccls. &@pd>"20100802"	US-PGPUB; USPAT; DERWENT	OR	OFF	2010/12/02 15:51

EAST Search History (Interference)

<This search history is empty>

12/2/2010 3:52:26 PM
C:\Documents and Settings\jshallenberger\My Documents\EAST\Workspaces\12045729_BL_diffusers.wsp

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 199 of 836

PTO/SB/30 (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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Request for Continued Examination (RCE) Transmittal

Address to:
Mail Stop RCE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Application Number	12/045,729
Filing Date	03-11-2008
First Named Inventor	John Roberts
Art Unit	2885
Examiner Name	Julie A. Shallenberger
Attorney Docket Number	5308-824

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. See Instruction Sheet for RCEs (not to be submitted to the USPTO) on page 2.

1. Submission required under 37 CFR 1.114 Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

   a. ☐ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.

      i. ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____

      ii. ☐ Other _____

   b. ☑ Enclosed

      i. ☑ Amendment/Reply

      ii. ☐ Affidavit(s)/ Declaration(s)

      iii. ☐ Information Disclosure Statement (IDS)

      iv. ☐ Other _____

2. Miscellaneous

   a. ☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of _____ months. (Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

   b. ☐ Other _____

3. Fees The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.

   a. ☑ The Director is hereby authorized to charge the following fees, any underpayment of fees, or credit any overpayments, to Deposit Account No. 50-0220 .

      i. ☑ RCE fee required under 37 CFR 1.17(e)

      ii. ☐ Extension of time fee (37 CFR 1.136 and 1.17)

      iii. ☐ Other _____

   b. ☐ Check in the amount of $ _____ enclosed

   c. ☐ Payment by credit card (Form PTO-2038 enclosed)

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.

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

Signature		Date	11-16-2010
Name (Print/Type)	Timothy J. Wall	Registration No.	50,743

CERTIFICATE OF MAILING OR TRANSMISSION

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

Signature			
Name (Print/Type)		Date	

This collection of information is required by 37 CFR 1.114. 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 and 1.14. This collection is estimated to take 12 minutes 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: Mail Stop RCE, 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.

Attorney's Docket No. 5308-824 PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re: John Roberts *et al.* Confirmation No.: 9825
Serial No.: 12/045,729 Group Art Unit: 2885
Filed: March 11, 2008 Examiner: Julie A. Shallenberger
For: APPARATUS AND METHODS FOR MULTIPLANAR OPTICAL DIFFUSERS AND DISPLAY PANELS FOR USING THE SAME

November 16, 2010

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

AMENDMENT ACCOMPANYING REQUEST FOR CONTINUED EXAMINATION (RCE)

Sir:

The present Amendment Accompanying Request for Continued Examination is provided to address the issues raised in the final Office Action mailed August 16, 2010.

It is not believed that an extension of time and/or additional fee(s)-including fees for net addition of claims-are required, beyond those that may otherwise be provided for in documents accompanying this paper. In the event, however, that an extension of time is necessary to allow consideration of this paper, such an extension is hereby petitioned under 37 C.F.R. §1.136(a). Any additional fees believed to be due in connection with this paper may be charged to our Deposit Account No. 50-0220.

Claim Amendments are included in a listing of the claims, which is provided beginning on page 2 of this paper.

Remarks begin on page 7 of this paper.

Amendments to the Claims:

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

Listing of the Claims:

1. (Currently amended) A solid state lighting device, comprising:

a plurality of solid state light emitters that are configured to emit light; and

a multiplane light diffuser including a first diffusion plane and a second diffusion plane that are separated by a gap, the multiplane light diffuser including first side that is configured to receive the light emitted from the plurality of solid state light emitters and a second side that is configured to transmit diffused light,

wherein the multiplane light diffuser comprises a diffuser plate that includes the first side of the multiplane light diffuser and is positioned a first distance from the plurality of solid state light emitters, the diffuser plate configured to define the first diffusion plane, and

wherein the diffuser plate comprises a structured refractive diffuser that includes a plurality of extrusion peaks that are divided by a plurality of extrusion grooves.

2. (Previously presented) The device of Claim 1, wherein the multiplane light diffuser comprises:

a diffuser sheet that includes the second side of the multiplane light diffuser and is positioned a second distance from the plurality of solid state light emitters, the diffuser sheet configured to define the second diffusion plane,

wherein the first distance is less than the second distance.

3. (Original) The device of Claim 2, wherein the diffuser sheet comprises:

a substantially transparent plate; and

a diffuser film supported by the substantially transparent plate.

4. (Original) The device of Claim 2, comprising a plurality of diffuser supports, wherein the diffuser supports comprise:

a proximal end that is configured to be positioned proximate the plurality of solid state light emitters; and

a distal end that is configured to support the diffuser sheet.

5. (Original) The device of Claim 4, wherein the diffuser plate comprises a plurality of diffuser plate holes that are configured to receive the plurality of diffuser supports.

6. (Original) The device of Claim 4, wherein the plurality of diffuser supports comprise steps for supporting, at the first distance from the plurality of solid state light emitters, the diffuser plate via the plurality of holes.

7. (Original) The device of Claim 2, wherein the diffuser sheet comprises a diffuser film, a brightness enhancing film, a polarizing film and a substantially clear plate configured to support the diffuser film, the brightness enhancing film, the polarizing film.

8. (Original) The device of Claim 2, wherein the plurality of solid state emitters comprise a third distance between adjacent ones of the plurality of solid state light emitters, and wherein the first distance comprises approximately one half the third distance.

9. (Original) The device of Claim 2, wherein the plurality of solid state emitters comprise a third distance between adjacent ones of the plurality of solid state light emitters, and wherein the second distance comprises a distance in a range between the third distance and 1.5 times the third distance.

10. (Previously presented) The device of Claim 1, wherein the diffuser plate comprises a plate including a light filter color.

11. (Canceled)

12. (Original) The device of Claim 1, further comprising means for transmitting first diffused light from the first diffusion plane to the second diffusion plane.

13. (Previously presented) The device of Claim 1, wherein the multiplane light diffuser comprises:

the first diffuser plate positioned at a first distance from the plurality of solid state emitters;

a second diffuser plate positioned at a second distance from the plurality of solid state emitters; and

a diffuser sheet supported by the second diffuser plate,

wherein the first distance is less than the second distance.

14. (Previously presented) A method of providing diffused light comprising:

emitting light from a plurality of solid state light emitters arranged in a planar configuration;

receiving the emitted light at a first side of a first diffusion plane that is a first distance from the plurality of solid state light emitters;

transmitting first diffused light from a structured refractive diffuser plate at a second side of the first diffusion plane;

receiving the first diffused light from the first diffusion plane at a first side of a second diffusion plane that is a second distance from the plurality of solid state light emitters; and

transmitting second diffused light from a second side of the second diffusion plane.

15. (Original) The method of Claim 14, wherein transmitting the first diffused light comprises transmitting the first diffused light from a diffuser plate and wherein

transmitting the second diffused light comprises transmitting the second diffused light from a diffuser sheet that is supported by a substantially transparent sheet.

16. (Original) The method of Claim 14, wherein transmitting the first diffused light comprises transmitting light from a first diffuser plate and wherein transmitting the second diffused light comprises transmitting light from a diffuser sheet that is supported by a second diffuser plate.

17. (Previously presented) The method of Claim 14, wherein transmitting the first diffused light comprises transmitting scattered diffusion light from a plate including a light filter color.

18. (Canceled)

19. (Original) The method of Claim 14, wherein the plurality of solid state light emitters comprise a third distance between adjacent ones of the plurality of solid state light emitters, wherein the first distance comprises approximately one half of the third distance, and wherein the second distance comprises a value in a range between substantially the third distance value and substantially 1.5 times the third distance value.

20. (Currently amended) A display comprising:

a backlighting panel comprising

a plurality of solid state light emitters arranged in a substantially planar configuration,

a first diffusion plane that is configured to receive light from the plurality of solid state light emitters and to transmit first diffused light, the first diffusion plane including a diffuser plate that is positioned a first distance from the plurality of solid state light emitters and that includes a structured refractive diffuser that includes a plurality of extrusion peaks that are divided by a plurality of extrusion grooves;

a second diffusion plane that is configured to receive the first diffused light and to transmit second diffused light

a plurality of diffuser supports configured to support a first diffuser plane structure at a first distance from the plurality of solid state light emitters and to support a second diffuser plane structure at a second distance from the plurality of solid state light emitters, wherein the second distance is greater than the first distance; and

a LCD display panel that is configured to receive the second diffused light and selectively transmit received light as display content.

21. (Currently amended) The device of Claim 1, wherein ~~structured refractive diffuser comprises a plurality of refractive extrusions~~ones of the plurality of extrusion peaks include a peak angle in a range of about 120 degrees to 170 degrees.

22. (Previously presented) The device of Claim 1, wherein the structured refractive diffuser comprises a plurality of crossed linear prismatic lenselets.

REMARKS

Applicants appreciate the detailed examination evidenced by the final Office Action mailed August 16, 2010 ("Office Action"). Applicants have amended the claims as set out above and respectfully submit that the pending claims are in condition for allowance for at least the reasons discussed herein.

Claims 1, 14 and 20 are Patentable

Claims 1-9 12-17, 19 and 20 stand rejected under 35 U.S.C. §103(a) as unpatentable over U. S. Patent No. 7,036,956 to Chou ("Chou") in view of U.S. Patent Publication No. 2007/0019419 to Hafuka ("Hafuka"). (Office Action, page 2.) Applicants respectfully traverse the rejection on the basis that Chou and Hafuka, alone or in combination, do not disclose or suggest all of the recitations of Claims 1, 14 and 20. Claim 1 is amended to recite, in part, that "the diffuser plate comprises a structured refractive diffuser that includes a plurality of extrusion peaks that are divided by a plurality of extrusion grooves."

Regarding Claim 1, the Office Action concedes that Chou does not teach the diffuser plate being a structured refractive diffuser, but cites Hafuka as providing the missing teaching. (Office Action, pages 2-3.) Specifically, citing paragraph 0039, the Office Action states that "synthetic resin is diffractive as well as dimmer dots being 'structured'." (Office Action, page 3.)

As an initial point, Applicants note that the Office Action allegation regarding synthetic resin being "diffractive" is without basis and unrelated to the claim recitations. The allegation is unrelated as Hafuka is wholly silent as to synthetic resin being diffractive. For example, a word search of Hafuka as provided in the U.S. Patent and Trademark Office online database corresponding to any term including the root word "diffract" was performed and yielded zero occurrences thereof. Accordingly, the allegation that the synthetic resin is "diffractive" is without basis. Additionally, even if Hafuka included "diffractive", which it does not, diffraction is substantively unrelated to the "structured refractive diffuser," as recited in Claim 1.

Additionally, Hafuka does not disclose or suggest that the dimmer dots 15a are structured. In fact, Hafuka describes screen printed dimmer dots 15a which appear to be ink combined with a light shielding agent to shield portions of the light. In this regard, not only are the dimmer dots not structured, they are also not refractive. Instead, they are operable to block portions of the light from transmission. Shielding portions of the light is wholly distinct from refraction, which occurs when waves travel from a medium with a first refractive index to a medium with second different refractive index at an angle other than 90 degrees. For example, in refraction, at the boundary between the media, the wave's phase velocity is altered, usually causing a change in direction. This is wholly distinct from blocking the light using printed dimmer dots. Accordingly, Chou and Hafuka, alone or in combination, do not disclose or suggest "structured refractive diffuser," as recited in Claim 1. Additionally, Claims 14 and 20 include similar recitations and are thus patentable over Chou and Hafuka for at least the same reasons.

Further, Claim 1 is amended to recite that the structured refractive diffuser includes "extrusion peaks that are divided by extrusion grooves." Applicants note that the Office Action cites U.S. Patent Publication No. 2006/0256582 to Chuang in rejecting other claims. In this regard, a discussion of Chuang relative to the additional recitations of Claim 1 will be provided.

Chuang appears to describe a prism sheet that includes multiple parallel prism lenses intersecting with each other. (Chuang, Abstract.) Chuang describes that the prism sheet may "provide both latitudinal and longitudinal convergence for the scattered lights from the diffusion film." (Chuang, Abstract.) Applicants respectfully submit that the prism sheet of Chuang is structurally and functionally distinct from the structured refractive diffuser including "extrusion peaks that are divided by extrusion grooves," as recited in Claim 1, as amended. To illustrate the stark contrast between a structure according to Claim 1 and the description in Chuang, FIG. 6A of the present application and FIG. 4 of Chuang are reproduced below for the Examiner's convenience.

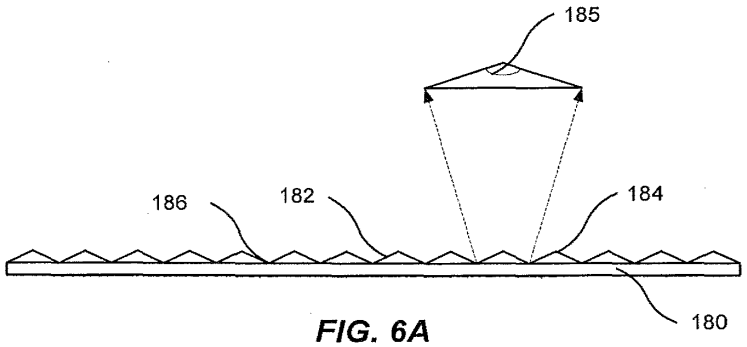


FIG. 6A

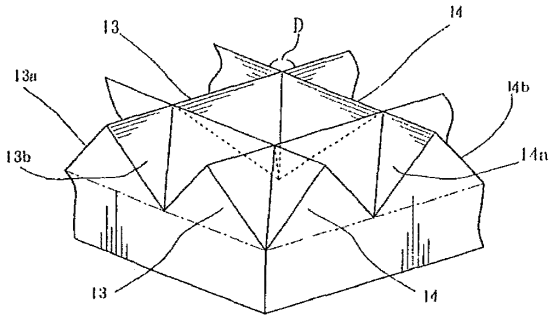


FIG. 4

As illustrated, Applicants' FIG. 6A illustrates extrusion peaks 184. In contrast, Chuang illustrates prisms that appear to define a structure that is opposite the extrusion peaks. For example, the prisms appear to include edges that surround valleys. In this regard, Chuang does not describe any structures that correspond to "extrusion peaks that are divided by extrusion grooves," as recited in Claim 1, as amended. Thus, Chuang is structurally distinct from the recitations of Claim 1.

In addition to being structurally distinct from the recitations of Claim 1, the prism sheet of Chuang is also functionally distinct. For example, Chuang describes that the primary purpose is to provide a prism sheet "which could provide both latitudinal and longitudinal convergence." Applicants respectfully submit that "convergence" appears to be functionally distinct from refraction and diffusion that may correspond to a structured **refractive diffuser**

as recited in Claim 1. Accordingly, Chuang does not provide the teachings that are missing from Chou and Hafuka. For at least these reasons, Claim 1 is patentable over the art of record, the allowance of which is respectfully requested. Additionally, Claim 20 includes similar recitations and is thus patentable over the art of record for at least the same reasons, the allowance of which is respectfully requested.

Many of the Dependent Claims Provide Additional Bases for Patentability

The dependent claims are patentable at least based on their dependence from a patentable independent claim. Moreover, many of the dependent claims contain recitations that are separately patentable. For example dependent Claim 8 recites, in part, "wherein the plurality of solid state emitters comprise a third distance between adjacent ones of the plurality of solid state light emitters, and wherein the first distance comprises approximately one half the third distance." In rejecting Claim 8, the Office Action states that:

> [i]t would have been obvious to one of ordinary skill in the art...to fit the desired amount of light emitters and provide enough of an air gap for refraction through diffusing mediums while maintaining a slim display. One would have been motivated...in order to optimize the light efficiency and the size of the display device. ...discovering an optimum value of a result effective variable involves only routine skill in the art.

(Office Action, page 6.) Applicants respectfully submit that the Office Action's alleged reason for obviousness is erroneous. For example, specifying a ratio of a distance between emitters and a distance to the first diffusion plane is not properly reasoned to fitting the desired amount light emitters while maintaining a slim display. Instead the ratio is based on a desired level of uniformity. Accordingly, as the reasoning alleged in the Office Action is not relevant to the claim recitation, the rejection of Claim 8 is untenable. As is well-established law, the standard for patentability does not depend on a showing of advantages or improvements, but rather obviousness. In this regard, as the Office Action has not provided a sufficient reason for finding the alteration from a ratio employed in the prior art in the direction and manner claimed, the rejection is untenable. (*See, e.g., Ex Parte Parthasarathy and Ciapetta*, 174 U.S.P.Q. 63, 1972 WL 17748 (Pat. & Trademark Office Bd. App. 1972).

In response to Applicants' arguments provided above, the Office Action states that "the fact that applicant has recognized another advantage which would naturally flow from following the suggestion of the prior art cannot be the basis for patentability." (Office Action, page 9.) This statement is erroneous. Applicants respectfully submit that the Office Action statement does not address the previously identified flaws in the rejection of Claim 8, namely that the alleged reason "one would have been motivated..." was wholly inapplicable to the recitations of Claim 8.

Applicants also note that the Office Action further adopts the statement of Applicants' previously provided argument in stating that "[o]ne...would have appreciated the advantages of achieving a desired amount of light uniformity." (Office Action, page 9.) This is yet further evidence that the Office Action appears to be engaged in hindsight reasoning informed solely by Applicants' disclosure, which is prohibited by the MPEP. *See* MPEP, §2142 ("[t]he tendency to resort to "hindsight" based upon applicant's disclosure is often difficult to avoid...[h]owever, impermissible hindsight must be avoided and the legal conclusion must be reached on the basis of the facts gleaned from the prior art").

The *2010 KSR Guidelines Update* published in the Federal Register on September 1, 2010, notes that "merely pointing to the presence of all claim elements in the prior art is not a complete statement of a rejection for obviousness." "Examination Guidelines Update: Developments in the Obviousness Inquiry After KSR v. Teleflex; Notice," 75 Federal Register 169 (1 September 2010), pp. 53647. Thus, the mere disclosure of the presence of particular claim elements in Chou and Hafuka does not disclose or suggest "wherein the plurality of solid state emitters comprise a third distance between adjacent ones of the plurality of solid state light emitters, and wherein the first distance comprises approximately one half the third distance," as recited in Claim 8. Accordingly, dependent Claim 8 is separately patentable over Chou and Hafuka, the allowance of which is respectfully requested.

Additionally, dependent Claim 9 is rejected using the same rationale as dependent Claim 8 and is separately patentable over Chou and Hafuka for at least the same reasons, the allowance of which is respectfully requested.

Additionally, dependent Claim 21 is amended to recite that "ones of the plurality of extrusion peaks include a peak angle in a range of about 120 degrees to 170 degrees." Such recitation is not disclosed by the art of record. Accordingly, dependent Claim 21 is separately patentable, the allowance of which is respectfully requested.

Dependent Claims Are Allowable

Applicants traverse the rejection of the remaining dependent claims. However, as each of these claims depends from a base claim that is believed to be in condition for allowance, Applicants do not believe that it is necessary to argue the allowability of each dependent claim individually. Applicants do not necessarily concur with the interpretation of these claims, nor with the bases for rejection set forth in the Office Action. Applicants therefore reserve the right to address the patentability of these claims individually as necessary in the future.

No New Matter

Applicants respectfully submit that no new matter is added by virtue of the amendments herein. For example, support for new Claims 1, 20 and 21 may be found in the Specification at, for example, paragraphs 0047 and 0048.

CONCLUSION

As all of the claims are now in condition for allowance, Applicants respectfully request allowance of the claims and passing of the application to issue in due course. Applicants urge the Examiner to contact Applicants' undersigned representative at (919) 854-1400 to resolve any remaining formal issues.

Respectfully submitted,

Timothy J. Wall
Registration No. 50,743

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Telephone: (919) 854-1400
Facsimile: (919) 854-1401

CERTIFICATION OF TRANSMISSION

I hereby certify that this correspondence is being transmitted via the Office electronic filing system in accordance with § 1.6(a)(4) to the U.S. Patent and Trademark Office on November 16, 2010.

Michele P. McMahan

Electronic Patent Application Fee Transmittal

Application Number:	12045729
Filing Date:	11-Mar-2008
Title of Invention:	Apparatus and Methods for Multiplanar Optical Diffusers and Display Panels for Using the Same
First Named Inventor/Applicant Name:	John Roberts
Filer:	Timothy Jennings Wall/Michele McMahan
Attorney Docket Number:	5308-824

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:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Request for continued examination	1801	1	810	810
		Total in USD ($)		**810**

Electronic Acknowledgement Receipt

EFS ID:	8844843
Application Number:	12045729
International Application Number:	
Confirmation Number:	9825
Title of Invention:	Apparatus and Methods for Multiplanar Optical Diffusers and Display Panels for Using the Same
First Named Inventor/Applicant Name:	John Roberts
Customer Number:	65106
Filer:	Timothy Jennings Wall/Michele McMahan
Filer Authorized By:	Timothy Jennings Wall
Attorney Docket Number:	5308-824
Receipt Date:	16-NOV-2010
Filing Date:	11-MAR-2008
Time Stamp:	11:54:46
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$810
RAM confirmation Number	9343
Deposit Account	500220
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)

1	Request for Continued Examination (RCE)	5308_824_RCE.pdf	146091 66b1088c2c8f61207188e3926ddbd2b58f4e2861	no	1
Warnings:					
This is not a USPTO supplied RCE SB30 form.					
Information:					
2		5308_824_Amendment.pdf	1131592 168a555c830525424726ffc339c32a47f7b6aef2	yes	13

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment Submitted/Entered with Filing of CPA/RCE	1	1
	Claims	2	6
	Applicant Arguments/Remarks Made in an Amendment	7	13

Warnings:					
Information:					
3	Fee Worksheet (PTO-875)	fee-info.pdf	30286 9c28f3d9301e3146b7119e4ac26853ae236f4b5e	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	1307969		

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.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/045,729	03/11/2008	John Roberts	5308-824	9825

65106 7590 08/16/2010

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RALEIGH, NC 27627

EXAMINER	
SHALLENBERGER, JULIE A	
ART UNIT	PAPER NUMBER
2885	
MAIL DATE	DELIVERY MODE
08/16/2010	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.

Office Action Summary	Application No.	Applicant(s)	
	12/045,729	ROBERTS ET AL.	
	Examiner	Art Unit	
	JULIE A. SHALLENBERGER	2885	

-- 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 *amendments submitted 6/14/10*.

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) *1-10,12-17,19-22* 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) *1-10,12-17,19-22* 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 _____ 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

The amendments submitted 6/14/10 have been entered.

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 1-9, 12-17, 19, and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chou (7,036,956) in view of Hafuka (2007/0019419).

In regard to claim 1, Chou teaches a solid state lighting device, comprising a plurality of solid state light emitters 37 that are configured to emit light; and a multiplane light diffuser including a first diffusion plane (corresponding to 34) and a second diffusion plane (corresponding to 36) that are separated by a gap (figures 3 and 4), the multiplane light diffuser including first side that is configured to receive the light emitted from the plurality of solid state light emitters and a second side that is configured to transmit diffused light the multiplane light diffuser comprises a diffuser plate 34 that includes the first side of the multiplane light diffuser and is positioned a first distance from the plurality of solid state light emitters, the diffuser plate configured to define the first diffusion plane, (col. 3 line 15-col. 4 line 49), but lacks the teaching of the diffuser plate being a structured refractive diffuser.

Hafuka teaches a structured refractive diffuser (synthetic resin is diffractive as well as dimmer dots being “structured”) [0039].

It would have been obvious to one of ordinary skill in the art at the time the invention was made to been obvious to make the diffusion sheet of Chou have a refractive structure in order to enhance the diffusivity of the element. One would have been motivated to modify the diffusion sheet of Chou as taught by Hafuka in order to improve the uniformity of the display output.

In regard to claim 2, Chou teaches a diffuser sheet 36 that includes the second side of the multiplane light diffuser and is positioned a second distance from the plurality of solid state light emitters, the diffuser sheet configured to define the second diffusion plane, wherein the first distance is less than the second distance (figures 3 and 4, col. 3 line 15-col. 4 line 49).

In regard to claims 3 and 7 Chou teaches the invention described above, but lacks the specific teaching of the diffuser sheet comprising a substantially transparent plate; and a diffuser film supported by the substantially transparent plate as recited in claim 3 of the diffuser sheet comprises a diffuser film, a brightness enhancing film, a polarizing film and a substantially clear plate configured to support the diffuser film, the brightness enhancing film, the polarizing film as recited in claim 7.

Hafuka teaches a diffuser film 13 supported by the substantially transparent plate 14 and the diffuser sheet comprises a diffuser film, a brightness enhancing film, a polarizing film and a substantially clear plate configured to support the diffuser film, the brightness enhancing film, the polarizing film [0037].

It would have been obvious to one of ordinary skill in the art at the time the invention was made to been obvious to make the diffusion sheet of Chou have a diffuser film, a brightness enhancing film, a polarizing film and a substantially clear plate configured to support the diffuser film in order to enhance the diffusivity of the element. One would have been motivated to modify the diffusion sheet of Chou as taught by Hafuka in order to improve the uniformity of the display output.

In regard to claim 4, Chou teaches a plurality of diffuser supports, wherein the diffuser supports 35, 55 comprise a proximal end that is configured to be positioned proximate the plurality of solid state light emitters; and a distal end that is configured to support the diffuser sheet (figures 3 and 4, col. 3 line 15-col. 4 line 49).

In regard to claim 5, Chou teaches the diffuser plate comprises a plurality of diffuser plate holes that are configured to receive the plurality of diffuser supports (col. 3 lines 30-38).

In regard to claim 6, Chou teaches the plurality of diffuser supports comprise steps for supporting, at the first distance from the plurality of solid state light emitters, the diffuser plate via the plurality of holes (col. 3 lines 30-38).

In regard to claims 8 and 9, Chou teaches the invention described above, but lacks the explicit teaching of the plurality of solid state emitters comprise a third distance between adjacent ones of the plurality of solid state light emitters, and wherein the first distance comprises approximately one half the third distance as recited in claim 8 or the plurality of solid state emitters comprise a third distance between adjacent

ones of the plurality of solid state light emitters, and wherein the second distance comprises a distance in a range between the third distance and 1.5 times the third distance as recited in claim 9.

However, it would have been obvious to one of ordinary skill in the art at the time the invention was made to make the first distance comprises approximately one half the third distance and the second distance comprises a distance in a range between the third distance and 1.5 times the third distance in order fit the desired amount of light emitters and provide enough of an air gap for refraction through diffusing mediums while maintaining a slim display. One would have been motivated to make the first distance comprises approximately one half the third distance and the second distance comprises a distance in a range between the third distance and 1.5 times the third distance in order to optimize the light efficiency and size of the display device. The applicant is also advise that it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 F.2nd 272, 205 USPQ 215 (CCPA 1980).

In regard to claim 12, Chou teaches a means for transmitting first diffused light from the first diffusion plane to the second diffusion plane (via air space - see figure 3, col. 3 lines 30-38).

In regard to claim 13, Chou teaches the invention described above as well as the multiplane light diffuser comprises: a first diffuser plate positioned at a first distance from the plurality of solid state emitters; a second diffuser plate positioned at a second distance from the plurality of solid state emitters wherein the first distance is less than

the second distance; but lacks the specific teaching of and a diffuser sheet supported by the second diffuser plate,. as recited in claim 13.

Hafuka teaches a diffuser sheet supported by a diffuser plate 14 [0038].

It would have been obvious to one of ordinary skill in the art at the time the invention was made to been obvious to make the diffusion sheet of Chou have a support plate in order to enhance the diffusivity of the element. One would have been motivated to modify the diffusion sheet of Chou as taught by Hafuka in order to improve the uniformity of the display output.

In regard to claim 14, the method(s) recited in this claim are considered inherent in view of the structure of Chou as described in claims 1 and 2 above.

In regard to claim 15, the method(s) recited in this claim are considered inherent in view of the structure of Chou as described in claim 3 above.

In regard to claim 16, the method(s) recited in this claim are considered inherent in view of the structure of Chou as described in claim 13 above.

.In regard to claim 17, the method(s) recited in this claim are considered inherent in view of the structure of Chou as described in claim 10 above.

In regard to claim 19, the method(s) recited in this claim are considered inherent in view of the structure of Chou as described in claim 9 above.

In regard to claim 20, Chou teaches a backlighting panel comprising a plurality of solid state light emitters 37 arranged in a substantially planar configuration, a first diffusion plane 34 that is configured to receive light from the plurality of solid state light emitters and to transmit first diffused light; a second diffusion plane 36 that is configured

to receive the first diffused light and to transmit second diffused light a plurality of diffuser supports 35,55 configured to support a first diffuser plane structure at a first distance from the plurality of solid state light emitters and to support a second diffuser plane structure at a second distance from the plurality of solid state light emitters, wherein the second distance is greater than the first distance; and a LCD display panel (col. 3 lines 51-53) that is configured to receive the second diffused light and selectively transmit received light as display content (figures 3 and 4, col. 3 line 15-col. 4 line 49) but lacks the teaching of the diffuser plate being a structured refractive diffuser.

Hafuka teaches a refractive diffuser (synthetic resin is diffractive [0039].

It would have been obvious to one of ordinary skill in the art at the time the invention was made to been obvious to make the diffusion sheet of Chou have a refractive structure in order to enhance the diffusivity of the element. One would have been motivated to modify the diffusion sheet of Chou as taught by Hafuka in order to improve the uniformity of the display output.

Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chou in view of Hafuka and further in view of Boyd (2004/0136172).

In regard to claim 10, Chou teaches the invention described above, including a diffuser plate, but lacks the specific teaching of the diffuser comprising a light filter color.

Boyd teaches a diffuser including a light filter color [0036]

It would have been obvious to one of ordinary skill in the art at the time the invention was made to make the diffuser of Chou colored as taught by Boyd in order to

filter out unwanted wavelengths. One would have been motivated to use a color filter in order to emit desired color(s) from the display as necessitated by particular applications of the backlight device.

Claims 20-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chou (7,036,956) in view of Chuang (2006/0256582).

In regard to claims 20-22, Chou teaches a backlighting panel comprising a plurality of solid state light emitters 37 arranged in a substantially planar configuration, a first diffusion plane 34 that is configured to receive light from the plurality of solid state light emitters and to transmit first diffused light; a second diffusion plane 36 that is configured to receive the first diffused light and to transmit second diffused light a plurality of diffuser supports 35,55 configured to support a first diffuser plane structure at a first distance from the plurality of solid state light emitters and to support a second diffuser plane structure at a second distance from the plurality of solid state light emitters, wherein the second distance is greater than the first distance; and a LCD display panel (col. 3 lines 51-53) that is configured to receive the second diffused light and selectively transmit received light as display content (figures 3 and 4, col. 3 line 15-col. 4 line 49), but lacks the teaching of the diffuser plate being a structured refractive diffuser with extrusions and/or crossed liner prismatic lenslets as recited in claims 20-22.

Chuang teaches a diffuser plate with structured refractive extrusions that are crossed linear prismatic lenslets (fig. 11)[0031-0032].

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the diffusion member of Chou to have refractive extrusions with crossed prismatic lenslets in order to achieve a desired light output for various applications of the display device. One would have been motivated to modify Chou's diffusion member to have crossed prismatic lenslets in order to optimize the quality of the display output.

Response to Arguments

Applicant's arguments filed 6/14/10 have been fully considered but they are not persuasive.

With regard to the applicant's argument that Hafuka does not teach a "structured" refractive diffuser, the diffuser plate 15 of Hafuka includes dimmer dots 15a [0039] (see fig. 2) and this constitutes a "structured" refractive diffuser.

In regard to the applicant's arguments against the rejection of claims 8 and 9 the fact that applicant has recognized another advantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985). One of ordinary skill in the art would have recognized and appreciated the advantages of achieving a desired amount of light uniformity.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JULIE A. SHALLENBERGER whose telephone number is (571)272-7131. The examiner can normally be reached on Monday - Friday 830-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jon-Suk (James) Lee can be reached on 571-272-7044. 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.

JAS
AU 2885
8/3/2010

/Jong-Suk (James) Lee/
Supervisory Patent Examiner, Art Unit 2885

Notice of References Cited	Application/Control No. 12/045,729	Applicant(s)/Patent Under Reexamination ROBERTS ET AL.	
	Examiner JULIE A. SHALLENBERGER	Art Unit 2885	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2004/0136172	07-2004	Boyd et al.	362/031
*	B	US-2006/0256582	11-2006	Chuang, Chih-Lun	362/620
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

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

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 230 of 836

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12045729	ROBERTS ET AL.
	Examiner	Art Unit
	JULIE A SHALLENBERGER	2885

SEARCHED			
Class	Subclass	Date	Examiner
362	612,616-622,624-629,634,97.1-97.4	3/12/10	JAS
	updated	8/2/10	JAS

SEARCH NOTES		
Search Notes	Date	Examiner
Consulted Sharon Payne	3/12/10	JAS
inventor search	3/12/10	JAS
fwd/bwd search	3/12/10	JAS
Consulted Isma Negron	8/2/10	JAS

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	443	362/612,616-622,624-629,634,97.1-97.4.ccls. &@pd>"20100312"	US-PGPUB; USPAT; DERWENT	OR	OFF	2010/08/02 17:45

EAST Search History (Interference)

<This search history is empty>

8/2/2010 5:46:09 PM
C:\Documents and Settings\jshallenberger\My Documents\EAST\Workspaces\12045729_BL_diffusers.wsp

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 232 of 836

Attorney's Docket No. 5308-824 PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re: John Roberts *et al.* Confirmation No.: 9825
Serial No.: 12/045,729 Group Art Unit: 2885
Filed: March 11, 2008 Examiner: Julie A. Shallenberger
For: APPARATUS AND METHODS FOR MULTIPLANAR OPTICAL DIFFUSERS AND DISPLAY PANELS FOR USING THE SAME

June 14, 2010

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

AMENDMENT AND RESPONSE

Sir:

The present Amendment and Response is being filed to address the issues raised in the Official Action mailed March 16, 2010.

It is not believed that an extension of time and/or additional fee(s)-including fees for net addition of claims-are required, beyond those that may otherwise be provided for in documents accompanying this paper. In the event, however, that an extension of time is necessary to allow consideration of this paper, such an extension is hereby petitioned under 37 C.F.R. §1.136(a). Any additional fees believed to be due in connection with this paper may be charged to our Deposit Account No. 50-0220.

Claim Amendments are included in a listing of the claims, which is provided beginning on page 2 of this paper.

Remarks begin on page 7 of this paper.

Amendments to the Claims:

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

Listing of the Claims:

1. (Currently amended) A solid state lighting device, comprising:

a plurality of solid state light emitters that are configured to emit light; and

a multiplane light diffuser including a first diffusion plane and a second diffusion plane that are separated by a gap, the multiplane light diffuser including first side that is configured to receive the light emitted from the plurality of solid state light emitters and a second side that is configured to transmit diffused light,

wherein the multiplane light diffuser comprises a diffuser plate that includes the first side of the multiplane light diffuser and is positioned a first distance from the plurality of solid state light emitters, the diffuser plate configured to define the first diffusion plane, and

wherein the diffuser plate comprises a structured refractive diffuser.

2. (Currently amended) The device of Claim 1, wherein the multiplane light diffuser comprises:

~~a diffuser plate that includes the first side of the multiplane light diffuser and is positioned a first distance from the plurality of solid state light emitters, the diffuser plate configured to define the first diffusion plane; and~~

a diffuser sheet that includes the second side of the multiplane light diffuser and is positioned a second distance from the plurality of solid state light emitters, the diffuser sheet configured to define the second diffusion plane,

wherein the first distance is less than the second distance.

3. (Original) The device of Claim 2, wherein the diffuser sheet comprises:

a substantially transparent plate; and

a diffuser film supported by the substantially transparent plate.

4. (Original) The device of Claim 2, comprising a plurality of diffuser supports, wherein the diffuser supports comprise:

a proximal end that is configured to be positioned proximate the plurality of solid state light emitters; and

a distal end that is configured to support the diffuser sheet.

5. (Original) The device of Claim 4, wherein the diffuser plate comprises a plurality of diffuser plate holes that are configured to receive the plurality of diffuser supports.

6. (Original) The device of Claim 4, wherein the plurality of diffuser supports comprise steps for supporting, at the first distance from the plurality of solid state light emitters, the diffuser plate via the plurality of holes.

7. (Original) The device of Claim 2, wherein the diffuser sheet comprises a diffuser film, a brightness enhancing film, a polarizing film and a substantially clear plate configured to support the diffuser film, the brightness enhancing film, the polarizing film.

8. (Original) The device of Claim 2, wherein the plurality of solid state emitters comprise a third distance between adjacent ones of the plurality of solid state light emitters, and wherein the first distance comprises approximately one half the third distance.

9. (Original) The device of Claim 2, wherein the plurality of solid state emitters comprise a third distance between adjacent ones of the plurality of solid state light emitters, and wherein the second distance comprises a distance in a range between the third distance and 1.5 times the third distance.

10. (Currently amended) The device of Claim 1[[2]], wherein the diffuser plate comprises a plate including a light filter colorscattering diffuser.

11. (Canceled)

12. (Original) The device of Claim 1, further comprising means for transmitting first diffused light from the first diffusion plane to the second diffusion plane.

13. (Currently amended) The device of Claim 1, wherein the multiplane light diffuser comprises:

thea first diffuser plate positioned at a first distance from the plurality of solid state emitters;

a second diffuser plate positioned at a second distance from the plurality of solid state emitters; and

a diffuser sheet supported by the second diffuser plate,

wherein the first distance is less than the second distance.

14. (Currently amended) A method of providing diffused light comprising:

emitting light from a plurality of solid state light emitters arranged in a planar configuration;

receiving the emitted light at a first side of a first diffusion plane that is a first distance from the plurality of solid state light emitters;

transmitting first diffused light from a structured refractive diffuser plate at a second side of the first diffusion plane;

receiving the first diffused light from the first diffusion plane at a first side of a second diffusion plane that is a second distance from the plurality of solid state light emitters; and

transmitting second diffused light from a second side of the second diffusion plane.

15. (Original) The method of Claim 14, wherein transmitting the first diffused light comprises transmitting the first diffused light from a diffuser plate and wherein transmitting the second diffused light comprises transmitting the second diffused light from a diffuser sheet that is supported by a substantially transparent sheet.

16. (Original) The method of Claim 14, wherein transmitting the first diffused light comprises transmitting light from a first diffuser plate and wherein transmitting the second diffused light comprises transmitting light from a diffuser sheet that is supported by a second diffuser plate.

17. (Currently amended) The method of Claim 14, wherein transmitting the first diffused light comprises transmitting scattered diffusion light from a plate including a light filter color~~scattering diffuser plate~~.

18. (Canceled)

19. (Original) The method of Claim 14, wherein the plurality of solid state light emitters comprise a third distance between adjacent ones of the plurality of solid state light emitters, wherein the first distance comprises approximately one half of the third distance, and wherein the second distance comprises a value in a range between substantially the third distance value and substantially 1.5 times the third distance value.

20. (Currently amended) A display comprising:

a backlighting panel comprising

a plurality of solid state light emitters arranged in a substantially planar configuration,

a first diffusion plane that is configured to receive light from the plurality of solid state light emitters and to transmit first diffused light, the first diffusion plane

including a diffuser plate that is positioned a first distance from the plurality of solid state light emitters and that includes a structured refractive diffuser;

a second diffusion plane that is configured to receive the first diffused light and to transmit second diffused light

a plurality of diffuser supports configured to support a first diffuser plane structure at a first distance from the plurality of solid state light emitters and to support a second diffuser plane structure at a second distance from the plurality of solid state light emitters, wherein the second distance is greater than the first distance; and

a LCD display panel that is configured to receive the second diffused light and selectively transmit received light as display content.

21. (New) The device of Claim 1, wherein structured refractive diffuser comprises a plurality of refractive extrusions.

22. (New) The device of Claim 1, wherein the structured refractive diffuser comprises a plurality of crossed linear prismatic lenselets.

REMARKS

Applicants appreciate the detailed examination evidenced by the Office Action mailed March 16, 2010 ("Office Action"). Applicants have amended the claims as set out above and respectfully submit that the pending claims are in condition for allowance for at least the reasons discussed herein.

Claim Objections are Overcome

The Office Action objects to Claims 10 as being of improper dependent form for failing to further limit the subject matter of a previous claim. (Office Action, page 2.) Although Applicants do not agree with the allegation that Claim 10 as originally filed does not further limit the subject matter, in an effort to advance prosecution, Applicants have amended Claim 10 responsive thereto and respectfully request that the objection to Claim 10 be withdrawn.

Claims 1, 14 and 20 are Patentable

Claims 1, 2, 4-6, 10, 12, 14, 17 and 20 stand rejected under 35 U.S.C. §102(b) as anticipated by U. S. Patent No. 7,036,956 to Chou ("Chou"). (Office Action, page 2.) Applicants respectfully traverse the rejection on the basis that Chou does not disclose or suggest all of the recitations of Claims 1, 14 and 20, as amended. Claim 1, is amended to include partial recitations corresponding to dependent Claims 2 and 11, which are amended and canceled, respectively, herein. In this regard, the §103 rejection of Claim 11 under Chou in view of U.S. Patent Publication No. 2007/0019419 to Hafuka ("Hafuka") (Office Action, page 6) as applied to amended Claim 1 will be addressed.

Claim 1, as amended, recites, in part:

> a multiplane light diffuser including a first diffusion plane and a second diffusion plane that are separated by a gap, the multiplane light diffuser including first side that is configured to receive the light emitted from the plurality of solid state light emitters and a second side that is configured to transmit diffused light,

> wherein the multiplane light diffuser comprises a diffuser plate that includes the first side of the multiplane light diffuser and is positioned a first distance from the plurality of solid state light emitters, the diffuser plate configured to define the first diffusion plane, and
>
> wherein the diffuser plate comprises a structured refractive diffuser.

Regarding Claim 11, the Office Action concedes that Chou lacks the teaching of a structured refractive diffuser and states that "Hafuka teaches a refractive diffuser (synthetic resin is diffractive [0039]." (Office Action, page 7.) Applicants respectfully submit that the Office Action improperly fails to consider a claim recitation, namely a "**structured** refractive diffuser." By way of example, Applicants' Specification at paragraph 0048 describes:

> Referring to FIG. 6A, a structured refractive diffuser plate 180 may include multiple refractive extrusions 182 that may be arranged in a pattern including rows and columns. The refractive extrusions 182 may include extrusion peaks 184 divided by extrusion grooves 186. In some embodiments, the extrusion peaks 184 may be formed to include a peak angle 185 in the range from 120° and 170°.

Applicants' FIG. 6A is reproduced below for the Examiner's convenience:

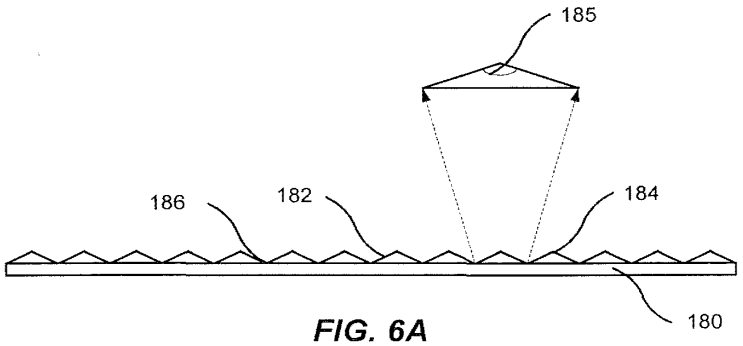


FIG. 6A

As described and illustrated above, the "structured" aspect of the claimed refractive diffuser may not be disregarded. Additionally, the "milky white light-guiding synthetic resin material" as described in Hafuka, does not contemplate the "structured" recitation. Although Hafuka does appear to describe screen printed dimmer dots 15a which appear to be ink combined with a light shielding agent to shield portions of the light, such dimmer dots are not

synonymous with features on a "structured refractive diffuser plate," as recited in Claim 1, as amended. Accordingly, Claim 1, as amended, is patentable over Chou and Hafuka, alone or in combination, the allowance of which is respectfully requested.

Additionally, amended independent Claims 14 and 20 include similar recitations as discussed above regarding Claim 1 and are thus patentable for at least the same reasons, the allowance of which is respectfully requested.

Many of the Dependent Claims Provide Additional Bases for Patentability

The dependent claims are patentable at least based on their dependence from a patentable independent claim. Moreover, many of the dependent claims contain recitations that are separately patentable. For example Dependent Claim 8 recites, in part, "wherein the plurality of solid state emitters comprise a third distance between adjacent ones of the plurality of solid state light emitters, and wherein the first distance comprises approximately one half the third distance." In rejecting Claim 8, the Office Action states that:

> [i]t would have been obvious to one of ordinary skill in the art...to fit the desired amount of light emitters and provide enough of an air gap for refraction through diffusing mediums while maintaining a slim display. One would have been motivated...in order to optimize the light efficiency and the size of the display device. ...discovering an optimum value of a result effective variable involves only routine skill in the art.

(Office Action, page 6.) Applicants respectfully submit that the Office Action's alleged reason for obviousness is erroneous. For example, specifying a ratio of a distance between emitters and a distance to the first diffusion plane is not properly reasoned to fitting the desired amount light emitters while maintaining a slim display. Instead the ratio is based on a desired level of uniformity. Accordingly, as the reasoning alleged in the Office Action is not relevant to the claim recitation, the rejection of Claim 8 is untenable. As is well-established law, the standard for patentability does not depend on a showing of advantages or improvements, but rather obviousness. In this regard, as the Office Action has not provided a sufficient reason for finding the alteration from a ratio employed in the prior art in the direction and manner claimed, the rejection is untenable. (*See, e.g., Ex Parte Parthasarathy and Ciapetta*, 174 U.S.P.Q. 63, 1972

WL 17748 (Pat. & Trademark Office Bd. App. 1972). Accordingly, dependent Claim 8 is separately patentable over Chou, the allowance of which is respectfully requested.

Additionally, dependent Claim 9 is rejected using the same rationale as dependent Claim 8 and is separately patentable over Chou for at least the same reasons, the allowance of which is respectfully requested.

Dependent Claims Are Allowable

Applicants traverse the rejection of the remaining dependent claims. However, as each of these claims depends from a base claim that is believed to be in condition for allowance, Applicants do not believe that it is necessary to argue the allowability of each dependent claim individually. Applicants do not necessarily concur with the interpretation of these claims, nor with the bases for rejection set forth in the Office Action. Applicants therefore reserve the right to address the patentability of these claims individually as necessary in the future.

No New Matter

Applicants respectfully submit that no new matter is added by virtue of the amendments herein. For example, support for new Claims 21 and 22 may be found in the Specification at, for example, paragraphs 0047 and 0048.

CONCLUSION

As all of the claims are now in condition for allowance, Applicants respectfully request allowance of the claims and passing of the application to issue in due course. Applicants urge the Examiner to contact Applicants' undersigned representative at (919) 854-1400 to resolve any remaining formal issues.

Respectfully submitted,

Timothy J. Wall
Registration No. 50,743

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CERTIFICATION OF TRANSMISSION

I hereby certify that this correspondence is being transmitted via the Office electronic filing system in accordance with § 1.6(a)(4) to the U.S. Patent and Trademark Office on June 14, 2010.

Audra Wooten

Electronic Acknowledgement Receipt

EFS ID:	7804415
Application Number:	12045729
International Application Number:	
Confirmation Number:	9825
Title of Invention:	Apparatus and Methods for Multiplanar Optical Diffusers and Display Panels for Using the Same
First Named Inventor/Applicant Name:	John Roberts
Customer Number:	65106
Filer:	Timothy Jennings Wall/Audra Wooten
Filer Authorized By:	Timothy Jennings Wall
Attorney Docket Number:	5308-824
Receipt Date:	14-JUN-2010
Filing Date:	11-MAR-2008
Time Stamp:	12:41:26
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		Amendment.pdf	862756 4836f327db2f271b03dc2f467f8a7e564f23c1f8	yes	11

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
	Claims	2	6
	Applicant Arguments/Remarks Made in an Amendment	7	11
Warnings:			
Information:			
	Total Files Size (in bytes):	862756	

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.

PTO/SB/06 (07-06)
Approved for use through 1/31/2007. OMB 0651-0032
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.

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number	Filing Date	☐ To be Mailed
12/045,729	03/11/2008	

APPLICATION AS FILED – PART I

	(Column 1)	(Column 2)	SMALL ENTITY ☐		OR	OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE ($)	FEE ($)		RATE ($)	FEE ($)
☐ 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	06/14/2010	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 20	Minus	** 20	= 0	X $ =		OR	X $52=	0
	Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 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		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)		RATE ($)	ADDITIONAL FEE ($)
	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:
/Katischa R. Wanzer/

This collection of information is required by 37 CFR 1.16. 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 12 minutes 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.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/045,729	03/11/2008	John Roberts	5308-824	9825

65106 7590 03/16/2010

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EXAMINER	
SHALLENBERGER, JULIE A	
ART UNIT	PAPER NUMBER
2885	
MAIL DATE	DELIVERY MODE
03/16/2010	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.

Office Action Summary	Application No.	Applicant(s)	
	12/045,729	ROBERTS ET AL.	
	Examiner	Art Unit	
	JULIE A. SHALLENBERGER	2885	

-- 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 *11 March 2008*.

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) *1-20* 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) *1-20* 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 *11 March 2008* 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 *4/21/09 & 6/5/09*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Objections

Claim 10 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form.

A diffuser by definition scatters light (see www.thefreedictionary.com/diffuser).

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, 2, 4-6, 10, 12,14, 17, and 20 are rejected under 35 U.S.C. 102(b) as being anticipated by Chou (7,036,956).

In regard to claim 1, Chou teaches a solid state lighting device, comprising a plurality of solid state light emitters 37 that are configured to emit light; and a multiplane light diffuser including a first diffusion plane 34 and a second diffusion plane 36 that are separated by a gap (figures 3 and 4), the multiplane light diffuser including first side that is configured to receive the light emitted from the plurality of solid state light emitters and a second side that is configured to transmit diffused light (col. 3 line 15-col. 4 line 49).

In regard to claim 2, Chou teaches the multiplane light diffuser comprises a diffuser plate 34 that includes the first side of the multiplane light diffuser and is positioned a first distance from the plurality of solid state light emitters, the diffuser plate configured to define the first diffusion plane; and a diffuser sheet 36 that includes the second side of the multiplane light diffuser and is positioned a second distance from the plurality of solid state light emitters, the diffuser sheet configured to define the second diffusion plane, wherein the first distance is less than the second distance (figures 3 and 4, col. 3 line 15-col. 4 line 49).

In regard to claim 4, Chou teaches a plurality of diffuser supports, wherein the diffuser supports 35, 55 comprise a proximal end that is configured to be positioned proximate the plurality of solid state light emitters; and a distal end that is configured to support the diffuser sheet (figures 3 and 4, col. 3 line 15-col. 4 line 49).

In regard to claim 5, Chou teaches the diffuser plate comprises a plurality of diffuser plate holes that are configured to receive the plurality of diffuser supports (col. 3 lines 30-38).

In regard to claim 6, Chou teaches the plurality of diffuser supports comprise steps for supporting, at the first distance from the plurality of solid state light emitters, the diffuser plate via the plurality of holes (col. 3 lines 30-38).

In regard to claim 10, Chou teaches the diffuser plate comprises a scattering diffuser (by definition, a diffuser scatters light).

In regard to claim 12, Chou teaches a means for transmitting first diffused light from the first diffusion plane to the second diffusion plane (via air space - see figure 3, col. 3 lines 30-38).

In regard to claim 14, the method(s) recited in this claim are considered inherent in view of the structure of Chou as described in claims 1 and 2 above.

In regard to claim 17, the method(s) recited in this claim are considered inherent in view of the structure of Chou as described in claim 10 above.

In regard to claim 20, Chou teaches a backlighting panel comprising a plurality of solid state light emitters 37 arranged in a substantially planar configuration, a first diffusion plane 34 that is configured to receive light from the plurality of solid state light emitters and to transmit first diffused light; a second diffusion plane 36 that is configured to receive the first diffused light and to transmit second diffused light a plurality of diffuser supports 35,55 configured to support a first diffuser plane structure at a first distance from the plurality of solid state light emitters and to support a second diffuser plane structure at a second distance from the plurality of solid state light emitters, wherein the second distance is greater than the first distance; and a LCD display panel (col. 3 lines 51-53) that is configured to receive the second diffused light and selectively transmit received light as display content (figures 3 and 4, col. 3 line 15-col. 4 line 49).

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 8, 9, and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chou.

In regard to claims 8 and 9, Chou teaches the invention described above, but lacks the explicit teaching of the plurality of solid state emitterscomprise a third distance between adjacent ones of the plurality of solid state light emitters, and wherein the first distance comprises approximately one half the third distance as recited in claim 8 or the plurality of solid state emitters comprise a third distance between adjacent ones of the plurality of solid state light emitters, and wherein the second distance comprises a distance in a range between the third distance and 1.5 times the third distance as recited in claim 9.

However, it would have been obvious to one of ordinary skill in the art at the time the invention was made to make the first distance comprises approximately one half the third distance and the second distance comprises a distance in a range between the third distance and 1.5 times the third distance in order fit the desired amount of light emitters and provide enough of an air gap for refraction through diffusing mediums while maintaining a slim display. One would have been motivated to make the first distance comprises approximately one half the third distance and the second distance comprises a distance in a range between the third distance and 1.5 times the third distance in order to optimize the light efficiency and size of the display device. The applicant is also advise that it has been held that discovering an optimum value of a result effective

variable involves only routine skill in the art. *In re Boesch*, 617 F.2nd 272, 205 USPQ 215 (CCPA 1980).

In regard to claim 19, the method(s) recited in this claim are considered inherent in view of the structure of Chou as described in claim 9 above.

Claims 3, 7, 11, 13, 15, 16, and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chou in view of Hafuka (2007/0019419).

In regard to claims 3 and 7 Chou teaches the invention described above, but lacks the specific teaching of the diffuser sheet comprising a substantially transparent plate; and a diffuser film supported by the substantially transparent plate as recited in claim 3 of the diffuser sheet comprises a diffuser film, a brightness enhancing film, a polarizing film and a substantially clear plate configured to support the diffuser film, the brightness enhancing film, the polarizing film as recited in claim 7.

Hafuka teaches a diffuser film 13 supported by the substantially transparent plate 14 and the diffuser sheet comprises a diffuser film, a brightness enhancing film, a polarizing film and a substantially clear plate configured to support the diffuser film, the brightness enhancing film, the polarizing film [0037].

It would have been obvious to one of ordinary skill in the art at the time the invention was made to been obvious to make the diffusion sheet of Chou have a diffuser film, a brightness enhancing film, a polarizing film and a substantially clear plate configured to support the diffuser film in order to enhance the diffusivity of the element.

One would have been motivated to modify the diffusion sheet of Chou as taught by Hafuka in order to improve the uniformity of the display output.

In regard to claim 11, Chou teaches the invention described above, but lacks the specific teaching of the diffuser plate comprises a structured refractive diffuser as recited in claim 11.

Hafuka teaches a refractive diffuser (synthetic resin is diffractive [0039].

It would have been obvious to one of ordinary skill in the art at the time the invention was made to been obvious to make the diffusion sheet of Chou have a refractive structure in order to enhance the diffusivity of the element. One would have been motivated to modify the diffusion sheet of Chou as taught by Hafuka in order to improve the uniformity of the display output.

In regard to claim 13, Chou teaches the invention described above as well as the multiplane light diffuser comprises: a first diffuser plate positioned at a first distance from the plurality of solid state emitters; a second diffuser plate positioned at a second distance from the plurality of solid state emitters wherein the first distance is less than the second distance; but lacks the specific teaching of and a diffuser sheet supported by the second diffuser plate,. as recited in claim 13.

Hafuka teaches a diffuser sheet supported by a diffuser plate 14 [0038].

It would have been obvious to one of ordinary skill in the art at the time the invention was made to been obvious to make the diffusion sheet of Chou have a

support plate in order to enhance the diffusivity of the element. One would have been motivated to modify the diffusion sheet of Chou as taught by Hafuka in order to improve the uniformity of the display output.

In regard to claim 15, the method(s) recited in this claim are considered inherent in view of the structure of Chou as described in claim 3 above.

In regard to claim 16, the method(s) recited in this claim are considered inherent in view of the structure of Chou as described in claim 13 above.

In regard to claim 18 the method(s) recited in this claim are considered inherent in view of the structure of Chou as described in claim 11 above.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Lee (2008/0002391), You (6,979,102) teach related display device structures.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JULIE A. SHALLENBERGER whose telephone number is (571)272-7131. The examiner can normally be reached on Monday - Friday 830-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jon-Suk (James) Lee can be reached on 571-272-7044. 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.

JAS
AU 2885

/Julie A Shallenberger/
Examiner, Art Unit 2885

Notice of References Cited	Application/Control No. 12/045,729	Applicant(s)/Patent Under Reexamination ROBERTS ET AL.	
	Examiner JULIE A. SHALLENBERGER	Art Unit 2885	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-7,036,956	05-2006	Chou, Shen-Hong	362/246
*	B	US-2007/0019419	01-2007	Hafuka et al.	362/373
*	C	US-6,979,102	12-2005	You, Dong Jae	362/218
*	D	US-2008/0002391	01-2008	Lee, Hyun-Su	362/97
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

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

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 257 of 836

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12045729	ROBERTS ET AL.
	Examiner	Art Unit
	JULIE A SHALLENBERGER	2885

SEARCHED			
Class	Subclass	Date	Examiner
362	612,616-622,624-629,634,97.1-97.4	3/12/10	JAS

SEARCH NOTES		
Search Notes	Date	Examiner
Consulted Sharon Payne	3/12/10	JAS
inventor search	3/12/10	JAS
fwd/bwd search	3/12/10	JAS

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (use as many sheets as necessary)				Complete if Known	
				Application Number	12/045,729
				Filing Date	March 11, 2008
				First Named Inventor	John Roberts et al.
				Art Unit	2871
				Examiner Name	David C. Nelms
Sheet	A1	of	A2	Attorney Docket Number	5308-824

U.S. PATENT DOCUMENTS AND APPLICATIONS

Examiner Initials*	Cite No.	Document Number (Number-Kind Code (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
	1.	US- 7,355,284	04-08-2008	Negley	
	2.	US- 6,932,497	08-23-2005	Huang	
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	8.	US- 2007/0127129 A1	06-07-2007	Wood et al.	
	9.	US- 2007/0127098 A1	06-07-2007	Wood	
	10.	US- 2007/0047204 A1	03-01-2007	Parker et al.	
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	19.	US- 2006/0061869 A1	03-23-2006	Fadel et al.	
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Examiner Initials*	Cite No.	Foreign Patent Document (Country Code, Number, Kind Code (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
	29.	EP 1 681 509	07-19-2006	Omron Corporation (JP)		Yes

Examiner Signature	/Julie Shallenberger/	Date Considered	3/12/10

*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.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /J.S./

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (use as many sheets as necessary)				Complete if Known	
				Application Number	12/045,729
				Filing Date	March 11, 2008
				First Named Inventor	John Roberts et al.
				Art Unit	2871
				Examiner Name	David C. Nelms
Sheet	A2	of	A2	Attorney Docket Number	5308-824

	30.	EP 1 653 255	05-03-2006	Pentair Water Pool and Spa, Inc. (US)		Yes
	31.	FR 2 814 220	03-22-2002	Koito Manufacturing Co., Ltd. (JP)		Abstract
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	33.	FR 2 586 844	03-06-1987	Sofrela SA (FR)		Abstract
	34.	JP 05-100106	04-23-1993	Dainippon Printing Co., Ltd.		Yes
	35.	WO 2007/026776	03-08-2007	Mitsubishi Rayon Co., Ltd. (JP)		Abstract
	36.	WO 03/044870	05-30-2003	Georges, Mireille (FR)		Abstract

NON PATENT LITERATURE DOCUMENTS			
Examiner Initials*	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published	T
	37.	International Search Report and Written Opinion (14 pages) corresponding to International Application No. PCT/US2008/070132; Mailing Date: October 14, 2008.	Yes
	38.	International Search Report and Written Opinion (14 pages) corresponding to International Application No. PCT/US2007/086237; Mailing Date: May 8, 2008.	Yes
	39.	International Search Report and Written Opinion (14 pages) corresponding to International Application No. PCT/US2007/086242; Mailing Date: March 4, 2008.	Yes

iDoc# 772540

Examiner Signature	/Julie Shallenberger/	Date Considered	3/12/10

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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /J.S./

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L2	755	362/612.ccls.	US-PGPUB; USPAT; DERWENT	OR	OFF	2010/03/12 11:11
L3	1185	362/616-622.ccls.	US-PGPUB; USPAT; DERWENT	OR	OFF	2010/03/12 11:11
L4	728	362/624-629.ccls.	US-PGPUB; USPAT; DERWENT	OR	OFF	2010/03/12 11:11
L5	240	362/634.ccls.	US-PGPUB; USPAT; DERWENT	OR	OFF	2010/03/12 11:11
L6	929	362/97.1-97.4.ccls.	US-PGPUB; USPAT; DERWENT	OR	OFF	2010/03/12 11:11
L7	10	("20070019419" | "20070201246" | "7163319" | "7510317").PN.	US-PGPUB; USPAT; DERWENT	OR	OFF	2010/03/12 11:37
L8	2	"20070103908"	US-PGPUB; USPAT	OR	OFF	2010/03/12 12:06
L9	29	("20010035922" | "20060023448" | "5808800" | "6642975" | "6902300" | "6974221" | "6979102" | "6995815" | "7059736").PN. OR ("2007/0019419" | "2007/0103908" | "2008/0002391" | "2008/0007947" | "2009/0097230" | "2009/0097232" | "2009/0122537" | "2009/0154139" | "2009/0161345" | "2009/0167982" | "2009/0168406" | "2009/0207584" | "2009/0219461" | "2009/0268434" | "2009/0296023" |	US-PGPUB; USPAT; USOCR	OR	OFF	2010/03/12 12:08

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 261 of 836

		"2009/0303414" | "2010/0027240" | "2010/0033952" | "2010/0033957" | "2010/0045897" | "2010/0046202" | "2010/0046204" | "2010/0061084" | "6964489" | "7163319" | "7324174").URPN.				
L10	886	((JOHN) near2 (ROBERTS)).INV.	US-PGPUB; USPAT	OR	OFF	2010/03/12 12:08
L11	30	((CHENHUA) near2 (YOU)).INV.	US-PGPUB; USPAT	OR	OFF	2010/03/12 12:08
L12	65	10 and "362".clas.	US-PGPUB; USPAT	OR	OFF	2010/03/12 12:11
L13	31	(US-20100061084-$ or US-20100046204-$ or US-20100046202-$ or US-20100045897-$ or US-20100033957-$ or US-20100033952-$ or US-20100027240-$ or US-20090303414-$ or US-20090296023-$ or US-20090268434-$ or US-20090219461-$ or US-20090207584-$ or US-20090168406-$ or US-20090167982-$ or US-20090161345-$ or US-20090154139-$ or US-20090122537-$ or US-20070019419-$ or US-20090097232-$ or US-20090097230-$ or US-20080007947-$ or US-20080002391-$ or US-20070103908-$ or US-20050068771-$). did. or (US-7163319-$ or US-7324174-$ or US-6964489-$ or US-7048425-$ or US-7604365-$ or US-6979102-$).did. or (US-20070019419-$).did.	US-PGPUB; USPAT; DERWENT	OR	OFF	2010/03/12 12:15
L14	1	13 and (refract$4 near5 diffus$3)	USPAT	OR	OFF	2010/03/12 12:16
L15	8	13 and (refract$4 near5 diffus$3)	US-PGPUB; USPAT	OR	OFF	2010/03/12 12:16

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 262 of 836

EAST Search History (Interference)

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Petitioner Hisense USA Corporation
Exhibit 1002 - Page 263 of 836

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (use as many sheets as necessary)				Complete if Known	
				Application Number	12/045,729
				Filing Date	March 11, 2008
				First Named Inventor	John Roberts et al.
				Art Unit	2871
				Examiner Name	David C. Nelms
Sheet	B1	of	B1	Attorney Docket Number	5308-824

U.S. PATENT DOCUMENTS AND APPLICATIONS

Examiner Initials*	Cite No.	Document Number (Number-Kind Code (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
	1.	US- 2008/0111949 A1	05-15-2008	Shibata et al.	
	2.	US- 2007/0195224 A1	08-23-2007	Chang	
	3.	US- 7,036,956 B1	05-02-2006	Chou	
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Examiner Initials*	Cite No.	Foreign Patent Document (Country Code, Number, Kind Code (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
	4.	JP 2008-034342 A	02-14-2008	Sony Corporation		Abstract
	5.	WO 2007/088655 A1	08-09-2007	Sharp Kabushiki Kaisha (JP)		Abstract
	6.	WO 2007/032454 A1	03-22-2007	Fuji Film Corporation (JP)		Abstract

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published	T
	7.	Extended European Search Report (10 pages) corresponding to European Application No. 09154919.6; Dated: May 8, 2009.	

iDoc# 786113

Examiner Signature	/Julie Shallenberger/	Date Considered	3/12/10

*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.

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UNITED STATES PATENT AND TRADEMARK OFFICE

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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/045,729	03/11/2008	John Roberts	5308-824

CONFIRMATION NO. 9825

65106
MYERS BIGEL SIBLEY & SAJOVEC, P.A.
P.O. BOX 37428
RALEIGH, NC 27627

PUBLICATION NOTICE



Title: Apparatus and Methods for Multiplanar Optical Diffusers and Display Panels for Using the Same

Publication No.US-2009-0231835-A1
Publication Date:09/17/2009

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

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 265 of 836

INFORMATION DISCLOSURE STATEMENT BY APPLICANT				Complete if Known	
				Application Number	12/045,729
				Filing Date	March 11, 2008
				First Named Inventor	John Roberts et al.
				Art Unit	2871
(use as many sheets as necessary)				Examiner Name	David C. Nelms
Sheet	B1	of	B1	Attorney Docket Number	5308-824

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	2.	US- 2007/0195224 A1	08-23-2007	Chang	
	3.	US- 7,036,956 B1	05-02-2006	Chou	
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	4.	JP 2008-034342 A	02-14-2008	Sony Corporation		Abstract
	5.	WO 2007/088655 A1	08-09-2007	Sharp Kabushiki Kaisha (JP)		Abstract
	6.	WO 2007/032454 A1	03-22-2007	Fuji Film Corporation (JP)		Abstract

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	7.	Extended European Search Report (10 pages) corresponding to European Application No. 09154919.6; Dated: May 8, 2009.	

iDoc# 786113

Examiner Signature		Date Considered	

*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.

EUROPEAN PATENT OFFICE

Patent Abstracts of Japan

PUBLICATION NUMBER : 2008034342
PUBLICATION DATE : 14-02-08

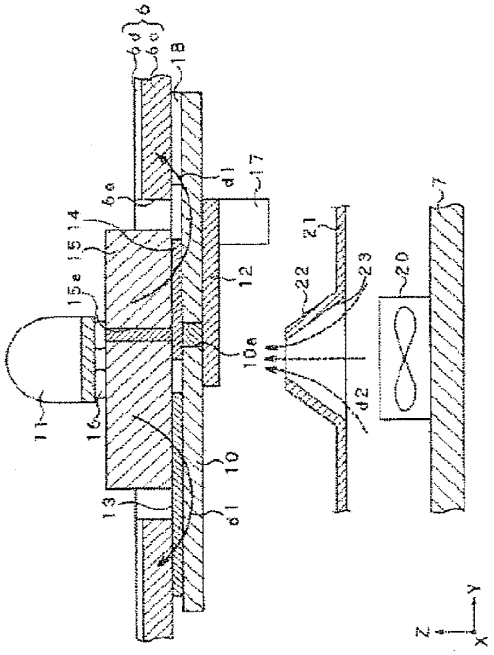
APPLICATION DATE : 23-01-07
APPLICATION NUMBER : 2007013149

APPLICANT : SONY CORP;

INVENTOR : OIDE TATSUYA;

INT.CL. : F21S 2/00 (2006.01), G02F 1/13357 (2006.01), H01L 33/00 (2006.01), F21V 29/00 (2006.01), F21S 8/04 (2006.01), F21Y 101/02 (2006.01)

TITLE : BACKLIGHT DEVICE, LIQUID CRYSTAL DISPLAY DEVICE, AND ELECTRONIC APPARATUS



ABSTRACT : PROBLEM TO BE SOLVED: To provide a backlight device simplifying its structure, capable of reducing the number of components and weight, to provide a liquid crystal display device equipped with the above backlight device, and to provide an electronic apparatus.

SOLUTION: A reflective sheet 6 is formed by joining a base material 6c having mechanical stiffness and a reflective material 6d having high-reflectivity characteristics. A plurality of light source substrates 10 mounted with a plurality of LEDs 11 illuminating illumination light is attached on a surface of the base material 6c side of the reflective sheet 6, each LED 11 is exposed from a surface of the reflective material 6d side through an opening part 6e penetrating the base material 6c and the reflective material 6d. With this, the reflective sheet 6 can be used as a base structure body of a backlight unit 3, and illumination light illuminated from each LED 11 can be reflected.

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(19)日本国特許庁(JP)　(12)公開特許公報(A)　(11)特許出願公開番号
特開2008-34342
(P2008-34342A)
(43)公開日　平成20年2月14日(2008.2.14)

(51)Int.Cl.			F I			テーマコード（参考）
F21S	2/00	(2006.01)	F21S	1/00	E	2H091
G02F	1/13357	(2006.01)	G02F	1/13357		2H191
H01L	33/00	(2006.01)	H01L	33/00	L	3K014
F21V	29/00	(2006.01)	F21V	29/00	A	3K243
F21S	8/04	(2006.01)	F21S	1/02	G	5F041

審査請求 未請求　請求項の数 13　ＯＬ　（全 18 頁）　最終頁に続く

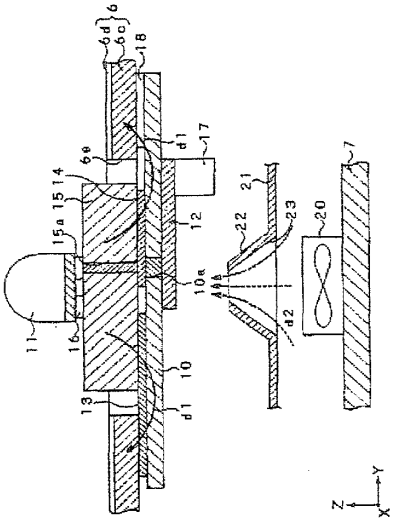
(21)出願番号　特願2007-13149(P2007-13149)
(22)出願日　平成19年1月23日(2007.1.23)
(31)優先権主張番号　特願2006-182029(P2006-182029)
(32)優先日　平成18年6月30日(2006.6.30)
(33)優先権主張国　日本国(JP)

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最終頁に続く

(54)【発明の名称】バックライト装置、液晶表示装置及び電子機器

(57)【要約】　（修正有）
【課題】構造を簡素化し、部品点数の削減が図れ、軽量化を図ることができるバックライト装置、このバックライト装置を備える液晶表示装置及び電子機器を提供すること。
【解決手段】反射シート６は、機械的剛性を有する基材６ｃと、高反射率特性を有する反射材６ｄを接合して形成される。反射シート６の基材６ｃ側の面には、照明光を照明する複数のＬＥＤ１１が実装された複数の光源基板１０が取り付けられ、各ＬＥＤ１１は、基材６ｃと反射材６ｄとを貫通する開口部６ｅを介して反射材６ｄ側の面から露出している。これにより、反射シート６をバックライトユニット３の基本構造体として用いることができるとともに各ＬＥＤ１１から照射された照明光を反射させることができる。
【選択図】図４



【特許請求の範囲】
【請求項1】
透過型の液晶パネルを背面側から照明するバックライト装置において、
照明光を照射する複数の発光素子が実装された複数の光源基板と、
上記光源基板が一方の面に複数取り付けられ、上記光源基板に実装された上記発光素子に対応する位置にそれぞれ形成された開口部から上記発光素子を他方の面に露出させ、上記発光素子から照射された照明光を他方の面で反射する反射シートと、
上記反射シートの他方の面側に上記反射シートと所定の対向間隔を介して対向され、上記反射シートから入射された上記照明光を層内において拡散する拡散導光プレートと、
上記拡散導光プレートに組み合わされ、複数の光学機能シートを積層してなり、上記透過型の液晶パネルに上記照明光を導光する光学機能シート積層体と
を備えることを特徴とするバックライト装置。
【請求項2】
上記光源基板は、ガラスエポキシ基板であることを特徴とする請求項１記載のバックライト装置。
【請求項3】
上記光源基板は、一方の面に配線用のパターンが形成され、他方の面に放熱用のパターンが形成され、
上記配線用のパターンは、他方の面のランドとスルーホールを介して接続されていることを特徴とする請求項１記載のバックライト装置。
【請求項4】
上記光源基板は、一方の面に、コネクタ又はハーネスが実装されていることを特徴とする請求項３記載のバックライト装置。
【請求項5】
更に、上記光源基板の一方の面側には、冷却手段が配設されることを特徴とする請求項１記載のバックライト装置。
【請求項6】
透過型の液晶パネルに照明光を供給するバックライト装置において、
前記照明光を照射する複数の発光素子が実装された複数の光源基板と、
前記各光源基板が設けられる第１の面と、前記第１の面に対向し、前記各発光素子から照射された照明光を反射する第２の面と、前記第１の面と第２の面とを連通し、前記各発光素子を前記第２の面から露出させるように前記各発光素子に対応してそれぞれ形成された複数の開口部とを有する反射シートと、
前記反射シートの第２の面と所定の間隔を介して直接的に対向して設けられ、前記各発光素子から照射された前記照明光及び前記反射シートの第２の面から入射された前記照明光を内部で拡散する拡散導光プレートと、
前記拡散導光プレートに組み合わされ、複数の光学機能シートを積層してなり、前記液晶パネルに前記照明光を導光する光学機能シート積層体と
を具備することを特徴とするバックライト装置。
【請求項7】
透過型の液晶パネルと、
上記透過型の液晶パネルを背面側から照明するバックライト装置を備え、
上記バックライト装置は、照明光を照射する複数の発光素子が実装された複数の光源基板と、上記光源基板が一方の面に複数取り付けられ、上記光源基板に実装された上記発光素子に対応する位置にそれぞれ形成された開口部から上記発光素子を他方の面に露出させ、上記発光素子から照射された照明光を他方の面で反射する反射シートと、上記反射シートの他方の面側に上記反射シートと所定の対向間隔を介して対向され、上記反射シートから入射された上記照明光を層内において拡散する拡散導光プレートと、上記拡散導光プレートに組み合わされ、複数の光学機能シートを積層してなり、上記透過型の液晶パネルに

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 270 of 836

上記照明光を導光する光学機能シート積層体とを備えることを特徴とする液晶表示装置。
【請求項8】
上記光源基板は、ガラスエポキシ基板であることを特徴とする請求項７記載の液晶表示装置。
【請求項9】
上記光源基板は、一方の面に配線用のパターンが形成され、他方の面に放熱用のパターンが形成され、
上記配線用のパターンは、他方の面のランドとスルーホールを介して接続されていることを特徴とする請求項７記載の液晶表示装置。
【請求項10】
上記光源基板は、一方の面に、コネクタ又はハーネスが実装されていることを特徴とする請求項９記載の液晶表示装置。
【請求項11】
更に、上記光源基板の一方の面側には、冷却手段が配設されることを特徴とする請求項７記載の液晶表示装置。
【請求項12】
透過型の液晶パネルと、
前記液晶パネルに前記照明光を供給するバックライト装置とを備え、
前記バックライト装置は、
前記照明光を照射する複数の発光素子が実装された複数の光源基板と、
前記各光源基板が設けられる第１の面と、前記第１の面に対向し、前記各発光素子から照射された照明光を反射する第２の面と、前記第１の面と第２の面とを連通し前記各発光素子を前記第２の面から露出させるように前記各発光素子に対応してそれぞれ形成された複数の開口部とを有する反射シートと、
前記反射シートの第２の面と所定の間隔を介して直接的に対向して設けられ、前記各発光素子から照射された前記照明光及び前記反射シートから入射された前記照明光を内部で拡散する拡散導光プレートと、
前記拡散導光プレートに組み合わされ、複数の光学機能シートを積層してなり、前記液晶パネルに前記照明光を導光する光学機能シート積層体とを有する
ことを特徴とする液晶表示装置。
【請求項13】
透過型の液晶パネルと、
前記液晶パネルに供給するための照明光を照射する複数の発光素子が実装された複数の光源基板と、前記各光源基板が設けられる第１の面と、前記第１の面に対向し、前記各発光素子から照射された照明光を反射する第２の面と、前記第１の面と第２の面とを連通し前記各発光素子を前記第２の面から露出させるように前記各発光素子に対応してそれぞれ形成された複数の開口部とを有する反射シートと、前記反射シートの第２の面と所定の間隔を介して直接的に対向して設けられ、前記各発光素子から照射された前記照明光及び前記反射シートから入射された前記照明光を内部で拡散する拡散導光プレートと、前記拡散導光プレートに組み合わされ、複数の光学機能シートを積層してなり、前記液晶パネルに前記照明光を導光する光学機能シート積層体とを有するバックライト装置と、
前記光源基板を冷却するための冷却手段と
を具備することを特徴とする電子機器。
【発明の詳細な説明】
【技術分野】
【0001】
本発明は、透過型の液晶パネルを照明するバックライト装置、このバックライト装置を備える液晶表示装置及び電子機器に関する。
【背景技術】
【0002】
液晶表示装置は、２枚の透明基板の間に液晶が封入され、電圧が印加されることにより

NSDOCID: <JP_____2008034342A__I_>

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 271 of 836

液晶分子の向きが変えられ光透過率を変化させることで所定の映像等が光学的に表示される。この液晶表示装置には、液晶自体が発光体ではないため、例えば液晶パネルの背面側に冷陰極蛍光ランプ（CCFL:Cold Cathode Fluorescent Lamp）や発光ダイオード（LED:Light Emitting Diode ）を光源とした照明光を照射するバックライト装置が備えられる。

【0003】

バックライト装置においては、液晶パネルを背面側から、複数のＬＥＤが実装された光源から照明光が照射され、この照明光に対して、各光学シートによって拡散、反射及び導光等の光学処理が施されることで、液晶パネルに対して照明光が全面に亘って均一かつ安定な状態で照射される。

【0004】

例えば、特許文献１のバックライト装置は、バックライト装置の基本構造体であるバックシャーシの一方の面に光源基板を取り付け、このバックシャーシと対向間隔を介して、反射シートを設ける構造を備えている。このため、特許文献１のバックライト装置は、バックシャーシと反射シートとの２重底構造を有するため構造が複雑化しかつ重量の増加も招いている。

【0005】

また、特許文献１のバックライト装置においては、各光源基板の一方の面側の直上に反射シートが存在し、各光源基板の他方の面にヒートプレートが取り付けられているので、各光源基板の一方の面と直上にある反射シートとの狭い対向間隔内の限られたスペースで各光源基板の一方の面に複数のＬＥＤやこれらＬＥＤをシリーズで配線する配線パターンや光源用のハーネス、コネクタ等の配線部品を実装させる必要があり、設計の自由度が制約されてしまう。

【0006】

更に、特許文献１のバックライト装置においては、光源基板の冷却手段に関して、ＬＥＤより発生した発生熱を光源基板に取り付けられているヒートプレートによってヒートパイプを介してヒートシンクに移動させ、この発生熱を空冷ファン等で冷却している。しかしながら、この冷却手段では、ヒートプレート等を介した熱伝導に依存するため冷却効率が光源基板の取付方法などに依存してしまう。また、光源基板、ヒートプレート、ヒートパイプ及びヒートシンク等は、アルミニウム部材から設けられているので、重量が重く、加工が困難であり、コストが高くなってしまう。

【特許文献1】特開２００５－３５２４２７号公報

【発明の開示】

【発明が解決しようとする課題】

【0007】

本発明は、このような従来の事情に鑑みて提案されたものであり、構造を簡素化し、部品点数の削減が図れ、軽量化を図ることができるバックライト装置、このバックライト装置を備える液晶表示装置及び電子機器を提供することを目的とする。

【0008】

また、本発明は、ＬＥＤから発生した発生熱を簡単な構成で効率よく冷却することができるバックライト装置及びこのバックライト装置を備える液晶表示装置を提供することを目的とする。

【課題を解決するための手段】

【0009】

上述した目的を達成するために本発明に係るバックライト装置は、透過型の液晶パネルを背面側から照明し、照明光を照射する複数の発光素子が実装された複数の光源基板と、上記光源基板が一方の面に複数取り付けられ、上記光源基板に実装された上記発光素子に対応する位置にそれぞれ形成された開口部から上記発光素子を他方の面に露出させ、上記発光素子から照射された照明光を他方の面で反射する反射シートと、上記反射シートの他方の面側に上記反射シートと所定の対向間隔を介して対向され、上記反射シートから入射された上記照明光を層内において拡散する拡散導光プレートと、上記拡散導光プレートに

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 272 of 836

組み合わされ、複数の光学機能シートを積層してなり、上記透過型の液晶パネルに上記照明光を導光する光学機能シート積層体とを備える。

【0010】

また、上述した目的を達成するために本発明に係る液晶表示装置は、透過型の液晶パネルと、上記透過型の液晶パネルを背面側から照明するバックライト装置とを備えるものである。

【0011】

本発明の他の観点に係るバックライト装置は、透過型の液晶パネルに照明光を供給するバックライト装置であって、前記照明光を照射する複数の発光素子が実装された複数の光源基板と、前記各光源基板が設けられる第１の面と、前記第１の面に対向し、前記各発光素子から照射された照明光を反射する第２の面と、前記第１の面と第２の面とを連通し、前記各発光素子を前記第２の面から露出させるように前記各発光素子に対応してそれぞれ形成された複数の開口部とを有する反射シートと、前記反射シートの第２の面と所定の間隔を介して直接的に対向して設けられ、前記各発光素子から照射された前記照明光及び前記反射シートの第２の面から入射された前記照明光を内部で拡散する拡散導光プレートと、前記拡散導光プレートに組み合わされ、複数の光学機能シートを積層してなり、前記液晶パネルに前記照明光を導光する光学機能シート積層体とを具備する。

【0012】

ここで「直接的に対向して」とは、反射シートと拡散導光プレートとの間に、両者を隔てるような他の部材が存在しないことを意味する。この構成により、反射シートの第１の面に各光源基板が設けられ、第２の面から各発光素子が露出するようになっているため、従来のバックライト装置において必要であった各光源基板を保持するための部材が不要となり、バックライト装置の薄型化、軽量化及びコスト低減を図ることができる。また、反射シートと拡散導光プレートとが直接的に対向しており、両者の間に例えば拡散プレート等の他の部材を設ける必要がないため、上述の薄型化、軽量化及びコスト低減の効果が更に高まることとなる。

【0013】

本発明の他の観点に係る液晶表示装置は、透過型の液晶パネルと、前記液晶パネルに前記照明光を供給するバックライト装置とを備え、前記バックライト装置は、前記照明光を照射する複数の発光素子が実装された複数の光源基板と、前記各光源基板が設けられる第１の面と、前記第１の面に対向し、前記各発光素子から照射された照明光を反射する第２の面と、前記第１の面と第２の面とを連通し前記各発光素子を前記第２の面から露出させるように前記各発光素子に対応してそれぞれ形成された複数の開口部とを有する反射シートと、前記反射シートの第２の面と所定の間隔を介して直接的に対向して設けられ、前記各発光素子から照射された前記照明光及び前記反射シートから入射された前記照明光を内部で拡散する拡散導光プレートと、前記拡散導光プレートに組み合わされ、複数の光学機能シートを積層してなり、前記液晶パネルに前記照明光を導光する光学機能シート積層体とを有している。

【0014】

本発明の他の観点に係る電子機器は、透過型の液晶パネルと、前記液晶パネルに供給するための照明光を照射する複数の発光素子が実装された複数の光源基板と、前記各光源基板が設けられる第１の面と、前記第１の面に対向し、前記各発光素子から照射された照明光を反射する第２の面と、前記第１の面と第２の面とを連通し前記各発光素子を前記第２の面から露出させるように前記各発光素子に対応してそれぞれ形成された複数の開口部とを有する反射シートと、前記反射シートの第２の面と所定の間隔を介して直接的に対向して設けられ、前記各発光素子から照射された前記照明光及び前記反射シートから入射された前記照明光を内部で拡散する拡散導光プレートと、前記拡散導光プレートに組み合わされ、複数の光学機能シートを積層してなり、前記液晶パネルに前記照明光を導光する光学機能シート積層体とを有するバックライト装置と、前記光源基板を冷却するための冷却手段とを具備する。

ISDOCID: <JP_____2008034342A__I_>

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 273 of 836

【0015】
ここで電子機器とは、例えばテレビジョン受像機やＰＣ（Personal Computer）等である。また冷却手段としては、冷却ファン、ヒートパイプ、ヒートシンク等、様々なものを用いることができる。またこの冷却手段は、光源基板側に設けられていてもよいし、液晶パネル及びバックライト装置とを保持する外筐の内面に設けられていてもよい。
【発明の効果】
【0016】
本発明によれば、バックライトユニットの基本構造体として用いることができるとともに各ＬＥＤから照射された照明光を反射させることができる反射シートの一方の面に、照明光を照射するＬＥＤが実装された光源基板を複数取り付けることで、構造が簡素化し、部品点数の削減が図れ、軽量化を図ることができる。
【発明を実施するための最良の形態】
【0017】
以下、本発明を適用したバックライト装置、液晶表示装置及び電子機器について、図面を参照して説明する。
【0018】
（第１実施形態）
まず、本発明の第１の実施形態について説明する。
本実施形態における液晶表示装置１は、例えば４０インチ以上の大型表示画面を有するテレビジョン受像機の表示パネルに用いられる。この液晶表示装置１は、図１及び図２に示すように、透過型の液晶パネル４を有する液晶パネルユニット２と、この液晶パネルユニット２の背面側に組み合わされ液晶パネルユニット２に対して照明光を照射する本発明が適用されたバックライトユニット３とを備える。
【0019】
バックライトユニット３により背面側から照明光が照射される液晶パネルユニット２は、略矩形状の液晶パネル４と、この液晶パネル４を保持する前面フレーム部材５ａと背面フレーム部材５ｂとを有する。
【0020】
前面フレーム部材５ａ及び背面フレーム部材５ｂに保持される液晶パネル４は、図２に示すように、スペーサビーズ等によって対向間隔が保持された第１のガラス基板４ａと第２のガラス基板４ｂとの間に液晶（図示せず）が封入されてなる。第１のガラス基板４ａの内面には、例えば、ストライプ状の透明電極と、絶縁膜と、液晶分子を一定方向に配列させる配向膜とが設けられる。また、第２のガラス基板４ｂの内面には、例えば、光の三原色のカラーフィルタと、このカラーフィルタを保護するオーバコート層と、ストライプ状の透明電極と、液晶分子を一定方向に配列させる配向膜とが設けられる。更に、第１のガラス基板４ａと第２のガラス基板４ｂの表面には、それぞれ偏向フィルムと位相差フィルム等からなる光学フィルム層４ｃが設けられている。
【0021】
以上のような構成からなる液晶パネル４においては、スペーサビーズ等によって対向間隔が保持された第１のガラス基板４ａと第２のガラス基板４ｂとの間に液晶が封入され、透明電極に電圧が印加されると、ポリイミドからなる配向膜によって液晶分子が界面に対して水平方向に配列されて液晶分子の向きを変えることで光透過率が変化される。そして、液晶パネル４は、光学フィルム層４ｃによってバックライトユニット３から照射された照明光の波長特性を無彩色化、白色化し、カラーフィルタによってフルカラー化を図り所定の映像等をカラー表示する。
【0022】
なお、液晶パネル４は、上述した構成に限定されるものではなく、従来提供されている種々の構成を備える液晶パネルであってもよい。
【0023】
液晶パネル４を保持する前面フレーム部材５ａ及び背面フレーム部材５ｂは、枠状に形

NSDOCID: <JP_____2008034342A__|_>

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 274 of 836

成され、図２に示すように、スペーサ２ａ，２ｂ及びガイド部材２ｃを介して液晶パネル４の外周縁部を前面フレーム部材５ａと背面フレーム部材５ｂとで液晶パネル４を挟み込み保持する。

【0024】

以上のように構成された液晶パネルユニット２においては、背面側にバックライトユニット３が組み合わされ、液晶パネルユニット２に対して照明光が照射されることで所定の映像等がカラー表示される。また、液晶表示装置１においては、次に説明するバックライトユニット３がその背面側に備えられることで、バックライトユニット３から液晶パネルユニット２に対して照明光が全面に亘って均一かつ安定な状態で照射されるため、輝度むらや色むら等が少なくなり画質等の向上が図られる。

【0025】

液晶パネルユニット２の背面側に組み合わされ照明光を照射するバックライトユニット３は、図２に示すように、液晶パネルユニット２の背面と略同じ大きさの外形寸法を有しており、背面フレーム部材５ｂに組み合わされる反射シート６と、反射シート６に取り付けられ、照明光を照明するための光源として複数の発光ダイオード（以下、ＬＥＤという。）が実装された複数の光源基板１０と、反射シート６と対向間隔を介して取り付けられ、光源基板１０から照射された照明光に光学処理を施す光学シートブロック３０とを有する。

【0026】

光源基板１０が取り付けられた反射シート６は、図２に示すように、液晶パネル４の外形よりもやや大型の略矩形薄板状の主面部６ａと、この主面部６ａの周囲に背面フレーム部材５ｂと外周部で組み合わされる外周壁部６ｂとを有する。また、反射シート６は、機械的剛性を有するアルミニウムプレートからなる基材６ｃ（図４参照）と、蛍光剤を含有し高反射率特性を有する発泡性ＰＥＴ（Polyethylene Terephthalate）等からなる反射材６ｄ（図４参照）とを接合して形成される。反射材６ｄは、基材６ｃの両主面のうち、光源基板１０が取り付けられる一方の面とは反対側の他方の面に接合される。更に、反射シート６には、図３に示すように、主面部６ａに後述する光源基板１０に実装されたＬＥＤ１１に対応する位置にそれぞれ形成された開口部６ｅが設けられている。

【0027】

なお、反射シート６は、アルミニウムプレートに限定されるものではなく、例えば鏡面を有するステンレスプレートを用いるようにしてもよい。また、反射シート６は、比較的小サイズの液晶表示装置に用いられる場合、例えば蛍光剤を含有した発泡性ＰＥＴ等からなる反射材６ｄで形成されるようにしてよい。

【0028】

反射シート６に取り付けられている光源基板１０は、図４に示すように、導電層が両面に形成されたガラスエポキシ基板であり、反射シート６の開口部６ｅより大型の略矩形薄板状に形成されている。また、光源基板１０の一方の面には、導電材料からなる配線用パターン１２が設けられ、他方の面には、放熱用パターン１３と、この放熱用パターン１３と電気的に絶縁された複数のランド１４とが長手方向の略同一軸線上に設けられている。

【0029】

更に、光源基板１０には、他方の面の各ランド１４と一方の面の配線用パターン１２とを電気的に接続させる複数のスルーホール１０ａが設けられている。このスルーホール１０ａは、スルーホール１０ａ内に金や銅等の金属メッキ処理を施すスルーホール接続やスルーホール１０ａ内に導電性ペーストを詰めること等によって、他方の面に設けられたランド１４と一方の面に設けられた配線用パターン１２とを電気的に接続させる。

【0030】

また、光源基板１０の他方の面に設けられたランド１４及び放熱用パターン１３上には、セラミック基板１５が熱伝導性に優れた接着材等で接着され実装されている。なお、セラミック基板１５は、ランド１４及び放熱用パターン１３上に半田付けによって実装されてもよい。

JSDOCID: <JP_____2008034342A__i_>

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 275 of 836

【0031】
このセラミック基板１５は、図４に示すように、熱伝導性を有するセラミック材からなり、略円形板状又は略矩形板状に形成されている。更に、セラミック基板１５の上面には、各ランド１４の配置位置に対応されたスルーホール１５ａが設けられている。また、セラミック基板１５の上面には、このスルーホール１５ａの配置位置に対応された照明光を照明するＬＥＤ１１が半田バンプ１６によって実装されている。このスルーホール１５ａは、スルーホール１５ａ内を金や銅等の金属メッキ処理を施すスルーホール接続やスルーホール１５ａ内に導電性ペーストを詰めること等によって、セラミック基板１５の上面に実装されたＬＥＤ１１と光源基板１０のランド１４とを電気的に接続させる。
【0032】
半田バンプ１６によってセラミック基板１５の上面に実装されたＬＥＤ１１は、図３に示すように、ランド１４及びスルーホール１５ａと同様に、光源基板１０の長手方向に略同一軸線上に、赤色ＬＥＤと緑色ＬＥＤと青色ＬＥＤとを組み合わせ複数実装されている。なお、ランド１４、スルーホール１５ａ及びＬＥＤ１１は、光源基板１０の長手方向に略同一軸線上に実装されることに限定されない。
【0033】
光源基板１０の一方の面に設けられ、スルーホール１０ａを介してランド１４と電気的に接続されている配線用パターン１２には、図４に示すように、例えばＬＥＤ１１の制御信号用リード線を接続するコネクタ１７が実装されている。
【0034】
また、光源基板１０は、その他方の面が、熱伝導性に優れた熱伝導性両面テープ１８によって反射シート６の一方の面に接着されることで反射シート６に取り付けられている。反射シート６には、光源基板１０の他方の面に実装されたＬＥＤ１１に対応する位置にそれぞれ開口部６ｅが形成されており、この開口部６ｅからＬＥＤ１１が反射シート６の他方の面に露出される。また、光源基板１０の他方の面には、反射シート６の一方の面に当接されるように放熱用パターン１３が設けられている。なお、光源基板１０を反射シート６に取り付ける方法としては、ネジによる締め付け、スナップフィット等でもよい。
【0035】
以上のような構成からなる光源基板１０は、他方の面側に設けられたＬＥＤ１１がセラミック基板１５のスルーホール１５ａ及び光源基板１０のスルーホール１０ａを介して、一方の面に設けられた配線用パターン１２と電気的に接続される。
【0036】
また、ＬＥＤ１１が半田バンプ１６によってセラミック基板１５に実装され、セラミック基板１５が放熱用パターン１３上に熱伝導性に優れた接着材によって接着され、熱伝導性に優れた熱伝導性両面テープ１８によって放熱用パターン１３が反射シート６の一方の面と当接されるように接着されていることで、図４中の矢印ｄ１方向のように、ＬＥＤ１１より発生した発生熱が熱伝導性を有するセラミック基板１５に伝導され、セラミック基板１５から放熱用パターン１３又は熱伝導性両面テープ１８を介して反射シート６へと伝導されるようになっている。
【0037】
なお、光源基板１０には、他方の面側に、ＬＥＤ１１とセラミック基板１５を覆い、ＬＥＤ１１より照射される照明光を拡散させるレンズを設けてもよい。また、光源基板１０は、ガラスエポキシ基板に限定されるものではなく、アルミニウム等のメタルコア基板でもよい。
【0038】
以上のような構成を有する光源基板１０は、図５に示すように、反射シート６の一方の面に、例えば、マトリックス状に３行６列で複数配列されている。この光源基板１０は、行方向、すなわち図５中の矢印Ｘ方向に近接して配列され、列方向、すなわち図５中の矢印Ｙ方向に離間して配列されている。また、行方向に配列された光源基板１０は、図示しないリード線によって電気的に接続されている。

NSDOCID: <JP_____2008034342A__I_>

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 276 of 836

【0039】
更に、反射シート６には、図５に示すように、各光源基板１０が列方向に離間して配列されることによって、２つの光源基板１０間に配置部６ｆが設けられる。この配置部６ｆには、後述する光学スタッド部材３４が挿入され立設される挿入孔６ｇが複数形成されている。配置部６ｆには、後述する光学スタッド部材３４が行方向に５個、列方向に３個、合計１５個配置されるため、この挿入孔６ｇは、各光学スタッド部材３４の配置位置に対応してそれぞれ行方向に５個、列方向に３個、合計１５個形成されている。
【0040】
また、本実施形態のバックライトユニット３を備える液晶表示装置１を組み込む電子機器５０（例えばテレビジョン受像機など）には、図４に示すように、バックライトユニット３の光源基板１０の一方の面側に、液晶表示装置１を覆う外筐７と、光源基板１０の冷却機能を促進する冷却ファン２０とが配設されている。また、この電子機器５０においては、バックライトユニット３の光源基板１０と、電子機器５０の外筐７との間に、電子機器５０の冷却ファン２０により送り込まれた空気を光源基板１０に吹き付ける風向制御板２１が配置されている。
【0041】
風向制御板２１は、反射シート６の主面部６ａよりやや大形の略矩形薄板状に形成される。この風向制御板２１のうち、光源基板１０に対向する面には、各光源基板１０に実装された各ＬＥＤ１１の実装位置に対応させた複数の突出部２２がプレス加工で形成されている。各突出部２２の頂面には、光源基板１０に対向する面に向かって小径となる貫通孔２３が形成されている。なお、風向制御板２１を、機械的強度を有する熱可塑性樹脂等で成形等により形成してもよい。
【0042】
この構成により、冷却ファン２０によって空気が外筐７内に送り込まれたとき、図４中の矢印ｄ２方向のように、送り込まれた空気が貫通孔２３によってガイドされ光源基板１０のＬＥＤ１１が実装されている領域及びこの近傍に集中的に直接吹き付けられる。これにより、バックライトユニット３は、各ＬＥＤ１１から発生した発生熱を効率よく冷却することができる。
【0043】
なお、上述したような冷却ファン２０に限定されず、如何なる冷却手段を配置させてもよい。また、冷却ファン２０及び風向制御板２１等の冷却手段を設けず、反射シート６による放熱だけで冷却してもよい。また、他の部品の配置等に応じて、電子機器５０の外筐７側ではなく、バックライトユニット３側（例えば、光源基板１０の、各ＬＥＤ１１が実装されていない方の面や、反射シート６の、光源基板１０が取り付けられている方の面）に冷却手段を設けてもよい。
【0044】
反射シート６に取り付けられた光学シートブロック３０は、図２に示すように、液晶パネル４の背面側に対向して設けられている。また、光学シートブロック３０は、拡散プレート３１、拡散導光プレート３２と、光学機能シート積層体３３と、複数の光学スタッド部材３４とを有する。
【0045】
拡散プレート３１は、一方の面に複数の光源基板１０が取り付けられた反射シート６の他方の面と所定の対向間隔を介して対向され、照明光の一部を透過するとともに一部を反射する。拡散プレート３１は、図２に示すように、透明な合成樹脂材料、例えば、アクリル樹脂等によって液晶パネル４よりやや大形の略矩形薄板状に成形されている。また、拡散プレート３１には、後述する光学スタッド部材３４が挿入される複数の拡散プレート貫通孔３１ａが形成されている。
【0046】
拡散プレート貫通孔３１ａは、図５に示すように、各光学スタッド部材３４の配置位置に対応してそれぞれ行方向に５個、列方向に３個、合計１５個形成されている。

NSDOCID: <JP____2008034342A__I_>

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 277 of 836

【0047】
拡散プレート３１には、図２に示すように、光源基板１０と対向する一方の面に、反射シート６にマトリックス状に配置された複数の光源基板１０の複数のＬＥＤ１１にそれぞれ対向する複数の調光ドット３１ｂが形成されている。
【0048】
照明光を反射する調光ドット３１ｂは、例えば酸化チタン、硫化バリウム等の遮光剤やガラス粉末、酸化ケイ素等の拡散剤を混合した反射性インクを用いてスクリーン印刷等によって形成される。また、調光ドット３１ｂは、対向するＬＥＤ１１の外径と略同径又はやや大径の略円形パターンからなる。拡散プレート３１は、光源基板１０から出射される照明光を調光ドット３１ｂによって反射シート６側に反射させる。また、拡散プレート３１は、調光ドット３１ｂの非形成領域で各ＬＥＤ１１から照射された照明光の入射角が拡散プレート３１の一方の面に対して臨界角を満たす場合に照明光を入射させる。すなわち、拡散プレート３１は、調光ドット３１ｂの非形成領域であっても、各ＬＥＤ１１から照射された照明光の入射角が拡散プレート３１の一方の面に対して臨界角を超えて入射される場合、照明光を反射する。これにより、拡散プレート３１は、調光ドット３１ｂによって、拡散導光プレート３２へ入射される照明光の入射光量を規制する。更に、拡散プレート３１は、調光ドット３１ｂによって、反射シート６との間で照明光を反復反射させることによって、照明光を全面に亘って均一な状態で拡散導光プレート３２へ入射させる。
【0049】
なお、拡散プレート３１は、１つのＬＥＤ１１に複数の調光ドット３１ｂが対向するようにドットパターンを形成してもよい。また、拡散プレート３１は、ＬＥＤ１１の照明光分布によって十分拡散される場合、省略してもよい。
【0050】
拡散導光プレート３２は、拡散プレート３１と所定の対向間隔を介して反射シート６と反対側に対向され、入射された照明光を内部で拡散する。拡散導光プレート３２は、図２に示すように、導光性を有する乳白色の合成樹脂材、例えば、アクリル樹脂やポリカーボネート樹脂等によって拡散プレート３１と略同形の略矩形薄板状に成形されている。また、拡散導光プレート３２は、反射シート６側の一方の面から入射された照明光を内部において屈折、反射させて拡散させることで、他方の面に組み合わされた光学機能シート積層体３３へ、照明光を全面に亘って均一な状態で導光させる。更に、拡散導光プレート３２は、ブラケット部材３２ａによって外周部が保持されて反射シート６の外周壁部６ｂに取り付けられる。
【0051】
光学機能シート積層体３３は、拡散導光プレート３２に組み合わされ、複数の光学機能シートが積層されてなる。光学機能シート積層体３３は、図２に示すように、拡散導光プレート３２と略同形の略矩形状に形成される。複数の光学機能シートとは、例えば、光源基板１０の光源から照射されて液晶パネル４に導光される照明光を直交する偏光成分に分解する機能を有する偏光フィルム、光波の位相差を補償して広角視野角化及び着色防止を図る機能を有する位相差フィルム、照明光を拡散する機能を有する拡散フィルム等である。
【0052】
なお、光学機能シート積層体３３は、上述した光学機能シートに限定されるものではなく、例えば輝度向上を図る輝度向上フィルム、位相差フィルムやプリズムシートを挟む上下２枚の拡散シート等を用いてもよい。
【0053】
光学スタッド３４は、反射シート６と拡散プレート３１との対向間隔と、拡散プレート３１と拡散導光プレート３２との対向間隔とをそれぞれ規定する。また、光学スタッド部材３４は、図５に示すように、２つの光源基板１０間の配置部６ｆに配置され、行方向、すなわち図５中の矢印Ｘ方向に５個、列方向、すなわち図５中の矢印Ｙ方向に３個、合計１５個備えられている。光学スタッド部材３４は、図２に示すように、例えば、ポリカー

NSDOCID: <JP_____2008034342A_I_>

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 278 of 836

ボ樹脂等の導光性と機械的剛性及びある程度の弾性を有する乳白色、透明等の光高反射部材によって一体に形成される。また、光学スタッド部材３４は、先端部が拡散導光プレート３２の一方の面に突き当てられ拡散導光プレート３２と反射シート６との対向間隔を規定する本体部３４ａと、この本体部３４ａの基端に連続して形成された取付部３４ｂとを有する。

【0054】

図２に示すように、本体部３４ａの先端側は、拡散導光プレート３２側に向かって次第に小径となるような円錐形状に形成されており、この円錐形状の基端に、拡散プレート貫通孔３１ａよりも大径である拡散プレート規定部３４ｃが突出形成されている。この拡散プレート規定部３４ｃの一方の面が拡散プレート３１の他方の面と当接される。更に、本体部３４ａの基端側には、反射シート６の挿入孔６ｇよりも大径である反射シート規定部３４ｄが突出形成されている。この反射シート規定部３４ｄの一方の面が反射シート６の他方の面と当接される。

【0055】

本体部３４ａの基端に連続して形成された取付部３４ｂは、図２に示すように、支軸部３４ｅと支持体３４ｆとからなる。支軸部３４ｅは、本体部３４ａと一体に形成され、反射シート６に形成された挿入孔６ｇに挿入されている。支持体３４ｆは、この支軸部３４ｅから基端の外周部に突出形成される。支持体３４ｆの先端は挿入孔６ｇよりも大径であり、先端面は挿入孔６ｇの一方の面側の周囲に支持される。この支持体３４ｆは、弾性特性を有し、挿入孔６ｇよりも大径である先端が径方向に押圧されると挿入孔６ｇよりも一時的に小径となり、反射シート６に脱着することが可能となる。

【0056】

ここで、バックライトユニット３の組立方法を説明する。

【0057】

先ず、既に一方の面に配線用パターン１２が設けられ、他方の面に放熱用パターン１３及びランド１４が設けられた光源基板１０の放熱用パターン１３及びランド１４上に、セラミック基板１５を熱伝導性に優れた接着剤等で接着させ実装させる。そして、セラミック基板１５の上面に複数のＬＥＤ１１を半田バンプ１６によって実装させる。そして、反射シート６の一方の面にこれら複数のＬＥＤ１１が実装された光源基板１０をマトリックス状に３行６列に配列させて熱伝導性に優れた熱伝導性両面テープ１８によって取り付ける。

【0058】

次に、図２に示すように、拡散プレート３１を、反射シート６の周囲に設けられた図示しない拡散プレート支持部上に配置させる。そして、反射シート６の各挿入孔６ｇと、各挿入孔６ｇの配置位置に対応して形成された拡散プレート貫通孔３１ａとを対向させる。

【0059】

次に、光学スタッド部材３４の取付部３４ｂを、反射シート６の他方の面側から拡散プレート３１の拡散プレート貫通孔３１ａを介して、挿入孔６ｇ内に押し込む。そして、光学スタッド部材３４の取付部３４ｂが挿入孔６ｇ内を通過する際に支持体３４ｆが小径となり、通過後弾性特性により挿入孔６ｇより大径に復帰するように押し込むことで、支持体３４ｆの先端面を挿入孔６ｇの一方の面側の周囲に支持させる。

【0060】

このとき、各光学スタッド部材３４は、支持体３４ｆの先端面が反射シート６の挿入孔６ｇの一方の面側の周囲に支持されるとともに、反射シート規定部３４ｄが反射シート６の他方の面と当接されることで反射シート６に取り付けられる。また、各光学スタッド部材３４は、反射シート６の周囲に設けられた図示しない拡散プレート支持部と拡散プレート規定部３４ｃとで拡散プレート３１を厚み方向（Ｚ方向）に挟持することで、反射シート６と拡散プレート３１との対向間隔を規定し、これら対向する主面間の平行度を全面に亘って高精度に位置決めする。

【0061】

INSDOCID: <JP_____2008034342A_I_>

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 279 of 836

次に、拡散導光プレート３２の一方の面を各光学スタッド部材３４の先端部に突き当てるようにして、拡散導光プレート３２をブラケット部材３２ａを用いて反射シート６の外周壁部６ｂに取り付ける。

【0062】

このとき、各光学スタッド部材３４は、その先端部が拡散導光プレート３２の一方の面に点又は狭い面積で接触され突き当てられるとともに、拡散プレート規定部３４ｃが拡散プレート３１の他方の面で当接されることで、拡散導光プレート３２と拡散プレート３１との対向間隔を規定し、これら対向する主面間の平行度を全面に亘って高精度に位置決めする。

【0063】

以上のように構成されたバックライトユニット３においては、反射シート６が、機械的剛性を有するアルミニウムプレートの基材６ｃの他方の面に蛍光剤を含有した高反射率特性を有する反射材６ｄを接合して形成されている。したがって、反射シート６は、その機械的剛性によりバックライトユニット３の基本構造体として機能するとともに、他方の面の高反射率特性を有する反射材６ｄによって各ＬＥＤ１１から照射された照明光及び拡散プレート３１で反射された照明光を拡散プレート３１側に反射させることができる。すなわち、上記特許文献１で備えられていたバックライト装置のバックシャーシと反射シートの組み合わせを、本発明では反射シート６の一部品に置き換えることができる。したがって、反射シート６の一方の面に、ＬＥＤ１１が実装された光源基板１０を複数取り付けることで、バックライトユニット３の構造を簡素化でき、部品点数の削減が図れ、軽量化を図ることができる。

【0064】

また、バックライトユニット３においては、光源基板１０の他方の面側にありセラミック基板１５の上面に実装されているＬＥＤ１１が、セラミック基板１５のスルーホール１５ａ及び光源基板１０のスルーホール１０ａを介して、光源基板１０の一方の面に設けられた配線用パターン１２と電気的に接続されているので、配線用パターン１２、コネクタ１７及びハーネス等の配線部品を光源基板１０の一方の面に実装させることができ、配線の設計の自由度の向上を図ることができる。

【0065】

更に、バックライトユニット３においては、図４中の矢印ｄ１方向のように、ＬＥＤ１１より発生した発生熱がセラミック基板１５に伝導され、セラミック基板１５から放熱用パターン１３及び熱伝導性両面テープ１８を介して反射シート６に伝導され、反射シート６によって放熱されることで、光源基板１０を冷却することができる。

【0066】

また、バックライトユニット３においては、反射シート６の一方の面にＬＥＤ１１が実装された光源基板１０が複数取り付けられているので、光源基板１０の一方の面に冷却手段を配置することができる。更に、光源基板１０の一方の面側に配置された冷却手段によって光源基板１０の一方の面を直接冷却することができる。このため、バックライトユニット３は、各ＬＥＤ１１から発生した発生熱を反射シート６により放熱するとともに、光源基板１０の一方の面を冷却手段によって直接冷却することで、各ＬＥＤ１１から発生した発生熱を簡単な構成で効率よく冷却することができる。

【0067】

更に、バックライトユニット３においては、光源基板１０が、反射シート６による放熱及び冷却ファン２０によって冷却されるので、光源基板１０に汎用性のあるガラスエポキシ基板を用いることができ、生産性の向上を図るとともにコストの削減を図ることができる。

【0068】

（第２実施形態）

次に、本発明の第２の実施形態について説明する。本実施形態において、上記第１の実施形態と同様の構成となる部分については同一の符号を付し、説明を省略または簡略化す

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 280 of 836

る。

【0069】

図６は、本実施形態における液晶表示装置１００の要部縦断面図であり、図７は、本実施形態における反射シート６と光源基板１０の要部切り欠き平面図であり、図８は、図７で示した反射シートの開口部６ｅと光源基板のＡ－Ａ´縦断面図である。

【0070】

図６に示すように、本実施形態の液晶表示装置１００は、上記第１の実施形態における図２等に示した液晶表示装置１と比較して、拡散プレート３１を設けていない点が異なる。すなわち、反射シート６と拡散導光プレート３２とは直接的に対向するように構成されている。したがって、光学スタッド部材３４においては、図２に示したような拡散プレート規定部３４ｃは設けられておらず、その本体部３４ａは、拡散導光プレート３２に当接する先端から反射シート規定部３４ｄにかけて略円錐状に形成されている。拡散プレート３１を廃することで、液晶表示装置１００の更なる薄型化、軽量化及びコストダウンを図ることができる。

【0071】

また、上記第１の実施形態において、図３に示したように各ＬＥＤ１１が光源基板１０上に直線状に実装されているのと異なり、本実施形態においては、図６～図８に示すように、ＬＥＤ１１は、非線状（十字状）に実装されている。

【0072】

具体的には、図７に示すように、各光源基板１０上には、４つのＬＥＤ１１がＸＹ方向に沿って十字状に近接して構成されたＬＥＤユニット１９が、各光源基板１０の長手方向（Ｘ方向）に所定間隔（例えば６０ｍｍ）を置いて複数（例えば６ユニット）設けられている。ただし、左端及び右端のＬＥＤユニット１９については、ＸＹ方向における十字状ではなく斜め方向にずれて配置され、また左右のＬＥＤユニット１９でその配置は対称的となっている。また、Ｙ方向において隣接する各光源基板１０は、互いに１８０度反転した状態となるように配置される。

【0073】

各ＬＥＤユニット１９は、例えばＸ方向に並んだそれぞれ一つの赤色ＬＥＤ１１ａ及び青色ＬＥＤ１１ｂと、Ｙ方向に並んだ２つの緑色ＬＥＤ１１ｃ及び１１ｄとで構成される。したがって、本実施形態においては、ＬＥＤユニット１９は６×４×１２＝２８８ユニット設けられ、ＬＥＤ１１は４×２８８＝１１５２個設けられることとなる。なお、ＬＥＤユニット１９及びＬＥＤ１１の数や配置間隔は、上述したものに限られるものではなく、液晶パネル４のサイズやＬＥＤ１１の発光能力等によって適宜変更可能である。

【0074】

また、本実施形態においては、各ＬＥＤ１１は非線状に設けられるため、反射シート６に設けられる開口部６ｅは、上記図３で示したような直線状ではなく、図７に示すように１つのＬＥＤ１１毎に例えば円柱状に形成され、各開口部６ｅは、各ＬＥＤ１１を反射シート６の反射材６ｄが設けられた方の面から露出させている。

【0075】

なお、図７に示すように、各光源基板１０の上記２つの緑色ＬＥＤ１１ｃ（Ｇ１）及び１１ｄ（Ｇ２）は、互いに色度が異なり、両者の平均色度が所定の色度となるように構成されている。すなわち、平均色度が所定の色度になりさえすれば、どのような色度の緑色ＬＥＤでも組み合わせることができる。このように構成することで、各色ＬＥＤの中でも特に大きい緑色ＬＥＤのばらつきを吸収することができる。

【0076】

そして、各緑色ＬＥＤ１１ｃ及び１１ｄ（Ｇ１及びＧ２）は、それぞれＸ方向に沿ってジグザグ状となるように配置されている。すなわち、各ＬＥＤユニット１９において各緑色ＬＥＤ１１ｃ及び１１ｄは上下の位置がＸ方向に行くにしたがって交互に入れ替わっている。

【0077】

NSDOCID: <JP_____2008034342A__I_>

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 281 of 836

また、上述したように、Ｙ方向において隣接する各光源基板１０は、互いに１８０度反転した状態となるように配置されるため、色度の異なる各緑色ＬＥＤ１１ｃ及び１１ｄをそれぞれＸ方向に沿って直線状に配置すると、Ｙ方向において隣接する光源基板１０間で、同一の色度を有する緑色ＬＥＤ１１ｃ同士及び１１ｄ同士（Ｇ１同士及びＧ２同士）が近接してしまい、これにより色むら及び輝度むらが生じてしまう。しかしながら、本実施形態のように緑色ＬＥＤ１１ｃ及び１１ｄをそれぞれジグザグ状に配置することで、Ｙ方向で隣接する光源装置２０間でＧ１同士及びＧ２同士の距離が近接することなく均一に配置されることとなるため、色むら及び輝度むら発生を抑えることができる。

【0078】

なお、上記緑色ＬＥＤ１１ｃ及び１１ｄには、色度のみならず輝度も異なるものを採用しても構わない。この場合、緑色ＬＥＤ１１ｃ及び１１ｄの平均輝度が所定の輝度となりさえすればどのような輝度の緑色ＬＥＤでも組み合わせることができる。

【0079】

また、ＬＥＤユニット１９に、緑色ＬＥＤ１１ｃ及び１１ｄのみならず、赤色ＬＥＤ１１ａまたは青色ＬＥＤ１１ｂも複数実装して、その複数の赤色ＬＥＤ１１ａまたは青色ＬＥＤ１１ｂの平均色度（または平均色度）が所定の色度（または輝度）となるようにしても構わない。

【0080】

図８に示すように、本実施形態においても、第１の実施形態と同様、各ＬＥＤ１１はスルーホール１５ａを有するセラミック基板１５上に半田バンプ１６を介して設けられている。しかし、上述のように本実施形態においては各ＬＥＤ１１が非線状に設けられているため、ランド１４、放熱用パターン１３及び配線用パターン１２は、直線状ではなく、各ＬＥＤ１１の配置に対応して非線状に設けられている。例えば、ＬＥＤ１１ｃとＬＥＤ１１ｄとの間に設けられた放熱用パターン１３は、当該２つのＬＥＤ１１ｃ及び１１ｄの放熱を兼ねるように形成されている。しかし、同図Ｘ方向に存在するＬＥＤ１１ａまたは１１ｂ（図７参照）が実装される各セラミック基板１５の下部においては、放熱用パターン１３は、各ＬＥＤ１１ａまたは１１ｂの放熱専用となるように形成されている。このような構成によっても、各ＬＥＤ１１からの発生する熱を、例えば同図矢印ｄ１に示すような経路で反射シート６から効率よく放熱することができる。また、各光源基板１０にも、各ＬＥＤ１１に対応してそれぞれスルーホール１０ａが設けられている。これにより、各ＬＥＤ１１のランド１４と、各ＬＥＤ１１の配置に応じて形成された配線用パターン１２とが電気的に接続されている。

【0081】

そして、本実施形態においては、上記第１の実施形態において設けられていた冷却ファン２０及び風向制御板２１を廃している。これにより、液晶表示装置１００の更なる薄型化、軽量化及びコスト低減を図ることができる。ただし、本発明はこの構成に限定されず、製品仕様に応じ、電子機器側またはバックライトユニット側に第１の実施形態と同様の冷却手段を設けてもよい。

【0082】

以上説明した上記第１及び第２の実施形態によれば、光源基板に汎用性のあるプリント配線基板を用いることで、生産性の向上を図るとともに、コストの削減を図ることができる。

【0083】

また、反射シートの一方の面に光源を有する光源基板を複数取り付けることで、反射シートとは反対側の光源基板の一方の面にコネクタやハーネス等の配線部品を実装させることができ、設計の自由度の向上を図ることができる。

【0084】

本発明は上述の実施形態にのみ限定されるものではなく、本発明の要旨を逸脱しない範囲内において種々変更を加え得ることは勿論である。

【0085】

SDOCID: <JP_____2008034342A_I_>

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 282 of 836

上述の実施形態においては、各光源基板１０を、反射シート６の一方の面に取り付けており、この一方の面から各光源基板１０がそのＺ方向の厚み分及びコネクタ１７の厚み分だけ突出するような構成となっていた。しかし、例えば、反射シート６の一方の面に、各光源基板６の形状及び厚みに適合した凹部を設けて、この凹部に各光源基板６を埋設するようにしてもよい。また、この場合、コネクタ１７も反射シート６の一方の面から突出しないように当該一方の面に埋設してもよい。更に光学スタッド部材３４の支持体３４ｆも反射シート６の一方の面に埋設してもよい。これにより、液晶表示装置の更なる薄型化が可能となる。

【0086】

上述の各実施形態においては、液晶表示装置をテレビジョン受像機に適用した例を示したが、例えばＰＣや屋外用の大型ディスプレイ装置等の他の電子機器に適用することも勿論可能である。

【図面の簡単な説明】

【0087】

【図1】本発明の第１の実施形態における透過型の液晶表示装置の要部分解斜視図である。

【図2】本発明の第１の実施形態における透過型の液晶表示装置の要部縦断面図である。

【図3】本発明の第１の実施形態における反射シートの開口部と光源基板の要部斜視図である。

【図4】本発明の第１の実施形態における反射シートの開口部と光源基板の要部縦断面図である。

【図5】本発明の第１の実施形態における反射シートと光源基板の組立体の背面図である。

【図6】本発明の第２の実施形態における液晶表示装置の要部縦断面図である。

【図7】本発明の第２の実施形態における反射シートと光源基板の要部切り欠き平面図である。

【図8】図７で示した反射シートの開口部と光源基板のＡ－Ａ´縦断面図である。

【符号の説明】

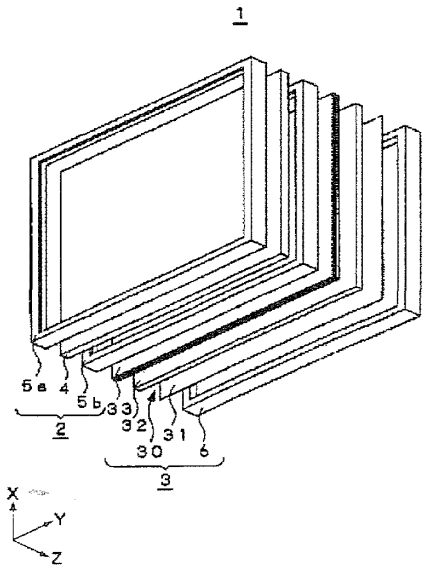
【0088】

１、１００…透過型の液晶表示装置
２…液晶パネルユニット
３…バックライトユニット
４…液晶パネル
６…反射シート
１０…光源基板
１１…発光ダイオード（ＬＥＤ）
１９…ＬＥＤユニット
３０…光学シートブロック
３１…拡散プレート
３２…拡散導光プレート
３３…光学機能シート積層体
３４…光学スタッド部材
５０…電子機器

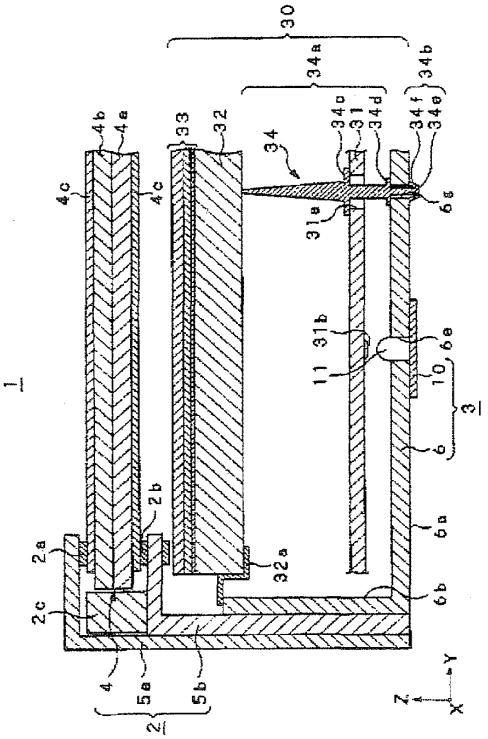
INSDOCID: <JP_____2008034342A_I_>

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 283 of 836

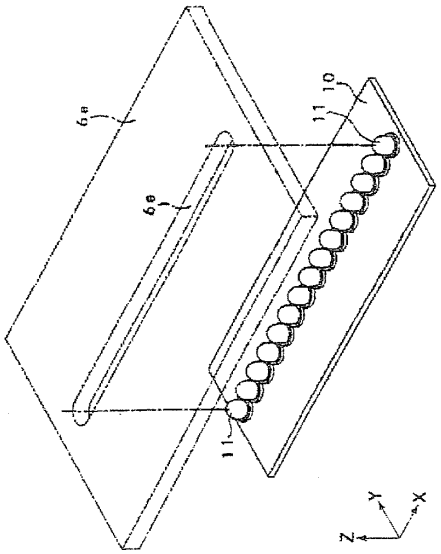
【図1】



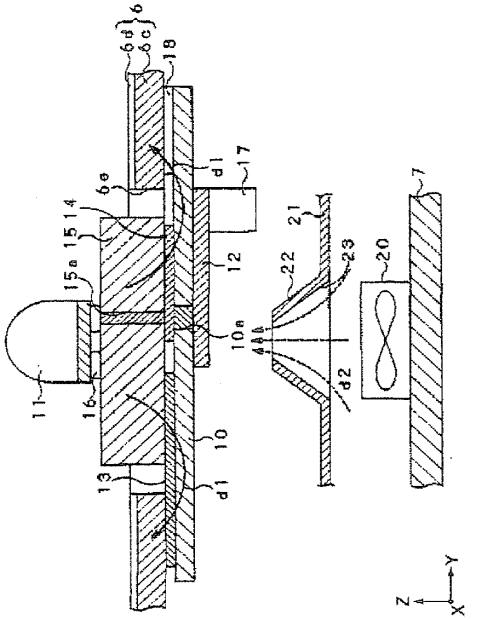
【図2】



【図3】

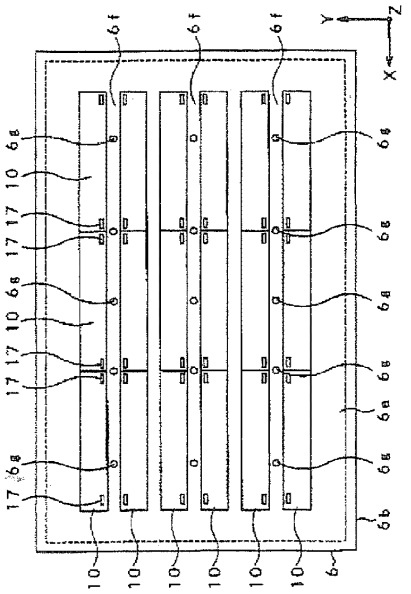


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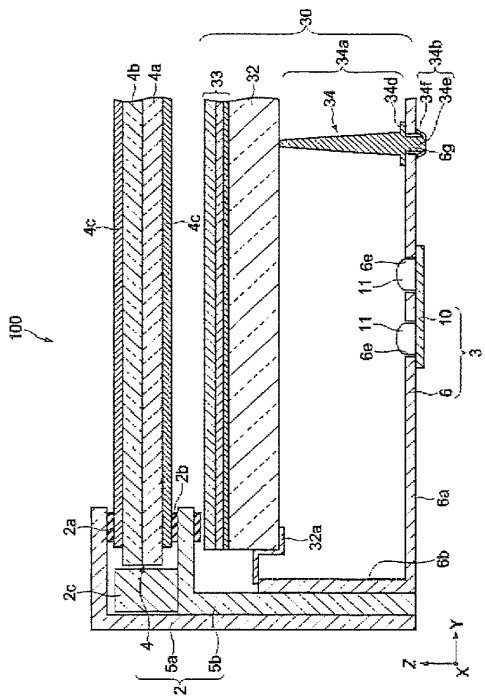


Petitioner Hisense USA Corporation
Exhibit 1002 - Page 284 of 836

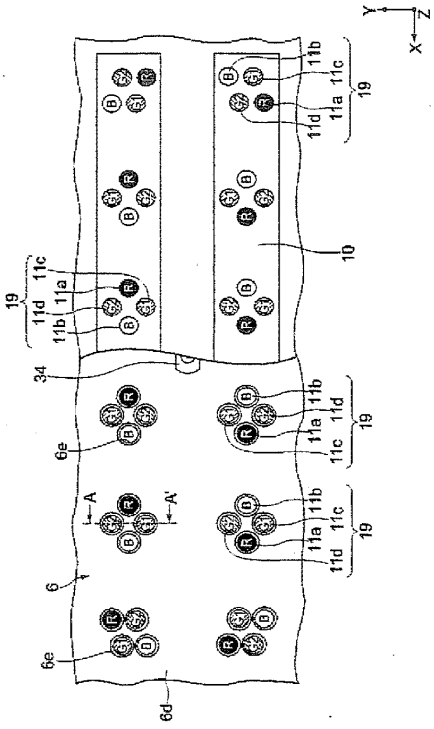
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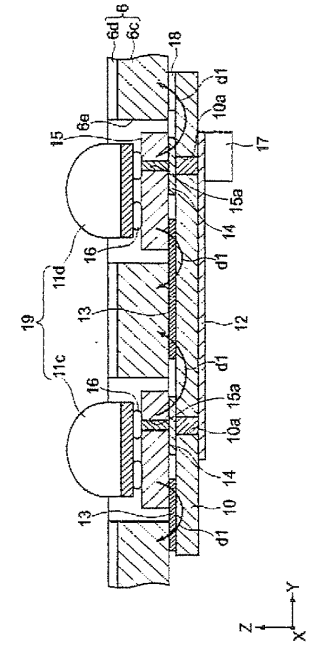
【図6】



【図7】



【図8】



NSDOCID: <JP_____2008034342A__I_>

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 285 of 836

(51)Int.Cl.	F I	テーマコード（参考）
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2H191 FA41Z FA85Z FD07 FD42 LA04 LA24
3K014 AA01 LA01 LB02 LB04
3K243 MA01
5F041 AA33 DC07 DC23 EE23 FF11

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 286 of 836

ILLUMINATION DEVICE AND LIQUID CRYSTAL DISPLAY DEVICE

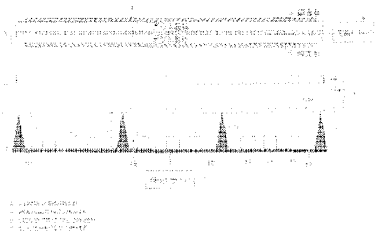
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Inventor(s): MASUDA TAKESHI; TANAKA ATSUYUKI; SUMIDA YUKIHIRO
Applicant(s): SHARP KK [JP]; MASUDA TAKESHI; TANAKA ATSUYUKI; SUMIDA YUKIHIRO
Classification:
- international: *F21S2/00; G02F1/13357; F21Y101/02;* **F21S2/00; G02F1/13**
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JP2006500753 (A)
JP4020989 (A)
JP3105002U (U)
WO2005124401 (A1)
JP2006243532 (A)

Abstract of **WO 2007088655 (A1)**

In a backlight device (3) placed layered on a liquid crystal panel (2), light sources (11) are partitioned into illumination regions (15) by partition walls (12), a first light diffusion member (13) is placed over the light source, and second light diffusion member (14) is layered on the first light diffusion member (13). The first light diffusion member (13) is placed such that a light incident surface (13a), into which light from each light source (11) enters, is located at a position that is higher than the light sources (11) and at the same height as or lower than the vertexes of the partition walls (11). The second light diffusion member (14) is placed over the first light diffusion member (13) with a gap in between and with a light incident surface (14a) placed at a position higher than the vertexes of the partition walls (12).; In the backlight device that is partitioned into the illumination regions and where the light sources are arranged in each of the illumination regions, each illumination region can be independently controlled without reducing performance as the illumination device.



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Petitioner Hisense USA Corporation
Exhibit 1002 - Page 287 of 836

(12) 特許協力条約に基づいて公開された国際出願

(19) 世界知的所有権機関
国際事務局

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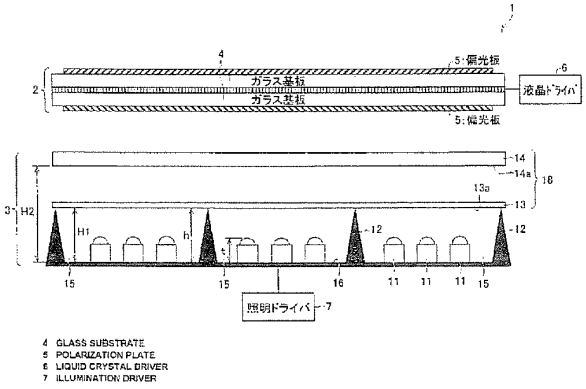
(74) 代理人: 特許業務法人原謙三国際特許事務所 (HARAKENZO WORLD PATENT & TRADEMARK); 〒5300041 大阪府大阪市北区天神橋２丁目北２番６号 大和南森町ビル Osaka (JP).

(81) 指定国 (表示のない限り、全ての種類の国内保護が可能): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ,

[続葉有]

(54) Title: ILLUMINATION DEVICE AND LIQUID CRYSTAL DISPLAY DEVICE

(54) 発明の名称: 照明装置及び液晶表示装置



(57) Abstract: In a backlight device (3) placed layered on a liquid crystal panel (2), light sources (11) are partitioned into illumination regions (15) by partition walls (12), a first light diffusion member (13) is placed over the light source, and second light diffusion member (14) is layered on the first light diffusion member (13). The first light diffusion member (13) is placed such that a light incident surface (13a), into which light from each light source (11) enters, is located at a position that is higher than the light sources (11) and at the same height as or lower than the vertexes of the partition walls (11). The second light diffusion member (14) is placed over the first light diffusion member (13) with a gap in between and with a light incident surface (14a) placed at a position higher than the vertexes of the partition walls (12). In the backlight device that is partitioned into the illumination regions and where the light sources are arranged in each of the illumination regions, each illumination region can be independently controlled without reducing performance as the illumination device.

(57) 要約: 液晶パネル（２）に積層して配置されるバックライト装置（３）では、隔壁（１２）で複数の照明領域（１５）に分割された複数の光源（１１）上に、各光源（１１）からの光が入射する光入射面（１３ａ）が、光源（１１）よりも高く、かつ、隔壁（１２）の頂点と同じかそれよりも低い位置にある第１の光拡散部材（１３）が配置され、かつ、該第１の光拡散部材（１３）上に、間隙を有して、光入射面（１４ａ）が隔壁（１２）の頂点よりも高い位置にある第２の光拡散部材（１４）が積層されている。これにより、

[続葉有]

WO 2007/088655 A1

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 289 of 836

LA, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) 指定国 (表示のない限り、全ての種類の広域保護が可能): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), ユーラシア (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), ヨーロッパ (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

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複数の照明領域に分割されると共に、各照明領域内に複数の光源が配置された構成のバックライト装置において、照明装置としての性能を低下させることなく、各照明領域の独立制御が可能となる

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 290 of 836

明 細 書

照明装置及び液晶表示装置

技術分野

[0001] 本発明は、複数の光源を有する照明装置と、該照明装置をバックライト装置として備えた液晶表示装置に関するものである。

背景技術

[0002] 液晶表示装置は薄型、低消費電力、高精細などの特徴を有し、製造技術の発達による画面サイズの大型化も伴い、従来、陰極線管(CRT)が主であったテレビ分野への普及が進行している。

[0003] ところが、液晶表示装置で表示される画像は、その表示方法に起因して、CRTの画像に対してコントラスト感(ダイナミックレンジ)が低く、また、動画表示の際には画像がぼけるなど、画質に対する問題点が指摘されている。そのため、近年は画質向上に関する技術開発が盛んになされている。

[0004] 例えば、特許文献1には、バックライト装置(照明部)の照明光の輝度を表示画像に応じて制御することによって、画像のコントラスト感(ダイナミックレンジ)を高める液晶表示装置が開示されている。

[0005] このような特許文献1に開示された技術を用い、バックライト装置を、独立に輝度制御可能な複数の照明領域を有する構成とすると共に、液晶表示装置を、該バックライト装置の照明領域に対応した複数の表示領域を仮想的に有する構成とし、バックライト装置における各照明領域の照明光の輝度を液晶表示装置の表示領域に表示される画像の明暗に応じて制御することで、ダイナミックレンジが拡大され、コントラスト感の高い画像を表示可能な液晶表示装置を実現することができる。

[0006] バックライト装置における各照明領域の照明光の輝度を、液晶表示装置の表示領域に表示される画像の明暗に応じて制御するとは、すなわち、明るい画像が表示される表示領域に対応する照明領域では照明光の輝度を高くし、暗い画像が表示される表示領域に対応する照明領域では照明光の輝度を低く制御することである。

[0007] 上記した複数の照明領域を有するバックライト装置として、例えば、図15に示す直

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 291 of 836

下型のバックライト装置110が考えられる。バックライト装置110は、複数の光源111を有しており、光源111と光源111との間が隔壁112によって仕切られ、複数の照明領域113が形成されている。

[0008] また、特許文献2には、表示画像の入力信号に応じてバックライト装置の点灯と消灯のタイミングを制御することにより、動画表示性能を向上させる液晶表示装置が開示されている。

[0009] 上記液晶表示装置は、照明装置が独立に点灯と消灯とを制御できる複数の照明領域を有すると共に、液晶表示部が照明装置の照明領域に対応した複数の表示領域を仮想的に有している。制御装置は、各照明領域の照明を、表示領域の走査が終了しかつ液晶が応答するまでの間は消灯し、液晶が応答した後に点灯するように制御する。これによれば、いわゆるインパルス型表示方式で動画表示性能に優れた液晶表示装置を実現できる。

[0010] 図16に、特許文献2に記載された、複数の照明領域を有する、直下型のバックライト装置120を示す。バックライト装置120は、複数の光源121を有し、光源121と光源121との間が隔壁122によって仕切られ、複数の照明領域124が形成されている。また、光出射側には、光を拡散する光拡散板123がさらに備えられている。

[0011] 図17に、特許文献3に記載された、複数の照明領域を有する、直下型のバックライト装置130を示す。バックライト装置130は、複数の波長(色)の異なる光源131、例えば、赤色のLED(発光ダイオード)光源131R、緑色のLED光源131G、青色のLED光源131Bを有する。これら複数の光源131は、赤、緑、青の3色を1組として、隔壁132(132－1, 132－2)にて照明領域134(134－1, 134－2, 134－3)ごとに仕切られている。光出射側には、光を拡散する光拡散シート133が備えられている。

[0012] ところで、このような1つの照明領域134内に複数の光源131を有する構成において、各照明領域134を区分する隔壁132の高さhと光拡散シート133が配置される高さHとが近接していると、全ての照明領域134を同一の明るさで点灯した場合に、隔壁132の上に相当する部分が暗部となって輝度ムラが発生してしまう。

[0013] これに対し、図17に示すように、光拡散シート133が配置される高さHを隔壁132の高さhよりも高くすることで、隔壁132と光拡散シート133の間に間隙が形成され、

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 292 of 836

各光源131からの光が隔壁132上で交錯するようになり、全ての照明領域134を同一の明るさで点灯した場合においても、輝度ムラが解消された均一な照明光を得ることができる。

特許文献1:日本国公開特許公報「特開2002－40390号公報(2002年2月6日公開)」

特許文献2:日本国公開特許公報「特開2005－128561号公報(2005年5月19日公開)」

特許文献3:日本国公開特許公報「特開平10－39300号公報(1998年2月13日公開)」

発明の開示

[0014] しかしながら、図17に示すような、複数の照明領域134に分割されると共に、各照明領域134内に複数の光源131が配置された構成のバックライト装置130を備えた従来の液晶表示装置においては、画質向上を図るためにバックライト装置130の各照明領域の輝度や、点灯・消灯を独立して制御すると、隔壁132の近傍で輪郭が発生して、表示品位が低下するといった問題がある。照明領域内に波長(色)の異なる光源131が配置されている場合は、波長に応じて色づいた輪郭が発生する。

[0015] 例えば、中央の照明領域134－1が明状態(点灯)で、その両側の照明領域134－2・134－3が暗状態(消灯)とした場合、中央の照明領域134－1と両側の照明領域134－2・134－3とを仕切る各隔壁132－1・132－2の近傍には色づいた輪郭が発生する。

[0016] 図17の上部に、中央の照明領域134－1と右側の照明領域134－2とを仕切る各隔壁132－1近傍に発生する輪郭の状態を示す。これに示すように、白色の領域の外側に黄色の輪郭が発生し、さらにその外側に赤色の輪郭が発生する。

[0017] このような輪郭が発生する原因は、全照明領域134を同一の明るさで点灯した場合に、隔壁132による輝度ムラの解消を可能にする、上記した隔壁132と光拡散シート133との間の間隙に起因する。

[0018] つまり、上記した隔壁132と光拡散シート133の間に間隙が設けられることで、各光源131から光拡散シート133に投影される領域が、照明領域134にある各光源131(

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 293 of 836

つまり赤色のLED光源131R、緑色のLED光源131G、及び青色のLED光源131B)と隔壁132との位置関係の違いによって異なる結果、輪郭が発生する。

[0019] この場合であれば、隔壁132－2の近くに配置された赤色のLED光源131Rの投影領域は、隔壁132－2側である左側で狭くなり、遠い位置に配置された隔壁132－1側である右側で広くなる。反対に、隔壁132－1の近くに配置された青色のLED光源131Bの投影領域は、隔壁132－1側であるその右側で狭くなり、遠い位置に配置された隔壁132－2側である左側で広くなる。両隔壁132－1・132－2から均等の隔たりをもって配置された緑色のLED光源131Gの投影領域は、両隔壁132－1・132－2側で等しくなる。

[0020] その結果、隔壁132－1の近傍には、赤、緑、青の3色の光が投影されて白色を呈する白色領域W1の外周に、赤色と緑色とが投影されて黄色を呈する黄色領域Y1と、さらにその外周に赤色が投影された赤色領域R1とが順に形成され、色づいた輪郭となる。また、他方、隔壁132－2の近傍には、赤、緑、青の3色の光が投影されて白色を呈する白色領域W1の外周に、青色と緑色とが投影されてシアン色を呈するシアン領域と、さらにその外周に青色が投影された青色領域とが順に形成され、色づいた輪郭となる。

[0021] また、図18に示すように、照明領域134内に波長(色)が同一の、例えば白色の光源131Wが複数配置され、隔壁132で隔離される構成のバックライト装置136において、例えば、中央の照明領域134－1が明状態(点灯)で、両側の照明領域134－2・134－3が暗状態(消灯)とした場合、中央の照明領域134－1と両側の照明領域134－2・134－3とを仕切る各隔壁132－1・132－2の近傍には、図18の上部に状態を示すような、輪郭が発生する。

[0022] 本発明は、このような課題を解決するために成されたものであって、複数の照明領域に分割されると共に、各照明領域内に複数の光源が配置された構成のバックライト装置において、照明装置としての性能を低下させることなく、各照明領域の独立制御が可能なバックライト装置を提供することにある。

[0023] 本発明に係る照明装置は、上記課題を解決するために、複数の光源と、上記複数の光源を複数の照射領域に分割するもので、一つの照射領域に複数の光源が含ま

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 294 of 836

れるように分割する隔壁と、上記複数の光源上に配置され、光の入射面が、上記複数の光源よりも高く、かつ、上記隔壁の頂点と同じかそれよりも低い位置にある第1の光拡散部材と、上記第1の光拡散部材上に間隙を有して積層して配置され、光の入射面が、上記隔壁の頂点よりも高い位置にある第2の光拡散部材とを備えることを特徴としている。

[0024] これによれば、1つの照明領域内の複数の光源からの光は、光の入射面が、光源よりも高く、かつ、隔壁の頂点と同じかそれよりも低い位置にある第1の光拡散部材に投影されることで、照明領域内の配置位置に違いによることなく、等しい投影領域にて投影されることとなる。これにより、複数の照明領域に分割されると共に、1つの照明領域内に複数の光源が配置された構成において、各照明領域の輝度や点灯・消灯を独立して制御しても、隔壁の近傍において、照明領域内の各光源の配置位置の違いによる輪郭が発生することはない。

[0025] また、これによれば、第1の光拡散部材上に間隙を有して、光の入射面が隔壁の頂点よりも高い位置に配置された第2の光拡散部材が積層されているので、隣合う照明領域からの光は、隔壁の頂点と第2の光拡散部材との間の間隙にて交錯した上で第2の光拡散部材にて拡散されるようになる。これにより、各照明領域を同じ明るさで点灯しても、隔壁上の近傍が暗部となり難く、全面で均一な照明光を得ることができる。

[0026] つまり、以上の構成により、複数の照明領域に分割されると共に、1つの照明領域内に複数の光源が配置された構成の照明装置において、全ての照明領域を同一の明るさで点灯した場合には全面で均一な照明光を得ることが可能で、かつ、各照明領域を独立に制御した場合においても、隔壁近傍に輪郭が発生しない滑らかな輝度変化を得ることができる照明装置を実現できる。

[0027] 本発明の液晶表示装置は、上記課題を解決するために、上記した本発明の照明装置を、液晶パネルに積層して備えた構成である。

[0028] 上述したように、本発明の照明装置は、複数の照明領域に分割されると共に、1つの照明領域内に複数の光源が配置された構成の照明装置において、全ての照明領域を同一の明るさで点灯した場合には全面で均一な照明光を得ることが可能で、かつ、各照明領域を独立に制御した場合においても、隔壁近傍に輪郭が発生しない滑

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 295 of 836

らかな輝度変化を得ることができるので、このような照明装置をバックライト装置として備えることで、各照明領域を独立制御することで有効に画質向上を図ることができる。

図面の簡単な説明

[0029] [図1]本発明の実施の一形態を示すものであり、液晶表示装置の要部の構成を示す模式図である。

[図2]上記液晶表示装置に備えられたバックライト装置の模式図である。

[図3]上記バックライト装置における要部の平面図である。

[図4]平行光源からの略平行光を入射角0° で光拡散部材に入射し、光拡散部材からの透過光の角度分布を受光器で測定する測定系の構成を示す説明図である。

[図5]光拡散部材に入射角0° で入射させる平行光源の、入射角と相対強度との関係を示す説明図である。

[図6]図5の特性を有する略平行光を入射角0° で第1及び第2の光拡散部材にそれぞれ入射させた場合に得られる各透過光(拡散光)の、出射角と相対強度との関係を示す説明図である。

[図7]本発明の実施のその他の形態を示すものであり、液晶表示装置に備えられたバックライト装置の模式図である。

[図8]上記バックライト装置における要部の平面図である。

[図9]本発明の一実施例のバックライト装置において、1つの照明領域を明状態(点灯)とし、残りの照明領域を暗状態(消灯)とした場合の、各光源からの光の第1の光拡散部材における投影領域、及び第2の光拡散部材からの出射光における位置と輝度との関係を示す説明図である。

[図10]本発明の他の実施例のバックライト装置において、1つの照明領域を明状態(点灯)とし、残りの照明領域を暗状態(消灯)とした場合の、各光源からの光の第1の光拡散部材における投影領域、及び第2の光拡散部材からの出射光における位置と輝度との関係を示す説明図である。

[図11]本発明の比較例のバックライト装置において、1つの照明領域を明状態(点灯)とし、残りの照明領域を暗状態(消灯)とした場合の、各光源からの光の第1の光拡

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 296 of 836

散部材における投影領域、及び第2の光拡散部材からの出射光における位置と輝度との関係を示す説明図である。

[図12]本発明の他の実施例のバックライト装置において、1つの照明領域を明状態(点灯)とし、残りの照明領域を暗状態(消灯)とした場合の、各光源からの光の第1の光拡散部材における投影領域、及び第2の光拡散部材からの出射光における位置と輝度との関係を示す説明図である。

[図13]本発明の他の実施例のバックライト装置において、1つの照明領域を明状態(点灯)とし、残りの照明領域を暗状態(消灯)とした場合の、各光源からの光の第1の光拡散部材における投影領域、及び第2の光拡散部材からの出射光における位置と輝度との関係を示す説明図である。

[図14]本発明の他の比較例のバックライト装置において、1つの照明領域を明状態(点灯)とし、残りの照明領域を暗状態(消灯)とした場合の、各光源からの光の第1の光拡散部材における投影領域、及び第2の光拡散部材からの出射光における位置と輝度との関係を示す説明図である。

[図15]従来技術を示すもので、直下型のバックライト装置の要部の斜視図である。

[図16]従来技術を示すもので、その他の直下型のバックライト装置の要部の断面図である。

[図17]従来技術を示すもので、その他の直下型のバックライト装置の要部の断面構成と、1つの照明領域を明状態(点灯)とし、残りの照明領域を暗状態(消灯)とした場合の、各光源からの光の光拡散部材における投影領域と、光拡散部材からの出射光における位置と輝度との関係を示す説明図である。

[図18]従来技術を示すもので、その他の直下型のバックライト装置の要部の断面構成と、1つの照明領域を明状態(点灯)とし、残りの照明領域を暗状態(消灯)とした場合の、各光源からの光の光拡散部材における投影領域と、光拡散部材からの出射光における位置と輝度との関係を示す説明図である。

符号の説明

[0030] 1 液晶表示装置

2 液晶パネル

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 297 of 836

3 バックライト装置(照明装置)

6 液晶ドライバ

7 照明ドライバ

11 光源

12 隔壁

18 光拡散手段

13 第1の光拡散部材

14 第2の光拡散部材

発明を実施するための最良の形態

[0031] 〔実施の形態1〕

本発明の実施の一形態について、図1～図6に基づいて、以下に説明する。

[0032] 図1は、液晶表示装置の要部の構成を示す模式図である。図1に示すように、本発明の実施の形態1に係る液晶表示装置1は、液晶パネル2と、液晶ドライバ6と、照明装置であるバックライト装置3と、照明ドライバ7とを備えている。

[0033] 液晶パネル2は、周囲で貼り合わされた一対のガラス基板4・4を有し、ガラス基板4・4の外面に、一対の偏光板5・5が備えられた構成である。ガラス基板4・4間には、特に図示してはいないが、液晶層が封入され、カラーフィルタ層、TFTアレイ等が形成されている。

[0034] 上記液晶パネル2が、例えばアクティブマトリクス型のものであれば、複数の走査線と複数の信号線の各交点に対応してマトリクス状に画素が配置され、各画素に対応してそれぞれTFT(スイッチング素子)が設けられている。液晶ドライバ6は、パネル走査線によってTFTを選択し、選択されたTFTを介して対応する画素電極に信号線から表示信号を供給することにより、各画素の液晶の透過率を制御して画像を表示する。

[0035] なお、液晶パネル2の構成としては、図示したものに限るものではなく、駆動モードによっては、偏光板5を具備しないものや2枚以外の数有するものなど、様々な液晶パネルを用いることができる。

[0036] バックライト装置3は、液晶パネル2の背面側に配され、背面側より液晶パネル2を

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 298 of 836

照明するものである。ここで、画質を向上させるためにバックライト装置3は、複数の照明領域に分割されており、照明ドライバ7は、バックライト装置3をそれぞれの照明領域毎に液晶パネル2を照射するように制御する。

[0037] 図2に、バックライト装置3の模式図を示し、図3に、バックライト装置3における要部の平面図を示す。

[0038] バックライト装置3は、図2に示すように、複数の白色の光源11と、複数の光源11を複数の照明領域に分割する隔壁12と、複数の光源11の上方に積層して配され、複数の光源11からの光を拡散する光拡散手段18を備えている。

[0039] 複数の光源11は、光源配置面16上に配置され、隔壁12にてその配置空間が区画されて複数の照明領域15に分割されている。上記光源11としては、例えばLEDを使用できるが、白色を呈する他の光源であってもよい。

[0040] 隔壁12は、上記光源配置面16を区画することで、複数の照明領域に分割しており、1つの照明領域15内に、複数の光源11が配置されるように分割する。ここでは、隔壁12は格子状をなし、9つの照明領域15に分割し、正方形状をなす各照明領域15内には、縦×横3つずつ合計9つの光源11が配置される。また、隔壁12は、光源配置面16から高くなるに従い壁の厚さが薄くなっており、その断面は鋭利な2等辺三角形状をなしている。

[0041] 上記光拡散手段18は、複数の光源11上に配置され、互いに離間して積層された複数枚の光拡散部材よりなる構成である。光拡散手段18を構成する光拡散部材の枚数、及びその間隙は、各照明領域15を独立制御した場合に、隔壁12の近傍で輪郭が発生しないことと、全ての照明領域15を同一の明るさで点灯した場合に、隔壁12上の近傍が暗部とならないことの、両条件を満たすように決定されればよい。

[0042] しかしながら、積層される光拡散部材の枚数増加に伴って光透過率が低下するため、2枚で構成することが好ましい。本実施の形態では、最低限の枚数である2枚の光拡散部材を用いて、上記光拡散手段18を実現しており、光源11に近い側の第1の光拡散部材1と、光源11より遠い側の第2の光拡散部材14とが、間隙をもって積層されてなる構成である。

[0043] 光源11側に配置された第1の光拡散部材13は、各光源11からの光を拡散するも

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 299 of 836

のである。そして、該第1の光拡散部材13は、各光源11からの光が入射する光入射面13aが、光源11よりも高く、かつ、隔壁12の頂点と同じかそれよりも低い位置に配置されている。

[0044] 即ち、第1の光拡散部材13における光源配置面16から上記光入射面13aまでの高さをH1、光源11における光源配置面16からの高さをt、隔壁12における光源配置面16からの高さをhとすると、t＜H1≦hを満足している(第1の条件)。

[0045] また、第2の光拡散部材14は、第1の光拡散部材13にて拡散された光をさらに拡散するものであるが、第1の光拡散部材13との間に間隙を有し、かつ、光入射面14aが、隔壁12の頂点よりも高い位置に配置されている。

[0046] 即ち、第2の光拡散部材14における光源配置面16から光入射面14aまでの高さをH2、隔壁12における光源配置面16からの高さをhとすると、H2＞hを満足している(第2の条件)。ここで、より好ましくは、隔壁12の頂点から第2の光拡散部材14の光入射面14aまでの高さqが、隔壁12の上面近傍が暗くなるという問題を解消可能な高さに設定されていることである(より好ましい第2の条件)。

[0047] 第1の光拡散部材13の配置に関し、上記した第1の条件を満足することで、照明領域15内にある各光源11それぞれの第1の光拡散部材13への投影領域を、光源11の配置位置に係らず、等しくすることができる。

[0048] これにより、複数の照明領域15に分割されると共に、1つの照明領域15内に複数の光源11が配置された構成のバックライト装置3において、照明ドライバ7にて各照明領域15の輝度や点灯・消灯を独立して制御しても、隔壁12の近傍において、照明領域15内の光源11の配置位置に応じた輪郭が発生することはない。

[0049] また、第2の光拡散部材14の配置に関し、上記した第2の条件を満足することで、隣り合う照明領域15・15からの照射光は、隔壁12の上に設けられた、隔壁12の頂点から第2の光拡散部材14の光入射面14aまでの間隙にて交錯して第2の光拡散部材14に投影される。したがって、各照明領域15を同じ明るさで点灯しても、隔壁12上の近傍が暗部となり難く、全面で均一な照明光を得ることができる。そして、この場合、より好ましい第2の条件を満足することで、各照明領域15を同じ明るさで点灯しても、隔壁12上の近傍が暗部となることはなく、全面でより均一な照明光を得ること

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 300 of 836

ができる。

[0050] さらに、このような複数枚の光拡散部材よりなる上記光拡散手段18においては、輝度ムラを解消するにおいて、次のいずれかの要件を満たすように、各光拡散部材を選択することがさらに望ましい。

[0051] 要件1:光拡散手段18を構成する複数枚の光拡散部材におけるヘイズ率(%)が、光源11よりも遠くに配置されるものほど高くなるように選択する(等しい場合も含む)。第1及び第2の光拡散部材13・14よりなる構成では、第1の光拡散部材13のヘイズ率(%)をHZ1、第2の光拡散部材14のヘイズ率(%)をHZ2とすると、0<HZ1≦HZ2<100となるように、各光拡散部材を選択する。

[0052] 要件2:光拡散手段18を構成する複数枚の光拡散部材における直線光透過率(%)が、光源11に近接して配置されているものほど高くなるように選択する(等しい場合も含む)。第1及び第2の光拡散部材13・14よりなる構成では、第1の光拡散部材13の直線光透過率をT1(%)、第2の光拡散部材14の直線光透過率をT2(%)とすると、0<T2≦T1<100となるように、各光拡散部材を選択する。

[0053] 要件3:光拡散手段18を構成する複数枚の光拡散部材における略平行光を入射して透過した拡散光の半値全角θ(deg)が、光源11に近接して配置されるものほど大きくなるように選択する(等しい場合も含む)。第1及び第2の光拡散部材13・14よりなる構成では、第1の光拡散部材13に略平行光を入射して透過した拡散光の半値全角をθ1(deg)、第2の光拡散部材14に略平行光を入射して透過した拡散光の半値全角をθ2[deg]とすると、0<θ1≦θ2<180となるように、各光拡散部材を選択する。

[0054] ここで、上記要件2と要件3とについて説明する。図4に示す構成で、平行光源からの略平行光を入射角0°で光拡散部材に入射し、該光拡散部材からの透過光の角度分布を受光器で測定する。図5に示す特性を持つ略平行光を、入射角0°で、上記第1の光拡散部材13、第2の光拡散部材14に入射すると、各光拡散部材12・14からの透過光は図6に示すような拡散光となる。図6においては、第1の光拡散部材13からの透過光を太線にて示し、第2の光拡散部材14からの透過光を細線にて示している。

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 301 of 836

[0055] 図6の結果から、第1及び第2の光拡散部材13・14の各透過率に着目して、入射する略平行光の入射角0° 方向の強度を100とし、第1の光拡散部材13を透過した出射角0° 方向の光の強度を直線光透過率と定義すると、直線光透過率T1＝1．9(%)となる。同様に、第2光拡散部材を透過した出射角0° 方向の光の強度を直線光透過率と定義すると、直線光透過率T2＝0．17(%)となる。したがって、上記した要件2である0＜T2≦T1＜100を満足する。

[0056] また、図6の結果から、第1及び第2の光拡散部材13・14を透過した各拡散光の半値角に着目すると、第1の光拡散部材13を透過した拡散光の半値全角θ1は16度で、第2の光拡散部材14を透過した拡散光の半値全角θ2は108° である。したがって、上記要件3である、0＜θ1≦θ2＜180(deg)を満足する。

[0057] このような要件1～3の何れかの要件を満足することで、複数の光拡散部材よりなる光拡散手段18において、各光源11からの光を、積層される複数の光拡散部材にて効率よく拡散して、輝度ムラを解消することができる。

[0058] 以上のように、本実施の形態の液晶表示装置1に備えられたバックライト装置3は、隔壁12で分割された複数の照明領域15を有すると共に、各照明領域15に複数の光源11を有する構成でありながら、上記した配置の条件を満足する第1及び第2の光拡散部材13・14を含む光拡散手段18を具備することで、全ての照明領域15を同一の明るさで点灯した場合には全面で均一な照明光を得ることが可能で、かつ、各照明領域15を独立に制御した場合においても、隔壁12近傍に輪郭が発生しない滑らかな輝度変化を得ることができる。

[0059] したがって、このようなバックライト装置3を備えた本実施の形態の液晶表示装置1では、各照明領域15を独立に制御することで、有効に画質向上を図ることが可能となる。

[0060] なお、本実施形態のバックライト装置3では、第1の光拡散部材13における光入射面13aの高さが上記隔壁12の頂点と同じである構成の例として、第1の光拡散部材13を隔壁12に密着して配置する構成を例示している。しかしながら、第1の光拡散部材13を、その全面を隔壁12に密着させて保持することは困難である。したがって、第1の光拡散部材13における光入射面13aの高さが隔壁12の頂点と同じである構成と

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 302 of 836

は、第1の光拡散部材と隔壁12の一部が密着していればよいものとする。

[0061] また、本実施の形態では、液晶表示装置1を例示し、照明装置の例として液晶パネル2を背面より照らすバックライト装置3を例示したが、上記構成を有するバックライト装置3を、他の照明装置として、液晶パネル2を照らす以外に使用することももちろん可能である。

[0062] 〔実施の形態2〕

本発明の実施のその他の形態について、図7、図8に基づいて、以下に説明する。

[0063] 図7は、本実施の形態の液晶表示装置におけるバックライト装置の要部の構成を示す模式図であり、図8は、バックライト装置8における要部の平面図である。

[0064] 実施の形態2の液晶表示装置と実施の形態1の液晶表示装置1との違いは、バックライト装置3に替えてバックライト装置8を備える点にあり、バックライト装置3とバックライト装置8との違いは、光源配置面16に配置された光源にある。

[0065] 即ち、バックライト装置3では、白色の光源11を複数備えていたが、バックライト装置8では、図8にも示すように、赤色の光源11R、緑色の光源11G、青色の光源11Bをそれぞれ複数備え、赤色、緑色、及び青色の3色で、白色を呈する照明光を実現させる構成である。そして、ここでは、1つの照明領域15内に、赤色の光源11R、緑色の光源11G、青色の光源11Bが、それぞれ3つずつ備えられている。なお、ここでは1つの照明領域15内に各色3つずつ光源11を配置したが、各色少なくとも1つずつ配置されていれば、白色の照明光とすることができる。

[0066] このような構成のバックライト装置8において、バックライト装置3と同様に、上記した配置の条件を満足する第1及び第2の光拡散部材13・14を含む光拡散手段18を具備することで、全ての照明領域15を同一の明るさで点灯した場合には全面で均一な照明光を得ることが可能であると共に、各照明領域15を独立に制御した場合には、隔壁12近傍に、赤、緑、青といった光源11の波長(色)に応じた輪郭が発生しない滑らかな輝度変化を得ることができる。

[0067] したがって、このようなバックライト装置8を備えた本実施の形態の液晶表示装置においても、実施の形態1の液晶表示装置1と同様に、各照明領域15を独立に制御することで、有効に画質向上を図ることが可能となる。

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 303 of 836

[0068] 以上のように、本発明に係る照明装置は、複数の光源と、上記複数の光源を複数の照射領域に分割するもので、一つの照射領域に複数の光源が含まれるように分割する隔壁と、上記複数の光源上に配置され、光の入射面が、上記複数の光源よりも高く、かつ、上記隔壁の頂点と同じかそれよりも低い位置にある第1の光拡散部材と、上記第1の光拡散部材上に間隙を有して積層して配置され、光の入射面が、上記隔壁の頂点よりも高い位置にある第2の光拡散部材とを備える構成である。

[0069] これによれば、1つの照明領域内の複数の光源からの光は、光の入射面が、光源よりも高く、かつ、隔壁の頂点と同じかそれよりも低い位置にある第1の光拡散部材に投影されることで、照明領域内の配置位置に違いによることなく、等しい投影領域にて投影されることとなる。これにより、複数の照明領域に分割されると共に、1つの照明領域内に複数の光源が配置された構成において、各照明領域の輝度や点灯・消灯を独立して制御しても、隔壁の近傍において、照明領域内の各光源の配置位置の違いによる輪郭が発生することはない。

[0070] また、これによれば、第1の光拡散部材上に間隙を有して、光の入射面が隔壁の頂点よりも高い位置に配置された第2の光拡散部材が積層されているので、隣合う照明領域からの光は、隔壁の頂点と第2の光拡散部材との間の間隙にて交錯した上で第2の光拡散部材にて拡散されるようになる。これにより、各照明領域を同じ明るさで点灯しても、隔壁上の近傍が暗部となり難く、全面で均一な照明光を得ることができる。

[0071] つまり、以上の構成により、複数の照明領域に分割されると共に、1つの照明領域内に複数の光源が配置された構成の照明装置において、全ての照明領域を同一の明るさで点灯した場合には全面で均一な照明光を得ることが可能で、かつ、各照明領域を独立に制御した場合においても、隔壁近傍に輪郭が発生しない滑らかな輝度変化を得ることができる照明装置を実現できる。

[0072] また、本発明に係る照明装置においては、上記第2の光拡散部材における光の入射面と上記隔壁の頂点との距離が、全ての照明領域を同一の明るさで点灯した場合に、上記隔壁上の近傍が暗部とならない距離に設定されていることがさらに好ましい。

[0073] また、本発明に係る照明装置においては、第2の光拡散部材のヘイズ率が第1の光

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 304 of 836

拡散部材のヘイズ率以上であること、第1の光拡散部材の直線光透過率が第2の光拡散部材の直線光透過率以上であること、或いは、第2の光拡散部材に略平行光を入射して透過した拡散光の半値全角が第1の光拡散部材に略平行光を入射して透過した拡散光の半値全角以上であることがさらに好ましい。

[0074] 上記した要件の何れかを満足することで、複数の光源からの光を、積層されて配置される第1及び第2の光拡散部材にて効率よく拡散して、輝度ムラを解消することができる。

[0075] 本発明の液晶表示装置は、上記課題を解決するために、上記した本発明の照明装置を、液晶パネルに積層して備えた構成である。

[0076] 上述したように、本発明の照明装置は、複数の照明領域に分割されると共に、1つの照明領域内に複数の光源が配置された構成の照明装置において、全ての照明領域を同一の明るさで点灯した場合には全面で均一な照明光を得ることが可能で、かつ、各照明領域を独立に制御した場合においても、隔壁近傍に輪郭が発生しない滑らかな輝度変化を得ることができるので、このような照明装置をバックライト装置として備えることで、各照明領域を独立制御することで有効に画質向上を図ることができる。

実施例

[0077] 〔実施例1〕

実施の形態1におけるバックライト装置3の実施例を説明する。上記バックライト装置3の構成において、複数の光源11として、日亜化学(株)製の(型番)NCCW022Sを使用した。光源のサイズはφ10mm×高さ10mmであった。また、第1の光拡散部材13としては、恵和(株)製の(製品名)オパルスBS－01を使用し、第2の光拡散部材14としては、日東樹脂工業(株)製の(製品名)CLAREX DR－IIIC DR－60Cを使用した。第1の光拡散部材13として用いたオパルスBS－01の厚さD1は、0.125(mm)、Haze率は、87(%)であった。一方、第2の光拡散部材14として使用したCLAREX DR－IIIC DR－60Cの厚さD2は、2.0(mm)、Haze率は96(%)であった。

[0078] また、隔壁12の光源配置面16からの高さhを25(mm)とし、第1の光拡散部材13

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 305 of 836

は隔壁12に密着して配置し、光源配置面16から第1の光拡散部材13における光入射面13aまでの高さH1を25(mm)とした。第2の光拡散部材14は、光源配置面16からその光入射面14aまでの高さH2が40(mm)となるように配置した。この場合、隔壁12の頂点から光入射面14aまでの高さqは、q=H2−(h+D1)で、約15(mm)であった。また、隔壁12は55mm間隔とし、同じ照明領域15に配置される光源の数は9個とした。

[0079] 図9に、上記実施例1のバックライト装置3において、1つの照明領域15−1を明状態(点灯)とし、残りの照明領域15−2を暗状態(消灯)とした場合の、光源11からの光の投影領域を示し、また、その上部に、第2の光拡散部材14からの出射光の位置と輝度との関係を調べた結果を示す。

[0080] 明状態にある照明領域15−1内にある各光源11からの光は、まず、第1の光拡散部材13に投影されるが、この際、それぞれの光源11からの投影領域Sは同一となる。したがって、第1の光拡散部材13を通過した後、第2の光拡散部材14に投影された照明光には輪郭が発生せず、図9の上部に示すような滑らかな輝度変化を得ることができた。

[0081] 〔実施例2〕

また、実施の形態1におけるバックライト装置3の他の実施例を説明する。実施例1との違いは、第1の光拡散部材13の配置高さにある。ここでは、図10に示すように、第1の光拡散部材13における光入射面13aを隔壁12の頂点よりも低い位置に配置しており、隔壁12の光源配置面16からの高さh25(mm)に対し、光源配置面16から第1の光拡散部材13における光入射面13aまでの高さH1は20(mm)とした。第2の光拡散部材14における隔壁12の頂点から光入射面14aまでの高さq(q=H2−h)は、15(mm)であった。

[0082] 実施例1と同様に、この場合も、明状態にある照明領域15−1内にある各光源11からの光の第1の光拡散部材13における投影領域S'は同一となるので、第2の光拡散部材14に投影された照明光には輪郭が発生せず、図10の上部に示すような滑らかな輝度変化を得ることができた。

[0083] 〔比較例1〕

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 306 of 836

これに対し、第1の光拡散部材13を隔壁12よりも高い位置に配置した比較例のバックライト装置30では、図11に示すように、明状態にある照明領域15－1内にある各光源11からの光の第1の光拡散部材13における投影領域s1・s2・s3が、各光源の照明領域15－1内の位置に応じて異なる。そのため、図11の上部に示すように、第2の光拡散部材14に投影された照明光には輪郭が発生してしまい、均一な照明とはならなかった。

[0084] 〔実施例3〕

実施の形態2におけるバックライト装置8の実施例を説明する。上記バックライト装置8の構成において、上記赤色の光源11Rとして、LUMILEDS社製の(型番)LXHL－PD01を使用し、緑色の光源11Gとして、LUMILEDS社製の(型番)LXHL－PM01を使用し、青色の光源11Bとして、LUMILEDS社製の(型番)LXHL－PB01を使用した。第1の光拡散部材13、第2の光拡散部材14としては、実施例1と同一のものを使用し、その他の構成も実施例1と同様とした。

[0085] 図12に、上記実施例3のバックライト装置8において、1つの照明領域15－1を明状態(点灯)とし、残りの照明領域15－2を暗状態(消灯)とした場合の、光源11からの光の投影領域を示し、また、その上部に、第2の光拡散部材14からの出射光の位置と輝度との関係を調べた結果を示す。

[0086] 明状態にある照明領域15－1内にある各光源11R・11G・11Bからの光は、まず、第1の光拡散部材13に投影されるが、この際、それぞれの光源11R・11G・11Bからの投影領域Sは同一となる。したがって、第1の光拡散部材13を通過した後、第2の光拡散部材14に投影された照明光には、光源11の色に応じた輪郭が発生せず、図12の上部に示すような滑らかな輝度変化を得ることができた。

[0087] 〔実施例4〕

また、実施の形態2におけるバックライト装置8の他の実施例を説明する。実施例3との違いは、第1の光拡散部材13の配置高さにある。ここでは、図13に示すように、第1の光拡散部材13における光入射面13aを隔壁12の頂点よりも低い位置に配置しており、隔壁12の光源配置面16からの高さh25(mm)に対し、光源配置面16から第1の光拡散部材13における光入射面13aまでの高さH1は20(mm)とした。第2の

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 307 of 836

光拡散部材14における隔壁12の頂点から光入射面14aまでの高さq(q＝H2－h)は、15(mm)であった。

[0088] 実施例3と同様に、この場合も、明状態にある照明領域15－1内にある各光源11からの光の第1の光拡散部材13における投影領域S'は同一となるので、第2の光拡散部材14に投影された照明光には光源11の色に応じた輪郭が発生せず、図13の上部に示すような滑らかな輝度変化を得ることができた。

[0089] 〔比較例2〕

これに対し、第1の光拡散部材13を隔壁12よりも高い位置に配置した比較例のバックライト装置80では、図14に示すように、明状態にある照明領域15－1内にある各光源11からの光の第1の光拡散部材13における投影領域s1・s2・s3が、各光源の照明領域15－1内の位置に応じて異なる。そのため、図14の上部に示すように、第2の光拡散部材14に投影された照明光には色付いた輪郭が発生してしまい、均一な照明とはならなかった。

産業上の利用の可能性

[0090] 薄型、低消費電力、高精細などの特徴を有する液晶表示装置等のバックライト装置等に、適用することができる。

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 308 of 836

請求の範囲

[1] 複数の光源と、

上記複数の光源を複数の照射領域に分割するもので、一つの照射領域に複数の光源が含まれるように分割する隔壁と、

上記複数の光源上に配置され、光の入射面が、上記複数の光源よりも高く、かつ、上記隔壁の頂点と同じかそれよりも低い位置にある第1の光拡散部材と、

上記第1の光拡散部材上に間隙を有して積層して配置され、光の入射面が、上記隔壁の頂点よりも高い位置にある第2の光拡散部材とを備えることを特徴とする照明装置。

[2] 上記第2の光拡散部材における光の入射面と上記隔壁の頂点との距離が、全ての照明領域を同一の明るさで点灯した場合に、上記隔壁上の近傍が暗部とならない距離に設定されていることを特徴とする請求項1に記載の照明装置。

[3] 第2の光拡散部材のヘイズ率が、第1の光拡散部材のヘイズ率以上であることを特徴とする請求項1に記載の照明装置。

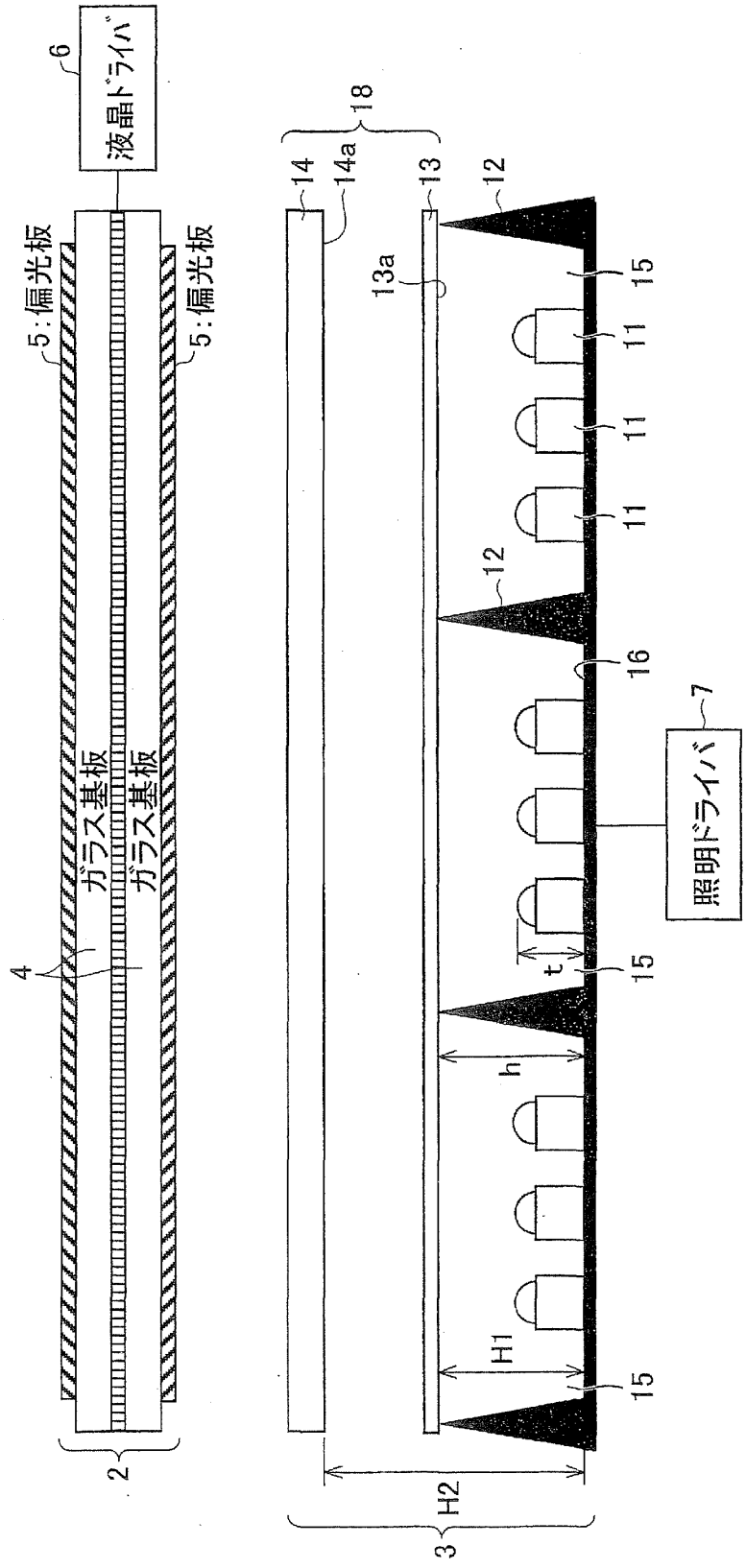
[4] 第1の光拡散部材の直線光透過率が、第2の光拡散部材の直線光透過率以上であることを特徴とする請求項1に記載の照明装置。

[5] 第2の光拡散部材に略平行光を入射して透過した拡散光の半値全角が、第1の光拡散部材に略平行光を入射して透過した拡散光の半値全角以上であることを特徴とする請求項1に記載の照明装置。

[6] 請求項1～4に記載の照明装置を、液晶パネルに積層して備えたことを特徴とする液晶表示装置。

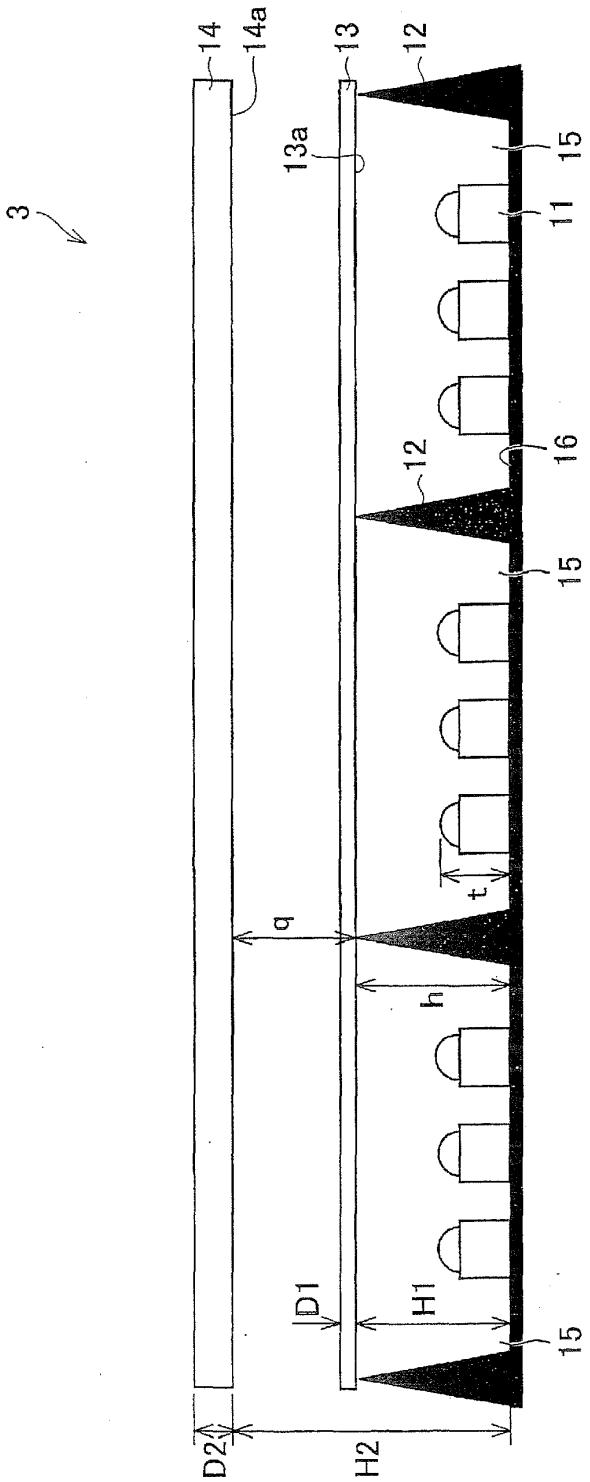
Petitioner Hisense USA Corporation
Exhibit 1002 - Page 309 of 836

[図1]

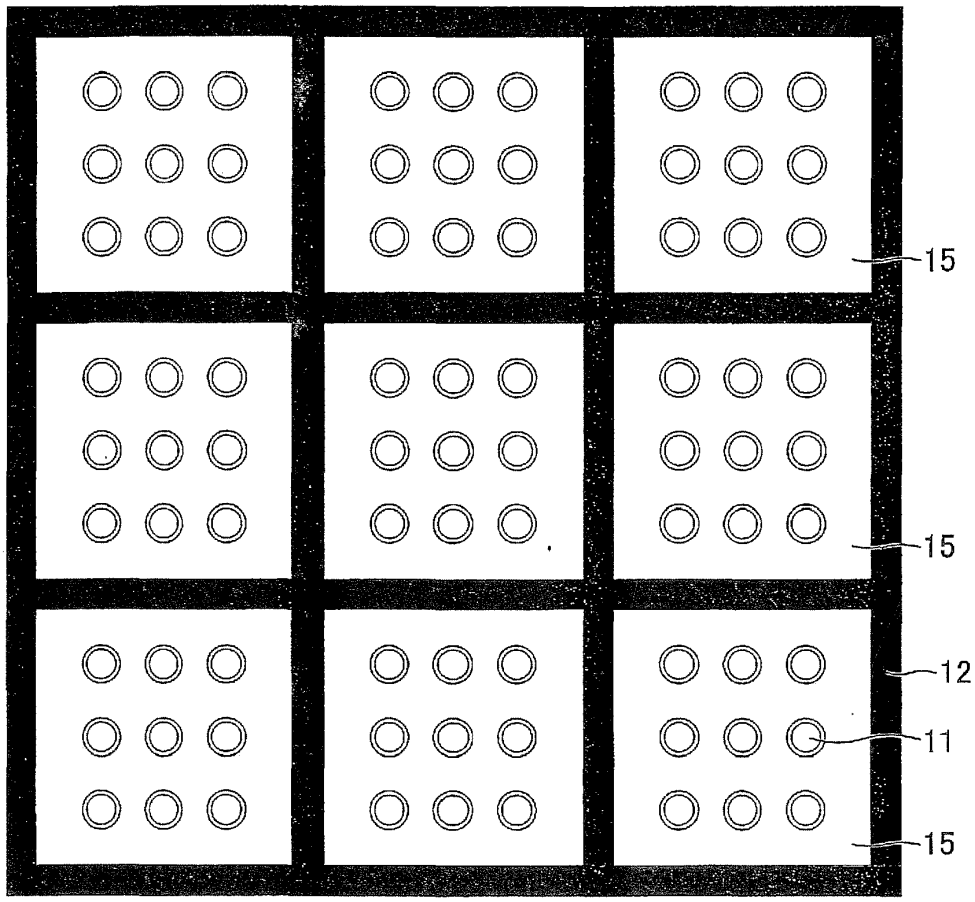


Petitioner Hisense USA Corporation
Exhibit 1002 - Page 310 of 836

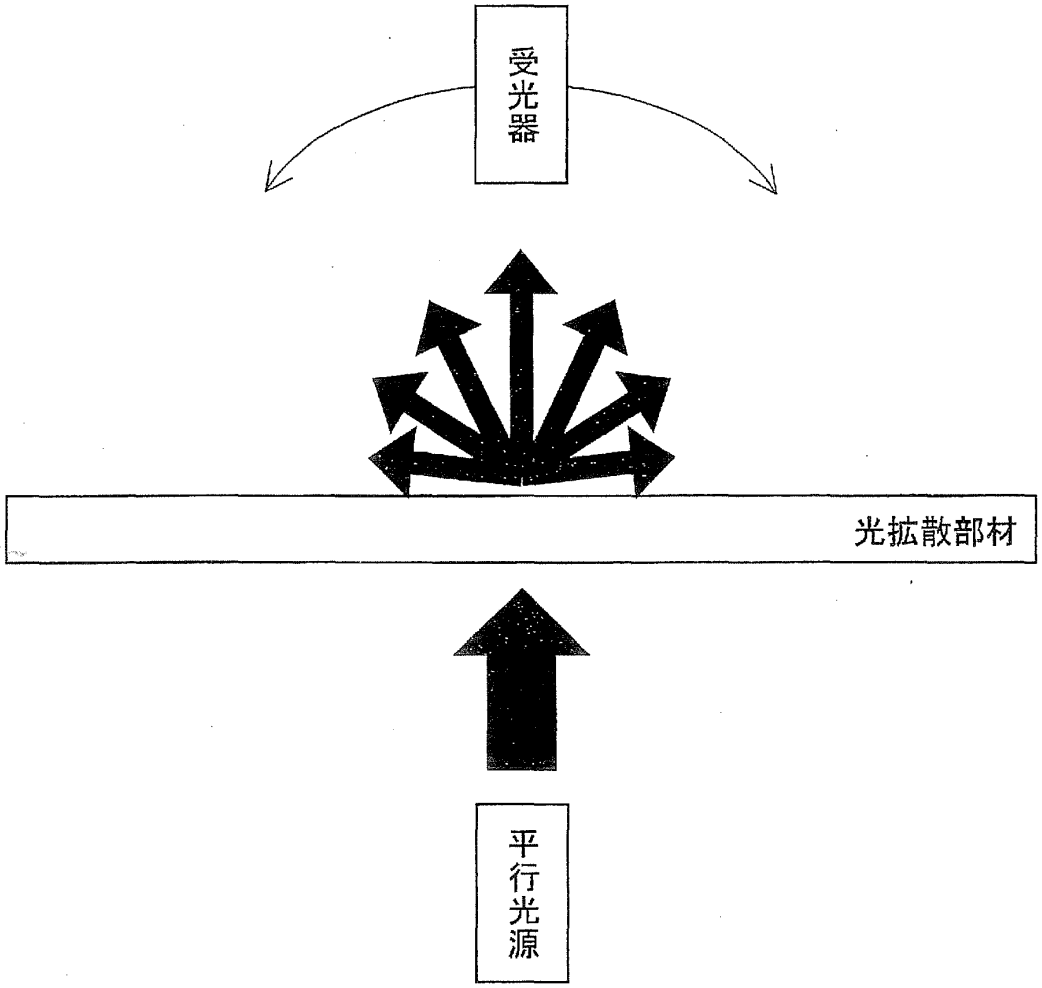
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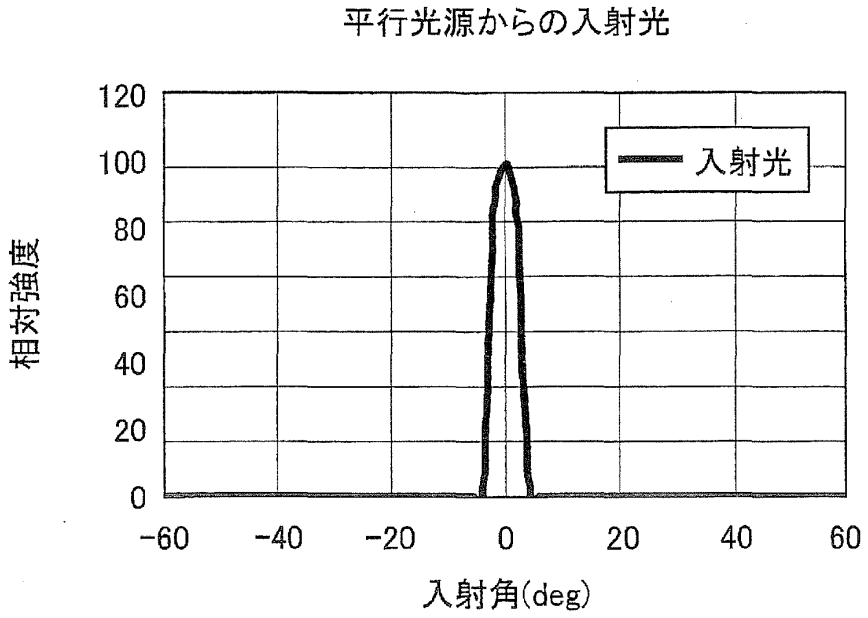
[図3]



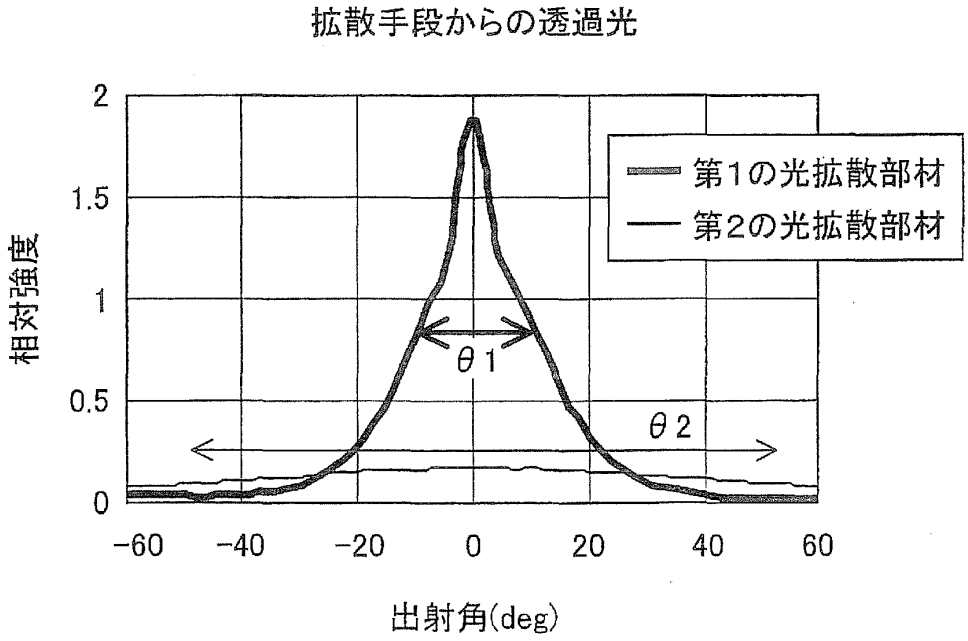
[図4]



[図5]

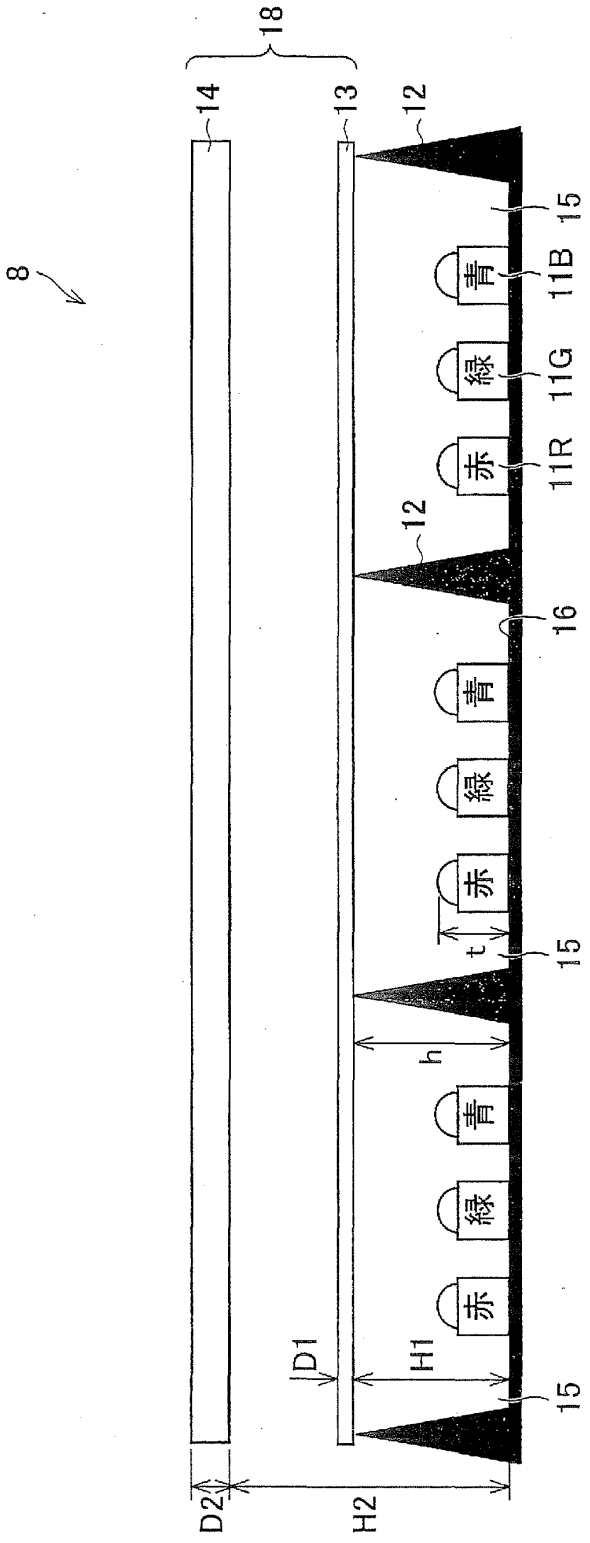


[図6]

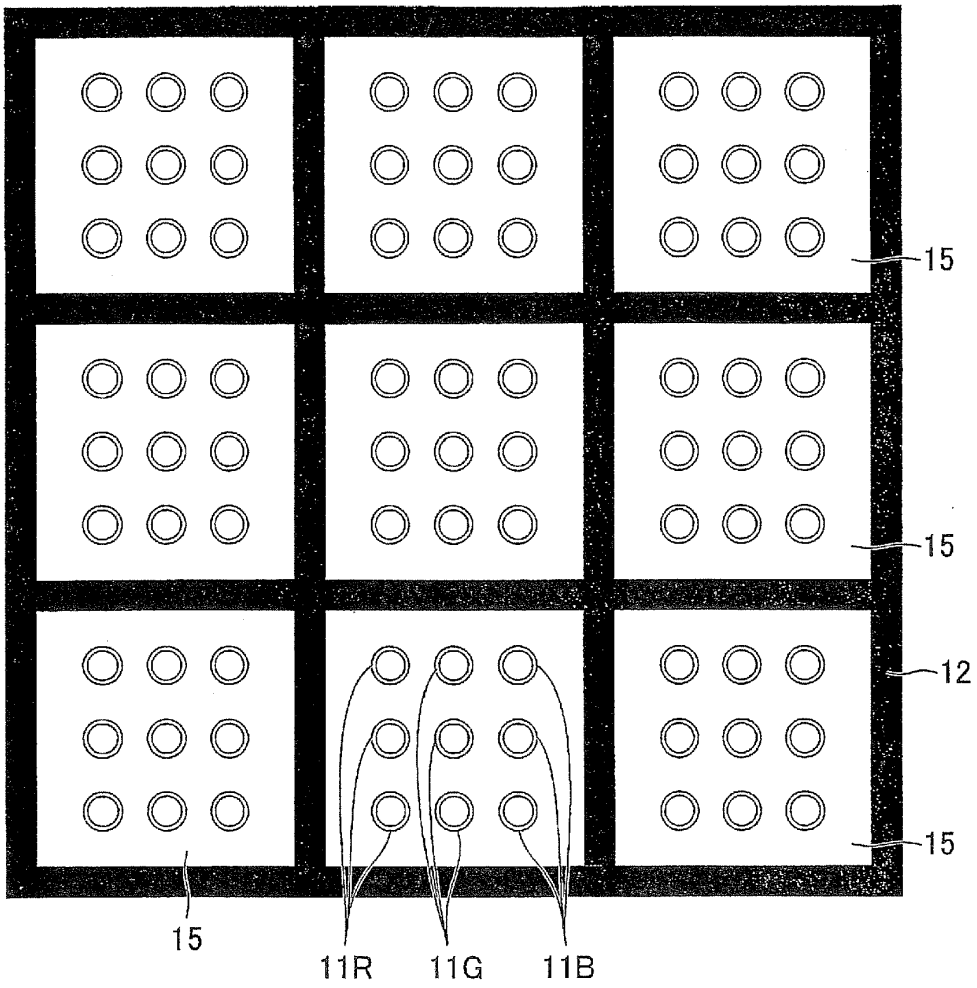


Petitioner Hisense USA Corporation
Exhibit 1002 - Page 314 of 836

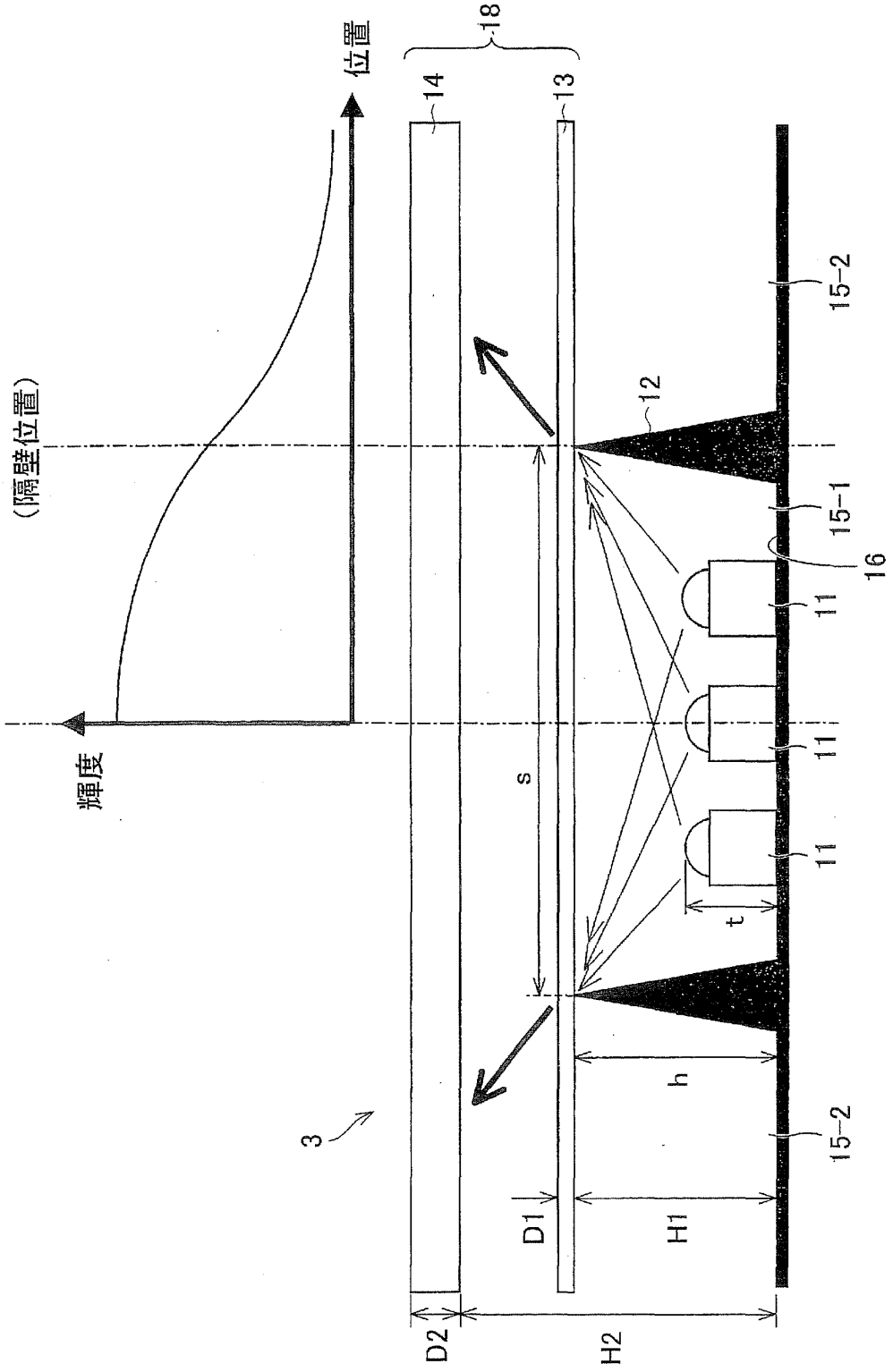
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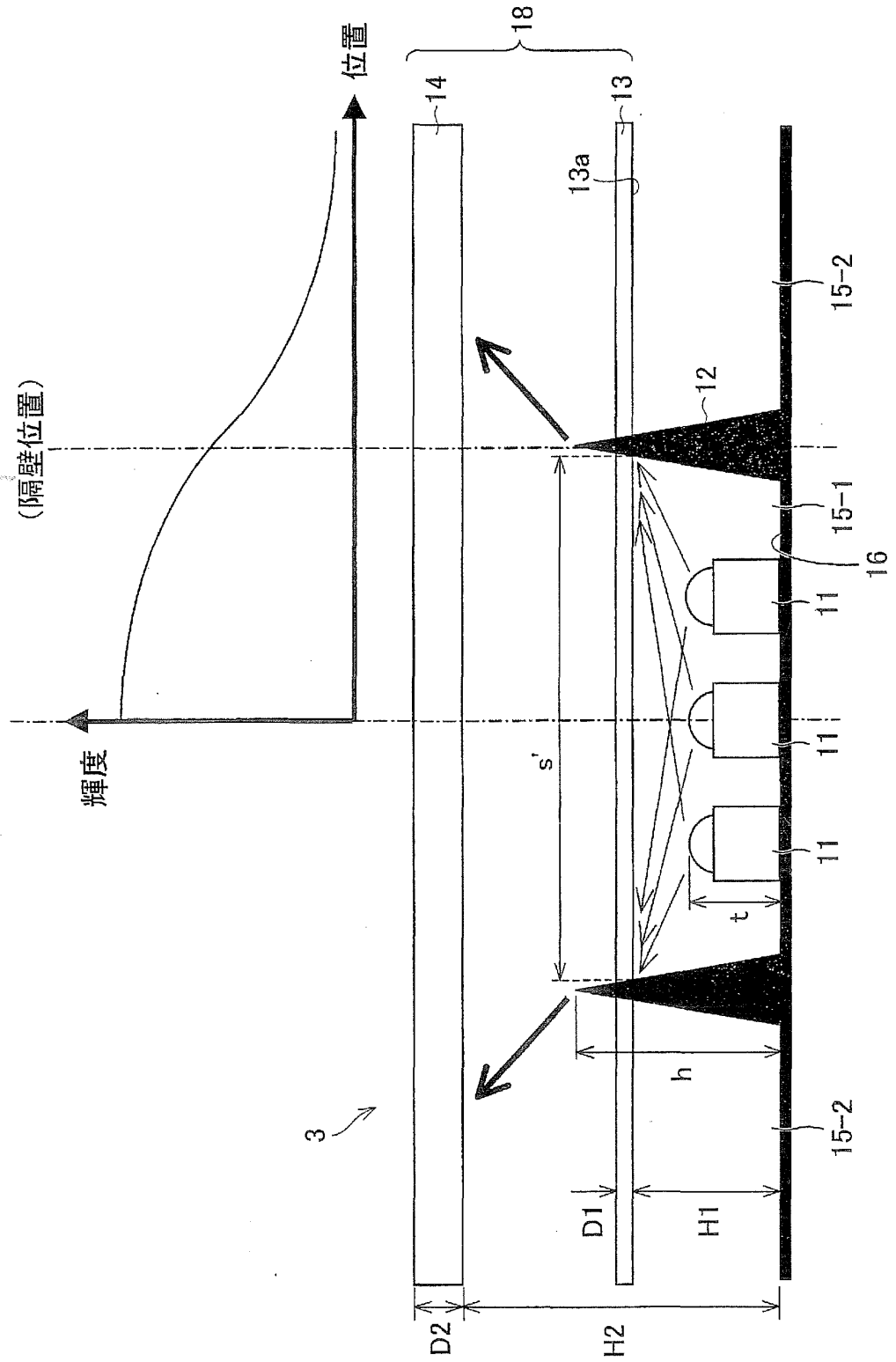
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[図9]

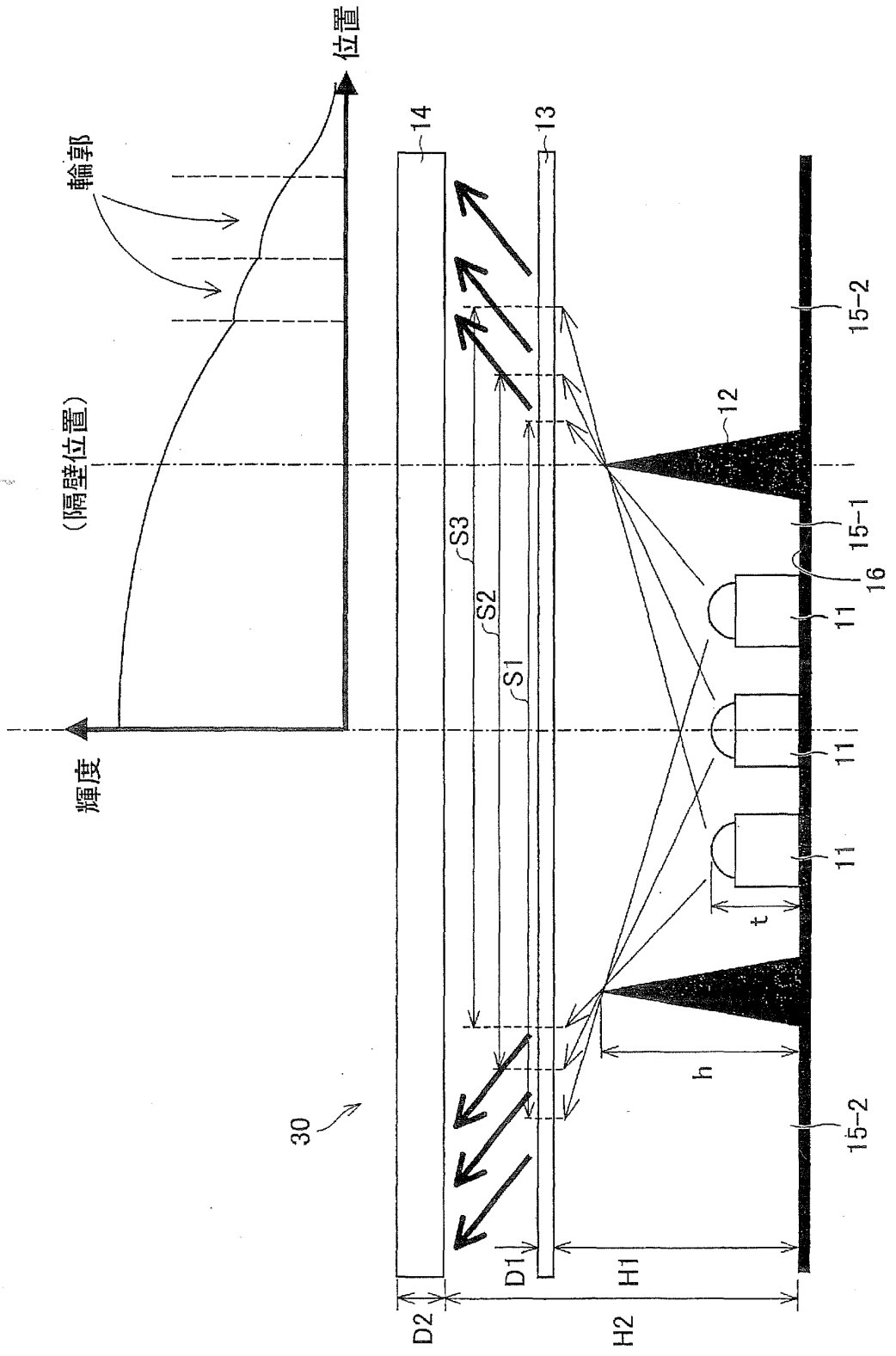


[図10]



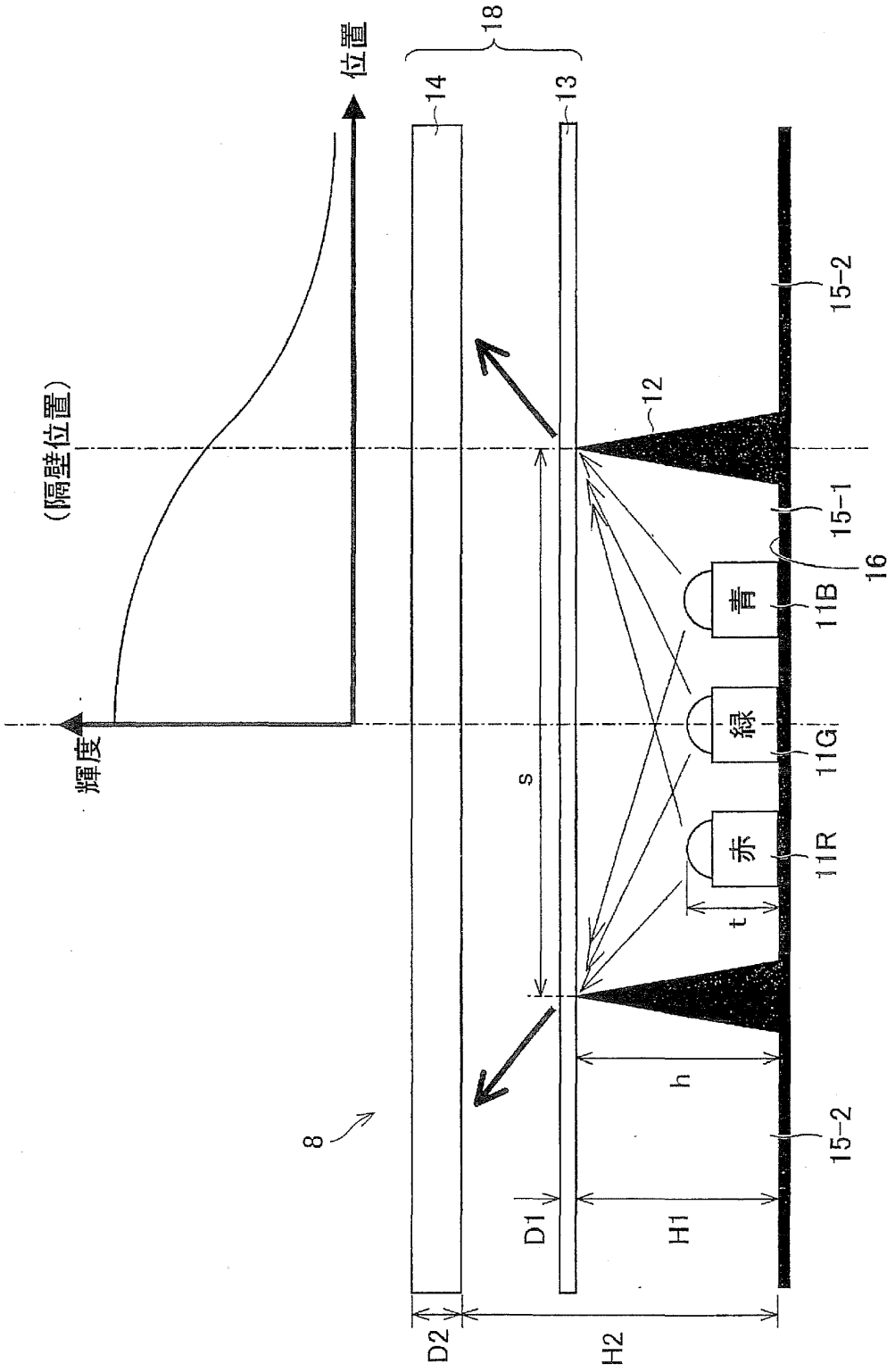
Petitioner Hisense USA Corporation
Exhibit 1002 - Page 318 of 836

[図11]

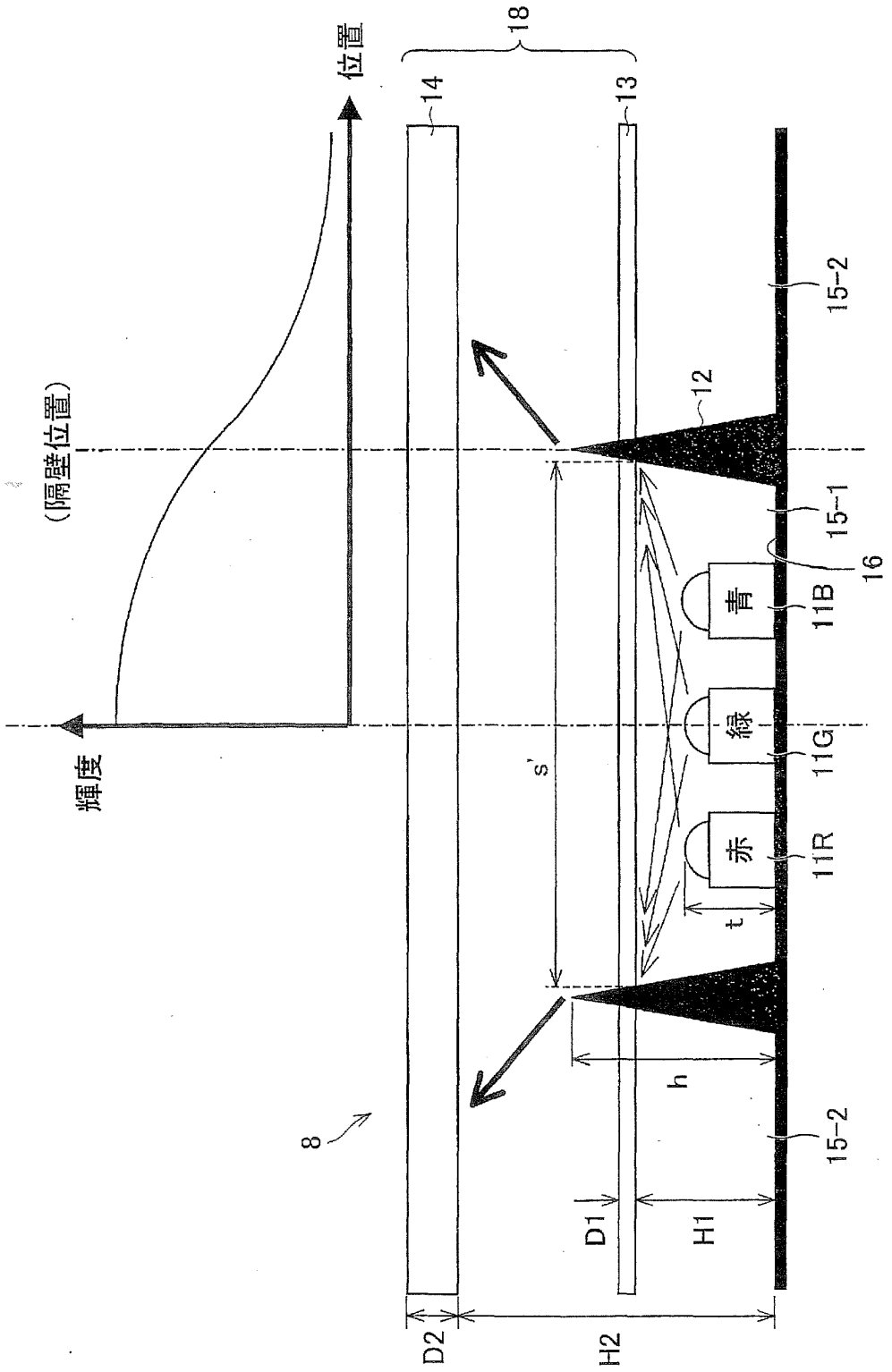


Petitioner Hisense USA Corporation
Exhibit 1002 - Page 319 of 836

[図12]

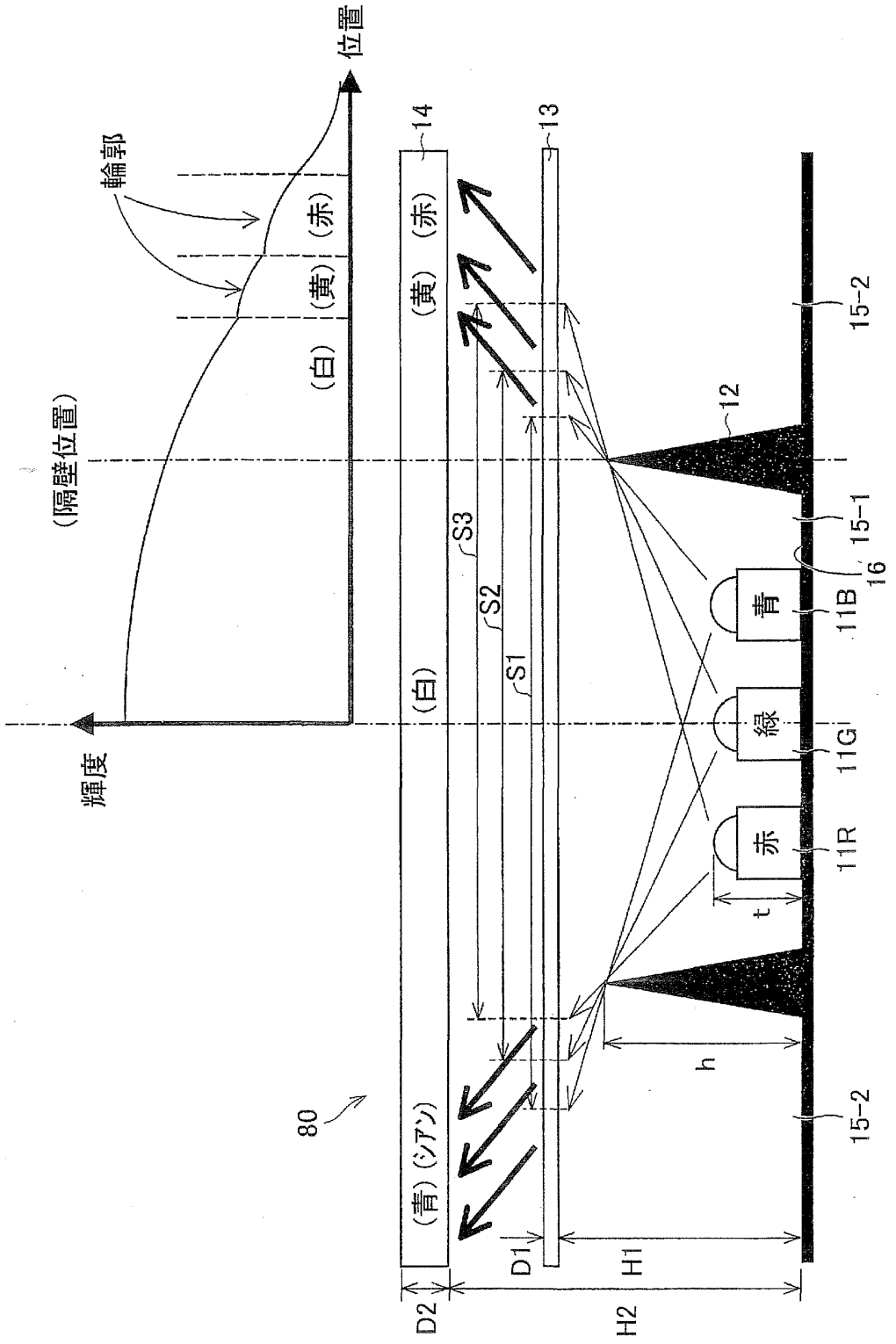


[図13]



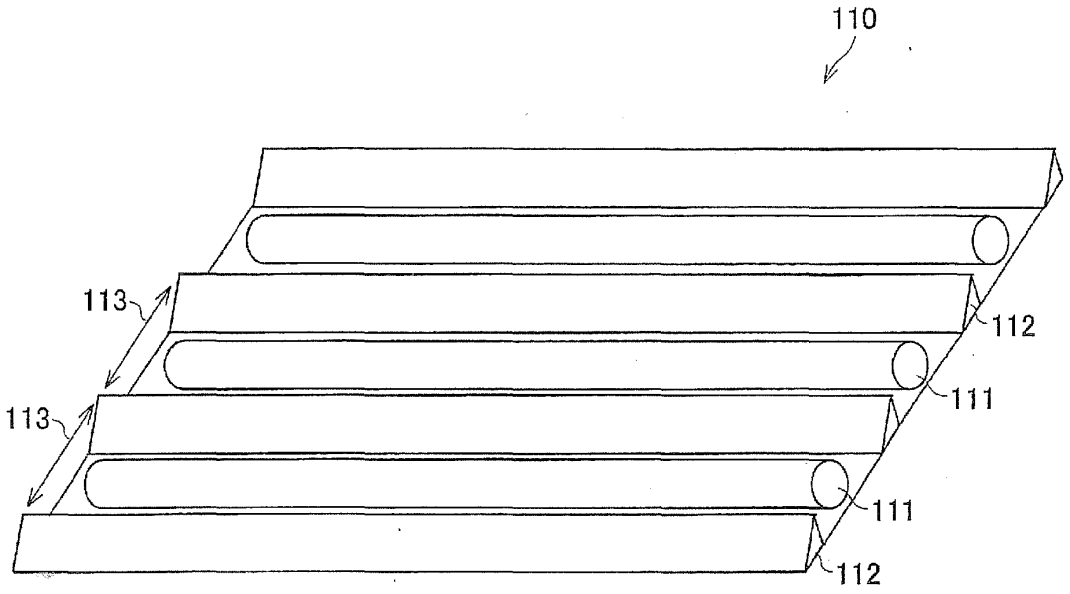
Petitioner Hisense USA Corporation
Exhibit 1002 - Page 321 of 836

[図14]

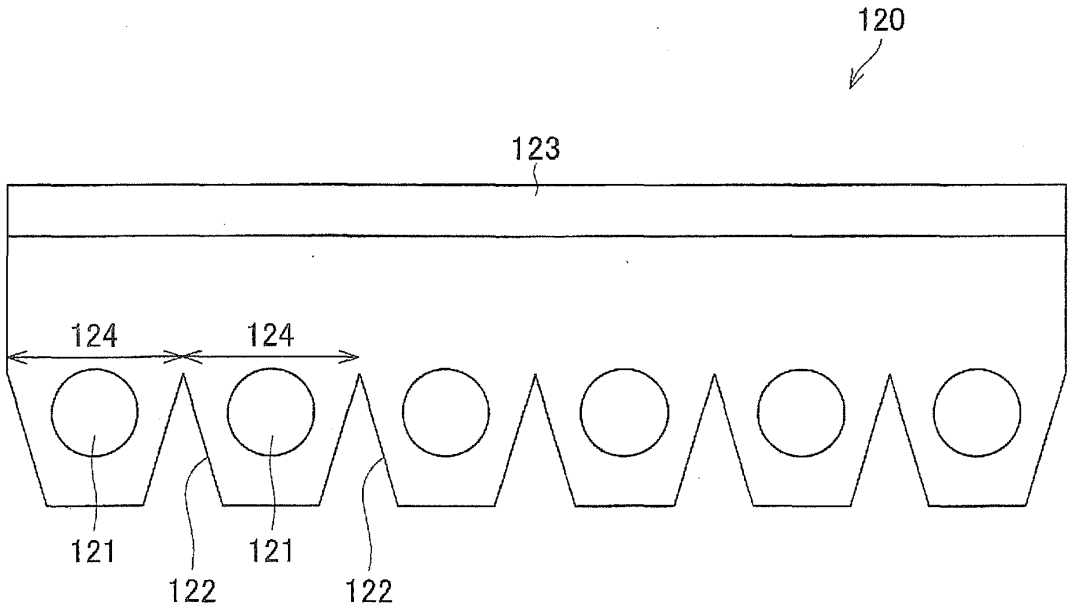


Petitioner Hisense USA Corporation
Exhibit 1002 - Page 322 of 836

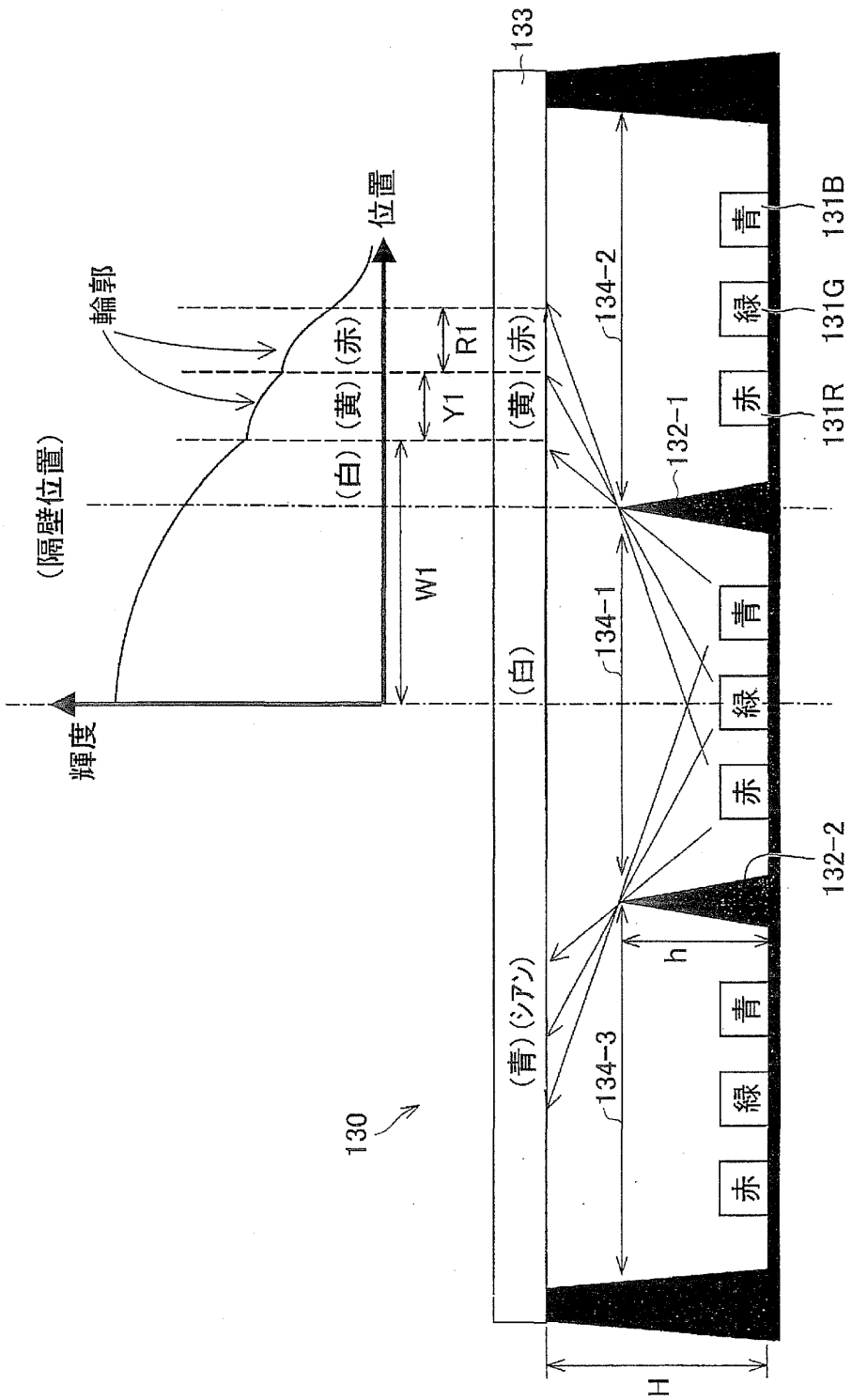
[図15]



[図16]

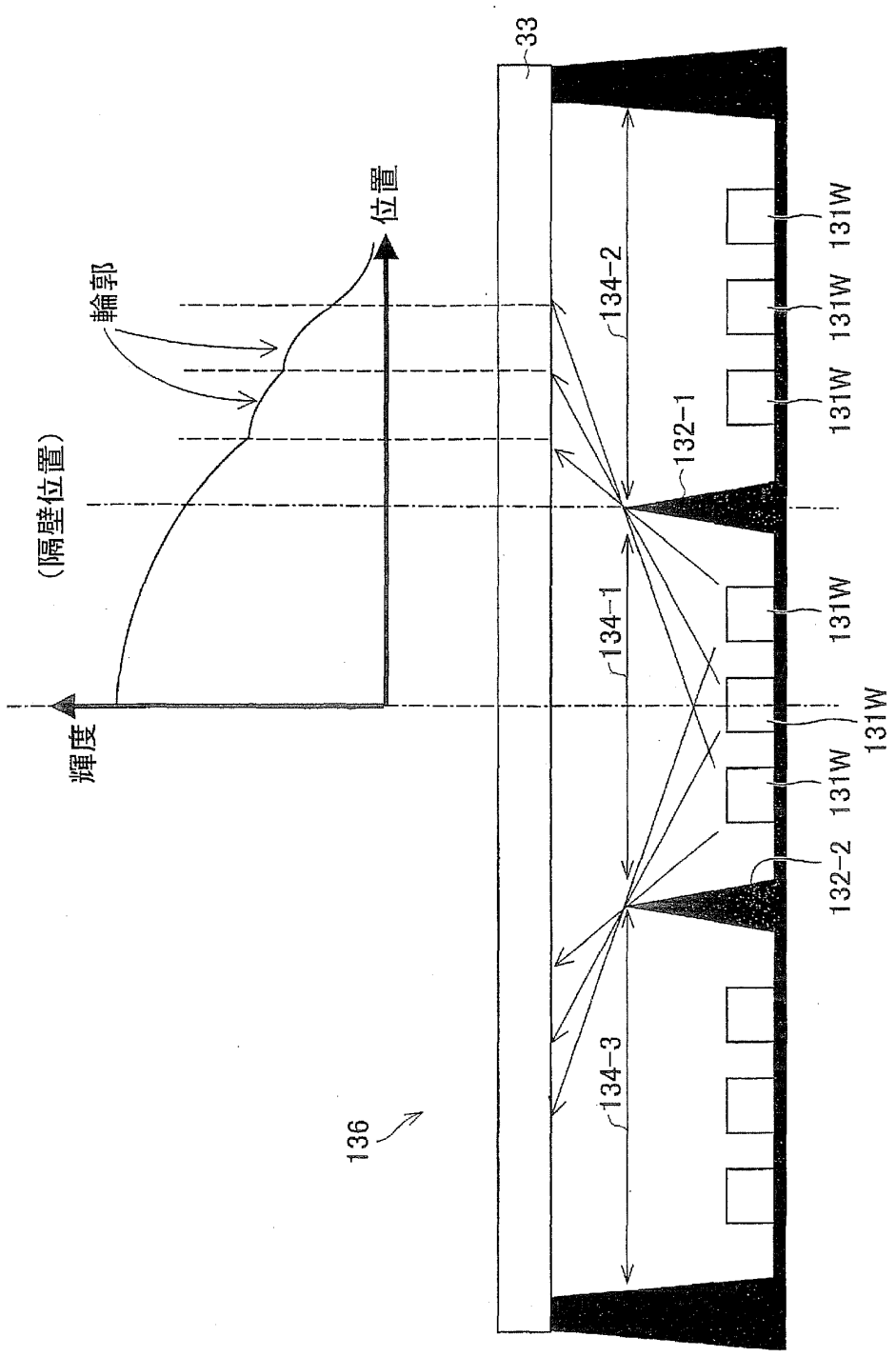


[図17]



Petitioner Hisense USA Corporation
Exhibit 1002 - Page 324 of 836

[図18]



Petitioner Hisense USA Corporation
Exhibit 1002 - Page 325 of 836

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2006/319343

A. CLASSIFICATION OF SUBJECT MATTER
F21S2/00(2006.01)i, *G02F1/13357*(2006.01)i, *F21Y101/02*(2006.01)n

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F21S2/00, G02F1/13357, F21Y101/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2006
Kokai Jitsuyo Shinan Koho 1971-2006 Toroku Jitsuyo Shinan Koho 1994-2006

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2006-500753 A (Siemens AG.), 05 January, 2006 (05.01.06), Full text; all drawings & WO 2004/031843 A1 & US 2004-62040 A & EP 1549997 A & DE 10245580 A	1-6
A	JP 4-20989 A (Hitachi, Ltd.), 24 January, 1992 (24.01.92), Full text; all drawings (Family: none)	1-6
A	JP 3105002 U (Kakyo Denshi Kofun Yugen Koshi), 18 August, 2004 (18.08.04), Full text; all drawings (Family: none)	1-6

[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
23 October, 2006 (23.10.06)	31 October, 2006 (31.10.06)
Name and mailing address of the ISA/	Authorized officer

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 326 of 836

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2006/319343

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2005/124401 A1 (Idemitsu Kosan Co., Ltd.), 29 December, 2005 (29.12.05), Full text; all drawings (Family: none)	1-6
E,A	JP 2006-243532 A (Sony Corp.), 14 September, 2006 (14.09.06), Full text; all drawings (Family: none)	1-6

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 327 of 836

国際調査報告

国際出願番号 PCT／JP2006／319343

A. 発明の属する分野の分類（国際特許分類（IPC））

Int.Cl. F21S2/00(2006.01)i, G02F1/13357(2006.01)i, F21Y101/02(2006.01)n

B. 調査を行った分野

調査を行った最小限資料（国際特許分類（IPC））

Int.Cl. F21S2/00, G02F1/13357, F21Y101/02

最小限資料以外の資料で調査を行った分野に含まれるもの

日本国実用新案公報	1922－1996年
日本国公開実用新案公報	1971－2006年
日本国実用新案登録公報	1996－2006年
日本国登録実用新案公報	1994－2006年

国際調査で使用した電子データベース（データベースの名称、調査に使用した用語）

C. 関連すると認められる文献

引用文献のカテゴリー＊	引用文献名 及び一部の箇所が関連するときは、その関連する箇所の表示	関連する請求の範囲の番号
A	JP 2006－500753 A（シーメンス アクチエンゲゼルシヤフト）2006.01.05, 全文, 全図 & WO 2004／031843 A1 & US 2004－62040 A & EP 1549997 A & DE 10245580 A	1－6
A	JP 4－20989 A（株式会社日立製作所）1992.01.24, 全文, 全図（ファミリーなし）	1－6

☑ C欄の続きにも文献が列挙されている。　☐ パテントファミリーに関する別紙を参照。

＊ 引用文献のカテゴリー
「A」特に関連のある文献ではなく、一般的技術水準を示すもの
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「L」優先権主張に疑義を提起する文献又は他の文献の発行日若しくは他の特別な理由を確立するために引用する文献（理由を付す）
「O」口頭による開示、使用、展示等に言及する文献
「P」国際出願日前で、かつ優先権の主張の基礎となる出願の日の後に公表された文献
「T」国際出願日又は優先日後に公表された文献であって出願と矛盾するものではなく、発明の原理又は理論の理解のために引用するもの
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「&」同一パテントファミリー文献

国際調査を完了した日	国際調査報告の発送日
23. 10. 2006	31. 10. 2006

国際調査機関の名称及びあて先
日本国特許庁（ISA／JP）
郵便番号100－8915
東京都千代田区霞が関三丁目4番3号

特許庁審査官（権限のある職員） 3X 9179
下原 浩嗣
電話番号 03－3581－1101 内線 3372

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 328 of 836

Ｃ（続き）．　関連すると認められる文献

引用文献のカテゴリー＊	引用文献名　及び一部の箇所が関連するときは、その関連する箇所の表示	関連する請求の範囲の番号
Ａ	ＪＰ　３１０５００２　Ｕ（科橋電子股▲ふん▼有限公司）２００４．０８．１８，全文，全図（ファミリーなし）	１－６
Ａ	ＷＯ　２００５／１２４４０１　Ａ１（出光興産株式会社）２００５．１２．２９，全文，全図（ファミリーなし）	１－６
ＥＡ	ＪＰ　２００６－２４３５３２　Ａ（ソニー株式会社）２００６．０９．１４，全文，全図（ファミリーなし）	１－６

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 329 of 836

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

(19) World Intellectual Property Organization
International Bureau

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PCT

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(51) International Patent Classification:
G09F 9/00 (2006.01) *B65D 81/20* (2006.01)
B65B 25/00 (2006.01) *G02F 1/13357* (2006.01)
B65B 31/06 (2006.01)

(21) International Application Number:
PCT/JP2006/318315

(22) International Filing Date:
8 September 2006 (08.09.2006)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
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2005-264460 12 September 2005 (12.09.2005) JP

(71) Applicant *(for all designated States except US)*: **FUJI FILM CORPORATION** [JP/JP]; 26-30, Nishiazabu 2-chome,, Minato-ku,, Tokyo 106-8620 (JP).

(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: **ENDO, Keisuke** [JP/JP]; c/o Fuji Film Corporation 200, Ohnakazato,, Fujinomiya-shi,, Shizuoka 418-8666 (JP).

(74) Agent: **MATSUURA, Kenzo**; Matsuura & Associates, P.O. Box 176, Shinjuku Sumitomo Bldg. 39F, 6-1, Nishi-shinjuku 2-chome, Shinjuku-ku, Tokyo, 1630239 (JP).

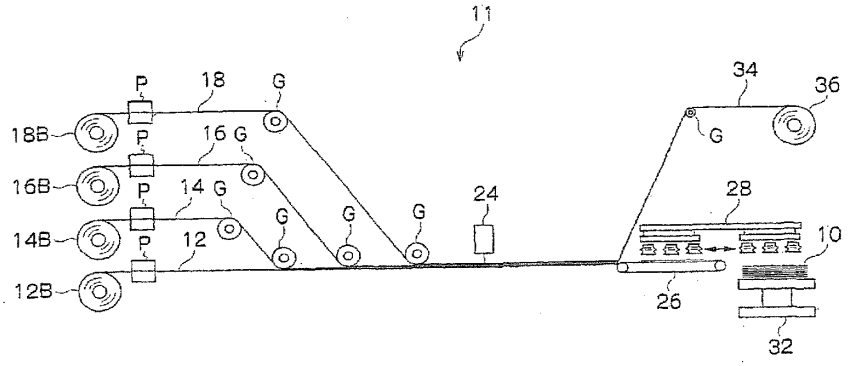
(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HN, HR, HU, ID, IL, IN, IS, KE, KG, KM, KN, KP, KR, KZ, LA,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

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: OPTICAL SHEET FOR DISPLAY AND METHOD FOR PRODUCING AND PACKAGING THE SAME



(57) Abstract: An optical sheet, an optical sheet for a display and a method for producing an optical sheet for a display suitable for producing a high quality optical sheet in a simple method without decrease in adhesion strength upon bonding optical sheets are provided. A coating film of an aqueous solution containing a water-soluble antistatic agent and a fluorine surfactant is formed on optical sheets whose plane size is equal to or larger than a product size in a thickness after drying of 0.03 to 0.2 g/m^2. After stacking the optical sheets, the optical sheets are bonded at one or more joining parts, and periphery of a laminate of the optical sheets after bonding is cut into the product size.

WO 2007/032454 A1

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 331 of 836

Description

OPTICAL SHEET FOR DISPLAY AND METHOD FOR PRODUCING AND PACKAGING THE SAME

Technical Field

The present invention relates to an optical sheet for a display, a method for producing the same, a package of an optical sheet for a display and a method for packaging the same, and relates to, for example, a technique for producing and packaging an optical sheet for a display in which a prism sheet and a light diffusion sheet are integrated.

Background Art

Recently, films such as light guide plates which diffuse light from a light source and lens films which focus light in the front direction have been used for electronic displays such as liquid crystal display devices and organic light emitting diodes.

In such applications, various optical films (sheets) are often used with being stacked. Japanese Patent Laid-Open No. 2004-184575 provides a semi-transmissive, semi-reflective polarizing film in which a reflective polarizing film, a retardation film and a semi-transmissive, semi-reflective layer are stacked in an optional order with an absorption type polarizing film being further stacked outside the three layers. The publication describes that as many as five films are present between a light source device and a liquid crystal cell, and such configuration improves screen luminance and reduces power consumption.

Japanese Patent Laid-Open No. 7-230001, Japanese Patent No. 3123006 and Japanese Patent Laid-Open No. 5-341132 disclose a film in which function of a light diffusion film and function of a lens film are integrated.

Disclosure of the Invention

However, in the above conventional configurations, stacking layers of films requires many steps, and not only the steps are complicated but also the cost increase is inevitable.

SDOCID: <WO_____2007032454A1_|_>

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 332 of 836

In addition, since the surface of flat lenses such as lenticular lenses and prism sheets are fragile and easily stained, they are generally delivered with a protective sheet being stacked on the surface.

However, such a protective sheet is merely discarded after it is removed from flat lenses, and the sheet undesirably not only wastes resources but also causes increase in the cost. In addition, operation of removing protective sheets from flat lenses is required, which then decreases productivity. Moreover, contaminants such as dust are easily attached to flat lenses upon removal of protective sheets from flat lenses due to electrostatic charge, causing problems of quality.

In addition, when stacking layers of films (sheets), scratches are easily generated due to friction upon stacking, friction from thermal expansion and thermal contraction and friction in handling.

In assembling steps of a backlight unit for a liquid crystal display panel and processing steps of punching or cutting the optical sheet used for the backlight unit into a predetermined shape, static eliminating air is sprayed by an ionizer, an aqueous solution containing an antistatic agent is applied or a coating film of an antistatic agent is formed by a spray or the like to prevent attachment of dust on the surface of sheets.

However, since the method using static eliminating air is merely temporary prevention of static charge in assembling line or processing steps, there is no anti-static effect upon use (assembling) after long time, for example, after delivered to assembling factories. Further, optical sheets for a display on which a coating film of an antistatic agent is formed lack uniformity in optical properties and have a problem that adhesion strength is decreased due to the antistatic agent applied to the surface in the secondary processing of combining a diffusion sheet and a prism sheet by bonding.

In addition, while produced optical sheets for a display are packaged with a packaging material so that they are not damaged, packaging optical sheets one by one involves a lot of effort and the cost inevitably increases.

Moreover, such packaging materials are merely discarded after they are removed from the sheet, and the materials undesirably not only waste resources but also cause increase in the cost. In addition, operation of removing packaging materials from a film is required, which then decreases productivity. Further, due to friction occurring during transportation, scratches are easily formed on the film.

INSDOCID: <WO 2007032454A1_I_>

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 333 of 836

The present invention has been made in view of such circumstances and aims at providing an optical sheet for a display and a method for producing the same suitable for producing a high quality laminate of sheet-shaped materials used for displays such as liquid crystal display devices in a simple method without decrease in the adhesion strength between the sheet-shaped materials.

The present invention also aims at providing a package of an optical sheet for a display and a method for packaging the optical sheet for a display, in which sheet-shaped materials used for displays such as liquid crystal display devices are easily packaged at a lower cost compared to conventional arts.

A first aspect of the present invention provides an optical sheet for a display comprising two or more optical sheets which are stacked and bonded at one or more parts, wherein a coating film containing a water-soluble antistatic agent and a fluorine surfactant is formed on at least one side of each bonding surface of the two or more optical sheets in a thickness of 0.03 to 0.2 g/m^2.

Optical sheets as herein described generally refer to various sheets having optical function. The sheets typically include diffusion sheets, polarizing plates (diffusion sheet film) and various lens sheets (including lenticular lenses, fly-eye lenses and prism sheets), and protective sheets (protective films) which have little optical function are also included.

According to this invention, since a coating film containing a water-soluble antistatic agent and a fluorine surfactant is formed on at least one side of each bonding surface of the optical sheets in a thickness of 0.03 to 0.2 g/m^2, anti-static effects are given to the optical sheets. Further, in the secondary processing in which two or more optical sheets are combined by bonding, the bonded surface is not separated in usual handling. In other words, the present inventors have found that a coating film containing not only a water-soluble antistatic agent but also a fluorine surfactant produces anti-static effects, and also prevents decrease in the adhesion strength caused by the antistatic agent and improves adhesiveness. In short, the fluorine surfactant produces wettability and thus prevents decrease in adherability of films due to the antistatic agent without damaging anti-static effects. Herein, the thickness of the coating film is set at 0.03 to 0.2 g/m^2, because not only anti-static effects but also wettability cannot be obtained when the coating film is thinner than 0.03 g/m^2, and also

SDOCID: <WO 2007032454A1 I >

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 334 of 836

because optical properties and appearance are affected by visible light when the coating film is thicker than 0.2 g/m^2.

Accordingly, the optical sheet for a display of the present invention has excellent anti-static properties and excellent adhesiveness for a long time. In addition, since the film thickness is less than the wavelength of visual light, transparency of a transparent resin which is a substrate is not damaged at all, and surface appearance is just the same as that of non-treated products. Further, the optical sheet of the present invention has good anti-fogging properties to significantly improve fogging inside a backlight unit due to temperature change, and also has an effect of improving scratch resistance. As a result, attachment of dust in handling optical sheets is reduced in not only processing steps but also assembling steps of backlights, and thus the quality of products is improved.

A second aspect of the present invention provides an optical sheet for a display comprising a lens sheet in which convex lenses are formed adjacent to each other in an axial direction almost on the whole area and a light diffusion sheet stacked on a surface and/or a backside of at least one lens sheet, wherein the lens sheet and the light diffusion sheet are bonded at one or more parts, and a coating film containing a water-soluble antistatic agent and a fluorine surfactant is formed on at least one side of each bonding surface of the lens sheet and the light diffusion sheet in a thickness of 0.03 to 0.2 g/m^2.

A third aspect of the present invention provides an optical sheet for a display comprising two lens sheets which are stacked and in which convex lenses are formed adjacent to each other in an axial direction almost on the whole area and a light diffusion sheet stacked on a surface and/or a backside of a laminate of the lens sheets, wherein the lens sheets themselves and the lens sheets and the light diffusion sheet are bonded at one or more parts, and a coating film containing a water-soluble antistatic agent and a fluorine surfactant is formed on at least one side of each bonding surface of the lens sheets themselves and the lens sheets and the light diffusion sheet in a thickness of 0.03 to 0.2 g/m^2.

These inventions describe a light diffusion sheet and a lens sheet as the optical sheet in the invention of the optical sheet for a display of the first aspect.

The "lens sheets" typically include lenticular lenses and prism sheets, and also diffraction gratings.

INSDOCID: <WO_____2007032454A1_I_>

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 335 of 836

In a fourth aspect of the present invention, the water-soluble antistatic agent is a cationic antistatic agent in the invention of the first to the third aspects.

For preventing static charge in an optical sheet, sufficient anti-static effects can be produced even in a thin film thickness when the water-soluble antistatic agent is a cationic antistatic agent.

A fifth aspect of the present invention provides a method for producing an optical sheet for a display, comprising the steps of: forming a coating film of an aqueous solution containing a water-soluble antistatic agent and a fluorine surfactant on at least one side of each bonding surface of two or more optical sheets whose plane size is equal to or larger than a product size in a thickness after drying of 0.03 to 0.2 g/m^2; stacking the two or more optical sheets whose plane size is equal to or larger than a product size; joining the two or more optical sheets at one or more parts; and cutting a laminate of the two or more optical sheets into the product size.

According to this invention, two or more optical sheets whose plane size is equal to or larger than a product size are stacked, the laminate is cut into the product size, and the optical sheets are joined at one or more parts thereof.

As a result, steps of cutting a number of films (sheets) each into a product size can be omitted, and also steps of stacking layers of films (sheets) with determining positions can be omitted. Further, the above problem with protective sheets does not arise, which is advantageous in view of both the cost and the quality.

Moreover, since an aqueous solution containing a water-soluble antistatic agent and a fluorine surfactant is applied in a thickness after drying of 0.03 to 0.2 g/m^2 in the step of coating, adhesiveness of films is improved.

As described above, this invention can provide a method for producing an optical sheet for a display suitable for producing a high quality optical sheet in a simple method without decrease in the adhesion strength between sheet-shaped materials.

The phrase "plane size is equal to or larger than a product size" means that not only lens sheets or diffusion sheets whose plane size is larger than a product size are included, but also lens sheets or diffusion sheets whose plane size is equal to the product size are included. In the latter case, one or more sides of a lens sheet or a diffusion sheet may not be cut in the step of cutting.

SDOCID: <WO 2007032454A1_I_>

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 336 of 836

A sixth aspect of the present invention provides a method for producing an optical sheet for a display, comprising the steps of: forming a coating film of an aqueous solution containing a water-soluble antistatic agent and a fluorine surfactant on at least one side of each bonding surface of a lens sheet in which convex lenses are formed adjacent to each other in an axial direction almost on the whole area and whose plane size is equal to or larger than a product size and a light diffusion sheet whose plane size is equal to or larger than a product size in a thickness after drying of 0.03 to 0.2 g/m^2; stacking the light diffusion sheet on a surface and/or a backside of at least one lens sheet; joining the lens sheet and the light diffusion sheet at one or more parts; and cutting a laminate of the light diffusion sheet and the lens sheet into the product size.

A seventh aspect of the present invention provides a method for producing an optical sheet for a display, comprising the steps of: forming a coating film of an aqueous solution containing a water-soluble antistatic agent and a fluorine surfactant on at least one side of each bonding surface of a lens sheet in which convex lenses are formed adjacent to each other in an axial direction almost on the whole area and whose plane size is equal to or larger than a product size and a light diffusion sheet whose plane size is equal to or larger than the product size in a thickness after drying of 0.03 to 0.2 g/m^2; stacking two of the lens sheet and stacking the light diffusion sheet on a surface and/or a backside of a laminate of the lens sheets; joining the lens sheets themselves and the lens sheets and the light diffusion sheet at one or more parts; and cutting periphery of a laminate of the light diffusion sheet and the lens sheets into the product size.

These inventions describe a light diffusion sheet and a lens sheet as the optical sheet in the invention of the method for producing an optical sheet for a display of the fifth aspect.

In an eighth aspect, coating in the step of forming the coating film is performed by an aerosol spraying method in the fifth to seventh aspects.

The aerosol spraying method provides excellent wetting properties on the surface of optical sheets such as light diffusion sheets and prism sheets. Since particles spread into a uniform thin film without agglomeration, an extremely thin and uniform coating film can be easily formed even on optical sheets of various surface shapes only by subjecting to aerosol spraying.

3NSDOCID: <WO_____2007032454A1_I_>

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 337 of 836

A package of an optical sheet for a display according to a ninth aspect of the present invention comprises a laminate of a product size in which two or more kinds of optical sheets are stacked in a predetermined order and which is packaged in a packaging material, wherein the packaging material is sealed by reducing pressure with the packaging material being brought into close contact with the laminate.

According to this invention, a packaging material is sealed with a laminate of plural kinds of optical sheets stacked in a predetermined order being brought into close contact with the packaging material. Accordingly, damage on the object to be packaged (laminate) can be prevented, and the number of operations upon assembling the laminate of optical sheets can be reduced, contributing to cost reduction.

Specifically, steps of cutting a number of films (sheets) each into a product size can be omitted, and also steps of stacking layers of films (sheets) with determining positions can be omitted. Further, damages on an object to be packaged can be prevented without using protective sheets and thus problems with protective sheets do not arise, which is advantageous in view of both the cost and the quality. Moreover, problems with stacking layers of films or thermal expansion or thermal shrinkage of films are not caused.

The "optical sheet" as herein described means the same as above.

For the "laminate of a product size", an aspect in which optical sheets larger than a product size are stacked and then cut into a product size is preferred.

When packaging a laminate with a packaging material (temporary packaging), preferably the laminate is transferred with one or more parts thereof being clipped.

A preferred aspect of "packaging materials" is one in which one side end (end) of a packaging material has an opening through which an object to be packaged (laminate) is inserted into the bag-shaped packaging material.

When "the packaging material is sealed by reducing pressure", an aspect in which a packaging material in which a laminate is packaged is brought into a vacuum condition at a predetermined degree of vacuum is preferred.

A package of an optical sheet for a display according to a tenth aspect of the present invention comprises a laminate of a product size in which two or more kinds of optical sheets are stacked in a predetermined order and periphery of the optical sheets is joined at one or more parts and which is packaged in a packaging material, wherein the

SDOCID: <WO_____2007032454A1_I_>

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 338 of 836

packaging material is sealed by reducing pressure with the packaging material being brought into close contact with the laminate.

According to this invention, since the periphery of a laminate is joined at one or more parts, damage due to friction between optical sheets constituting the laminate during transport of the laminate can be prevented. An aspect of joining four sides of the laminate is more preferred. When four sides of the periphery of a laminate are joined, the laminate is more firmly fixed, and mixing of contaminants such as dust can be more effectively prevented.

For joining optical sheets constituting a laminate, joining members such as adhesive or double-sided adhesive tape may be used, or joining by welding may be applied. Heating with ultrasonic wave or heating by irradiation of laser beams can be used as a device for welding optical sheets constituting a laminate. In the aspect using welding, the step of cutting a laminate composed of optical sheets larger than a product size into a product size and the step of joining the optical sheets constituting the laminate can be integrated.

The invention described in an eleventh aspect relates to an aspect of the package of an optical sheet for a display according to the ninth or tenth aspect, and the optical sheets include a lens sheet and a diffusion sheet.

According to the invention described in the eleventh aspect, by combining a lens sheet which is fragile and easily contaminated and a diffusion sheet in which scratches are not noticeable (namely, using a diffusion sheet on at least one surface of a laminate), damage and contamination of the lens sheet can be prevented. An aspect of stacking a diffusion sheet on both sides of a lens sheet is more preferred.

The lens sheets include a "lens sheet in which convex lenses are formed adjacent to each other in an axial direction almost on the whole area". The "lens sheet in which convex lenses are formed adjacent to each other in an axial direction almost on the whole area" is typically a lenticular lens or a prism sheet, and also diffraction gratings are included.

The invention described in a twelfth aspect relates to an aspect of the package of an optical sheet for a display according to the ninth to eleventh aspects, and the optical sheets include a stacked lens sheet in which a plurality of lens sheets are stacked and a diffusion sheet.

NSDOCID: <WO_____2007032454A1_I_>

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 339 of 836

Aspects of stacked lens sheets in which a plurality of lens sheets are stacked include an aspect in which sheets are stacked so that the axis of each lens sheet is substantially at right angles and an aspect in which the angle is slightly adjusted to prevent moire stripes.

The invention described in a thirteenth aspect relates to an aspect of the package of an optical sheet for a display according to any one of the ninth to twelfth aspects, and the optical sheets in the laminate are stacked in an order to be installed in a backlight unit.

By stacking optical sheets in an order to be installed in a backlight unit (BLU), assembling steps of BLU can be simplified.

The invention described in a fourteenth aspect relates to the package of an optical sheet for a display according to any one of the ninth to thirteenth aspects, and the packaging material has a predetermined elasticity at least at a portion where the member comes into contact with the laminate.

The invention described in the fourteenth aspect ensures close contact between the packaging material and the laminate and thus can prevent scratches due to friction between the packaging material and the laminate and generation of dust. Furthermore, in an aspect using a heat-shrinkable resin film for the packaging material, close contact and air tightness between the packaging material and the laminate can be further improved by employing shrink packaging together.

To achieve the above object, the method for packaging an optical sheet for a display according to a fifteenth aspect of the present invention comprising the steps of: temporarily packaging a laminate of a product size in which two or more kinds of optical sheets are stacked in a predetermined order in a packaging material; reducing the pressure in the packaging material so that the packaging material is brought into close contact with the laminate; and sealing the packaging material with the packaging material being brought into close contact with the laminate

An aspect using an optical sheet larger than a product size includes a cutting step of cutting a laminate composed of optical sheets larger than a product size into a product size.

SDOCID: <WO_____2007032454A1_I_>

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 340 of 836

When a heat-shrinkable material is used as a packaging material, preferably the pressure reduction step (or the sealing step) includes a heating step of heating a packaging material in which a laminate is temporarily packaged.

The method for packaging an optical sheet for a display according to a sixteenth aspect of the present invention comprising the steps of: joining a laminate of a product size in which two or more kinds of optical sheets are stacked in a predetermined order at one or more parts of the periphery of the optical sheets; temporarily packaging the laminate whose periphery is joined at one or more parts in the step of joining in a packaging material; reducing the pressure in the packaging material so that the packaging material is brought into close contact with the laminate; and sealing the packaging material with the packaging material being brought into close contact with the laminate.

In an aspect in which at least one part of the laminate is bonded, displacement of optical sheets or friction of sheets due to such displacement can be prevented upon packaging (particularly upon handling).

As described above, according to the optical sheet for a display and the method for producing the same of the present invention, a high quality optical sheet for a display and a method for producing the same suitable for producing such an optical sheet in a simple method without decrease in the adhesion strength upon bonding optical sheets can be provided.

Further, according to the package of an optical sheet for a display of the present invention and a method for packaging the optical sheet for a display, an object to be packaged (a laminate composed of plural kinds of optical sheets) can be packaged in close contact with a packaging material, and damage on the object to be packaged can be prevented. In addition, the number of operations for incorporating members necessary for assembling a backlight is reduced, contributing to reduction of production cost.

Brief Description of the Drawings

Figure 1 illustrates a cross-sectional structure of an optical sheet for a display of the first embodiment;

Figure 2 illustrates a cross-sectional structure of an optical sheet for a display of the second embodiment;

\SDOCID: <WO_____2007032454A1_I_>

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 341 of 836

Figure 3 illustrates a cross-sectional structure of an optical sheet for a display of the third embodiment;

Figure 4 illustrates a cross-sectional structure of an optical sheet for a display of the fourth embodiment;

Figure 5 illustrates a cross-sectional structure of an optical sheet for a display of the fifth embodiment;

Figure 6 illustrates a cross-sectional structure of an optical sheet for a display of the sixth embodiment;

Figure 7 is a schematic view of line for producing an optical sheet for a display applied to the first method;

Figure 8 is a schematic view of line for producing an optical sheet for a display applied to the second method;

Figure 9 is a schematic view of line for producing an optical sheet for a display applied to the third method;

Figure 10 is a schematic view of line for producing an optical sheet for a display applied to the fourth method;

Figure 11 is a schematic view of line for producing an optical sheet for a display applied to the fifth method;

Figure 12 is a schematic view of line for producing an optical sheet for a display applied to the sixth method;

Figure 13A illustrates arrangement of sheets on a plane, which are to be punched out from a laminate in the first method;

Figure 13B illustrates arrangement of sheets on a plane, which are to be punched out from a laminate in the first method;

Figure 14A illustrates arrangement of sheets on a plane, which are to be punched out from a laminate in the second to sixth methods;

Figure 14B illustrates arrangement of sheets on a plane, which are to be punched out from a laminate in the second to sixth methods;

Figure 15 is a table showing the composition of a resin solution used for preparing a prism sheet;

Figure 16 is a schematic view of an apparatus for producing a prism sheet;

ISDOCID: <WO_____2007032454A1_I_>

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 342 of 836

Figure 17A illustrates a method for packaging the optical sheet for a display shown in Figure 1 to Figure 6;

Figure 17B illustrates a method for packaging the optical sheet for a display shown in Figure 1 to Figure 6;

Figure 17C illustrates a method for packaging the optical sheet for a display shown in Figure 1 to Figure 6; and

Figure 17D illustrates a method for packaging the optical sheet for a display shown in Figure 1 to Figure 6.

Description of symbols

10 ... optical sheet for display, 11 ... line for producing optical sheet for display, 12 ... first diffusion sheet, 12B ... roll, 14 ... first prism sheet, 16 ... second prism sheet, 18 ... second diffusion sheet, 20 ... optical sheet for display, 20 ... solid concentration, 21 ... line for producing optical sheet for display, 24 ... laser head, 26 ... conveyor, 28 ... suction-type lateral transfer device, 30 ... optical sheet for display, 31 ... line for producing optical sheet for display, 32 ... stacking device, 34 ... laminate, 36 ... roll, 40 ... optical sheet for display, 41 ... line for producing optical sheet for display, 42 ... dispenser, 44 ... dispenser, 46 ... dispenser, 48 ... pressing device, 50 ... melting point, 51 ... line for producing optical sheet for display, 52 ... tape feeder, 54 ... tape feeder, 56 ... tape feeder, 60 ... optical sheet for display, 61 ... line for producing optical sheet for display, 62 ... ultrasonic horn, 64 ... ultrasonic horn, 66 ... ultrasonic horn, 72 ... laser head, 74 ... laser head, 76 ... laser head, 78 ... laser head, 82 ... coating device, 82B ... feeder, 82C ... coating head 83 ... emboss roller, 84 ... nip roller, 85 ... device for curing resin, G ... guide roller, P ... device for forming coating film (aerosol spraying device), 100 ... bundle, 104 ... packaging material, 108 ... air suction nozzle, 110 ... heat seal mechanism

Best Mode for Carrying out the Invention

In the following, embodiments of the present invention are described with reference to the attached figures.

[Optical sheet for display]

INSDOCID: <WO_____2007032454A1_I_>

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 343 of 836

First, configurations of examples of optical sheets for a display produced by the method for producing an optical sheet for a display of the present invention (first to sixth embodiments) are described. Then, the methods for producing an optical sheet for a display are described.

Figure 1 is a cross-sectional view illustrating a configuration of an example of an optical sheet for a display produced by the method for producing an optical sheet for a display according to the present invention (a first embodiment).

The optical sheet for a display 10 is a module of optical sheets in which a first diffusion sheet 12, a first prism sheet 14, a second prism sheet 16 and a second diffusion sheet 18 are stacked from the bottom.

The first diffusion sheet 12 and the second diffusion sheet 18 are a sheet in which beads are fixed to the surface (one side) of a transparent film (support) by a binder and which has certain light diffusing ability. The beads on the first diffusion sheet 12 and that on the second diffusion sheet 18 have a different diameter (average particle size). Also, each sheet has different light diffusion ability.

A resin film can be used as the transparent film (support) used for the first diffusion sheet 12 and the second diffusion sheet 18. Known materials such as polyethylene, polypropylene, polyvinyl chloride, polyvinylidene chloride, polyvinyl acetate, polyester, polyolefin, acryl, polystyrene, polycarbonate, polyamide, PET (polyethylene terephthalate), biaxially oriented polyethylene terephthalate, polyethylene naphthalate, polyamideimide, polyimide, aromatic polyamide, cellulose acylate, cellulose triacetate, cellulose acetate propionate and cellulose diacetate can be used as a material of the resin film. Of these, polyester, cellulose acylate, acryl, polycarbonate and polyolefin are particularly preferably used.

The beads on the first diffusion sheet 12 and the second diffusion sheet 18 must have a diameter of 100 μm or less, preferably 25 μm or less. For example, beads may have an average particle size of 17 μm in a given distribution range of 7 to 38 μm.

The first prism sheet 14 and the second prism sheet 16 are a lens sheet in which convex lenses formed in one axial direction are disposed adjacent to each other almost on the whole sheet, for example, at a pitch of 50 μm, an irregularity height of 25 μm and an apex angle of the convex part of 90 degrees (right angle).

SDOCID: <WO_____2007032454A1_I_>

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 344 of 836

The first prism sheet 14 and the second prism sheet 16 are disposed so that the axis of the convex lens (prism) is substantially perpendicular to each other. Specifically, in Figure 1, the axis of the convex lens of the first prism sheet 14 is disposed in the direction perpendicular to the sheet plane, while the axis of the convex lens of the second prism sheet 16 is disposed in the direction parallel to the sheet plane. In Figure 1, to be able to see that the section of the second prism sheet 16 is convex, the section is shown in a direction different from the actual direction.

Various known aspects can be applied to the material of the first prism sheet 14 and the second prism sheet 16 and the method of producing them. For example, a method of producing a resin sheet may be used, in which a sheet-shaped resin material extruded through a die is pressed between a transfer roller (having a pattern opposite to that of a prism sheet on the surface) rotating at substantially the same rate as the extrusion rate of the resin material and a nip roller board positioned against the transfer roller and rotating at the same rate, thereby transferring irregularity patterns on the surface of the transfer roller to the resin.

Also, a method of producing a resin sheet in which a transfer plate (stamper) having a pattern opposite to that of a prism sheet on the surface and a resin plate are stacked and press-molding is performed by a hot press by heat transfer may be used.

Resin materials which can be used in such methods include thermoplastic resins such as polymethyl methacrylate resins (PMMA), polycarbonate resins, polystyrene resins, MS resins, AS resins, polypropylene resins, polyethylene resins, polyethylene terephthalate resins, polyvinyl chloride resins (PVC), thermoplastic elastomers, copolymers thereof and cycloolefin polymers.

For another method, a method of producing a resin sheet in which irregularities on the surface of an embossed roller (having a pattern opposite to that of a prism sheet on the surface) are transferred to a transparent film which is similar to those used for the first diffusion sheet 12 and the second diffusion sheet 18 (polyester, cellulose acylate, acryl, polycarbonate, polyolefin, etc.) may be used.

More specifically, a method of producing an embossed sheet may be used, in which a transparent film in which two or more layers of an adhesive layer and a resin layer (e.g., UV curable resin) are formed by sequentially applying an adhesive and a resin is continuously transferred, and the transparent film is put over the rotating

SDOCID: <WO_____2007032454A1_I_>

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 345 of 836

embossed roller, thereby transferring irregularities on the surface of the embossed roller to the resin layer, and the resin layer is cured with the transparent film being put over the embossed roller (for example, by irradiating with UV). The adhesive may not be used.

The method of producing the first prism sheet 14 and the second prism sheet 16 is not limited to the above examples, and other methods may be used as long as desired irregularity patterns can be formed on the surface.

As shown in Figure 1, a joining part 10A combines layers at the left and the right ends of the optical sheet for a display 10. The sheets are bonded by the joining part 10A by applying adhesive, for example, on the top surface of each sheet (the first diffusion sheet 12, the first prism sheet 14, and the second prism sheet 16).

The optical sheet for a display 10 described above is disposed, for example, between a light source device and a liquid crystal cell, and used to constitute a whole liquid crystal display device. This produces an advantage that assembling of liquid crystal display devices is very easy in addition to various advantages already described (being able to produce optical sheets for a display through steps simpler than those in conventional arts at low cost with high quality).

Next, another example (a second embodiment) of an optical sheet for a display produced by the method for producing an optical sheet for a display according to the present invention is described. Figure 2 is a cross-sectional view illustrating a configuration of an optical sheet for a display 20. The same reference numerals are used for members which are the same as or similar to those in Figure 1 (the first embodiment), and detailed description thereof is omitted.

The optical sheet for a display 20 is composed of a diffusion sheet 12, a first prism sheet 14 and a second prism sheet 16 which are stacked from the bottom. The second diffusion sheet 18 is omitted because diffusibility as wide as that in the above-described optical sheet for a display 10 is not required.

As shown in Figure 2, a joining part 20A combines layers at the left and the right ends of the optical sheet for a display 20. The joining method is substantially the same as that in the first embodiment.

The optical sheet for a display 20 described above is disposed, for example, between a light source device and a liquid crystal cell, and used to constitute a whole liquid crystal display device as in the first embodiment.

SDOCID: <WO_____2007032454A1_I_>

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 346 of 836

Next, still another example (a third embodiment) of an optical sheet for a display produced by the method for producing an optical sheet for a display according to the present invention is described. Figure 3 is a cross-sectional view illustrating a configuration of an optical sheet for a display 30. The same reference numerals are used for members which are the same as or similar to those in Figure 1 (the first embodiment) and Figure 2 (the second embodiment), and detailed description thereof is omitted.

The optical sheet for a display 30 is composed of a first diffusion sheet 12, a prism sheet 14 and a second diffusion sheet 18 which are stacked from the bottom.

In the optical sheet for a display 30, the second prism sheet 16 is omitted because diffusibility in the direction perpendicular to the sheet plane as in the above-described optical sheet for a display 10 is not required.

As shown in Figure 3, a joining part 30A combines layers at the left and the right ends of the optical sheet for a display 30. The joining method is substantially the same as that in the first embodiment.

The optical sheet for a display 30 described above is disposed, for example, between a light source device and a liquid crystal cell, and used to constitute a whole liquid crystal display device as in the first embodiment.

Next, still another example (a fourth embodiment) of an optical sheet for a display produced by the method for producing an optical sheet for a display according to the present invention is described. Figure 4 is a cross-sectional view illustrating a configuration of an optical sheet for a display 40. The same reference numerals are used for members which are the same as or similar to those in Figure 1 (the first embodiment) and Figure 2 (the second embodiment), and detailed description thereof is omitted.

The optical sheet for a display 40 is composed of a diffusion sheet 12 and a prism sheet 14 which are stacked from the bottom. The second diffusion sheet 18 is omitted because diffusibility as wide as that in the optical sheet for a display 10 is not required. The second prism sheet 16 is omitted because diffusibility in the direction perpendicular to the sheet plane as in the optical sheet for a display 10 is not required.

NSDOCID: <WO 2007032454A1_I_>

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 347 of 836

As shown in Figure 4, a joining part 40A combines layers at the left and the right ends of the optical sheet for a display 40. The joining method is substantially the same as that in the first embodiment.

The optical sheet for a display 40 described above is disposed, for example, between a light source device and a liquid crystal cell, and used to constitute a whole liquid crystal display device as in the first embodiment.

Next, still another example (a fifth embodiment) of an optical sheet for a display produced by the method for producing an optical sheet for a display according to the present invention is described. Figure 5 is a cross-sectional view illustrating a configuration of an optical sheet for a display 50. The same reference numerals are used for members which are the same as or similar to those in Figure 1 (the first embodiment) and Figure 2 (the second embodiment), and detailed description thereof is omitted. The optical sheet for a display 50 is composed of a first prism sheet 14, a second prism sheet 16 and a diffusion sheet 18 which are stacked from the bottom. The first diffusion sheet 12 is omitted because diffusibility as wide as that in the above-described optical sheet for a display 10 is not required.

As shown Figure 5, a joining part 50A combines layers at the left and the right ends of the optical sheet for a display 50. The joining method is substantially the same as that in the first embodiment.

The optical sheet for a display 50 described above is disposed, for example, between a light source device and a liquid crystal cell, and used to constitute a whole liquid crystal display device as in the first embodiment.

Next, still another example (a sixth embodiment) of an optical sheet for a display produced by the method for producing an optical sheet for a display according to the present invention is described. Figure 6 is a cross-sectional view illustrating a configuration of an optical sheet for a display 60. The same reference numerals are used for members which are the same as or similar to those in Figure 1 (the first embodiment) and Figure 2 (the second embodiment), and detailed description thereof is omitted. The optical sheet for a display 60 is composed of a first prism sheet 14 and a diffusion sheet 18 which are stacked from the bottom. The first diffusion sheet 12 is omitted because diffusibility as wide as that in the above-described optical sheet for a display 10 is not required. The second prism sheet 16 is omitted because diffusibility in

SDOCID: <WO 2007032454A1 I >

Petitioner Hisense USA Corporation
Exhibit 1002 - Page 348 of 836

the direction perpendicular to the sheet plane as in the above-described optical sheet for a display 10 is not required.

As shown Figure 6, a joining part 60A combines layers at the left and the right ends of the optical sheet for a display 60. The joining method is substantially the same as that in the first embodiment.

The optical sheet for a display 60 described above is disposed, for example, between a light source device and a liquid crystal cell, and used to constitute a whole liquid crystal display device as in the first embodiment.

[Method for producing optical sheet for display]

The methods for producing an optical sheet for a display (first to sixth methods) are now described. These methods can be commonly applied to the optical sheets for a display 10 to 60 described earlier, but for illustrative purposes, a method applied to production of an optical sheet for a display of a four-layer structure (the first embodiment) is described.

Figure 7 is a schematic view of production line for an optical sheet for a display 11 applied to the first method. The first diffusion sheet 12, the first prism sheet 14, the second prism sheet 16 and the second diffusion sheet 18 shown in Figure 1 described earlier are each wound around rolls 12B, 14B, 16B and 18B disposed at the left end of the figure.

The rolls 12B, 14B, 16B and 18B are each held by the rotational axis of a feeding device which is not shown. The first diffusion sheet 12, the first prism sheet 14, the second prism sheet 16 and the second diffusion sheet 18 can be fed from the rolls 12B, 14B, 16B and 18B at about the same rate.

A coating film composed of a water-soluble antistatic agent and a fluorine surfactant is formed on each of the first diffusion sheet 12, the first prism sheet 14, the second prism sheet 16 and the second diffusion sheet 18 that have been fed using device for forming a coating film P, P ... described later (coating film forming step), and with being held by guide rollers G, G ..., the sheets are finally stacked at the upstream of the laser head 24 described later (stacking step).

In the coating device P, a coating film composed of an water-soluble antistatic agent and a fluorine surfactant is formed on at least the surface of each of the first

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Exhibit 1002 - Page 349 of 836