

App. No. 16/933,932
Dkt. No.: MAN2241-045R
Re.: Office Action of September 30, 2020

- US 4763993 Vogeley
- US 2001/0009508 Umemoto et al.

At least the Present Application and PCT/US2009/068770 share a priority claim to at least US Provisional Application Serial No. 61/138,736 filed December 18, 2008, and the following references were cited in the International Search Report for the '770 PCT Application (please note, repetitive or equivalent references may be omitted):

- US 2006/0132699 Cho et al.
- US 2006/0209266 Utsunomiya
- US 2007/0151664 Shin

The following references were cited in the national stage examination of one or more applications claiming priority to the '770 PCT Application (please note, repetitive or equivalent references may be omitted):

- EP 1951020 ISL Media Singapore PTE LTD
- EP 1408476 Barco NV
- US 2008/0285290 Ohashi et al.
- US 2010/0079949 Nakamichi et al.

At least the Present Application and PCT/US2008/083792 share a priority claim to at least US Provisional Application Serial No. 61/115,333 filed November 17, 2008, and the following references were cited in the International Search Report for the '792 PCT Application (please note, repetitive or equivalent references may be omitted):

- JP 08-194437 Matsushita Electric Works LTD.
- JP 2002-158475 Fujitsu General LTD.
- KR 10-2007-0070675 Nautilus Hyosung Inc.

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The following references were cited in the national stage examination of one or more applications claiming priority to the '792 PCT Application (please note, repetitive or equivalent references may be omitted):

- EP 1762892 Hitachi LTD
- JP 1997-160512 Golden Kitsuzu KK
- JP 2001-131682 Nippon Seiki Co LTD.
- JP 2002-006282 Toshiba Corp.
- JP 2004-199675 International Business Mach Corp
- JP 2006-513577 Choi et al.
- KR 10-2000-047899 Sony Corp.
- KR 10-2004-0067701 Icurie Lab Holdings Limited
- KR 10-2007-0048294 LG Electronics Inc.
- KR 20-2000-00018 Samsung Electronics Co., Ltd.
- US 6,211,934 Habing et al.

At least the Present Application and US Application Serial No. 16/983,842 filed August 3, 2020 share a priority claim to at least the '307 Application, and the following references were specifically cited in a rejection in one or more office actions in the '842 Application (please note, repetitive or equivalent references may be omitted):

- US 6,392,727 Larson

At least the Present Application and US Application Serial No. 15/135,032 filed April 21, 2016 share a priority claim to at least the '307 Application, and the following references were specifically cited in a rejection in one or more office actions in the '032 Application (please note, repetitive or equivalent references may be omitted):

App. No. 16/933,932
Dkt. No.: MAN2241-045R
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- KR 2006-0016469 Ra Dong

At least the Present Application and US Application Serial No. 15/180,968 filed June 13, 2016 share a priority claim to at least the '330 Application, and the following references were specifically cited in a rejection in one or more office actions in the '968 Application (please note, repetitive or equivalent references may be omitted):

- No such references not already listed.

At least the Present Application and US Application Serial No. 14/803,848 filed July 20, 2015 share a priority claim to at least the '330 Application, and the following references were specifically cited in a rejection in one or more office actions in the '848 Application (please note, repetitive or equivalent references may be omitted):

- US 9,089,079 Dunn

At least the Present Application and US Application Serial No. 14/508,767 filed October 7, 2014 share a priority claim to at least the '330 Application, and the following references were specifically cited in a rejection in one or more office actions in the '767 Application (please note, repetitive or equivalent references may be omitted):

- No such references not already listed.

At least the Present Application and US Application Serial No. 13/937,777 filed July 9, 2013 share a priority claim to at least the '330 Application, and the following references were specifically cited in a rejection in one or more office actions in the '777 Application (please note, repetitive or equivalent references may be omitted):

- US 7,667,964 Kang et al.

At least the Present Application and US Application Serial No. 13/605,530 filed September 6, 2012 share a priority claim to at least the '330 Application, and the following references were specifically cited in a rejection in one or more office actions in the '530 Application (please note, repetitive or equivalent references may be omitted):

- US 7,602,469 Shin
- US 8,269,916 Ohkawa
- US 2010/0171889 Pantel et al.
- US 2007/0065091 Hinata et al.

Furthermore, Applicant respectfully submits that at least MPEP § 2004.10 states that “[w]hen in doubt, it is desirable and safest to submit information. Even though the attorney, agent, or applicant doesn’t consider it necessarily material, someone else may see it differently and embarrassing questions can be avoided. The court in *U.S. Industries v. Norton Co.*, 210 USPQ 94, 107 (N.D. N.Y. 1980) stated ‘[i]n short, the question of relevancy in close cases, should be left to the examiner and not the applicant.’ See also *LaBounty Mfg., Inc. v. U.S. Int’l Trade Comm’n*, 958 F.2d 1066, 22 USPQ2d 1025 (Fed. Cir. 1992).”

Claim Rejection Under 35 USC § 103

Examiner has rejected claims 1 and 8 under 35 USC § 103 as allegedly being obvious over US Pat. No. 5,869,919 to Sato *et. al.* (“Sato”) in view of US Pat. No. 6,211,934 to Habing *et. al.* (“Habing”). Examiner has rejected claims 1-5 and 10 under 35 USC § 103 as allegedly being obvious over Sato in view of US Pub. No. 2002/0033919 to Sanelle *et. al.* (“Sanelle”). Examiner has rejected claims 6-7 and 9 under 35 USC § 103 as allegedly being obvious over Sato in view of Sanelle and US Pub. No.

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2005/0134526 to Willem *et. al.* ("Willem"). Examiner has rejected claims 17-18 under 35 USC § 103 as allegedly being obvious over Sato in view of Willem. Examiner has rejected claim 19 under 35 USC § 103 as allegedly being obvious over Sato in view of Willem and Sanelle. Applicant respectfully traverses.

Claim 1 is amended to require that the portion of the airflow pathway extending between the electronic image assembly and the cover panel be part of a closed loop. Sato, on the other hand, teaches that the arrowed line 416 represent ambient air which enters and exits the unit. *See e.g.*, figure 4. The addition of Habing and/or Sanelle does not change this analysis as Habing and Sanelle are not cited to supply such limitations. OA of 9/30/20 at pg. 3-5. In light of the foregoing, Applicant respectfully submits that claim 1 is allowable with claims 3-7 and 10 being allowable as proper dependents therefrom.

With particular regard to claim 17, Applicant refers Examiner to the section entitled "Allowable Subject Matter", which is hereby incorporated by reference. For at least the reasons set forth more fully therein, Applicant respectfully submits that claim 17 is allowable with claims 18-19 being allowable as proper dependents therefrom.

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Conclusion

Applicant respectfully submits that the present application is now in condition for allowance, and such action is earnestly requested. Telephone inquiry to the undersigned in order to clarify or otherwise expedite prosecution of the present application is respectfully encouraged.

Respectfully submitted,

Date: December 18, 2020

/Adam J. Smith/
Adam J. Smith
Registration No. 72,962
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Electronic Patent Application Fee Transmittal				
Application Number:		16933932		
Filing Date:		20-Jul-2020		
Title of Invention:		ELECTRONIC DISPLAY WITH COOLING		
First Named Inventor/Applicant Name:		William Dunn		
Filer:		Adam Jeffery Smith/Brianna Lacy		
Attorney Docket Number:		MAN2241-045R		
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
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	260	260
Total in USD (\$)				260

Electronic Acknowledgement Receipt	
EFS ID:	41435186
Application Number:	16933932
International Application Number:	
Confirmation Number:	5816
Title of Invention:	ELECTRONIC DISPLAY WITH COOLING
First Named Inventor/Applicant Name:	William Dunn
Customer Number:	8698
Filer:	Adam Jeffery Smith/Brianna Lacy
Filer Authorized By:	Adam Jeffery Smith
Attorney Docket Number:	MAN2241-045R
Receipt Date:	18-DEC-2020
Filing Date:	20-JUL-2020
Time Stamp:	16:02:05
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	\$260
RAM confirmation Number	E2020BHG02271327
Deposit Account	194076
Authorized User	Brianna Lacy
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: 37 CFR 1.16 (National application filing, search, and examination fees) 37 CFR 1.17 (Patent application and reexamination processing fees)	

37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	MAN2241-045R_Supp_IDS_12-2020.pdf	612161	no	4
			adc5d6e8b99efccce90dfcabe95080ed2d77b166e		

Warnings:

Information:

2		MAN2241-045R_OAR_12-18-20.pdf	82416	yes	19
			1f9037cb3379ff81c96eabbd70e39364562f9e2d		

Multipart Description/PDF files in .zip description

Document Description		Start	End
Amendment/Req. Reconsideration-After Non-Final Reject		1	1
Claims		2	7
Applicant Arguments/Remarks Made in an Amendment		8	19

Warnings:

Information:

3	Fee Worksheet (SB06)	fee-info.pdf	30662	no	2
			5999d9d3b9dc2348cb8d87cdac4b545a7b71e1de		

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Total Files Size (in bytes):			725239
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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.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875				Application or Docket Number 16/933,932		Filing Date 07/20/2020		☐ To be Mailed		
ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO										
APPLICATION AS FILED - PART I										
		(Column 1)		(Column 2)						
FOR		NUMBER FILED		NUMBER EXTRA		RATE (\$)		FEE (\$)		
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))		N/A		N/A		N/A				
☐ SEARCH FEE (37 CFR 1.16(k), (l), or (m))		N/A		N/A		N/A				
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))		N/A		N/A		N/A				
TOTAL CLAIMS (37 CFR 1.16(j))		minus 20 = *				x \$100 =				
INDEPENDENT CLAIMS (37 CFR 1.16(h))		minus 3 = *				x \$460 =				
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))		If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 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				
APPLICATION AS AMENDED - PART II										
		(Column 1)		(Column 2)		(Column 3)				
AMENDMENT	12/18/2020		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR		PRESENT EXTRA		RATE (\$)	ADDITIONAL FEE (\$)
	Total (37 CFR 1.16(i))		* 17	Minus	** 20	= 0		x \$100 =		0
	Independent (37 CFR 1.16(h))		* 3	Minus	*** 3	= 0		x \$480 =		0
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))									
									TOTAL ADD'L FEE	0
AMENDMENT			CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR		PRESENT EXTRA		RATE (\$)	ADDITIONAL FEE (\$)
	Total (37 CFR 1.16(i))		*	Minus	**	=		x \$0 =		
	Independent (37 CFR 1.16(h))		*	Minus	***	=		x \$0 =		
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))									
									TOTAL ADD'L FEE	
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.									LIE	
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".									/SHEILA D CHAPMAN/	
*** 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.										

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.

Doc code: IDS

PTO/SB/08a (01-10)

Doc description: Information Disclosure Statement (IDS) Filed

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 contains a valid OMB control number.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	16933932
	Filing Date	2020-07-20
	First Named Inventor	William Dunn
	Art Unit	2835
	Examiner Name	Michael A. Matey
	Attorney Docket Number	MAN2241-045R

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Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear		
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Examiner Initial*	Cite No	Foreign Document Number ³	Country Code ²ⁱ	Kind Code ⁴	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear	T ⁵
	1	JPH9-160512	JP	A	1997-06-20	Golden Kitsuzu KK		
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NON-PATENT LITERATURE DOCUMENTS								Remove
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, pages(s), volume-issue number(s), publisher, city and/or country where published.						T ⁵

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	Filing Date		2020-07-20
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	Art Unit	2835	
	Examiner Name	Michael A. Matey	
	Attorney Docket Number	MAN2241-045R	

1			
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EXAMINER SIGNATURE			
Examiner Signature		Date Considered	
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¹ See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. ² Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). ³ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁴ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁵ Applicant is to place a check mark here if English language translation is attached.			

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		16933932
	Filing Date		2020-07-20
	First Named Inventor	William Dunn	
	Art Unit	2835	
	Examiner Name	Michael A. Matey	
	Attorney Docket Number	MAN2241-045R	

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

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. See 37 CFR 1.97(e)(1).

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 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Adam J. Smith/	Date (YYYY-MM-DD)	2020-11-23
Name/Print	Adam J. Smith	Registration Number	72962

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour 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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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 the Freedom of Information Act requires disclosure of these records.
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 inspections 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.

Electronic Patent Application Fee Transmittal				
Application Number:		16933932		
Filing Date:		20-Jul-2020		
Title of Invention:		ELECTRONIC DISPLAY WITH COOLING		
First Named Inventor/Applicant Name:		William Dunn		
Filer:		Adam Jeffery Smith/Brianna Lacy		
Attorney Docket Number:		MAN2241-045R		
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
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	260	260
Total in USD (\$)				260

Electronic Acknowledgement Receipt	
EFS ID:	41200311
Application Number:	16933932
International Application Number:	
Confirmation Number:	5816
Title of Invention:	ELECTRONIC DISPLAY WITH COOLING
First Named Inventor/Applicant Name:	William Dunn
Customer Number:	8698
Filer:	Adam Jeffery Smith/Brianna Lacy
Filer Authorized By:	Adam Jeffery Smith
Attorney Docket Number:	MAN2241-045R
Receipt Date:	23-NOV-2020
Filing Date:	20-JUL-2020
Time Stamp:	15:10:28
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	\$260
RAM confirmation Number	E2020AMF10482194
Deposit Account	194076
Authorized User	Brianna Lacy
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: 37 CFR 1.16 (National application filing, search, and examination fees) 37 CFR 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	Foreign Reference	JPH9160512.pdf	771422	no	14
			3cec47340b228ae569122572e9fcd22f29c88c3		

Warnings:**Information:**

2	Information Disclosure Statement (IDS) Form (SB08)	MAN2241-045R_Supp_IDS.pdf	612004	no	4
			8045c32707e4e894e9196c0ab805ce6a25bf2276		

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3	Fee Worksheet (SB06)	fee-info.pdf	30661	no	2
			1c45b178ca48bc8345b2bc48c9439ef05e9d5fa7		

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New Applications Under 35 U.S.C. 111

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Bibliography

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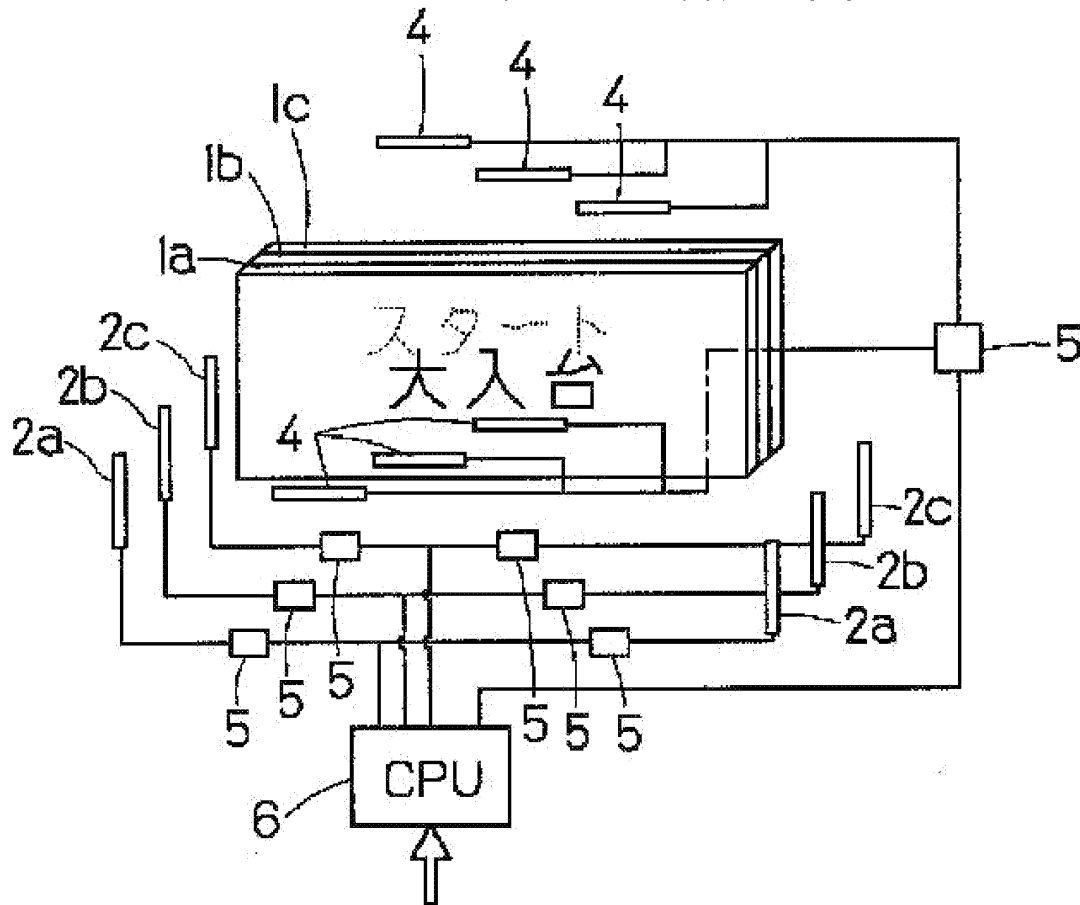
Overview

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(57) [Overview]

PROBLEM TO BE SOLVED: To make it possible to display various information and at the same time, provide the decorative effect of electric light by providing an electric light display, particularly on an end rail portion at the top of pachinko game board.

SOLUTION: A plurality of light-transmitting acrylic resin plates 1a to 1c are stacked one on another, and the surface of one side of at least one of the acrylic resin plates 1a to 1c is engraved so that the acrylic resin plates 1a to 1c can be illuminated independently from their side end faces. The sources 2a to 2c of light applied to the acrylic resin plates 1a to 1c from their sides provided three primary colors independently of one another. For the light sources 3a to 3c that provide three primary colors independently, cold-cathode tubes are used. Of a plurality of the acrylic resin plates, the frontmost one is further laminated with a half-mirror plate or a polarizing plate.



Scope of Claims

Close

[Patent Claims]

[Claim 1] An electric display board is characterized in that a plurality of light transmissive acrylic resin plates are laminated and laminated, and an engraving is performed on at least 1 side surfaces of at least one of the acrylic resin plates so that light can be irradiated separately from the side end surface of the acrylic resin plate.

[Claim 2] An electric display panel according to claim 1, wherein the light source of the light irradiated from the side surface of the acrylic resin plate is a light source having 3 primary colors independent of each other.

[Claim 3] An electric display panel according to claim 2, wherein a cold cathode tube is used as an independent light source of 3 primary colors.

[Claim 4] An electronic display panel according to claim 1, wherein a half mirror plate is further laminated on the uppermost side of the plurality of acrylic resin plates.

[Claim 5] An electronic display panel according to claim 1, wherein a polarizing plate is further laminated on the uppermost side of the plurality of acrylic resin plates.

Detailed Description

[Close](#)

[Detailed description of the invention]

[0001]

[Technical field of invention] The present invention relates to an electronic display panel capable of displaying a message or the like on a side surface by irradiating light from an end surface using a light transmissive resin plate or the like.

[0002]

[Problem to be solved by the invention] Conventionally, a technique of controlling an LED matrix to display characters and patterns by electric power is known. For example, a liquid crystal plate or the like can be referred to as a matrix control. Since color images or the like can be clearly displayed by using a color liquid crystal plate or the like, it is very convenient to display various kinds of information on a screen.

[0003] However, when a color liquid crystal plate is used, arbitrary information can be displayed on a screen, but a control circuit for controlling a liquid crystal matrix becomes complicated, which leads to an expensive device. Further, since a liquid crystal plate has very poor yield and a large amount of large area cannot be manufactured, it is difficult to manufacture a large-sized display plate. In addition, a color matrix using an LED can constitute a large screen, but has a disadvantage in that it is expensive as well as a color liquid crystal.

[0004] Conventionally, in the case of a pachinko parlor, display of a large base and display of a big win have been performed on a per table basis, but almost all of them are manually performed by attaching a resin plate to a glass surface. However, once the plate is mounted, it is cumbersome and cumbersome. Also, recent illumination displays have become aesthetically pleasing and less noticeable only by mounting such plates.

[0005] It exerts the decoration effect by an electric light at the same time the present invention is what noted such a point, indicates the end rail portion of the pachinko stand upper part by an electric light especially and displays various kinds of information.

It is an object of the present invention to provide an electric display board.

[0006]

[Means for solving the problem] In order to achieve the above object, the present invention adopts the following means. In other words, a plurality of acrylic resin plates are laminated, and at least 1 of these acrylic resin plates are engraved, so that light can be irradiated separately from the side end surface of the acrylic resin plate. Thus, the acrylic resin plate can be electrically displayed in units of units, and by stacking the resin plates, it is possible

to superimpose a plurality of engraving or to lift only an arbitrary engraving from a plurality of engraving. In addition, a light source of light irradiated from a side surface of an acrylic resin plate is an independent light source of 3 primary colors. By this means, it is possible to irradiate different colors for each of the acrylic resin sheets, and thus it is possible to further enhance the decorativeness. Further, if 3 primary colors are mixed for each acrylic resin plate, the selection of the color of light is further increased. In other words, the meaning that 3 primary colors are independent light sources includes a configuration in which 1 colors of each acrylic resin plate are irradiated with 3 primary colors, and a constitution in which 3 primary colors are irradiated on each acrylic resin plate.

[0007]Further, when a cold cathode tube is used as a light source for irradiating an acrylic resin plate, it is possible to reduce power consumption and also reduce the amount of heat generation. Further, a half mirror plate or a polarizing plate is further laminated on the uppermost side of the acrylic resin plate. As a result, when viewed from the front side when the electric display is not performed, only a glass plate or a reflection plate can be seen, so that the effect of the electric display is more emphasized.

[0008]

[Embodiment of invention] Hereinafter, one embodiment of the present invention is described according to the attached Drawings. FIG. 1 and FIG. 2 show a case where an example of the present invention is applied to a curtain panel positioned above a Pachinko table, and 1 a, 1 b, and 1 c are light transmissive acrylic resin plates, which are appropriately selected from a colorless transparent plate, a colored transparent plate, a translucent plate, and the like. Here, the term "light transmittance" means that an acrylic resin sheet can travel inside the acrylic while internally reflecting the incident light, and it is meant to exclude an opaque property such as blocking light and a translucent property having low transparency. 2a, 2b, and 2c are the light sources which consists of a cold cathode tube, respectively, and emits light, respectively in the three primary colors of the light which 2a calls red, 2b calls green, and 2c calls blue. The light sources 2 a, 2 b, and 2 c are provided corresponding to the respective side end surfaces of the acrylic resin plates 1 a, 1 b, and 1 c. In other words, red light sources 1 a and 2 a are provided on both side end surfaces of the acrylic resin plate 2 a, and further 2 light sources are provided in the same relationship. Thus, when the light source 2 a is turned on, the acrylic resin plate 1 a is irradiated, and when the light source 2 b is turned on, the acrylic resin plate 1 b is turned on.

When the light source 2 c is lit, the acrylic resin plate 1 c is irradiated.

[0009]At least one of the acrylic resin plates 1 a, 1 b, and 1 c is engraved on at least one of the surfaces of the acrylic resin plates 1 a, 1 b, and 1 c, such as a character or an arbitrary figure. For example, if it is applied to a pachinko machine, characters such as "Lucky table", "Large table", and "start" are engraved on the respective acrylic resin plates 2 a, 1 b, and 1 c as shown in FIG. 1. The surrounding wavy line 3 is a decorative enclosure.

[0010]In FIG. 1, reference numerals 4. 4 denote cold cathode tubes connected in parallel, and the color thereof is arbitrarily colored. 5. 5 are power source circuits for lighting the lig

ht sources or cold cathode tubes connected thereto, and the power supply circuit 5. 5 is connected to the CPU 6 and is controlled ON and off. Information for controlling the states of the light sources 2 a to 2 c and the cold-cathode tubes 5. 5 is input to the CPU 6. For example, as this information, a plurality of pieces of information, such as the hit information of each of the tables, the lucky table information for indicating a table with a high probability of winning, or information indicating that the throttle is rotating, can be input, and in the CPU 6, an arbitrary light source and a cold cathode tube are lit according to a program predetermined based on these pieces of information. It should be noted that this information may be directly provided from each pachinko machine, or if a plurality of pachinko machines are centrally managed, an address may be determined from the central control device and the information may be output. A configuration directly applied from a pachinko machine would be simpler as a program and circuit.

[0011]It is now assumed that an electric display is performed using the engraved acrylic resin plates 1 a, 1 b, and 1 c shown in FIG. 2. At this time, if the target pachinko table is a lucky table, the light source 1 c is irradiated with the acrylic resin plate 2 c, and the "lucky table" and the engraved portion are illuminated with blue light. Next, when the throttle starts, the acrylic resin plate 1 b is irradiated with green light, and the character "start" is illuminated with green light together with the display of "Lucky Table" irradiated with blue light. When a large entry is made, a light source for a "Lucky table" and a "start" is turned off, a red light is irradiated on an acrylic resin plate 1 a, and a character "large entry" is displayed in red.

Note that the light sources 1 a - 1 c for displaying these lights may be kept on, but it is preferable to blink them for more effective lighting. This can be easily achieved by a program given in advance to the CPU 6. If the cold cathode tubes 5. 5 are flashed, more effective illumination is possible.

[0012]In this embodiment, a structure in which 3 acrylic resin plates are laminated is described, but it is needless to say that the number of sheets to be stacked, characters to be engraved, and the like can be freely set. Further, when a half mirror or a polarizing plate is further laminated on the surface side of the acrylic resin plate 1 a, it is recognized as a simple mirror or a reflecting plate at the time of extinction, so that the lighting effect at the time of lighting becomes higher. As another example, it is also possible to additionally employ a configuration in which a reflective optical sensor is installed at an arbitrary position of a pachinko machine, and a character such as "welcome" engraved on an acrylic resin plate laminated in addition is irradiated on the pachinko machine when a player is seated in front of the pachinko machine for a predetermined number of seconds.

[0013]In addition, although the present invention has been described with reference to the case where an electric display is applied to a curtain panel of a pachinko machine, it is needless to say that the present invention can be widely applied to a general advertising board or a decorative board.

[0014]

[Effect of the Invention] According to the present invention, since the above-described means is used, it is possible to provide an extremely effective electronic display board in which an engraved character or the like of an acrylic resin plate is illuminated with light of a plurality of colors.

Brief description of the drawings

Close —

[Brief Description of the Drawings]

[Fig. 1]The schematic view showing one embodiment of the present invention,

[Fig. 2]FIG. 4 is a plan view showing an embodiment of an acrylic resin plate ;.

[Explanation of letters or numerals]

1 a, 1 b, 1 c acrylic resin plate

2 a, 2 b, 2 c light source

3 Wavy Line

4 cold cathode tube

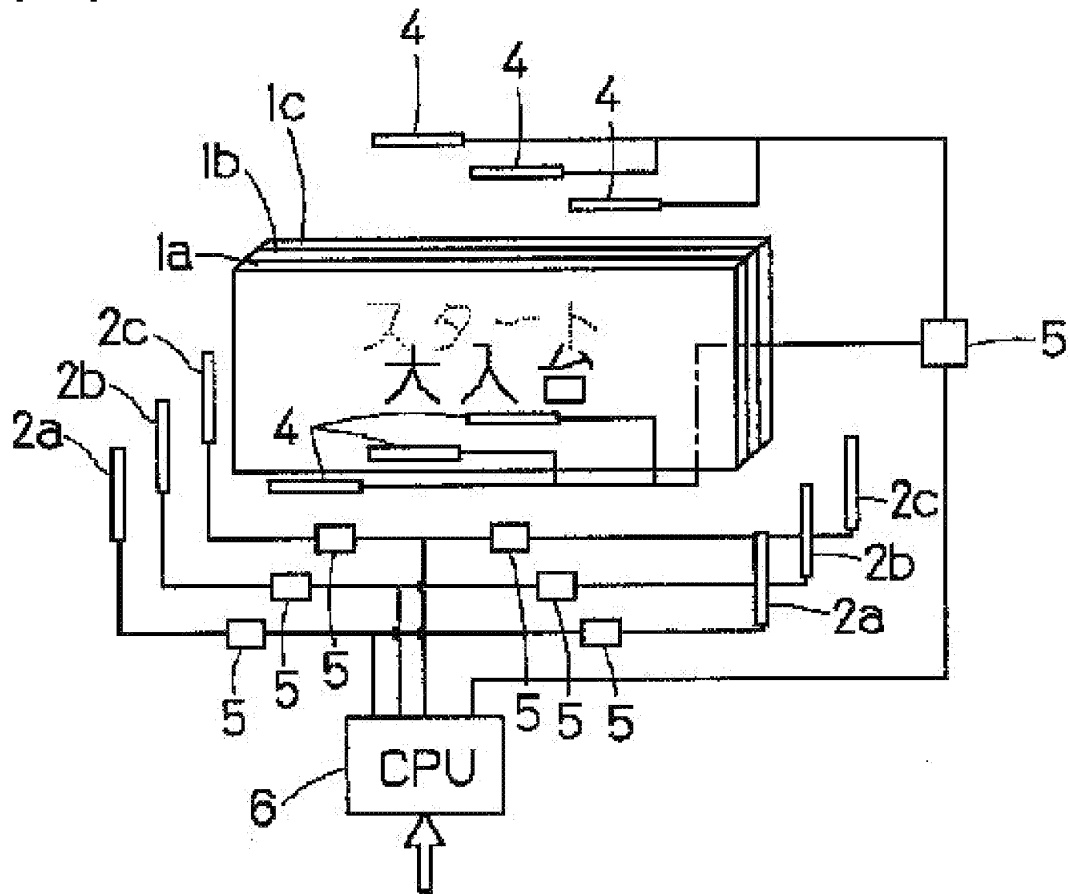
5 Light Source or Power Supply Circuit

6 CPU

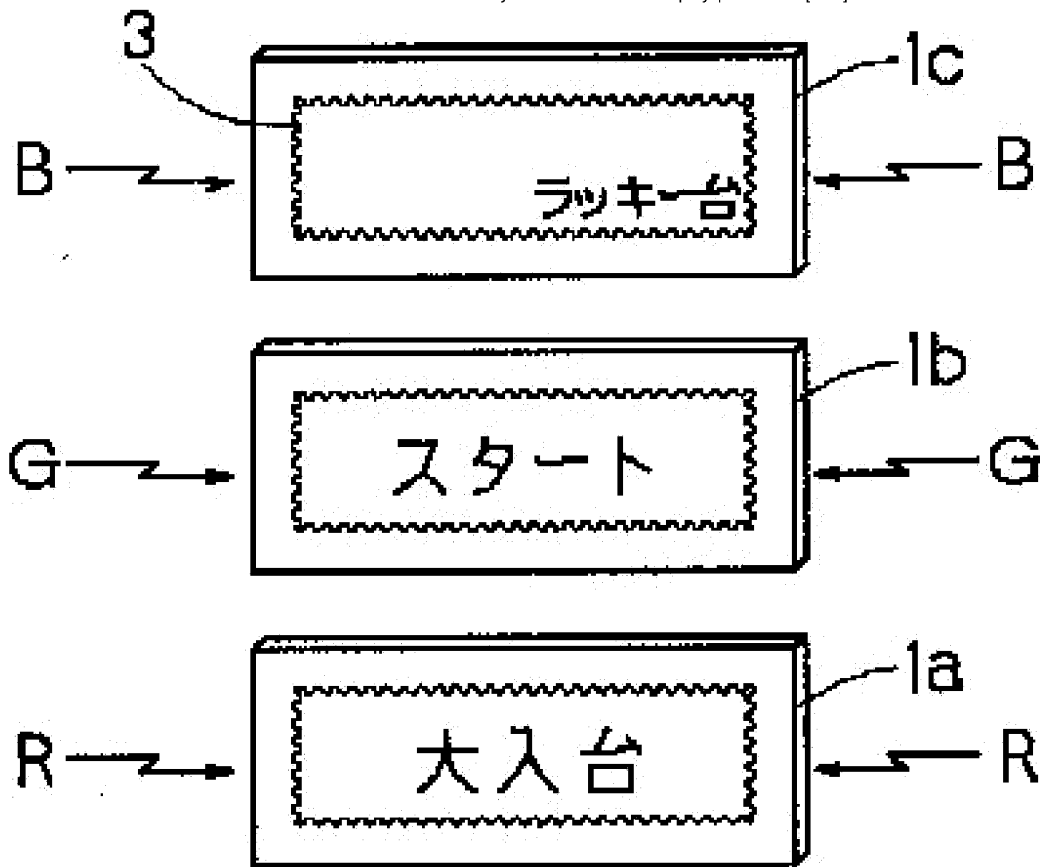
Drawings

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[FIG.1]



[FIG.2]



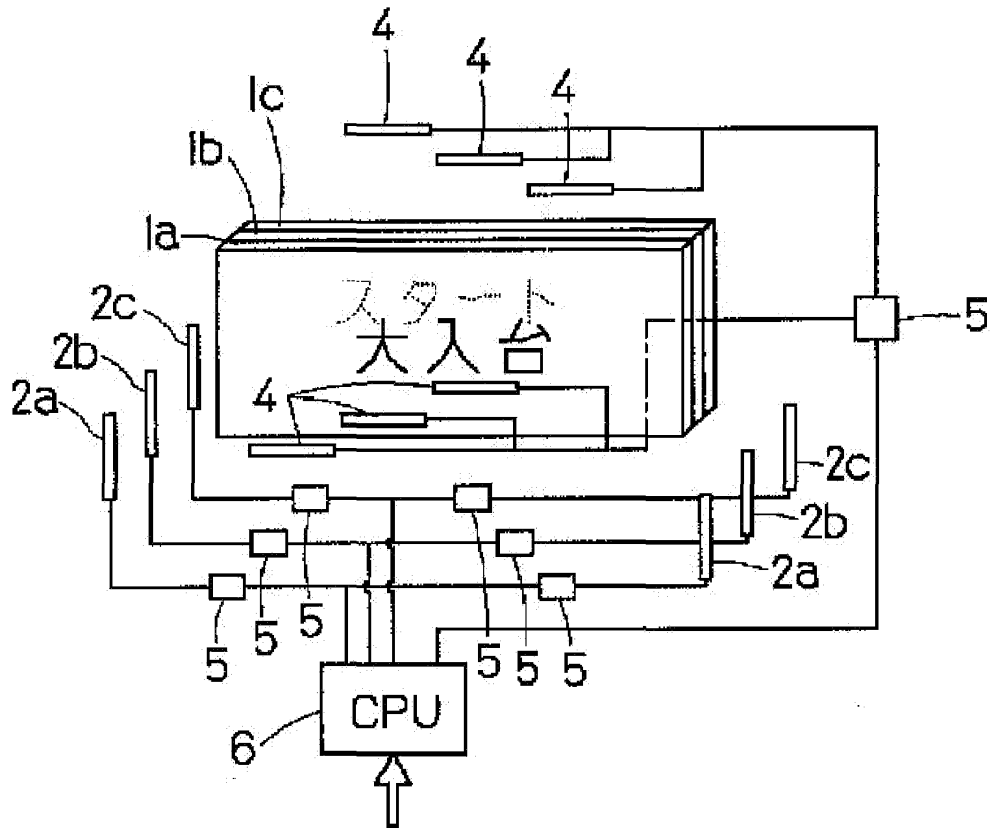
Drawings

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Representative drawing | 1 | 2

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Representative drawing

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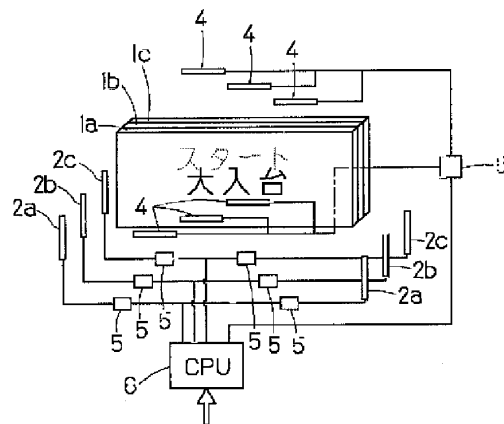
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(54)【発明の名称】 電光表示板

(57)【要約】

【課題】 特にパチンコ台上部の幕板部分に電光表示を設け、各種の情報を表示すると同時に、電光による装飾効果を発揮することができる電光表示板を提供する。

【解決手段】 複数の光透過性のアクリル酸樹脂板を重ねて積層し、これらのアクリル酸樹脂板の少なくとも1枚の片側表面には彫刻を施し、このアクリル酸樹脂板の側端面からそれぞれ別個に光を照射可能とした。アクリル酸樹脂板の側面から照射する光の光源は、3原色が独立した光源とした。また、3原色が独立した光源として、冷陰極管を用いた。複数のアクリル酸樹脂板のうち、一番表側には、さらにハーフミラー板、または偏光板を積層した。



【特許請求の範囲】

【請求項1】複数の光透過性のアクリル酸樹脂板を重ねて積層し、これらのアクリル酸樹脂板の少なくとも1枚の片側表面には彫刻を施し、このアクリル酸樹脂板の側端面からそれぞれ別個に光を照射可能としたことを特徴とする電光表示板。

【請求項2】アクリル酸樹脂板の側面から照射する光の光源は、3原色が独立した光源とした請求項1記載の電光表示板。

【請求項3】3原色が独立した光源として冷陰極管を用いた請求項2記載の電光表示板。

【請求項4】複数のアクリル酸樹脂板のうち、一番表側には、さらにハーフミラー板を積層した請求項1記載の電光表示板。

【請求項5】複数のアクリル酸樹脂板のうち、一番表側には、さらに偏光板を積層した請求項1記載の電光表示板。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、光透過性の樹脂板などを用い、端面から光を照射することによって側面にメッセージ等を表示することができる電光表示板に関するものである。

【0002】

【発明が解決しようとする課題】従来からLEDマトリックスを制御して文字や模様を電光表示する技術は知られている。たとえば液晶板なども広い概念としてはマトリックス制御による表示ということができる。そして、カラー液晶板などを利用すればカラー画像なども鮮明に表示することができるので、各種の情報を画面に表示するには非常に便利な構成である。

【0003】ところで、カラー液晶板を利用すれば、任意の情報を画面に表示することができるが、液晶マトリックスを制御するための制御回路は複雑になり、機器としては高価なものになってしまう。又、液晶板は歩留まりが非常に悪く、広い面積のものを大量に製造することができないので、大画面の表示板を製造することは困難である。また、LEDを利用したカラーマトリックスであれば大画面を構成することができるが、カラー液晶と同様にコストが高つくという欠点がある。

【0004】ところで、従来からパチンコ店では大入台の表示や、大当たりの表示を台ごとに行っていたが、樹脂製のプレートガラス面に取り付けるなど、手作業で行うのがほとんどであった。しかし一度一度プレートを取り付けるとは手間がかかって面倒である。また、最近の電飾表示は華美になっており、このようなプレートを取り付けるだけでは目立ちにくい。

【0005】本発明はこのような点に着目したもので、特にパチンコ台上部の幕板部分を電光表示し、各種の情報を表示すると同時に、電光による装飾効果を発揮する

ことができる電光表示板を提供することを目的とする。

【0006】

【課題を解決するための手段】本発明では上記目的を達成するために、次のような手段を採用した。即ち、複数のアクリル酸樹脂板を積層し、これらのアクリル酸樹脂板の少なくとも1枚に彫刻を施し、このアクリル酸樹脂板の側端面からそれぞれ別個に光を照射可能とした。これによって、アクリル酸樹脂板を単位ごとに電光表示することができ、この樹脂板を積層していることによって、複数の彫刻を重ね合わせたり、複数の彫刻のうちから任意の彫刻だけを光によって浮き上がらせることが可能となる。また、アクリル酸樹脂板の側面から照射する光の光源は、3原色が独立した光源とした。この手段によって、アクリル酸樹脂板ごとに別々の色を照射することができ、より装飾性を増すことができる。また、3原色を各アクリル酸樹脂板ごとに混合するようにすれば、光の色の選択はさらに広がることになる。即ち、3原色が独立した光源とするという意味は、3原色のそれぞれ1色を各アクリル酸樹脂板に照射する構成と、それぞれのアクリル酸樹脂板に3原色を照射する構成の何れも含むものとする。

【0007】さらに、アクリル酸樹脂板に対する照射のための光源として、冷陰極管を用いた場合には、消費電力を低く押さえることができると同時に、発熱量も少なくすることができる。さらにまた、アクリル酸樹脂板の一番表側には、さらにハーフミラー板、あるいは偏光板を積層することとした。これによって、電光表示を行っていないときに表面側から見た場合には単なるガラス板、あるいは反射板としてしか見えないので、電光表示の効果がより強調されることになる。

【0008】

【発明の実施の形態】以下、本発明の一実施形態を、添付した図面に従って説明する。図1および図2は本発明の例をパチンコ台の上方に位置する幕板に適用したところを示し、1a・1b・1cはそれぞれ光透過性のアクリル酸樹脂板であり、無色透明板、あるいは着色透明板、半透明板などから適宜選択したものである。ここで、光透過性とは、アクリル酸樹脂板の一特徴としての、入射光が内部反射しながらアクリル内部を進行することができることを示し、光を遮断するような不透明や、透明度が低い半透明などは除くことを意味している。2a・2b・2cはそれぞれ冷陰極管からなる光源であり、2aが赤、2bが緑、2cが青という光の3原色をそれぞれ発光する。光源2a・2b・2cはアクリル酸樹脂板1a・1b・1cのそれぞれの両側端面に対応して設置されている。即ち、アクリル酸樹脂板1aの両側端面には赤色の光源2a・2aが設けられ、別の2枚についても同様の関係で設けられている。従って、光源2aが点灯するときにはアクリル酸樹脂板1aを照射し、光源2bが点灯するときにはアクリル酸樹脂板1b

を照射し、光源2cが点灯するときにはアクリル酸樹脂板1cを照射することになる。

【0009】ここで、それぞれのアクリル酸樹脂板1a・1b・1cのうち少なくとも片側表面には文字や任意の図形など、彫刻を施す。例えば、パチンコ台に適用するのであれば、図2のようにそれぞれのアクリル酸樹脂板1a・1b・1cに「ラッキー台」「大入台」や「スタート」などの文字を彫刻しておく。周囲の波線3は飾り用の囲みである。

【0010】ここで、図1中、4…4は並列接続された冷陰極管であり、その色は任意に着色されている。5…5はそれぞれに接続された光源、あるいは冷陰極管を点灯するための電源回路であり、これらの電源回路5…5はCPU6に接続され、オン・オフが制御される。CPU6には各光源2a～2c、および冷陰極管5…5の状態を制御するための情報が入力される。例えば、この情報としては、各台の当たり情報や、当たりの確率が高い台を示すためのラッキー台情報、あるいはスロットルが回転していることを示す情報など、複数の情報を入力することができ、CPU6ではこれらの情報に基づいて予め定められたプログラムに従って任意の光源や冷陰極管を点灯する。なお、この情報はそれぞれのパチンコ台から直接与えてもよいし、複数のパチンコ台を集中管理しているのであれば、この集中管理装置からアドレスを定めたいで情報を出力してもよい。パチンコ台から直接与える構成のほうがプログラムおよび回路としてはより簡易になるであろう。

【0011】いま、図2の彫刻を施したアクリル酸樹脂板1a・1b・1cを利用して、電光表示を行うとする。このとき、対象のパチンコ台がラッキー台であるならば、アクリル酸樹脂板1cに対して光源2cが照射されており、「ラッキー台」と彫刻した部分が青色光で照明されることになる。次に、スロットルがスタートすればアクリル酸樹脂板1bに対して緑色光が照射され、青色光で照射されている「ラッキー台」の表示と共に「スタート」の文字が緑色光で照明される。そして、大入りに突入した場合には「ラッキー台」および「スタート」に対する光源が消灯する代わりにアクリル酸樹脂板1aに赤色光が照射され、「大入台」の文字が赤色で表示さ

れる。尚、これらの表示のための光源1a～1cは点灯を持続させることもあるが、より効果的な照明のためには点滅させることが好ましい。これはCPU6に予め与えられるプログラムによって容易に達成することができる。ここで、冷陰極管5…5を点滅させれば、さらに効果的な照明が可能になる。

【0012】本実施形態では3枚のアクリル酸樹脂板を積層した構成を説明したが、積層する枚数や彫刻を施す文字などは自由に設定することができることはもちろんである。また、アクリル酸樹脂板1aの表面側にハーフミラー、あるいは偏光板をさらに積層させた場合には、消灯時には単なるミラーや反射板として把握されることになるので、点灯時の照明効果はより高くなる。また、別の実施例として、パチンコ台の任意の位置に反射形の光センサを設置しておき、遊戯者がパチンコ台の前に一定秒数座れば、さらに追加して積層したアクリル酸樹脂板に彫刻した「welcome」などの文字を照射する構成を追加的に採用することも自由である。

【0013】なお、本実施形態ではパチンコ台の幕板にこれら電光表示を適用する場合について説明したが、一般の広告板や装飾板などに広く活用することができるのはいうまでもなく、これらも本発明の範囲に属する。

【0014】

【発明の効果】本発明では上述した手段を用いたので、アクリル酸樹脂板の予め彫刻された文字などが複数の色からなる光で照明され、非常に効果的な電光表示板とすることが可能となった。

【図面の簡単な説明】

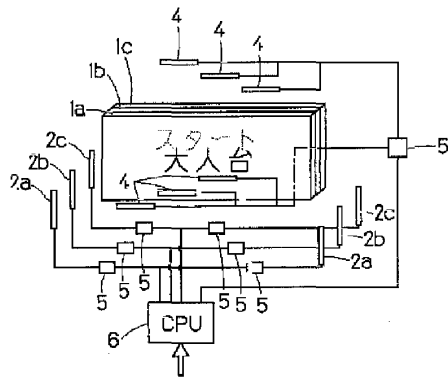
【図1】本発明の一実施形態を示す概略図、

【図2】アクリル酸樹脂板の一実施形態を示す平面図である。

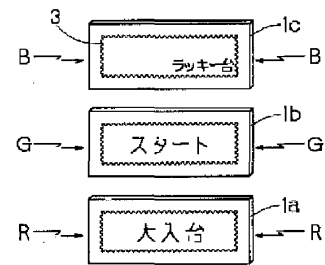
【符号の説明】

- 1a・1b・1c アクリル酸樹脂板
- 2a・2b・2c 光源
- 3 波線
- 4 冷陰極管
- 5 光源あるいは電源回路
- 6 CPU

【図1】



【図2】





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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
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6300 Riverside Drive
Dublin, OH 43017

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PTO/SB/08a (01-10)

Doc description: Information Disclosure Statement (IDS) Filed

Approved for use through 07/31/2012. OMB 0651-0031

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	16933932
	Filing Date	2020-07-20
	First Named Inventor	William Dunn
	Art Unit	2835
	Examiner Name	Michael A Matey
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	First Named Inventor	William Dunn		
	Art Unit	2835		
	Examiner Name	Michael A Matey		
	Attorney Docket Number	MAN2241-045R		

	1	JPH855567	JP	A	1996-02-27	Canon KK		
	2	JP2003076286	JP	A	2003-03-14	NGK Insulators LTD		

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		16933932
	Filing Date		2020-07-20
	First Named Inventor	William Dunn	
	Art Unit	2835	
	Examiner Name	Michael A Matey	
	Attorney Docket Number	MAN2241-045R	

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Signature	/Adam J. Smith/	Date (YYYY-MM-DD)	2020-10-29
Name/Print	Adam J. Smith	Registration Number	72962

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Espacenet

JPH0855567A IMAGE DISPLAY DEVICE

Applicants: CANON KK

Inventors: AZUMA HISAFUMI,KAWATE SHINICHI,SATO YASUE

Classifications:

IPC **G09F9/00; H01J29/00; H01J31/12; H01J7/24;** (IPC1-7): H01J29/86; G09F9/00; H01J7/24;

CPC **H01J29/006 (EP); H05K7/20972 (EP);** H01J2201/3165 (EP); H01J2329/00 (EP);

Priorities: JP12331595A 1995-05-23; JP12744694A 1994-06-09

Application: JPH0855567A 1995-05-23

Publication: JPH0855567A 1996-02-27

Published as: **AT188311T; AT207240T; CN1102797C; CN1133487A; DE69514151T2; DE69523344T2; EP0686991A1; EP0686991B1; EP0844640A2; EP0844640A3; EP0844640B1; JP3234740B2; JPH0855567A; KR100220358B1; KR960002433A; US5869919A**

IMAGE DISPLAY DEVICE

Abstract

PURPOSE:To substantially eliminate image distortion and a different error so as to enable an excellent image to be stably displayed by providing a blowing means for circulating gas between a display panel and an outer case.

CONSTITUTION:A fan (blowing means) 117 is provided between a display panel 100 and an outer case 115 so that air is taken in from outside the display panel 100 to forcibly create cooling airflow. As dust is removed by a filter 118, cooling air introduced from the outside by the fan 117 is allowed to advance following the flow indicated by the index line 116 to cool a substrate (rear plate) 201, while the temperature of the cooling air rises. Thereafter, the cooling air circulates around a face plate 205 and the temperature of the plate 205 approaches that of the cooling air through heat exchange. As a result, the temperature difference between the substrate 201 and the plate 205 decreases, the distribution of temperatures inside the panel 100 becomes uniform, the difference in the amount of thermal expansion between both plates decreases, and heat distortion decreases, whereby image distortion and a different error can be prevented.

(19) 日本国特許庁 (J P)

(12) 公開特許公報 (A)

(11) 特許出願公開番号

特開平8-55567

(43) 公開日 平成8年(1996)2月27日

(51) Int.Cl. ⁹	識別記号	庁内整理番号	F I	技術表示箇所
H 0 1 J 7/24				
G 0 9 F 9/00	3 0 4 B	7426-5H		
H 0 1 J 29/86	Z			

審査請求 未請求 請求項の数11 O L (全 14 頁)

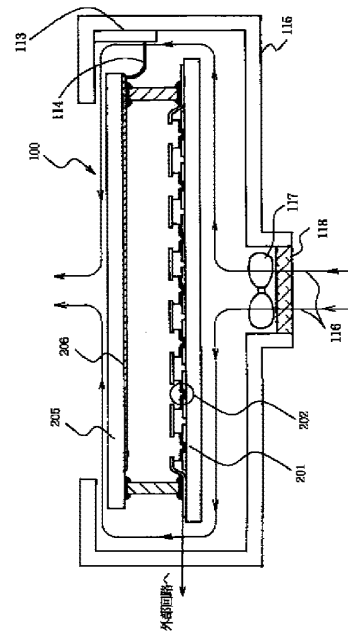
(21) 出願番号	特願平7-123315	(71) 出願人	000001007 キヤノン株式会社 東京都大田区下丸子3丁目30番2号
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(33) 優先権主張国	日本 (J P)	(74) 代理人	弁理士 若林 忠

(54) 【発明の名称】 画像表示装置

(57) 【要約】

【目的】 画面に歪みが発生することなく、色ずれの生じない画像表示装置を実現すること。

【構成】 蛍光体を配したフェースプレートと、電子放出素子を配したリアプレートと、を対向配置し、前記電子放出素子より放出された電子を前記蛍光体に照射して画像を表示する表示パネルを、外装ケース中に収容して構成される画像表示装置において、前記表示パネルと、前記外装ケースとの間の気体を流通させるための送風手段を備えたことを特徴とする。



【特許請求の範囲】

【請求項1】 蛍光体を配したフェースプレートと、電子放出素子を配したリアプレートと、を対向配置し、前記電子放出素子より放出された電子を前記蛍光体に照射して画像を表示する表示パネルを、外装ケース中に収容して構成される画像表示装置において、

前記表示パネルと、前記外装ケースとの間の気体を流通させるための送風手段を備えたことを特徴とする画像表示装置。

【請求項2】 前記リアプレートに熱伝導部材を設けた請求項1に記載の画像表示装置。

【請求項3】 前記フェースプレートを透光性の導電性材料で被覆した請求項1に記載の画像表示装置。

【請求項4】 前記リアプレートの複数の平板状の突起物を設けた請求項1に記載の画像表示装置。

【請求項5】 前記熱伝導部材と、前記透光性の導電性部材と、が電氣的に接続された請求項2または請求項3に記載の画像形成装置。

【請求項6】 前記複数の平板状の突起物の長軸が前記送風手段による基体の流通方向と平行に配置されている請求項4に記載の画像表示装置。

【請求項7】 前記外装ケースの前記リアプレート側の面の中央部に前記送風手段が配置されている請求項1に記載の画像表示装置。

【請求項8】 前記外装ケース及び前記リアプレートの下部の間に前記送風手段が配置されている請求項1に記載の画像表示装置。

【請求項9】 前記表示パネルを駆動する駆動回路が前記外装ケース内に配置されている請求項1に記載の画像表示装置。

【請求項10】 前記送風手段が横長ファンである請求項1、4、6のいずれかに記載の画像表示装置。

【請求項11】 前記熱電子放出素子が表面伝導型電子放出素子である請求項1～10のいずれかに記載の画像表示装置。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は、電子源を用いたフラットな画像表示装置に関する。

【0002】

【従来の技術】近年、大きく重いブラウン管に代わる画像表示装置として、軽く、薄型のいわゆるフラットディスプレイが注目されている。フラットディスプレイとしては液晶表示装置(Liquid Crystal Display)が盛んに研究開発されているが、液晶表示装置には画像が暗い、視野角が狭いといった課題が依然として残っている。液晶表示装置に代わるものとして電子源より放出される電子ビームを蛍光体に照射して蛍光を発生させることで画像を表示する自発光型のフラットディスプレイがある。電子線源を用いた自発光型のフラットディスプレイは液

晶表示装置に比べて明るい画像が得られると共に視野角も広い、更に、大画面化、高精細化の要求にもこたえ得るとから、そのニーズが高まりつつある。

【0003】電子線を用いた自発光型平板状画像表示装置は、例えばフェースプレート(face plate)とリアプレート(rear plate)に挟まれた真空パネル内に、電子ビームを発生する電子放出素子を配して構成されるものである。電子放出素子として表面伝導型電子放出素子を用い、該電子ビームを加速して蛍光体に照射し、蛍光体を発光させて画像を表示させる薄型の画像表示装置が本出願人により出願されている(特開平3-261024号公報等)。

【0004】図10は、上述の表面伝導型電子放出素子を用いた平板状画像表示装置の1例を示す模式的断面図である。

【0005】図10において、1001は青板ガラス等の絶縁材で構成される基板、1002は表面伝導型の電子放出素子である。1003は基板1001上に形成された絶縁層、1004は基板1001および絶縁層1003上に形成され、電子ビームが通過する孔を持った変調電極であるところのグリッドである。1005はA1薄膜のメタルバック1007で覆われた蛍光体1006がパネル内側に設置された青板ガラスからなるフェースプレート、1008はフリットガラスであり、外枠1009を挟んでフェースプレート1005と基板1001が封着され、真空外囲器を構成している。表面伝導型電子放出素子1002、グリッド1003は外部駆動回路(不図示)に接続され、メタルバック1007は高圧ケーブル1014によって高圧電源1013に接続されている。

【0006】図11は表面伝導型の電子放出素子1002の構成を詳細に示す模式図である。

【0007】図11において1102、1103は一定の間隔Lを隔てて設置された素子電極、1104は有機Pd(例えばCCP4230奥野製薬株式会社製)を塗布することによって形成された薄膜である。1105は電子を放出する電子放出部で、フォーミングと呼ばれる通電処理によって形成される。ここでフォーミングとは、素子電極1102、1103間に電圧を印加通電し、局所的に前記薄膜1104を破壊、変形もしくは変質させ、電氣的に高抵抗な状態にした電子放出部1105を形成することである。

【0008】なお、電子放出部1105としては、薄膜1103の一部に発生した亀裂を用いることもある。この場合には、その亀裂付近から電子放出が行われる。この他、表面伝導型電子放出素子として薄膜としてSnO₂膜を用いたもの、Au薄膜によるもの[G. Dittmer: "Thin Solid Films", 9, 317 (1972)]、In₂O₃/SnO₂薄膜によるもの[M. Hartwell and C. G. Fon

stad:” IEEE Trans. ED Conf. ”、519 (1975)]、カーボン薄膜によるもの [荒木久 他: 真空、第26巻、第1号、22頁 (1983)] 等が報告されている。

【0009】上述の画像表示装置は内部の圧力がおおよそ 10^{-6} torrの真空中に維持され、外部駆動回路によって図11に示した素子電極1102、1103に駆動パルス電圧が印加されると電子がビーム状に放出される。該電子ビームはグリッド1003を通過し、高圧電源1013から蛍光体1006、メタルバック1007に印加された正の高電圧によって加速され、蛍光体1006に衝突して蛍光体1006を発光させる。前記電子ビームの速度は、駆動回路1020がグリッド1006に印加する電圧によって制御することができ、それによって蛍光体の発光状態が制御され、所望の画像が表示される。

【0010】なお、電子源として表面伝導型電子放出素子を用いたもののほか熱カソードを用いた熱電子源、電界放出型電子放出素子 (W. P. Dyke & W. W. Dolan, "Field emission" Advance in Electron Physics、8、89 (1956) や C. A. Spindt, "Physical properties of thin-film field emission cathodes with molybdenum cones", J. Appl. Phys.、47、5248 (1976) 等)、金属/絶縁層/金属型電子放出素子 (C. A. Mead, "The tunnel-emission amplifier, J. Appl. Phys.、32、646 (1961) 等) を用いたものが知られている。

【0011】

【発明が解決しようとする課題】このような画像表示装置にあっては、電子を蛍光体に衝突させて蛍光を発せしめること、電子放出素子に電流を流して電子を放出させること、及び平面的に複数個配列された電子放出素子を電気配線を介して順次駆動すること等、に起因して必然的に発熱が生じる。この発熱によって基板1001及びフェースプレート1005は不可避免的に加熱され、両者に温度差を生じたり、部分的な温度の不均一を生ずる。そしてこの温度差若しくは温度の不均一により熱膨張量の差が生じ、場合によっては画面が歪んでしまったり、色ずれが起きるということが懸念される。

【0012】この問題は画面サイズが大きくなるとさらに深刻な問題となることが予想される。

【0013】本発明は上述した技術的課題を解決した画像表示装置を提供することを目的とする。本発明の別の目的は、表示パネルを構成するリアプレートとフェースプレートの熱膨張量の差を生じないか、若しくは極めて低い値に抑えた画像表示装置を提供することにある。本

発明のさらに別の目的は、画像の歪みおよび色ずれを実質的に生ずることなく優れた画像を安定して表示できる画像表示装置を提供することにある。

【0014】

【課題を解決するための手段】上述した目的を達成する本発明の画像表示装置は、下述する構成のものである。

【0015】即ち、本発明の画像表示装置は、蛍光体を配したフェースプレートと、電子放出素子を配したリアプレートと、を対向配置し、前記電子放出素子より放出された電子を前記蛍光体に照射して画像を表示する表示パネルを、外装ケース中に収容して構成される画像表示装置において、前記表示パネルと、前記外装ケースとの間の気体を流通させるための送風手段を備えたことを特徴とするものである。

【0016】本発明の画像表示装置によれば、上述した解決すべき技術的課題が解決され、上述の目的が達成される。本発明の画像表示装置においては、送風手段を備えたことで表示手段を構成するフェースプレートとリアプレートとの間で空気を媒介とした熱交換が行われ、各プレート間の温度差が少なくなる。また、フェースプレート、リアプレートそれぞれの温度分布も均一化されるため、リアプレートとフェースプレートの熱膨張量の差が減少する。これにより、本発明の画像表示装置は、画面の歪みおよび色ずれを実質的に生ずることがなく優れた画像を安定して表示できる。

【0017】更にリアプレートに高熱伝導性の導電性材料からなる熱伝導部材を設けた場合には、リアプレートでの放熱を更に良好に行うことができ、更に効率良く表示パネルの温度分布均一化が図られる。また、フェースプレート面上を透明な導電性材料で被覆し、熱伝導性材料を用いてフェースプレート、リアプレート上に形成した熱伝導性部材を連結させることによって、一層の熱分布均一化向上が図られる。そして、この構成では画像表示領域での自然光の反射をも低減することが可能であり、更にはほこりなどの吸着が抑制されるという利点もある。

【0018】

【実施例】本発明の画像表示装置は、前述した通りの構成のものである。

【0019】図1を参照しながら本発明の画像表示装置の一例を説明する。図1は、本発明の画像表示装置の一例を示す模式図である。図1の画像表示装置は、外装ケース115中に表示パネル100を収容して構成されている。表示パネル100は、蛍光体206を配したフェースプレート205と、電子放出素子202を配したリアプレート201と、を対向配置させて構成されている。117は、表示パネル100と、外装ケース115との間の気体を流通させるためのファン (送風手段) である。ここで、ファン117は、パネル外部より空気を取り入れ、強制的に矢印116の方向に示す冷却空気を

の流れを作り出すように配されている。

【0020】以上の構成により本発明の画像表示装置は、基本的になりたつ。図1に示した例ではこれらの構成に加えて、高圧電源113、高圧電源113から表示パネル100の蛍光体に高電圧を供給するための高圧ケーブル114及び、外部より取り入れた空気中のごみや塵を取り除くためのフィルタ118が設けられている。

【0021】本例における表示パネル100の冷却動作について以下に説明する。

【0022】冷却用空気は、表示パネル100を囲む外装ケース115に取り付けられたファン117によって外部より導入される。フィルタ118によってごみが除去された冷却用空気は、指示線116が示す流れにしたがって進み、表示パネル100の基板201を冷却し、同時に該冷却用空気の温度も上昇する。その後、前記冷却用空気は表示パネル100のフェースプレート205側に回り込み、フェースプレート205は回りこんだ冷却用空気と熱交換し、冷却用空気の温度に近づく。結果的に表示パネル200のリアプレート、すなわち基板201とフェースプレート205の温度差が少なくなり、フェースプレート205、基板201のそれぞれの温度分布およびこれらを含む表示パネル100内の温度分布が均一化する。これにより、両プレートの熱膨張量の差が減少して熱歪みが減少し、画像歪みや色ずれが実質的に生じなくなる。

【0023】なお、空気の流れを逆にし、フェースプレート205側から空気を導入して基板201側に供給する構成とすることもできる。

【0024】送風手段の外装ケースへの取付け位置は、特に限定されるものではないが、フェースプレート部の開口を覆う画面カバーを設けた場合には、送風手段によって流通する空気が外部の空気と直接接触しないので、熱交換の効率が向上する。

【0025】更にリアプレートに高熱伝導性の導電性材料からなる熱伝導部材を設けた場合には、リアプレートでの放熱を更に良好に行うことができ、更に効率良く表示パネルの温度分布均一化が図られる。また、フェースプレート面上を透明な導電性材料で被覆し、熱導電性材料を用いてフェースプレート、リアプレート上に形成した熱伝導性部材を連結させることによって、一層の熱分布均一化向上が図られる。そして、この構成では画像表示領域での自然光の反射をも低減することが可能であり、更にはほこりなどの吸着が抑制されるという利点もある。

【0026】このリアプレート上に配置される熱伝導性部材材料としては高熱伝導性材料であるCu、Alが適しており、特にCuが望ましい。またフェースプレート上に配置される熱伝導性部材材料としてはITO、SnO₂が適している。

【0027】表示パネルに画像を表示させるためにIC

を含む駆動回路が必要であるが、この駆動回路をも冷却するのが好ましい。そのため気流を妨げないように空間を介して駆動回路を配置させると画像表示装置の肥大を招くことなく、装置を形成することができる。

【0028】本例で示した表示パネル100は入力された表示画像信号に応じた駆動信号を生成する駆動回路（不図示）により駆動されるものである。表示パネル100について図2および図3を参照して説明する。

【0029】図2は表示パネル100の構成を示す断面図、図3(a)および図3(b)のそれぞれは、図2中の表面伝導型の電子放出素子の上面図および断面図である。

【0030】尚、電子放出素子202の数は、図に示したものに限定されるものではない。

【0031】図2において、201はガラス等の絶縁材で構成され、リアプレートである基板、202は表面伝導型の電子放出素子である。203は基板201上に形成された絶縁層、204は基板201および絶縁層203上に形成され、電子ビームが通過する孔を持った変調電極であるところのグリッドである。205はフェースプレートであり、A1薄膜のメタルバックが配された蛍光体206がフェースプレート205の内側に設けられている。208はフリットガラスであり、外枠209を挟んでフェースプレート205と基板201が封着され、真空外囲器を形成している。

【0032】素子電極203、204、グリッド204、蛍光体206は、各配線（不図示）によって外囲器外部に取り出され、電気的な接続がなされている。

【0033】電子放出素子202について図3を参照して説明する。

【0034】図3において、302、303は一定の間隔を隔て設置された素子電極、304は電子放出部を含む薄膜、305は電子放出部である。本例における電子放出部305を含む薄膜304のうち、電子放出部305となる部分は粒径が数十オングストロームの導電性微粒子からなり、電子放出素子305以外の電子放出部を含む薄膜304は微粒子膜からなる。なお、ここで述べる微粒子膜とは、複数の微粒子が集合した膜であり、その微細構造として、微粒子が個々に分散配置された状態のみならず、微粒子が互いに隣接、あるいは重なり合った状態（島状も含む）の膜をさす。なお、電子放出部を含む薄膜304は、導電性微粒子が分散されたカーボン薄膜等としてもよい。

【0035】本例の画像表示装置の作製方法を以下に述べる。

【0036】まず、表面伝導型電子放出素子202の作製法について述べる。基板201を十分に洗浄後、真空蒸着技術、フォトリソグラフィ技術（エッチング、リフトオフ等の加工技術も含む）により該基板201の面上にニッケル等の素子電極302、303を、例えば素子

電極間隔 $L=2\mu\text{m}$ 、素子電極長さ $W=300\mu\text{m}$ 、素子電極302、303の膜厚 $d=1000\text{\AA}$ の大きさで形成する。素子電極302、303の材料としては導電性を有するものであれば金属、半導体等どのようなものであっても良い。

【0037】次に、基板201上に設けられた素子電極302と素子電極303との間に、有機金属溶液を塗布して放置することにより、有機金属薄膜を形成する。なお、有機金属溶液とは、前記Pd、Ru、Ag、Au、Ti、In、Cu、Cr、Fe、Zn、Sn、Ta、W、Pb等の金属を主元素とする有機化合物の溶液である。この後、有機金属薄膜を加熱焼成処理し、リフトオフ、エッチング等によりパターニングして図3に示す様な薄膜304を形成する。なお、薄膜304の材質は上述した例のみに制限されるものではなく、Pd、Ru、Ag、Au、Ti、In、Cu、Cr、Fe、Zn、Sn、Ta、W、Pb等の金属、PdO、 SnO_2 、 In_2O_3 、PbO、 Sb_2O_3 等の酸化物、 HfB_2 、 ZrB_2 、 LaB_6 、 CeB_6 、 YB_4 、 Gd_2B_4 等の硼化物、TiC、ZrC、HfC、TaC、SiC、WC等の炭化物、TiN、ZrN、HfN等の窒化物、Si、Ge等の半導体、カーボン、AgMg、NiCu、Pb、Sn等でも良い。さらに、電子放出部を含む薄膜304の形成法は、真空蒸着法、スパッタ法、化学的気相堆積法、分散塗布法、ディッピング法、スピナー法等が適用可能で、要するに薄膜が形成できれば特に作製方法は問わない。

【0038】なお、電子源として表面伝導型電子放出素子のほか熱カソードを用いた熱電子源、電界放出型電子放出素子等、要するに電子を放出する素子であれば特に制限されない。

【0039】次いで、表面伝導型電子放出素子202に電力を供給するための配線（不図示）を形成する。まず、Au、Cu、Al等の金属の蒸着、スパッタ等の手段を用い数 μm 程度の厚さで成膜し、フォトリソグラフィ技術（エッチング、リフトオフ等の加工技術も含む）によって素子電極303、304に重なる様に配線を施す。さらに、前記配線の端は外囲器外に出ており、外部と電気的接続ができる様になっている。なお、ここで配線の作製方法はこの他、メッキ法、導電性ペーストを用い他印刷法等他の手段も適応でき、作製手段は特に制限されない。

【0040】次いで、グリッド204と絶縁層203を形成する。まず SiO_2 をスパッタ法により1～5 μm 程度成膜し、さらにAu、Cu等の金属を0.5～1 μm 程度蒸着またはスパッタ法で成膜する。フォトリソグラフィ技術（エッチング、リフトオフ等の加工技術も含む）によって表面伝導型電子放出素子202の電子放出部305よりやや大きく電子を通過させる孔を前記Au、Cu等の金属に開け、さらに孔を開けたAu、Cu

等の金属をマスクにして前記絶縁膜である酸化膜をエッチングし、同様に電子を通過させる孔を開ける。さらに、前記Au、Cu等の金属をフォトリソグラフィ技術（エッチング、リフトオフ等の加工技術も含む）によって配線を兼ねたグリッドを形成する。該グリッド配線の端は外囲器外に出ており、外部と電気的接続ができる様になっている。

【0041】蛍光体206を塗布し、該蛍光体にAlのメタルバックを施したフェースプレート205と、前述の表面伝導型電子放出素子等を作製した基板201とを外枠209を間に挟んだ形態とし、フェースプレート205、基板201と外枠209が接する部分にフリットガラスを塗布し、フリットガラスの封着温度（例えば、日本電気硝子（株）製のLS-0206を用いた場合450℃）で、所定の時間（同フリットでは10分）加熱し、封着を行う。なお、蛍光体206としてカラー蛍光体を用いる場合には、蛍光体206の画素と基板の電子源の位置合わせを行う。

【0042】排気管（不図示）を通して表示パネル100内の圧力をおおよそ 10^{-6}torr に真空排気する。続いて、フォーミング、すなわち素子電極302、303に通電処理を行い、さらに表示パネル100全体を加熱して脱ガス、ゲッタ（不図示）をフラッシュし、排気管を封じ切り、表示パネル100を作製する。

【0043】次に、上述の様に作製した表示パネル100を外装ケース115内に設置して画像表示装置が得られる。

【0044】以下、具体的な実施例を挙げて本発明を詳細に説明するが、本発明はこれに限定されるものではない。

【0045】（実施例1）図1に示される画像表示装置を作製した。

【0046】まず、表示パネル100を作製した。基板201の大きさは240mm×320mm、フェースプレートの大きさは190mm×270mmであった。電子源である表面伝導型電子放出素子202は、図3に示した構造を持ち、膜厚1000 $\text{\AA}$ の金である素子電極302、303を、素子電極間隔 $L=2\mu\text{m}$ 、素子電極長さ $W=150\mu\text{m}$ として形成した。続いて、薄膜304として有機金属溶液である有機パラジウム（奥野製薬（株）製、ccp-4230）含有溶液を塗布した後、300℃で10分間の加熱処理をして、パラジウムを主成分とする微粒子）からなる微粒子膜を形成した。

【0047】次に、表面伝導型電子放出素子202に電力を供給するための配線（不図示）として、厚さ2 μm 、幅150 μm のCu配線を施した。グリッド204として厚さ1 μm 、幅800 μm 、電子通過孔として500 μm ×100 μm を備えた金にて形成した。絶縁層203としては SiO_2 を用いた。

【0048】上記の各部材のうち、金属、 SiO_2 はス

パッタ法によって成膜し、加工はフォトリソグラフィ技術（エッチング、リフトオフ等の加工技術も含む）によって行った。フェースプレート205はRGBの三色のカラー蛍光体206を持ち、それぞれ各色の画素の大きさは $800\mu\text{m} \times 250\mu\text{m}$ であった。

【0049】次に、基板201とフェースプレート205を位置合わせして外枠209を挟んだ状態とし、日本電気硝子（株）製のLS-0206を用いて、 450°C で10分間加熱して封着した。続いて、排気管（不図示）を通して表示パネル内の圧力を 10^{-6}torr に真空排気した。フォーミングは三角波形（底辺 1msec 、周期 10msec 、波高値 5V ）の電圧パルスで 60sec 間印加して電子放出部を305を形成した。

【0050】次に、表示パネル100全体を 130°C で24時間加熱脱ガスし、ゲッタ（不図示）をフラッシュして排気管を封じ切り、本例の画像表示装置のパネル部を作製した。続いて上述の様に作製した表示パネル100を、図1に示す様に、風量 $1\text{m}^3/\text{min}$ の性能を持つファン117を有する外ケース115内に設置して本例の画像表示装置を構成した。

【0051】上述の様に作製した画像表示装置に外部駆動回路より電気信号を送って駆動し、画像を表示させた。長時間表示させても画面周辺部での色ずれは見られず、優れた画像を安定して表示できた。

【0052】（実施例2）フェースプレートの前面に透明なカバーを設置したものについて説明する。

【0053】図4は本例の画像表示装置の構成を示す断面図である。

【0054】本例は、図1に示した第1の実施例と同様に構成された表示パネル100を用いるものであり、表示パネル100を覆う透明な画面カバー419を設けたものである。その他の部材である高電圧源413、高圧ケーブル414、外ケース415、ファン417およびフィルタ418のそれぞれは図1中の高電圧源113、高圧ケーブル114、外ケース115、ファン117およびフィルタ118と同様に機能するものである。

【0055】本例における外装ケース415には、表示パネル100のフェースプレート側となる面に上述した画面カバー419が取り付けられている。この画面カバー419によって表示パネル100のフェースプレート面からの排気（および吸気）は不可能となるため、ファン417およびフィルタ418のそれぞれは、外ケース415の側部（図中左端部）の表示パネル100の基板裏面部分に対応する位置に設けられている。また、上記の側部の表示パネル100と画面カバー419の間に対応する位置には、ファン417によって取り込まれた冷却用空気を排出するための孔が設けられている。

【0056】画面カバー419はガラス、プラスチック等が好適であるが、表示パネル100からの光を透過するものであれば材質は特に問わない。また画面カバー4

19に光学薄膜のコーティング等の反射防止処理、プラスチックフィルムのラミネート等の飛散防止処理等の処理を行っても良い。反射防止処理を施した場合には、視認性を向上することができ、飛散防止処理を行った場合には、安全性を向上することができる。

【0057】表示パネル100の作製方法、画像の表示方法は第1の実施例と同様に行うことができる。

【0058】次に、本例における冷却動作について説明する。

【0059】第1の実施例と同様に、ファン417によって外部より導入され、フィルタ418によってごみが除去された冷却用空気は指示線416が示す流れにしたがって表示パネル100の基板201を冷却し、同時に該空気の温度も上昇する。その後、前記冷却空気は表示パネル100のフェースプレート205側に回り込み、フェースプレート205と画面カバー419の間を通り抜けながらフェースプレート205と熱交換し、冷却空気の温度に近づく。

【0060】本例では、画面カバー419を設けたことによって、外部の空気と冷却空気とが直接接しないために、実施例1と比較して熱交換の効率が向上した。

【0061】この結果、実施例1と同様に表示パネル200のリアプレートすなわち基板201とフェースプレート205の温度差がさらに小さくなり、フェースプレート205、基板201それぞれの温度分布およびこれらを含む表示パネル内の温度分布がより一層均一化した。これにより、両プレートの熱膨張量の差が減少して熱歪みがさらに減少し、画像歪みや色ずれがさらに減少した。また、破壊が発生することもなく、信頼性が向上した。

【0062】本例の構成について、以下により具体的に説明する。

【0063】表示パネル100として、実施例1と同じパネルを用い、図4に示す様に設置した。画面カバー419として表面に厚さ 0.05mm プラスチックフィルムを貼り、飛散防止処理をした厚さ 2mm のアクリル板をフェースプレート205から 1cm 離して設置した。ファン117の風量は実施例1と同じ $1\text{m}^3/\text{min}$ であった。

【0064】次に、外部回路より電気信号を送って表示パネルを駆動し、画像を表示させた。1時間動作させて温度分布が一定になった後、フェースプレート205と基板201の温度差を測ったところ、実施例1のものよりも温度差が少なかった。また、画面周辺部での色ずれは全く見られず、破壊も起こらなかった。

【0065】また、送風ファン417、フィルタ418を図1に示したように外ケースに設置し、排気口をフェースプレート205とリアプレート201が対向する面と略垂直な面、すなわち、図4における側面のうちの1つの面あるいは複数の面に1つあるいは複数の個設けても

よい。このように構成した場合、空気は送風ファン417によってリアプレート401を冷却後、排気口を設置していない側面を通してフェースプレート205側へ送られてフェースプレート205を冷却し、前記排気口より排気され、実施例1と同様の効果を得ることができる。

【0066】排気口を1つ設ける場合には、空気の流れの制御が容易となるため、発熱部が偏在する画像表示装置での冷却に適したものとなる。

【0067】排気口を複数設ける場合には、フェースプレートの略中心点に対して対称となるように対向して1対設けることが好ましい。このような構成とすることにより、リアパネルから排気口を設置していない側面を通して送られてくる空気がフェースプレートの略中心にてぶつかり、各排気口から排気される。この場合には、温度分布が均一になりやすいという特徴を有する。

【0068】(実施例3)電子源に熱電子源を用いた例について説明する。

【0069】本例の画像表示装置全体の構造は図1に示した実施例1と同様であり、表示パネル100の構造のみを異なるものであるため、表示パネル部分のみの構造について説明する。

【0070】図5は本例で用いた電子源の構成を示す斜視図である。

【0071】図5において、201はガラス基板、502は厚さ1 μm のタングステンでできたフィラメント層、503は配線の代わりとなる厚さ200 μm 、幅300 μm のCuでできた導電性支持層、504は熱電子を放出する熱電子放出部である。さらに、図6に電子ビーム制御用グリッドの構成を示す。同図において603は厚さ1ミリの感光性ガラス基板でできた絶縁基板、604は該絶縁基板603上に密着した厚さ1 μm のAuでできたグリッド電極であり、この絶縁基板603とグリッド電極604には光学的に位置合わせされた大きさ400 μm ×100 μm の電子通過孔が開いている。

【0072】本例における上記の部分以外の表示パネルの構造は図2に示したものと同じであり、フェースプレート205は画像表示装置の構造も図1に示したものと同じである。図5、図6において導電性支持層503を介して熱電子放出部505に電流を流すことによって電子放出部505が加熱され熱電子を放出する。熱電子はグリッド604によって変調され、さらに高圧電源113より蛍光体206に印加された高電圧によって加速され、蛍光体206に衝突して蛍光体206を発光させ、画像が表示される。

【0073】本例の表示パネル100は実施例1のものと同じ大きさを持つ。すなわち、基板201の大きさは240mm×320mm、フェースプレートの大きさは190mm×270mmで、RGBの三色のカラー蛍光体206を持ち、それぞれ各色の画素の大きさは800

μm ×250 μm とした。絶縁基板603とグリッド電極604は基板201の熱電子源等の加工と別に、両方とも金属はスパッタ法によって成膜し、加工はフォトリソグラフィ技術(エッチング、リフトオフ等の加工技術も含む)によって行った。グリッド電極604を有する絶縁基板603を表示パネル内に設置し、外部と電気的な接続を取り、第1の実施例と同様に基板201とフェースプレート205を位置合わせして外枠209を挟み、日本電気硝子(株)製のLS-0206を用い450℃、10分間加熱し封着した。その後の作製工程は実施例1と同様に行った。

【0074】次に、上述の様に作製した表示パネル100を図1の様に、風量1 m^3/min の性能を持つファン17を有する外ケース115内に外ケース115からフェースプレートを1cmはなして設置した。

【0075】上述の様に作製した画像表示装置に外部回路より電気信号を送り駆動させ画像を表示させた。本例では電子源として熱電子源を用いているので基板からの熱の発生が大きい。1時間動作させ温度分布が一定になった後、フェースプレート205と基板201の温度差を測ったところ±6℃以内であり、実施例1よりも温度差が大きかったが、さらに長時間動作させても画面周辺部での色ずれは見られず、破損も起こらなかった。

【0076】[実施例4]画像表示装置内にパネルを駆動する電子回路を内蔵させた例について説明する。図7に本例の画像表示装置を示す。

【0077】図7において、715は外装ケース、717は風量4 m^3/min のファン、720は電子放出素子およびグリッドを電気的に駆動するための駆動回路、721は電子放出素子およびグリッドへ電気信号を送るためのケーブルである。

【0078】本例のこの他の構成は図1に示した実施例1と同様である。図7中、100は表示パネル、713は高圧電源であり、714は高圧電源から表示パネル100の蛍光体に高電圧を供給するための高圧ケーブルである。715は本画像装置の外装ケース、716は冷却空気の流れを表す指示線、717はパネル外部より空気を取り入れ、強制的に矢印716に示す冷却空気の流れを作り出すためのファンであり、718は外部より取り入れた空気中のあるごみや塵を取り除くためのフィルタである。

【0079】本例における外装ケース715は、平板状の表示パネル100とともに駆動回路720をも囲むもので、表示パネル100のフェースプレート201(図2参照)側の面にはフェースプレート201を露出させる大きな開口が設けられ、基板201側の面には、略中央部にファン717およびフィルタ718を収容するための筒状の容器が形成されている。

【0080】また、駆動回路720は、中央に冷却用の空気を通すための開口を有するものであり、これによ

り、冷却用の空気は、駆動回路の裏面もしくは表示パネル100と駆動回路720の間を通過して表示パネル100のフェースプレート201側へ流れる。

【0081】実施例1と同様にファン717によって外部より導入され、フィルタ118によってごみが除去された冷却用空気は指示線116が示す流れにしたがって駆動回路720と表示パネル100の基板201を冷却し、同時に該空気の温度も上昇する。その後前記冷却空気は表示パネル100のフェースプレート205側に回り込み、フェースプレート205と画面カバー419の間を通り抜けながらフェースプレート205と熱交換し冷却空気の温度に近づく。1時間動作させ温度分布が一定になった後、フェースプレート205と基板201の温度差を測ったところ実施例1と同様温度差は極めて小さく、さらに長時間表示させても画面周辺部での色ずれは見られず、破損も起こらなかった。

【0082】本例のものは、駆動回路が組み込まれているので、使用する際には表示画像信号を供給するのみで表示が行われるため、装置の使用性が向上したのとなっている。

【0083】(実施例5) フェースプレート表面上に熱伝導の良好な透明膜を被覆し、リアプレート表面上にリアプレート材(青板ガラス)よりも熱伝導率が大なる金属膜825と平板状の突起物からなるフィンを形成した例について説明する。図8に本例の画像表示装置を示す。

【0084】図8において、830はフェースプレートの温度均一化、反射防止と帯電による埃の付着を防止する目的で、フェースプレート表面上にコーティングした熱伝導部材の透明膜である。817は風量 $5\text{ m}^3/\text{min}$ の横流ファンであり、825はリアプレート裏面上に形成した熱伝導部材であるAgの金属膜825、さらに、金属膜825上には、Agのフィン827を設置した。本例のその他の構成は実施例2と同様である。

【0085】本例の構成において、フェースプレート、外枠、そして基板からなる表示パネル100の作製方法、画像の表示方法は実施例1と同様である。フェースプレート表面上にコーティングした透明膜830は、真空蒸着によりITO/SnO₂を塗布して成膜した。

【0086】リアプレート裏面上にはAgの金属膜825と、さらに、金属膜825上にフィン827を形成した。金属膜825、フィン827ともにスクリーン印刷により形成し、金属膜825の厚さはほぼ $20\text{ }\mu\text{m}$ 程度、前記フィン827の高さ、幅、長さはそれぞれ数十 μm 、1mm、5mmである。金属膜825の熱伝導率は 430 W/mK 程度であり、リアプレート(青板ガラス)の熱伝導率(1.1 W/mK)より大きいので、金属膜825を通じて熱伝導が行われ、リアプレートの温度均一化が達成できた。また、フェースプレート上の防塵膜830により、フェースプレートへの埃付着が防止

でき、フェースプレート表面印度が防塵膜830無しの場合よりも均一化することが確認できた。さらに、表示パネル100で生じた熱が、金属膜825上のフィン827を通じて伝導し、ファン817から送風される冷却空気へ効果的に放熱することができ、同時に駆動回路820上のICも冷却できた。

【0087】本例における冷却動作について以下に説明する。

【0088】横長のファン817によって外部より導入され、フィルタ818によってごみが除去された冷却用空気は指示線816が示す流れにしたがって進む。これにより、表示パネル100の基板201の裏面上の金属膜825とフィン827を冷却し、同時に該冷却空気の温度も上昇する。その後、前記冷却空気は表示パネル100のフェースプレート205側に回り込み、フェースプレート205と画面カバー819の間を通り抜けながらフェースプレート205上のITO/SnO₂膜と熱交換し、冷却空気の温度に近づく。

【0089】1時間動作させ、温度分布が一定になった後、フェースプレート205と基板201の温度差を測定したところ、実施例1と同程度の温度差であり、さらに長時間表示させても画面周辺部での色ずれは見られず、破損も起こらなかった。

【0090】本例ではリアプレート裏面の熱伝導部材にAgを用いたが、Cuを用いると更に良好になる。また、本例では、実施例4と同様に、駆動回路820が外装ケース815内に組み込まれているので、使用する際には表示信号を供給するのみで表示が行われるため、装置の使用性が向上したのとなっている。

【0091】なお、先に述べたITO/SnO₂の成膜方法は、本例で述べた真空蒸着に限らず、印刷、スプレー法等でも何ら問題なく、透明膜830により爆縮防止等、安全性の向上もはかれる。また、少なくともフェースプレート表面上の画像が表示される画像表示領域が透明であれば、他の部位は不透明の熱伝導部材で被覆しても何ら問題ない。

【0092】(実施例6) フェースプレートと外枠、リアプレートからなる表示パネル表面上に熱伝導の良好な透明膜を被覆し、リアプレート上にリアプレート材(青板ガラス)よりも熱伝導率が大なる金属板とフィン(凹凸)を設置した例について説明する。図9に本例の画像表示装置を示す。

【0093】図9において、830は表示パネル全体の温度均一化と帯電による埃の付着を防止する目的で、全表面上にコーティングした熱伝導部材の透明膜である。なお、引き出し電極部にはガラス成分の絶縁膜(不図示)を成膜した後に透明膜830をコーティングした。817は風量 $5\text{ m}^3/\text{min}$ の横流ファンであり、826はリアプレート裏面上に設置した熱伝導部材であるアルミ製の金属板、さらに、前記金属板上には、アルミ製

のフィン827を設置した。フィン827の長手方向は、垂直方向と一致させておりアルミ金属板826とアルミフィン827の斜視図を図12に示す。本例のその他の構成は実施例2と同様である。

【0094】本例の構成において、フェースプレート、外枠、そして基板からなる表示パネル100の作製方法、画像の表示方法は実施例1と同様である。表示パネル表面上にコーティングした透明膜830は、真空蒸着によりITO/SnO₂を塗布して成膜した。

【0095】また、リアプレート裏面上には、切削加工により形成したアルミ製の金属板826と、金属板826上のフィン827を設置し、金属板826の板厚は3mm、フィン827の高さ、幅、長さはそれぞれ、3mm、2mm、10mmとした。金属板826の熱伝導率は190W/mK程度であり、リアプレート（青板ガラス）の熱伝導率（1.1W/mK）より大きいため、金属板826を通じて熱伝導が行われ、リアプレートの温度均一化が達成できた。なお、金属板826はリアプレート裏面のみでなく、外枠部からフェースプレート205上の画像表示部以外まで拡大してもよく、重量が問題とならない限り大きく設置した方が好ましい。また、フェースプレート上の防塵膜830によりフェースプレートへの埃付着が防止でき、フェースプレート表面温度が防塵膜830無しの場合よりも均一化することが確認できた。さらに、表示パネル100で生じた熱が、金属板826上のフィン827を通じて伝導し、横長のファン817から送風される冷却空気へ効果的に放熱することができ、同時に駆動回路820上のICも冷却できた。本例では、フィン827の長手方向をファンの送風方向と一致するように設置しており、放熱効率を高めている。

【0096】本例における冷却動作について説明する。実施例2と同様にファン817によって外部より導入され、フィルタ818によってごみが除去された冷却用空気は指示線816が示す流れにしたがって進む。これにより、表示パネル100の基板201の裏面上の金属板826とフィン827を冷却し、同時に該冷却空気の温度も上昇する。金属板826とフィン827と十分な熱交換が行われると、主として表示パネル上の熱伝導部材である透明膜830を通じて、温度の大小に応じて、熱流が伝導する。そのため、表示パネルの温度分布が平坦化される。

【0097】1時間動作させ、温度分布が一定になった後、フェースプレート205と基板201の温度差を測定したところ、実施例1と同程度の温度差であり、さらに長時間表示させても画面周辺部での色ずれは見られず、破損も起こらなかった。

【0098】本例では、実施例4と同様に、駆動回路820が外装ケース815内に組み込まれているので、使用する際には表示信号を供給するのみで表示が行われる

ため、装置の使用性が向上したものとなっている。

【0099】なお、先に述べた透明膜830（ITO/SnO₂）の成膜方法は、本実施例で述べた真空蒸着に限らず、印刷、スプレー法等でも何ら問題ない。また、透明膜830は、少なくともフェースプレート上の画像表示部のみが透明であればよく、外枠等のその他の部分は第5の実施例で示したAg膜を形成しても、上述した効果が得られる。

【0100】また、以上述べたフィン827の形状は、上記の単純なものに限らず、表面積を増加させるように、フィン上にさらにフィンを設けてあってもよい。放熱量は放熱部の表面積にほぼ比例するが、一般には表面積を増加させると、ファンの圧力損失が大きくなり、送風流量が減少する。そのため、冷却目的とする流路形状に応じて、フィン形状および表面積を適時設定する。

【0101】

【発明の効果】本発明は以上説明したように構成されているので、以下に記載するような効果を奏する。

【0102】表示パネルを構成するリアプレートとフェースプレートの熱膨張量の差が減少するため、画面の歪みおよび色ずれが減少し、画質が向上された画像表示装置とすることができる効果がある。

【図面の簡単な説明】

【図1】本発明の画像表示装置の1例を示す模式的断面図である。

【図2】図1中の表示パネル100の構成を示す模式図である。

【図3】（a）、（b）のそれぞれは、本発明の画像表示装置に適用可能な電子線発生装置の上面図および正面図である。

【図4】画面カバーを有する画像表示装置一例を示す模式図である。

【図5】本発明に適用可能な熱電子を放出する電子源の一例を示す模式図である。

【図6】熱電子源の熱電子放出部とグリッドの構成を示す模式図である。

【図7】駆動回路を内蔵する画像表示装置の一例を示す模式図である。

【図8】フィンとファンを備えた画像表示装置の一例を示す模式図である。

【図9】フィンとファンを備えた画像表示装置の一例を示す模式図である。

【図10】表面伝導型電子放出素子を用いた画像表示装置の一例を示す模式図である。

【図11】表面伝導型電子放出素子の一例を示す模式図である。

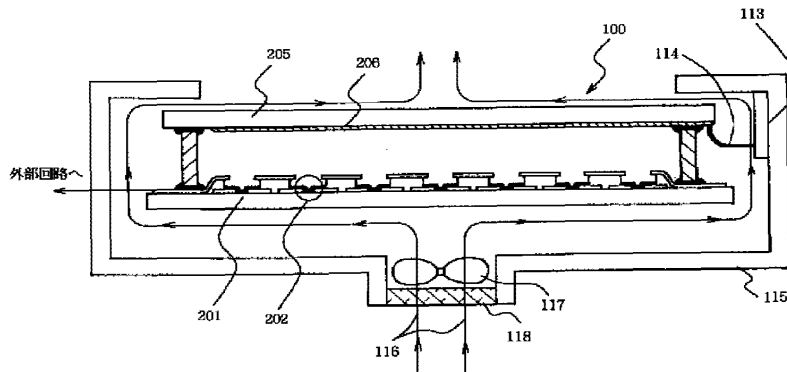
【図12】図9に示したフィンの構成を示す模式図である。

【符号の説明】

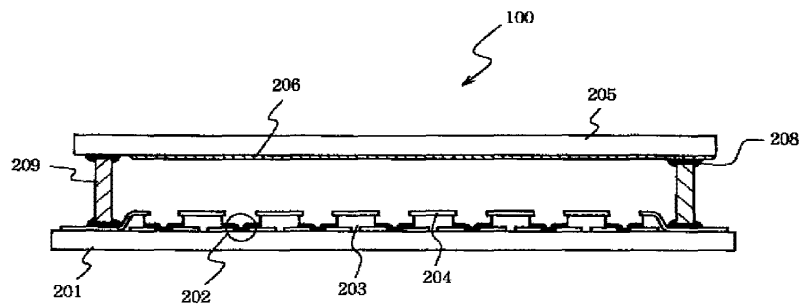
100 表示パネル

113, 413, 713	高圧電源	209	外枠
114, 414, 714	高圧ケーブル	302, 303	素子電極
115, 415, 715	外ケース	304	薄膜
117, 417, 717	ファン	305	電子放出部
118, 418, 718	フィルタ	419	画面カバー
201	基板	502	フィラメント層
202	電子放出素子	503	導電性支持層
203	絶縁層	504	熱電子放出部
204	グリッド	603	絶縁基板
205	フェースプレート	604	グリッド電極
206	蛍光体	720	駆動回路
208	フリットガラス	721	ケーブル

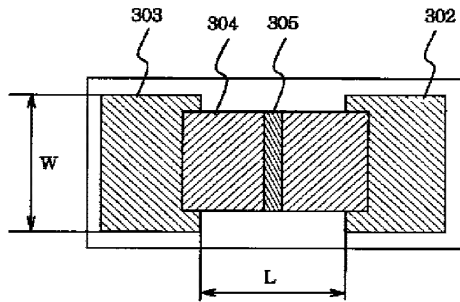
【図1】



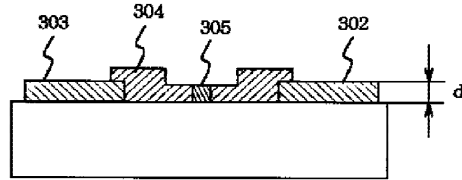
【図2】



【図3】

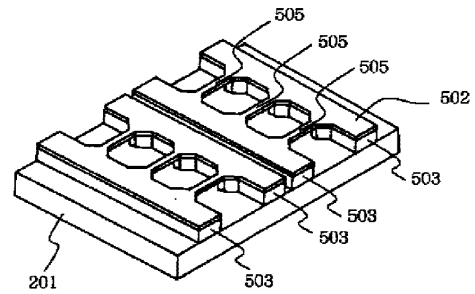


(a)

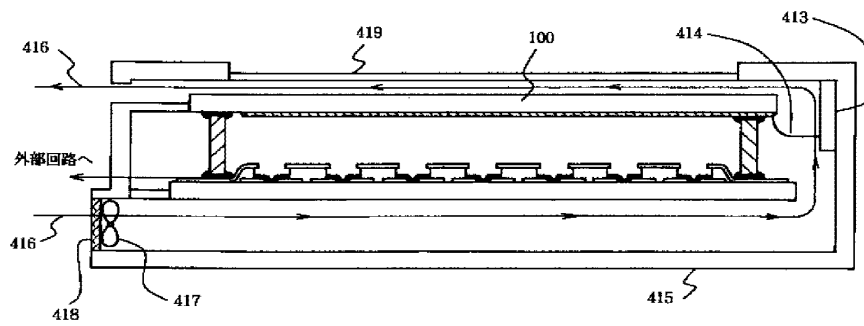


(b)

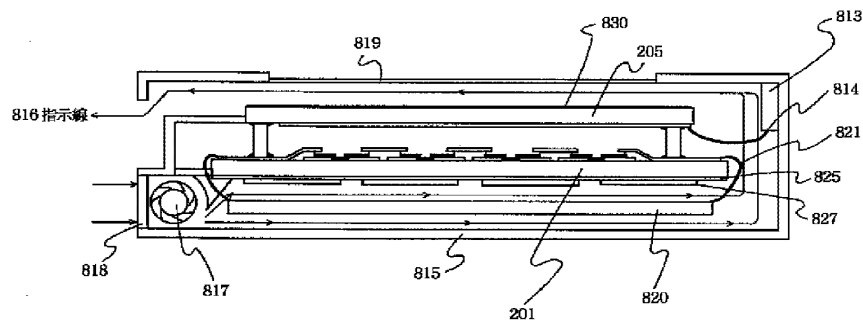
【図5】



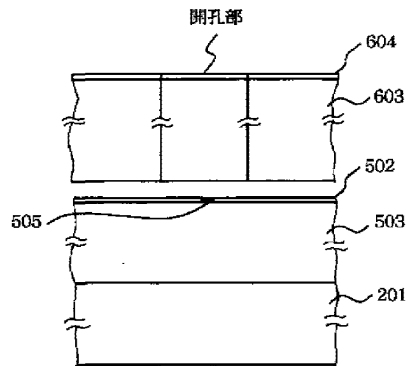
【図4】



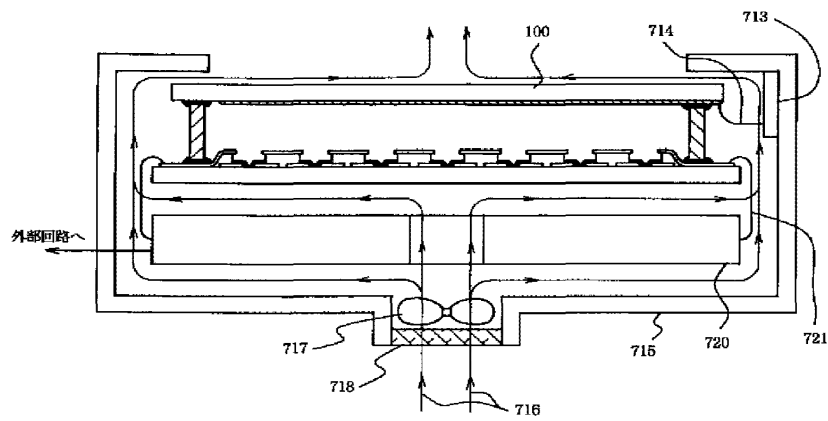
【図8】



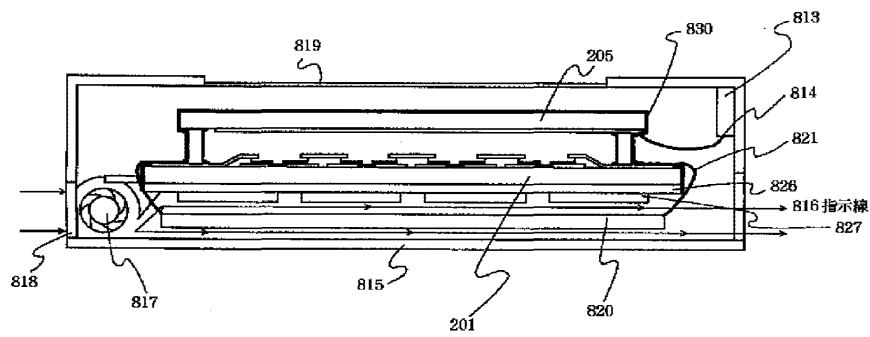
【図6】



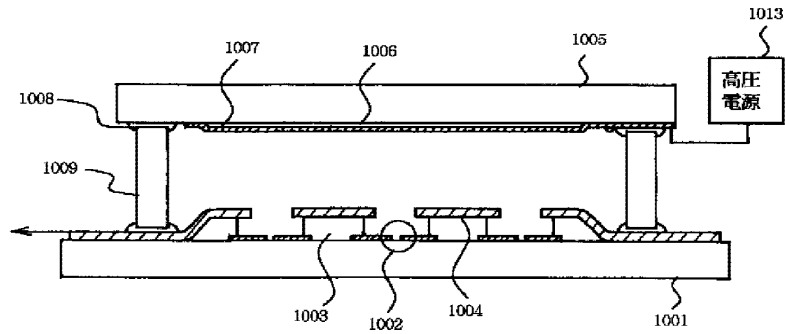
【図7】



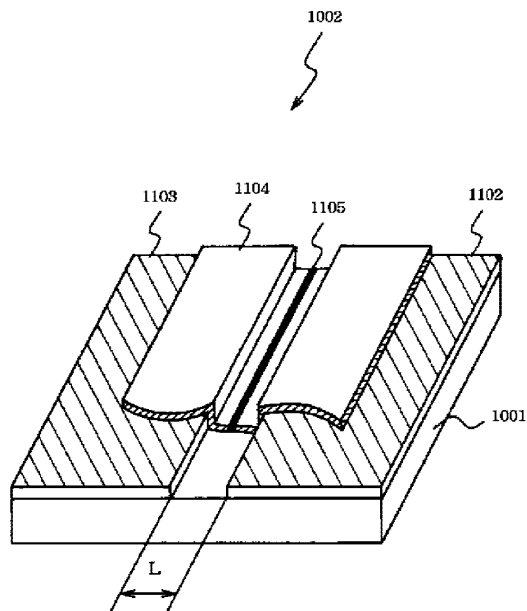
【図9】



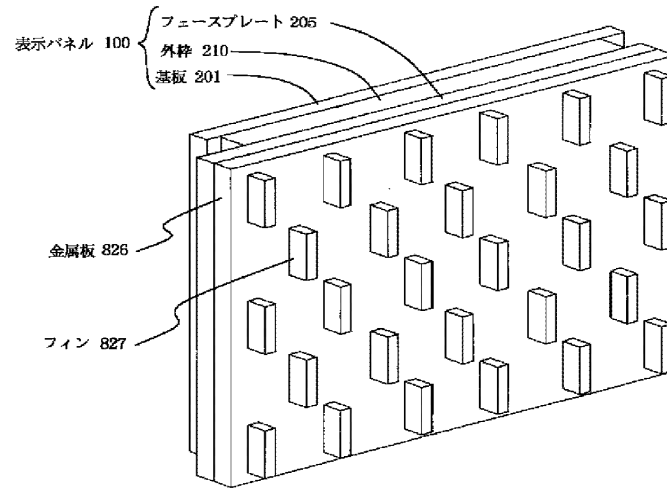
【図10】



【図11】



【図12】





Espacenet

JP2003076286A COOLING SYSTEM FOR DISPLAY DEVICE

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Classifications:

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COOLING SYSTEM FOR DISPLAY DEVICE

Abstract

PROBLEM TO BE SOLVED: To provide a cooling system which can effectively utilize functional characteristics of a display device by relaxing important matters imposed on constitution materials of respective parts of the device from points of view of heat resistance by properly cooling the display device and then improving the operation reliability of the display device even under strict use conditions. **SOLUTION:** This invention relates to the display device which is provided with a light guide plate wherein light is guided and a panel part provided opposite the back of the light guide plate and having an array of a number of actuator parts corresponding to many pixels and displays vided corresponding to an image signal on the light guide plate by controlling leak light at a specific position of the light guide plate by controlling the displacement of the actuator parts to and away from the light guide plate according to the properties of the inputted image signal. This cooling system cools the light guide plate from behind by controlling a flow of fluid coming into contact with the back of the light guide plate of the display device. Preferably, the flow passage of the fluid coming into contact with the back of the light guide plate is formed nearby the back of the light guide plate by a partition plate and a pressure feeding means for controlling the flow velocity of the fluid is interposed in the flow passage.

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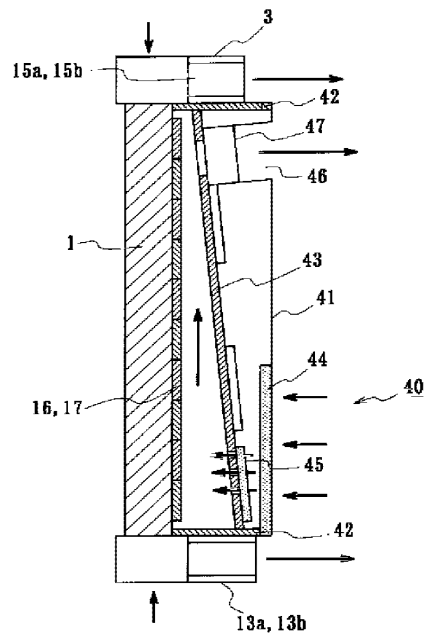
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(54) 【発明の名称】 ディスプレイ装置用の冷却システム

(57) 【要約】

【課題】 ディスプレイ装置を適切に冷却することにより、装置各部の構成材料について耐熱性の観点から課される要件を緩和し、厳しい使用条件下でもディスプレイ装置の作動信頼性を向上させて、その機能的特性を効果的に活用可能とする冷却システムを提案する。

【解決手段】 本発明は、光が導入される導光板と、該導光板の背面に対向して設けられ、かつ、多数の画素に対応した数のアクチュエータ部が配列された駆動部を含むパネル部とを具え、入力される画像信号の属性に応じて導光板に対するアクチュエータ部の接触・離隔方向の変位動作を制御して、導光板の所定部位における漏れ光を制御することにより、導光板に画像信号に応じた映像を表示させるディスプレイ装置を対象とする。本発明による冷却システムは、該ディスプレイ装置における導光板の背面に接触する流体の流れを制御して、導光板を背面側から冷却するものである。好適には導光板の背面に接触する流体の流路を、仕切板により導光板の背面近傍領域に形成し、その流路中に流体の流速を制御するための圧送手段を介挿する。



【特許請求の範囲】

【請求項1】光が導入される導光板と、該導光板の背面に対向して設けられ、かつ、多数の画素に対応した数のアクチュエータ部が配列された駆動部を含み、入力される画像信号の属性に応じて前記導光板に対する前記アクチュエータ部の接触・離隔方向の変位動作を制御して、前記導光板の所定部位における漏れ光を制御することにより、前記導光板に前記画像信号に応じた映像を表示させるパネル部とを具えるディスプレイ装置において、前記導光板の背面に接触する流体の流れを制御して、該導光板を背面側から冷却することを特徴とする冷却システム。

【請求項2】前記流体の流路を、少なくとも前記導光板の背面近傍領域に形成する仕切板を具えることを特徴とする、請求項1記載の冷却システム。

【請求項3】前記流路が、前記流体の流速を制御するための圧送手段を具えることを特徴とする、請求項2記載の冷却システム。

【請求項4】前記流路が循環流路であることを特徴とする、請求項2又は3記載の冷却システム。

【請求項5】前記流路が、前記導光板の背面近傍領域における下流側で、上流側よりも小さい断面積を有することを特徴とする、請求項2又は3記載の冷却システム。

【請求項6】前記流路が、前記流体の流速を制御するための圧送手段を前記下流側に具えることを特徴とする、請求項5記載の冷却システム。

【請求項7】前記仕切板が、少なくとも前記流路の下流側で放熱部を有することを特徴とする、請求項5記載の冷却システム。

【請求項8】前記放熱部が放熱フィンであることを特徴とする、請求項7記載の冷却システム。

【請求項9】前記循環流路を形成する仕切壁が、外気との接触面を有することを特徴とする、請求項4記載の冷却システム。

【請求項10】前記仕切壁が、少なくとも外気との接触面において放熱部を有することを特徴とする、請求項9記載の冷却システム。

【請求項11】前記放熱部が放熱フィンであることを特徴とする、請求項10記載の冷却システム。

【請求項12】前記仕切板が熱伝導率の高い材料、好適にはアルミニウム等の金属材料からなることを特徴とする、請求項7又は10記載の冷却システム。

【発明の詳細な説明】

【0001】

【技術分野】本発明は、フラットパネル形式のディスプレイ装置を対象とする冷却システムに関するものである。

【0002】

【背景技術】本出願人は、光が導入される導光板と、その導光板の一方の板面に対向して設けられ、かつ、多数

の画素に対応した数のアクチュエータ部が配列された駆動部とを含み、入力される画像信号の属性に応じて導光板に対する前記アクチュエータ部の接触・離隔方向の変位動作を制御して、導光板の所定部位における漏れ光を制御することにより、導光板に画像信号に応じた映像を表示させるディスプレイ装置を提案している（特開平7-287176号公報、特開平11-194723号公報参照）。このような特定の構成を有するディスプレイ装置を、以下、「対象ディスプレイ装置」と称する。

【0003】上述した対象ディスプレイ装置は、既存の液晶ディスプレイやプラズマディスプレイとは異なり、基本的に封止構造を必要としないために分割パネル構造を採用することができ、パネルの大型化・薄型化に比較的容易に対応可能である。また、直視型であるために高コントラスト化が可能であり、外光の影響下でも色が褪せにくく、CRTと対比しても、より優れた視野角が得られるものである。

【0004】ところで、対象ディスプレイ装置を使用して実用的な大型ディスプレイを実現する場合、光源からの発熱による好ましくない影響を排除するために、光源近傍を空冷ファン等により冷却することが考えられる。これは、ディスプレイ装置の各部、とりわけ導光板や駆動部におけるアクチュエータ部につき、主として耐熱性の観点から構成材料の選択自由度が制約されるのを、可能な限り回避するのが望ましいためである。なお、このような冷却ファンは、本出願人の先の特許出願に係る特許願2001-100954号（本願の出願時点において未公開の先願である。）に開示されている。

【0005】

【発明の課題】本発明の課題は、対象ディスプレイ装置を適切に冷却することにより、該ディスプレイ装置における各部の構成材料について耐熱性の観点から課される要件を緩和し、厳しい使用条件下でも該ディスプレイ装置の作動信頼性を向上させて上述した有利な機能的特性を効果的に活用可能とする冷却システムを提案することである。

【0006】

【課題の解決手段】発明者らは、上記課題の解決手段について鋭意検討を重ねたところ、対象ディスプレイ装置の駆動部におけるアクチュエータ部が導光板に対して接触・離隔変位することによっても発熱が生じ、その発熱は対象ディスプレイ装置の大型化に伴って顕在化するため、光源近傍の冷却とは別に、導光板およびアクチュエータ部を含む駆動部も全体的に冷却するのが望ましいことが判明した。

【0007】本発明は上記の知見に基づくものであり、光が導入される導光板と、該導光板の背面に対向して設けられ、かつ、多数の画素に対応した数のアクチュエータ部が配列された駆動部を含み、入力される画像信号の属性に応じて前記導光板に対する前記アクチュエータ部

の接触・離隔方向の変位動作を制御して、前記導光板の所定部位における漏れ光を制御することにより、前記導光板に前記画像信号に応じた映像を表示させるパネル部とを具えるディスプレイ装置において、前記導光板の背面に接触する流体の流れを制御して、該導光板を背面側から冷却することを特徴とする新規な冷却システムを提供するものである。

【0008】本発明による冷却システムは、対象ディスプレイ装置における導光板の背面に接触する流体の流れを制御して該導光板を背面側から冷却するものである。したがって、対象ディスプレイ装置を大型化する場合でも、導光板に対するアクチュエータ部の接触・離隔変位に基づいて発熱が生じてアクチュエータ部および導光板全体を効果的に冷却されるため、該ディスプレイ装置における導光板や駆動部におけるアクチュエータ部等の構成材料につき、主として耐熱性の観点から課される要件を緩和し、厳しい使用条件下でも該ディスプレイ装置の作動信頼性を向上させ得ると共に上述した有利な機能的特性を効果的に活用することが可能である。また、アクチュエータ部および導光板を全体的に冷却することにより、対象ディスプレイ装置の温度を効果的に均一化することができ、ひいては該ディスプレイ装置の作動特性の局所的なバラツキを回避することも可能である。

【0009】本発明を実施するにあたり、導光板の背面に接触する流体の流路を少なくとも導光板の背面近傍領域に形成する仕切板を設けるのが好適である。この流路は、循環流路として形成することができる。流路中には、流体の流速を制御するための圧送手段、例えばシロッコファン等の圧送ファンを配置するのが望ましい。流路は、導光板の背面近傍領域における下流側で上流側よりも小さい断面積を有する構成とすることが可能である。この場合には、流体の流速を制御するための圧送手段を、流路の下流側に配置するのが望ましい。

【0010】導光板の背面に接触する流体の流路を循環流路として構成する場合、少なくとも当該流路の下流側で、放熱フィン等からなる放熱部を仕切板に設けるのが好適である。

【0011】また、導光板の背面に接触する流体の流路を限定する仕切板が外気との接触面を有する場合には、少なくともその接触面において、放熱フィン等からなる放熱部を仕切板に設けるのが好適である。

【0012】なお、仕切板は熱伝導率の高い材料、例えばアルミニウム等の金属材料で構成するのが有利である。

【0013】

【実施の形態】以下、本発明を図示の実施形態について更に詳述する。

【0014】図1～図3は、本発明による冷却システムを適用するディスプレイ装置の一例を示すものである。このディスプレイ装置は、光が各側面から導入される導

光板1と、行列配置した複数のパネルによって構成したパネル部2と、これらパネルの貼り付け時の位置決めを行うと共にパネル部2の周辺の光漏れを防止するフレーム3と、導光板1の側面に対してそれぞれ配置した光源4a、4b；5a、5b；6a、6b；7a、7bと、導光板の側面と共に光源4a、4b；5a、5b；6a、6b；7a、7bをそれぞれ包囲し、光源4a、4b；5a、5b；6a、6b；7a、7bからの光にそれぞれ対応する反射面を有するリフレクタ8、9、10、11と、リフレクタ8、9、10、11の側面にそれぞれ固定された空冷ファン12a、12b；13a、13b；14a、14b；15a、15bとを具える。このようなディスプレイ装置は、例えば、公共施設の垂直壁面に配置される。

【0015】導光板1に入射される光としては、紫外域、可視域、赤外域のいずれでもよい。導光板1は、その内部に導入された光が前面及び背面において板の外部に透過せず全反射するような光屈折率を有するものであり、導入される光の波長領域での透過率が均一かつ高いものであることが必要である。このような性質を有するものであれば特にその材質は制限されないが、具体的には、例えばガラス、石英、アクリル、ポリカーボネート等の透光性プラスチック、透光性セラミックス等、あるいは異なる屈折率を有する材料の複数層構造体、又は表面にコーティング層を設けたものなどが一般的なものとして挙げられる。

【0016】導光板1の厚さを、矩形の導光板1の対角線方向の長さの0.01倍以上かつ0.1倍未満とする。これによって、導光板1の側面に導入された光は、その側面に対向する側面まで直進しやすくなる。これについては、後に実験データを用いて説明する。

【0017】図1の2-2線に沿う断面に対応する図2に示すように、パネル部2を構成するパネル16、17はそれぞれ、導光板として作用するガラス板16-1、17-1と、それに対向するドライバICを搭載したプリント基板16-2、17-2と、これらの間に介在する所定の画素数のディスプレイ素子16-3、17-3とを有する。

【0018】パネル16の詳細を、図3を参照して説明する。ディスプレイ素子16-3は、ガラス板16-1すなわち導光板1の一方の板面に対向して設けられ、かつ、複数の画素に対応した数のアクチュエータ部18a、18bが配列された駆動部19を有する。また、装置に入力される画素信号の属性に応じて導光板の一部として機能するガラス板16-1に対するアクチュエータ部18a、18bの接触・離隔方向の変位動作を制御し、これによって導光板1の所定部位における漏れ光を制御することにより、画像信号に応じた映像を導光板1に表示させる。

【0019】アクチュエータ部18a、18bは、ジル

コニアなどのセラミックスで構成された基板20に肉薄部21a, 21bを形成し、その肉薄部21a, 21b上に、例えば上下面に電極膜が形成された圧電／電歪層又は反強誘電体層22a, 22b、白色散乱体層23a, 23b、有色発光体層24a, 24b及びコンタクト層25a, 25bを順次に形成した構成とされている。また、基板20によって、複数の支柱26a, 26b, 26cを介してガラス板16-1が支持され、このガラス板16-1は、例えばシリコンオイル33を介して導光板1に密着して配置されている。なお、支柱26a, 26b, 26cとガラス板16-1との間には、リフレクタ又は光吸収層28a, 28b, 28cが配置されている。

【0020】図3の左側に示すアクチュエータ部18aは、ディスプレイ素子16-3の発光時に対応するものであり、この状態では圧電／電歪層又は反強誘電体層22a及び肉薄部21aが上方に突出しており、コンタクト素子25aがガラス板16-1に接触している。したがって、導光板1に導入されて導光板1の前面側に位置する内面と導光板1に密着して配置されたガラス板16-1の背面側に位置する内面との間で全反射していた光が、コンタクト層25aを経て有色発光体層24aの表面まで透過し、有色発光体層24aの色に対応する色の散乱光としてガラス板16-1を通過して導光板1の前面側から出射する。

【0021】これに対して、図3の右側に示すアクチュエータ部18bは、ディスプレイ素子16-3の非発光時に対応するものであり、この状態では圧電／電歪層又は反強誘電体層22b及び肉薄部21bが下方に引っ込んでおり、コンタクト層25bがガラス板16-1から隔離している。したがって、導光板1に導入された光は、導光板1の前面側から出射することなく、導光板1の内面とガラス板16-1の内面との間で全反射を繰り返しながら他方の側面に向けて進行する。

【0022】再び図2を参照して説明すると、フレーム3は、ガラス板3-1と、これに対向する黒コートガラス板3-2とを有し、これらガラス板3-1と黒コートガラス板3-2の間には空気層3-3が形成される。

【0023】パネル16, 17を貼り付ける前にフレーム3を貼り付けることによって、パネル16, 17の位置決めを行うことができるとともに、パネル部2周辺の光漏れを防止することができる。

【0024】導光板1、フレーム3及びパネル16, 17は、ガasket 29, 30, 31, 32によってそれぞれ接続され、これら導光板1、フレーム3、パネル16, 17及びガasket 29, 30, 31, 32によって包囲された空間に、導光板1及びガラス板3-1, 16-1, 17-1の屈折率に比較的近い屈折率のシリコンオイル33が充填されている。

【0025】なお、本発明を適用する対象ディスプレイ

装置の基本的な構成及び機能については、前述した特開平7-287176号公報及び特開平11-194723号公報等に開示されているため、詳細な説明は省略する。

【0026】次に、上述した構成の対象ディスプレイ装置に適用することのできる、本発明に係る冷却システムの第1実施形態につき、図4を参照して具体的に説明する。

【0027】前述したとおり、対象ディスプレイ装置の光源に対応するリフレクタには、空冷ファンが固定されている。これらのうち、図4には空冷ファン13a, 13b; 15a, 15bのみが示されている。本実施形態に係る冷却システム40では、導光板1及びパネル16, 17の背面側全体をリアカバー41で覆い、光源及び空冷ファンに近接する上部及び下部領域でリアカバー41の内面に断熱材42を施す。また、リアカバー41と導光板1及びパネル16, 17の背面側との間には、平坦形状を有する仕切板43を配置する。仕切板43を垂直面に対して傾斜させて配置し、導光板1及びパネル16, 17と仕切板43との間隔を、下方から上方に向けて漸減させる。仕切板43は、導光板1及びパネル16, 17の背面側に冷却チャンバを画成するものであり、熱伝導率の高い材料、例えばアルミニウム等の金属材料で構成するのが有利である。リアカバー41の下部に目の粗いフィルタ44を配置した吸気口を設ける。リアカバー41のフィルタ44に対向する領域で、仕切板43の下部に目の微細なフィルタ45を配置した吸気口を設ける。リアカバー41の上部に、導光板1及びパネル16, 17に向けて内方に突出する凹部46を設ける。この凹部46に対応する位置で、仕切板43の上部に排気口及び圧送ファン47を設ける。圧送ファン47は、例えばシロッコファンで構成することができる。

【0028】上述した構成の冷却システム40において、対象ディスプレイ装置の作動時に圧送ファン47を作動させると、外気がフィルタ44, 45を経て仕切板43により画成される冷却チャンバ内に導入され、その際に空気中の塵埃等の異物が除去される。冷却チャンバ内に導入された外気は、導光板1及びパネル16, 17を背面側から冷却しつつチャンバの下部から上部に向けて流れ、仕切板43の上部における排気口から圧送ファン47に吸引され、リアカバー41の凹部46から外部に排気される。これにより、対象ディスプレイ装置の作動時に導光板1及びパネル16, 17を背面側から効果的に冷却することができる。なお、導光板1及びパネル16, 17と仕切板43との間隔が下方から上方に向けて漸減することにより空気流の流速が下方から上方に向けて徐々に増加するため、空気流の温度が冷却チャンバの下方から上方に向けて増加する場合でも、ほぼ一様な冷却作用を発現させることが可能である。

【0029】本実施形態に係る冷却システムによれば、

対象ディスプレイ装置を大型化する場合にあっても、導光板1に対するアクチュエータ部18a、18bの接触・離隔変位に基づく発熱に際してアクチュエータ部18a、18bおよび導光板1全体が効果的に冷却されるため、対象ディスプレイ装置における導光板1や駆動部におけるアクチュエータ部18a、18b等の構成材料につき、主として耐熱性の観点から課される要件を緩和し、厳しい使用条件下でも該ディスプレイ装置の作動信頼性を向上させ得ると共に、対象ディスプレイ装置に固有の有利な機能的特性を効果的に活用することが可能である。また、アクチュエータ部18a、18bおよび導光板1を全体的に冷却することにより、対象ディスプレイ装置の温度を効果的に均一化することができ、その作動特性の局所的なバラツキを回避することが可能である。なお、本実施形態に係る冷却システムの冷却能力は、圧送ファン47の作動速度を適切に調整し、導光板1及びパネル16、17に沿う気流の流速を制御することにより、容易に調整することが可能である。

【0030】図5は、本発明に係る冷却システムの第2実施形態を示すものである。

【0031】本実施形態に係る冷却システム50では、導光板1及びパネル16、17の背面側全体をリアカバー51で覆い、光源及び空冷ファンに近接する上部及び下部領域でリアカバー51の内面に断熱材52を施す。また、リアカバー51と導光板1及びパネル16、17の背面側との間に、平坦形状を有する仕切板53を配置する。仕切板53を垂直面に対して平行に配置し、導光板1及びパネル16、17と仕切板53との間隔を高さ方向に見て一定とする。仕切板53は、導光板1及びパネル16、17の背面側に冷却チャンバを画成するものであり、アルミニウム等の金属材料で構成するのが有利である。リアカバー51の下部に目の粗いフィルタ54を配置した吸気口を設ける。リアカバー51のフィルタ54に対向する領域で、仕切板53の下部及び中間部にそれぞれ目の微細なフィルタ55a、55bを配置した吸気口を設ける。リアカバー51の上部に、導光板1及びパネル16、17に向けて内方に突出する凹部56を設ける。この凹部56に対応する位置で、仕切板53の上部に排気口及び圧送ファン57を設ける。圧送ファン57は、例えばシロッコファンで構成することができる。

【0032】上述した構成の冷却システム50において、対象ディスプレイ装置の作動時に圧送ファン57を作動させると、外気がフィルタ54、55a、55bを経て仕切板53により画成される冷却チャンバ内に導入され、その際に空気中の塵埃等の異物が除去される。冷却チャンバ内に導入された外気は、導光板1及びパネル16、17を背面側から冷却しつつチャンバの下部から上部に向けて流れ、仕切板53の上部における排気口から圧送ファン57に吸引され、リアカバー51の凹部5

6から外部に排気される。これにより、対象ディスプレイ装置の作動時に導光板1及びパネル16、17を背面側から効果的に冷却することができる。なお、仕切板53の下部に配置されたフィルタ55aから冷却チャンバ内に導入された外気は、上方に向けて流れる際に冷却に伴って温度が増加するが、本実施形態では仕切板53の中間部にもフィルタ55bを配置した吸気口を設けて新鮮な外気を補給するため、導光板1及びパネル16、17の背面側をほぼ一様に冷却することが可能である。

【0033】上記以外の点において、第2実施形態に係る冷却システムは第1実施形態に係るものと同様の作用効果を奏するものである。

【0034】図6は、上述した第2実施形態の変形例を示すものである。

【0035】本例では、第2実施形態に係る冷却システム50において、フィルタ55bよりも上側の領域で仕切板53の内面に、導光板1及びパネル16、17に向けて突出する稜上の突起53a、53b、53cを設け、これらの突起をバッフルとして機能させることにより導光板1及びパネル16、17の背面に沿う気流を攪拌して冷却作用を促進させるものである。

【0036】上記以外の点において、本例に係る冷却システムは第2実施形態に係るものと同様の作用効果を奏するものである。

【0037】図6は、本発明に係る冷却システムの第3実施形態を示すものである。

【0038】本実施形態に係る冷却システム60では、導光板1及びパネル16、17の背面側全体をリアカバー61で覆い、光源及び空冷ファンに近接する上部及び下部領域でリアカバー61の内面に断熱材62を施す。また、リアカバー61と導光板1及びパネル16、17の背面側との間に、平坦形状を有する仕切板63を配置する。仕切板63を垂直面に対して平行に配置し、導光板1及びパネル16、17と仕切板63との間隔を高さ方向に見て一定とする。仕切板63は、導光板1及びパネル16、17の背面側に冷却チャンバを画成するものであり、アルミニウム等の金属材料で構成するのが有利である。リアカバー61の下部に熱交換器64を配置する。熱交換器64に対向する領域で、仕切板63の下部に吸気口65を設ける。また、仕切板63の上部に排気口及び圧送ファン67aを設ける。圧送ファン67aは、例えばシロッコファンで構成することができる。リアカバー61の下部に配置した熱交換器64をシュラウド68で覆い、シュラウド68の上部に第2の圧送ファン67bを配置する。

【0039】上述した構成の冷却システム60において、対象ディスプレイ装置の作動時に圧送ファン67a、67bを作動させると、外気が熱交換器64及びシュラウド68の内部を経て圧送ファン67bに吸引され、外部に排気される。これと同時に、リアカバー61

及び仕切板63により形成される循環流路を空気流が圧送ファン67aにより圧送されて循環し、その間に導光板1及びパネル16、17を背面側から効果的に冷却すると共に熱交換器64において外気と熱を交換することにより十分な温度まで冷却される。

【0040】本実施形態によれば、外気から隔絶された流体流を導光板1及びパネル16、17の背面側で循環させることにより、精密な構造を有する駆動部を、外気中に含まれる塵埃等から確実に保護することができ、フィルタ等の定期交換を行うための保守作業が不要となることである。また、導光板1及びパネル16、17を背面側から冷却するための流体として適当な温度特性を有する液状又はガス状の熱媒体を使用することも可能である。

【0041】上記以外の点において、本実施形態に係る冷却システムは、基本的には前記の各実施形態に係るものと同様の作用効果を奏するものである。

【0042】上述したところから明らかなとおり、本発明によれば、対象ディスプレイ装置を適切に冷却することにより、該ディスプレイ装置における各部の構成材料について耐熱性の観点から課される要件を緩和し、厳しい使用条件下でも該ディスプレイ装置の作動信頼性を向上させて上述した有利な機能的特性を効果的に活用可能とする冷却システムを実現することが可能である。

【0043】なお、本発明が上述した特定に実施形態に限定されるものでなく、その範囲内で多くの変形・変更が可能であることは勿論である。例えば、図4～図6の

実施形態において、仕切板43、53の上部における圧送ファン47、57に隣接する領域に、外気との接触面側で放熱部としての放熱フィン等を設けることができる。同様に、図7の実施形態においては、リアカバー61の上部で圧送ファン67a、67bと対向する領域に、外気との接触面側で放熱部としての放熱フィン等を設けることができる。

【図面の簡単な説明】

【図1】本発明を好適に適用することのできる対象ディスプレイ装置の正面図である。

【図2】図1の2-2線に沿う部分断面図である。

【図3】同ディスプレイ装置の要部を示す拡大断面図である。

【図4】本発明による冷却システムの第1実施形態を示す断面図である。

【図5】本発明による冷却システムの第2実施形態を示す断面図である。

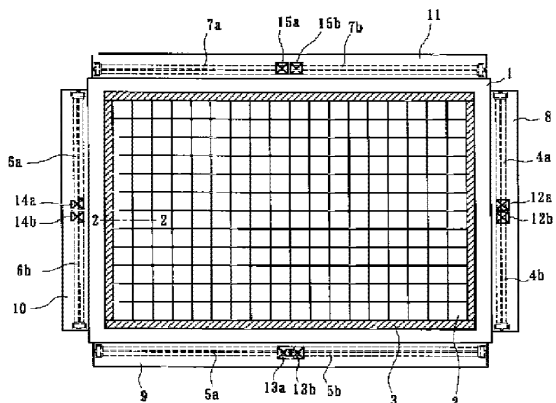
【図6】第2実施形態の変形例を示す断面図である。

【図7】本発明による冷却システムの第3実施形態を示す断面図である。

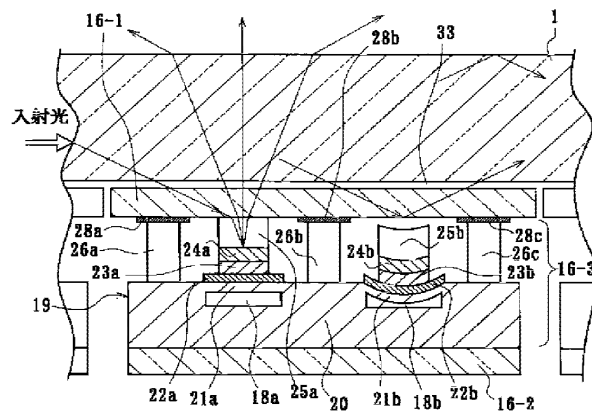
【符号の説明】

1 導光板、18a、18b アクチュエータ部、19 駆動部、40、50、60 冷却システム、41、51、61 リアカバー、43、53、63 仕切板、44、45、54、55a、55b フィルタ、64 熱交換器、47、57、67a、67b 圧送ファン、68 シュラウド

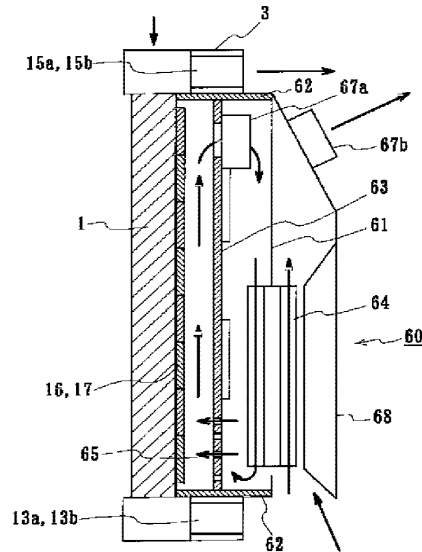
【図1】



【図3】



【図7】



フロントページの続き

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Fターム(参考) 2H041 AA13 AB40 AZ00
5G435 AA12 BB15 FF08 GG44

Electronic Patent Application Fee Transmittal				
Application Number:		16933932		
Filing Date:		20-Jul-2020		
Title of Invention:		ELECTRONIC DISPLAY WITH COOLING		
First Named Inventor/Applicant Name:		William Dunn		
Filer:		Adam Jeffery Smith/Brianna Lacy		
Attorney Docket Number:		MAN2241-045R		
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
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	260	260
Total in USD (\$)				260

Electronic Acknowledgement Receipt	
EFS ID:	40980729
Application Number:	16933932
International Application Number:	
Confirmation Number:	5816
Title of Invention:	ELECTRONIC DISPLAY WITH COOLING
First Named Inventor/Applicant Name:	William Dunn
Customer Number:	8698
Filer:	Adam Jeffery Smith/Brianna Lacy
Filer Authorized By:	Adam Jeffery Smith
Attorney Docket Number:	MAN2241-045R
Receipt Date:	29-OCT-2020
Filing Date:	20-JUL-2020
Time Stamp:	11:31:26
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	\$260
RAM confirmation Number	E20200SB32421171
Deposit Account	194076
Authorized User	Brianna Lacy
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: 37 CFR 1.16 (National application filing, search, and examination fees) 37 CFR 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	Information Disclosure Statement (IDS) Form (SB08)	MAN2241-045R_IDS_10-28-20.pdf	612269	no	4
			c8bd14290786e310d46dbfc8e73f120ae576bdc8		
Warnings:					
Information:					
2	Foreign Reference	JPH855567.pdf	1009366	no	15
			3c503ab020f7e8c29f8a6bf5403c977f48c82e79		
Warnings:					
Information:					
3	Foreign Reference	JP2003076286.pdf	669116	no	9
			b5ac84e5b85273ba7f921b2c163b37255a494807		
Warnings:					
Information:					
4	Fee Worksheet (SB06)	fee-info.pdf	30661	no	2
			c9f144ebede97125a9fad04797a05e07f7df3cae		
Warnings:					
Information:					
Total Files Size (in bytes):			2321412		

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.
16/933,932	07/20/2020	William Dunn	MAN2241-045R	5816
8698	7590	09/30/2020		
STANDLEY LAW GROUP LLP			EXAMINER	
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			ART UNIT	PAPER NUMBER
			2835	
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			09/30/2020	ELECTRONIC

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 the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

standleydocketing@standleyllp.com

Notice of Pre-AIA or AIA Status

The present application is being examined under the pre-AIA first to invent provisions.

DETAILED ACTION

Information Disclosure Statement

1. It is desirable to avoid the submission of long lists of documents if it can be avoided. Clearly irrelevant and marginally pertinent cumulative information should be eliminated. If a long list is submitted, those documents which have been specifically brought to applicant's attention and/or are known to be of most significance should be highlighted. See *Penn Yan Boats, Inc. v. Sea Lark Boats, Inc.*, 359 F. Supp. 948, 175 USPQ 260 (S.D. Fla. 1972), *affd*, 479 F.2d 1338, 178 USPQ 577 (5th Cir. 1973), *cert. denied*, 414 U.S. 874 (1974). *But of. Molins PLC v. Textron Inc.*, 48 F.3d 1172, 33 USPQ2d 1823 (Fed. Cir. 1995). See MPEP 2004.

Applicant's duty of disclosure of material and information is not satisfied by presenting a patent examiner with "a mountain of largely irrelevant [material] from which he is presumed to have been able, with his expertise and with adequate time, to have found the critical [material]. It ignores the real world conditions under which examiners examines. Applicant has a duty not just to disclose pertinent prior art references but to make a disclosure in such a way as not to "bury" it within other disclosures of less relevant prior art; See *Golden Valley Microwave Foods Inc. v. Weaver Popcorn Co. Inc.*, 24 USPQ2d 1801 (N.D. Ind. 1992); *Molins PLC v. Textron Inc.*, 26 USPQ2d 1889, at 1899 (D.Del 1992); *Penn Yan Boats, Inc. v. Sea Lark Boats, Inc. et al.*, 175 USPQ 260, at 272 (S.D. Fl. 1972).

The examiner is not afforded the time to thoroughly review each reference, given the number of references cited. By initialing each of the cited references on the accompanying 1449 form(s), the examiner is merely acknowledging the submission of the cited references and indicating that only a cursory review was made of the cited references.

Claim Rejections - 35 USC § 103

2. In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

The following is a quotation of pre-AIA 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, 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 negated by the manner in which the invention was made.

Claim(s) 1 & 8 is/are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Sato et al. US5869919 in view of Habing et al. US6211934

Per claim 1 Sato et al. teaches a cooling system (title) for an electronic image assembly (100, fig.2), the cooling system comprising: a housing (415) for the electronic

image assembly (see fig.4); a transparent panel (419, see fig.4) forming a front portion of the housing (see fig.4), wherein the transparent panel is located forward of, and at least some distance from, the electronic image assembly (see fig.4); an airflow pathway passing through the housing between said electronic image assembly and said transparent panel (see fig.4; col.9, line 3-12); an air circulation device (417) positioned to force air through the airflow pathway (see fig.4; col.9, line 3-12);

Sato et al. does not explicitly teach at least one polarizer, located at said transparent panel and configured to reduce solar energy.

Habing et al. however discloses at least one polarizer, located at said transparent panel and configured to reduce solar energy (col.5, line 31-39).

It would have been obvious at the time the invention was made to a person having ordinary skill in the art to have a polarizer on a transparent panel as taught by Habing et al. in the electronic image assembly of Sato et al., because the polarizer reduces the heat being transmitted to the electronic image assembly via the transparent panel and also reduces glare on the electronic image assembly, thus ensuring that the display is cool enough and clear enough to be placed and viewed outdoors.

Per claim 8 Sato et al. in view of **Habing et al.** teaches the cooling system of claim 1 wherein: said at least one polarizer is configured to reduce solar energy received at said electronic image assembly (col.5, line 31-39).

It would have been obvious at the time the invention was made to a person having ordinary skill in the art to have a polarizer reduce solar energy as taught by Habing et al. in the cooling system of Sato et al., because it reduces the heat being transmitted to the electronic image assembly, and also reduces the glare on the

electronic image assembly, thus ensuring that the electronic image assembly is cool and clear to watch when placed outdoors.

Claim(s) 1-5 & 10 is/are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Sato et al. US5869919 in view of Sanelle et al. US2002/0033919.

Per claim 1 Sato et al. teaches a cooling system for an electronic image assembly (100; title), the cooling system comprising: a housing (415) for the electronic image assembly (see fig.4); a transparent panel (419, see fig.4) forming a front portion of the housing (see fig.4), wherein the transparent panel is located forward of, and at least some distance from, the electronic image assembly (see fig.4); an airflow pathway passing through the housing between said electronic image assembly and said transparent panel (see fig.4; col.9, line 3-12); an air circulation device (417) positioned to force air through the airflow pathway (see fig.4; col.9, line 3-12);

Sato et al. does not explicitly teach at least one polarizer, located at said transparent panel and configured to reduce solar energy.

Sanelle et al. however discloses at least one polarizer (115; [0073]), located at said transparent panel (125, see fig.8; [0062]) and configured to reduce solar energy ([0002]-[0004], [0014]).

It would have been obvious at the time the invention was made to a person having ordinary skill in the art to have a polarizer on a transparent panel as taught by Sanelle et al. in the electronic image assembly of Sato et al., because the polarizer reduces the heat being transmitted to the display via the transparent panel and also

reduces glare on the electronic image assembly, thus ensuring that the electronic image assembly is cool enough and clear enough to be placed and viewed outdoors.

Per claim 2 Sato et al. in view of **Sanelle et al.** teaches the cooling system of claim 1 wherein: said at least one polarizer (115) is located adjacent to an inward facing surface of said transparent panel (125, see fig.8).

Per claim 3 Sato et al. teaches the cooling system of claim 1

Sato et al. does not explicitly teach further comprising: at least one film having anti-reflection properties located at said transparent panel.

Sanelle et al. however discloses at least one film (131) having anti-reflection properties located at said transparent panel ([0063]).

It would have been obvious at the time the invention was made to a person having ordinary skill in the art to have an anti-reflection property located at said transparent panel as taught by Sanelle et al. in the cooling system of Sato et al., because it improves reflections caused by the sun, thus ensuring improved clarity and visibility of the electronic image assembly when placed outdoors.

Per claim 4 Sato et al. in view of Sanelle et al. teaches the cooling system of claim 1 wherein: said airflow pathway encircles said electronic image assembly and is configured to accommodate circulating gas (see fig.4).

Per claim 5 Sato et al. in view of Sanelle et al. teaches the cooling system of claim 4 further comprising: an open loop airflow pathway passing behind said electronic image assembly (see fig.4).

Per claim 10 Sato et al. in view of **Sanelle et al.** teaches the cooling system of claim 1 wherein: said at least one polarizer comprises a linear polarizer ([0018]).

Claim(s) 6-7 & 9 is/are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Sato et al. US5869919 in view of Sanelle et al. US2002/0033919 as applied to claim 5 above and further in view of Willem et al. US2005/0134526.

Per claim 6 Sato et al. in view of Sanelle et al. teaches the cooling system of claim 5

Sato et al. in view of Sanelle et al. does not explicitly teach further comprising: a heat exchanger located rearward of the electronic image assembly, wherein a first portion of said heat exchanger forms part of said open loop airflow pathway, and wherein a second portion of said heat exchanger forms part of said airflow pathway.

Willem et al. however discloses a heat exchanger (146) located rearward of the electronic image assembly (112, see fig.2), wherein a first portion of said heat exchanger (see fig.2, "side portion") forms part of said open loop airflow pathway (see fig.2), and wherein a second portion of said heat exchanger (see fig.2, "back portion") forms part of said airflow pathway (see fig.2).

It would have been obvious at the time the invention was made to a person having ordinary skill in the art to have a heat exchanger form part of an open loop airflow pathway and said airflow pathway as taught by Willem et al. in the cooling system of Sato et al. in view of Sanelle et al., because it ensures an effective dissipation of heat from the electronic image assembly.

Per claim 7 Sato et al. in view of Sanelle et al. teaches the cooling system of claim 6 further comprising:

Sato et al. in view of Sanelle et al. an inlet located at a first portion of said housing for ingesting ambient air into said open loop airflow pathway; and an exhaust located at a second portion of said housing for exhausting ambient air from said open loop airflow pathway.

Willem et al. however discloses an inlet located (see fig.2, “portion that enters 146”) at a first portion of said housing for ingesting ambient air into said open loop airflow pathway (see fig.2); and an exhaust (126 & 128, see fig.2) located at a second portion of said housing for exhausting ambient air from said open loop airflow pathway (see fig.2).

It would have been obvious at the time the invention was made to a person having ordinary skill in the art to have an inlet and an exhaust as taught by Willem et al. in the cooling system of Sato et al. in view of Sanelle et al., because it ensures proper flow of air around the electronic image assembly, thus ensuring an effective dissipating of heat from the electronic image assembly.

Per claim 9 Sato et al. in view of Sanelle et al. teaches the cooling system of claim 1 wherein: said at least one polarizer is configured to reduce solar energy thermally interacting with air forced in said airflow pathway.

Willem et al. however discloses the cooling system of claim 1 wherein: said at least one polarizer is configured to reduce solar energy thermally interacting with air forced in said airflow pathway (see fig.1C-2; [0058], “the polarizer which reduces the solar energy to the electronic image assembly would also have the same effect on the airflow pathway, thus reducing the solar energy to the airflow pathway”).

It would have been obvious at the time the invention was made to a person having ordinary skill in the art to have a polarizer configured to reduce solar energy thermally interacting with air forced in said airflow pathway as taught by Willem et al. in the cooling system of Sato et al. in view of Sanelle et al., because it ensures a more effective cooling of the electronic image assembly, thus ensuring that the electronic image assembly does not overheat when placed outdoors in extreme heat.

Claim(s) 17-18 is/are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Sato et al. US5869919 in view of Willem et al. US2005/0134526.

Per claim 17 Sato et al. teaches a method for cooling an electronic image assembly (title), said method comprising the steps of: placing said the electronic image assembly (100) within a housing (415); forcing air through an airflow pathway (see fig.4) within said housing (see fig.4), wherein at least a portion of said airflow pathway extends between an electronic image assembly and a transparent panel (419, see fig.4) forming a front portion of said housing and spaced apart from said electronic image assembly (fig.4); and

Sato et al. does not explicitly teach providing one or more solar energy reduction layers at said transparent panel configured to reduce the amount of solar energy transferred to said air in said airflow pathway.

Willem et al. however discloses providing one or more solar energy reduction layers (150) at said transparent panel (140, [0054], line 1-2) configured to reduce the amount of solar energy transferred to said air in said airflow pathway ([0058], “the

polarizer which reduces the solar energy to the electronic image assembly would also have the same effect on the airflow pathway, thus reducing the solar energy to the airflow pathway")

It would have been obvious at the time the invention was made to a person having ordinary skill in the art to have a polarizer configured to reduce solar energy in said airflow pathway as taught by Willem et al. in the method of Sato et al., because it ensures a more effective cooling of the electronic image assembly, thus ensuring that the electronic image assembly does not overheat when placed outdoors in extreme heat.

Per claim 18 Sato et al. in view of **Willem et al.** teaches the cooling method of claim 17 wherein: at least one of said one or more solar energy reduction layers comprise a polarizer (150; [0058]).

Claim(s) 19 is/are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Sato et al. in view of Willem et al. US2005/0134526 as applied to claim 18 above and further in view of Sanelle et al. US2002/0033919.

Per claim 19 Sato et al. in view of Willem et al. teaches the cooling method of claim 18 wherein: at least one of said one or more solar energy reduction layers comprise a film having anti-reflection properties.

Sato et al. in view of Willem et al. does not explicitly teach the cooling method of claim 18 wherein: at least one of said one or more solar energy reduction layers comprise a film having anti-reflection properties.

Sanelle et al. however discloses at least one of said one or more solar energy reduction layers comprise a film having anti-reflection properties (131; [0063]).

It would have been obvious at the time the invention was made to a person having ordinary skill in the art to have an anti-reflection property as taught by Sanelle et al. in the method of Sato et al. in view of Willem et al., because it improves reflections caused by the sun, thus ensuring improved clarity and visibility of the electronic image assembly when placed outdoors.

Allowable Subject matter

Claims 11 - 16 are allowable

3. **Regarding Independent claim 11**, patentability exists, at least in part, with the claimed combination of elements and features of: A cooling system for an electronic image assembly, the cooling system comprising: a housing for the electronic image assembly; a transparent cover panel forming a front portion of the housing, the transparent cover panel located forward of, and at least some distance from, the electronic image assembly; **an open loop airflow pathway passing through the housing behind the electronic image assembly; a closed loop gas circulation pathway contained within the housing**, wherein a portion of said closed loop gas circulation pathway passes between said transparent cover panel and said electronic image assembly; an inlet located at a first portion of said housing for ingesting ambient air into said open loop airflow pathway; an exhaust located at a second portion of said housing for exhausting ambient air from said open loop airflow pathway; an air circulation device positioned along said open loop airflow pathway between said inlet

and said exhaust, wherein said air circulation device is configured to force ambient air through the open loop air flow pathway; a gas circulation device positioned along said closed loop gas circulation pathway to force circulating gas around the closed loop pathway; a heat exchanger located rearward of the electronic image assembly, wherein a first portion of said heat exchanger forms part of said open loop airflow pathway, and wherein a second portion of said heat exchanger forms part of said closed loop gas circulation pathway; and one or more solar energy reduction layers located at said transparent panel, wherein each of said one or more solar energy reduction layers is configured to prevent a portion of solar energy entering said transparent cover from thermally interacting with circulating gas at said portion of said closed loop gas circulation pathway passing between said transparent panel and said electronic image assembly or thermally interacting with said electronic image assembly.

Claim(s) 12-16, depends on claim 11 therefore allowable for the same reason.

Claim 20 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claim 20, includes allowable subject matter because of the cooling method of claim 17 further comprising the steps of: forcing ambient air through a second airflow pathway within said housing, wherein said second airflow pathway extends behind said electronic image assembly; and thermally transferring heat between said air in said airflow pathway and said ambient air in said second airflow pathway at a heat exchanger common to said airflow pathway and said second airflow pathway, **wherein**

said airflow pathway defines a closed loop and said air in said airflow pathway comprises circulating gas.

Email Communication

4. Applicant is encouraged to authorize the Examiner to communicate via email by filing form PTO/SB/439 either via USPS, Central Fax, or EFS-Web. See MPEP 502.01, 502, 502.05.

Conclusion

5. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Applicants are directed to consider additional pertinent prior art included on the Notice of References Cited (PTOL 892) attached herewith. The Examiner has pointed out particular references contained in the prior art of record within the body of this action for the convenience of the Applicant. Although the specified citations are representative of the teachings in the art and are applied to the specific limitations within the individual claim, other passages and figures may apply. Applicant, in preparing the response, should consider fully the entire reference as potentially teaching all or part of the claimed invention, as well as the context of the passage as taught by the prior art or disclosed by the Examiner.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MICHAEL A MATEY whose telephone number is (571)270-5648. The examiner can normally be reached on Monday-Friday 9AM-6PM EST.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at <http://www.uspto.gov/interviewpractice>.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, JAYPRAKASH GANDHI can be reached on 5712723740. 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 <https://ppair-my.uspto.gov/pair/PrivatePair>. 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.

/MICHAEL A MATEY/
Examiner, Art Unit 2835

Notice of References Cited	Application/Control No. 16/933,932		Applicant(s)/Patent Under Reexamination Dunn et al.	
	Examiner MICHAEL A MATEY		Art Unit 2835	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-6493440-B2	12-2002	Gromatzky; Jonathan A.	G02F1/133385	379/161
*	B	US-5869919-A	02-1999	Sato; Yasue	H01J29/006	313/17
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*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
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Search Notes 	Application/Control No. 16/933,932	Applicant(s)/Patent Under Reexamination Dunn et al.
	Examiner MICHAEL A MATEY	Art Unit 2835

CPC - Searched*		
Symbol	Date	Examiner
G02B5/30 OR G02B6/0055 OR G02F1/133528 OR G02F2001/133388 OR G02F1/133308 OR G02F1/133385 OR G07F17/3211 OR G09F13/0413 OR G09F13/12 OR G02F1/0311 OR	09/17/2020	MM
H05K7/202,206,20972.cpc.	09/17/2020	MM
H05K7/20136 H05K7/20163 H05K7/20972	09/17/2020	MM
G02F1/133308 OR G02F2001/133334 OR G02F1/133385 OR G02F2201/08 OR G02F2201/36 OR G02F1/133528 OR H01L51/5234 OR H05K9/0081 OR H05K7/20972 OR Y02P20/133	09/17/2020	MM

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US Classification - Searched*			
Class	Subclass	Date	Examiner

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Search Notes		
Search Notes	Date	Examiner
Please see attached Inventor Assignee East search history	09/17/2020	MM
conducted an IP.com search (Claims)	09/17/2020	MM
Please see attached PGPub text search	09/17/2020	MM
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Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

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✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
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CLAIMS										
☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47										
CLAIM		DATE								
Final	Original	09/17/2020								
	1	✓								
	2	✓								
	3	✓								
	4	✓								
	5	✓								
	6	✓								
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	14	=								
	15	=								
	16	=								
	17	✓								
	18	✓								
	19	✓								
	20	O								

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Application No: 16/933,932

Foreign Priority claimed: ☐ Yes ☒ No

35 USC 119 (a-d) conditions met: ☐ Yes ☒ No

☐ Met After Allowance

Verified and Acknowledged: /MICHAEL A MATEY/

Examiner's Signature

Initials

Title: ELECTRONIC DISPLAY WITH COOLING

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
07/20/2020	349	2835	MAN2241-045R
RULE			

APPLICANTS

Manufacturing Resources International, Inc., Alpharetta, GA,

INVENTORS

William Dunn, Alpharetta, GA, UNITED STATES

Tim Hubbard, Alpharetta, GA, UNITED STATES

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See attached certification statement.

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Signature	/Adam J. Smith/	Date (YYYY-MM-DD)	2020-08-26
Name/Print	Adam J. Smith	Registration Number	72962

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

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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 inspections 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.

EAST Search History

EAST Search History (Prior Art)

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	"6701143" "6714410" "6727468"			
	"6742583" "6812851" "6825828"			
	"6833992" "6839104" "6850209"			
	"6885412" "6886942" "6891135"			
	"6909486" "6943768" "6961108"			
	"7015470" "7059757" "7083285"			
	"7157838" "7161803" "7190416"			
	"7190587" "7209349" "7212403"			
	"7259964" "7269023" "7284874"			
	"7396145" "7447018" "7452121"			
	"7457113" "7480140" "7535543"			
	"7591508" "7602469" "7667964"			
	"7682047" "7752858" "7753567"			
	"7762707" "7800706" "7813124"			
	"7903416" "7995342" "8004648"			
	"8035968" "8081465" "8102173"			
	"8142027" "8208115" "8223311"			
	"8241573" "8248784" "8254121"			
	"8269916" "8270163" "8274622"			
	"8274789" "8300203" "8310824"			
	"8320119" "8351014" "8358397"			
	"8369083" "8373841" "8379182"			
	"8400608" "8472174" "8472191"			
	"8482695" "8497972" "8590602"			
	"8649170" "8649176" "8654302"			
	"8678603" "8693185" "8700226"			
	"8711321" "8749749" "8755021"			
	"8758144" "8760613" "8767165"			
	"8773633" "8804091" "8823916"			
	"8827472" "8854572" "8854595"			
	"8879042" "8976313" "8988647"			
	"9030641" "9089079" "9119325"			

		"9119330" "9173322" "9173325" "9282676" "9285108" "9313917" "9370127" "9448569" "9451060" "9451733" "9456525" "9470924" "9500896" "9516485" "9549490" "9594271" "9613548" "9622392" "9629287" "9648790" "9655289" "9703230" "9723765" "9797588" "9801305" "9823690" "9835893" "9894800" "D608775").PN.				
S51	1,007	((("20180042134") or ("10506740") or ("9801305") or ("9173325") or ("20150237761") or ("20160041423") or ("9835893") or ("8654302") or ("20110013114") or ("8351014") or ("20150366101") or ("20110085301") or ("9119325") or ("9030641") or ("20130279154") or ("20140111758") or ("20030094006") or ("6684653") or ("20080041077") or ("9723765") or ("20160242329") or ("10278311") or ("20170332523") or ("10548247") or ("20190208674") or ("20180310439") or ("20070002536") or ("10485147") or ("20080055856") or ("7486513") or ("7342789") or ("8472174") or ("20170257978") or ("20110058326") or ("20080055851") or ("20080212282") or ("9629287") or ("20140295748") or ("8988647") or ("20090255142") or ("20120106081") or ("8823916") or ("10266984") or ("20140369003") or ("4327274") or ("9119330") or ("20120012300") or ("20170303442") or ("20080245083") or ("20130170139") or ("8322155") or ("9115916") or ("8369083") or ("9267714") or ("20140123683") or ("10045467") or ("8649170") or ("20170127579") or ("20080041076") or ("20190289754") or ("20130139530") or ("20160345461") or ("8327656") or ("10314212") or ("20180343774") or ("9175434") or ("20170127556") or ("9699939") or ("20200029460") or ("20150195959") or ("10398063") or ("9560789") or ("9549490") or ("10524384") or ("20170268159") or ("10400385") or ("20170234623") or ("20140345834") or ("7864527") or ("6924981") or ("7729115") or ("20120281161") or	US-PGPUB; USPAT	OR	OFF	2020/02/27 06:08

	("9451733") or ("20040190247") or ("8755021") or ("4026263") or ("20040100770") or ("20120105790") or ("20080030951") or ("6775137") or ("3277956") or ("8749749") or ("20050263142") or ("20110238143") or ("6085701") or ("7165539") or ("20030091363") or ("6771916") or ("8590602") or ("20090086428") or ("20190059175") or ("10214037") or ("20180162151") or ("20120206687") or ("9897336") or ("20180364519") or ("20170023823") or ("6345511") or ("20110099834") or ("20090052132") or ("10143106") or ("10398058") or ("8627581") or ("8804091") or ("9408332") or ("20190193436") or ("9873273") or ("9470924") or ("6308526") or ("20160236494") or ("20160016423") or ("20160143191") or ("20160377303") or ("20180317330") or ("8773633") or ("10359659") or ("10088702") or ("9278564") or ("7918799") or ("20150009627") or ("20160192536") or ("20110261523")).PN. or (("9282676") or ("20180223846") or ("20090209863") or ("10499516") or ("20190335613") or ("20150022967") or ("9797588") or ("20100251742") or ("20160195254") or ("20140321103") or ("20150327409") or ("9089079") or ("20100305775") or ("20190111758") or ("9370127") or ("9285108") or ("20160302331") or ("2299939") or ("8145363") or ("6205796") or ("20020134544") or ("6367410") or ("20190037738") or ("20190170383") or ("7086453") or ("20050056404") or ("8152904") or ("10514176") or ("20110072970") or ("20090086432") or ("20110077555") or ("20180235066") or ("8622162") or ("6408630") or ("6196003") or ("20140313698") or ("20120180979") or ("20010008071") or ("20180035569") or ("5402844") or ("20020012375") or ("20090185346") or ("20160050797") or ("6408937") or ("20190335573") or ("20190239365") or ("20010021847") or ("5901167") or ("20110195652") or ("20070279861") or ("6843306") or ("6164369") or				
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	("8425435") or ("7411785") or ("10010722") or ("10160290") or ("7841721") or ("4182303") or ("20110139525") or ("5931016") or ("7724516") or ("20180106484") or ("20150351214") or ("9010141") or ("20160178716") or ("5936646") or ("20130190661") or ("RE43007") or ("20160066478") or ("20030057546") or ("7796376") or ("4840225") or ("9967964") or ("20040049178") or ("9204578") or ("6828675") or ("20190170604") or ("20150223367") or ("9575149") or ("20170115366") or ("6044648") or ("20180335053") or ("20020116933") or ("6635053") or ("10082549") or ("5657641") or ("20170321907") or ("6490874") or ("20140260965") or ("7318821") or ("6592577") or ("20170261273") or ("6674642") or ("20040001310") or ("20050090814") or ("7207986") or ("20070028769") or ("4534780") or ("5269146") or ("20080055563") or ("9885526") or ("20110297351") or ("9353966") or ("RE30043") or ("20100232107") or ("20030077499") or ("4056091") or ("6830842") or ("20160265805") or ("20140190037") or ("8379182") or ("6298681") or ("20040040324") or ("20110077556") or ("6334323") or ("8932238") or ("2819330") or ("4478055") or ("7403392") or ("20110126559") or ("5611476") or ("7911782") or ("7946986") or ("20200005592") or ("6167947") or ("20030217566") or ("4860824") or ("20020092316") or ("5906108") or ("20030145616") or ("6321547") or ("20030145621") or ("20110197613").PN. or ("7093454") or ("8297070") or ("20180094840") or ("20090056910") or ("20040048123") or ("20060218812") or ("20120137716") or ("4344479") or ("20060080996") or ("10502468") or ("8051672") or ("20150373882") or ("5476138") or ("6021150") or ("20110077557") or ("8009419") or ("8381541") or ("8105265") or ("7537849") or ("7010929") or ("5835349") or ("10477724") or ("6494252") or ("6964176") or				
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	("20160270254") or ("9210830") or ("20080156014") or ("6350033") or ("20090107160") or ("4906182") or ("20140146468") or ("10130006") or ("20070144192") or ("20180059270") or ("20030011983") or ("20150369514") or ("20180100671") or ("20120131944") or ("10054698") or ("6948328") or ("10415848") or ("9258926") or ("8117864") or ("20150083368") or ("6587336") or ("20040042905") or ("20170021695") or ("20100057263") or ("7788940") or ("20090099498") or ("6957026") or ("20180214303") or ("10398066") or ("4967830") or ("6793465") or ("20140146467") or ("20160189842") or ("20050180772") or ("20150373874") or ("8947873") or ("20080141708") or ("20120031392") or ("4397121") or ("5529120") or ("9551358") or ("20180291798") or ("20160252289") or ("20190053399") or ("20190239381") or ("5193735") or ("4318722") or ("5982619") or ("5285644") or ("10292305") or ("20170067643") or ("9568206") or ("20140260383") or ("5538075") or ("7963118") or ("5046554") or ("5570740") or ("7701715") or ("20150250067") or ("20160037685") or ("20190249882") or ("9441839") or ("4773589") or ("9784490") or ("20120130298") or ("8979788") or ("20110277967") or ("4026283") or ("20190200488") or ("10440856") or ("20080024978") or ("20120024501") or ("20130021746") or ("10015896") or ("8959941") or ("8422218") or ("20130032310") or ("8591206") or ("20140111940") or ("9101078") or ("4953365") or ("8964391") or ("5590539") or ("6026565") or ("20160258657") or ("20140360492") or ("9982920") or ("20090178780") or ("5825621") or ("8854572") or ("20130068441") or ("5748656") or ("2513373") or ("4285210") or ("5564980") or ("8248801") or ("20120162906") or ("8361059") or ("20150285516") or ("20100139306") or ("20130170140") or ("20140123493") or ("20190171092")				
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	or ("3415312") or ("5086754") or ("8435277") or ("6796372") or ("20140290567") or ("20140124167") or ("8899171")).PN. or ("7701714") or ("20070274043") or ("4242872") or ("8964390") or ("20100238394") or ("20200025408") or ("20180370263") or ("20100296245") or ("20180038660") or ("4307578") or ("20200037456") or ("5467250") or ("20080306577") or ("7724517") or ("20110075363") or ("20190291542") or ("7780657") or ("6109339") or ("6649290") or ("20190327865") or ("20160230634") or ("20020168556") or ("10434804") or ("5065586") or ("8236240") or ("20070209380") or ("20170122573") or ("7778013") or ("9969193") or ("9261310") or ("6506111") or ("5524442") or ("4674476") or ("20130228313") or ("5349829") or ("4922890") or ("8274622") or ("20070097604") or ("8358397") or ("2564344") or ("20020173266") or ("8760867") or ("20170307282") or ("20070274858") or ("7414845") or ("4987881") or ("20180317350") or ("20180363278") or ("4142575") or ("20080017355") or ("20070267741") or ("4090370") or ("20100000758") or ("20070246678") or ("20170064874") or ("20110000710") or ("20130025818") or ("5895418") or ("7213639") or ("20090193830") or ("20180073753") or ("20070233055") or ("20150273974") or ("20090107657") or ("7956284") or ("20060207757") or ("5110264") or ("20150224800") or ("20070093799") or ("9496200") or ("20070241468") or ("20130206058") or ("5937667") or ("4589712") or ("20060069418") or ("8210205") or ("20180292142") or ("20140262180") or ("20070161974") or ("4706739") or ("RE45111") or ("20170080730") or ("4449764") or ("10264716") or ("9789746") or ("20180160819") or ("20190193439") or ("9048344") or ("7510174") or ("10442226") or ("20080024980") or ("20050259397") or ("20030012234") or ("20190113247") or ("5832986") or				
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	("20180128510") or ("20080196870") or ("7795533") or ("20090257773") or ("20180275293") or ("20150354874") or ("6914919") or ("5606870") or ("20200056795") or ("7652884") or ("5749243") or ("6138469") or ("20180214302") or ("9387709") or ("4866743") or ("20040163797") or ("20170311476") or ("7203063") or ("20120227389") or ("20100007258") or ("7325410") or ("5267446") or ("7418825") or ("20110075353") or ("2320501") or ("20190198895") or ("9759438") or ("20070236881") or ("20130252533") or ("20030151892") or ("5113844") or ("20170345346") or ("20110232869") or ("6232682") or ("4701415") or ("20040083740") or ("5499277").PN. or ("20110140820") or ("7165412") or ("20170363306") or ("5320167") or ("20060254753") or ("20170311487") or ("7377935") or ("9354001") or ("7258161") or ("20090107159") or ("10524397") or ("20170245400") or ("8081054") or ("20050205241") or ("7492593") or ("5533357") or ("7334630") or ("6779348") or ("20060126296") or ("4505118") or ("10514174") or ("7128025") or ("20150259847") or ("10488089") or ("20160003546") or ("20180094841") or ("20080023178") or ("20020023453") or ("7096928") or ("10006721") or ("20110077514") or ("4158950") or ("20080158815") or ("20180283803") or ("20160320149") or ("20190219285") or ("20020148415") or ("9042099") or ("20190184852") or ("7832231") or ("4488192") or ("9613548") or ("20090200000") or ("20140133099") or ("20120327600") or ("7184269") or ("20160198588") or ("20180199467") or ("20170321911") or ("10074954") or ("8929075") or ("6920043") or ("7013955") or ("20180315356") or ("7802734") or ("8250877") or ("4297318") or ("20020050338") or ("20130055748") or ("20080148760") or ("8899066") or ("9943014") or ("20060000582") or ("7397661") or ("20200025429") or ("20080259566") or ("20170328589") or ("7677057") or				
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	("9631880") or ("20120279684") or ("9313931") or ("5605047") or ("10371451") or ("20150068171") or ("20010013404") or ("20030136134") or ("20020139514") or ("9810439") or ("20050024831") or ("5458188") or ("8482695") or ("20030159456") or ("20090112368") or ("8037714") or ("10309665") or ("20120285543") or ("5560362") or ("20180156228") or ("20140133096") or ("9042098") or ("7969727") or ("4242876") or ("20180017345") or ("20070295492") or ("20060177714") or ("6280318") or ("20160290666") or ("4330946") or ("20190021186") or ("20130056177") or ("20070258612") or ("20150292775") or ("20040095728") or ("7672125") or ("4622947") or ("20120121487") or ("10060350") or ("6944023") or ("7757753") or ("6889750") or ("20100277864") or ("20150165871") or ("20160298540") or ("20080141686") or ("20160061532") or ("20120031601") or ("20090260372") or ("10241103") or ("4348604") or ("20170328879") or ("20080049396") or ("7458228") or ("2990695") or ("20170356597") or ("4449511") or ("4370861") or ("9313930") or ("5477687") or ("5357586") or ("8693199") or ("7340912") or ("6775996")).PN. or (("7073566") or ("7710722") or ("20080024981") or ("20080024987") or ("20170172016") or ("20190141911") or ("7026065") or ("20050258259") or ("7818835") or ("20060219381") or ("20090216304") or ("7555792") or ("20190316948") or ("20090288440") or ("20080142203") or ("4022550") or ("5692467") or ("4324110") or ("20050006488") or ("10544902") or ("4373577") or ("5586932") or ("7134486") or ("4146086") or ("7980094") or ("20050174714") or ("5816318") or ("4848318") or ("20100118275") or ("2179734") or ("7802439") or ("5205276") or ("9441840") or ("5596622") or ("9593876") or ("7511960") or ("2873582") or ("5522216") or ("20150153109") or				
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	("20130105120") or ("4380156") or ("20050241803") or ("20080161976") or ("20070073369") or ("7036559") or ("20110094714") or ("20100319365") or ("20090120630") or ("20180139864") or ("20080135224") or ("20080310112") or ("20090173473") or ("4690209") or ("8157626") or ("20180136187") or ("20080161975") or ("9151540") or ("3290028") or ("20070074682") or ("6992483") or ("5253485") or ("2526874") or ("10334764") or ("7832992") or ("8619425") or ("20110315364") or ("20170223870") or ("5042262") or ("6728102") or ("5582241") or ("20030044663") or ("4704658") or ("7131486") or ("10174975") or ("20170176605") or ("20130312645") or ("9038406") or ("7819634") or ("7673592") or ("20150000319") or ("20030205363") or ("4147299") or ("9605875") or ("20080062647") or ("3373732") or ("20090225514") or ("8941993") or ("8453471") or ("20090225513") or ("7184267") or ("20180135880") or ("9476649") or ("20180263811") or ("20080156887") or ("10458682") or ("4495545") or ("20100011803") or ("10240845") or ("20020148604") or ("6061087") or ("20170038123") or ("4505131") or ("5239834") or ("5610968") or ("20080055848") or ("20140053558") or ("9173324") or ("6829900") or ("6909283") or ("20190226461") or ("6209622") or ("20130047653") or ("9689720") or ("20160245558") or ("4033825") or ("20090209193") or ("8178831") or ("20150047384") or ("20190331369") or ("4803846") or ("7854135") or ("9392733") or ("20170067644") or ("5694442") or ("7975494") or ("20180352676") or ("20030085024") or ("20120318328") or ("20190113259") or ("20180324976") or ("8055388") or ("20130334447") or ("6007205") or ("20100149754")).PN. or (("20190219311") or ("8235777") or ("7911793") or ("9746235") or ("5732123") or ("20080176503") or ("4611791") or ("4294225") or				
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	("8546717") or ("7497252") or ("7341201") or ("4168706") or ("5050390") or ("9351694") or ("20120125028") or ("8699737") or ("5088295") or ("4333517") or ("9267737") or ("8189334") or ("8297067") or ("9752803") or ("20110315363") or ("6991024") or ("10485113") or ("20160116224") or ("20130083479") or ("20120160454") or ("20090090115") or ("4092088") or ("7830657") or ("7856838") or ("7534167") or ("20030231467") or ("20180199450") or ("4430994") or ("8601827") or ("9223360") or ("20180314103") or ("20130220579") or ("9338924") or ("20080160901") or ("20080141707") or ("20110272120") or ("9835357") or ("20110061591") or ("4190099") or ("20170038346") or ("4336692") or ("8089764") or ("7878889") or ("5572880") or ("6896612") or ("9918413") or ("8235776") or ("7957132") or ("8693198") or ("6131571") or ("20100307716") or ("20180328600") or ("6279337") or ("8431404") or ("20150343554") or ("20110030932") or ("20160120058") or ("7363879") or ("20170164525") or ("20120120542") or ("20190143445") or ("20090007581") or ("20200039260") or ("20140153689") or ("9908195") or ("20190069449") or ("4755236") or ("20110207391") or ("20170181325") or ("6497110") or ("9297571") or ("20060279930") or ("8968232") or ("5562411") or ("20080060372") or ("7185697") or ("20130269204") or ("20140260361") or ("5361591") or ("20110218600") or ("3470704") or ("6167621") or ("20030062149") or ("5689968") or ("20080196868") or ("9228779") or ("5890371") or ("RE36808") or ("20120012283") or ("6704198") or ("10568217") or ("20030164231") or ("20040089442") or ("20110134604") or ("6942018") or ("10371443") or ("4485642") or ("7984684") or ("8467168") or ("20110105010") or ("9763366") or ("5724828") or ("20110289943") or ("20120171943") or ("20190196312")				
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	or ("9086859") or ("20100078156") or ("20070268669") or ("6393730") or ("20180347578") or ("5240403") or ("4295342") or ("5348077") or ("20050098299") or ("20120318492") or ("20180155969") or ("20090013553") or ("8467189") or ("5526650") or ("20140314395") or ("9283109") or ("7385810") or ("20110061832") or ("20070084463") or ("20120167600") or ("9032742") or ("4589265")).PN. or ("20110088883") or ("20070030650") or ("10139159") or ("9273875") or ("4138857") or ("20020135981") or ("7610764") or ("4308042") or ("6053238") or ("9414519") or ("20080058697") or ("20120133256") or ("9267881") or ("20100246118") or ("9677822") or ("8439104") or ("9968010") or ("8378677") or ("4859405") or ("9055696") or ("6217440") or ("6865825") or ("20140151003") or ("8031468") or ("20120270310") or ("20130081790") or ("20120127657") or ("20120167610") or ("20120075797") or ("20100188082") or ("8240165") or ("7905106") or ("4265220") or ("10189114") or ("7348527") or ("20160120059") or ("10184699") or ("20130104414") or ("20040257766") or ("20010045104") or ("6564795") or ("7905096") or ("20100321887") or ("9282684") or ("7946112") or ("20160288244") or ("20070102426") or ("9648790") or ("20180238623") or ("8119300") or ("20140250713") or ("20120118534") or ("9128681") or ("10151539") or ("7040101") or ("4424190") or ("5467615") or ("8035968") or ("6182608") or ("20190053400") or ("6580609") or ("20060133033") or ("10288328") or ("8514575") or ("20180045138") or ("20040169771") or ("9920708") or ("6230501") or ("20090260777") or ("20020121095") or ("20030154724") or ("20090310300") or ("4046529") or ("20150182650") or ("5513558")).PN.				
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S52	428	S51 and @ad<="20080320"	US-PGPUB; USPAT; IBM_TDB	ADJ	OFF	2020/02/27 06:09
S53	29	(US-20090154096-\$ or US-20060082271-\$ or US-20180088398-\$ or US-20140334100-\$ or US-20130194782-\$ or US-20120236499-\$ or US-20110167845-\$ or US-20110162831-\$ or US-20110058326-\$ or US-20100177479-\$ or US-20090086430-\$ or US-20080285290-\$ or US-20070081344-\$ or US-20090279240-\$ or US-20040135482-\$ or US-20110085301-\$ or US-20090244472-\$ or US-20090135365-\$ or US-20090126906-\$ or US-20150009627-\$ or US-20130201685-\$ or US-20120188481-\$ or US-20110122162-\$).did. or (US-6493440-\$ or US-5991153-\$ or US-5869919-\$ or US-5748269-\$ or US-8274622-\$ or US-10088702-\$).did.	US-PGPUB; USPAT	ADJ	OFF	2020/02/27 06:14
S54	4,133	((("MANUFACTURING") near3 ("RESOURCES"))	US-PGPUB; USPAT	ADJ	OFF	2020/02/28 10:45
S55	0	S54 and (enclosure and "electronic image assembly" and display and "open loop" and "closed loop").clm.	US-PGPUB; USPAT	ADJ	OFF	2020/02/28 10:46
S56	40	S54 and ("open loop" and "closed loop").clm.	US-PGPUB; USPAT	ADJ	OFF	2020/02/28 10:47
S57	1,123	cross flow heat exchanger	US-PGPUB; USPAT	ADJ	OFF	2020/02/28 10:53
S58	253	S57 and (LCD or display or panel)	US-PGPUB; USPAT	ADJ	OFF	2020/02/28 10:54
S59	3,471	H05K7/202,206,20972.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2020/02/28 11:31
S60	597,701	"59" and (LCD or display or panel)	US-PGPUB; USPAT	ADJ	OFF	2020/02/28 16:07
S61	3,471	H05K7/202,206,20972.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2020/02/28 16:08

S62	3,471	H05K7/202,206,20972.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2020/02/28 16:40
S63	579	S62 and (LCD or display or panel)	US-PGPUB; USPAT	ADJ	OFF	2020/02/28 16:40
S64	166	S63 and @ad<="20080320"	US-PGPUB; USPAT; IBM_TDB	ADJ	OFF	2020/02/28 16:42
S65	927	((Dunn) near2 (William)) or ((Hubbard) near3 (Tim))	US-PGPUB; USPAT	ADJ	OFF	2020/02/28 17:18
S66	839	((((Dunn) near2 (William)) or ((Hubbard) near3 (Tim))).inv.	US-PGPUB; USPAT	ADJ	OFF	2020/02/28 17:20
S67	4,133	((("MANUFACTURING") near3 ("RESOURCES"))	US-PGPUB; USPAT	ADJ	OFF	2020/02/28 17:20
S68	4,737	S67 or S65	US-PGPUB; USPAT	ADJ	OFF	2020/02/28 17:20
S69	0	S68 and (electronic image and cooling and enclosure and heat exchanger and (air or gas))	US-PGPUB; USPAT	ADJ	OFF	2020/02/28 17:23
S70	0	S68 and (electronic image and cooling and enclosure and heat exchanger and (air or gas))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2020/02/28 17:25
S72	0	S68 and ("electronic image assembly" and "cooling system" and enclosure and "heat exchanger" and air)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2020/02/28 17:32
S74	141	S68 and ("open loop" and "closed loop")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2020/02/28 17:33
S75	141	S68 and ("open loop" and "closed loop")	US-PGPUB; USPAT	ADJ	OFF	2020/02/28 17:34

S76	141	S75 and @ad<="20191209"	US-PGPUB; USPAT; IBM_TDB	ADJ	OFF	2020/02/28 17:35
S77	929	((Dunn) near2 (William)) or ((Hubbard) near3 (Tim))	US-PGPUB; USPAT	ADJ	OFF	2020/03/11 16:56
S78	4,144	((("MANUFACTURING") near3 ("RESOURCES"))	US-PGPUB; USPAT	ADJ	OFF	2020/03/11 16:56
S79	4,748	S78 or S77	US-PGPUB; USPAT	ADJ	OFF	2020/03/11 16:56
S80	142	S79 and ("open loop" and "closed loop")	US-PGPUB; USPAT	ADJ	OFF	2020/03/11 16:56
S81	97	S80 and cool\$3	US-PGPUB; USPAT	ADJ	OFF	2020/03/11 16:56
S82	77	S81 and (transparent same display)	US-PGPUB; USPAT	ADJ	OFF	2020/03/11 16:57
S83	2	"15789331"	US-PGPUB; USPAT	ADJ	OFF	2020/03/11 17:16
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S94	116	"20010009508" or "5869919"	US-PGPUB; USPAT; IBM_TDB	ADJ	ON	2020/09/14 01:40
S95	37	((polarizer or polarize) same (sun or solar or radiation)) with (display or LCD) and (airflow) and (blower or fan or air)	US-PGPUB; USPAT; IBM_TDB	ADJ	ON	2020/09/14 01:58
S96	22,544	(G02F1/133308 OR G02F2001/133334 OR G02F1/133385 OR G02F2201/08 OR G02F2201/36 OR G02F1/133528 OR H01L51/5234 OR H05K9/0081 OR H05K7/20972 OR Y02P20/133).CPC.	US-PGPUB; USPAT; IBM_TDB	ADJ	ON	2020/09/14 02:02
S97	7,648	S96 and (polarizer or polariser or polarise or polarize)	US-PGPUB; USPAT; IBM_TDB	ADJ	ON	2020/09/14 02:02
S98	7,536	S97 and (solar or sun or uv or ultraviolet or light or sunshine)	US-PGPUB; USPAT; IBM_TDB	ADJ	ON	2020/09/14 02:03
S99	7,454	S98 and (display or panel or lcd)	US-PGPUB; USPAT; IBM_TDB	ADJ	ON	2020/09/14 02:04
S100	3,193	S99 and (air or blower or cool\$3 or fan)	US-PGPUB; USPAT; IBM_TDB	ADJ	ON	2020/09/14 02:04
S101	115	electronic display and (closed near2 cool\$3)	US-PGPUB; USPAT; IBM_TDB	ADJ	OFF	2020/09/14 02:05
S102	980	S100 and @ad<="20091218"	US-PGPUB; USPAT; IBM_TDB	ADJ	OFF	2020/09/14 02:05
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S108	177	((("MANUFACTURING") near3 ("RESOURCES") near3 ("INTERNATIONAL") near3 ("INC"))).AS,AANM.	USPAT	ADJ	OFF	2020/09/14 02:15
S109	1,233	((("DUNN") near3 ("William")) OR (("HUBBARD") near3 ("Tim"))).INV.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	ADJ	OFF	2020/09/14 02:15
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S115	2	((("6493440") or ("20090154096"))).PN.	US-PGPUB; USPAT	OR	OFF	2020/09/14 02:15
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S120	2	((("20050073632") or ("20070206158")).PN.	US-PGPUB; USPAT	OR	OFF	2020/09/14 02:15
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S122	2	"15719374"	US-PGPUB; USPAT; IBM_TDB	ADJ	OFF	2020/09/14 02:15
S123	115	electronic display and (closed near2 cool\$3)	US-PGPUB; USPAT; IBM_TDB	ADJ	OFF	2020/09/14 02:15
S124	8	S101 and @ad<="20080320"	US-PGPUB; USPAT; IBM_TDB	ADJ	OFF	2020/09/14 02:15
S125	526	display and (closed near2 loop near3 gas)	US-PGPUB; USPAT; IBM_TDB	ADJ	OFF	2020/09/14 02:15
S126	166	S125 and @ad<="20071116"	US-PGPUB; USPAT; IBM_TDB	ADJ	OFF	2020/09/14 02:15
S127	42	S126 and heat exchanger	US-PGPUB; USPAT; IBM_TDB	ADJ	OFF	2020/09/14 02:15
S128	1,212	H05K7/202 G02F1/133385 H05K7/20136 H05K7/20163 H05K7/20972	US-PGPUB; USPAT; IBM_TDB	OR	OFF	2020/09/14 02:15
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S133	28,454	((closed and open) with (gas or cool\$3 or dissipation)) and (display or panel or screen)	US-PGPUB; USPAT; IBM_TDB	ADJ	OFF	2020/09/14 02:15
S134	1,721	S133 and ("361".clas. or H05K\$.cpc. or G06F\$.cpc.)	US-PGPUB; USPAT; IBM_TDB	ADJ	OFF	2020/09/14 02:15

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	("20180317330") or ("8773633") or ("10359659") or ("10088702") or ("9278564") or ("7918799") or ("20150009627") or ("20160192536") or ("20110261523")).PN. or ("9282676") or ("20180223846") or ("20090209863") or ("10499516") or ("20190335613") or ("20150022967") or ("9797588") or ("20100251742") or ("20160195254") or ("20140321103") or ("20150327409") or ("9089079") or ("20100305775") or ("20190111758") or ("9370127") or ("9285108") or ("20160302331") or ("2299939") or ("8145363") or ("6205796") or ("20020134544") or ("6367410") or ("20190037738") or ("20190170383") or ("7086453") or ("20050056404") or ("8152904") or ("10514176") or ("20110072970") or ("20090086432") or ("20110077555") or ("20180235066") or ("8622162") or ("6408630") or ("6196003") or ("20140313698") or ("20120180979") or ("20010008071") or ("20180035569") or ("5402844") or ("20020012375") or ("20090185346") or ("20160050797") or ("6408937") or ("20190335573") or ("20190239365") or ("20010021847") or ("5901167") or ("20110195652") or ("20070279861") or ("6843306") or ("6164369") or ("8425435") or ("7411785") or ("10010722") or ("10160290") or ("7841721") or ("4182303") or ("20110139525") or ("5931016") or ("7724516") or ("20180106484") or ("20150351214") or ("9010141") or ("20160178716") or ("5936646") or ("20130190661") or ("RE43007") or ("20160066478") or ("20030057546") or ("7796376") or ("4840225") or ("9967964") or ("20040049178") or ("9204578") or ("6828675") or ("20190170604") or ("20150223367") or ("9575149") or ("20170115366") or ("6044648") or ("20180335053") or ("20020116933") or ("6635053") or ("10082549") or ("5657641") or ("20170321907") or ("6490874") or ("20140260965") or ("7318821") or ("6592577") or ("20170261273") or ("6674642") or ("20040001310") or				
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	("20050090814") or ("7207986") or ("20070028769") or ("4534780") or ("5269146") or ("20080055563") or ("9885526") or ("20110297351") or ("9353966") or ("RE30043") or ("20100232107") or ("20030077499") or ("4056091") or ("6830842") or ("20160265805") or ("20140190037") or ("8379182") or ("6298681") or ("20040040324") or ("20110077556") or ("6334323") or ("8932238") or ("2819330") or ("4478055") or ("7403392") or ("20110126559") or ("5611476") or ("7911782") or ("7946986") or ("20200005592") or ("6167947") or ("20030217566") or ("4860824") or ("20020092316") or ("5906108") or ("20030145616") or ("6321547") or ("20030145621") or ("20110197613").PN. or ("7093454") or ("8297070") or ("20180094840") or ("20090056910") or ("20040048123") or ("20060218812") or ("20120137716") or ("4344479") or ("20060080996") or ("10502468") or ("8051672") or ("20150373882") or ("5476138") or ("6021150") or ("20110077557") or ("8009419") or ("8381541") or ("8105265") or ("7537849") or ("7010929") or ("5835349") or ("10477724") or ("6494252") or ("6964176") or ("20160270254") or ("9210830") or ("20080156014") or ("6350033") or ("20090107160") or ("4906182") or ("20140146468") or ("10130006") or ("20070144192") or ("20180059270") or ("20030011983") or ("20150369514") or ("20180100671") or ("20120131944") or ("10054698") or ("6948328") or ("10415848") or ("9258926") or ("8117864") or ("20150083368") or ("6587336") or ("20040042905") or ("20170021695") or ("20100057263") or ("7788940") or ("20090099498") or ("6957026") or ("20180214303") or ("10398066") or ("4967830") or ("6793465") or ("20140146467") or ("20160189842") or ("20050180772") or ("20150373874") or ("8947873") or ("20080141708") or ("20120031392") or ("4397121") or ("5529120") or				
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	("9551358") or ("20180291798") or ("20160252289") or ("20190053399") or ("20190239381") or ("5193735") or ("4318722") or ("5982619") or ("5285644") or ("10292305") or ("20170067643") or ("9568206") or ("20140260383") or ("5538075") or ("7963118") or ("5046554") or ("5570740") or ("7701715") or ("20150250067") or ("20160037685") or ("20190249882") or ("9441839") or ("4773589") or ("9784490") or ("20120130298") or ("8979788") or ("20110277967") or ("4026283") or ("20190200488") or ("10440856") or ("20080024978") or ("20120024501") or ("20130021746") or ("10015896") or ("8959941") or ("8422218") or ("20130032310") or ("8591206") or ("20140111940") or ("9101078") or ("4953365") or ("8964391") or ("5590539") or ("6026565") or ("20160258657") or ("20140360492") or ("9982920") or ("20090178780") or ("5825621") or ("8854572") or ("20130068441") or ("5748656") or ("2513373") or ("4285210") or ("5564980") or ("8248801") or ("20120162906") or ("8361059") or ("20150285516") or ("20100139306") or ("20130170140") or ("20140123493") or ("20190171092") or ("3415312") or ("5086754") or ("8435277") or ("6796372") or ("20140290567") or ("20140124167") or ("8899171").PN. or ("7701714") or ("20070274043") or ("4242872") or ("8964390") or ("20100238394") or ("20200025408") or ("20180370263") or ("20100296245") or ("20180038660") or ("4307578") or ("20200037456") or ("5467250") or ("20080306577") or ("7724517") or ("20110075363") or ("20190291542") or ("7780657") or ("6109339") or ("6649290") or ("20190327865") or ("20160230634") or ("20020168556") or ("10434804") or ("5065586") or ("8236240") or ("20070209380") or ("20170122573") or ("7778013") or ("9969193") or ("9261310") or ("6506111") or ("5524442") or ("4674476") or ("20130228313") or				
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	("5349829") or ("4922890") or ("8274622") or ("20070097604") or ("8358397") or ("2564344") or ("20020173266") or ("8760867") or ("20170307282") or ("20070274858") or ("7414845") or ("4987881") or ("20180317350") or ("20180363278") or ("4142575") or ("20080017355") or ("20070267741") or ("4090370") or ("20100000758") or ("20070246678") or ("20170064874") or ("20110000710") or ("20130025818") or ("5895418") or ("7213639") or ("20090193830") or ("20180073753") or ("20070233055") or ("20150273974") or ("20090107657") or ("7956284") or ("20060207757") or ("5110264") or ("20150224800") or ("20070093799") or ("9496200") or ("20070241468") or ("20130206058") or ("5937667") or ("4589712") or ("20060069418") or ("8210205") or ("20180292142") or ("20140262180") or ("20070161974") or ("4706739") or ("RE45111") or ("20170080730") or ("4449764") or ("10264716") or ("9789746") or ("20180160819") or ("20190193439") or ("9048344") or ("7510174") or ("10442226") or ("20080024980") or ("20050259397") or ("20030012234") or ("20190113247") or ("5832986") or ("20180128510") or ("20080196870") or ("7795533") or ("20090257773") or ("20180275293") or ("20150354874") or ("6914919") or ("5606870") or ("20200056795") or ("7652884") or ("5749243") or ("6138469") or ("20180214302") or ("9387709") or ("4866743") or ("20040163797") or ("20170311476") or ("7203063") or ("20120227389") or ("20100007258") or ("7325410") or ("5267446") or ("7418825") or ("20110075353") or ("2320501") or ("20190198895") or ("9759438") or ("20070236881") or ("20130252533") or ("20030151892") or ("5113844") or ("20170345346") or ("20110232869") or ("6232682") or ("4701415") or ("20040083740") or ("5499277").PN. or ("20110140820") or ("7165412") or ("20170363306") or ("5320167") or ("20060254753") or				
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	("20170311487") or ("7377935") or ("9354001") or ("7258161") or ("20090107159") or ("10524397") or ("20170245400") or ("8081054") or ("20050205241") or ("7492593") or ("5533357") or ("7334630") or ("6779348") or ("20060126296") or ("4505118") or ("10514174") or ("7128025") or ("20150259847") or ("10488089") or ("20160003546") or ("20180094841") or ("20080023178") or ("20020023453") or ("7096928") or ("10006721") or ("20110077514") or ("4158950") or ("20080158815") or ("20180283803") or ("20160320149") or ("20190219285") or ("20020148415") or ("9042099") or ("20190184852") or ("7832231") or ("4488192") or ("9613548") or ("20090200000") or ("20140133099") or ("20120327600") or ("7184269") or ("20160198588") or ("20180199467") or ("20170321911") or ("10074954") or ("8929075") or ("6920043") or ("7013955") or ("20180315356") or ("7802734") or ("8250877") or ("4297318") or ("20020050338") or ("20130055748") or ("20080148760") or ("8899066") or ("9943014") or ("20060000582") or ("7397661") or ("20200025429") or ("20080259566") or ("20170328589") or ("7677057") or ("9631880") or ("20120279684") or ("9313931") or ("5605047") or ("10371451") or ("20150068171") or ("20010013404") or ("20030136134") or ("20020139514") or ("9810439") or ("20050024831") or ("5458188") or ("8482695") or ("20030159456") or ("20090112368") or ("8037714") or ("10309665") or ("20120285543") or ("5560362") or ("20180156228") or ("20140133096") or ("9042098") or ("7969727") or ("4242876") or ("20180017345") or ("20070295492") or ("20060177714") or ("6280318") or ("20160290666") or ("4330946") or ("20190021186") or ("20130056177") or ("20070258612") or ("20150292775") or ("20040095728") or ("7672125") or ("4622947") or ("20120121487") or ("10060350") or ("6944023") or ("7757753") or			
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	("6889750") or ("20100277864") or ("20150165871") or ("20160298540") or ("20080141686") or ("20160061532") or ("20120031601") or ("20090260372") or ("10241103") or ("4348604") or ("20170328879") or ("20080049396") or ("7458228") or ("2990695") or ("20170356597") or ("4449511") or ("4370861") or ("9313930") or ("5477687") or ("5357586") or ("8693199") or ("7340912") or ("6775996")).PN. or ("7073566") or ("7710722") or ("20080024981") or ("20080024987") or ("20170172016") or ("20190141911") or ("7026065") or ("20050258259") or ("7818835") or ("20060219381") or ("20090216304") or ("7555792") or ("20190316948") or ("20090288440") or ("20080142203") or ("4022550") or ("5692467") or ("4324110") or ("20050006488") or ("10544902") or ("4373577") or ("5586932") or ("7134486") or ("4146086") or ("7980094") or ("20050174714") or ("5816318") or ("4848318") or ("20100118275") or ("2179734") or ("7802439") or ("5205276") or ("9441840") or ("5596622") or ("9593876") or ("7511960") or ("2873582") or ("5522216") or ("20150153109") or ("20130105120") or ("4380156") or ("20050241803") or ("20080161976") or ("20070073369") or ("7036559") or ("20110094714") or ("20100319365") or ("20090120630") or ("20180139864") or ("20080135224") or ("20080310112") or ("20090173473") or ("4690209") or ("8157626") or ("20180136187") or ("20080161975") or ("9151540") or ("3290028") or ("20070074682") or ("6992483") or ("5253485") or ("2526874") or ("10334764") or ("7832992") or ("8619425") or ("20110315364") or ("20170223870") or ("5042262") or ("6728102") or ("5582241") or ("20030044663") or ("4704658") or ("7131486") or ("10174975") or ("20170176605") or ("20130312645") or ("9038406") or ("7819634") or ("7673592") or				
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	("20150000319") or ("20030205363") or ("4147299") or ("9605875") or ("20080062647") or ("3373732") or ("20090225514") or ("8941993") or ("8453471") or ("20090225513") or ("7184267") or ("20180135880") or ("9476649") or ("20180263811") or ("20080156887") or ("10458682") or ("4495545") or ("20100011803") or ("10240845") or ("20020148604") or ("6061087") or ("20170038123") or ("4505131") or ("5239834") or ("5610968") or ("20080055848") or ("20140053558") or ("9173324") or ("6829900") or ("6909283") or ("20190226461") or ("6209622") or ("20130047653") or ("9689720") or ("20160245558") or ("4033825") or ("20090209193") or ("8178831") or ("20150047384") or ("20190331369") or ("4803846") or ("7854135") or ("9392733") or ("20170067644") or ("5694442") or ("7975494") or ("20180352676") or ("20030085024") or ("20120318328") or ("20190113259") or ("20180324976") or ("8055388") or ("20130334447") or ("6007205") or ("20100149754")).PN. or (("20190219311") or ("8235777") or ("7911793") or ("9746235") or ("5732123") or ("20080176503") or ("4611791") or ("4294225") or ("8546717") or ("7497252") or ("7341201") or ("4168706") or ("5050390") or ("9351694") or ("20120125028") or ("8699737") or ("5088295") or ("4333517") or ("9267737") or ("8189334") or ("8297067") or ("9752803") or ("20110315363") or ("6991024") or ("10485113") or ("20160116224") or ("20130083479") or ("20120160454") or ("20090090115") or ("4092088") or ("7830657") or ("7856838") or ("7534167") or ("20030231467") or ("20180199450") or ("4430994") or ("8601827") or ("9223360") or ("20180314103") or ("20130220579") or ("9338924") or ("20080160901") or ("20080141707") or ("20110272120") or ("9835357") or ("20110061591") or ("4190099") or ("20170038346") or ("4336692") or ("8089764") or				
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	("7878889") or ("5572880") or ("6896612") or ("9918413") or ("8235776") or ("7957132") or ("8693198") or ("6131571") or ("20100307716") or ("20180328600") or ("6279337") or ("8431404") or ("20150343554") or ("20110030932") or ("20160120058") or ("7363879") or ("20170164525") or ("20120120542") or ("20190143445") or ("20090007581") or ("20200039260") or ("20140153689") or ("9908195") or ("20190069449") or ("4755236") or ("20110207391") or ("20170181325") or ("6497110") or ("9297571") or ("20060279930") or ("8968232") or ("5562411") or ("20080060372") or ("7185697") or ("20130269204") or ("20140260361") or ("5361591") or ("20110218600") or ("3470704") or ("6167621") or ("20030062149") or ("5689968") or ("20080196868") or ("9228779") or ("5890371") or ("RE36808") or ("20120012283") or ("6704198") or ("10568217") or ("20030164231") or ("20040089442") or ("20110134604") or ("6942018") or ("10371443") or ("4485642") or ("7984684") or ("8467168") or ("20110105010") or ("9763366") or ("5724828") or ("20110289943") or ("20120171943") or ("20190196312") or ("9086859") or ("20100078156") or ("20070268669") or ("6393730") or ("20180347578") or ("5240403") or ("4295342") or ("5348077") or ("20050098299") or ("20120318492") or ("20180155969") or ("20090013553") or ("8467189") or ("5526650") or ("20140314395") or ("9283109") or ("7385810") or ("20110061832") or ("20070084463") or ("20120167600") or ("9032742") or ("4589265").PN. or ("20110088883") or ("20070030650") or ("10139159") or ("9273875") or ("4138857") or ("20020135981") or ("7610764") or ("4308042") or ("6053238") or ("9414519") or ("20080058697") or ("20120133256") or ("9267881") or ("20100246118") or ("9677822") or ("8439104") or ("9968010") or ("8378677") or ("4859405") or				
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		("9055696") or ("6217440") or ("6865825") or ("20140151003") or ("8031468") or ("20120270310") or ("20130081790") or ("20120127657") or ("20120167610") or ("20120075797") or ("20100188082") or ("8240165") or ("7905106") or ("4265220") or ("10189114") or ("7348527") or ("20160120059") or ("10184699") or ("20130104414") or ("20040257766") or ("20010045104") or ("6564795") or ("7905096") or ("20100321887") or ("9282684") or ("7946112") or ("20160288244") or ("20070102426") or ("9648790") or ("20180238623") or ("8119300") or ("20140250713") or ("20120118534") or ("9128681") or ("10151539") or ("7040101") or ("4424190") or ("5467615") or ("8035968") or ("6182608") or ("20190053400") or ("6580609") or ("20060133033") or ("10288328") or ("8514575") or ("20180045138") or ("20040169771") or ("9920708") or ("6230501") or ("20090260777") or ("20020121095") or ("20030154724") or ("20090310300") or ("4046529") or ("20150182650") or ("5513558")).PN.				
S147	428	S146 and @ad<="20080320"	US-PGPUB; USPAT; IBM_TDB	ADJ	OFF	2020/09/14 02:15
S148	29	(US-20090154096-\$ or US- 20060082271-\$ or US-20180088398-\$ or US-20140334100-\$ or US- 20130194782-\$ or US-20120236499-\$ or US-20110167845-\$ or US- 20110162831-\$ or US-20110058326-\$ or US-20100177479-\$ or US- 20090086430-\$ or US-20080285290-\$ or US-20070081344-\$ or US- 20090279240-\$ or US-20040135482-\$ or US-20110085301-\$ or US- 20090244472-\$ or US-20090135365-\$ or US-20090126906-\$ or US- 20150009627-\$ or US-20130201685-\$ or US-20120188481-\$ or US- 20110122162-\$).did. or (US-6493440-\$ or US-5991153-\$ or US-5869919-\$ or US-5748269-\$ or US-8274622-\$ or US- 10088702-\$).did.	US-PGPUB; USPAT	ADJ	OFF	2020/09/14 02:15

S149	4,332	((("MANUFACTURING") near3 ("RESOURCES"))	US-PGPUB; USPAT	ADJ	OFF	2020/09/14 02:15
S150	2	S149 and (enclosure and "electronic image assembly" and display and "open loop" and "closed loop").clm.	US-PGPUB; USPAT	ADJ	OFF	2020/09/14 02:15
S151	54	S149 and ("open loop" and "closed loop").clm.	US-PGPUB; USPAT	ADJ	OFF	2020/09/14 02:15
S152	1,161	cross flow heat exchanger	US-PGPUB; USPAT	ADJ	OFF	2020/09/14 02:15
S153	264	S152 and (LCD or display or panel)	US-PGPUB; USPAT	ADJ	OFF	2020/09/14 02:15
S154	3,706	H05K7/202,206,20972.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2020/09/14 02:15
S155	617,836	"59" and (LCD or display or panel)	US-PGPUB; USPAT	ADJ	OFF	2020/09/14 02:15
S156	3,706	H05K7/202,206,20972.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2020/09/14 02:15
S157	3,706	H05K7/202,206,20972.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2020/09/14 02:15
S158	626	S157 and (LCD or display or panel)	US-PGPUB; USPAT	ADJ	OFF	2020/09/14 02:15
S159	166	S158 and @ad<="20080320"	US-PGPUB; USPAT; IBM_TDB	ADJ	OFF	2020/09/14 02:15
S160	966	((Dunn) near2 (William)) or ((Hubbard) near3 (Tim))	US-PGPUB; USPAT	ADJ	OFF	2020/09/14 02:15
S161	875	((((Dunn) near2 (William)) or ((Hubbard) near3 (Tim))))inv.	US-PGPUB; USPAT	ADJ	OFF	2020/09/14 02:16
S162	4,332	((("MANUFACTURING") near3 ("RESOURCES"))	US-PGPUB; USPAT	ADJ	OFF	2020/09/14 02:16
S163	4,941	S162 or S160	US-PGPUB; USPAT	ADJ	OFF	2020/09/14 02:16

S164	2	S163 and (electronic image and cooling and enclosure and heat exchanger and (air or gas))	US-PGPUB; USPAT	ADJ	OFF	2020/09/14 02:16
S165	2	S163 and (electronic image and cooling and enclosure and heat exchanger and (air or gas))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2020/09/14 02:16
S166	2	S163 and ("electronic image assembly" and "cooling system" and enclosure and "heat exchanger" and air)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2020/09/14 02:16
S167	158	S163 and ("open loop" and "closed loop")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	OFF	2020/09/14 02:16
S168	158	S163 and ("open loop" and "closed loop")	US-PGPUB; USPAT	ADJ	OFF	2020/09/14 02:16
S169	149	S168 and @ad<="20191209"	US-PGPUB; USPAT; IBM_TDB	ADJ	OFF	2020/09/14 02:16
S170	966	((Dunn) near2 (William)) or ((Hubbard) near3 (Tim))	US-PGPUB; USPAT	ADJ	OFF	2020/09/14 02:16
S171	4,332	((("MANUFACTURING") near3 ("RESOURCES"))	US-PGPUB; USPAT	ADJ	OFF	2020/09/14 02:16
S172	4,941	S171 or S170	US-PGPUB; USPAT	ADJ	OFF	2020/09/14 02:16
S173	158	S172 and ("open loop" and "closed loop")	US-PGPUB; USPAT	ADJ	OFF	2020/09/14 02:16
S174	113	S173 and cool\$3	US-PGPUB; USPAT	ADJ	OFF	2020/09/14 02:16
S175	90	S174 and (transparent same display)	US-PGPUB; USPAT	ADJ	OFF	2020/09/14 02:16
S176	4	"15789331"	US-PGPUB; USPAT	ADJ	OFF	2020/09/14 02:16
S177	202	("10080316" "10088702" "10194564" "10212845" "10278311" "10314212" "10359659" "10398066"	US-PGPUB; USPAT	ADJ	OFF	2020/09/14 02:16

	"10420257" "10485113"			
	"10499516" "10506738"			
	"10506740" "20010001459"			
	"20010019454" "20020009978"			
	"20020033919" "20020050793"			
	"20020065046" "20020084891"			
	"20020101553" "20020112026"			
	"20020126248" "20020148600"			
	"20020149714" "20020154255"			
	"20020164944" "20020164962"			
	"20020167637" "20030007109"			
	"20030020884" "20030043091"			
	"20030104210" "20030128511"			
	"20030214785" "20040012722"			
	"20040035032" "20040035558"			
	"20040036622" "20040036834"			
	"20040042174" "20040103570"			
	"20040105159" "20040135482"			
	"20040165139" "20040223299"			
	"20050012039" "20050012722"			
	"20050062373" "20050073632"			
	"20050073639" "20050127796"			
	"20050134525" "20050134526"			
	"20050213950" "20050229630"			
	"20050237714" "20050253699"			
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S202	516	(display or LCD or panel) and (transparent (panel or screen or display)) and (polarizer or polarize or "optical filter" or polarizing or tint) and ((air cool\$3 or fan or blower or air) with (air path or groove or space or opening or space))	US-PGPUB; USPAT; IBM_TDB	ADJ	ON	2020/09/15 11:07
S203	31,497	(G02B5/30 OR G02B6/0055 OR G02F1/133528 OR G02F2001/133388 OR G02F1/133308 OR G02F1/133385	US-PGPUB; USPAT; IBM_TDB	ADJ	ON	2020/09/15 13:23

		OR G07F17/3211 OR G09F13/0413 OR G09F13/12).CPC.				
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S206	590	(transparent (panel or screen or display)) and S205	US-PGPUB; USPAT; IBM_TDB	ADJ	ON	2020/09/15 13:28
S207	314	(air cool\$3 or fan or blower or air) and S206	US-PGPUB; USPAT; IBM_TDB	ADJ	ON	2020/09/15 13:29
S208	223	S207 not S202	US-PGPUB; USPAT; IBM_TDB	ADJ	ON	2020/09/15 13:29
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S212	215	S203 and S210	US-PGPUB; USPAT; IBM_TDB	ADJ	ON	2020/09/15 13:41
S213	199	S212 not (S207 or S208 or S202)	US-PGPUB; USPAT; IBM_TDB	ADJ	ON	2020/09/15 13:41
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S220	0	((polarizer or polarize or "optical filter" or polarizing or tint) same (display or lcd or screen) same (air or fan or cool\$3 or blower) same (solar or sunlight or sun)) and S219	US-PGPUB; USPAT; IBM_TDB	ADJ	OFF	2020/09/15 14:05

S221	15	((polarizer or polarize or "optical filter" or polarizing or tint) and (display or lcd or screen) and (air or fan or cool\$3 or blower) and (solar or sunlight or sun)) and S219	US-PGPUB; USPAT; IBM_TDB	ADJ	OFF	2020/09/15 14:06
S222	65	("4687298" "4749261" "4806221" "5132830" "5150235" "5187510" "5196953" "5232634" "5237437" "5239406" "5249071" "5299041" "5311340" "5661578" "5680185" "5706067" "5724111" "5754262" "5768019" "5808714").PN. OR ("6211934").URPN.	US-PGPUB; USPAT; USOCR	ADJ	ON	2020/09/15 14:08
S223	65	("4687298" "4749261" "4806221" "5132830" "5150235" "5187510" "5196953" "5232634" "5237437" "5239406" "5249071" "5299041" "5311340" "5661578" "5680185" "5706067" "5724111" "5754262" "5768019" "5808714").PN. OR ("6211934").URPN.	US-PGPUB; USPAT; USOCR	ADJ	ON	2020/09/15 17:19

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S41	8	electronic display image assembly front portion rear portion open loop ambient air flow path closed loop gas circulation path heat exchanger pathway gas circulation device force circulating gas air circulation device	US-PGPUB; USPAT	AND	OFF	2019/09/02 03:02
S42	8	electronic display image assembly front portion rear portion open loop ambient air flow path closed loop gas circulation path heat exchanger pathway gas circulation device force circulating	US-PGPUB; USPAT	AND	OFF	2019/09/02 03:02
S43	79	electronic display image assembly front portion rear portion open loop ambient air flow path closed loop gas circulation path heat exchanger pathway	US-PGPUB; USPAT	AND	OFF	2019/09/02 03:03
S44	79	display image front portion rear portion open loop ambient air flow path closed loop gas circulation path heat exchanger pathway	US-PGPUB; USPAT	AND	OFF	2019/09/02 03:04
S45	79	display image front portion rear portion open loop air flow path closed loop gas circulation path heat exchanger pathway	US-PGPUB; USPAT	AND	OFF	2019/09/02 03:04

S46	225	display image front portion rear portion open loop air flow path closed loop heat exchanger pathway	US-PGPUB; USPAT	AND	OFF	2019/09/02 03:04
S47	146	S46 not S45	US-PGPUB; USPAT	AND	OFF	2019/09/02 03:05
S48	175	display image front portion rear portion open loop air flow path closed loop heat exchanger pathway fan	US-PGPUB; USPAT	AND	OFF	2019/09/02 03:08
S86	22	cooling system electronic image assembly enclosure mounting space transparent display surface front open loop air flow path closed loop gas circulation path heat exchanger gas circulation device air circulation device.clm.	US-PGPUB; USPAT	AND	OFF	2020/03/11 18:26
S87	75	cooling system electronic image assembly enclosure mounting space surface front open loop air flow path closed loop gas circulation path heat exchanger gas circulation device air circulation device.clm.	US-PGPUB; USPAT	AND	OFF	2020/03/11 18:26
S88	81	cooling system electronic image enclosure mounting space surface front open loop air flow path closed loop gas circulation path heat exchanger gas circulation device air circulation device.clm.	US-PGPUB; USPAT	AND	OFF	2020/03/11 18:26
S89	167	cooling enclosure mounting space surface front open loop air flow path closed loop gas circulation path heat exchanger gas circulation device air circulation device.clm.	US-PGPUB; USPAT	AND	OFF	2020/03/11 18:27
S90	180	enclosure mounting space surface front open loop air flow path closed loop gas circulation path heat exchanger gas circulation device air circulation device.clm.	US-PGPUB; USPAT	AND	OFF	2020/03/11 18:27
S91	84	electronic image enclosure mounting space surface front open loop air flow path closed loop gas circulation path heat exchanger gas circulation device air circulation device.clm.	US-PGPUB; USPAT	AND	OFF	2020/03/11 18:27
S180	12	electronic display image assembly front portion rear portion open loop ambient air flow path closed loop gas circulation path heat exchanger pathway gas circulation device force circulating gas air circulation device	US-PGPUB; USPAT	AND	OFF	2020/09/14 02:15
S181	12	electronic display image assembly front portion rear portion open loop ambient air flow path closed loop gas circulation path heat exchanger pathway gas circulation device force circulating	US-PGPUB; USPAT	AND	OFF	2020/09/14 02:15

S182	149	electronic display image assembly front portion rear portion open loop ambient air flow path closed loop gas circulation path heat exchanger pathway	US-PGPUB; USPAT	AND	OFF	2020/09/14 02:15
S183	150	display image front portion rear portion open loop ambient air flow path closed loop gas circulation path heat exchanger pathway	US-PGPUB; USPAT	AND	OFF	2020/09/14 02:15
S184	150	display image front portion rear portion open loop air flow path closed loop gas circulation path heat exchanger pathway	US-PGPUB; USPAT	AND	OFF	2020/09/14 02:15
S185	368	display image front portion rear portion open loop air flow path closed loop heat exchanger pathway	US-PGPUB; USPAT	AND	OFF	2020/09/14 02:15
S186	218	S185 not S184	US-PGPUB; USPAT	AND	OFF	2020/09/14 02:15
S187	299	display image front portion rear portion open loop air flow path closed loop heat exchanger pathway fan	US-PGPUB; USPAT	AND	OFF	2020/09/14 02:15
S188	24	cooling system electronic image assembly enclosure mounting space transparent display surface front open loop air flow path closed loop gas circulation path heat exchanger gas circulation device air circulation device.clm.	US-PGPUB; USPAT	AND	OFF	2020/09/14 02:16
S189	93	cooling system electronic image assembly enclosure mounting space surface front open loop air flow path closed loop gas circulation path heat exchanger gas circulation device air circulation device.clm.	US-PGPUB; USPAT	AND	OFF	2020/09/14 02:16
S190	102	cooling system electronic image enclosure mounting space surface front open loop air flow path closed loop gas circulation path heat exchanger gas circulation device air circulation device.clm.	US-PGPUB; USPAT	AND	OFF	2020/09/14 02:16
S191	191	cooling enclosure mounting space surface front open loop air flow path closed loop gas circulation path heat exchanger gas circulation device air circulation device.clm.	US-PGPUB; USPAT	AND	OFF	2020/09/14 02:16
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9/17/2020 7:24:45 PM

C:\Users\mmatey\Documents\EAST\Workspaces\16933932 (Electronic display with cooling).wsp

Doc code: IDS

PTO/SB/08a (01-10)

Doc description: Information Disclosure Statement (IDS) Filed

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	Filing Date	2020-07-20
	First Named Inventor	William Dunn
	Art Unit	2835
	Examiner Name	Michael A Matey
	Attorney Docket Number	MAN2241-045R

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	1	KR10-1904363	KR	B1	2018-09-27	Manufacturing Resources International, Inc.		×
	2	WO2018/200260	WO	A1	2018-11-01	Manufacturing Resources International, Inc.		☐
	3	WO2018/200905	WO	A1	2018-11-01	Manufacturing Resources International, Inc.		☐

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Art Unit	2835	
Examiner Name	Michael A Matey	
Attorney Docket Number	MAN2241-045R	

4	CN108700739	CN	A	2018-10-23	Manufacturing Resources International, Inc.	☒
5	CA2809019	CA	C	2019-09-25	Manufacturing Resources International, Inc.	☐
6	JP2004286940	JP	A	2004-10-14	Hitachi Ie Systems Co Ltd.	☒
7	EP3423886	EP	A0	2019-01-09	Manufacturing Resources International, Inc.	☐
8	KR20000000118	KR	U	2000-01-15	Samsung Electronics Co., Ltd.	☒
9	KR20000047899	KR	A	2000-07-25	Sony Corp.	☒
10	KR1020040067701	KR	A	2004-07-30	Curie Lab Holdings Limited	☒
11	AU2017216500	AU	B2	2019-01-17	Manufacturing Resources International, Inc.	☐
12	AU2016220308	AU	B2	2019-03-21	Manufacturing Resources International, Inc.	☐
13	AU2015229457	AU	B2	2019-03-07	Manufacturing Resources International, Inc.	☐
14	KR10-1958375	KR	B1	2019-03-08	Manufacturing Resources International, Inc.	☒

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	Attorney Docket Number	MAN2241-045R		

15	EP3468321	EP	A1	2019-04-10	Manufacturing Resources International, Inc.		☐
16	EP3138372	EP	B1	2019-05-08	Manufacturing Resources International, Inc.		☐
17	JP2019-512721	JP	A	2019-05-16	Manufacturing Resources International, Inc.		☐
18	KR10-2006-0070176	KR	A	2006-06-23	Samsung Electronics Co., Ltd		☒
19	BRPI0820231-1	BR		2019-02-12	Manufacturing Resources International, Inc.		☒
20	CA27982777	CA	C	2019-06-25	Manufacturing Resources International, Inc.		☐
21	EP3117693	EP	B1	2019-08-07	Manufacturing Resources International, Inc.		☐
22	CN107251671	CN	B	2019-08-02	Manufacturing Resources International, Inc.	Patent No. ZL201680010005.X	☐
23	KR10-2010515	KR	B1	2019-08-07	Manufacturing Resources International, Inc.		☒
24	JP6526245	JP	B2	2019-05-17	Manufacturing Resources International, Inc.		☒
25	EP2567283	EP	B1	2019-10-16	Manufacturing Resources International, Inc.		☐

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26	CA2888494	CA	C	2019-09-24	Manufacturing Resources International, Inc.	☐
27	KR10-2013-0126034	KR	A	2013-11-20	Daesung Eltec Co., Ltd.	☐
28	JP2002-6282	JP	A	2002-01-09	Toshiba Corp	☒
29	KR10-0563049	KR	B1	2006-03-24	Samsung SDI Co., Ltd.	☒
30	KR10-2063885	KR		2020-01-02	Manufacturing Resources International, Inc.	☒
31	KR10-2067751	KR	B1	2002-01-13	Manufacturing Resources International, Inc.	☒
32	EP3615978	EP	A1	2020-03-04	Manufacturing Resources International, Inc.	☐
33	EP3616481	EP	A1	2020-03-04	Manufacturing Resources International, Inc.	☐
34	WO2015/138609	WO	A2	2015-09-17	Manufacturing Resources International, Inc.	☐
35	EP2909829	EP	B1	2020-02-12	Manufacturing Resources International, Inc.	☐
36	JP2011-14593	JP	A	2011-01-20	Hitachi High-Technologies Corp	☒

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37	EP3624574	EP	A1	2020-03-18	Manufacturing Resources International, Inc.	☐
38	AU2017228430	AU	B2	2020-03-05	Manufacturing Resources International, Inc.	☐
39	JP2006-176112	JP	A	2006-07-06	Harman Becker Automotive Sys	☒
40	KR10-2104342	KR	B1	2020-04-20	Manufacturing Resources International, Inc.	☒
41	KR10-2109072	KR	B1	2020-05-04	Manufacturing Resources International, Inc.	☒
42	WO2020/081687	WO	A1	2020-04-23	Firefly Systems Inc.	☐
43	JP6688402	JP	B2	2020-04-07	Manufacturing Resources International, Inc.	☒
44	JP2006-32890	JP	A	2006-02-02	Metal Ind Res & Dev CT	☒
45	JP2002006282	JP	A	2002-01-09	Toshiba Corp.	☒

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Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

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. See 37 CFR 1.97(e)(1).

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See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

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A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Adam J. Smith/	Date (YYYY-MM-DD)	2020-08-26
Name/Print	Adam J. Smith	Registration Number	72962

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	2	WO2018/200260	WO	A1	2018-11-01	Manufacturing Resources International, Inc.		☐
	3	WO2018/200905	WO	A1	2018-11-01	Manufacturing Resources International, Inc.		☐

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Art Unit	2835	
Examiner Name	Michael A Matey	
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4	CN108700739	CN	A	2018-10-23	Manufacturing Resources International, Inc.	☒
5	CA2809019	CA	C	2019-09-25	Manufacturing Resources International, Inc.	☐
6	JP2004286940	JP	A	2004-10-14	Hitachi Ie Systems Co Ltd.	☒
7	EP3423886	EP	A0	2019-01-09	Manufacturing Resources International, Inc.	☐
8	KR20000000118	KR	U	2000-01-15	Samsung Electronics Co., Ltd.	☒
9	KR20000047899	KR	A	2000-07-25	Sony Corp.	☒
10	KR1020040067701	KR	A	2004-07-30	Curie Lab Holdings Limited	☒
11	AU2017216500	AU	B2	2019-01-17	Manufacturing Resources International, Inc.	☐
12	AU2016220308	AU	B2	2019-03-21	Manufacturing Resources International, Inc.	☐
13	AU2015229457	AU	B2	2019-03-07	Manufacturing Resources International, Inc.	☐
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19	BRPI0820231-1	BR		2019-02-12	Manufacturing Resources International, Inc.		☒
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28	JP2002-6282	JP	A	2002-01-09	Toshiba Corp	☒
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Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

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. See 37 CFR 1.97(e)(1).

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See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

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A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Adam J. Smith/	Date (YYYY-MM-DD)	2020-08-26
Name/Print	Adam J. Smith	Registration Number	72962

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16/933,932 -- GAU: 2835

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Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear
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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.M/

SEC et al. v. MRI
SEC Exhibit 1022.0479
IPR2023-00221

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