

2/25

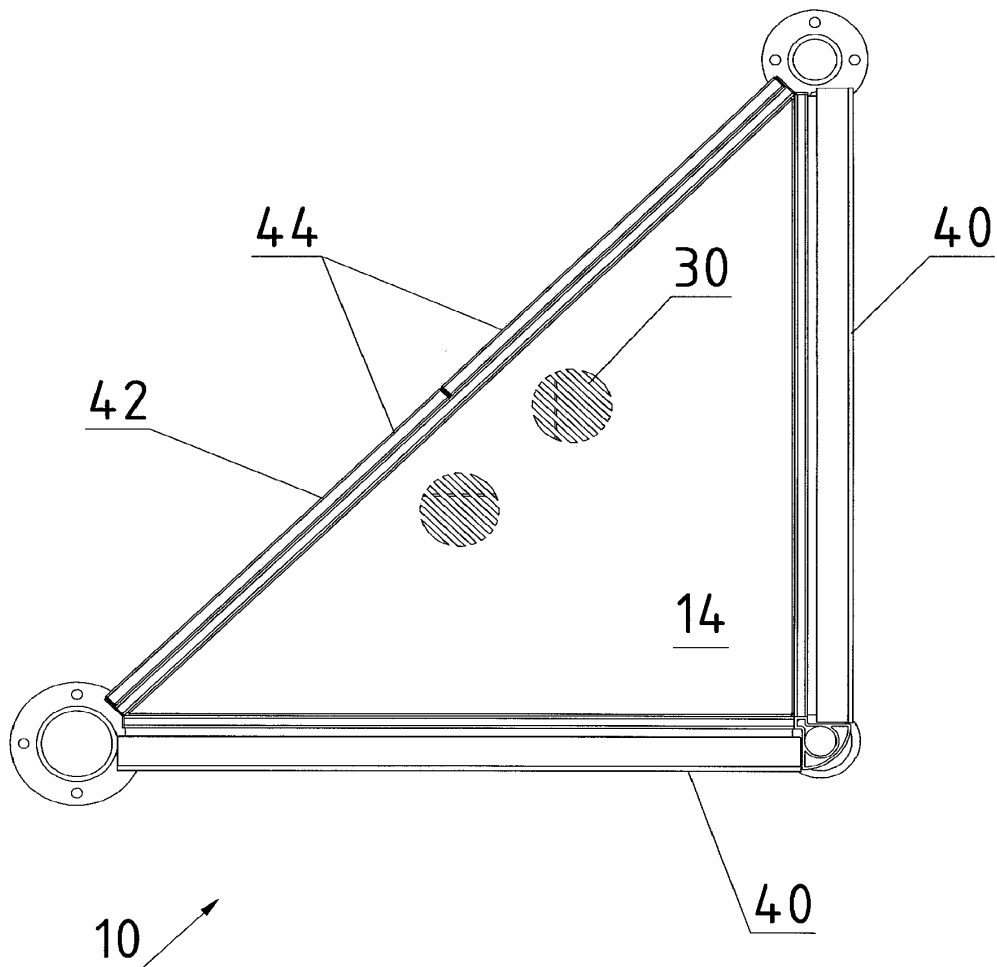


FIG. 2

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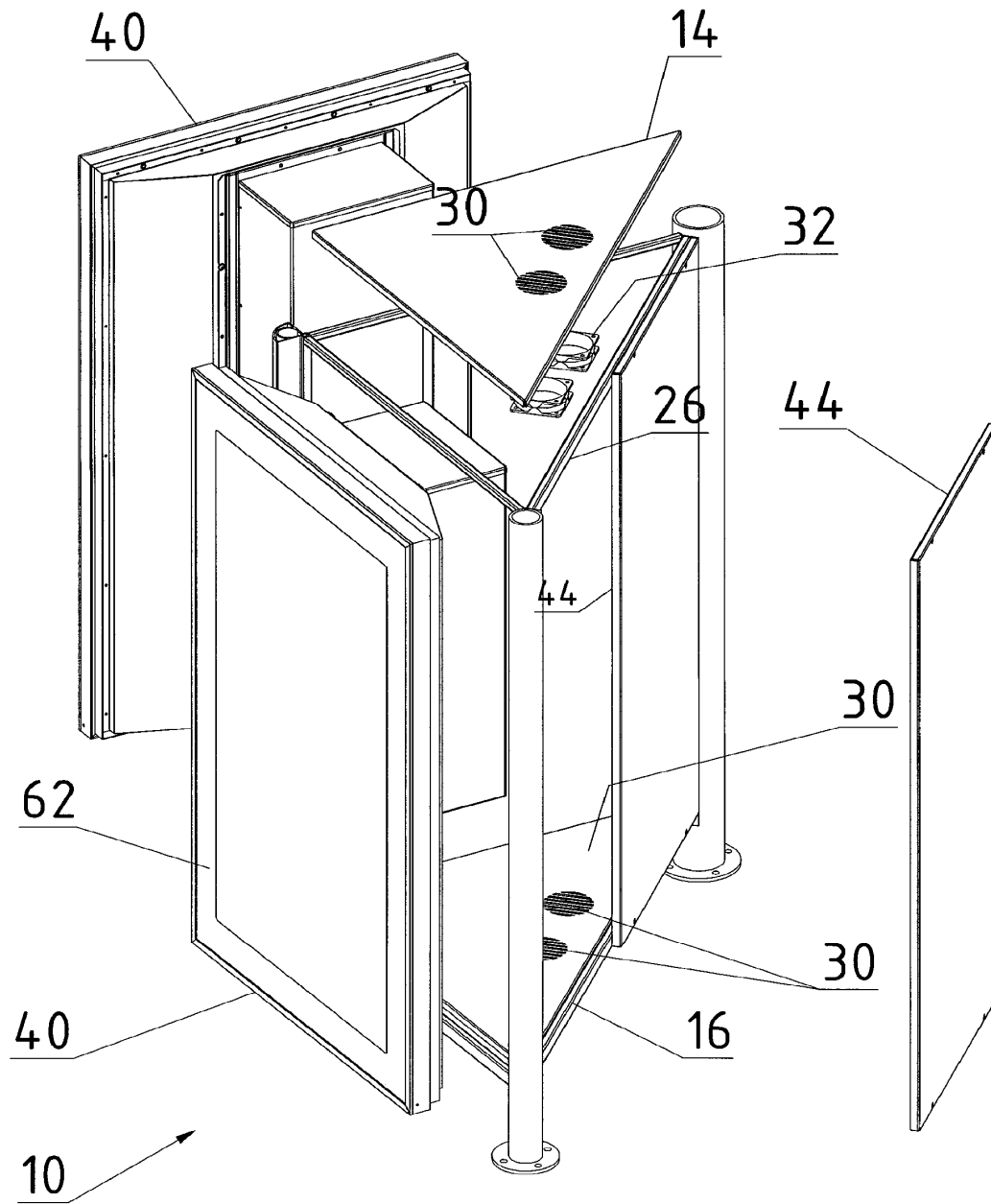


FIG. 3

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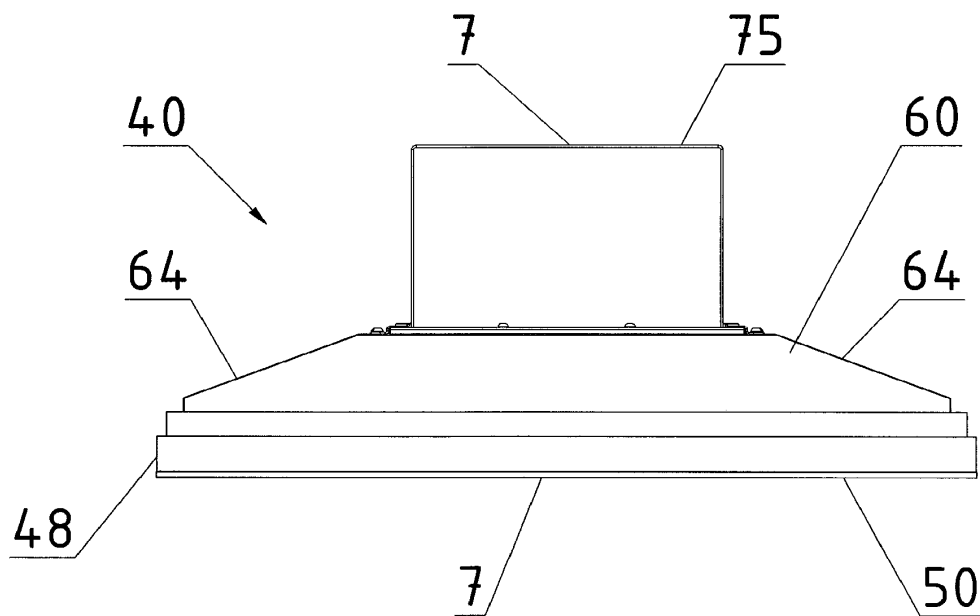


FIG. 4

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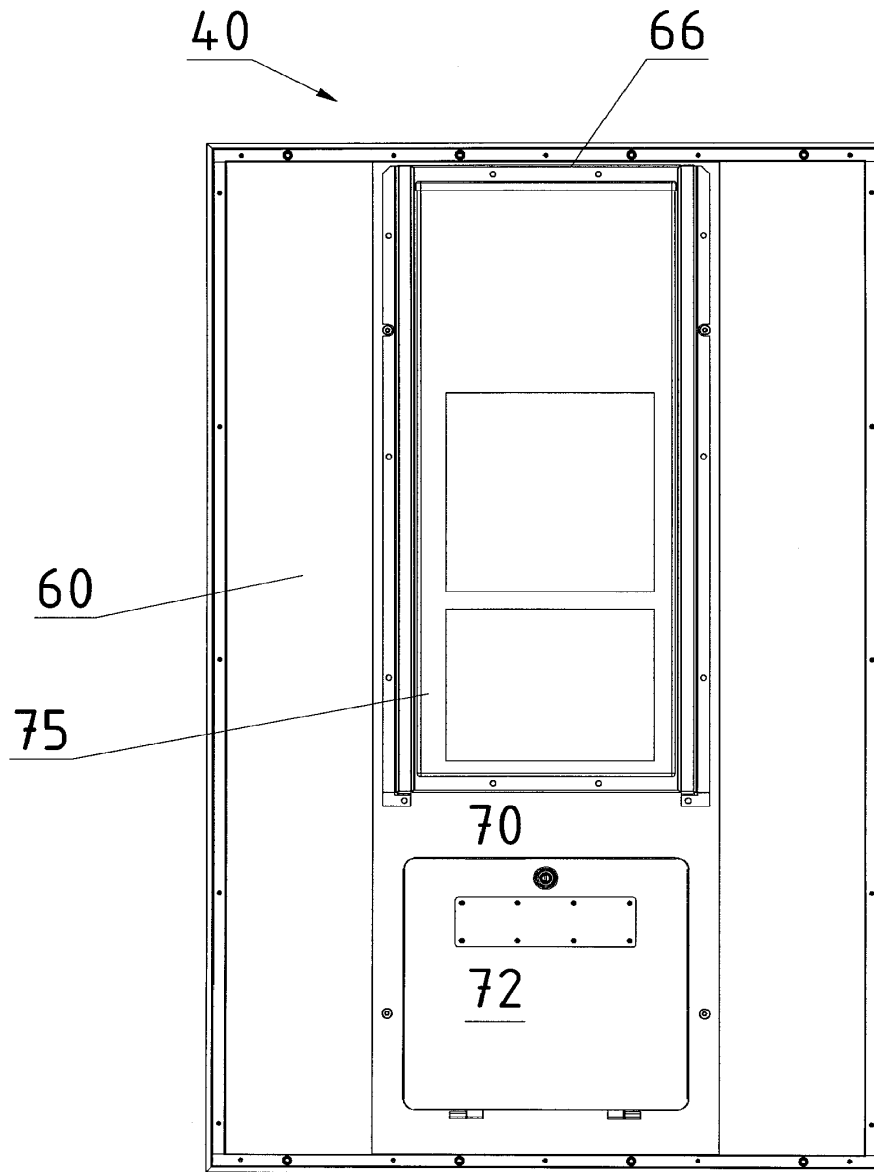


FIG. 5

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6/25

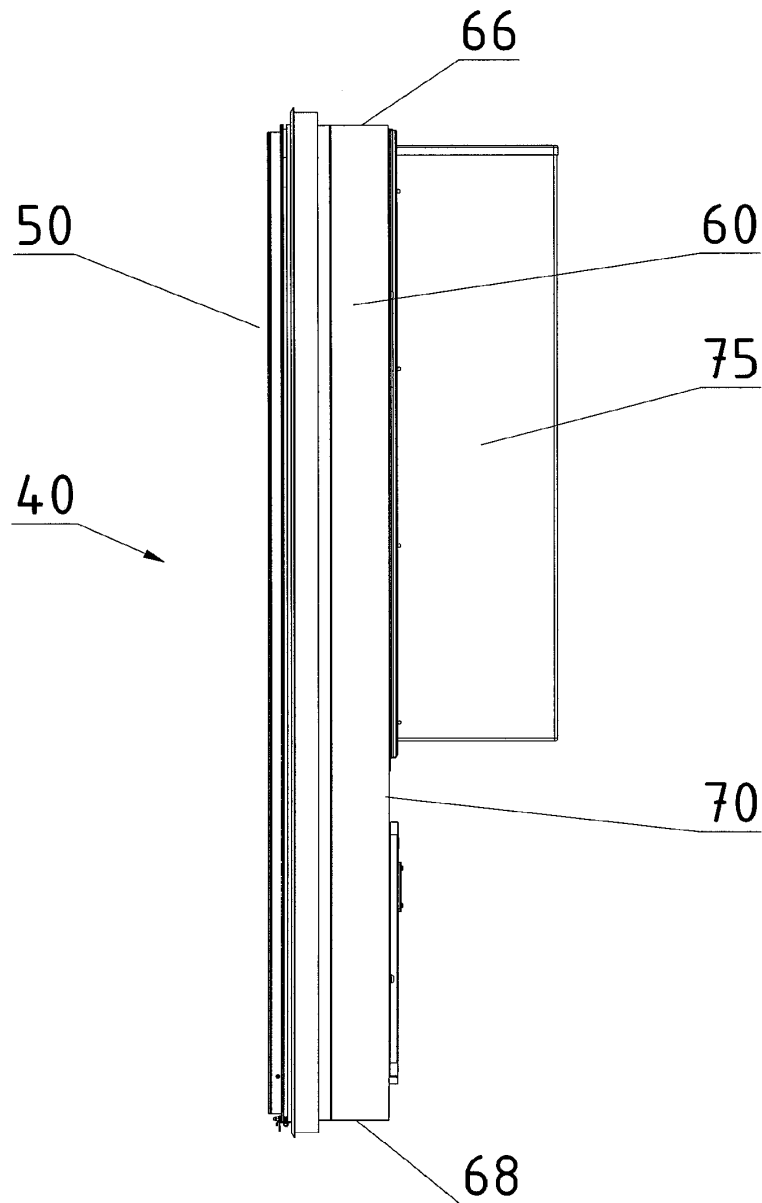
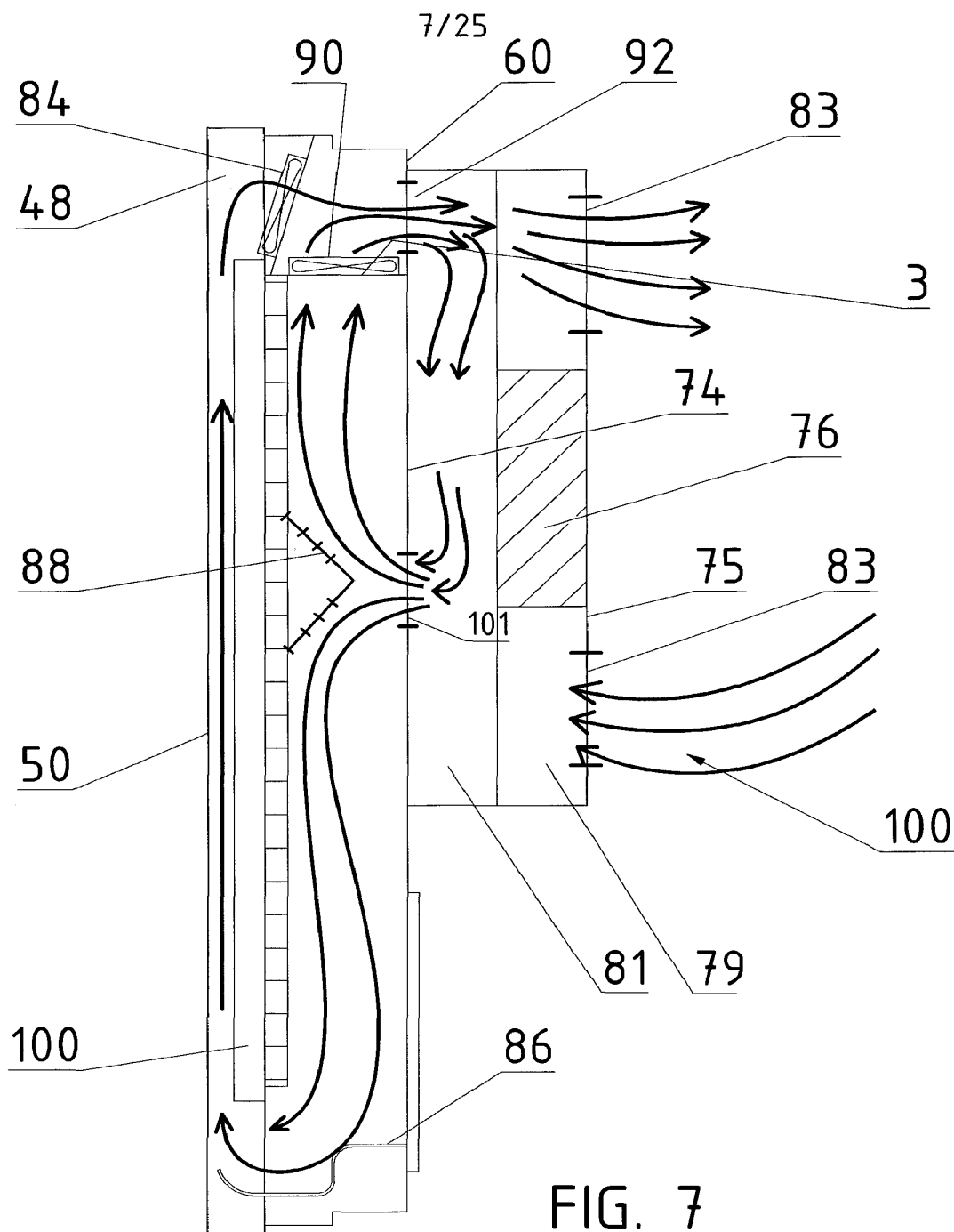


FIG. 6

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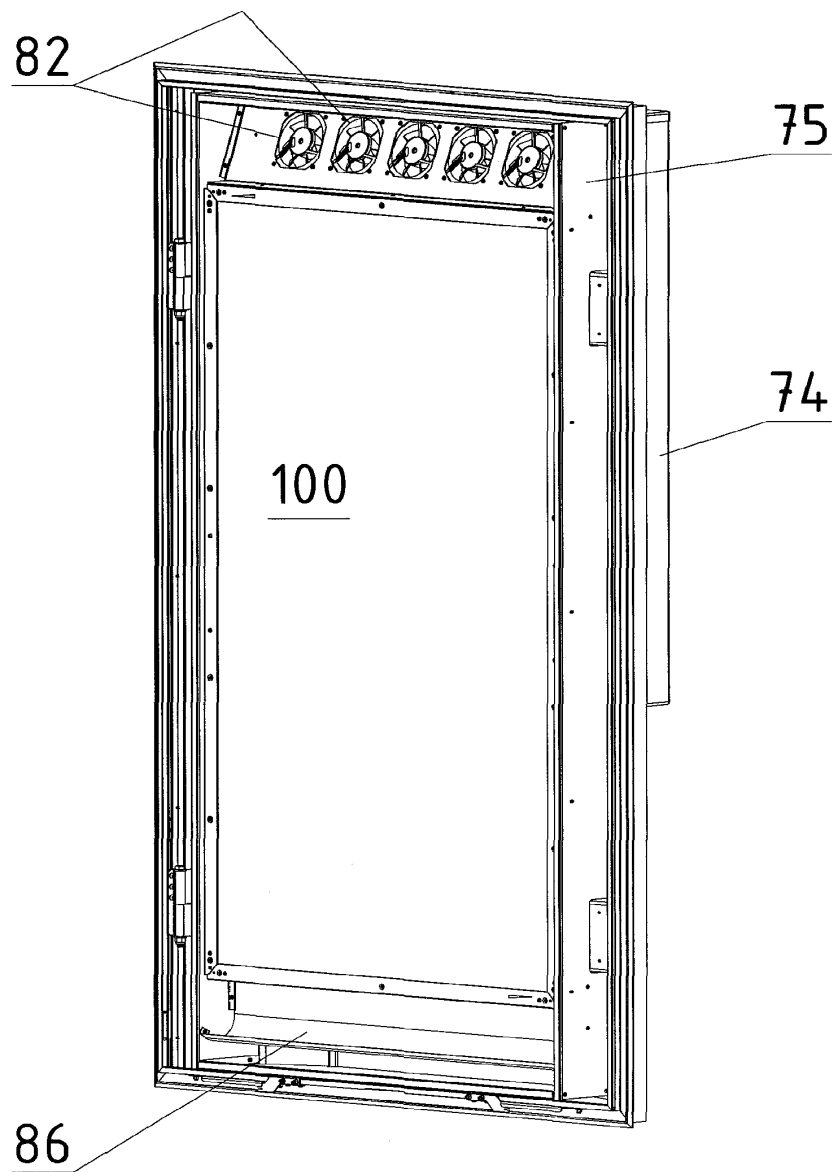


FIG. 8

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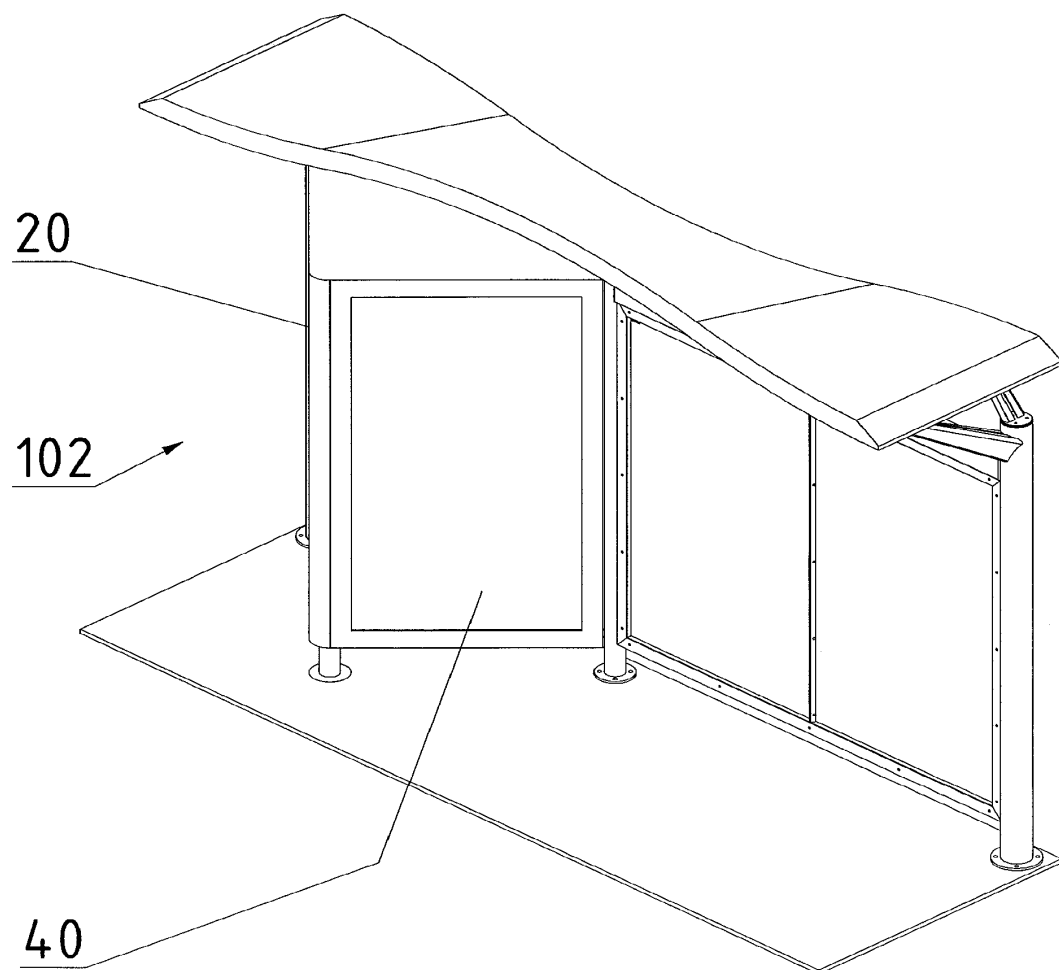


FIG. 9

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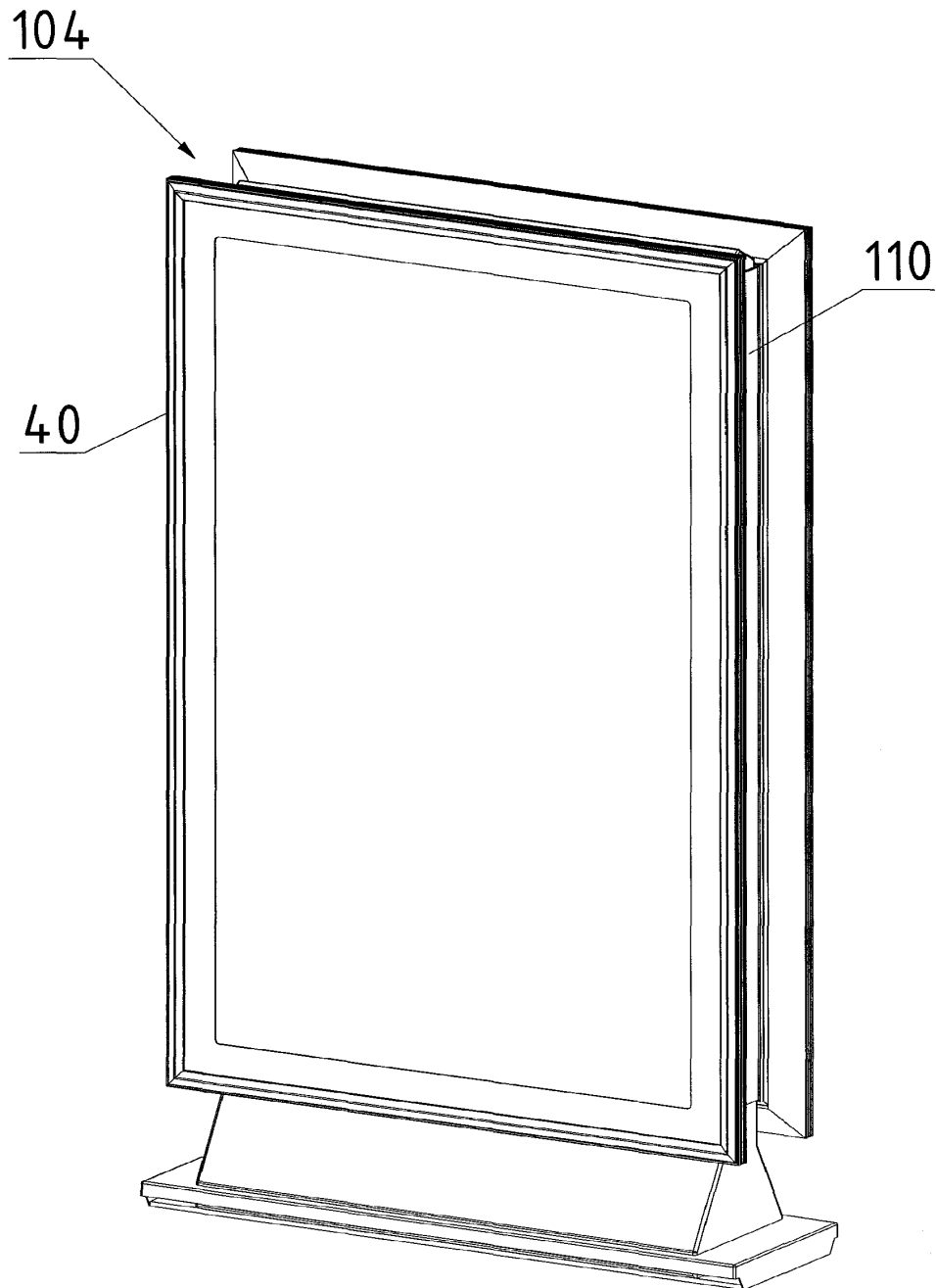


FIG. 10

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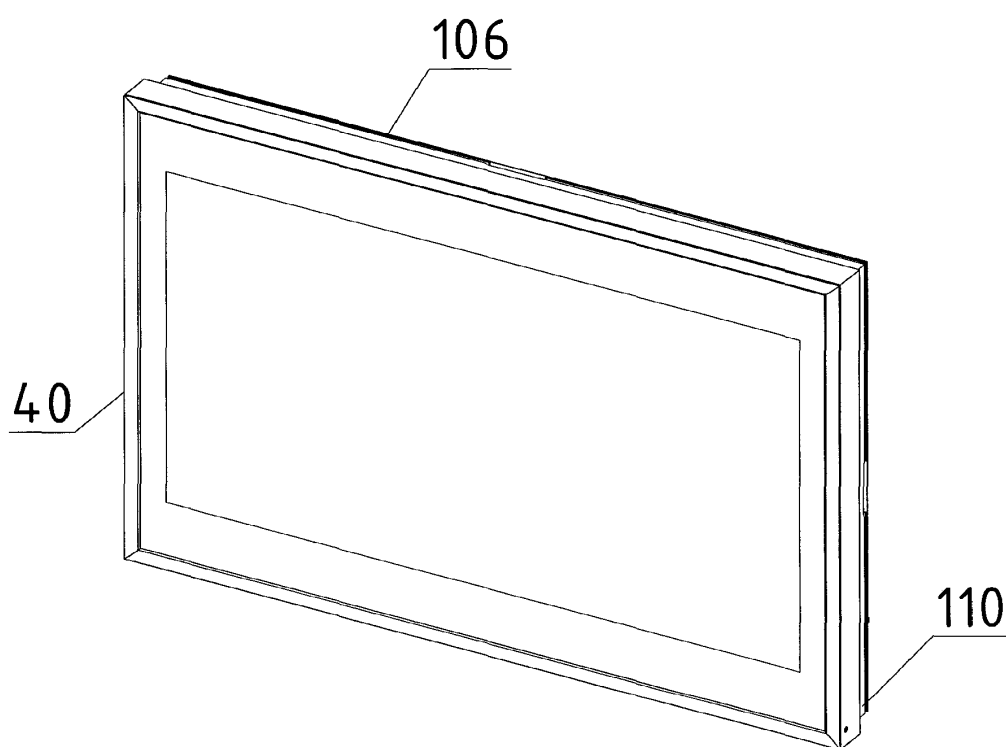


Fig. 11

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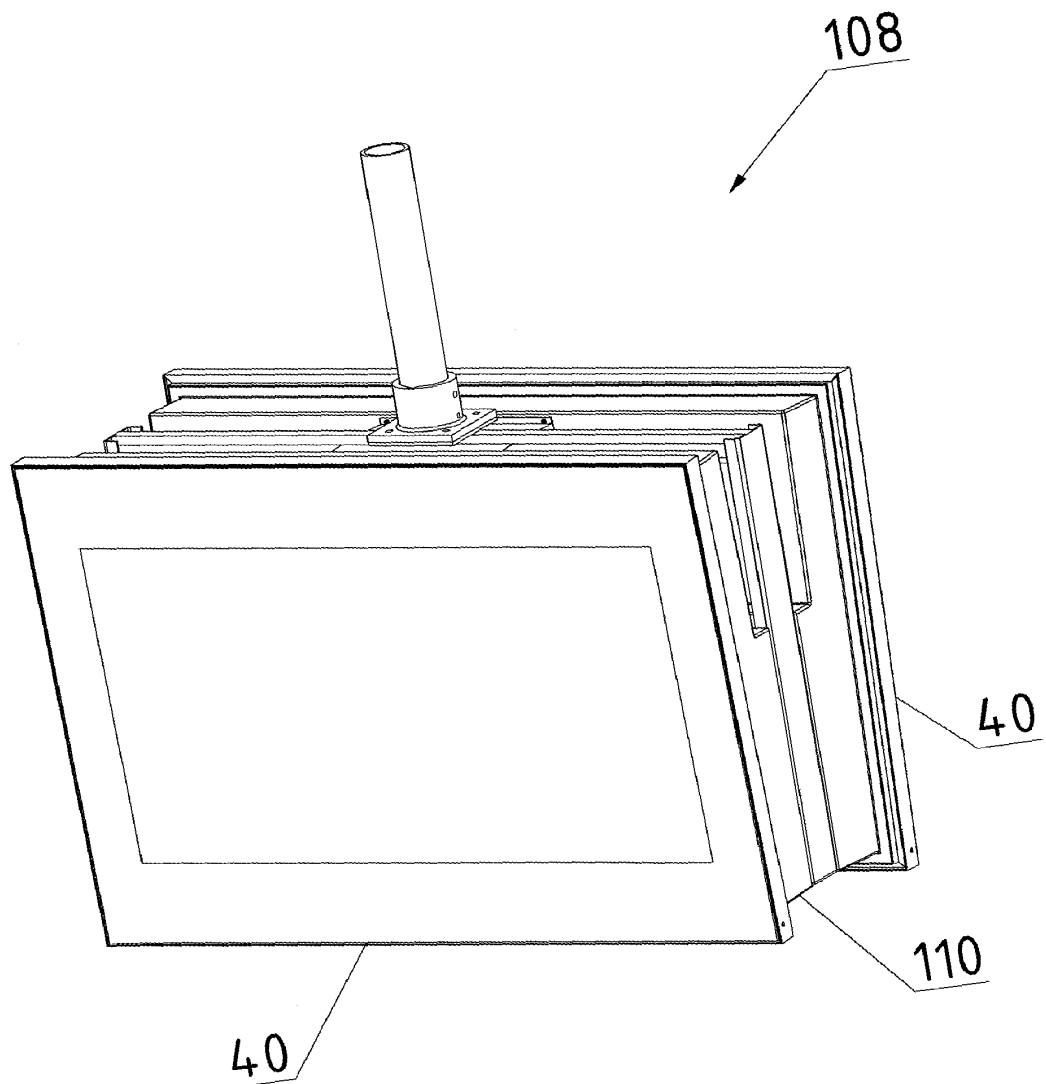


FIG. 12

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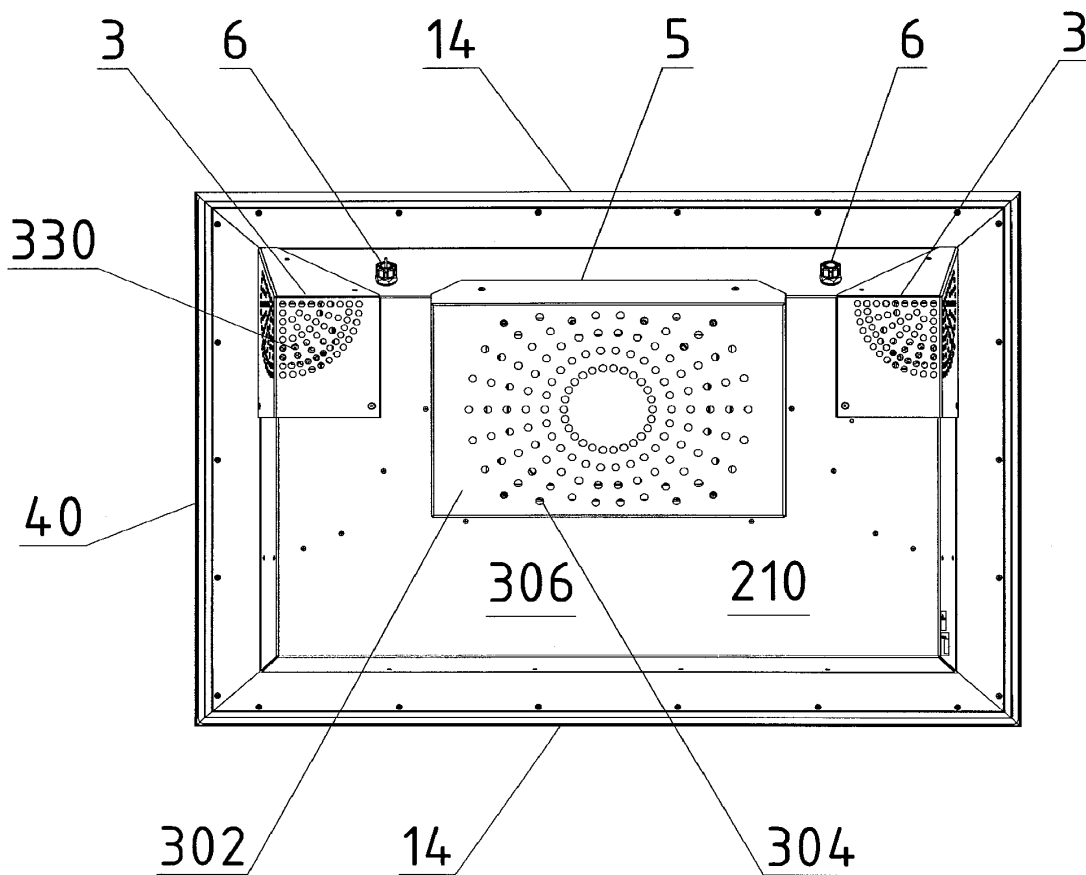


Fig. 13

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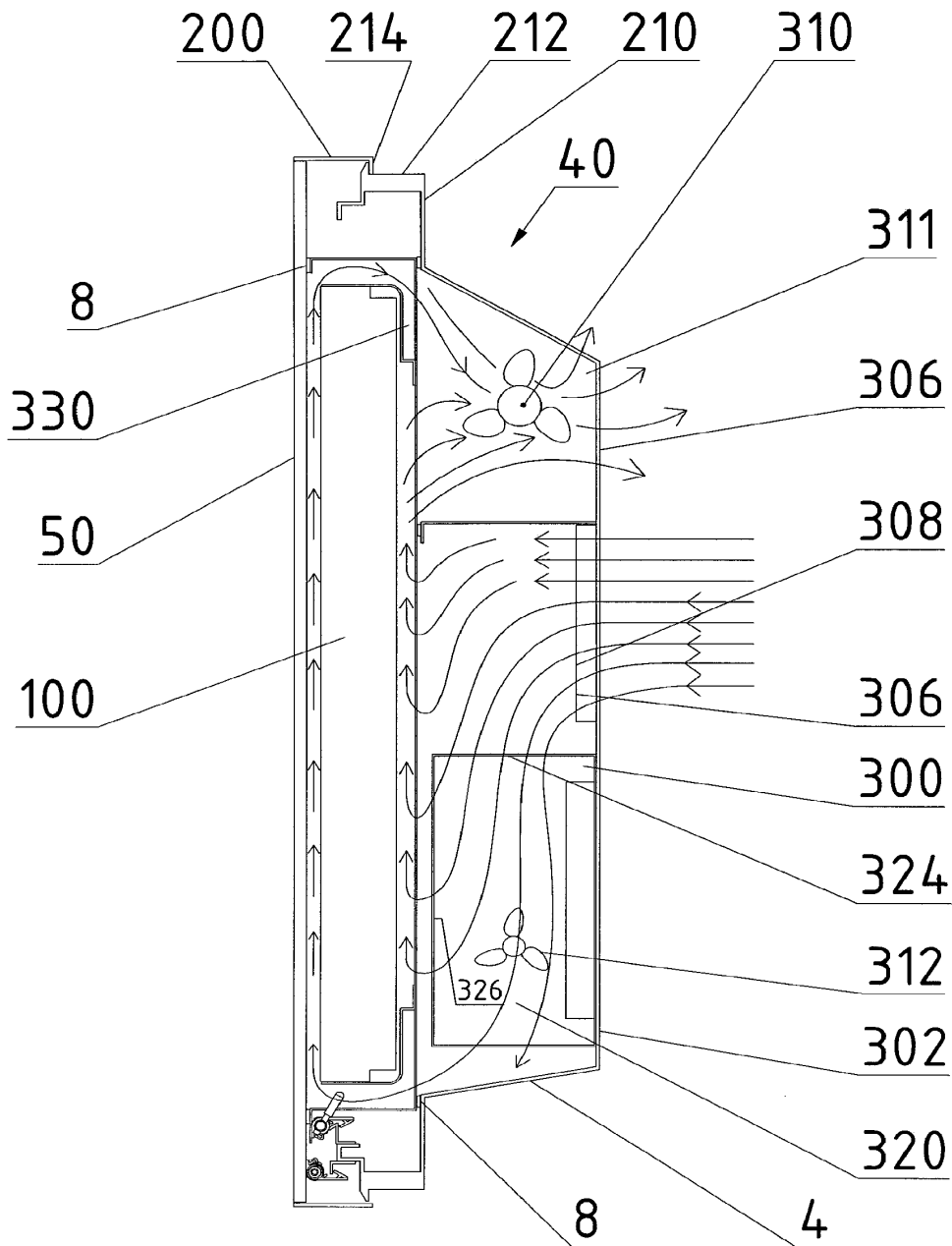


FIG. 14

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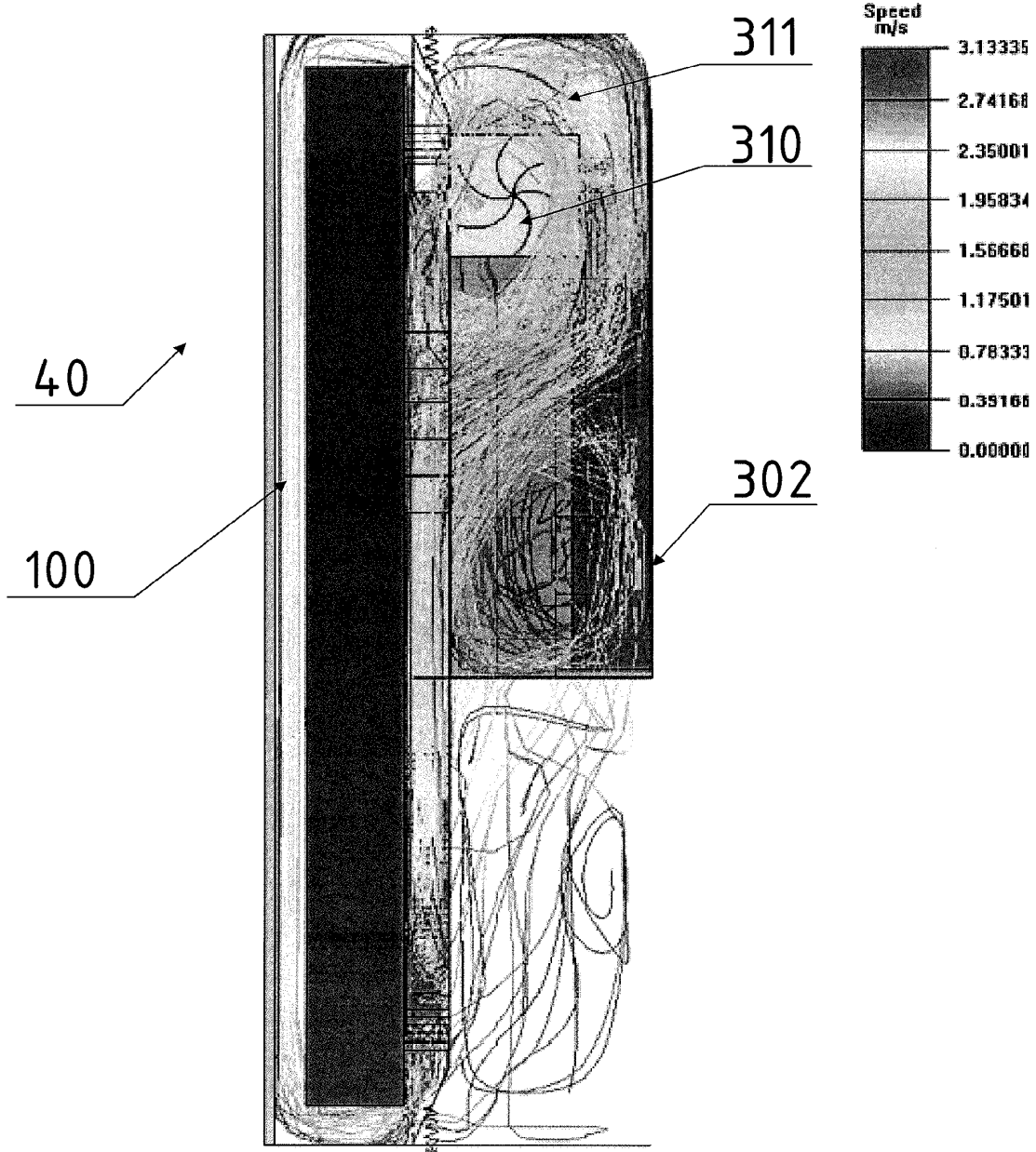


FIG. 15

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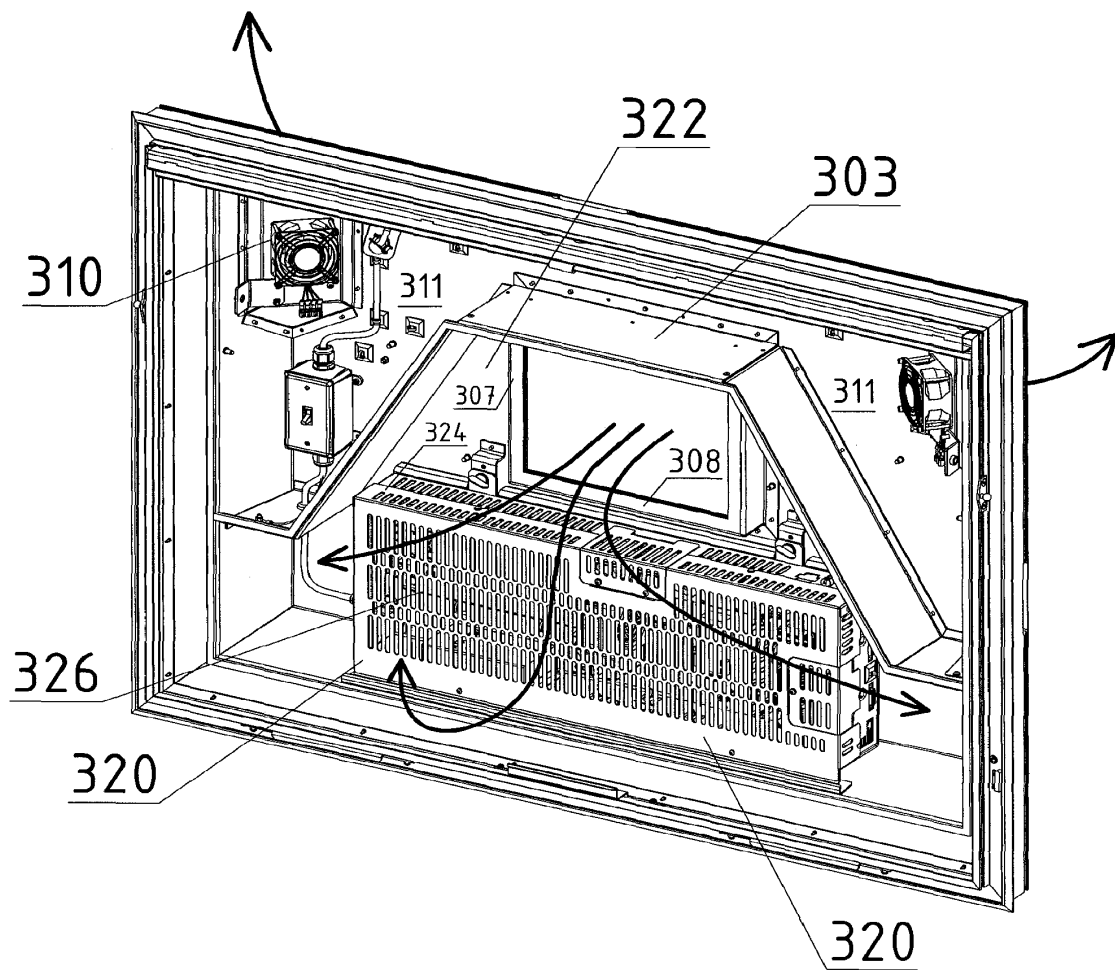


FIG. 16

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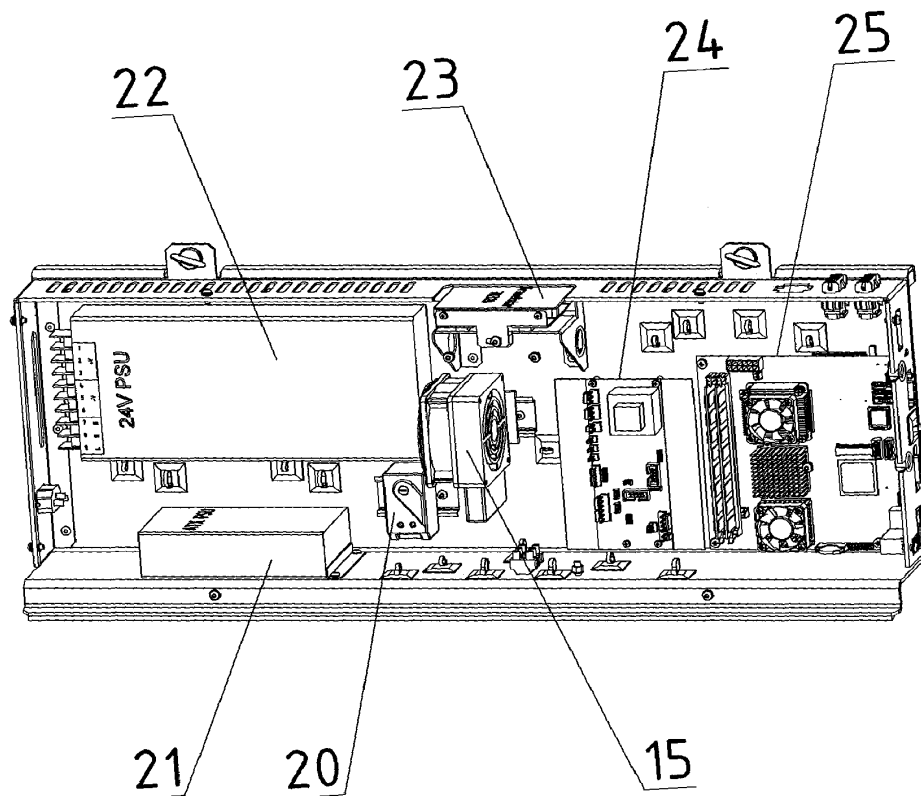


Fig. 17

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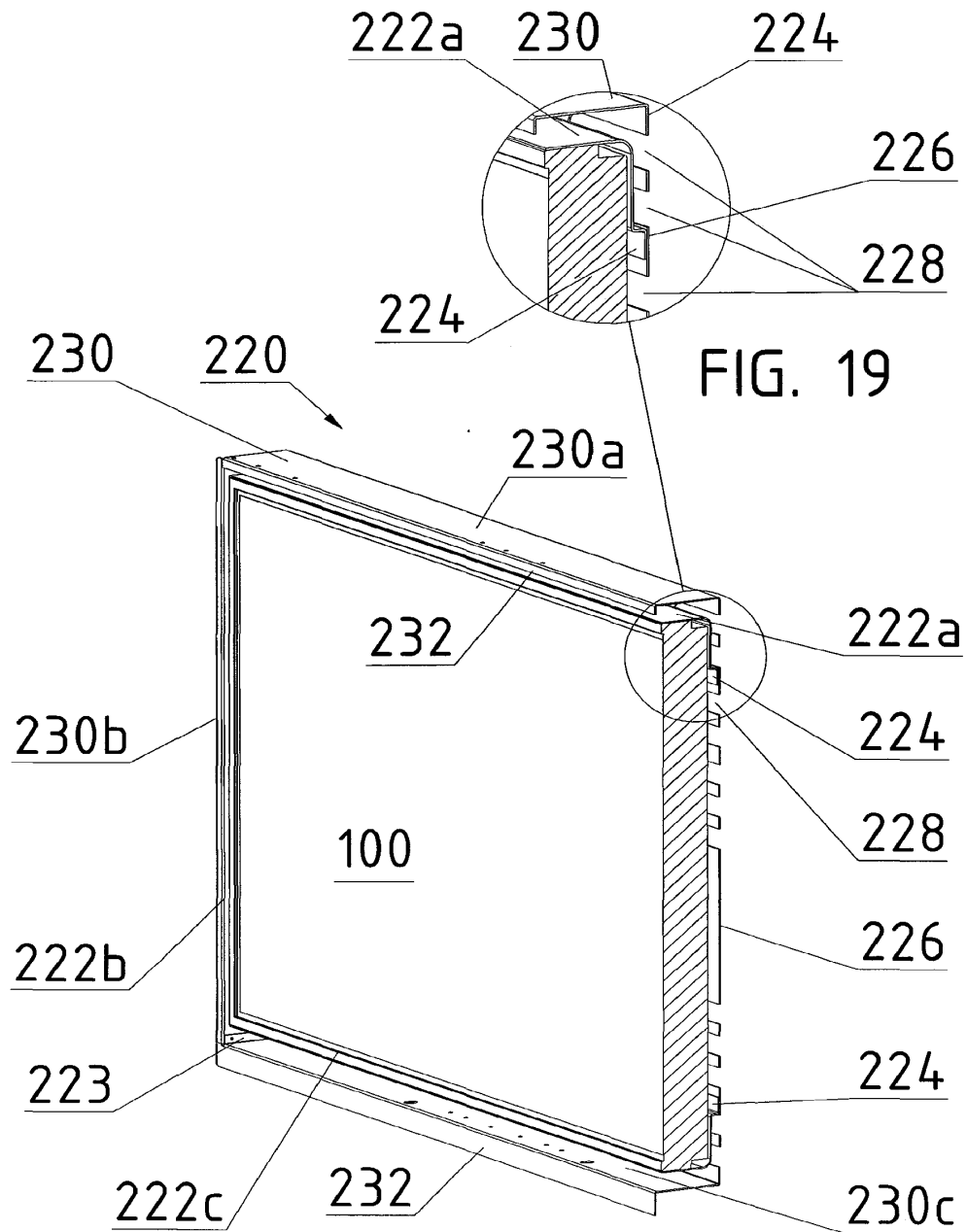
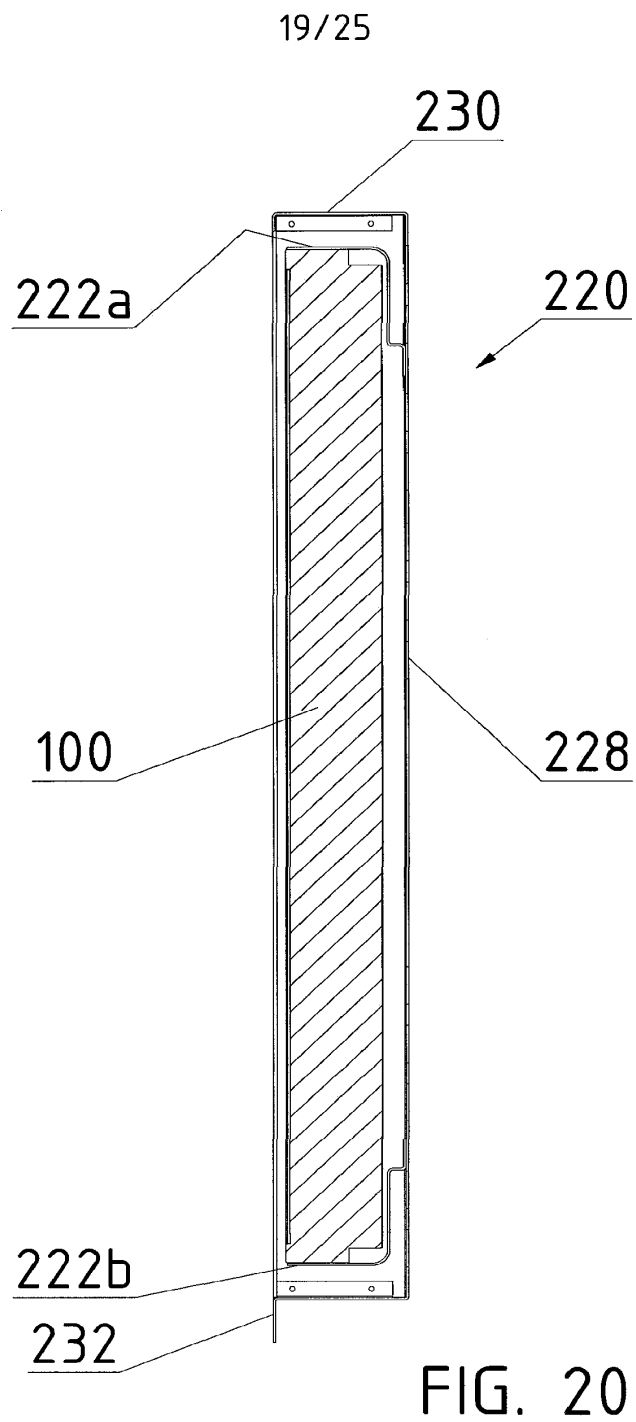


FIG. 19

FIG. 18

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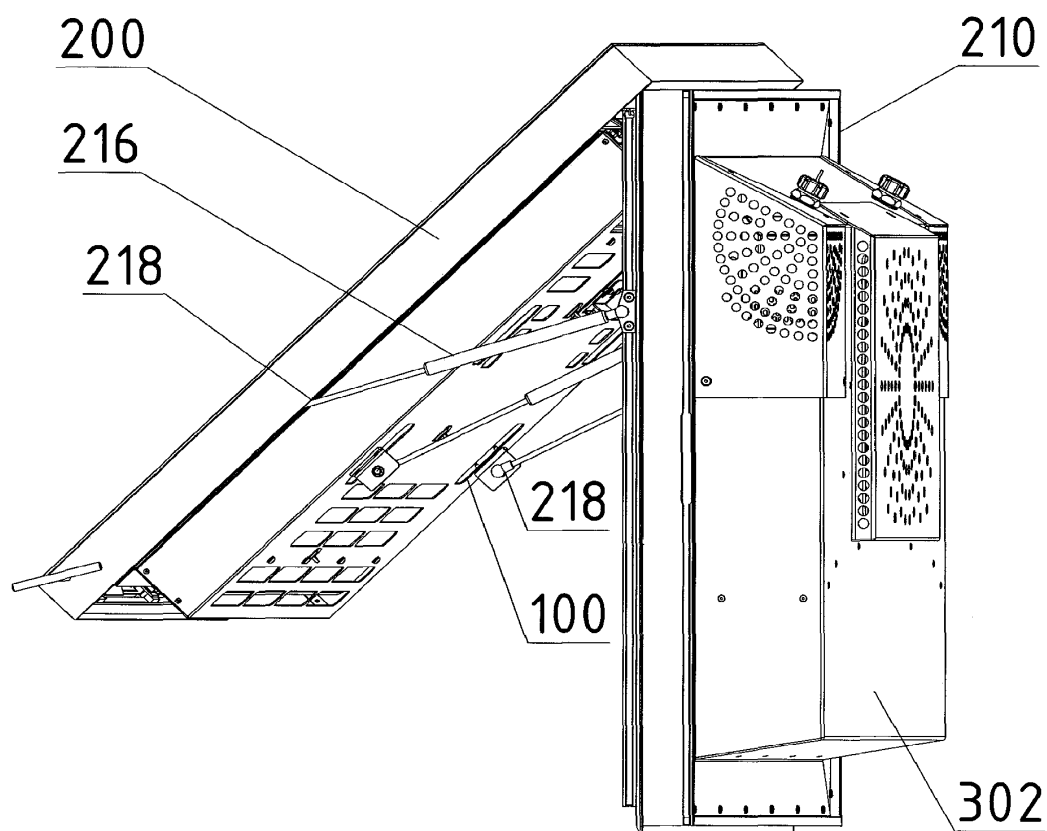


FIG. 21

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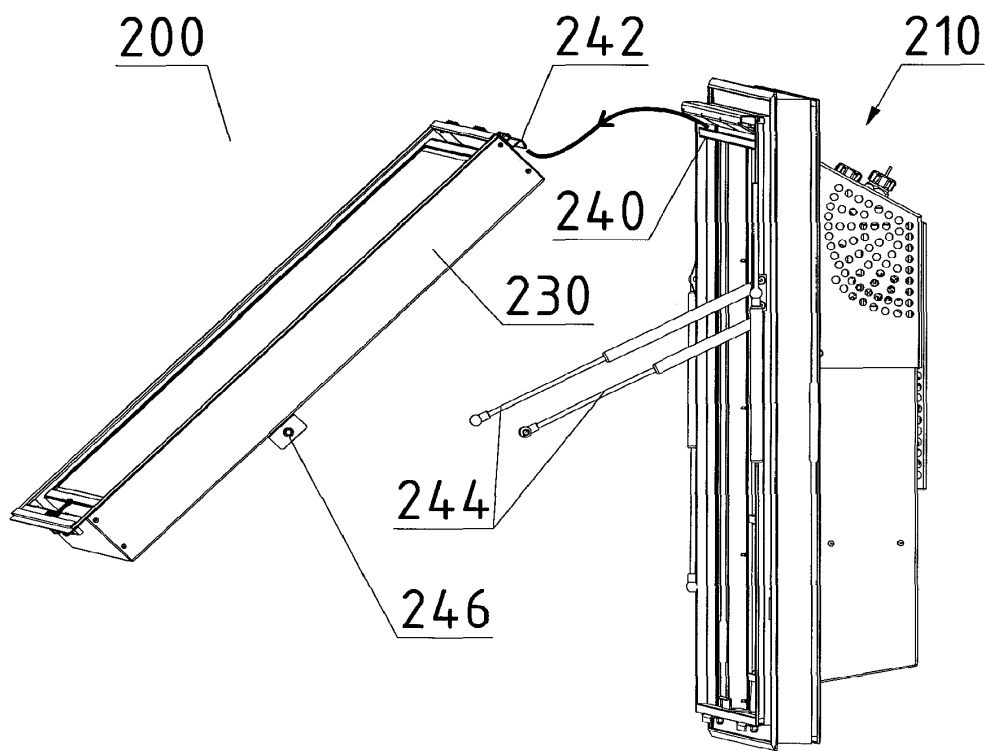


FIG. 22

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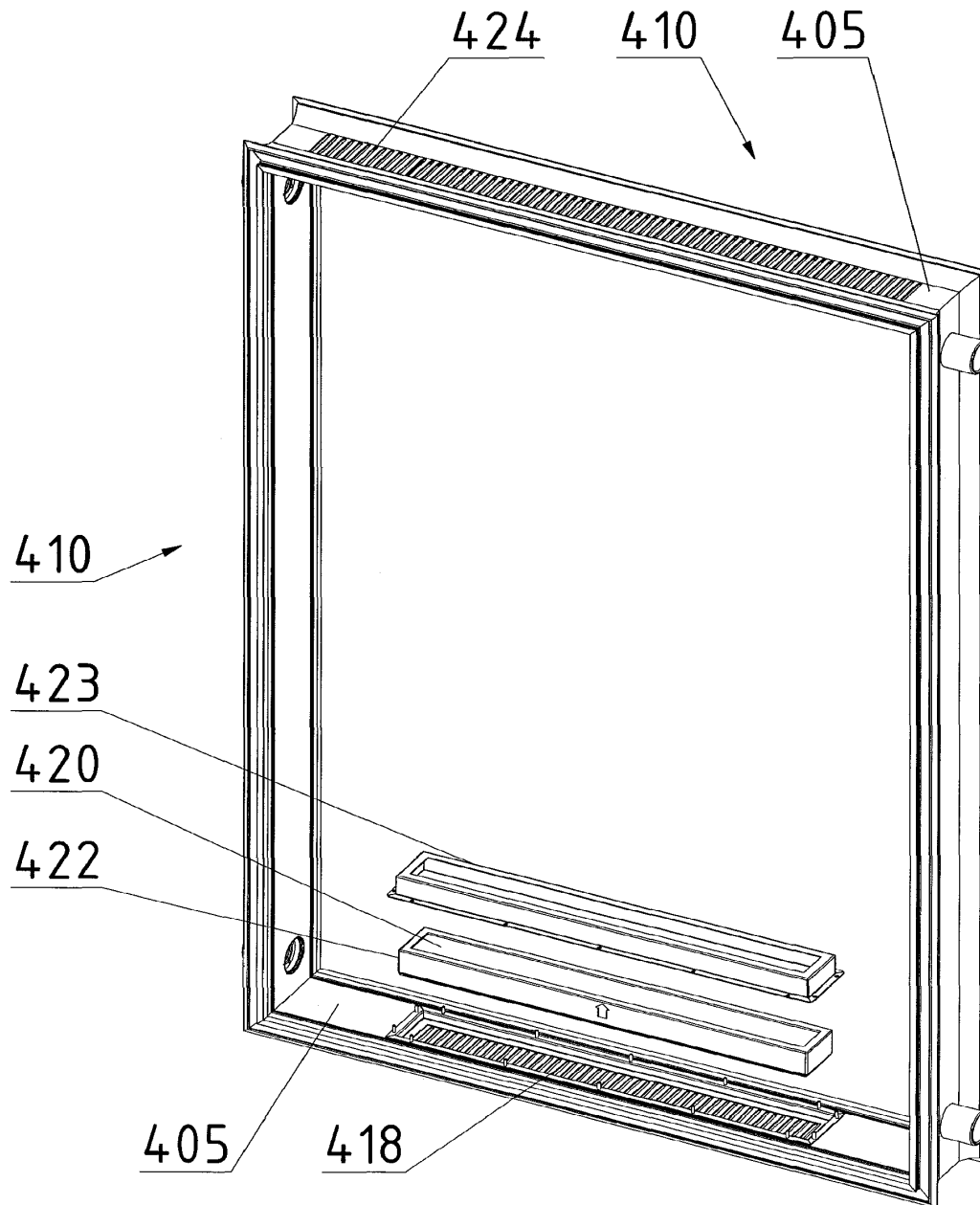


FIG. 23

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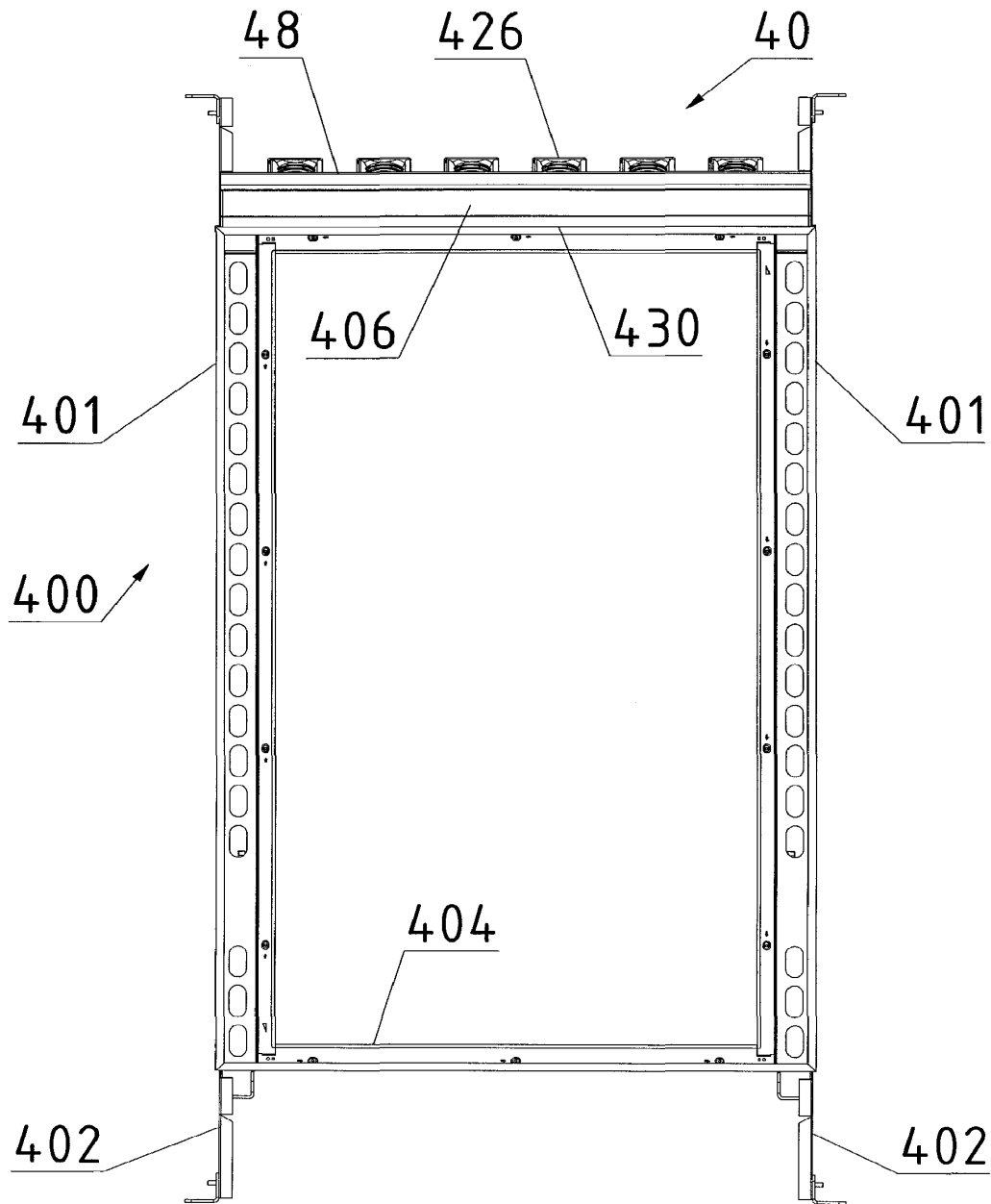


FIG. 24

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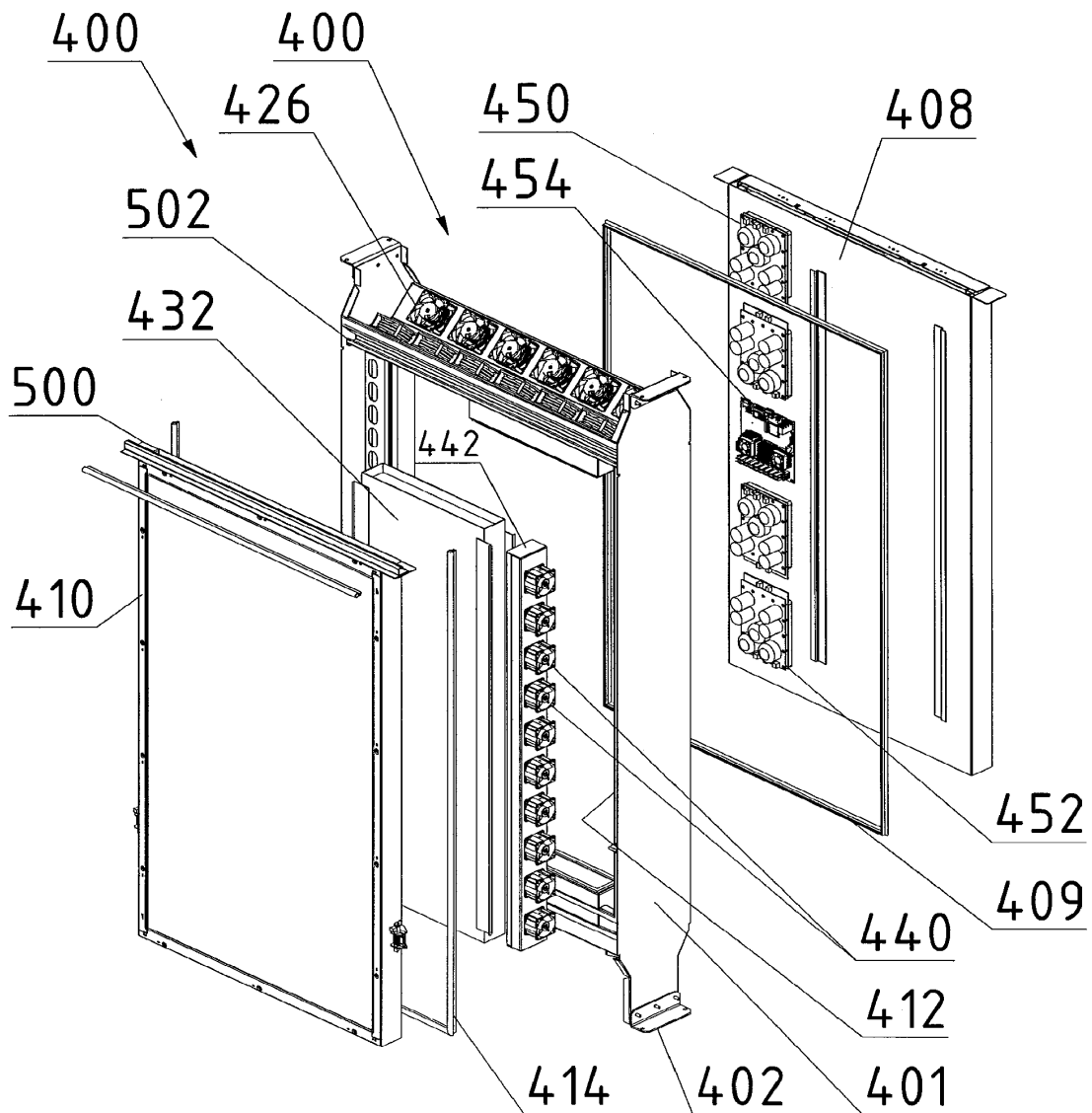


FIG. 25

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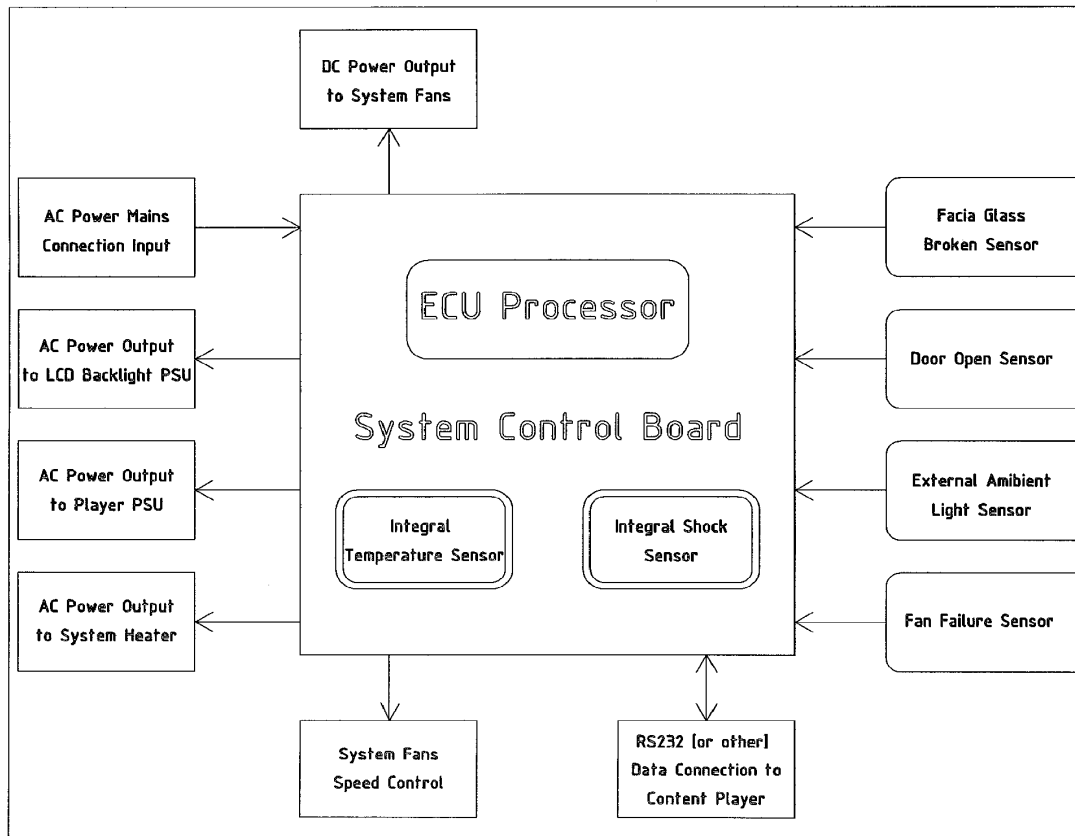


FIG. 26

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CA2009/000629

A. CLASSIFICATION OF SUBJECT MATTER IPC: H04N 5/64 (2006.01) , G09F 9/00 (2006.01) , H04N 5/655 (2006.01) , H05K 7/20 (2006.01) According to International Patent Classification (IPC) or to both national classification and IPC														
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) IPC: all (2006.01) Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic database(s) consulted during the international search (name of database(s) and, where practicable, search terms used) Canadian patent database, Delphion, WEST and Google Some search term used: enclosure, TV, flat panel, display, temperature, outdoor, housing, air, signage, AC, heat, ventilation														
C. DOCUMENTS CONSIDERED TO BE RELEVANT <table border="1"> <thead> <tr> <th>Category*</th> <th>Citation of document, with indication, where appropriate, of the relevant passages</th> <th>Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td>X</td> <td>Peerless, Environmental Enclosure For 42"-50" Flat Panel LCD or Plasma Screens, 2007, [retrieved on 13 July 2009]. Retrieved from the Internet: <URL: http://www.peerlessmounts.com/pcattachments/SELL%20SHEET-LIT0170-1-1.PDF></td> <td>1-7, 9-16, 18-25</td> </tr> <tr> <td>Y</td> <td></td> <td>8, 17</td> </tr> <tr> <td>Y</td> <td>Broadcast Engineering, Chief unveils flat-panel TV enclosures, 11 January 2007 [retrieved on 13 July 2009]. Retrieved from the Internet: <URL: http://www.broadcastengineering.com/products/chief-flat-panel-tv/index.html></td> <td>8, 17</td> </tr> </tbody> </table>			Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	X	Peerless, Environmental Enclosure For 42"-50" Flat Panel LCD or Plasma Screens, 2007, [retrieved on 13 July 2009]. Retrieved from the Internet: <URL: http://www.peerlessmounts.com/pcattachments/SELL%20SHEET-LIT0170-1-1.PDF >	1-7, 9-16, 18-25	Y		8, 17	Y	Broadcast Engineering, Chief unveils flat-panel TV enclosures, 11 January 2007 [retrieved on 13 July 2009]. Retrieved from the Internet: <URL: http://www.broadcastengineering.com/products/chief-flat-panel-tv/index.html >	8, 17
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.												
X	Peerless, Environmental Enclosure For 42"-50" Flat Panel LCD or Plasma Screens, 2007, [retrieved on 13 July 2009]. Retrieved from the Internet: <URL: http://www.peerlessmounts.com/pcattachments/SELL%20SHEET-LIT0170-1-1.PDF >	1-7, 9-16, 18-25												
Y		8, 17												
Y	Broadcast Engineering, Chief unveils flat-panel TV enclosures, 11 January 2007 [retrieved on 13 July 2009]. Retrieved from the Internet: <URL: http://www.broadcastengineering.com/products/chief-flat-panel-tv/index.html >	8, 17												
[] Further documents are listed in the continuation of Box C. [] See patent family annex. <table border="1"> <tbody> <tr> <td>* Special categories of cited documents :</td> <td>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</td> </tr> <tr> <td>"A" document defining the general state of the art which is not considered to be of particular relevance</td> <td>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</td> </tr> <tr> <td>"E" earlier application or patent but published on or after the international filing date</td> <td>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</td> </tr> <tr> <td>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</td> <td>"&" document member of the same patent family</td> </tr> <tr> <td>"O" document referring to an oral disclosure, use, exhibition or other means</td> <td></td> </tr> <tr> <td>"P" document published prior to the international filing date but later than the priority date claimed</td> <td></td> </tr> </tbody> </table>			* Special categories of cited documents :	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention	"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone	"E" earlier application or patent but published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art	"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family	"O" document referring to an oral disclosure, use, exhibition or other means		"P" document published prior to the international filing date but later than the priority date claimed	
* Special categories of cited documents :	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention													
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone													
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"O" document referring to an oral disclosure, use, exhibition or other means														
"P" document published prior to the international filing date but later than the priority date claimed														
Date of the actual completion of the international search 15 July 2009 (15-07-2009)		Date of mailing of the international search report 30 July 2009 (30-07-2009)												
Name and mailing address of the ISA/CA Canadian Intellectual Property Office Place du Portage I, C114 - 1st Floor, Box PCT 50 Victoria Street Gatineau, Quebec K1A 0C9 Facsimile No.: 001-819-953-2476		Authorized officer C. Wong 819- 934-2666												



Espacenet

Bibliographic data: WO2010007821 (A1) — 2010-01-21

ELECTRONIC APPARATUS, IMAGE DISPLAY, AND METHOD OF COOLING
ELECTRONIC APPARATUS

Inventor(s): SAKAMOTO HITOSHI [JP]; MIKUBO KAZUYUKI [JP];
HASHIGUCHI TAKEYA [JP] ± (SAKAMOTO, HITOSHI, ; MIKUBO,
KAZUYUKI, ; HASHIGUCHI, TAKEYA)

Applicant(s): NEC CORP [JP]; SAKAMOTO HITOSHI [JP]; MIKUBO KAZUYUKI
[JP]; HASHIGUCHI TAKEYA [JP] ± (NEC CORPORATION, ;
SAKAMOTO, HITOSHI, ; MIKUBO, KAZUYUKI, ; HASHIGUCHI,
TAKEYA)

Classification: - international: G09F9/00; H01L23/467
- cooperative: G02F1/133385; H01L23/467; H05K7/20954;
H05K7/20972; G02F2201/36; H01L2924/0002 more

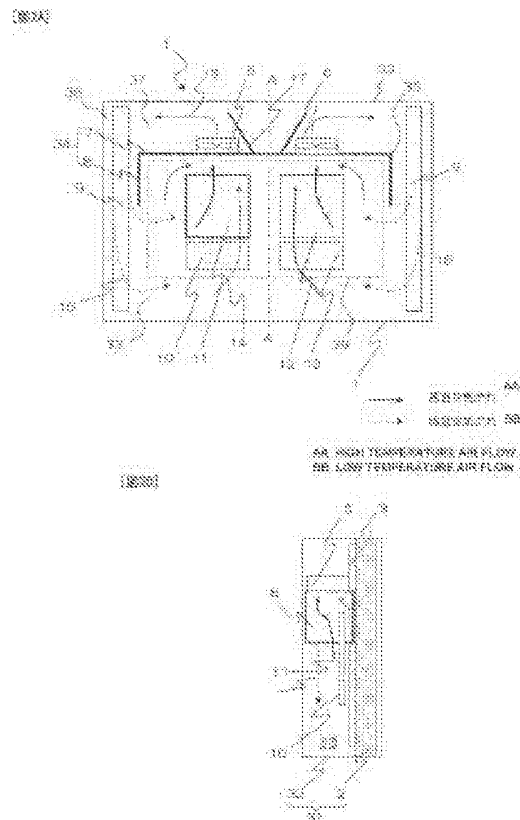
Application number: WO2009JP57347 20090410 Global Dossier

Priority number (s): JP20080186178 20080717

Also published as: EP2306438 (A1) EP2306438 (A4) JPWO2010007821 (A1)
US2011114384 (A1) US8698010 (B2)

Abstract of WO2010007821 (A1)

Disclosed is an electronic apparatus (1) having a simple structure where dustproofness and cooling performance are enhanced. The electronic apparatus (1) comprises an enclosure (31) forming a hermetically-sealed internal space (33), a circuit section (39) provided in the internal space (33), a first partition panel (34) provided in the internal space (33) and having a vertical partitioning portion (7) at least a part of which extends laterally above the circuit section (39) and terminates in front of the facing side surfaces of the enclosure (31), and fans (5, 6) penetrating the vertical partitioning portion (7).



(12) 特許協力条約に基づいて公開された国際出願

(19) 世界知的所有権機関
国際事務局



(10) 国際公開番号

WO 2010/007821 A1

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2010 年 1 月 21 日(21.01.2010)

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- (21) 国際出願番号: PCT/JP2009/057347
- (22) 国際出願日: 2009 年 4 月 10 日(10.04.2009)
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- (30) 優先権データ:
特願 2008-186178 2008 年 7 月 17 日(17.07.2008) JP
- (71) 出願人 (米国を除く全ての指定国について): 日本電気株式会社(NEC CORPORATION) [JP/JP]; 〒1088001 東京都港区芝五丁目 7 番 1 号 Tokyo (JP).
- (72) 発明者; および
- (75) 発明者/出願人 (米国についてのみ): 坂本 仁 (SAKAMOTO, Hitoshi) [JP/JP]; 〒1088001 東京都港区芝五丁目 7 番 1 号 日本電気株式会社内 Tokyo (JP). 三窪 和幸(MIKUBO, Kazuyuki) [JP/JP]; 〒1088001 東京都港区芝五丁目 7 番 1 号 日本電

気株式会社内 Tokyo (JP). 橋口 毅哉 (HASHIGUCHI, Takeya) [JP/JP]; 〒1088001 東京都港区芝五丁目 7 番 1 号 日本電気株式会社内 Tokyo (JP).

(74) 代理人: 宮崎 昭夫, 外(MIYAZAKI, Teruo et al.); 〒1070052 東京都港区赤坂 1 丁目 9 番 2 0 号 第 1 6 興和ビル 8 階 Tokyo (JP).

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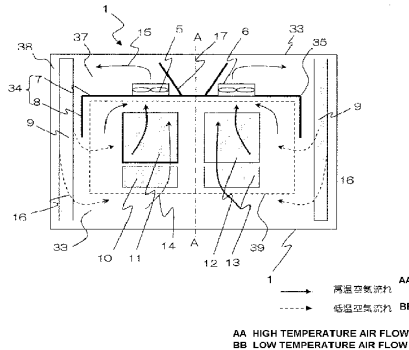
(84) 指定国 (表示のない限り、全ての種類の広域保護が可能): ARIPO (BW, GH, GM, KE, LS, MW, MZ,

[続葉有]

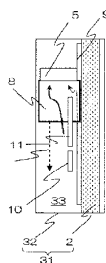
(54) Title: ELECTRONIC APPARATUS, IMAGE DISPLAY, AND METHOD OF COOLING ELECTRONIC APPARATUS

(54) 発明の名称: 電子装置及び画像表示装置、ならびに電子装置の冷却方法

[図2A]



[図2B]



(57) Abstract: Disclosed is an electronic apparatus (1) having a simple structure where dustproofness and cooling performance are enhanced. The electronic apparatus (1) comprises an enclosure (31) forming a hermetically-sealed internal space (33), a circuit section (39) provided in the internal space (33), a first partition panel (34) provided in the internal space (33) and having a vertical partitioning portion (7) at least a part of which extends laterally above the circuit section (39) and terminates in front of the facing side surfaces of the enclosure (31), and fans (5, 6) penetrating the vertical partitioning portion (7).

(57) 要約: 防塵性と冷却性を高めた簡易な構造の電子装置 (1) であって、電子装置 (1) は、密閉された内部空間 (33) を形成する外囲器 (31) と、内部空間 (33) に設けられた回路部 (39) と、内部空間 (33) に設けられ、上下方向仕切り部 (7) を有する第 1 の仕切り板 (34) であって、上下方向仕切り部 (7) の少なくとも一部が、回路部 (39) よりも上方を横方向に延び、外囲器 (31) の両側側面の手前で終端する第 1 の仕切り板 (34) と、上下方向仕切り部 (7) を貫通するファン (5)、(6) と、を有している。

WO 2010/007821 A1

WO 2010/007821 A1



NA, SD, SL, SZ, TZ, UG, ZM, ZW), ユーラシア
(AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), ヨーロッパ
(AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB,
GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL,
NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF,

CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD,
TG).

添付公開書類:

— 国際調査報告 (条約第 21 条(3))

明 細 書

発明の名称：

電子装置及び画像表示装置、ならびに電子装置の冷却方法

技術分野

[0001] 本発明は電子装置及び画像表示装置、ならびに電子装置の冷却方法に関し、特に駅ホームや構内、空港ロビー等の半屋外などの公共場所に設置される、密閉式の大型液晶表示装置の冷却構造に関する。

背景技術

[0002] 近年の電子装置は、部品実装の高密度化、装置の大型化、設置場所の多様化が進んでいる。電子装置は元来、精密機器として、使用環境を考慮して取り扱われてきたが、今後はこれまで使用されてこなかった耐環境性が求められる場所での使用が進むと考えられる。

[0003] 一例として、大型画像表示装置の公共場所での設置が進んでいる。駅のホームや空港などにおいて大量の情報を表示するために、従来の発光ダイオード（ＬＥＤ）などを用いた画像表示装置にかわり、液晶方式などの画像表示装置への要望が高まっている。液晶表示装置は、搭載されている液晶や電子部品が高温や粉塵に対して脆弱であるため、これらの課題に対処して、従来の画像表示装置に対して長期的な信頼性において遜色ないものにする必要がある。

[0004] 画像表示装置では、大画面化、高輝度化による商品性の向上により、光源部となるバックライト、電源供給部の消費電力は増加傾向にある。音声機能、パーソナルコンピュータ機能も搭載され、商品としてのパフォーマンスも向上してきており、それに伴い、画像表示装置全体の消費電力が増加してきている。

[0005] この種の画像表示装置では、パネルの画質均一性、長寿命化など、高い信頼性を実現するために、光源部品、制御部品、電源部品の動作保証のための温度規格を満たす冷却技術が、要素技術の一つとなっている。家庭用のテ

レビに用いられる液晶表示装置などとは違い、公共の場で用いられる画像表示装置は連続運転が基本で、設置場所に応じた耐環境性が要求される。駅のホームなどで用いられる場合、導電性の塵埃や高温多湿の環境に対して脆弱であってはならない。さらに、自然対流で冷却される液晶面は大型になるにつれて、上下で温度差ができやすくなるが、温度差が極度に大きくなると画質の均一性が失われてしまう。そこで、公共の場で用いられる大型の画像表示装置の冷却技術が求められている。

[0006] 図 1 に、本発明に関連する液晶表示装置の分解図を示す。液晶パネル 102 の後ろにはバックライトとして蛍光ランプ 103 などが設置されている。ランプ両端、すなわち画像表示装置両端には電極 104、105 が設けられ、輝度の均一化を図るため反射板 106 が設けられている。液晶パネル表面の温度がばらつくとパネルの発光状態にばらつきが生じるために、パネル面内の温度をなるべく均一にする必要がある。このため、液晶パネル 102 とバックシャーシー 108 の間には光の拡散により輝度を均一化するために一定の空間が設けられている。この空間では内部に対流が生じるために、特に上下方向に温度差がつきやすい。このため、反射板 106 のバックシャーシー側には、熱拡散を促すためにグラフィイトなどを用いた熱拡散シート 107 が設置されることがある。前面の液晶パネル 102 から熱拡散シート 107 までの空間は、輝度の安定化、均一化のために、外部から埃などが侵入しない密閉構造になっていることが多い。これらの部材を用いた液晶表示装置で液晶表示パネルの冷却を行うには、内部の主要な発熱部品であるランプを、外気に直接接触しないで冷却することが重要である。

[0007] この目的のために、一般的には、画像表示装置内に比較的低温の周辺空気を導入するフィルター付きの吸気口と排気口を設け、装置内に搭載された光源部品、制御部品、電源部品を周辺空気によって冷却する手段が採用されている。吸気口にフィルターを設けることで、ある程度粉塵の侵入を阻止することができる。しかしながら、この方法では、フィルターの交換を定期的に行う必要がある。さらに、半屋外などの公共場所に設置される画像表示装置

においては、微細な粉塵はフィルターを通過して侵入してしまう。外気中に飛散する非導電性及び導電性の微細な塵埃は、装置内部の光源部品、制御部品、電源部品上に堆積する。特に、導電性の塵埃が侵入した場合、装置内に搭載された電子回路部品間でショートが発生する可能性があり、信頼性向上の妨げとなり、商品性を高める上で大きな課題となる。

[0008] このため、従来から、防塵性及び冷却性に優れ、半屋外などの公共場所への設置に適した画像表示装置の検討が行われている。例えば特許第 3 9 7 5 5 0 6 号公報（以下、特許文献 1 という。）に開示された画像表示装置では、液晶表示パネル用の蛍光ランプは防塵性の収納部に收容されている。収納部は、前面が画像表示部で、背面が反射板で形成されている。蛍光ランプにより熱せられた空気は、画像表示装置の両側側面に設けられたコ字状のダクトに導出された後、ダクト内で冷却され、再び收容部に戻される。従って、蛍光ランプの防塵、冷却という要求に対しては一定の効果を奏している。

[0009] 特開 2 0 0 3 - 2 1 8 2 3 号公報及び特開 2 0 0 4 - 2 9 4 8 6 3 号公報には各々、液晶パネルの冷却技術と、電源の冷却性に優れた画像表示装置と、が記載されている。

発明の開示

[0010] 特許文献 1 記載の冷却技術では、液晶表示パネル用のランプのみの冷却を対象としている。しかし、液晶表示装置では、これ以外に表示内容を制御する制御基板、パネルや制御基板への電源を供給する電源供給部などの回路部が必要となる。近年では、その他装置ユーザーのニーズの多様化により、パーソナルコンピュータ機能や音声機能などのオプション装置が搭載されることも多い。これら基板部品やオプション装置はいずれも粉塵に対して脆弱であるために、これらを含めた液晶表示装置全体が防塵構造をとることが望ましい。

[0011] 近年の液晶表示装置では、発生熱量全体に対する熱量比は、蛍光ランプ、インバータ回路の光源部分が約 6 0 %、音声機能、パーソナルコンピュータ機能、電源供給部などに搭載される電子回路部品が約 4 0 % となっている。

従って、蛍光ランプ部の防塵構造と冷却手段のみでは、他の音声機能、パーソナルコンピュータ機能、電源供給部に対し、外気中に飛散する塵埃に対する防塵性や、設置環境温度での搭載部品全ての温度規格を満たす冷却性を確保することは難しく、信頼性の点で十分とはいえない。

[0012] 塵埃侵入を防止する観点からは、液晶表示装置として独立して機能できるだけの部品を密閉構造内に収容した密閉型液晶表示装置が好ましい。しかし、密閉型の液晶表示装置では外気の流入がないために、個々の部品は高い温度の空気により冷却されることになる。一般的には、ファンを個々の部品に対して設置することが考えられるが、多くの部品に対応できるだけのファンを搭載することは効率的でなく、ファンの存在自体が冷却を阻害する可能性もある。

[0013] 前述のように、屋外、半屋外に設置される電子装置には、耐環境性が求められる。例えば、夏場における設置環境温度は40℃を想定しなければならない。その上、外気中に飛散する塵埃の侵入を防止して、装置内蔵部品の信頼性を確保する必要がある。防塵構造とすることにより、冷却のための外気導入が不可能となるため、比較的低温の外気による装置の冷却は望めない。

[0014] 液晶パネル寿命と温度とは密接な関係にある。設置環境温度が40℃の場合、液晶パネル温度は、設計マージンを含めて55℃以下に抑えなければ、液晶パネルの長期的な信頼性を確保することができない。公共場所に設置される画像表示装置においては、連続運転を想定することは当然のことながら、表示内容の重要性や大量の設置台数などの理由によって、家庭向け画像表示装置以上の信頼性が求められている。しかしながら、密閉性の筐体や、高い環境温度などは、いずれも冷却にとっては不利な条件である。さらに、液晶表示装置では大画面化とともに薄型、軽量化、低コスト化が望まれており、防塵性と冷却性を簡易な構造で両立させることが重要な課題となっている。

[0015] 本発明は、上記事情に鑑みてなされたものであって、簡易な構造で、回路部が塵埃の侵入を防止可能な密閉筐体に収容され、かつ回路部を効率的に冷

却することが可能な電子装置及び電子装置の冷却方法を提供することを目的とする。

[0016] 本発明の一実施態様に係る電子装置は、密閉された内部空間を形成する外囲器と、内部空間に設けられた回路部と、内部空間に設けられ、上下方向仕切り部を有する第1の仕切り板であって、上下方向仕切り部は、少なくとも一部が、少なくとも一部の回路部よりも上方を横方向に延び、外囲器の両側側面の手前で終端する、第1の仕切り板と、上下方向仕切り部を貫通する第1のファンと、を有している。

[0017] 本発明の他の一実施態様によれば、密閉された内部空間を形成する外囲器と、内部空間に設けられた回路部と、を有する電子装置の冷却方法が提供される。この冷却方法は、内部空間を水平方向に延びるように内部空間に設けられ少なくとも一部の回路部とその上方空間とを仕切る上下方向仕切り部に設けられた開口を通して、上下方向仕切り部の下面側から上下方向仕切り部の上面側へ内部空間の空気を送出することと、上下方向仕切り部の上面側へ送出された空気を、上下方向仕切り部の上面に沿って外囲器の側面に向かわせることと、外囲器の側面に至った空気を、外囲器の側面に沿って下降させながら冷却することと、冷却された空気を開口に向けて上昇させることと、によって空気を内部空間内で循環させることを含んでいる。

[0018] 本発明のさらに他の一実施態様によれば、同様の構成の電子装置の冷却方法が提供される。この冷却方法は、内部空間を水平方向に延びるように内部空間に設けられ少なくとも一部の回路部とその上方空間とを仕切る上下方向仕切り部に設けられた開口を通して、上下方向仕切り部の上面側から上下方向仕切り部の下面側へ内部空間の空気を送出することと、上下方向仕切り部の下面側へ送出された空気を、外囲器の側面の下部に向かわせることと、外囲器の側面の下部に至った空気を、外囲器の側面に沿って上昇させながら冷却することと、外囲器の側面に沿って上昇した空気を、上下方向仕切り部の上面に沿って開口に向かわせることと、によって空気を内部空間内で循環させることを含んでいる。

[0019] 本発明によれば、簡易な構造で防塵性と冷却性に優れた電子装置及び電子装置の冷却方法を提供することができる。

図面の簡単な説明

[0020] [図1]本発明に関連する画像表示装置の内部構造を示す断面図である。

[図2A]本発明の第1の実施形態に係る画像表示装置の内部構造を示す断面図（背面側から見た断面図）である。

[図2B]本発明の第1の実施形態に係る画像表示装置の内部構造を示す断面図（図2AのA-A線に沿った側方断面図）である。

[図3]図1に示す画像表示装置の概念的な分解斜視図である。

[図4A]縦置きで設置・使用される画像表示装置の内部構造を示す断面図（背面側から見た断面図）である。

[図4B]縦置きで設置・使用される画像表示装置の内部構造を示す断面図（図4AのA-A線に沿った側方断面図）である。

[図5]本発明の第2の実施形態に係る画像表示装置の内部構造を示す断面図である。

[図6]本発明の第3の実施形態に係る画像表示装置の内部構造を示す概念図である。

[図7A]本発明の第4の実施形態に係る画像表示装置の内部構造を示す断面図（背面側から見た断面図）である。

[図7B]本発明の第4の実施形態に係る画像表示装置の内部構造を示す断面図（図7AのA-A線に沿った側方断面図）である。

[図8A]本発明の第5の実施形態に係る画像表示装置の内部構造を示す断面図（背面側から見た断面図）である。

[図8B]本発明の第5の実施形態に係る画像表示装置の内部構造を示す断面図（図8AのA-A線に沿った側方断面図）である。

[図9]図8A、8Bに示す実施形態における第1の仕切り板とファンの概略構成を示す概略図である。

[図10A]図8A、8Bに示す実施形態の変形例に係る、画像表示装置の内部構

造を示す断面図（背面側から見た断面図）である。

[図10B]図8A、8Bに示す実施形態の変形例に係る、画像表示装置の内部構造を示す断面図（図10AのA-A線に沿った側方断面図）である。

[図11]本発明の第6の実施形態に係る画像表示装置の、第1の仕切り板の概略図である。

[図12A]本発明の第7の実施形態に係る画像表示装置の内部構造を示す断面図（背面側から見た断面図）である。

[図12B]本発明の第7の実施形態に係る画像表示装置の内部構造を示す断面図（図12AのA-A線に沿った側方断面図）である。

[図13]図12A、12Bに示す実施形態における第1の仕切り板とファンの概略構成を示す概略図である。

[図14A]本発明の実施例に係る画像表示装置の内部構造を示す断面図（背面側から見た断面図）である。

[図14B]本発明の実施例に係る画像表示装置の内部構造を示す断面図（図14AのA-A線に沿った側方断面図）である。

[図15]図14A、14Bに示す画像表示装置の背面側から見た斜視図である。

[図16A]本発明の実施例の効果の説明する概略図である。

[図16B]本発明の実施例の効果の説明する概略図である。

[図17]ファンの設置間隔の一例を示す概略図である。

[図18]ファンの設置間隔の一例を示す概略図である。

[図19]ファンの設置間隔と整流板の一例を示す概略図である。

[図20]ファンのPQ特性図の一例である。

[図21]本発明と比較例における発熱部品の温度を示すグラフである。

符号の説明

- [0021] 1 液晶表示装置
 2 液晶画像表示部
 5 ファン

- 6 ファン
- 7 上下方向仕切り部
- 8 鉛直方向延長部
- 9 インバータ回路部
- 10 コンピュータ部
- 11 制御基板
- 12 電源供給部
- 13 音声制御部
- 17 整流板
- 31 外囲器
- 32 筐体
- 33 内部空間
- 34 第1の仕切り板
- 35 端部
- 36 連通孔
- 37 上部空間
- 38 側方空間
- 39 回路部
- 40 第2の仕切り板

発明を実施するための最良の形態

[0022] 以下、図面を参照して、本発明の電子装置及び画像表示装置について説明する。以下では、密閉型の大型液晶表示装置を例に本発明を説明するが、本発明はこれに限定されず、プラズマディスプレイ装置、CRT (Cathode Ray Tube) 方式の画像表示装置等にも同様に適用することができる。また、本発明は、画像表示以外の密閉型の電子装置にも広く適用することができる。

[0023] (第1の実施形態)

図2A、2Bは、本実施形態に係る画像表示装置の内部構造を示す断面図で、図2Aは背面側から見た断面図、図2Bは図2AのA-A線に沿った側

方断面図である。図 3 は、図 2 A、2 B に示す画像表示装置の概念的な分解斜視図である。

- [0024] これらの図を参照すると、画像表示装置 1 は、密閉された内部空間 33 を形成する外囲器 31 と、内部空間 33 に設けられた回路部 39 と、を有している。外囲器 31 は、装置前面に位置する画像表示部（表示パネル）2 と、画像表示部 2 とともに密閉容器を形成する筐体 32 と、を備えている。筐体 32 は中央筐体部 41 と、裏板 42 と、天板 43 とによって構成されている。表示パネル部 2 の前面には、防塵シート 48 を間に挟んで、固定金具 45 で周囲を固定された無反射透明板 44 が設置されている。
- [0025] 回路部 39 は画像表示部 2 に画像を表示させる回路部であって、装置中央に設けられたコンピュータ部 10、液晶表示部を制御するための制御基板 11、画像表示装置への電源供給を行う電源供給部 12、及び音声制御部 13 などから構成されている。この他、装置の左右両端にはバックライトに電力を供給するインバータ部 9 が設置されている。
- [0026] 内部空間 33 の上部には第 1 の仕切り板 34 が設けられている。第 1 の仕切り板 34 は上下方向仕切り部 7 を備えている。上下方向仕切り部 7 は水平に延びており、コンピュータ部 10、制御基板 11、電源供給部 12、及び音声制御部 13 の上方を横方向に延び、筐体 32 の両側側面の手前で終端している。第 1 の仕切り板 34 は、上下方向仕切り部 7 の筐体 32 の側面側の端部 35 から鉛直方向下方に延びる一対の鉛直方向延長部 8 を有している。この結果、第 1 の仕切り板 34 は、搭載発熱部品であるコンピュータ部 10、制御基板 11、電源供給部 12、及び音声制御部 13 の上部に『⌈』の字状に設置され、第 1 の仕切り板 34 で仕切られた上部空間 37 を形成している。鉛直方向延長部 8 は必要とされる冷却性能によっては省略することもできる。また、回路部 39 の配置は一例であって、回路部の配置によっては、コンピュータ部 10、制御基板 11、電源供給部 12、音声制御部 13 などの一部が第 1 の仕切り板 34 の上方に位置していてもかまわない。
- [0027] 第 1 の仕切り板 34 は画像表示部 2 の上面に固定されている。具体的には

、第１の仕切り板３４は画像表示部２のシャーシー４６に固定ねじ４７を介して固定されている。第１の仕切り板３４は、装置前後方向には、画像表示部２の裏面から裏板４２まで延びている。

[0028] 上下方向仕切り部７には開口３６が設けられ、一對のファン５，６が、開口３６の位置で、上下方向仕切り部７を貫通して設けられている。ファン５，６は上下方向仕切り部７に固定されている。ファン５，６は上下方向仕切り部７の下方から気体を吸入し、上下方向仕切り部７の上方に気体を排出し、これによって上下方向仕切り部７で仕切られた上部空間３７に循環流を発生させる。ファン５，６は、制御基板１１と電源供給部１２のそれぞれの鉛直方向上方に設置されている。ファンは本実施形態では一對設けられているが、必要とされる冷却性能によっては１台、または３台以上設けられていてもよい。

[0029] 上下方向仕切り部７は、その上面の、ファン５，６の近傍であってファン５，６よりも水平方向中央寄りの位置に、ファン５，６の側に傾斜して設けられた整流板１７を備えている。整流板１７の傾斜角度は例えば４５°である。

[0030] 図２Ａ，２Ｂには、本実施形態の画像表示装置内部の気流が概念的に示されている。コンピュータ部１０、制御基板１１、電源供給部１２、音声制御部１３等の装置中央部の回路部３９からの発熱によって暖められた空気はファン５，６に吸い込まれて、上下方向仕切り部７を通過して上部空間３７に排出される。上部空間３７に排出された高温の空気は左右方向に分流し（水平分岐流１５）、鉛直方向延長部８と筐体３２の間の側方空間３８を下向きに流れ（下降流１６）、内部空間３３の下部に達し、その後再び装置中央部の回路部３９に上昇流１４となって流入する。主として回路部３９で受け取った熱は筐体３２の外壁を介して外部に放熱される。空気は筐体３２の外壁に沿って概ね『』の字状に流れるため、筐体３２の外壁を介した外部との熱交換が効率的に行われる。

[0031] 本実施形態によれば、攪拌冷却作用は、ファン５，６と、冷却空気の流れ

を制御する第１の仕切り板３４と、によって実現される。第１の仕切り板３４は一般的に考えられる受熱部と放熱部とを結ぶ通風路としての仕切り板ではなく、その構造を限定することにより、循環流の最大化と効率化を可能としている。本実施形態における効率的な冷却では、ファンの台数や電力を抑制しながら、部品を冷却、すなわち部品を規定温度以下に抑えつつ、放熱（装置外部に対しての排熱）を可能としている。一般的な冷却方法では、発熱部品近傍にファンを設置し、高い風速を利用して部品の冷却をしつつ、暖められた空気を装置の排気口より排出している。しかし、本実施形態の場合、密閉構造を前提としているために排気口がなく、排気に頼らない排熱技術が必要となる。そのため、本実施形態では、熱を攪拌によって筐体表面へ移動させ、筐体表面を介した熱伝導によって放熱を行っている。そのため、筐体外側の表面では自然対流による冷却となる。本実施形態ではこのような攪拌効果を利用することにより、筐体表面をより広く利用した効率的な放熱ができる。

[0032] 本実施形態によれば、ファン５，６は熱拡散に効果的な循環流を発生し、攪拌効果を最大限に発生させる。本実施形態では、放熱後の最も温度が下がった下降流１６をコンピュータ部１０、制御基板１１、電源供給部１２、及び音声制御部１３に還流するので、これらの回路部３９に対して個別の熱対策を施す必要はない。

[0033] 第１の仕切り板３４は下向きに「」の字状の構成を有しているため、上向きファン５，６と組み合わせたときに、上部空間３７において高温のよどみができない。高温のよどみ空気は、回路部３９の冷却を阻害するだけでなく、装置の内部空間３３に上下方向の温度差を作る原因となり、ひいては液晶パネルの画質に影響を及ぼす可能性がある。本実施形態では、回路部３９からの熱はファン入り口に集約され、ファン出口のある上部空間３７で高流の水平分岐流１５が形成されるため、高温のよどみができない構造を確立することができる。

[0034] 上部空間３７に抜けた空気は水平分岐流１５となって装置の左右側面に向

かって流れるが、整流板 17 を設けてあるため、圧力損失を抑えながら気流を左右方向に向けることができ、冷却効果を一層高めることができる。

[0035] 本実施形態の液晶表示装置では、他の液晶表示装置で多く見られるように、バックライト用のインバータ部 9 が装置左右側面に配されている。第 1 の仕切り板 34 は鉛直方向延長部 8 を有しているため、インバータ部 9 を通過する空気の流速を高めに維持することができる。その結果、インバータ部 9 を効率的に冷却することができる。インバータ部 9 自身は内部空間 33 の下端付近まで設置されているが、鉛直方向延長部 8 は下端まで延伸するよりは、内部空間 33 の中ほどの高さにとどめておくほうが、装置全体の冷却にとって好ましい。

[0036] 本実施形態の冷却構造によれば、第 1 の仕切り板 34 が装置内部に循環流を発生させ、回路部 39 からの熱を装置全体に拡散し、放熱を促進させることができる。従来の冷却方法に比べて、空気の温度差が小さくても効率的な冷却が可能であり、密閉容器からの放熱特性を向上させることができる。画像表示装置の場合、画像表示面である装置前面からの冷却は不可能であるが、本実施形態では、大きな面積を有する背面側を利用した放熱が可能となる。また、画像表示装置においては、画像表示部背面に隣接して発熱部品が搭載されていることが通常であるが、本実施形態によれば、効果的な循環流によって、発熱した熱を装置内部の表示部側から背面側へ移動させることが可能となる。さらに、装置内部を循環流が面内方向に循環する構造のために、筐体 32 の側面、天板 43、及び筐体の下面を利用した放熱も可能となる。その結果、表示部以外のすべての面を利用した放熱が可能となる。

[0037] 第 1 の仕切り板 34 はファンの風量を最大限利用することができるだけでなく、その単純な仕切り構造によって、回路部 39 との干渉も最小限に抑えられ、回路部 39 の各電子部品を効率的に冷却することができる。さらに、その単純な構造のために循環空気の圧力損失も小さく、循環流量を大きく設定することが可能であるため、冷却上有利である。

[0038] 本実施形態の画像表示装置では、内蔵される部品全体が一つの密閉構造に

収納されるために、従来のようにランプの収容部について特別な冷却機能を搭載する必要がない。そのため、一般的な液晶表示装置の部品をそのまま使用することができ、コスト抑制が可能である。

[0039] 第1の仕切り板34とファン5, 6は、その位置や形状を最適化することによって、インバータ回路部9、制御基板11、電源供給部12などの装置内蔵部品を効果的に冷却することができるため、冷却性能の改善が容易である。例えば、第1の仕切り板34の形状を変化させることで、個別部品の冷却効果を調節することができる。このことは効率的であるだけでなく、低コスト化、設置作業の簡素化につながる。また、第1の仕切り板34は発熱領域全体を覆うように形成されているため、回路部39との干渉が発生しにくい。このため、第1の仕切り板34は汎用性が高く、多くの画像表示装置に対して適用可能である。その結果、多くの画像表示装置について、搭載電子回路部品温度の安定化、蛍光ランプを一定輝度で点灯することによる輝度安定化、温度均一化による液晶パネルの高寿命化などを実現することができる。

[0040] 本実施形態の液晶表示装置は、縦置きで設置・使用される場合もある。この場合においても、攪拌冷却を実現するために、横置きの場合と同様な循環流れを形成することが望ましい。図4A, 4Bに示すように、液晶表示装置内部の中央より上昇流14を生成し、ファン5, 6によって循環流として左右に展開することが好ましい。縦置きで使用する場合には、インバータ部9が上下端に設置されるため、循環流を上下方向にいきわたらせることが比較的難しい。ただし、下端に位置するインバータ部9は、装置内部で最も低温の雰囲気にとらされているために、循環流に依存した冷却の必要性は低い。

[0041] (第2の実施形態)

以降の実施形態では主に第1の実施形態から変更となっている事項について説明する。特記なき場合は第1の実施形態の説明を参照されたい。

[0042] 本実施形態の概念図を図5に示す。本実施形態では、ファン5, 6は第1

の仕切り板 3 4 の上方から気体を吸入し、第 1 の仕切り板 3 4 の下方に気体を排出するようにされている。第 1 の仕切り板 3 4 は第 1 の実施形態と同様の構造であるが、ファンを下向きに設置することで、図 5 に示すような循環流を生成することができる。この場合、ファン 5, 6 からの流れは液晶表示装置内部の制御基板や電源供給部などの回路部 3 9 に沿って下向きに流れる。ファン 5, 6 から比較的流速の高い流れが供給されるため、回路部 3 9 の部品群の効率的な冷却を実現できる。

[0043] (第 3 の実施形態)

本実施形態の概念図を図 6 に示す。本実施形態では、第 2 の実施形態と同様ファン 5, 6 を下向きに設置しているが、さらに、第 1 の仕切り板 3 4 の、一対のファン 5, 6 の間の位置に連通孔 2 1 が設けられている。このような構造によって、液晶表示装置内部における上下の通風効果を高められる。循環する空気の圧力損失が小さくなるために、ファンからの流量を増すことができ、回路部 3 9 へより多くの冷却空気を供給できる。このため、部品への冷却効果を一層高めることができる。

[0044] (第 4 の実施形態)

本実施形態の概念図を図 7 A, 7 B に示す。図 7 A は背面側から見た画像表示装置の断面図、図 7 B は図 7 A の A-A 線に沿った側方断面図である。本実施形態は、液晶表示装置が縦置きで設置、使用される場合に好適に適用できる。本実施形態では、内部空間 3 3 の下部に、回路部 3 9 よりも下方を横方向に延び、筐体 3 2 の水平方向両側側面の手前で終端する、第 2 の仕切り板 3 4' を有している。第 2 の仕切り板 3 4' の両側端部からは鉛直方向延長部 8' が鉛直方向上方に延びている。第 1 の仕切り板 3 4 にはファン 5 が、第 2 の仕切り板 3 4' にはファン 6 が貫通して設けられている。装置外の温度が高い場合など、下側のインバータ部 9 にも大きな温度負荷がかかる条件のもとでは、例えば、図 7 A に示すように上下に『』の字の仕切り板第 1、第 2 の仕切り板 3 4, 3 4' を設置し、循環流が装置内部全体に行き渡るような構造にすることが好ましい。下側に設置されるファン 6 が上昇流

を誘導し、装置内部の攪拌を促進するだけでなく、下側のインバータ部 9 を通る流れを生じさせるために、この部分の冷却効果を高める効果がある。冷却条件によっては、ファン 6 は必ずしも必要ではない。筐体の側面や背面で冷却された空気は比重が大きいため、下降流となって自然にインバータ部 9 の下側に回り込みためである。逆に冷却条件によっては、第 1 の仕切り板 3 4 と第 2 の仕切り板 3 4' の各々に一对のファンを設けることもできる。回路部 3 9 の配置によっては、第 2 の仕切り板 3 4' は回路部 3 9 の一部の部品よりも上方に位置していてもよい。鉛直方向延長部 8' は冷却条件によっては不要である。

[0045] (第 5 の実施形態)

内部空間に循環流を形成するための効果的なファンの設置方法については、いくつかの構造が考えられる。図 8 A, 8 B にはこのような実施形態の一例を、図 9 には、図 8 A, 8 B に示す実施形態における第 1 の仕切り板とファンの概略構成を示す。図 8 A は背面側から見た画像表示装置の断面図、図 8 B は図 8 A の A-A 線に沿った側方断面図である。一对のファン 5, 6 が第 1 の仕切り板 3 4 a の上下方向仕切り部 7 a に設けられている。上下方向仕切り部 7 a は、横方向に延びる中央部 5 1 と、中央部 5 1 より下方の位置を横方向に延びる一对の両側側部 5 2 と、中央部 5 1 と一对の両側側部 5 2 とを結ぶ一对の傾斜部 5 3 と、を有し、一对のファン是一对の傾斜部 5 3 で上下方向仕切り部 7 a を貫通している。本実施形態では傾斜部 5 3、すなわちファンの設置面は 45° 傾いているが、傾斜角度は適宜選定できる。ファンの設置面を傾けることにより、整流板を使わずに、圧力損失を抑えながら、流れの向きを変えることができる。

[0046] 筐体 3 2 の高さが画像表示部 2 よりも高い場合は、図 10 A, 10 B に示すように、画像表示部 2 の上端面を仕切り板の一部として利用することもできる。図 10 A は背面側から見た画像表示装置の断面図、図 10 B は図 10 A の A-A 線に沿った側方断面図である。この場合、画像表示部 2 上部の熱も排熱することが可能である。

[0047] (第6の実施形態)

図11は、図9に示す第1の仕切り板の変形形態を示す。上下方向仕切り部7aと鉛直方向延長部8aとの連結部は湾曲した形状を有している。循環流の圧力損失を最小限にするためには、流路の急激な曲がりになるべく抑えることが望ましい。直角に曲げられる流体は圧力損失が大きくなるために、図11のように、第1の仕切り板34aが滑らかに湾曲することによって圧力損失を低減することができる。なお、本実施形態は第5の実施形態以外のあらゆる実施形態の第1及び第2の仕切り板と組み合わせることが可能である。

[0048] (第7の実施形態)

本実施形態の概念図を図12A、12Bに示す。図13には、図12A、12Bに示す実施形態における第1の仕切り板とファンの概略構成を示す。図12Aは背面側から見た画像表示装置の断面図、図12Bは図12AのA-A線に沿った側方断面図である。一对のファン5、6が設けられ、第1の仕切り板34bの上下方向仕切り部7bは、筐体32の上面から鉛直方向下方に延びる一对の鉛直部54と、鉛直部54の下端から筐体32の両側側面に向かって横方向に延びる一对の両側側部55と、を有し、一对のファン5、6是一对の鉛直部54で上下方向仕切り部7bを貫通している。ファン5、6を対向式とすることで、回路部39を装置内上部まで設置することが可能である。さらに、同図に示すように筐体32の高さが画像表示部2より高い場合は、画像表示部2の上部もファン5、6の設置場所として利用できるため、画像表示装置1全体の厚みを薄くすることが可能となる。

[0049] (実施例)

ここで、公共場所に用いられる比較的大型で密閉型の52インチ液晶表示装置に本発明を適用した実施例を示す。52インチの液晶画像表示部は、高さ約650mm、幅約1150mmである。パネルとバックライトなどを含めた液晶画像表示部は、厚み約45mmである。この液晶画像表示部を密閉筐体に組み込んだ液晶表示装置の断面図を図14A、14Bに、背面側から

見た斜視図を図 1 5 に示す。図 1 4 A は背面側から見た画像表示装置の断面図、図 1 4 B は図 1 4 A の A - A 線に沿った側方断面図である。

[0050] これらの図を参照すると、液晶画像表示部背面側に設置された制御基板 1 1 や電源基板（電源供給部） 1 2 の直上に位置する部分にそれぞれファン 5 , 6 が設置されている。これらの基板はそれぞれ 3 0 0 mm の幅をもち、装置内部の中央寄りに設置されている。これにあわせてファン 5 , 6 もその中心間距離 2 2 0 mm で設置されている。ファン 5 , 6 は発熱部品からの熱を吸気するだけでなく、『 』の字型の第 1 の仕切り板 3 4 の上部に滞留している空気も同時に循環させることができ、装置内部での熱の滞留を抑制する効果がある。熱せられた空気はファン 5 , 6 を通り、装置左右端の領域へと向かう。このとき暖められた空気は装置の前後方向に攪拌され、温度も緩和される。その結果、インバータ部 9 の冷却効果を得ることができる。攪拌されつつ装置の左右端部を下降し、装置中央部に戻る流れは、温度の低い装置の左右や背面側の壁面を通じて排熱する。

[0051] 背面側の外部にはフィン 2 5 が形成されており、自然対流での放熱効果を得ている。フィン 2 5 は背面に加えて側面に設けてもよい。フィン 2 5 を設置することで背面側ないし側面側での放熱効率を極めて効果的に高めることができる。前後方向の攪拌効果により、発熱は液晶パネル前面側で生じ、排熱は背面側で行われる。本実施例の循環流は図 1 6 A に示すように、装置内部を面内方向に循環するように形成されている。これに対して図 1 6 B に示すように、前後を仕切るように仕切り板 1 2 2 を形成することも考えられるが、その場合流路形状のアスペクト比が大きく扁平になるため、圧力損失が大きくなってしまい、好ましくない。

[0052] 本実施例では、図 1 7 に示すように、横方向に延びる第 1 の仕切り板 3 4 上に狭い間隔でファン 5 , 6 が設置されているが、2 台のファン 5 , 6 間の距離は、下部に設置されている発熱部品が搭載されている基板のサイズや位置に応じて変えることが望ましい。例えば、図 1 8 に示すように、ファン間の距離を 5 0 0 mm 程度に広くとることが良好な場合も考えられる。循環流

の循環パスが短くなるために、装置内部の左右の領域において大きな流量を得ることができる。第1の仕切り板34の上部領域においては、ファン間のエリアに流入しようとする流れが発生するために、図19のように整流板17を設置して装置の左右端方向に気流が流れやすくすることも好ましい。

- [0053] 52インチ液晶表示装置の場合を例に、ファンの選定の目安を説明する。52インチの装置の冷却負荷を約300Wと仮定する。装置内部で攪拌しながら循環する空気は、その過程で5℃の温度差をもって、発熱基板領域で温められたり、フィン部で冷却されたりしていると考ええる。空気の温度差5℃の熱容量で300W程度の熱を移動させようとする、約3.0m³/分の流量が必要となる。2つのファンでこれらの流量を得ようとする場合、1台あたり約1.5m³/分の供給能力が求められる。これに見合うファンの例として図20に直径120mmのファンのPQ特性を示す。同図より、12ボルトのDC電力を供給して運転するとき、約15Paの圧力損失のもとで1.5m³/分を供給できることがわかる（運転ポイント）。本実施例による循環流生成構造によれば、循環系の圧力差を15Pa以下にすることで、必要な流量を得ることができる。圧力差が大きな従来の放熱構造の場合、必要流量を得ることができず、装置内部の温度上昇に依存した冷却になってしまう。装置内部の極度の温度上昇は、内蔵部品の冷却が不十分となる可能性を高める。

- [0054] 最後に、本発明の効果を確認するため、いくつかの仕切り板とファン構成について実機で評価した結果を説明する。それぞれの構成について、図21に、画像表示装置に搭載された発熱部品の平均温度と最大温度及び最小温度を記録した部品の温度を示す。比較例1と比較例2はいずれも、本発明の仕切り板構成によらずに装置内部を攪拌する構成である。これらの平均温度上昇値は32から34℃であった。

- [0055] 「仕切り板A1」は図18に示す構造で、ファン間の距離を大きく（中心間距離500mm）とり、ファンの排気方向は上向きとした。「仕切り板A2」は図19に示す構造で、A1の構造に整流板を追加した構造である。整流板を設けることにより、流れ方向を制御することができ、循環流の形成効

果が得られる。「仕切り板B」は図6に示す構造で、ファン間の距離を大きくとり、ファンの排気方向は下向きとし、仕切り板の中央に連通孔を設けた構造である。「仕切り板C」は構造としては図15に示すものと同じであるが、ファンの排気方向は下向きとした。ファン間の距離は小さく（中心間距離220mm）、整流板は設けていない。仕切り板BとCの場合でも、比較例に対する優位性が得られた。「仕切り板D」は図17に示す構造で、ファン間距離を小さく（中心間距離220mm）とり、ファンの排気方向は上向きとし、整流板を設けている。平均温度上昇値は24℃を記録しており、単純に攪拌するだけの比較例の冷却構造に比べて10℃近い温度低減効果を得ることができた。仕切り板Aに関しても平均温度上昇値は約25℃を記録しており、比較例に対する優位性が認められ、本発明の効果が確認された。

[0056] 以上、実施形態及び実施例を参照して本願発明を説明したが、本願発明は上記実施形態及び実施例に限定されるものではない。本願発明の構成や詳細には、本願発明おのスコープ内で当業者が理解し得る様々な変更をすることができる。

[0057] この出願は2008年7月17日に出願された日本出願特願2008-186178を基礎とする優先権を主張し、その開示の全てをここに取り込む。

請求の範囲

- [請求項1] 密閉された内部空間を形成する外囲器と、
前記内部空間に設けられた回路部と、
前記内部空間に設けられ、上下方向仕切り部を有する第1の仕切り板であって、前記上下方向仕切り部は、少なくとも一部が、少なくとも一部の前記回路部よりも上方を横方向に延び、前記外囲器の両側側面の手前で終端する、第1の仕切り板と、
前記上下方向仕切り部を貫通する第1のファンと、
を有している、電子装置。
- [請求項2] 前記第1の仕切り板は、前記上下方向仕切り部の前記外囲器の前記側面側の端部から鉛直方向下方に延びる鉛直方向延長部を有している、請求項1に記載の電子装置。
- [請求項3] 前記上下方向仕切り部と前記鉛直方向延長部との連結部は湾曲した形状を有している、請求項2に記載の電子装置。
- [請求項4] 前記ファンは前記上下方向仕切り部の下方から気体を吸入し、前記上下方向仕切り部の上方に気体を排出するようにされている、請求項1から3のいずれか1項に記載の電子装置。
- [請求項5] 前記ファンは一对設けられ、
前記上下方向仕切り部は水平に延びており、
前記上下方向仕切り部は、その上面の、前記ファンの近傍であって該ファンよりも水平方向中央寄りの位置に、該ファンの側に傾斜して設けられた整流板を備えている、
請求項4に記載の電子装置。
- [請求項6] 前記ファンは一对設けられ、
前記上下方向仕切り部は、横方向に延びる中央部と、該中央部より下方の位置を横方向に延びる一对の両側側部と、該中央部と該一对の両側側部とを結ぶ一对の傾斜部と、を有し、
前記一对のファンは前記一对の傾斜部で前記上下方向仕切り部を貫

通している、

請求項 4 に記載の電子装置。

[請求項 7]

前記ファンは一对設けられ、

前記上下方向仕切り部は、前記外囲器の上面から鉛直方向下方に延びる一对の鉛直部と、該鉛直部の下端から前記外囲器の前記両側側面に向かって横方向に延びる一对の両側側部と、を有し、

前記一对のファンは前記一对の鉛直部で前記上下方向仕切り部を貫通している、

請求項 4 に記載の電子装置。

[請求項 8]

前記ファンは前記上下方向仕切り部の上方から気体を吸入し、前記上下方向仕切り部の下方に気体を排出するようにされている、請求項 1 から 3 のいずれか 1 項に記載の電子装置。

[請求項 9]

前記ファンは一对設けられ、前記上下方向仕切り部の、該一对のファンの間の位置に連通孔が設けられている、請求項 8 に記載の電子装置。

[請求項 10]

前記回路部は、前記液晶表示部を制御するための制御基板と、前記電子装置への電源供給を行う電源供給部と、を有し、

前記ファンは、前記制御基板と前記電源供給部のそれぞれの鉛直方向上方に設置されている、請求項 1 から 9 のいずれか 1 項に記載の電子装置。

[請求項 11]

前記内部空間に設けられ、少なくとも一部が、前記少なくとも一部の前記回路部よりも下方を横方向に延び、前記外囲器の前記水平方向両側側面の手前で終端する、第 2 の仕切り板を有している、請求項 1 から 10 のいずれか 1 項に記載の電子装置。

[請求項 12]

前記第 2 の仕切り板を貫通する第 2 のファンを有している、請求項 11 に記載の電子装置。

[請求項 13]

前記外囲器は、装置前面に位置する画像表示部と、該画像表示部とともに密閉容器を形成する筐体と、を備え、前記回路部は前記画像表

示部に画像を表示させる回路部である、請求項 1 から 12 のいずれか 1 項に記載の電子装置を用いた画像表示装置。

[請求項14] 密閉された内部空間を形成する外囲器と、前記内部空間に設けられた回路部と、を有する電子装置の冷却方法であって、

前記内部空間を水平方向に延びるように前記内部空間に設けられ少なくとも一部の前記回路部とその上方空間とを仕切る上下方向仕切り部に設けられた開口を通して、前記上下方向仕切り部の下面側から前記上下方向仕切り部の上面側へ前記内部空間の空気を送出することと、

前記上下方向仕切り部の前記上面側へ送出された前記空気を、前記上下方向仕切り部の前記上面に沿って前記外囲器の側面に向かわせることと、

前記外囲器の前記側面に至った前記空気を、前記外囲器の前記側面に沿って下降させながら冷却することと、

冷却された前記空気を前記開口に向けて上昇させることと、

によって前記空気を前記内部空間内で循環させることを含む、電子装置の冷却方法。

[請求項15] 密閉された内部空間を形成する外囲器と、前記内部空間に設けられた回路部と、を有する電子装置の冷却方法であって、

前記内部空間を水平方向に延びるように前記内部空間に設けられ少なくとも一部の前記回路部とその上方空間とを仕切る上下方向仕切り部に設けられた開口を通して、前記上下方向仕切り部の上面側から前記上下方向仕切り部の下面側へ前記内部空間の空気を送出することと、

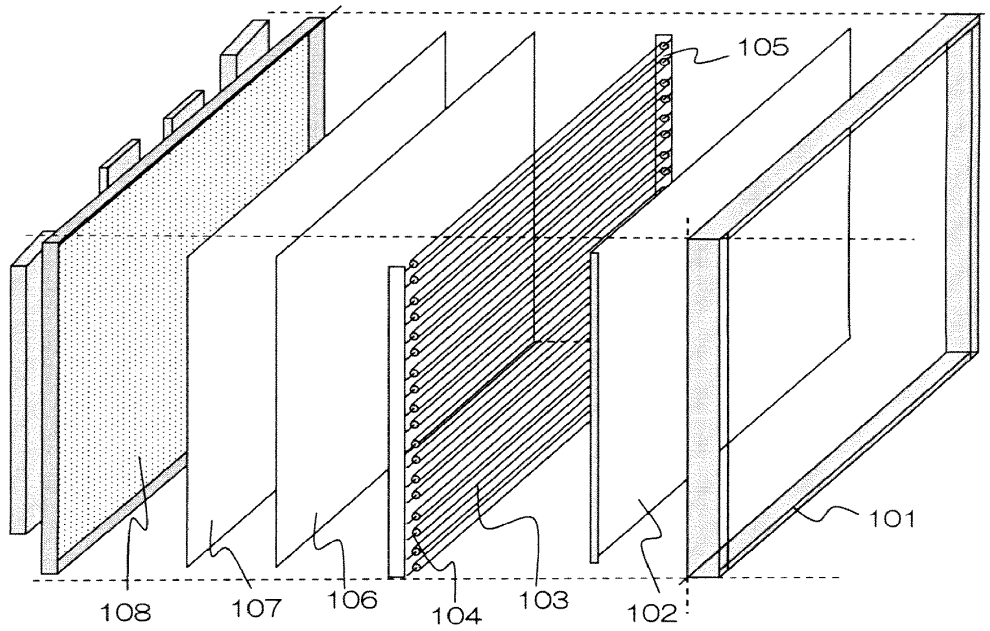
前記上下方向仕切り部の前記下面側へ送出された前記空気を、前記外囲器の側面の下部に向かわせることと、

前記外囲器の前記側面の下部に至った前記空気を、前記外囲器の前記側面に沿って上昇させながら冷却することと、

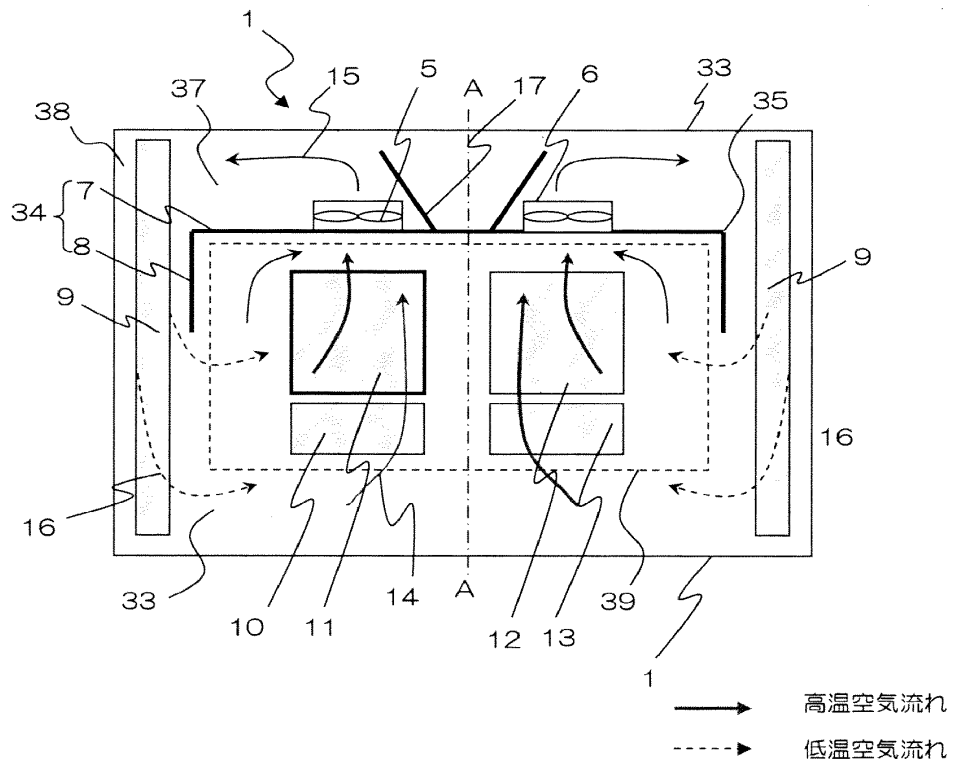
前記外圍器の前記側面に沿って上昇した前記空気を、前記上下方向仕切り部の前記上面に沿って前記開口に向かわせることと、

によって前記空気を前記内部空間内で循環させることを含む、電子装置の冷却方法。

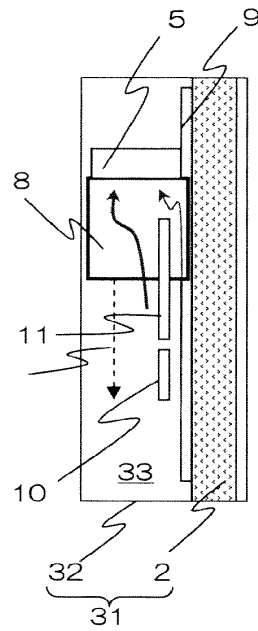
[図1]



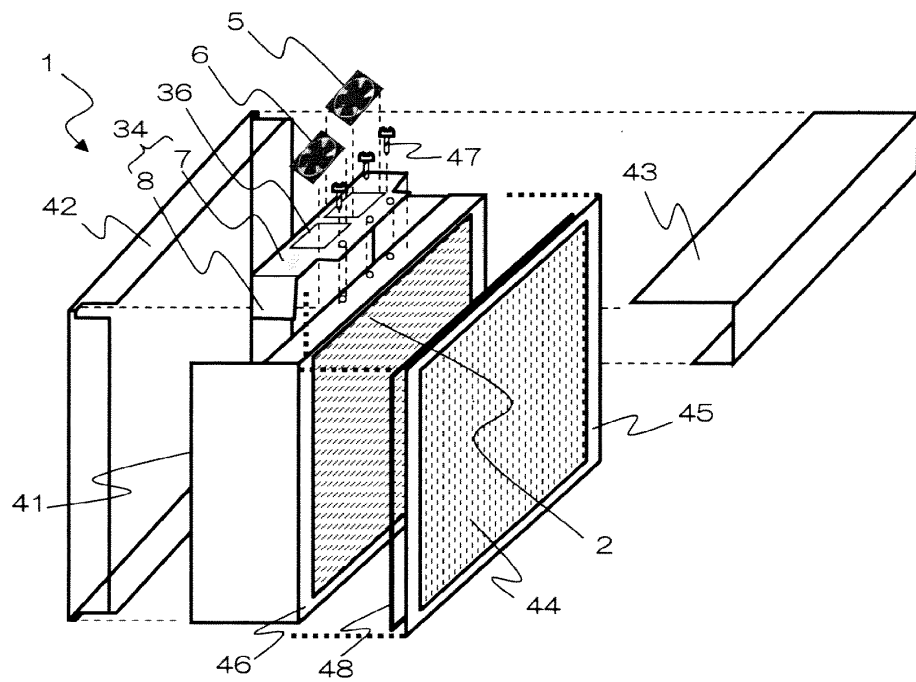
[図2A]



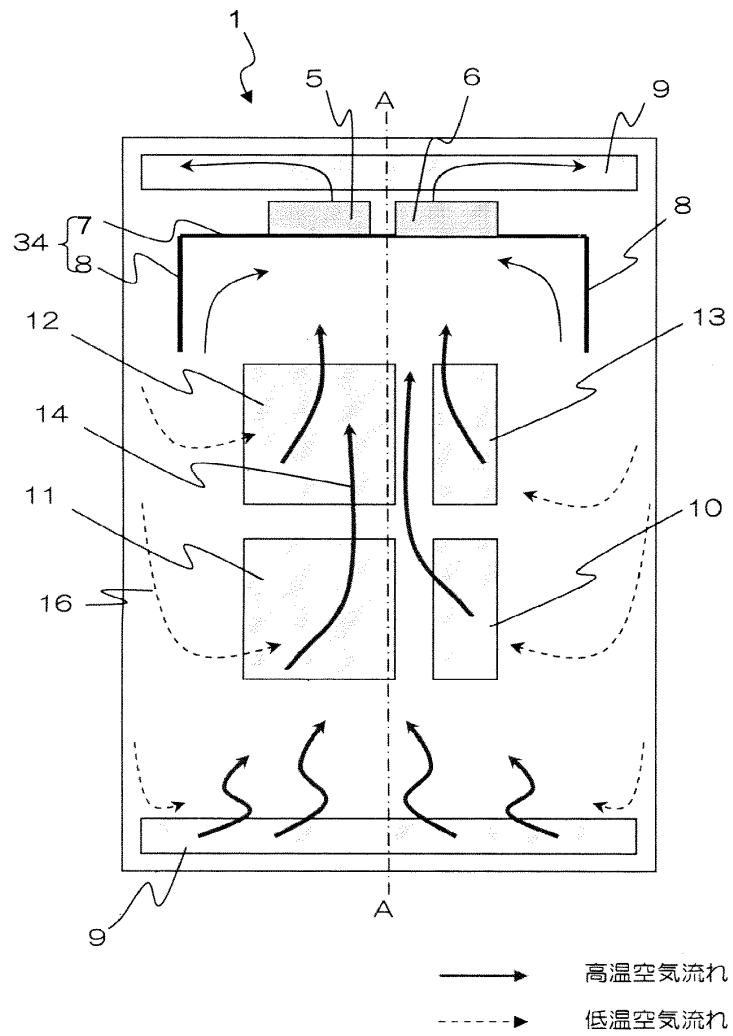
[図2B]



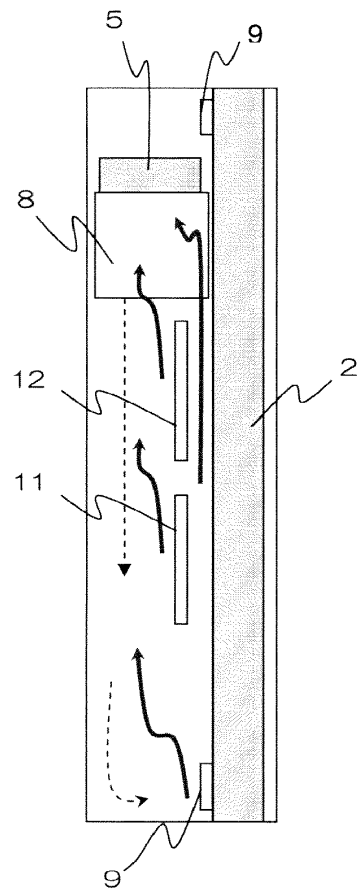
[図3]



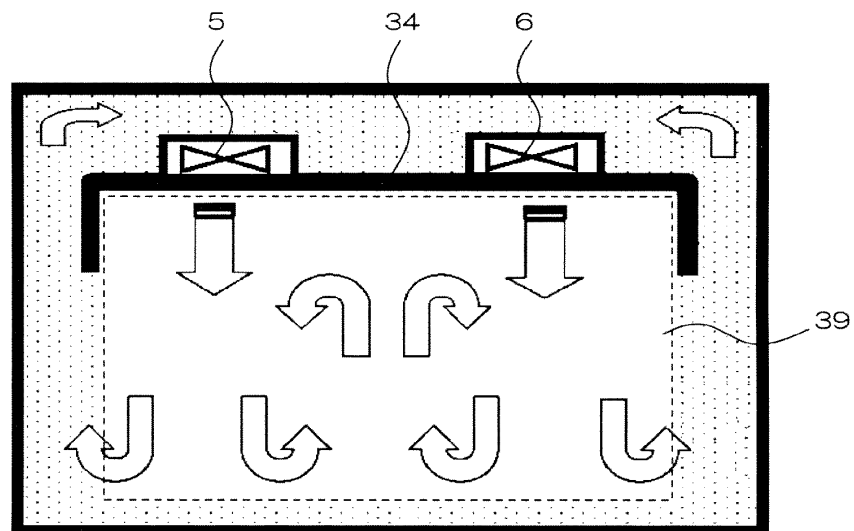
[図4A]



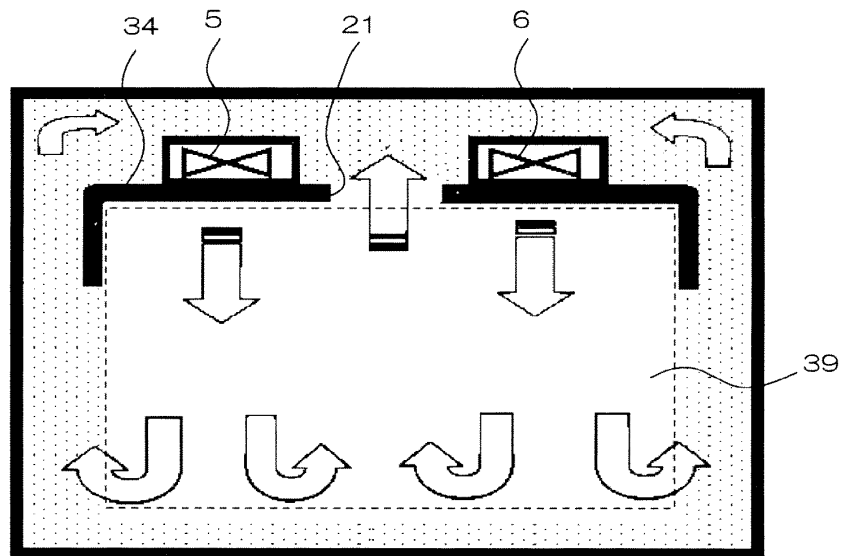
[図4B]



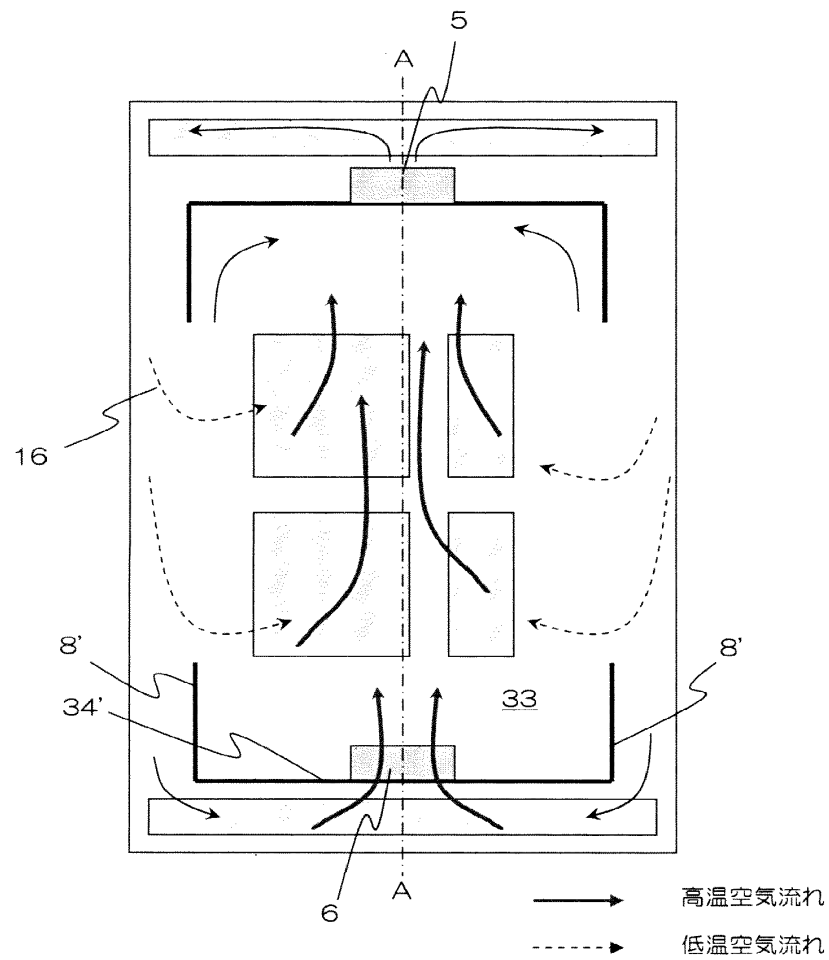
[図5]



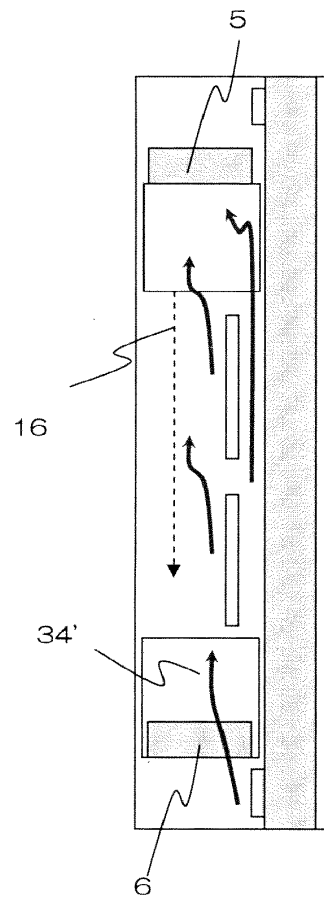
[図6]



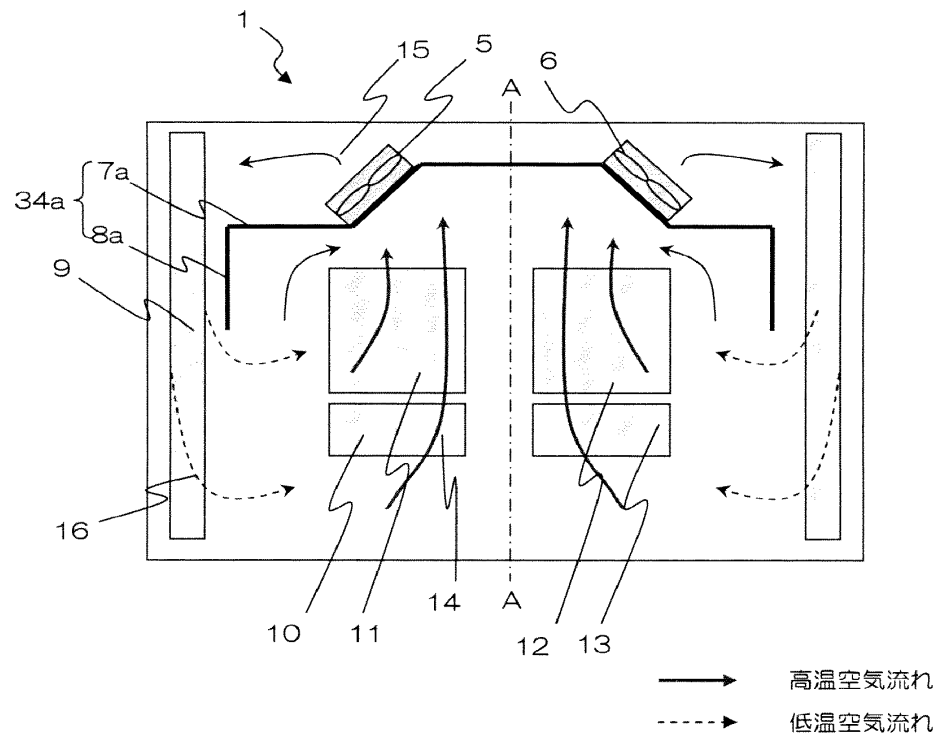
[図7A]



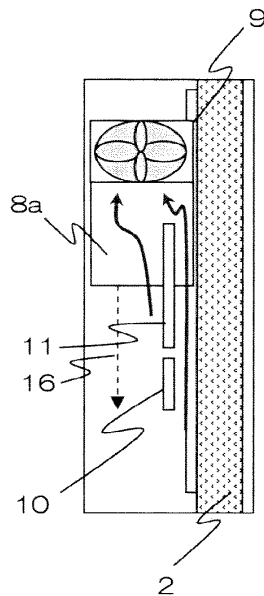
[図7B]



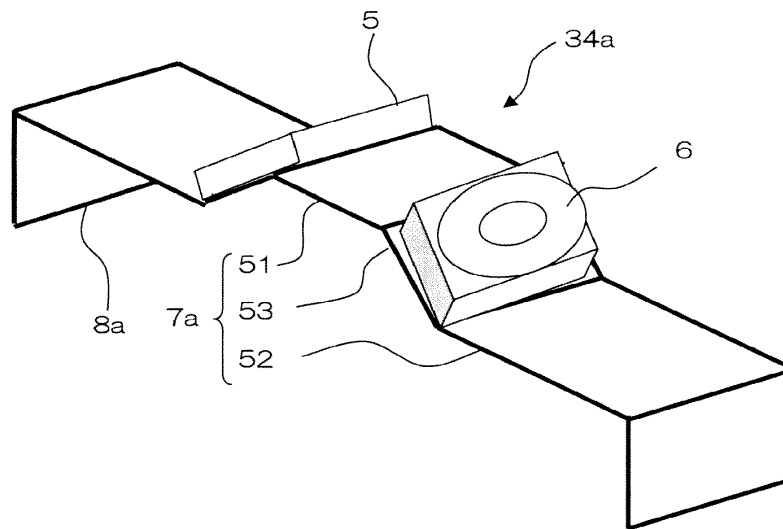
[図8A]



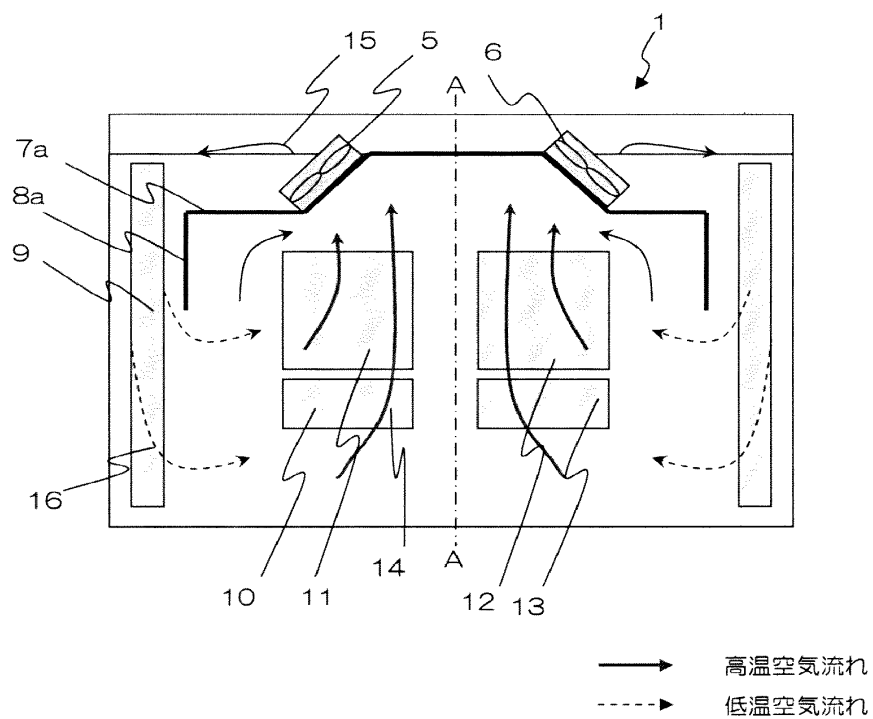
[図8B]



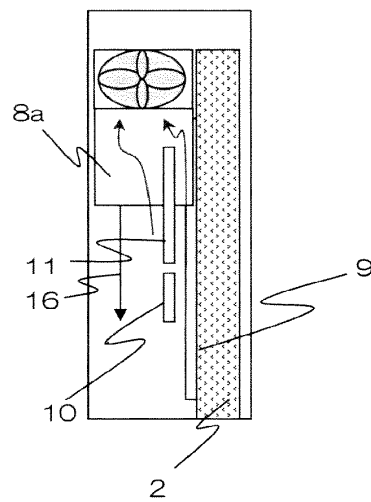
[図9]



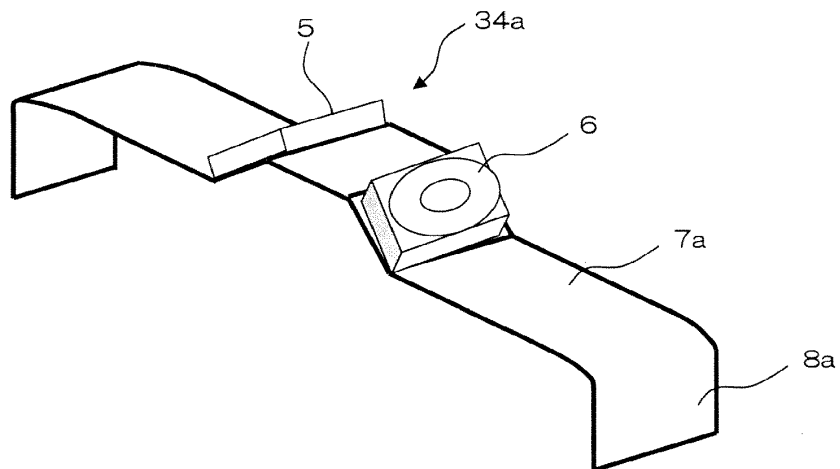
[図10A]



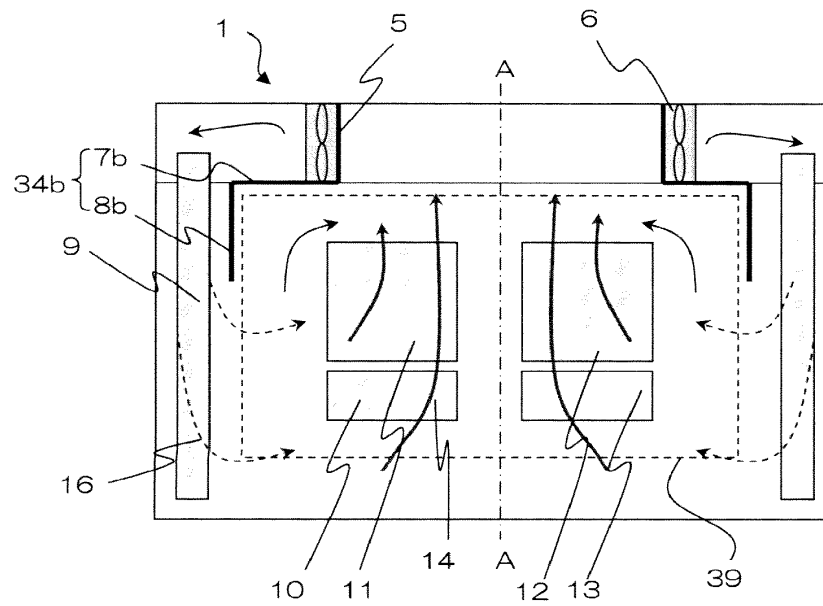
[図10B]



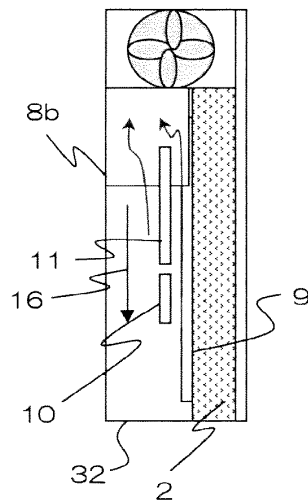
[図11]



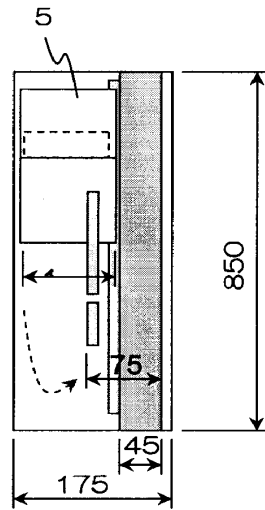
[図12A]



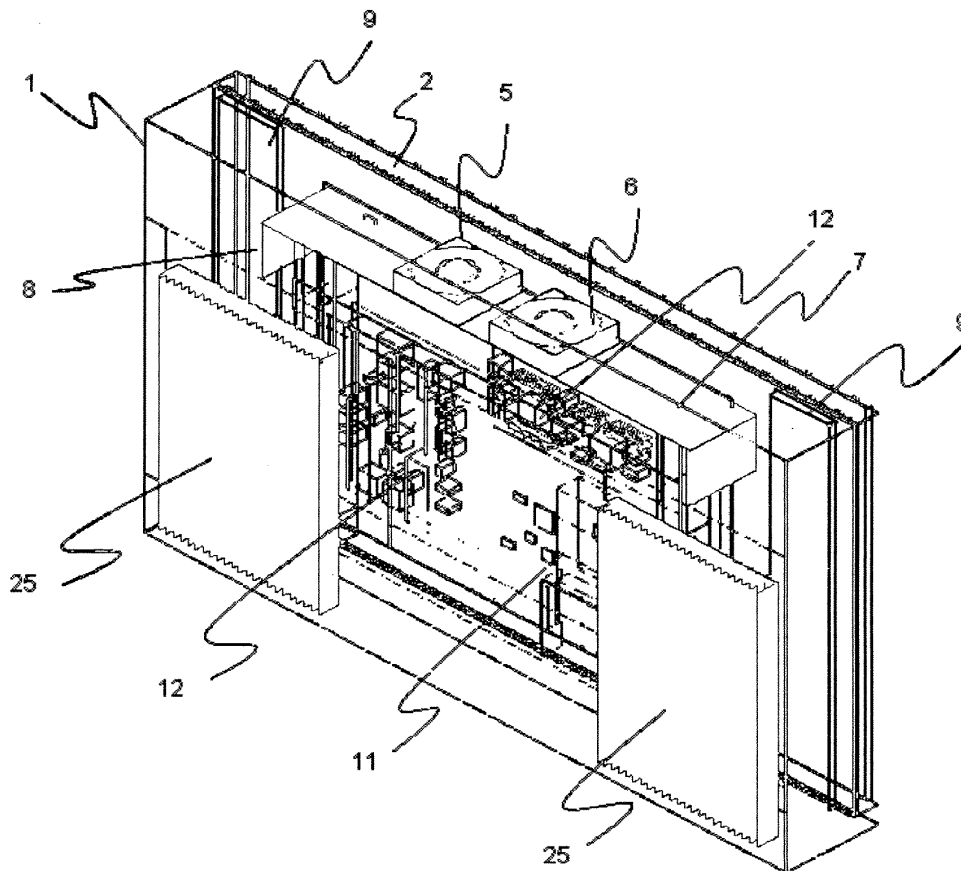
[図12B]



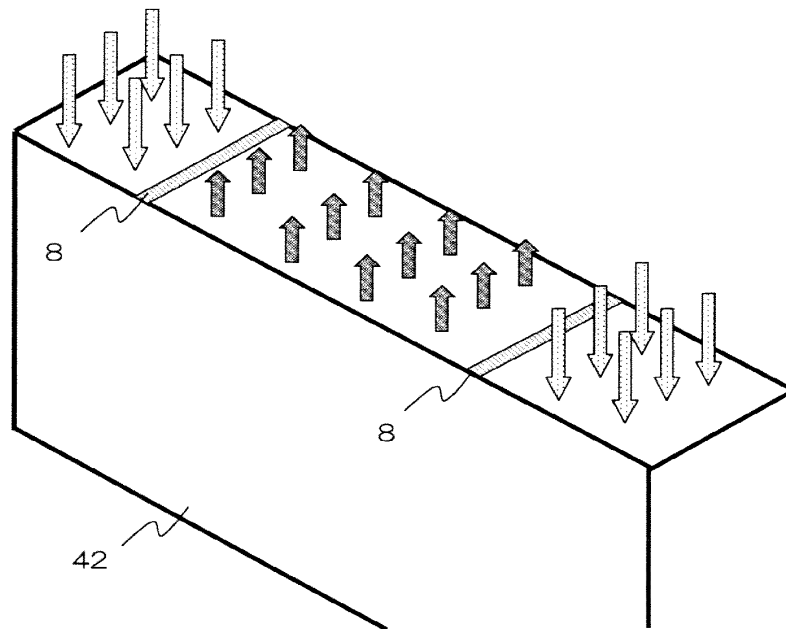
[図14B]



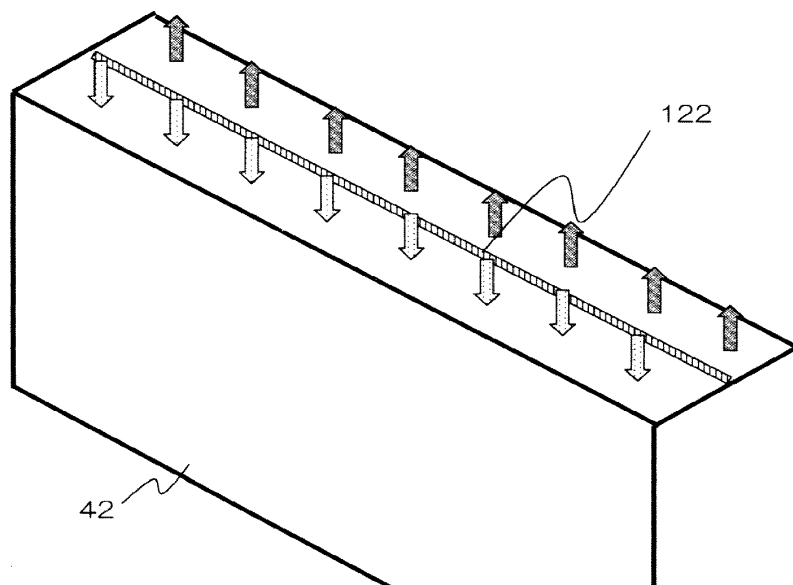
[図15]



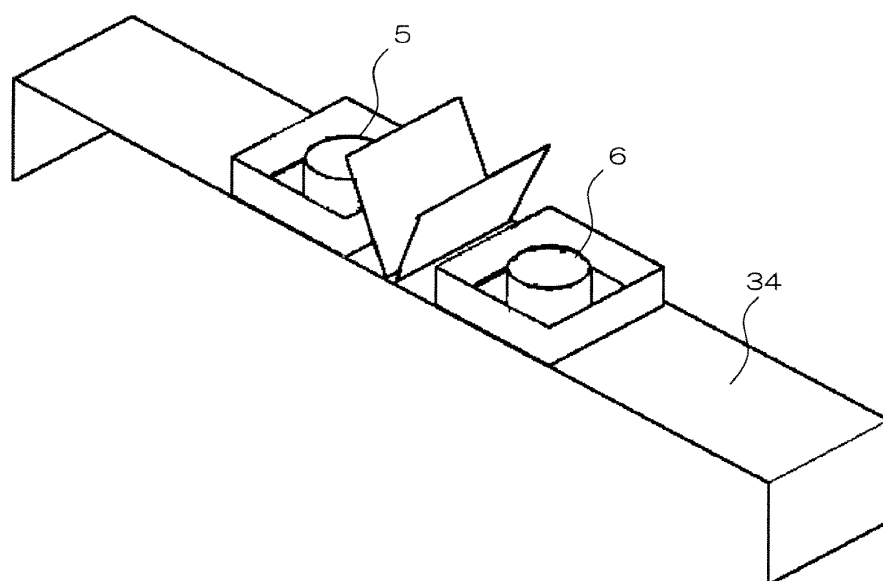
[図16A]



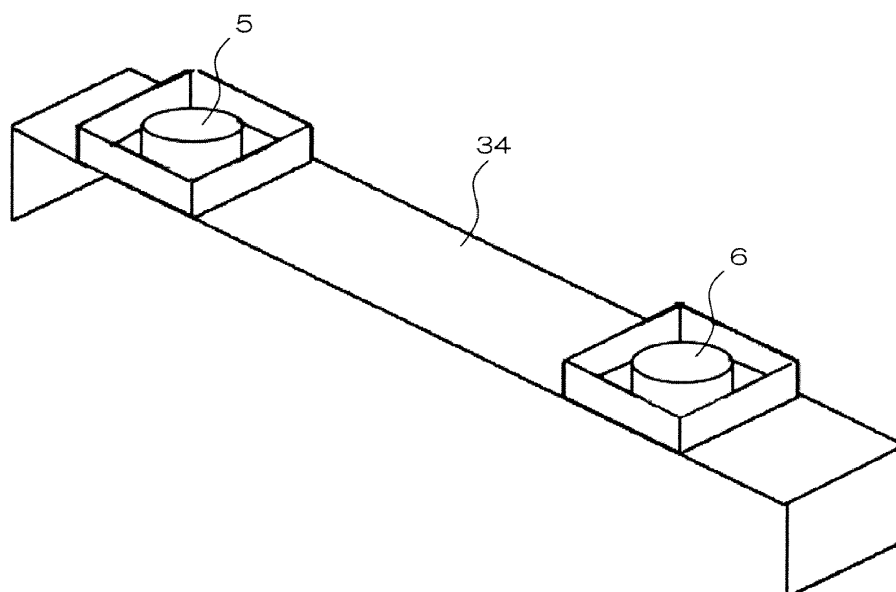
[図16B]



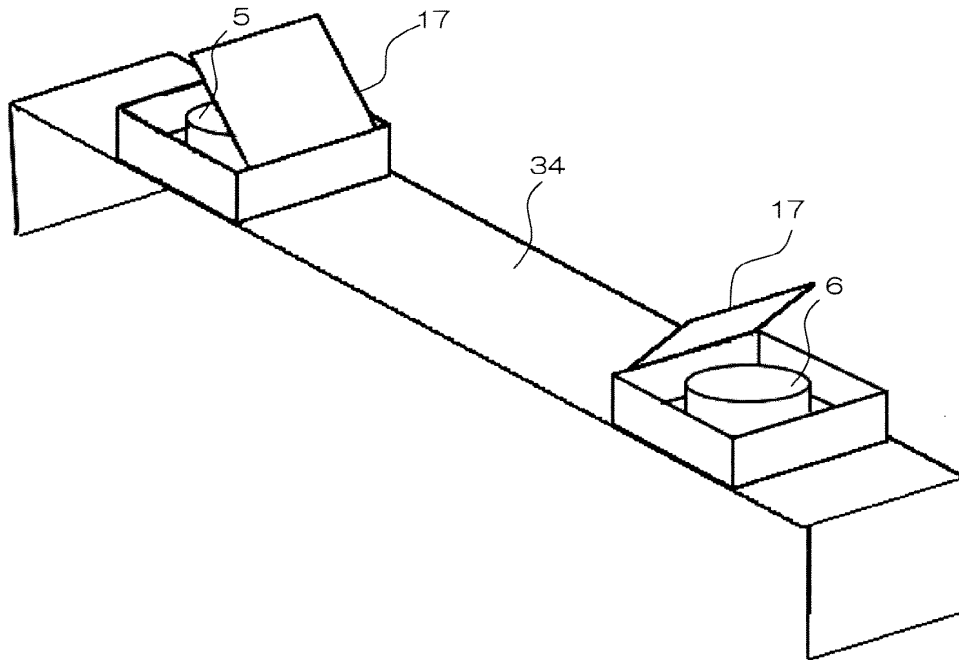
[図17]



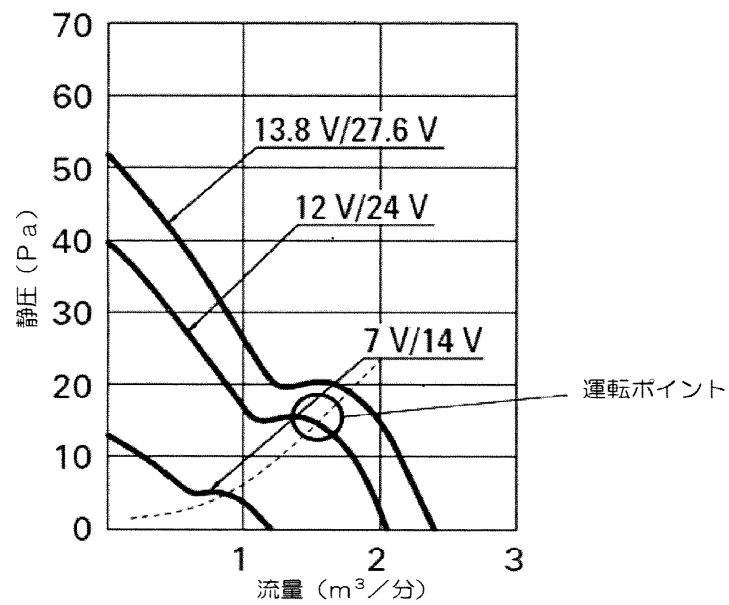
[図18]



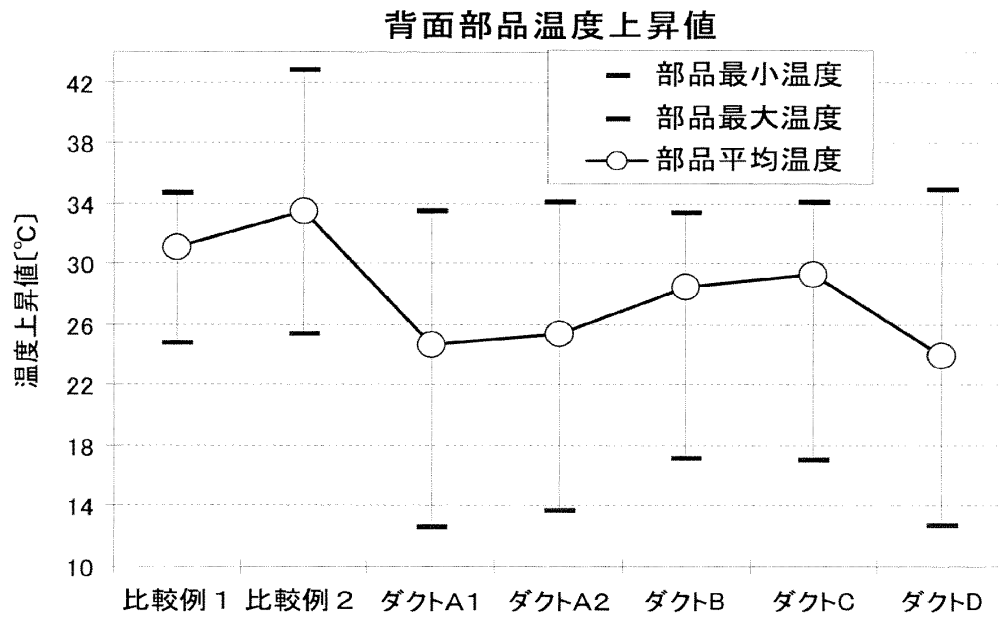
[図19]



[図20]



[図21]



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2009/057347

A. CLASSIFICATION OF SUBJECT MATTER

G09F9/00(2006.01) i, H01L23/467(2006.01) i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

G09F9/00, H01L23/467

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

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2009
Kokai Jitsuyo Shinan Koho	1971-2009	Toroku Jitsuyo Shinan Koho	1994-2009

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	JP 2005-181799 A (Hoshimitsu Co., Ltd.), 07 July, 2005 (07.07.05), Par. Nos. [0014] to [0038]; Figs. 1 to 4 (Family: none)	1-4, 8-15 5-7
Y	JP 2000-156581 A (Fujitsu General Ltd.), 06 June, 2000 (06.06.00), Par. No. [0016]; Fig. 3 (Family: none)	5
Y	JP 2004-031539 A (Hitachi Kokusai Electric Inc.), 29 January, 2004 (29.01.04), Par. Nos. [0008] to [0015]; Fig. 1 (Family: none)	6

☒ Further documents are listed in the continuation of Box C.☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"F" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search
08 May, 2009 (08.05.09)Date of mailing of the international search report
19 May, 2009 (19.05.09)Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

Facsimile No.

Telephone No.

Form PCT/ISA/210 (second sheet) (April 2007)

SEC et al. v. MRI
SEC Exhibit 1031.0970
IPR2023-00254

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2009/057347

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2004-158641 A (Mitsubishi Electric Corp.), 03 June, 2004 (03.06.04), Par. Nos. [0022] to [0031]; Fig. 1 (Family: none)	7

Form PCT/ISA/210 (continuation of second sheet) (April 2007)

SEC et al. v. MRI
SEC Exhibit 1031.0971
IPR2023-00254

国際調査報告		国際出願番号 PCT/J P 2 0 0 9 / 0 5 7 3 4 7	
A. 発明の属する分野の分類（国際特許分類（IPC）） Int.Cl. G09F9/00(2006.01)i, H01L23/467(2006.01)i			
B. 調査を行った分野 調査を行った最小限資料（国際特許分類（IPC）） Int.Cl. G09F9/00, H01L23/467			
最小限資料以外の資料で調査を行った分野に含まれるもの 日本国実用新案公報 1922-1996年 日本国公開実用新案公報 1971-2009年 日本国実用新案登録公報 1996-2009年 日本国登録実用新案公報 1994-2009年			
国際調査で使用した電子データベース（データベースの名称、調査に使用した用語）			
C. 関連すると認められる文献			
引用文献の カテゴリー*	引用文献名 及び一部の箇所が関連するときは、その関連する箇所の表示	関連する 請求項の番号	
X	JP 2005-181799 A（株式会社星光）2005.07.07, 【0014】－【0038】、図1－4（ファミリーなし）	1-4, 8-15	
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☒ C欄の続きにも文献が列挙されている。 ☐ パテントファミリーに関する別紙を参照。			
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C (続き) . 関連すると認められる文献		
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Y	JP 2004-158641 A (三菱電機株式会社) 2004. 06. 03, 【 0 0 2 2 】 － 【 0 0 3 1 】、図 1 (ファミリーなし)	7



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SNOW-MELTING PANEL

Inventor(s): KATO HISASHI; TAKADA EIJI ± (KATO HISASHI, ; TAKADA EIJI)

Applicant(s): HITACHI METALS LTD ± (HITACHI METALS LTD)

Classification: - international: ***E01B19/00; E01C11/26; E01H5/10***
- Euro:

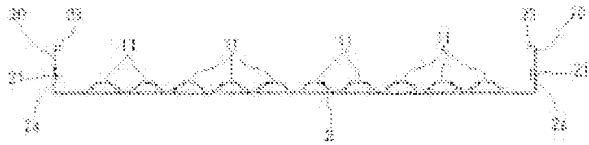
Application number: JP20080183720 20080715

Priority number(s): JP20080183720 20080715

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Abstract of JP2010024624 (A)

PROBLEM TO BE SOLVED: To provide a snow-melting panel capable of reducing its manufacturing cost and preventing the occurrence of distortion of a heat radiating board and problems of water puddle and corrosion due to the distortion of the heat radiating board. ;
SOLUTION: This snow-melting panel is constituted by joining a heat radiating flat plate 2 having an upper face being a heat radiating face and a flow passage forming member 10 forming a zigzag flow passage mutually by welding to make a heat medium flow between them. The sections around the heat radiating flat plate 2 are bent into L-shape to form a bent part 2a, which is joined with a tie plate 20 by welding. The flow passage forming member 10 is constituted by connecting a linear groove member 11 and a U-shaped groove member 13 mutually. ; COPYRIGHT: (C)2010,JPO&INPIT



(19) 日本国特許庁(JP)

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(21) 出願番号	特願2008-183720 (P2008-183720)	(71) 出願人	000005083 日立金属株式会社 東京都港区芝浦一丁目2番1号
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(54) 【発明の名称】 消雪パネル

(57) 【要約】

【課題】 製造コストを抑えるとともに放熱板の歪を低減させ、放熱板の歪から生じる水溜りや耐食性の問題を解消した消雪パネルを提供する。

【解決手段】 上面が放熱面である薄い放熱平板2と、つづら折り状の流路を形成する流路形成部材10とを溶接接合して、その間に熱媒体を流動させる。放熱平板2の周囲をL字状に折り曲げて、折り曲げ部2aとなし、更にこの折り曲げ部2aに帯板20を溶接接合している。流路形成部材10は、直線溝部材11とU字溝部材13とを連結して構成する。

【選択図】 図2



【特許請求の範囲】

【請求項1】

上面が放熱面である薄い放熱平板と、この放熱平板の下面に溶接接合し、その一方の表面と前記放熱平板との間に熱媒体が流動するつづら折り状の流路を形成する流路形成部材とを備えた消雪パネルにおいて、

前記放熱平板の周囲をL字状に折り曲げ、更にこの折り曲げ部に帯板を溶接接合したことを特徴とする消雪パネル。

【請求項2】

前記帯板の溶接接合部ではない他端側はL字状に折り曲げ加工されていることを特徴とする請求項1に記載の消雪パネル。

【請求項3】

前記流路形成部材は前記熱媒体が流入する第1のノズル部材と、前記熱媒体が流出する第2のノズル部材と、これらに間に配設され台形状断面を有する複数列の直線溝部材と、相隣る直線溝部材の端部が接続される複数のU字溝部材とからなり、前記直線部材、前記第1、第2のノズル部材及びU字溝部材との連結部に継目部を設け、当該継目部は固着されると共に、前記各直線溝部材はその短手方向のツバ部が長手方向の全長にわたって前記放熱平板に溶接接合されることを特徴とする請求項1又は2に記載の消雪パネル。

【請求項4】

請求項1乃至3のいずれかに記載の消雪消雪パネルを線路に沿って複数枚配置し、各々の消雪パネルは一端から持ち上げ可能とするとともに、熱媒体の供給管および排出管にフレキシブル管を用いて並列に接続し、前記帯板には、取手を設けたことを特徴とする消雪パネル。

【発明の詳細な説明】

【技術分野】

【0001】

本発明は、積雪地帯に敷設された軌条の周囲に設置される消雪パネルに関する。

【背景技術】

【0002】

積雪地帯に敷設された鉄道路線においては、列車を安全に運行するために、軌条の周囲に消雪パネルを設置し、消雪パネル上に堆積した雪（除雪された及び降雪した雪）を消雪パネルの裏面を流動する熱媒体（例えば地下水などの温水）で溶融することが行われている。

【0003】

この種の消雪装置として、例えば特許文献1には、上面が放熱面である薄い平板と、この平板の下面に接合した、複数列の幅広で浅い凹部、およびこの凹部各列となり同士をつなぐ幅広で浅い凹部、からなる連続した凹部を有する溝付板と、この溝付板の連続した幅広で浅い凹部と前記平板とで形成される幅広で浅い流路の両端に設けた配管接続口と、からなる消雪用放熱器において、前記平板と溝付板との周囲を取り囲む帯薄板に延長部を設けて、前記溝付板の下面と敷設面との間に間隙を設け、該間隙に向けて前記配管接続口を開口した消雪用放熱器が記載されている。また、溝付板の周囲を取り囲む帯薄板は箱形を形成させて消雪用放熱器の強度を大きくさせることが記載されている。

【0004】

また、特許文献2には、特許文献1に記載の消雪用放熱器を水平に対して勾配を設けて設置することが記載されている。また、特許文献3には、特許文献1における溝付板を、台形状断面を有する直線溝部材と、U字溝部材とを接合して構成することが記載されている。そして、これらの消雪装置を構成する平板と溝付板とは専ら溶接接合されている。

【0005】

【特許文献1】特公平6-76681号公報

【特許文献2】特開平11-152701号公報

【特許文献3】特開2007-85057号公報

【発明の開示】

【発明が解決しようとする課題】

【0006】

しかしながら、特許文献1及び2に記載のものでは、接合の際には、大きな溶接歪が発生する。特に、平板の一面と溝付板とを溶接接合するために、平板の放熱面が凹となる歪が生じやすく、消雪の際には凹部が水溜りとなり放熱面に錆びが発生させることとなる。そのために、溶接接合の後に歪取り工程を必要としていた。特許文献3に記載のものは、この歪取り工程の削減を図ったものであるが、溶接歪を低減することはできるものの、歪取り工程を撲滅するには至っていない。

【0007】

また、箱形に形成させた帯薄板を溶接で溝付板の周囲に溶接しては製造コストが嵩むという問題を有していた。更に、この種の消雪パネルは銅板を主材料にして構成するので、その重量が約100kgになり、特許文献2に記載のようにメンテナンスのために開閉可能のように構成した場合、消雪パネルと設置ベースとの間に手を挟みやすいといった問題もあった。

【0008】

本発明は、上記の事項に留意してなされたもので、製造コストを抑えるとともに放熱板の歪を低減させ、放熱板の歪から生じる水溜りや耐食性の問題を解消した消雪パネルを提供することを目的としている。また他の目的は、メンテナンス時においても安全に作業することのできる消雪パネルを提供することである。

【課題を解決するための手段】

【0009】

本発明は、上面が放熱面である薄い放熱平板と、この放熱平板の下面に溶接接合し、その一方の表面と前記放熱平板との間に熱媒体が流動するつづら折り状の流路を形成する流路形成部材とを備えた消雪パネルにおいて、前記放熱平板の周囲をL字状に折り曲げ、更にこの折り曲げ部に帯板を溶接接合したことを特徴とする消雪パネルである。

【0010】

上記の構成によれば、放熱平板の周囲をL字状に折り曲げ、更にこの折り曲げ部に帯板を溶接接合したことを特徴としているので、一旦放熱平板と流路形成部材との溶接接合によって、放熱平板の放熱面が凹となるような溶接歪が発生するものの、折り曲げ部に帯板を溶接接合することによって、放熱平板の放熱面が凸となるような溶接歪が発生する。したがって、消雪の際の放熱面の水溜りの発生を防止することができる。

【0011】

また、本発明において、前記帯板の溶接接合部ではない他端側はL字状に折り曲げ加工されていることが望ましい。

この構成によれば、消雪パネル全体の強度を更に高められるとともに、帯板の先端で手を切創する事故を防止することができる。

【0012】

また、上記発明において、前記流路形成部材は前記熱媒体が流入する第1のノズル部材と、前記熱媒体が流出する第2のノズル部材と、これらの間に配設され台形状断面を有する複数列の直線溝部材と、相隣る直線溝部材の端部が接続される複数のU字溝部材とからなり、前記直線部材、前記第1、第2のノズル部材及びU字溝部材との連結部に継目部を設け、当該継目部は固着されると共に、前記各直線溝部材はその短手方向のツバ部が長手方向の全長にわたって前記放熱平板に溶接接合されることが好ましい。

上記の構成によれば、流路形成部材を放熱平板に溶接する際の溶接歪を低減できるとともに製造コストを抑えることができる。

【0013】

また、請求項1乃至3のいずれかに記載の消雪消雪パネルを線路に沿って複数枚配置し、各々の消雪パネルは一端から持ち上げ可能とするとともに、熱媒体の供給管および排出管にフレキシブル管を用いて並列に接続し、前記帯板には、取手を設けることができる。

この構成によれば、メンテナンスのために消雪パネルを開閉した場合においても消雪パネルと設置ベースとの間に手を挟んだりする事故を防止することができる。

【発明の効果】

【0014】

本発明にかかる消雪パネルによれば、放熱平板の周囲をL字状に折り曲げ、更にこの折り曲げ部に帯板を溶接接合したことを特徴としているので、一旦放熱平板と流路形成部材との溶接接合によって、放熱平板の放熱面が凹となるような溶接歪が発生するものの、折り曲げ部に帯板を溶接接合することによって、放熱平板の放熱面が凸となるような溶接歪が発生する。したがって、消雪の際の放熱面の水溜りの発生を防止することができる。

【発明を実施するための最良の形態】

【0015】

以下に、本発明に係る消雪パネルの一実施例を添付図面に基づいて詳述する。

図1は本発明に係る消雪パネルの一実施例の底面図、図2は図1におけるA-A断面図である。図3は直線溝部材を示し、図4はU字溝部材を示している。図5は図1におけるC-C断面図を示している。図6は本発明に係る消雪パネルの製造工程を示す消雪パネルの断面図、図7は溶接工程における溶接歪の状態を示す模式側面図である。また図8は本発明に係る消雪パネルを設置した状態を示す断面図である。

【0016】

図1及び図2に示すように、消雪パネル1は、略長方形の薄板鋼板製の放熱平板2と、流体が流入する第1ノズル部41と流体が排出される第2ノズル部43とを連なるように、つづら折り状に流路を形成する流路形成部材10と、放熱平板2を囲むように設けた帯板20とから主に構成している。流路形成部材10は、薄板鋼板を断面略台径に折り曲げ加工した長尺の直線溝部材11を複数列並べ、この直線溝部材11の端部同士をU字溝部材13で接続して第1ノズル部41から第2ノズル部43まで流体が流動する流路を形成している。また、消雪パネル1の長辺の一つには蝶番部17が設けられ、短辺側の帯板20には設置ベースに固定するための固定部45が設けられている。更に、消雪パネル1全体がねじれたり変形したりしないように補強部材15が（図中では3箇所）設けられている。

【0017】

放熱平板2は、図2に示すように、その周囲はL字状に折り曲げられた折り曲げ部2aが形成されている。そして、帯板20には、一端が消雪パネルの内側になるようにL字状に折り曲げられたエッジ部23と、他端側が放熱平板2の折り曲げ部2aと重なり合わせるための溶接部21が形成されている。

【0018】

図3に示すように、直線溝部材11は、その内部を流動する温水と放熱平板2との接触面積を広げるために、断面が台形状（上辺の幅Wb、底辺の幅Wa）に形成され、両側の全長（L2）にわたってツバ部11aを有した長尺の部材である。

【0019】

また、図4に示すようにU字溝部材13は、半円形部13aと、段付部13bからなる。図6に示すように、各U字溝部材13は、段付部13bに直線溝部材11の端部が差し込まれるように設置されている。これらのU字溝部材13は、直線溝部材11の両方の端部に並置されており、U字溝部材13と直線溝部材11とにより、相隣り合う直線溝部材同士が連通して、単一の流路が形成される（図1参照）。

【0020】

続いて、消雪パネル1の製造工程について、図6、図7を参照して詳細に説明する。

まず、図6(a)に示すように、放熱平板2に直線溝部材11を所定の数だけ複数本並べる。また、図示しないU字溝部材13をつづら折流路を形成するように直線溝部材11の端部に配置する（図1参照）。そして、直線溝部材11の両端に形成したツバ部11aと放熱平板2とを流路形成部材10の全長に亘って、溶接接合する。溶接接合は、シーム溶接又はアーク溶接が好適である。

【0021】

このとき、放熱平板2には、流路形成部材10を溶接接合する面のみが加熱されることとなる。すると、溶接を施したツバ部11aが収縮し、直線溝部材11の熱影響を受けていない部分（直線溝部材11のツバ部11aを除いた大部分）としては収縮しないので、図7（a）に示すように、薄板からなる放熱平板2の放熱面2bが凹面となるように歪が発生する。このままの状態では、消雪パネルで消雪した水が凹面に溜まり、その部分から放熱平板2を腐食させてしまうこととなる。

【0022】

そこで、図6（b）に示すように、放熱平板2の周囲をプレス等を用いて折り曲げ加工して折り曲げ部2aを形成する。そして、この折り曲げ部2aに帯板20の溶接部21を重ね合わせ、溶接接合する。すると、図7（b）に示すように、帯板20の溶接の影響を受けて折り曲げ部2aが収縮するので、放熱平板2の放熱面2bが凸面となるような歪を生じる。最後に、流路形成部材10の両端に第1ノズル部材41及び第2ノズル部材43を接続し、溶融亜鉛メッキ処理を施して消雪パネル1が得られる。放熱面2bが凸面となるように設けていれば、放熱面に水が溜まることはなく、消雪パネルが腐食することを防止できる。

なお、溶接によって生じる歪量は、溶接長さや溶接熱量を調整することで、増減することが可能である。

【0023】

続いて、消雪パネル1の使用状態について、図8を用いて詳細に説明する。

図8（a）に示すように、線路等の軌道に沿って、コンクリート製の基礎61が設けられる。基礎61には、雨水を排出したり電線等を配設したりするための側溝63が形成されている。そして、側溝壁65に沿って、消雪パネル1への熱媒体を給排水する供給管51、排水管53が設けられる。基礎61の上には設置ベース50が設けられ、この設置ベース50の上に消雪パネル1が一辺を蝶番部17（図1参照）で開閉可能のように設置される。

【0024】

そして、消雪パネル1の第1ノズル、第2ノズルにはスィベルジョイント57が接続され、供給管51、排水管53との間はフレキシブル管55で接続されている。なお、この消雪パネル1は、軌道に沿って複数枚設置される。

【0025】

熱媒体には例えば不凍液が用いられ、積雪が始まると図示しないボイラ室で不凍液を10℃程度に加熱して、ポンプによって供給管51を経由し、消雪パネル1に供給される。消雪パネル1に積雪した雪は、ここで熱交換して融かされ、不凍液は排水管53を経由してボイラ室へ戻され再び10℃程度に加熱される。

【0026】

ところで、側溝63に配設した電線等のメンテナンスが必要な場合がある。その場合には、図8（b）に示すように、取手59を利用して消雪パネル1を上方に開くことができるようになっている。取手59を用いて消雪パネル1の開閉作業を行うことで、指を挟んでしまうような事故を防止することができる。

【図面の簡単な説明】

【0027】

【図1】本発明に係る消雪パネルの一実施例の底面図である。

【図2】図1におけるA-A断面図である。

【図3】直線溝部材を示し、（a）は正面図、（b）は平面図である。

【図4】U字形部材を示し、（a）は平面図、（b）は（a）のB-B線断面図である。

【図5】図1におけるC-C断面図である。

【図6】本発明に係る消雪パネルの製造工程を示す消雪パネルの断面図である。

【図7】溶接工程における溶接歪の状態を示す模式側面図である。

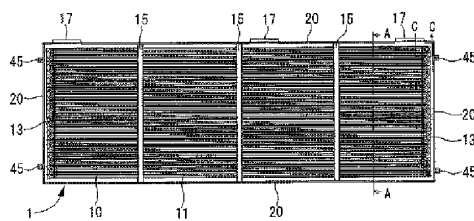
【図8】本発明に係る消雪パネルを設置した状態を示す断面図である。

【符号の説明】

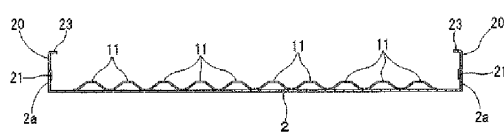
【0028】

1：消雪パネル、2：放熱平板、2a：折り曲げ部、2b：放熱面、
 10：流路形成部材、11：直線溝部材、11a：ツバ部、13：U字溝部材、13a：
 半円径部、13b：段付部（継目部）、15：補強部材、17：蝶番部、
 20：帯板、21：溶接部、23：エッジ部、
 41：第1ノズル部材、43：第2ノズル部材、45：固定部、
 50：設置ベース、51：供給管、53：排水管、55：フレキシブル管、57：スィベ
 ルジョイント、59：取手、
 61：基礎、63：側溝、65：側溝壁、

【図1】

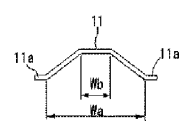


【図2】

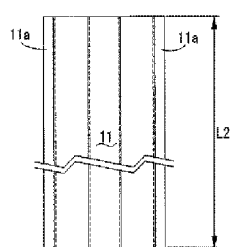


【図3】

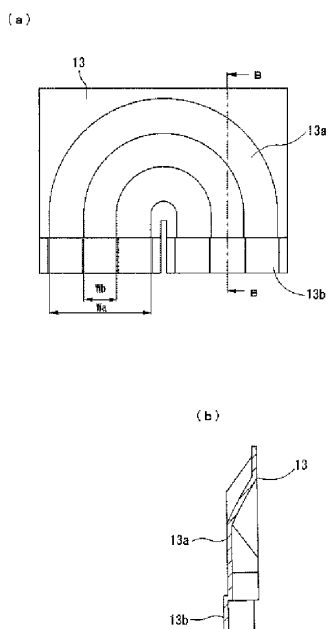
(a)



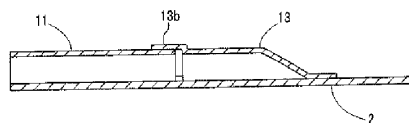
(b)



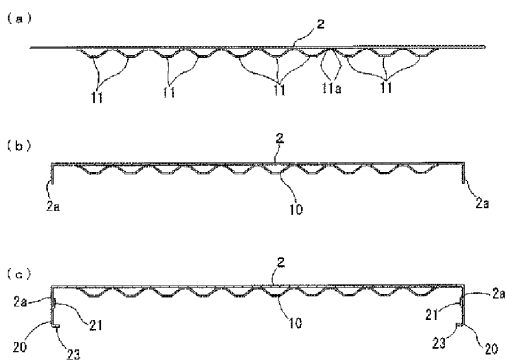
【図4】



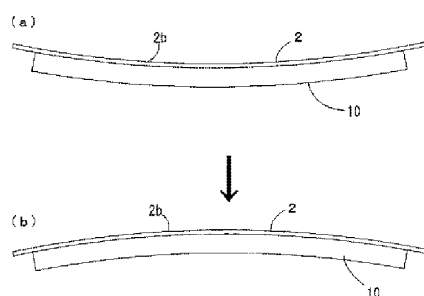
【図5】



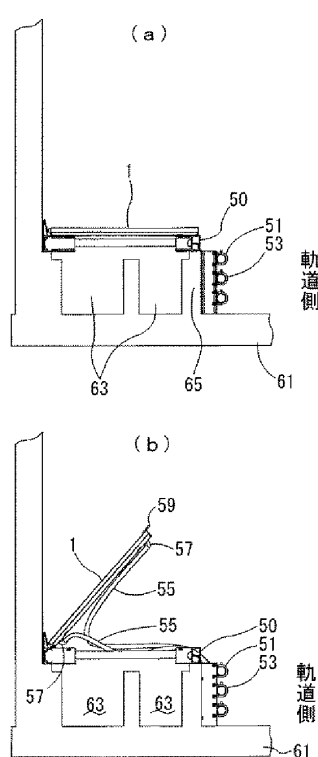
【図6】



【図7】



【図8】



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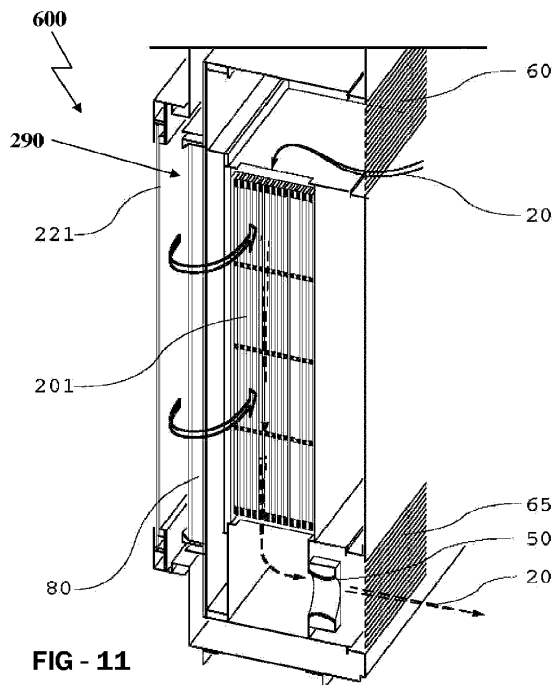
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[Continued on next page]

(54) Title: THERMAL CONTROL SYSTEM FOR AN ELECTRONIC DISPLAY



(57) Abstract: A cooling assembly for an electronic image assembly and a display assembly containing the same. Some embodiments use ambient gas to cool power modules and/or an image assembly (sometimes backlight). Other embodiments use a closed loop of circulating gas which passes across the front surface of an image assembly and through a heat exchanger. An open loop passes through the heat exchanger and extracts heat from the circulating gas. Ambient air may be used as the ambient gas. An optional additional channel may be used to cool the back portion of the image assembly or backlight with ambient gas. Some embodiments also use thermally conductive plates and ribs to distribute the heat and avoid hot spots in the display. The cooling assembly can be used with any type of electronic assembly for producing an image.

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Thermal Control System for an Electronic Display

Inventors: William Dunn, Tim Hubbard, Ware Bedell

Technical Field

[0001] The exemplary embodiments generally relate to cooling systems and in particular to cooling systems for electronic displays.

Background of the Art

[0002] Conductive and convective heat transfer systems for electronic displays generally attempt to remove heat from the electronic components in a display through as many sidewalls of the display as possible. In order to do this, the systems of the past have relied primarily on fans for moving internal air within the housing past the components to be cooled and out of the display. These components are typically power supplies. In some cases, the heated air is moved into convectively thermal communication with fins.

[0003] While such heat transfer systems have enjoyed a measure of success in the past, improvements to displays and new display applications require even greater cooling capabilities. In particular, cooling devices for electronic displays of the past have generally used convective heat dissipation systems that function to cool only the rear interior portion of the display. When used outdoors or in other warm environments, this is not adequate, especially when radiative heat transfer from the sun through a front display surface becomes a major factor. In many applications 200 Watts or more of power through a front display surface is common. Furthermore, the market is demanding larger screen sizes for displays. With increased electronic display screen size and corresponding front display surface size more heat will be generated and more heat will be transmitted into the displays. Also, when displays are used in outdoor environments the ambient air may contain contaminants (dust, dirt, pollen, water vapor, brake dust, sand, smoke, etc.) which, if ingested into the display for cooling the interior can cause damage to the interior components of the display.

[0004] Modern displays (especially those which are used outdoors) have become increasingly brighter, with some backlights producing 1,000-2,000 nits or more. In order to produce this level of brightness, illumination devices such as CCFL assemblies, LEDs, organic LEDs, and plasma assemblies may produce a relatively large amount of heat. Further, the illumination devices require a relatively large amount of power in order to generate the required brightness level. This large amount of power is typically supplied through one or more power supplies for the display. These power supplies may also become a significant source of heat for the display.

[0005] A large fluctuation in temperature is common when devices of the past are used in outdoor environments, direct sunlight, or other difficult thermal environments. Such temperature fluctuation adversely affects both the lifetime and the performance of the electronic components in these devices.

Summary of the Exemplary Embodiments

[0006] While the systems of the past have attempted to remove heat only through the non-display sides and rear components of an electronic display, a preferred embodiment may cause convective heat transfer from the front face of the image assembly as well (the side which faces an intended viewer). These preferred embodiments may comprise two separate flow paths for gas through an electronic display. A first flow path may be a closed loop and a second flow path may be an open loop. The closed loop path travels across the front surface of the image assembly, continues to the rear of the display where it may enter a heat exchanger, finally returning to the front surface of the image assembly. The open loop path draws gas (ex. ambient air) through the rear of the display (possibly through a heat exchanger) and then exhausts it out of the display housing. A heat exchanger may be used to transfer heat from the closed loop to the open loop and exhausted out of the display. Optionally, the open loop may also be forced behind the image assembly (sometimes a backlight other times an OLED or other type of image-producing assembly), in order to cool the image assembly and/or backlight assembly (if a backlight is necessary for the

particular type of display being used). A cross-flow heat exchanger may be used in an exemplary embodiment.

[0007] Other embodiments relate to a system for cooling the following portions of an electronic display, either alone or in combination: (1) power module(s), (2) backlight, and (3) front display surface. Power modules with heat dissipating assemblies (ex. cold plates and/or heat sinks) may be used with some embodiments where the side of the power module containing the heat dissipating assembly is placed in the path of ambient gas while the side of the power module containing sensitive electrical components remains in a separate environment. An isolating structure may provide the necessary gaseous (and sometimes particulate/contaminate) isolation between the two sides of the power modules. The closed loop may or may not be used when cooling the power modules with an open loop of ambient gas.

[0008] Backlights with a front and rear sides may be used with some embodiments for LCD displays where the front side contains the illumination devices and the rear side contains a thermally conductive surface for dissipating the heat from the illumination devices. Ideally, there should be a low level of thermal resistance between the front and rear sides of the backlights.

[0009] Other embodiments may place the power modules in thermal communication with a plurality of thermally conductive ribs where the ribs are placed in the path of cooling air (sometimes ambient gas). The heat from the power modules is distributed throughout the ribs and removed by the cooling air. It has been discovered that forcing air through the relatively narrow channels defined by the ribs improves the ability to remove heat from the power modules.

[0010] In another embodiment, both the power modules and the display backlight (or image assembly) are in thermal communication with the ribs. In this way, a single path of cooling air (sometimes ambient gas) can be used to cool two of the warmest components of a typical electronic display. For example, and not by way of limitation, LED arrays are commonly used as the illumination devices for LCD displays. It has been found that the optical properties of LEDs (and other illumination devices) can vary depending on temperature. Thus, when an LED is exposed to room temperatures, it may output light with a certain luminance, wavelength, and/or color temperature.

However, when the same LED is exposed to high temperatures, the luminance, wavelength, color temperature, and other properties can vary. Thus, when a temperature variation occurs across an LED backlight (some areas are at a higher temperature than others) there can be optical inconsistencies across the backlight which can be visible to the observer. By using the embodiments herein, heat buildup can be evenly distributed across the ribs and removed from the display. This can prevent any potential 'hot spots' in the backlight which may become visible to the observer because of a change in optical properties of the illumination devices (sometimes, but not always LEDs). In other embodiments, the image assembly (rather than a backlight) is in thermal communication with the ribs. The image assembly may comprise any form of electronic assembly for generating an image, including but not limited to: LCD, light emitting diode (LED), organic light emitting diode (OLED), field emitting displays (FED), light-emitting polymers (LEP), plasma displays, and any other flat/thin panel displays.

[0011] The ribs may provide an isolated chamber from the rest of the display so that ambient air can be ingested and used to cool the ribs. This is beneficial for situations where the display is being used in an outdoor environment and the ingested air may contain contaminants (pollen, dirt, dust, water, smoke, etc.) that would damage the sensitive electronic components of the display.

[0012] If a backlight is used with the particular display application, a backlight with front and rear sides may be used where the front side contains the illumination devices and the rear side contains a thermally conductive surface for dissipating the heat from the illumination devices. Ideally, there should be a low level of thermal resistance between the front and rear sides of the backlights. An exemplary embodiment contains a metal core PCB with LEDs on the front side and a metallic surface on the rear side.

[0013] By the aspects described below, the exemplary embodiments herein have made consistent cooling possible for large electronic displays, even in hot climates and placed in direct sunlight. The embodiments also do not require any form of air conditioner (although it may be used if desired), which reduces the space and energy requirements for the display.

[0014] The foregoing and other features and advantages of the exemplary embodiments will be apparent from the following more detailed description of the particular embodiments of the invention, as illustrated in the accompanying drawings.

Brief Description of the Drawings

[0015] A better understanding of an exemplary embodiment will be obtained from a reading of the following detailed description and the accompanying drawings wherein identical reference characters refer to identical parts and in which:

[0016] **FIGURE 1** is a perspective view of a typical power module;

[0017] **FIGURE 2** is a perspective view of two power modules installed within an isolating structure;

[0018] **FIGURE 3** is a perspective view of an embodiment where the cooling air may be used to cool the power modules and a backlight assembly;

[0019] **FIGURE 4** is a perspective view of an embodiment which is similar to that which was shown in Figure 3 with the exception that a heat sink is now being used with the power modules;

[0020] **FIGURE 5** shows a perspective view of an embodiment where a plurality of channels are created between the backlight assembly and the isolating structure;

[0021] **FIGURE 7** shows a perspective section view of another embodiment which uses a thermally-conductive plate and thermally-conductive ribs;

[0022] **FIGURE 8** shows a perspective section view of another embodiment where the ribs are used to distribute heat from and cool a backlight assembly;

[0023] **FIGURE 9** is a rear perspective view of an embodiment where the rear cover of the display has been removed;

[0024] **FIGURE 10A** is a perspective section view of another embodiment showing the closed loop and open loop channels;

[0025] **FIGURE 10B** is a perspective section view similar to the view shown in Figure 10A where the rear and side covers have been removed;

[0026] FIGURE 11 is a perspective section view of another embodiment showing inlet and exhaust apertures for the ambient gas which is used only within the heat exchanger and not within additional optional channels; and

[0027] FIGURE 12 is a perspective section view of an exemplary embodiment where a cross-flow heat exchanger is used to separate high power and low power electrical assemblies.

Detailed Description

[0028] FIGURE 1 shows one embodiment of a typical power module 7 which may be used with some of the embodiment described herein. A printed circuit board 6 may be attached to the power module 7 and may contain a plurality of electronic components 5 which may be necessary to operate and control the power module 7. These electronic components 5 may include, but are no means limited to resistors, capacitors, op-amps, wire harnesses, connectors, and inductors. A baseplate 8 may be attached to the power module 7 and may act as a heat dissipating assembly for the power module 7, such that heat which is generated by the power module 7 is transferred to the baseplate 8. In some embodiments there may be more components used, such as a conductive pad located between the power module and the baseplate 8. Also, as discussed further below, any type of heat sink or fin assembly may be used with the baseplate 8 to further enhance its thermodynamic properties. There may be conductive pads placed between the baseplate 8 and a heat sink assembly also.

[0029] FIGURE 2 shows two power modules installed within an isolating structure 9 which substantially prevents gaseous and contaminate communication between the two sides of the power module. The baseplates 8 of the power modules are shown on the side of the isolating structure 9 where surrounding-environment cooling air 4 is designed to pass over the baseplates 8. Gaskets 11 may be used to provide a gaseous (and/or contaminate) seal between the power modules and the isolating structure 9. Cooling air 4 is sometimes drawn from the environment surrounding the display. This environment may contain harmful contaminants which could damage various electrical components in the display. These harmful contaminants include, but

are not limited to: dust, smoke, pollen, water vapor, other harmful particulate and other harmful gases. Thus, one of the purposes for the isolating structure 9 is to prevent the surrounding-environment cooling air 4 from contacting some of the sensitive electronic components of the display, including but not limited to the electronic components 5 (shown in Figure 1) which are required to operate and control the power modules. By mounting the power modules within the isolating structure 9, surrounding-environment cooling air 4 can be drawn into the display housing and forced over the baseplates 8 (and optional heatsinks and fins) in order to cool the power modules. This can be accomplished without exposing sensitive electronic components to the potentially harmful surrounding-environment cooling air 4.

[0030] FIGURES 3 and 4 show embodiments where the cooling air 4 may be used to cool the power modules and a backlight assembly 140. These embodiments show a backlight assembly 140 which contains a plurality of illumination devices (ex. LEDs) 141 which are mounted to a printed circuit board (PCB). An exemplary embodiment would use a metal core PCB or any other mounting structure which would have a relatively low level of thermal resistance so that heat can transfer from the illumination devices 141 to the rear surface of the backlight assembly 140 where it can be removed by the cooling air 4. The illumination devices 141 could be LED, halogen, CCFL, or any other device which produces light. Further, a backlight assembly may not even be necessary for some embodiments such as plasma, OLED, LEP, or FED displays. However, these display types are also known to generate heat and where backlight cooling is described in this application these methods could also be applied to the cooling of rear surfaces of these electronic image assemblies. Thus, where backlight assemblies are shown, a plasma, OLED, FED, or LEP image assembly could be substituted. The electronic components 5 may be isolated from the cooling air 4 by using the isolating structure 9.

[0031] FIGURE 4 shows an embodiment which is similar to that which was shown in Figure 3 with the exception that a heat sink 12 is now in thermal communication with the power modules in order to further facilitate the transfer of heat away from the power modules. It should of course be noted that many types of heat sinks are available which are made of many different materials and have many different geometry types.

Any form of heat sink is particularly contemplated with various embodiments and may be used to satisfy different operating conditions.

[0032] FIGURE 5 shows another embodiment where a plurality of channels 15 are created between the backlight assembly 140 and the isolating structure 9. Channel separators 16 may be used to separate each channel 15 and provide structural rigidity to the overall assembly. The channel separators 16 would preferably be fabricated out of thermally conductive material so that they may also transfer heat between the backlight assembly 140 and the isolating structure 9. A thermally conductive channel separator 16 can also extract heat from either the backlight assembly 140 or the isolating structure 9 and may dissipate the heat into the air moving through the channel 15. Thus, some channel separators 16 may contain fins or heat sinks in order to facilitate heat transfer to the air moving through the channel 15.

[0033] FIGURE 6 shows a view down a single channel 15 which contains the heat sink 12 for a power module which is mounted within the isolating structure 9. Some channels 15 may contain power modules and others may not. A channel fan 17 may be used to draw air through the channel 15 in order to cool the heat sink 12 (if used) and the channel separators 16 (if thermally conductive) as well as the backlight 140 (or LED assembly for an LED display). Each channel 15 may contain one or more channel fans 17. Some channels may not contain a fan at all, but may rely solely on natural convection to allow heat to rise and exit the channel. As will be discussed at length below, the fans can be placed anywhere in the display assembly and may be used to draw air through the channels, push air through the channels, or a combination of both.

[0034] While the display is in operation, the channel fans 17 may run continuously. Alternatively, temperature sensing devices (not shown) may be placed in each channel and used to measure the temperature within the channel or any of the channel components (backlight or display assembly, isolating structure, or channel separators). Based on data received from these temperature sensing devices, the various fans may be selectively engaged depending on which channel requires cooling. Thus, fans 17 which draw air through channels 15 which contain power modules may run more often or at higher speeds due to the greater amount of heat coming from the power modules.

Also, channels which contain power modules may contain larger fans or a plurality of fans in order to cool the channel.

[0035] FIGURE 7 shows another embodiment which uses a thermally-conductive plate 10 and ribs 18. In one embodiment, the baseplate 8 of the power module would be in thermal communication with the thermally-conductive plate 10. In other embodiments, a baseplate 8 may not be used and instead, the power module 7 would be in direct thermal communication with the thermally conductive plate 10. Due to the thermally-conductive nature of the plate 10 and ribs 18 and the thermal communication between them, heat which is produced by the power modules would be distributed throughout the plate 10 and ribs 18. In an exemplary embodiment, a path of cooling air 20 (ambient gas) is used to remove the heat which has accumulated on the plate 10 and ribs 18. Alternatively, a natural convection process could also be used to allow the heat to escape the plate 10 and ribs 18.

[0036] A plurality of mounting posts may be used to mount electronic assemblies such as PCBs, hard drives, timing and control boards, inductors, and even the power modules if desired. The mounting posts may also be thermally conductive so that the heat which is generated by these electronic assemblies can also be transferred to the plate 10 and the ribs 18 and removed by the cooling air 20.

[0037] In an exemplary embodiment, the plate 10 would provide a gaseous and contaminate barrier between the side containing the ribs 18 (and cooling air 20) and the side containing the mounting posts, power modules, and any other electronic assemblies. If the plate 10 provides an adequate barrier, ambient air may be ingested as cooling air 20 and the risk of contaminants entering the side of the plate 10 containing the sensitive electronic components may be reduced or eliminated. An inlet aperture 25 may be used to accept the cooling air 20 and direct it along the ribs 18.

[0038] The ribs 18 shown in this embodiment contain a hollow rectangular cross-section, but this is not required. Other embodiments may contain ribs with I-beam cross-sections, hollow square cross-sections, solid rectangular or solid square cross-sections, 'T' cross-sections, 'Z' cross-sections, corrugated or honeycomb cross-section, or any combination or mixture of these. It is preferable that the ribs 18 are thermally conductive. Metal may be used to produce the ribs 18 in some embodiments.

[0039] **FIGURE 8** shows another embodiment where the ribs 18 are used to distribute heat from and cool a backlight assembly. The backlight assembly in this embodiment includes a plurality of illumination devices 32 which are mounted on a thermally conductive substrate 30. In an exemplary embodiment, the illumination devices 32 would be LEDs and the thermally conductive substrate 30 would be a PCB and more preferably a metal core PCB. On the surface of the thermally conductive substrate 30 which faces the ribs 18 there may be a thermally conductive surface 35. In an exemplary embodiment, the thermally conductive surface 35 would be metallic and more preferably aluminum. It is preferred that the ribs 18 are in thermal communication with the rear surface 35 and that the rear surface 35 is in thermal communication with the thermally conductive substrate 30. In some embodiments however, the thermally conductive substrate 30 may comprise traditional PCB materials rather than a metal core PCB or any highly thermally conductive materials. It is most preferable that there is a low level of thermal resistance between the illumination devices 32 and the ribs 18. Cooling air 20 may again be forced along the ribs 18 in order to remove heat from the backlight assembly. Of course, this could also occur through natural convection, but more efficient cooling has been typically observed through forced convection. An image assembly (such as an OLED display which may not utilize a backlight) could also be used in place of the backlight assembly in order to cool the image assembly.

[0040] As noted above, many illumination devices (especially LEDs and OLEDs) may have performance properties which vary depending on temperature. When 'hot spots' are present within a backlight or illumination assembly, these hot spots can result in irregularities in the resulting image which might be visible to the end user. Thus, with the embodiments described herein, the heat which may be generated by the backlight assembly can be distributed throughout the various ribs and thermally-conductive surfaces to remove hot spots and cool the backlight.

[0041] In an exemplary embodiment, the ribs 18 may be used to cool both the backlight assembly and the power modules. In a further exemplary embodiment, the ribs 18 can also be used to cool any additional electronic assemblies by placing them in thermal communication with the thermally-conductive plate 10. Thus, with the ribs 18 in a central location, the 'front' would be towards an intended observer of the display while

the 'back' would be on the opposite side of an intended observer. Therefore, the front side of the ribs 18 would be in thermal communication with a backlight assembly (or other illumination or image-producing assembly) and the rear side of the ribs would be in thermal communication with a rear plate (i.e. thermally-conductive plate 10). A single path of cooling air can then be used to cool the interior of the display while the various hot spots can distribute heat throughout the ribs and other thermally conductive surfaces to provide the most efficient cooling. This can be accomplished without having to expose sensitive electrical components to the contaminants and/or particulate of ambient gas.

[0042] **FIGURE 9** shows the rear of an exemplary electronic display 100, where the rear cover for the display housing has been removed in order to show the internal components. In this embodiment, fan assemblies 102 and 103 for a closed loop of circulating gas may be placed along two opposing edges of a heat exchanger 101. Preferably, fan assembly 102 is the inlet for the heat exchanger and fan assembly 103 is the exit for the heat exchanger 101. These assemblies can optionally be reversed however, where fan assembly 103 is the inlet and fan assembly 102 is the exit. Further, both assemblies 102 and 103 are not required. Some embodiments may use only one fan assembly for the closed loop of circulating gas. If only one fan assembly is used, it is preferable to place the fan assembly at the inlet of the heat exchanger 101, so that the circulating gas is 'pulled' across the front of the image assembly and pushed through the heat exchanger 101. This is not required however; other embodiments may pull the isolated gas through the heat exchanger 101. Other embodiments may push the isolated gas across the front of the image assembly. Fan assemblies 104 and 105 for an open loop of ambient gas may be placed along two opposing edges of the display housing. Again, both assemblies 104 and 105 are not required as some embodiments may use only one assembly and may use the open loop fan assemblies in a push or pull design. Therefore, when referring to the placement of the various fan assemblies, the terms 'push', 'pull', 'force', and 'draw' will be used interchangeably and any orientation may be used with the various embodiments herein.

[0043] The circulating gas which is being forced by the closed loop fan assemblies is primarily circulating around the display. For example, the circulating gas travels in a

loop where it contacts the front surface of the image assembly (see Figures 10A-10B) and transfers heat from the image assembly to the circulating gas. The circulating gas is then preferably directed (or forced, pulled, etc.) into the heat exchanger 101 in order to transfer heat from the circulating gas to the ambient gas. Afterwards, the circulating gas exits the heat exchanger 101 and may return to the front surface of the image assembly. The circulating gas may also pass over several electronic components 110 in order to extract heat from these devices as well. The electronic components 110 may be any components or assemblies used to operate the display including, but not limited to: transformers, circuit boards, resistors, capacitors, batteries, power modules, motors, inductors, illumination devices, wiring and wiring harnesses, lights, thermo-electric devices, and switches. In some embodiments, the electrical components 110 may also include heaters, when the display assembly might be used in cold-weather environments.

[0044] In order to cool the circulating gas (as well as optionally cooling a backlight assembly or image assembly as taught above) ambient gas is ingested into the display housing by the open loop fan assembly 104 and/or 105. The ambient gas may simply be ambient air which is surrounding the display 100. In some embodiments, the ambient gas may be air conditioned prior to being drawn into the display by one or more air conditioning assemblies (not shown). Once the ambient gas is ingested into the display, it may be directed (or forced) through the heat exchanger 101 and optionally also across the rear surface of the backlight assembly or image assembly (see Figures 10A-10B) or through ribs/channels as shown above or across power modules as shown above. By using the heat exchanger 101, heat is transferred from the circulating gas to the ambient gas. The heated ambient gas is then expelled out of the display housing.

[0045] Although not required, it is preferable that the circulating gas and ambient gas do not mix. In a preferred embodiment, the heat exchanger 101 would be a cross-flow heat exchanger. However, many types of heat exchangers are known and can be used with any of the embodiments herein. The heat exchanger 101 may be a cross-flow, parallel flow, or counter-flow (tube-within-a-tube or otherwise) heat exchanger. In an exemplary embodiment, the heat exchanger 101 would be a cross-flow and would be comprised of a plurality of stacked layers of thin plates. The plates may have a

corrugated or honeycomb design, where a plurality of channels or pathways travel down the plate length-wise. The plates may be stacked such that the directions of the pathways are alternated with each adjacent plate, so that each plate's pathways are substantially perpendicular to the pathways of the adjacent plates. Thus, gas may enter the heat exchanger only through plates whose channels or pathways travel parallel to the path of the gas. Because the plates are alternated, the closed loop and ambient gases may travel in plates which are adjacent to one another and heat may be transferred between the two gases without mixing the gases themselves (if the heat exchanger is adequately sealed, which is preferable but not required).

[0046] In an alternative design, an open gap may be placed in between pairs of channelized or honeycomb plates. The open gap may travel in a direction which is perpendicular to the channels of the plates. This open gap may be created by running two strips of material or tape (esp. very high bond (VHB) tape) between two opposite edges of the plates in a direction that is perpendicular to the direction of the channels in the adjacent plates. Thus, gas may travel through the open gap (parallel to the strips or tape) but would not pass through the open gap in a direction which is perpendicular to the strips or tape (parallel to the channels of the adjacent plates).

[0047] Other types of cross-flow heat exchangers could include a plurality of tubes which contain the first gas and travel perpendicular to the path of the second gas. As the second gas flows over the tubes containing the first gas, heat is exchanged between the two gases. Obviously, there are many types of cross-flow heat exchangers and any type would work with the embodiments herein.

[0048] An exemplary heat exchanger may have plates where the sidewalls are relatively thin so that heat can easily be exchanged between the two paths of gas. A plurality of materials can be used to create the heat exchanger. Preferably, the material used should be corrosion resistant, rot resistant, light weight, and inexpensive. Metals are typically used for heat exchangers because of their high thermal conductivity. However, it has been discovered that plastics and composites can also satisfy the thermal conditions for electronic displays. An exemplary embodiment would utilize polypropylene as the material for constructing the plates for the heat exchanger. It has been found that although polypropylene may seem like a poor thermal conductor, the

large amount of surface area relative to the small material thickness, results in an overall thermal resistance that is low. Thus, an exemplary heat exchanger would be made of plastic and would thus produce a display assembly that is thin and lightweight. Specifically, corrugated or honeycomb plastic may be used for each plate layer.

[0049] As mentioned above, both inlet and exit fan assemblies are not required for the embodiments. Alternatively, only a single fan assembly may be used for each loop. Thus, only an inlet fan assembly may be used with the closed loop and only an exhaust fan assembly may be used with the open loop. Alternatively, one of the loops may have both inlet and exit fan assemblies while the other loop only has either an inlet or exit assembly.

[0050] The gas used in both loops can be any number of gaseous matters. In some embodiments, air may be used as the gas for both loops. Preferably, the gas which travels through the closed loop should be substantially clear, so that when it passes in front of the image assembly it will not affect the appearance of the image to a viewer. The gas which travels through the closed loop should also be substantially free of contaminants and/or particulate (ex. dust, dirt, pollen, water vapor, smoke, etc.) in order to prevent an adverse effect on the image quality and damage to the internal electronic components. It may also be preferable to keep the gas within the open loop from having contaminants. An optional filter (not shown) may be used to ensure that the air (either in the closed or open loop) stays free of contaminants. However, in an exemplary embodiment the open loop may be designed so that contaminants could possibly be present within the ambient gas but this will not harm the display. In these embodiments, the heat exchanger (and the optional path behind the image assembly or backlight or through the ribs) is properly sealed so that any contaminants in the ambient gas would not enter sensitive portions of the display. Thus, in these exemplary embodiments, ingesting ambient air for the ambient gas, even if the ambient air contains contaminants, will not harm the display. This can be particularly beneficial when the display is used in outdoor environments or indoor environments where contaminants are present in the ambient air.

[0051] **FIGURE 10A** shows a cross-section of another embodiment of a display 200. In this figure, the rear cover 250 and side covers 251 and 252 are shown to illustrate

one method for sealing the overall display 200. The image assembly 220 is shown near the front of the display 200. As discussed above, the image assembly 220 may comprise any form of electronic assembly for generating an image, including but not limited to: LCD, light emitting diode (LED), organic light emitting diode (OLED), field emitting displays (FED), light-emitting polymers (LEP), plasma displays, and any other flat/thin panel displays. The front display surface 221 is placed in front of the image assembly 220, defining a channel 290 through which the circulating gas may flow. The front display surface 221 may be any transparent material (glass, plastic, or composite) and may comprise several layers for polarizing light, reducing glare or reflections, and protecting the internal display components. In an exemplary embodiment, the front display surface 221 would comprise two panes of glass which are laminated together with optical adhesive (preferably index-matching). Further, a polarizing layer may be attached to one of the panes of glass in order to reduce the internal reflections and solar loading on the image assembly 220. It is most preferable that the polarizing layer be attached to the inner surface of the front display surface 221 (the one facing the closed loop channel 290) and also contain an anti-reflective (AR) coating.

[0052] For the embodiment shown in Figure 10A, the image assembly 220 may be an LCD stack with a backlight assembly 222. Some backlights may use cold cathode fluorescent lamps (CCFLs) to produce the illumination necessary for generating an image. In an exemplary embodiment, the backlight assembly 222 would comprise a printed circuit board (PCB) with a plurality of LEDs (light emitting diodes) on the front surface. As discussed above, an exemplary embodiment would have a low level of thermal resistance between the front surface of the backlight assembly 222 and the rear surface 223 of the backlight. A metallic PCB may be used for this purpose. The rear surface 223 of the backlight may contain a thermally conductive material, such as a metal. Aluminum may be an exemplary material for the rear surface 223. A second surface (or plate) 224 may be placed in close proximity behind the rear surface 223 of the backlight assembly 222. The space between the rear surface 223 of the backlight and the second surface 224 may define an additional optional open loop channel 225 through which ambient gas may travel in order to cool the backlight assembly 222. This

open loop channel 225 may be similar to the channel 15 shown above, except open loop channel 225 may be narrower.

[0053] FIGURE 10B shows the same cross section from Figure 10A with the rear cover 250 and side covers 251 and 252 removed and the closed and open loop air flows shown for explanatory purposes. The closed loop fan assembly 202 is used to propel the circulating gas 210 around the closed loop. A first open loop fan assembly 203 may be used to draw ambient gas 211 through the heat exchanger 201. Optionally, a second open loop fan assembly 204 may be used to draw ambient gas 212 through the optional channel 225 for cooling the backlight assembly 222. The optional second open loop fan assembly 204 can also be used to exhaust ambient gas which has traveled through the heat exchanger 201 and through the channel 225. If a second open loop fan assembly 204 is not used, the first open loop fan assembly 203 may be used to exhaust the ambient gas 211 that has traveled through the heat exchanger 201.

[0054] As noted above, in an exemplary embodiment the ambient gas does not mix with the circulating gas. It may be important for the image quality that the circulating gas remains free of particulate and contaminates as this gas travels in front of the image assembly 220. Since gas for the open loop may contain various contaminates, a preferable embodiment should be adequately sealed to prevent the gas from the two loops from mixing. This is not necessary however, as filters (either removable or permanent) may be used to minimize the effect of particulate for both the open and closed loops.

[0055] FIGURE 11 is a perspective section view of another embodiment of a display assembly 600 showing inlet 60 and exhaust 65 apertures for the ambient gas 20. The inlet aperture 60 may contain a screen or filter (removable or permanent) to remove any particulate (although this may not be necessary). One or more fans 50 may be used to draw the ambient gas 20 into the inlet aperture 60 and through the heat exchanger 201. In this embodiment, the ambient gas 20 is only drawn through the heat exchanger 201 and not through any additional optional channels or ribs. This embodiment may be used when the display assembly 80 (or backlight assembly) does not require the additional cooling of an additional channel. For example, and not by way of limitation,

this embodiment 600 may be used when an OLED is used as the image assembly 80. Further, this embodiment 600 may be used when the LCD backlight is not generating large amounts of heat because it is not required to be extremely bright (perhaps because it is not used in direct sunlight). Still further, this embodiment may be used when the ambient gas 20 contains particulate or contaminants which may damage the display. In these situations, it may be desirable to limit the exposure of the display to the ambient gas 20. Thus, in these situations it may be desirable to only ingest ambient gas 20 into the heat exchanger 201 and not through any additional cooling channels.

[0056] In some embodiments, the ambient gas 20 may be air conditioned (or otherwise cooled) before it is directed into the heat exchanger 201. A front display surface 221 may be used to create an anterior (front) wall of the channel 290 and/or protect the image assembly 80 from damage. An exemplary front display surface 221 may be glass. Another embodiment for the front display surface 221 may be two panes of glass which are laminated together using optical adhesive. Solar loading (radiative heat transfer from the sun through the front display surface 221 may result in a heat buildup on the image assembly 80 (ex. OLED or LCD assembly). This heat may be transferred to the circulating gas, where this heat may then be transferred to the ambient gas 20 and expelled from the display. The image assembly could be any one of the following: LCD, plasma display assembly, OLED, light emitting polymer (LEP) assembly, organic electro luminescence (OEL) assembly, or LED display assembly.

[0057] **FIGURE 12** shows an exemplary embodiment where a circulating gas 400 is forced between a front display surface 221 and an image assembly 80 and then through a heat exchanger 201 in order to remove at least a portion of the heat absorbed from the image assembly 80 and front display surface 221. The circulating gas 400 may be propelled by a closed loop fan assembly 410. The heat exchanger 201 may accept circulating gas 400 in one direction while accepting ambient gas 310 in a substantially perpendicular direction such that heat may transfer between the two gases.

[0058] In this embodiment, an optional additional flow of ambient gas 300 is accepted through the inlet aperture 350 and directed along channel 225 in order to cool the rear portion of the image assembly 80 (possibly a backlight). This embodiment uses a set of ribs 18, similar to the designs shown above in Figures 7 and 8. This embodiment also

uses a thermally-conductive plate 10, similar to the one shown in Figure 7. When this optional additional flow of ambient gas 300 is used, it is preferable that the anterior (front) surface 500 of the channel 225 be thermally conductive and preferably in thermal communication with at least a portion (preferably the rear portion) of the image assembly 80. Inlet aperture 350 may accept both ambient gas 310 and 300, or there may be separate inlet apertures for each flow of gas 310 and 300.

[0059] Similar to some of the previously described embodiments, the circulating gas 400 also passes over electronic assemblies in order to accept heat from these electronic assemblies. In this exemplary embodiment, the electronic assemblies have been separated by the heat exchanger 201 into two groups. The first group of electronic assemblies 900 may be considered the high power assemblies and may include but are not limited to: power modules, inductors, transformers, and other power-related devices. The second group of electronic assemblies 910 may be considered the low power assemblies and may include but are not limited to: timing and control boards, hard drives and other storage devices, video cards, software drivers, microprocessors, and other control devices. It is known to those skilled in the art that some high power electronic assemblies can cause electrical interference with other electronic assemblies that may be sensitive to electrical interference. Thus, in the exemplary embodiment shown, the heat exchanger 201 is used to separate the lower power electronic assemblies 910 from the high power electronic assemblies 900 to ensure a minimum amount of interference between the two. Further, some high power electronic assemblies 900 are known to also generate heat. This heat may be transferred to the circulating gas 400 prior to introducing this gas into the heat exchanger 201. In the exemplary embodiment shown, ambient air can be ingested as the ambient gas 310 and there is little risk of damage to the electrical assemblies 910 and 900 because the ambient gas 310 would preferably never contact these electrical assemblies. However, the electrical assemblies 910 and 900 will remain cool (as well as clean and dry) because of the cross-flow from the circulating gas 400.

[0060] The cooling system described herein may run continuously. However, if desired, temperature sensing devices (not shown) may be incorporated within the electronic display to detect when temperatures have reached a predetermined

threshold value. In such a case, the various cooling fans may be selectively engaged when the temperature in the display reaches a predetermined value. Predetermined thresholds may be selected and the system may be configured to advantageously keep the display within an acceptable temperature range. Typical thermostat assemblies can be used to accomplish this task. Thermocouples may be used as the temperature sensing devices. The speed of the various fan assemblies can also be varied depending on the temperature within the display.

[0061] It should be particularly noted that the spirit and scope of the disclosed embodiments provides for the cooling of any type of electronic display. By way of example and not by way of limitation, embodiments may be used in conjunction with any of the following: LCD (all types), light emitting diode (LED), organic light emitting diode (OLED), field emitting display (FED), light emitting polymer (LEP), organic electro luminescence (OEL), plasma displays, and any other type of thin/flat panel display. Furthermore, embodiments may be used with displays of other types including those not yet discovered. In particular, it is contemplated that the system may be well suited for use with large LED backlit, high definition (1080i or 1080p or greater) liquid crystal displays (LCD). While the embodiments described herein are well suited for outdoor environments, they may also be appropriate for indoor applications (e.g., factory/industrial environments, spas, locker rooms, kitchens, bathrooms) where thermal stability of the display may be at risk.

[0062] It should also be noted that the variety of cooling channels that are shown in the figures may be shown in a horizontal or vertical arrangement but it is clearly contemplated that this can be reversed or changed depending on the particular embodiment. Thus, the closed loop may run horizontally or vertically and in a clockwise or counter-clockwise direction. Further, the open loop may also be horizontal or vertical and can run left to right, right to left, and top to bottom, or bottom to top.

[0063] Having shown and described preferred embodiments, those skilled in the art will realize that many variations and modifications may be made to affect the described invention and still be within the scope of the claimed invention. Additionally, many of the elements indicated above may be altered or replaced by different elements which

will provide the same result and fall within the spirit of the claimed invention. It is the intention, therefore, to limit the invention only as indicated by the scope of the claims.

CLAIMS

1. A cooling system for an electronic image assembly having a front and back portion, the system comprising:

- a front display surface spaced apart from the front portion of the electronic image assembly;
- a channel defined by the space between the front display surface and the front portion of the electronic image assembly;
- a heat exchanger in gaseous communication with the channel, the heat exchanger having first and second gas pathways, where the first gas pathway is in gaseous communication with the channel;
- a first fan assembly positioned so as to force circulating gas through the channel and the first gas pathway; and
- a second fan assembly positioned so as to force ambient gas through the second gas pathway.

2. The cooling system of claim 1 wherein:

- the heat exchanger is a cross-flow heat exchanger.

3. The cooling system of claim 1 further comprising:

- a plate spaced apart from the rear portion of the electronic image assembly;
- a second channel defined by the space between the plate and the rear portion of the electronic image assembly; and
- wherein the second fan assembly is further positioned so as to force ambient gas through the second channel.

4. The cooling system of claim 3 further comprising:

a power module in electrical communication with the electronic image assembly;
and

a heat sink in thermal communication with the power module and placed within
the second channel.

5. The cooling system of any one of claims 3 or 4 further comprising:

a plurality of ribs placed within the second channel.

6. An electronic display assembly comprising:

an electronic image assembly;

an isolating structure space apart from the electronic image assembly;

a channel defined by the space between the isolating structure and the
electronic image assembly;

a power module having electronic components on a first side and a heat sink on
the second side, where the power module is attached to the isolating
structure so that the heat sink is within the channel and the electronic
components are outside the channel; and

a fan positioned so as to draw ambient gas through the channel.

7. The electronic display assembly of claim 6 further comprising:

a rib placed within the channel and in thermal communication with the isolating structure.

8. The electronic display assembly of claim 7 further comprising:

a surface placed within the channel and in thermal communication with the electronic image assembly and the rib;

9. The electronic display assembly of any one of claims 6, 7, or 8 wherein:

the electronic image assembly is a liquid crystal display.

10. The electronic display assembly of any one of claims 6, 7, or 8 wherein:

the electronic image assembly is an OLED display.

11. An electronic display assembly comprising:

an electronic image assembly having a front and rear portion;

a surface on the rear portion of the electronic image assembly and in thermal communication with the electronic image assembly;

a plate spaced apart from the surface;

a first channel defined by the space between the plate and the surface;

a power module in electrical communication with the electronic image assembly and in thermal communication with the plate; and

a first fan positioned so as to draw ambient gas through the first channel.

12. The electronic display assembly of claim 11 further comprising:
- a rib placed within the first channel and in thermal communication with the plate and the surface.
13. The electronic display assembly of claim 12 further comprising:
- a front display surface spaced apart from the front portion of the electronic image assembly;
 - a second channel defined by the space between the front display surface and the front portion of the electronic image assembly;
 - a heat exchanger in gaseous communication with the second channel, the heat exchanger having first and second gas pathways, where the first gas pathway is in gaseous communication with the second channel;
 - a second fan positioned so as to force ambient gas through the second gas pathway; and
 - a third fan positioned so as to force circulating gas through the second channel and the first gas pathway.
14. The electronic display assembly of any one of claims 11 through 13 wherein:
- the electronic image assembly is a LCD.
15. The electronic display assembly of any one of claims 11 through 13 wherein:
- the electronic image assembly is an OLED.

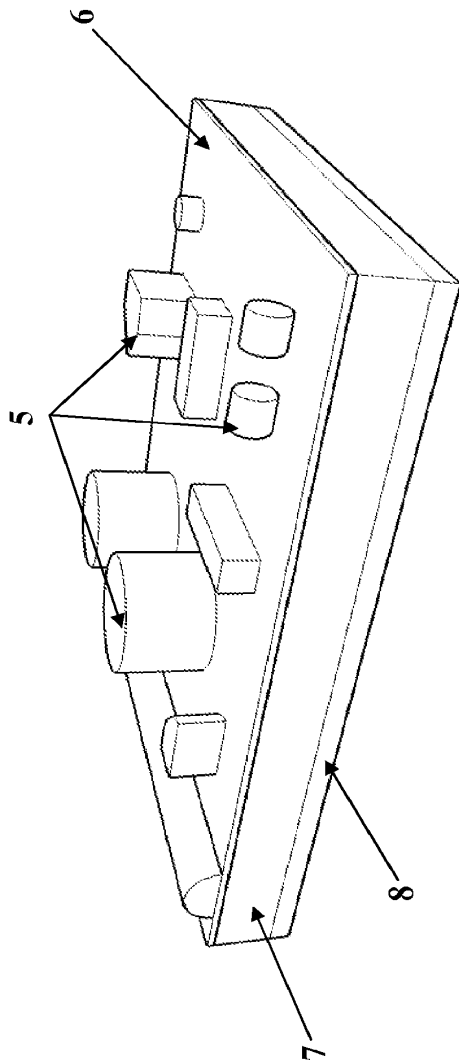


FIG - 1

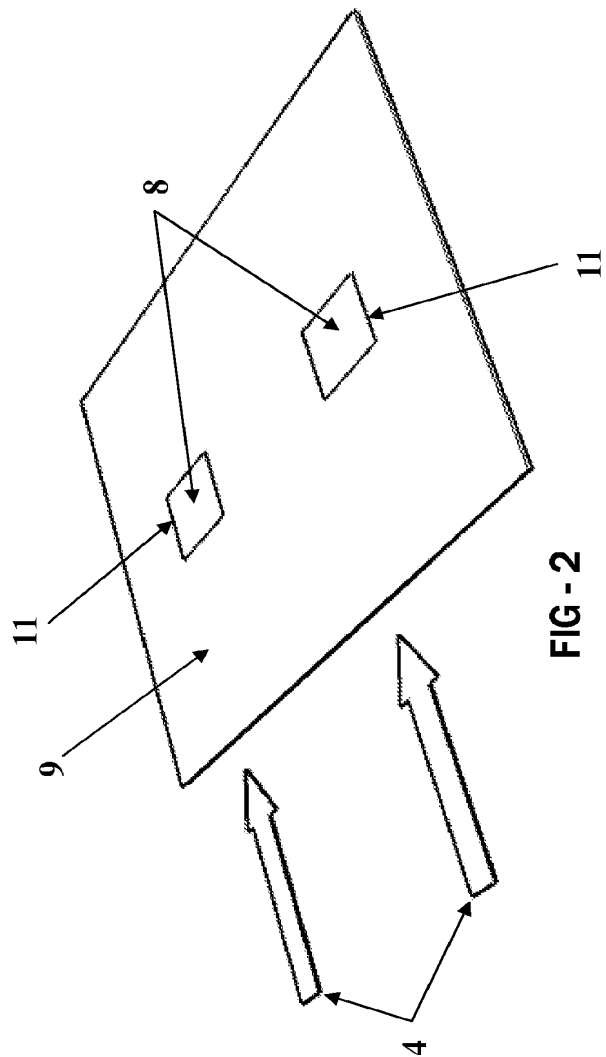


FIG - 2

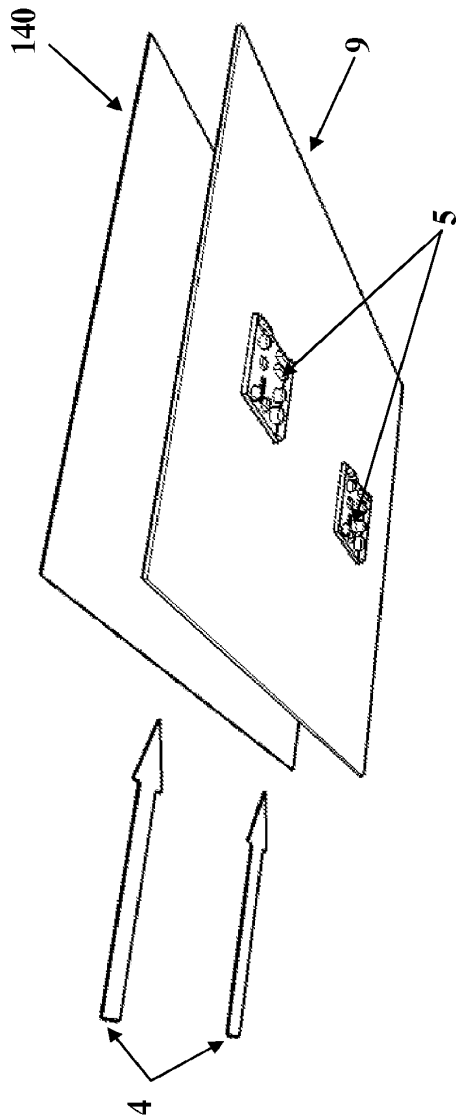


FIG - 3

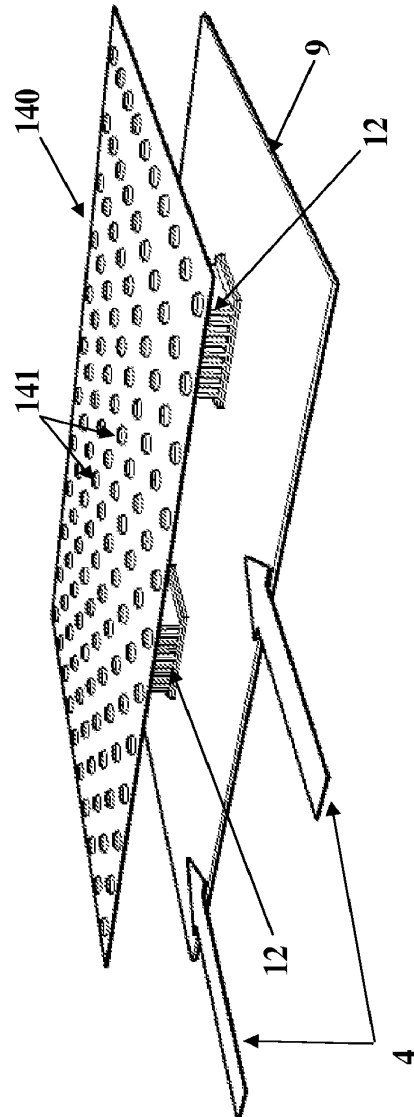
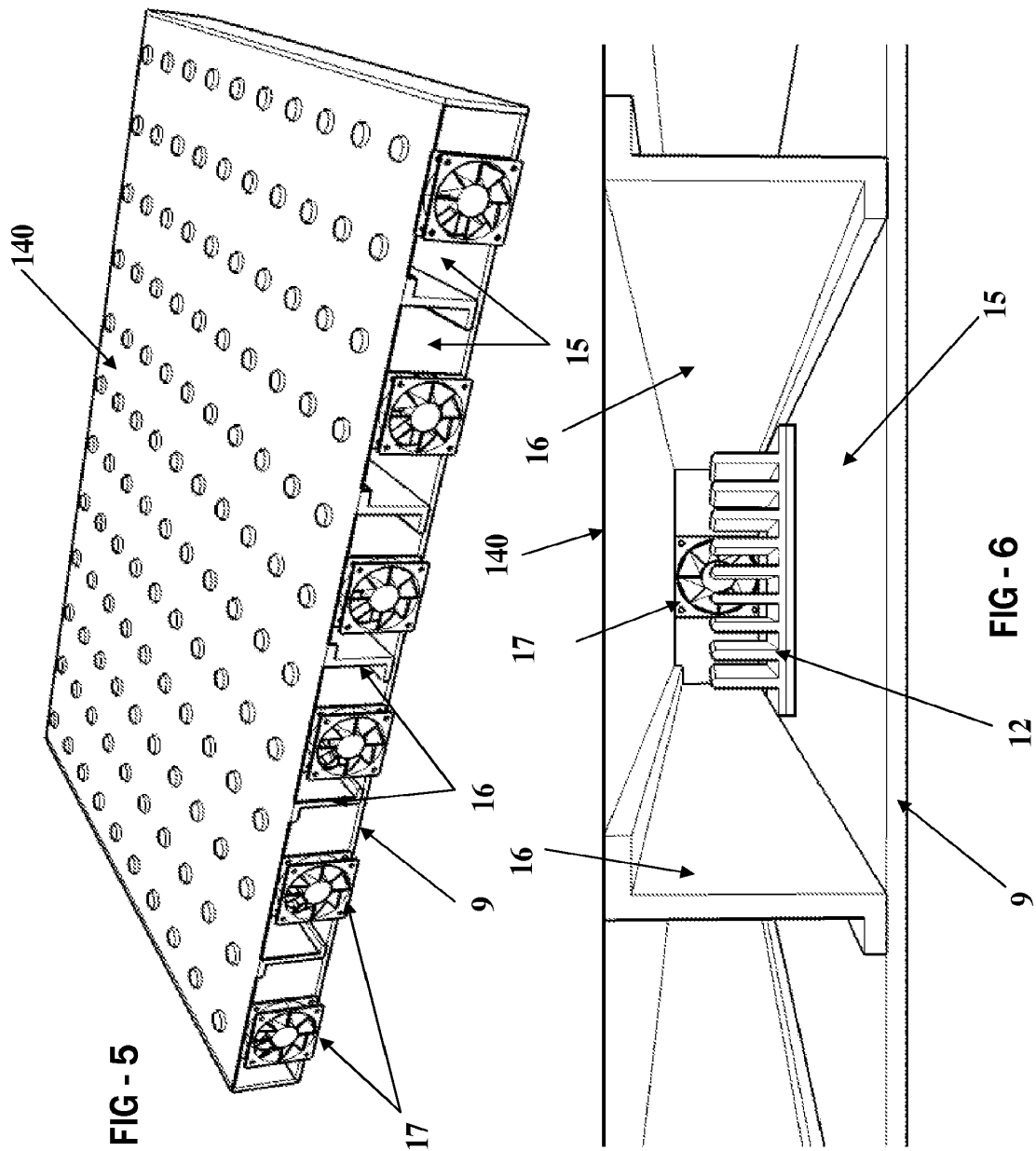
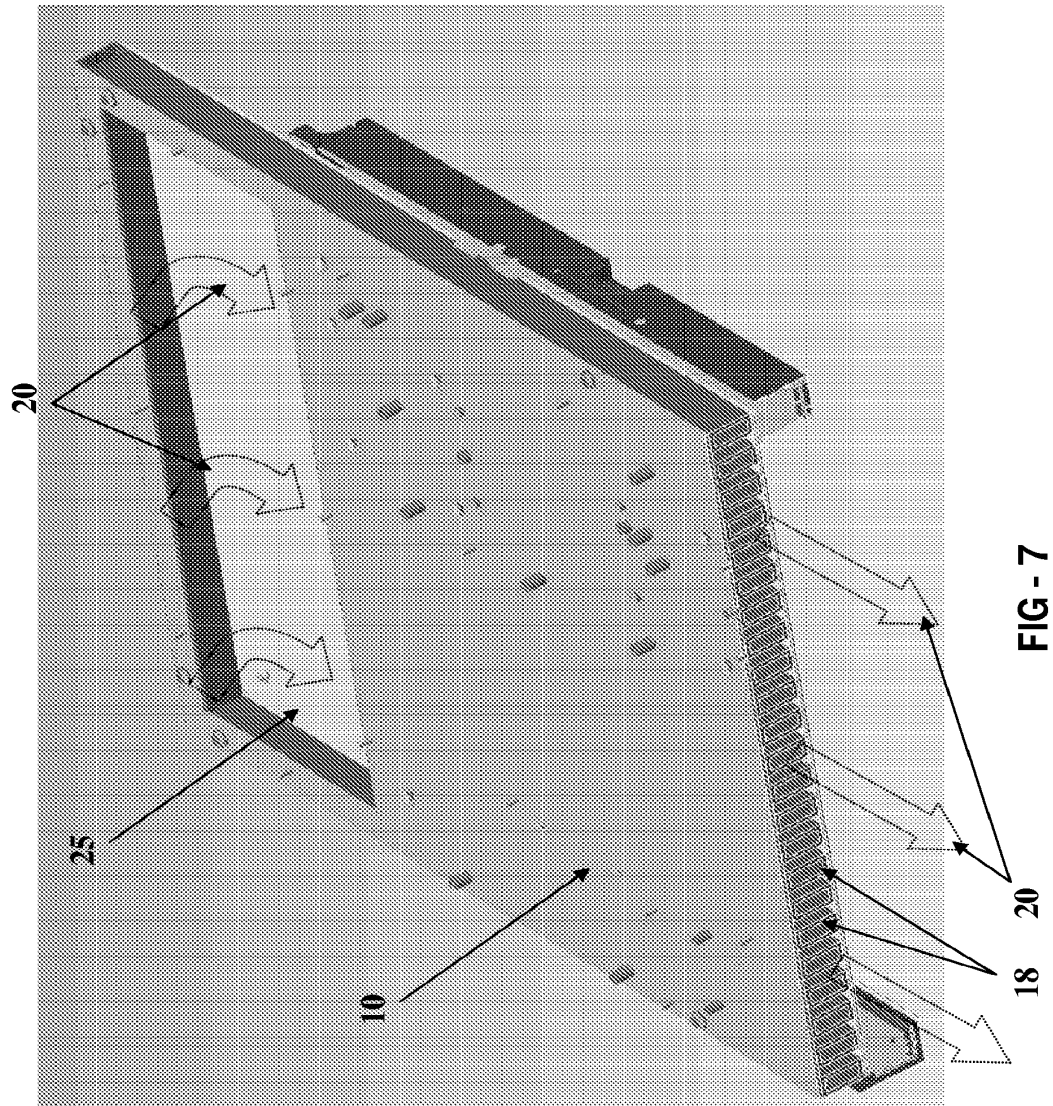
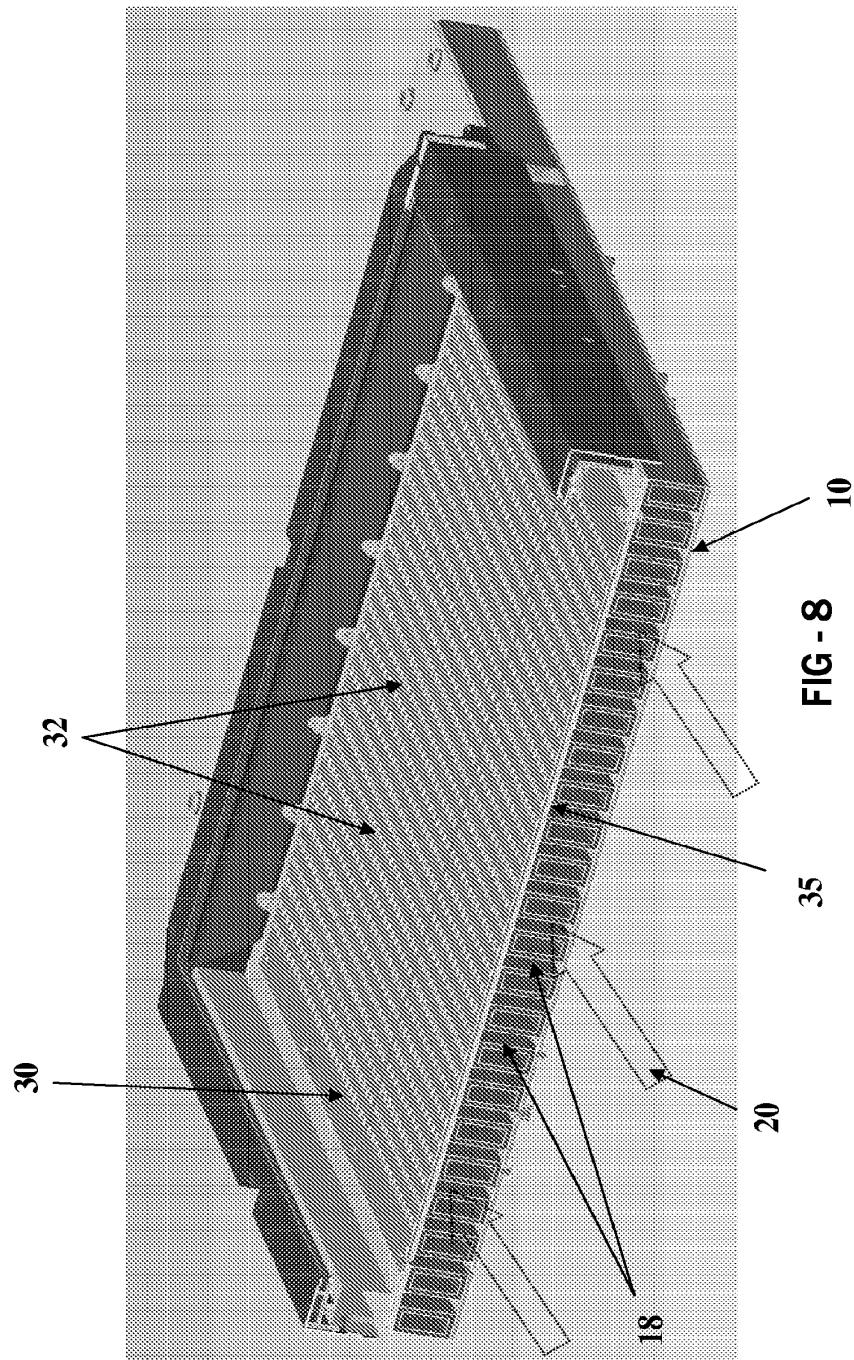


FIG - 4







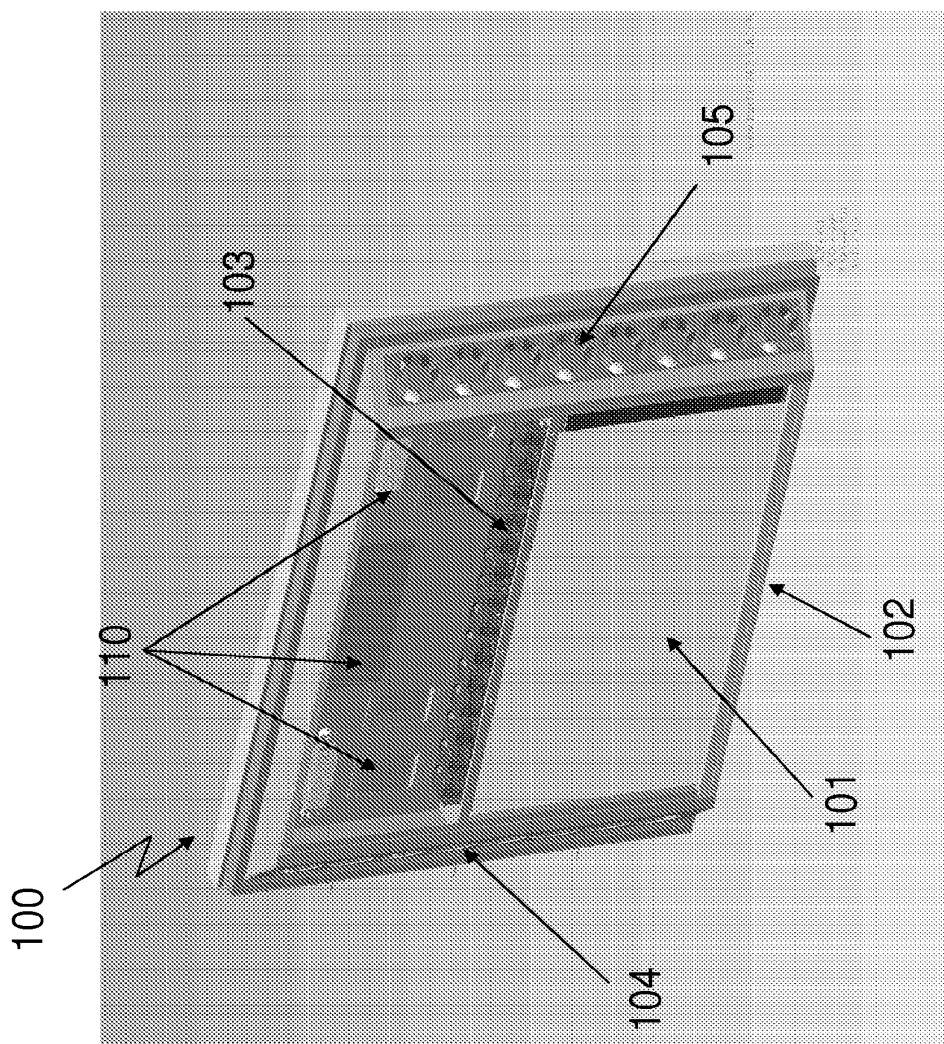


FIG - 9

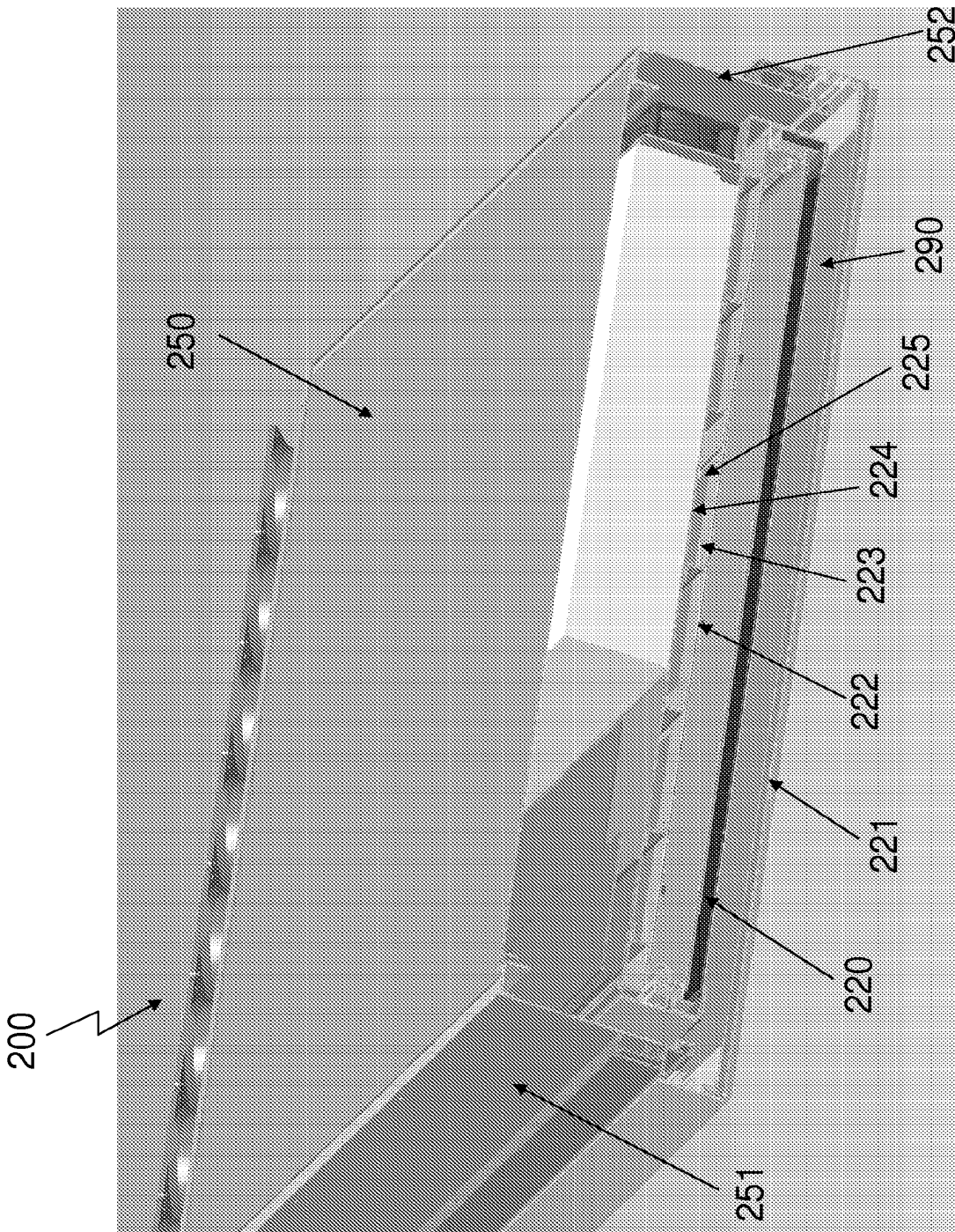


FIG - 10A

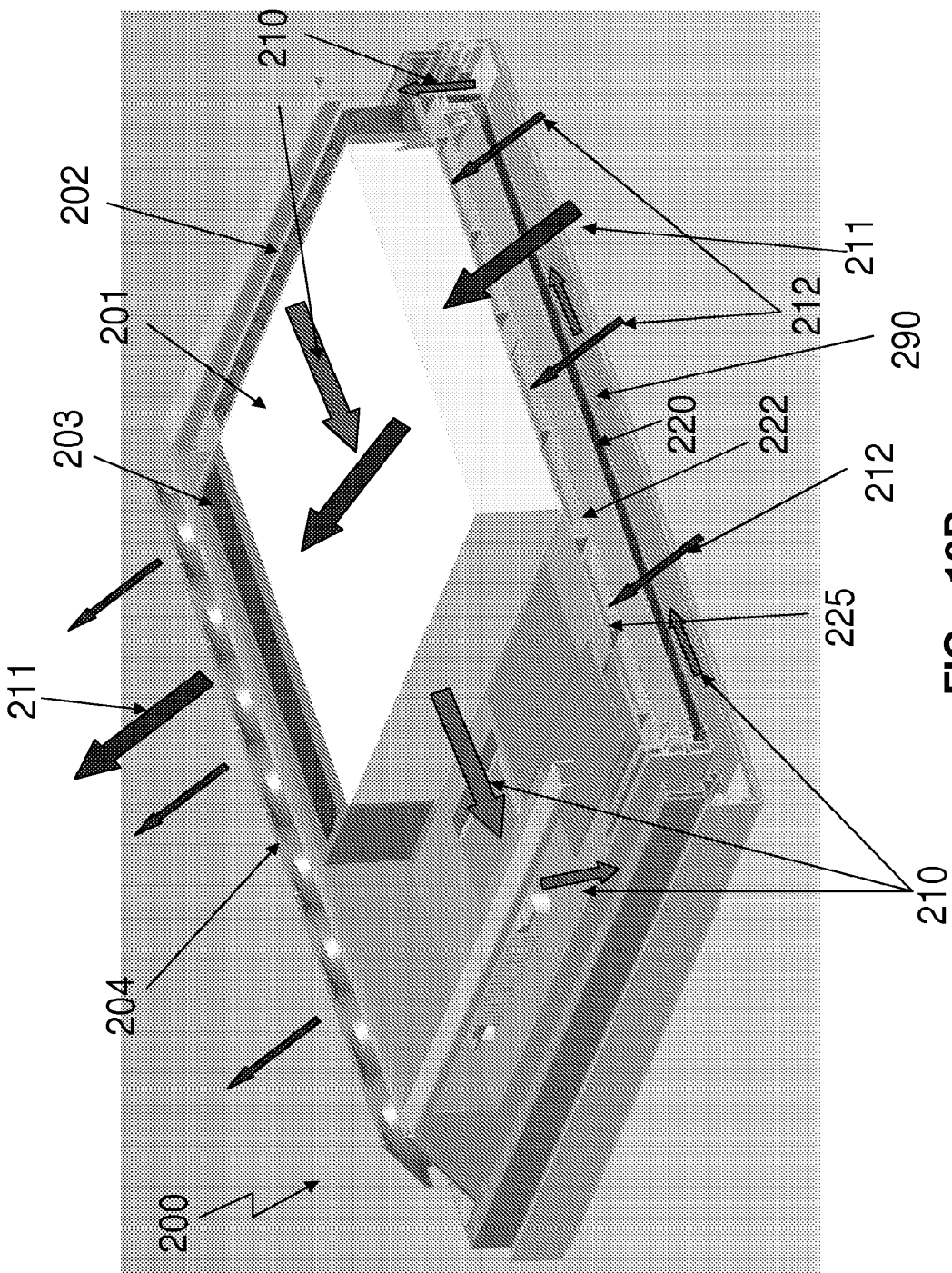
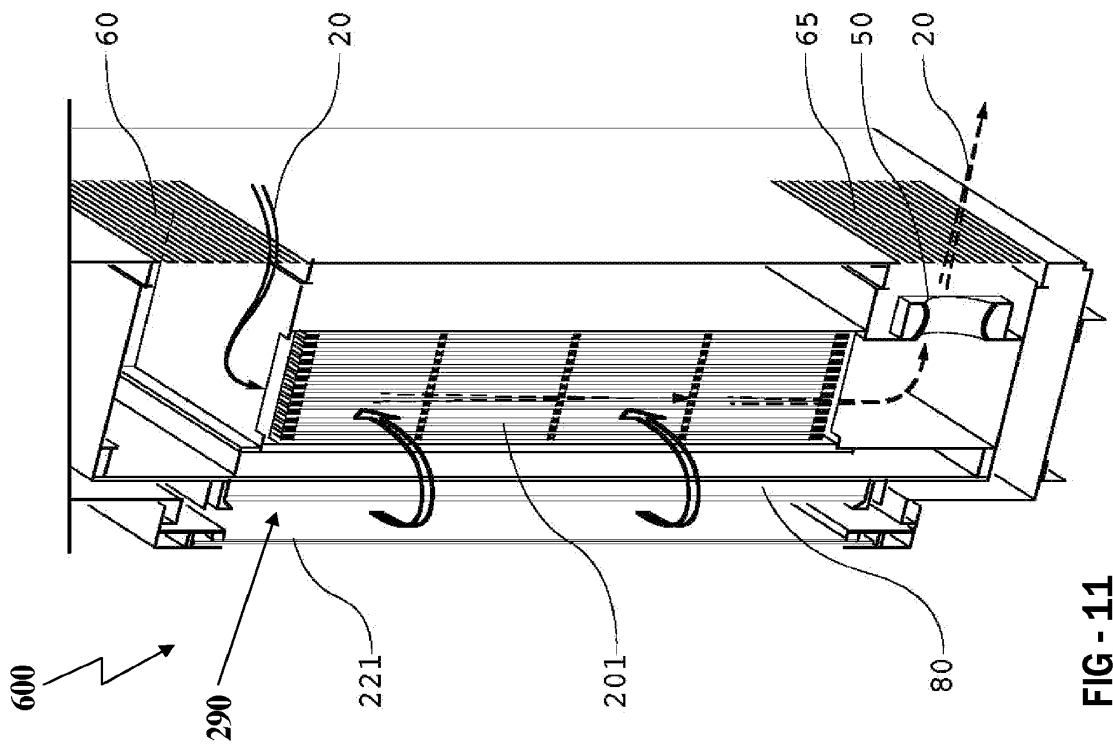
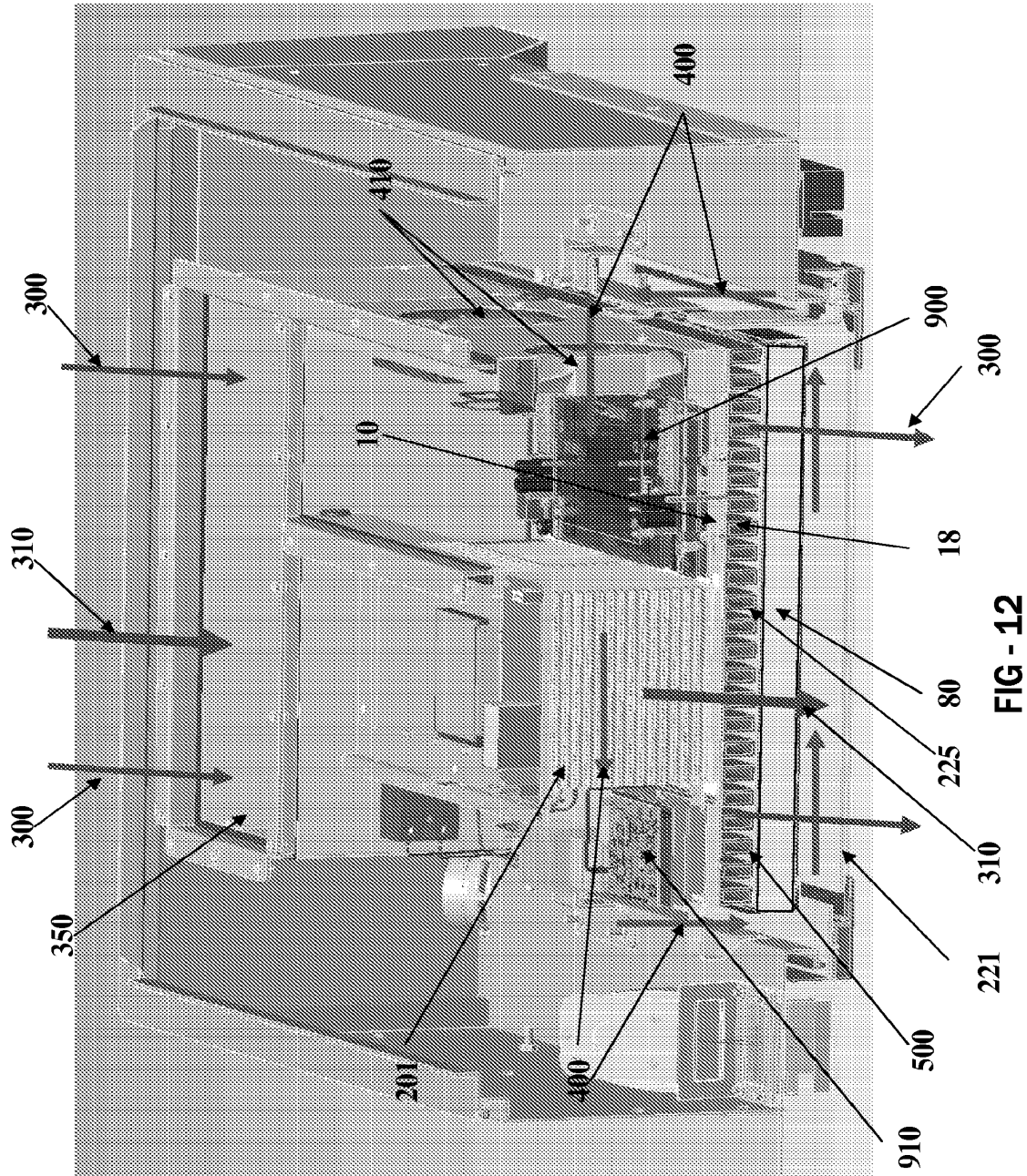


FIG - 10B





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[Continued on next page]

(54) Title: THERMAL PLATE WITH OPTIONAL COOLING LOOP IN ELECTRONIC DISPLAY

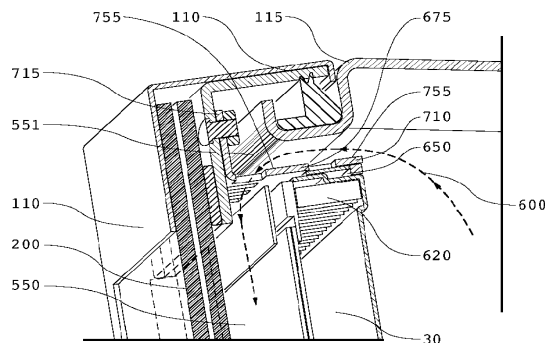


FIG. 3

(57) Abstract: An electronic display having one or more thermal plates in thermal communication with an image assembly and a thermally-conductive housing (and optional door frame). In some embodiments, the thermal plate is in thermal communication with the door frame which is in thermal communication with the housing. A channel may be defined between a transparent plate assembly and the image assembly where a fan may force cooling air through the channel. The cooling air may also pass through apertures in the thermal plate(s). An exemplary image assembly may provide an LED edge-lit LCD or an OLED display. In some embodiments, two displays may be provided in a back-to-back orientation within a single housing. The display may dissipate heat without the need to ingest ambient air.

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INTERNATIONAL SEARCH REPORT

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PCT/US2010/058925**A. CLASSIFICATION OF SUBJECT MATTER*****G02F 1/1333(2006.01)i***

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

G02F 1/1333; G02F 1/13357; G02F 1/13; G02F 1/133; F21V 8/00; G03B 21/132; G02F 1/1335

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

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

cKOMPASS(KIPO internal) & Keywords: heat, "heat sink", "thermal plate", fan, LED, evacuat*

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	JP 2004-004581 A (SEIKO EPSON CORP.) 08 January 2004 See abstract, figs. 1-2, and paragraph [0068] - paragraph [0080].	1,2 3-20
X A	JP 2005-017556 A (SANYO ELECTRIC CO., LTD. et al.) 20 January 2005 See abstract, figs 5-6, and paragraph [0029] - paragraph [0045].	1,2 3-20
A	JP 06-082745 A (TOHOKU RICOH CO., LTD.) 25 March 1994 See abstract, figs 1-8, and their corresponding descriptions.	1-20
A	KR 10-1998-0020934 A (ORION ELECTRONICS CO., LTD.) 25 June 1998 See abstract, figs 1-3, and their corresponding descriptions.	1-20
A	JP 08-339034 A (MATSUSHITA ELECTRIC IND CO., LTD.) 24 December 1996 See abstract, figs 1-4, and their corresponding descriptions.	1-20
A	JP 2004-205599 A (VICTOR CO OF JAPAN LTD) 22 July 2004 See abstract, figs 1-6, and their corresponding descriptions.	1-20
A	KR 10-2004-0097466 A (LG.PHILIPS LCD CO., LTD.) 18 November 2004 See abstract, figs 1-3, and their corresponding descriptions.	1-20



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2010/058925

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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KR 10-2004-0097466 A	18.11.2004	None	



Espacenet

Bibliographic data: KR20070048294 (A) — 2007-05-09**COOLING APPARATUS FOR USE IN FLAT DISPLAY DEVICE**

Inventor(s): KIM HONG KI [KR] ± (KIM, HONG KI)
Applicant(s): LG ELECTRONICS INC [KR] ± (LG ELECTRONICS INC)
Classification: - **international:** H01J11/34; H01J17/28
- **cooperative:** H01J11/34; H01J17/16; H01J17/28;
H05K7/20972 [more](#)
Application number: KR20050105172 20051104 [Global Dossier](#)
Priority number(s): KR20050105172 20051104
Also published as: [CN1960618 \(A\)](#) [CN1960618 \(B\)](#) [KR100747848 \(B1\)](#)

Abstract not available for KR20070048294 (A)
Abstract of corresponding document: CN1960618 (B)

There is provided a cooling apparatus for a flat display device. The cooling apparatus includes a flat display module, a front cover for protecting a front portion of the flat display module, a back cover for protecting a rear portion of the flat display module, an air inlet formed on a portion of the back cover to allow external air to be introduced into the back cover, an air outlet formed on another portion of the back cover and extending along a longitudinal length of the flat panel display module; a fan disposed inside the back cover and aligned with the air outlet formed on the back cover, and an air outlet channel formed in the back cover and aligned with the air outlet formed on the back cover, the air outlet having an effective exhaust area having a longitudinal length extending in a longitudinal direction of the flat display module.



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전체 청구항 수 : 총 11 항

(54) 평면 디스플레이 기기의 냉각 장치

(57) 요약

본 발명에 따른 평면 디스플레이 기기의 냉각장치는 평면 디스플레이 모듈; 상기 평면 디스플레이 모듈의 전방을 보호하는 프론트 커버; 상기 평면 디스플레이 모듈의 후방을 보호하는 백커버; 상기 백커버의 일측에 형성되어 외기가 흡입되는 흡입구; 상기 백커버의 타측에 형성되고, 상기 평면 디스플레이 모듈의 길이방향으로 길게 형성되는 백커버측 개구부; 상기 백커버측 개구부와 정렬되는 팬; 및 상기 백커버측 개구부와 정렬되는 상태에서, 그 형상이 상기 평면 디스플레이 모듈의 길이방향으로의 길이가 다른 방향의 길이보다 긴 상태로 유효토출면적을 제공하는 사각형상인 팬의 토출구가 포함된다.

제안되는 바와 같은 본 발명에 의해서, 송풍팬의 설치를 위한 별도의 공간이 요구되지 않아서 평면 디스플레이 기기가 보다 얇아지고 간소하게 되면서도 충분한 방열효과를 얻을 수 있고, 재료가 절감되고, 설치가 편리해지는 장점을 얻을 수 있다.

대표도

도 6

특허청구의 범위

청구항 1.

평면 디스플레이 모듈;

상기 평면 디스플레이 모듈의 전방을 보호하는 프론트 커버;

상기 평면 디스플레이 모듈의 후방을 보호하는 백커버;

상기 백커버의 일측에 형성되어 외기가 흡입되는 흡입구;

상기 백커버의 타측에 형성되고, 상기 평면 디스플레이 모듈의 길이방향으로 길게 형성되는 백커버측 개구부;

상기 백커버측 개구부와 정렬되는 팬; 및

상기 백커버측 개구부와 정렬되는 상태에서, 그 형상이 상기 평면 디스플레이 모듈의 길이방향으로의 길이가 다른 방향의 길이보다 긴 상태로 유효토출면적을 제공하는 직사각형상인 팬의 토출구가 포함되는 평면 디스플레이 기기의 냉각장치.

청구항 2.

제 1 항에 있어서,

상기 팬은 횡류팬인 평면 디스플레이 기기의 냉각장치.

청구항 3.

제 1 항에 있어서,

상기 팬은 시로코팬인 평면 디스플레이 기기의 냉각장치.

청구항 4.

제 3 항에 있어서,

상기 팬은 양방향 흡입팬인 평면 디스플레이 기기의 냉각장치.

청구항 5.

제 3 항에 있어서,

상기 시로코팬은 복수개가 일렬로 정렬되는 평면 디스플레이 기기의 냉각장치.

청구항 6.

제 3 항에 있어서,

상기 시로코팬의 흡입측으로 공기의 유동방향을 가이드하는 유로 가이드가 포함되는 평면 디스플레이 기기의 냉각장치.

청구항 7.

제 1 항에 있어서,

상기 백커버측 개구부는 상기 백커버의 테두리부에 형성되는 평면 디스플레이 기기의 냉각장치.

청구항 8.

제 1 항에 있어서,

상기 흡입구는 상기 백커버의 테두리부 및/또는 배면에 형성되는 평면 디스플레이 기기의 냉각장치.

청구항 9.

평면 디스플레이 모듈;

상기 평면 디스플레이 모듈을 내부에 보호하는 커버;

상기 커버의 일측에 형성되어 외기가 흡입되는 흡입구;

상기 백커버의 타측에 형성되는 백커버측 개구부; 및

상기 백커버측 개구부와 정렬된 상태에서 공기를 토출하고, 토출구의 유효토출면적이 실질적인 직사각형으로서 상기 평면 디스플레이 모듈의 길이방향인 제 1 방향이 상기 평면 디스플레이 모듈의 폭방향인 제 2 방향보다 긴 팬이 포함되는 평면 디스플레이 기기의 냉각장치.

청구항 10.

제 9 항에 있어서,

상기 팬은 횡류팬인 평면 디스플레이 기기의 냉각장치.

청구항 11.

제 9 항에 있어서,

상기 팬은 시로코팬인 평면 디스플레이 기기의 냉각장치.

명세서

발명의 상세한 설명

발명의 목적

발명이 속하는 기술 및 그 분야의 종래기술

본 발명은 평면 디스플레이 기기에 관한 것으로서, 상세하게는 평면 디스플레이 기기 내부의 고열이 신속하고 안정적으로 외부로 배출하도록 하는 평면 디스플레이 기기의 냉각장치에 관한 것이다.

평면 디스플레이 기기는 일반적인 음극선관과는 달리 매트릭스 형태로 배열되는 구동회로에 의해서, 각 화소의 발광상태가 서로 달리 구현되어 전체적으로 화상을 형성하는 장치이다. 이러한 평면 디스플레이 기기는 상기 음극선관과는 달리 부피가 작기 때문에, 협소한 실내공간에서 차지하는 공간이 작아서 소비자의 선호도가 높고 근래들어 그 사용이 현저하게 증

가하고 있다. 상기 평면 디스플레이 기기에 적용되는 평면 디스플레이 모듈은 그 구동방식에 따라서, 액정표시장치(Liquid Crystal Display : LCD), 전계 방출 표시장치(Field Emission Display : FED), 플라즈마 디스플레이 패널(Plasma Display Panel : PDP) 및 일렉트로 루미네센스(Electro-Luminescence : EL) 표시장치 등이 있다. 이들 디스플레이 모듈에 의해서 제작되는 평면 디스플레이 기기는 부피가 작아서 사용자의 편리함을 추구할 수는 있지만, 폭이 좁은 평면 형태의 내부 공간에 다수의 발열부품들이 집적되어 제작되기 때문에, 모듈의 구동 중에 발생하는 열이 방출되도록 하는 것은 중요한 해결 과제이다.

특히, PDP 장치는 방전가스의 방전현상에 의해서 화상이 형성되고 전장부품 등에 의해 고온의 열이 발생되기 때문에, 이와 같은 열이 신속하게 방출되지 아니하면 기기가 오작동되거나 고장을 일으키는 주된 요인으로 작용하는 것이 현실이다. 물론, 다른 방식으로 구동되는 평면 디스플레이 모듈도 방열성능이 기기의 성능을 제한하는 것은 물론이다.

상기되는 평면 디스플레이 기기의 냉각과 관련되는 문제를 해결하기 위하여 종래에 적용된 방법은, 열이 다량으로 발생하는 특정 발열부품의 뒷면에 비교적 크기의 히트싱크를 부착하여 특정 부품을 냉각하고, 전체적으로는 평면 디스플레이 기기의 커버에 다수의 홀을 뚫어서 공기가 평면 디스플레이 기기의 내외부로 연통할 수 있도록 하는 방법이 있다. 그러나, 이러한 방법은 고열이 발생하는 특정의 부품에 대한 냉각 효과는 기대할 수 있으나, 기기의 내부공간에 모이는 열이 외부로 방출되는 과정이 원활하게 수행되지 않기 때문에, 기기가 안정적으로 동작되지 못하는 문제점이 있다.

상기되는 방법을 개선하기 위하여 평면 디스플레이 기기의 형성방향에 직교되는 방향으로, 백커버의 중간부에서 후방을 향하여 축류팬이 설치되어 기기 내부의 고온공기가 디스플레이 기기의 후방으로 강제로 배출되는 방식이 적용된 바가 있다. 그러나, 이러한 방식은 비록 기기의 내부에 고이는 열기가 외부로 방출되는 효율은 높일 수가 있으나, 공기가 방출되는 동작 중에 많은 소음이 발생할 뿐만 아니라, 공기가 배출되기 위하여 기기의 배면과 벽면과의 사이에는 수십 센티미터 이상의 간격이 제공되어야 하는 문제점이 있다. 그리고, 축류팬이 설치되어 기기의 내부 공기를 빨아들이기 위하여 축류팬과 평면 디스플레이 모듈의 사이에 제공되어야 하는 간격과, 축류팬의 자체적인 간격으로 인하여 평면 디스플레이 모듈의 폭이 그만큼 두꺼워지는 문제점이 있다.

또한, 백커버의 면 상에 외부 공기가 흡입되거나 토출되도록 하기 위하여 다수의 개공이 형성됨으로서, 백커버의 강도를 떨어뜨리는 문제점이 있고, 이러한 강도상의 문제로 인하여 백커버의 재질을 보다 두껍게 형성해야 되기 때문에, 원가를 상승시키는 문제점이 있다.

발명이 이루고자 하는 기술적 과제

본 발명은 상기되는 문제점을 개선하기 위하여 제안되는 것으로서, 평면 디스플레이 기기가 보다 얇아지고 간소하게 되면서도 충분한 방열효과를 얻을 수 있는 평면 디스플레이 기기의 냉각장치를 제공하는 것을 목적으로 한다.

또한, 냉각장치의 제조비가 절감될 수 있을 뿐만 아니라, 유동 소음이 최소화될 수 있는 평면 디스플레이의 냉각장치를 제공하는 것을 목적으로 한다.

또한, 평면 디스플레이 기기 내부의 공기가 자연대류에 의해서도 외부로 방출되도록 함으로써, 방열 효율이 더욱 개선되고, 유동소음의 저감효과가 더욱 극대화되는 평면 디스플레이 기기의 냉각장치를 제안하는 것을 목적으로 한다.

또한, 평면 디스플레이 기기의 내부에서 공기의 유동방향이 개선되어 평면 디스플레이 기기의 설치에 대한 자유도가 개선될 수 있는 평면 디스플레이 기기의 냉각장치를 제안하는 것을 목적으로 한다.

또한, 평면 디스플레이 기기의 커버에 형성되는 통공의 형성 위치 및 구조를 개선하여 백커버의 강도를 증대시키는 평면 디스플레이 기기의 냉각장치를 제안하는 것을 목적으로 한다.

발명의 구성

상기되는 목적을 달성하기 위한 본 발명에 따른 평면 디스플레이 기기의 냉각장치는 평면 디스플레이 모듈; 상기 평면 디스플레이 모듈의 전방을 보호하는 프론트 커버; 상기 평면 디스플레이 모듈의 후방을 보호하는 백커버; 상기 백커버의 일측에 형성되어 외기가 흡입되는 흡입구; 상기 백커버의 타측에 형성되고, 상기 평면 디스플레이 모듈의 길이방향으로 길게 형성되는 백커버측 개구부; 상기 백커버측 개구부와 정렬되는 팬; 및 상기 백커버측 개구부와 정렬되는 상태에서, 그 형상이 상기 평면 디스플레이 모듈의 길이방향으로의 길이가 다른 방향의 길이보다 긴 상태로 유효토출면적을 제공하는 사각형상인 팬의 토출구가 포함된다.

다른 측면에 따른 본 발명의 평면 디스플레이 기기의 냉각장치는 평면 디스플레이 모듈; 상기 평면 디스플레이 모듈을 내부에 보호하는 커버; 상기 커버의 일측에 형성되어 외기가 흡입되는 흡입구; 상기 백커버의 타측에 형성되는 백커버측 개구부; 및 상기 백커버측 개구부와 정렬된 상태에서 공기를 토출하고, 토출구의 유효토출면적이 실질적인 직사각형으로서 상기 평면 디스플레이 모듈의 길이방향인 제 1 방향이 상기 평면 디스플레이 모듈의 폭방향인 제 2 방향보다 긴 팬이 포함된다.

제안되는 본 발명에 의해서 평면 디스플레이 기기에 대한 냉각효율이 개선되는 장점을 얻을 수 있고, 유동소음이 줄어들고, 평면 디스플레이 기기의 설치에 방해가 없이 보다 자유롭게 설치 가능하고, 팬의 동작에 있어서 동작 신뢰성이 향상되고, 원가가 절감되는 장점이 있다.

이하에서는 도면을 참조하여 본 발명의 바람직한 실시예를 상세하게 설명한다. 다만, 본 발명의 사상은 제시되는 실시예에 제한되지 아니하며, 본 발명의 사상을 이해하는 당업자는 동일한 사상의 범위 내에 포함되는 다른 실시예를 용이하게 제안할 수 있을 것이나, 이 또한 본 발명 사상의 범위 내에 포함된다고 할 것이다.

<제 1 실시예>

도 1은 본 발명에 따른 평면 디스플레이 기기의 사시도이다.

도 1을 참조하면, 본 발명의 평면 디스플레이 기기(1)는 평면 디스플레이 모듈(2)과, 상기 평면 디스플레이 모듈(2)의 전방을 지지하고 보호하는 프론트 커버(3)와, 평면 디스플레이 모듈(2)의 후방을 지지하고 보호하는 백 커버(4)가 포함된다. 그리고, 상기 백 커버(4)의 상측 테두리에는 평면 디스플레이 기기(1) 내부의 뜨거운 공기가 배출되는 백커버측 개구부(5)가 형성된다. 상기 백커버측 개구부(5)는 다수개의 슬릿이 집합되는 구조로 제공됨으로써, 백커버(4)의 강도저하가 발생되지 않도록 하는 것이 바람직하다. 다시 말하면, 상기 백커버측 개구부(5)는 전체적으로 평면 디스플레이 기기(1) 내부의 고온 공기가 토출되는 부분을 칭하는 것으로서, 그 내부 면적은 다수개의 슬릿이 집합되는 형태로 제공되어 있다.

상기 평면 디스플레이 모듈(2)은, 액정표시장치, 전계 방출 표시장치, 플라스마 디스플레이 패널, 및 일렉트로 루미네센스 표시장치등과 같이 매트릭스 형태로 화소가 배치되고 동작되는 모듈이 적용될 수가 있으나, 바람직하기로는 고열이 발생되는 PDP 모듈이 예시될 수 있다.

상기 프론트 커버(3)와 백커버(4)는 전체적으로 내부 공간에 평면 디스플레이 모듈(2)을 수용한 상태에서 외부와 내부를 구획하고 내부에 장착되는 부품을 보호하는 물품으로서, 본 실시예에서는 프론트 커버(3)와 백커버(4)가 별도의 물품으로 제공되어 양자가 결합되는 양상으로 설명이 되고 있으나, 어떠한 다른 형태로 제공되는 것도 가능하다. 예를 들면, 프론트 커버(3)와 백커버(4)가 단일의 물품으로 제공되는 것도 가능한 일이다. 다만, 프론트 커버(3)가 평면 디스플레이 기기의 전방을 보호하고, 백커버(4)가 평면 디스플레이 기기의 후방을 보호하는 용도로 사용되는 것은 당연하다. 그리고, 상기 백커버(4)의 내면과 평면 디스플레이 모듈(2)의 후면에 제공되는 다수의 발열부품과의 사이에는 소정의 간격이 제공되고, 상기 간격을 통해서 공기가 유동하여 상기 발열부품을 냉각시킨 뒤에, 상기 백커버측 개구부(5)를 통하여 배출되는 것도 당연하다.

상기되는 평면 디스플레이 기기의 사시도를 참조하여 본 발명 냉각장치의 동작을 설명한다.

상기 평면 디스플레이 기기(1)가 동작되면, 평면 디스플레이 모듈(2)에는 많은 열이 발생되는데, 특히, 평면 디스플레이 모듈(2)의 후면부의 발열부품에서 발생되는 열은 외부에서 유입된 공기에 의해서 냉각되고, 이후에 뜨거워진 공기는 상방으로 이동한 뒤에 상기 백커버측 개구부(5)를 통하여 외부로 배출되는 과정을 거친다. 이와 같이 뜨거워진 공기가 상방으로 이동되는 자연대류에 과정에 의해서 평면 디스플레이 기기의 내부의 공기가 배출될 수 있기 때문에 냉각효과가 더욱 증진되는 장점을 얻을 수 있다. 이와 같이 자연대류에 의한 냉각효과가 극대화되도록 하기 위하여, 상기 평면 디스플레이 기기(1)의 내부로 유입되는 공기는 평면 디스플레이 기기(1)의 하면부의 거의 전체 영역을 통하여 내부로 유입되도록 하여, 평면 디스플레이 모듈(2)의 후면부를 전체적으로 경유하도록 하여 냉각효율이 더욱 개선되도록 하는 것이 바람직하다.

또한, 상기 백커버측 개구부(5)는 백커버(4) 테두리의 경사진 부위에 제공되어 고온공기가 유동되는 방향(상측방향) 그대로 토출되도록 함으로써, 고온공기의 유동이 더욱 원활하게 이루어지는 장점이 있다.

물론, 평면 디스플레이 모듈(2)의 전면부는 외부로 노출되어 있기 때문에, 평면 디스플레이 모듈(2)의 전면부에서 발생하는 열은 외부 공기의 자연대류에 의해서 신속하게 방출될 수 있다.

도 2는 본 발명의 평면 디스플레이 기기에서 백커버 상면의 일부를 제거한 부분 절개 사시도이다.

도 2를 참조하면, 상기 백커버(4) 상면의 내측에는 횡류팬(7)이 디스플레이 기기의 길이방향으로 길게 설치된다. 이와 같이 횡류팬(7)이 설치됨으로써, 백커버(4) 상면부는 뜨거운 내부 공기가 외부로 방출되는 간격을 제공하게 된다. 이와 같이 좌우로 길이가 긴 백커버(4) 상면을 통하여 고온공기가 토출될 수 있기 때문에, 공기토출과정이 보다 용이해져서 공기의 유동저항 및 유동소음이 감소되고, 고온공기의 방열효율이 높아지는 장점을 얻을 수 있다.

상기 횡류팬(7)의 구성을 보다 상세하게 설명한다. 상기 횡류팬(7)은 백커버(4)의 좌우 길이 방향으로 길게 제공되는 횡류팬 임펠러(도 3의 10참조)와 상기 횡류팬 임펠러(10)의 일정 간격으로 횡류팬 임펠러(10)를 구획하고 횡류팬 임펠러(10)의 강도를 보강하는 원형의 플레이트(11)가 포함된다. 또한, 상기 횡류팬(7)의 일측으로는 구동축(15)과 상기 구동축(15)에 연결되는 모터(14)가 더 형성되어, 모터(14)의 회전력이 횡류팬(7)으로 전달되도록 한다.

또한, 상기 횡류팬 임펠러(10)의 회전시에 공기의 유동을 가이드하기 위하여 상기 횡류팬 임펠러(10)는 전체적으로 하우징(18)의 내부에 수용되는데, 상기 하우징(18)은 횡류팬 임펠러(10)의 전방으로 이격된 일측에 형성되는 스크롤(12)과, 이격된 타측에 형성되어 공기의 유동을 안정화시키는 스테빌라이저(13)가 포함된다. 상기 스크롤(12)은 횡류팬 임펠러(10)의 전방에 놓이고 상기 스테빌라이저(13)는 횡류팬 임펠러(10)의 후방에 놓여서, 상기 횡류팬 임펠러(10)는 도면을 기준으로 시계방향으로 회전하게 된다.

도 3에 제시되는 도 1의 I-I' 선의 단면도를 참조하여, 상기 횡류팬(7)에 의한 고온공기의 토출 작용을 상세하게 설명한다.

상기 횡류팬(7)은 이미 설명된 바와 같이 시계 방향으로 회전하는 동작에 의해서, 상기 백커버(4) 내부 공간의 공기가 상방으로 이동하여 스크롤(12)을 따라서 이동된 뒤에, 상기 백커버측 개구부(5)를 통하여 외부로 배출된다.

설명된 바와 같이 상기 횡류팬(7)은 상기 백커버(4) 상면의 길이방향으로 실질적으로 전체 길이에서 길게 제공되어 있기 때문에, 다량의 고온공기가 토출될 수 있다. 물론, 화면의 크기가 작아서 전체 길이에 대하여 횡류팬(7)이 제공될 필요가 없는 경우에는, 특정길이만큼만 백커버측 개구부(5) 및 횡류팬(7)이 설치될 수도 있을 것이다. 이와 같이 고온공기의 배출면적이 크게 제공됨으로써 공기의 배출에 있어서 방해가 줄어들 수 있고, 이로 인한 공기의 유동저항과 유동소음이 줄어드는 장점을 얻을 수 있다. 그리고, 고온 공기가 백커버(4)의 상면을 통하여 배출되기 때문에 백커버(4)의 배면과 벽면과의 간격부에는 공기의 원활한 배출을 위한 별도의 간격을 제공할 필요가 없다. 그러므로, 본 발명의 평면 디스플레이 기기는 벽면에 완전히 말착되어 장착될 수 있고, 그만큼 실내공간을 좁게 차지하게 되는 장점을 얻을 수 있다.

도 4는 도 2에서 횡류팬 임펠러와 모터등이 제거된 상태의 평면 디스플레이 기기의 사시도이고, 도 5는 도 4의 II-II'의 단면도이다.

도 4 및 도 5를 참조하여 본 발명에 따른 평면 디스플레이 기기의 냉각장치의 작용을 설명하면, 평면 디스플레이 기기의 상단부에는 스크롤(12)이 전방경계를 이루고, 스테빌라이저(13)가 후방경계를 이루는 직사각형 형태의 토출구(20)가 제공되는 것을 볼 수 있다. 물론, 상기 토출구(20)의 내부에는 상기 횡류팬(7)이 장착되고, 상기 토출구(20)는 상기 횡류팬(7)에 의해서 공기가 토출되는 면적을 제공하게 된다.

상기 토출구(20)는 실질적으로 평면 디스플레이 기기의 고온공기가 토출되는 면적으로서 유효토출면적(S)이라고 할 수 있는데, 본 발명에서는 상기 유효토출면적(S)은 백커버(4)의 상면에서 직사각형의 형태로 크게 제공됨으로써, 평면 디스플레이 기기 내부의 고온공기는 보다 신속하고 효율적으로 외부로 배출될 수 있는 것이다. 따라서, 상기 유효토출면적(S)이 크게 제공되면 크게 제공될 수록 고온공기의 배출이 보다 신속하게 이루어질 수 있고, 공기의 유동 중에 발생하는 소음이 줄어들고, 고온공기의 방열효율이 증가될 수 있는 것은 당연하게 짐작될 것이다.

또한, 유효토출면적(S)이 커지게 되면 디스플레이 기기의 내부를 통과하는 공기의 유량이 그만큼 늘어나게 되어서 냉각효율이 그만큼 높아지기 때문에, 백커버(4)의 배면에 별도로 설치되는 흡입공 및 토출공이 필요치 않게 된다. 그러므로, 다수의 공기 흡입구 및 토출구에 의해서 백커버(4)의 강도를 보강하기 위하여 백커버(4)의 재질을 고강도의 강판으로 할 필요가 없어지기 때문에 재료가 절감되는 장점을 얻을 수도 있다.

또한, 동일한 백커버(4) 상면의 전체면적 중에서 상기 유효토출면적(S)이 크게 제공되면 크게 제공될 수록, 평면 디스플레이 기기의 화면이 커져서 발열량이 많아지더라도 디스플레이 기기의 전후 두께는 얇아질 수 있는 장점을 얻을 수 있게 된다. 특히, 본 실시예와 같이 횡류팬(7)이 형성되는 경우에는, 횡류팬(7)은 다른 부품에 의한 방해가 없이 평면 디스플레이 기기(1)의 전후두께에 전체적으로 설치될 수 있기 때문에, 고온공기에 대한 방열효율이 더욱 개선될 수 있는 장점이 있다.

또한, 본 발명에 따른 평면 디스플레이 기기의 냉각장치는, 상기 유효토출면적(S)이 디스플레이 모듈의 형성방향, 다시 말하면 평면 디스플레이 기기 테두리부의 길이방향으로 길게 제공되는 제 1 모서리부와, 상기 디스플레이 기기 테두리의 길이방향과 수직되는 방향으로 상기 제 1 모서리부에 비하여 짧게 제공되는 제 2 모서리부로 이루어지는 직사각형으로 이루어져 있다. 물론, 상기 제 1 모서리부와 제 2 모서리부는 각각 평행 두개의 선을 가지고서 직사각형으로 이루게 된다. 그러므로, 얇은 평면 형상으로 제공되는 평면 디스플레이 기기에 있어서 유효토출면적(S)이 그만큼 커질 수 있고, 유효토출면적(S)이 형성되는 평면 디스플레이 기기 일면의 형상과 유사한 형상으로서 해당되는 면의 실질적인 전체면적에 걸쳐서 제공되어 있기 때문에, 고온공기가 배출되는 면적이 그만큼 증가되는 장점을 얻을 수 있다.

도 6은 본 발명에 따른 평면 디스플레이 기기의 냉각장치의 작용을 설명하기 위한 평면 디스플레이 기기의 배면도이다.

도 6을 참조하면, 상기 백커버(4)에는 백커버측 개구부(5)에 더하여 공기가 백커버(4)의 내부공간으로 유입되도록 하기 위한 측면 흡입구(16)와 배면 흡입구(17)가 더 형성된다.

상기 흡입구(16)(17)의 작용을 설명하면, 먼저 상기 측면 흡입구(16)는 백커버(4) 하단 테두리부의 경사진 부위에 형성되어 외부의 저온공기가 평면 디스플레이 기기의 내부 공간으로 상방으로 흡입되도록 한다. 물론, 상기 측면 흡입구(16)를 통하여 흡입되는 공기는 상기 백커버측 개구부(5)를 통하여 배출되는 공기를 보상하기 위하여 흡입되는 공기로서, 자연대류에 의해서 발생하는 음압과 상기 백커버측 개구부(5)를 통하여 배출되는 공기에 의한 음압을 보상하기 위하여 흡입되는 공기이다.

상기 측면 흡입구(16)를 통하여 흡입되는 공기는, 평면 디스플레이 모듈(2)의 배면에 제공되는 다수 부품의 고열이 전체적으로 냉각되도록 한 뒤에 상기 횡류팬(7)으로 흡입되고, 그 뒤에는 백커버측 개구부(5)를 통하여 배출되는 과정을 거치게 된다.

또한, 도면에 제시되는 바와 같이 상기 측면 흡입구(16)는 백커버(4) 하단 테두리부의 좌우방향을 가로질러 형성되도록 함으로써, 흡입되는 공기에 의해서 평면 디스플레이 모듈(2)의 부품이 좌우방향에 걸쳐서 그 전부가 냉각되도록 하는 것이 바람직하다. 도면에서 화살표는 공기의 유동방향을 설명하고 있다.

상기 백커버(4) 내부의 고온 공기가 토출되는 작용을 중심으로 설명하면, 상기 횡류팬(7)은 상기 백커버(4)의 상면에 좌우방향을 가로질러서 실질적으로 상면의 전체길이에 형성되고, 상기 유효토출면적(S)도 상기 횡류팬(7)과 대응되어 백커버(4) 상면의 좌우방향을 가로질러서 백커버(4) 상면의 전체면적에 형성되어 있다. 그러므로, 상기 백커버(4) 하면의 좌우방향의 전체길이부를 통하여 흡입된 저온공기는 수직방향으로 그대로 상승하면서 열을 식힌뒤에 상면을 통하여 배출된다. 물론, 횡류팬(7)의 길이가 짧게 제공되는 경우에는 평면 디스플레이 기기의 코너부에 대한 방열효과는 어느 정도 줄어들 수 있으나, 그렇다 할지라도 직사각형상의 넓은 유효토출면적(S)에 의해서 방열효율이 개선되는 것은 당연하다.

한편, 상기 평면 디스플레이 모듈(2)의 각 부품 중에서도 특히 고열이 발생하는 부품(예를 들면 전원부), 저온조건이 필수적으로 요구되는 부품(예를 들면 TCP 칩(Tape Carrier Package Chip))이 있다.

이와 같은 부품별 동작조건을 만족시키기 위하여, 열적 안정성이 요구되는 부품은 상기 측면흡입구(16)의 인접위치에 형성되어 외부에서 유입되는 차가운 공기에 의해서 신속하게 냉각되도록 하는 것이 바람직하다. 또한, 다량의 열이 발생하는 부품의 경우에는 발생된 열이 다른 회로부에 영향을 주지 않으면서 신속하게 외부로 배출되도록 하기 위하여, 상기 횡류팬(7)의 인접위치에 형성되는 것이 바람직하다.

또한, 상기 배면 흡입구(17)는, 평면 디스플레이 모듈(2)의 회로배치로 인하여 부품의 위치를 변동시키지 못하고 특정 위치에 놓여야만 되는 경우에 사용될 수 있다. 다시 말하면, 상기 배면 흡입구(17)는 발열물품이 배치되는 평면 디스플레이 모듈(2)의 특정 위치에 대응되는 백커버(4)상의 위치에 형성되어, 외기가 배면 흡입구(17)를 통하여 직접 유입되면서 유입되는 저온 공기에 의해서 발열물품이 냉각되도록 하는 목적으로 사용될 수 있다. 다만, 상기 배면 흡입구(17)는 본원발명

의 실시예 필수적인 구성요소라고는 할 수 없으며, 발열물품의 위치가 조정될 수 있는 경우에는 상기 측면 흡입구(16)의 인접위치 또는 횡류팬(7)의 인접위치로 발열물품의 위치를 이동시켜서 별도의 배면 흡입구(17)가 요구되지 않도록 할 수도 있다.

설명된 바와 같이 본 발명에 따른 냉각장치에 의해서 백커버(4)의 어느 일측 테두리부에 길게 팬이 놓일 수 있기 때문에, 백커버 내부의 고온공기의 방열성능이 한층 더 개선되고, 냉각 장치의 동작 상의 신뢰성이 좋아지는 장점을 얻을 수 있다.

<제 2 실시예>

본 발명의 제 2 실시예는 다른 부분에 있어서는 상기 제 1 실시예와 동일하고, 평면 디스플레이 기기 내부의 고온공기가 토출되도록 하는 송풍팬의 구조가 달라지는 것이 특징적으로 다르다. 그러므로, 이하의 설명에서는 본 실시예에 있어서 구성이 달라지는 부분에 대해서만 상세하게 설명하고, 설명이 되지 아니하는 부분에 대해서는 상기 제 1 실시예에 대하여 설명된 바가 인용되는 것으로 한다.

도 7은 본 발명의 제 2 실시예에 따른 평면 디스플레이 기기의 사시도이다.

도 7을 참조하면, 평면 디스플레이 모듈(32)과, 상기 평면 디스플레이 모듈(32)의 전방부를 보호하는 프론트 커버(33)과, 상기 평면 디스플레이 모듈(32)의 후방부를 보호하는 백커버(34)가 포함된다. 또한, 상기 백커버(34)의 상면에는 평면 디스플레이 기기 내부의 고온공기가 토출되는 백커버측 개구부(51)(52)가 포함된다. 상기 백커버측 개구부(51)(52)는 백커버(34) 상면의 좌측에 형성되는 제 1 백커버측 개구부(51)와 우측에 형성되는 제 2 백커버측 개구부(52)가 포함된다.

이와 같이 상기 백커버측 개구부(51)(52)가 좌우로 나뉘어져 제공됨으로써, 평면 디스플레이 기기의 코너부에 대한 냉각이 보다 원활하게 수행될 수 있는 장점을 얻을 수 있다.

도 8은 본 발명의 제 2 실시예에서 백커버의 상면부가 제거된 상태에서 그 내부를 도시한 평면 디스플레이 기기의 사시도이다.

도 8을 참조하면, 상기 제 1 백커버측 개구부(51)의 내부에는 제 1 시로코팬(41)이 정렬되어 놓이고, 상기 제 2 백커버측 개구부(52)의 내부에는 제 2 시로코 팬(46)이 정렬되어 놓여있다. 이와 같은 배치에 의해서 평면 디스플레이 기기 내부의 고온공기는 시로코 팬(41)(46)에 의해서 송풍되어 상기 백커버측 개구부(51)(52)를 통하여 배출된다.

상기 시로코팬(41)(46) 및 그와 관련되는 구성을 보다 상세하게 설명한다. 다만, 이하의 설명은 제 1 시로코팬(41)에 대하여만 행하지만, 제 2 시로코팬(46)에 대하여도 마찬가지로 적용될 수 있는 것은 물론이다.

상기 제 1 시로코팬(41)은 양방향 흡입 시로코팬으로서, 하우징(43)의 좌측단과 우측단이 모두 개구되어 있고, 시로코팬 임펠러(42)는 하우징의 개구되는 좌측단과 우측단까지 연장되어 있다. 또한, 시로코팬의 구성의 간소화를 위하여 상기 임펠러(42)를 회전시키는 모터는 임펠러(42)의 중앙부에 위치한다. 또한, 상기 임펠러(42)에 의해서 하우징(43)의 좌측단과 우측단을 통하여 흡입되는 공기는, 상방으로 송풍되어 적사각형의 유효토출면적(S)을 가지는 제 1 토출구(45)를 통하여 토출되어 제 1 백커버측 개구부(51)를 통하여 외부로 배출된다.

한편, 상기 시로코팬(41)(46)의 흡입측을 통하여 유입되는 공기가 원활하게 가이드되도록 하기 위하여, 상기 하우징(43)의 좌측단 및 우측단에 형성되는 개구부와, 상기 토출구(45)를 서로 다른 공간으로 구획하는 유로 가이드(50)가 제공된다. 상기 유로 가이드(50)는 완만하게 하향 만곡되어 평면 디스플레이 기기의 내부 공기가 원활하게 시로코 팬의 내부로 유입되도록 한다. 그리고, 상기 유로 가이드(50)는 시로코팬의 내부로 흡입되는 공기가 평면 디스플레이 기기 내부의 고온공기로 제한되고 상기 토출구(45)를 통하여 이미 토출된 공기의 역유입을 방지하는 차단막으로서의 기능도 수행한다.

도 9는 본 발명의 제 2 실시예에 따른 냉각장치의 작용을 설명하는 도면이다. 먼저, 평면 디스플레이 기기의 하단부를 통하여 흡입되는 공기는 평면 디스플레이 기기의 내부 공간을 전체적으로 냉각시킨 뒤에, 상기 시로코팬 양측단의 개구부를 향하여 이동한다. 이때, 상기 유로 가이드(50)는 제 1, 2, 3, 4 유로 가이드(51)(52)(53)(54)를 포함하고, 각각의 유로 가이드는 하우징(43)과 접하는 면을 정점으로 하여 하향으로 만곡되어 있다. 이와 같이 만곡되는 형상을 취함으로써 하측에서 유입되는 공기가 하우징(43)의 좌측단과 우측단을 통하여 원활하게 유입될 수 있도록 한다.

그리고, 상기 시로코팬(41)(46)의 좌우측단의 개구부를 통하여 흡입된 공기는 임펠러(42)에 의해서 그 토출방향이 절환되어 토출구(45) 및 백커버측 개구부(51)를 통하여 외부로 토출된다.

또한, 본 실시예에서도 백커버의 유효토출면적(S)은 평면 디스플레이 기기의 연장방향 다시 말하면 길이방향으로 긴 직사각형의 형상으로 제공되어 있기 때문에, 비교적 넓은 고온공기 토출면적을 제공할 수 있는 장점이 있다. 나아가서, 넓은 상기 유효토출면적(S)에 의해서 공기의 유동저항 및 소음을 줄일 수 있는 장점을 얻을 수 있다.

한편, 도시되지는 아니하였으나, 상기 시로코팬(41)(46)의 몸체가 설치되는 직근 하측부에는 공기의 유동이 작아서 냉각 효과가 충분히 일어나지 아니할 수 있는데, 이와 같이 방열이 부족한 부분에 대한 냉각이 원활하게 일어날 수 있도록 하기 위하여 상기 시로코팬(41)(46)의 하측부와 대응되는 백커버(4)의 배면에는 배면흡입구(도 6의 17참조)가 더 제공되도록 할 수도 있을 것이다.

또한, 상기 시로코팬(41)(46)은 두개가 형성되는 것으로 본 실시예에서는 설명이 되어 있지만 근래들어 대두되고 있는 화면의 대형화에 따라서 100인치에 육박하는 대형화면에 대해서는 세개 이상의 시로코팬이 일렬로 제공되는 것도 가능한 일이다. 이와 같이 시로코팬이 배치되는 경우에는 실질적으로 백커버의 상면이 전체적으로 유효토출면적이 될 수 있기 때문에 방열효율이 더욱 개선될 것임은 용이하게 짐작될 것이다.

또한, 상기 시로코팬(41)(46)은 좌우 양측단부를 통하여 공기가 흡입되는 양방향 흡입팬을 설명하고 있으나, 이에 제한되지 아니하고 모터가 임펠러의 어느 일단부에 설치된 상태에서 일방향을 통하여 공기가 흡입되는 일방향 흡입팬을 사용할 수도 있다. 그러나, 이 경우에도 전체적으로 토출구는 직사각형의 유효토출면적을 가지는 구조로 제공됨으로써, 공기의 유동저항 및 유동소음이 줄어드는 것은 용이하게 예측가능할 것이다. 나아가서, 일방향 흡입팬이 사용되는 경우에는 두개 이상 복수개의 시로코팬이 일렬로 사용되어 고온공기의 토출공간을 넓게하는 것이 바람직할 것이다.

한편, 본 발명의 사상을 설명함에 있어서, 상기 유효토출면적은 직사각형인 것으로 설명을 하였으나, 팬의 토출구를 어떠한 형상으로 제공하는가에 따라서, 길이가 긴 어느 한 쌍의 모서리 중에서 하나는 길고 다른 하나는 길이가 짧은 사다리꼴 형상으로 제공되더라도 이는 실질적으로 어느 일 방향의 길이가 다른 일방향으로의 길이에 비하여 길이가 긴 직사각형으로 볼 수 있을 것이다.

발명의 효과

제안되는 바와 같은 본 발명에 의해서, 송풍팬의 설치를 위한 별도의 공간이 요구되지 않아서 평면 디스플레이 기기가 보다 얇아지고 간소하게 되면서도 충분한 방열효과를 얻을 수 있는 장점이 있다.

또한, 평면 디스플레이 기기의 단면 형상과 유사한 형상으로서, 고온공기의 토출구를 제공하기 때문에 구조가 간단해지면서도, 유동 소음이 최소화될 수 있는 장점이 있다.

또한, 평면 디스플레이 기기 내부의 공기가 팬으로 부터 제공되는 음압뿐만 아니라 자연대류에 의해서 외부로 배출될 수 있기 때문에, 디스플레이 기기의 내부에서 공기의 순환이 원활하게 이루어지는 장점이 있다.

또한, 평면 디스플레이 기기의 내부에서 공기의 유동방향이 개선되어 평면 디스플레이 기기의 설치에 대한 자유도가 개선될 수 있는 장점이 있다.

또한, 평면 디스플레이 기기 내부를 흐르는 공기의 유속이 빨라지면서, 백 커버의 배면에 별도의 개공이 형성될 필요가 없어지기 때문에, 백커버의 강도를 보강하기 위하여 백커버를 이루는 강판의 재질을 값비싼 고강도의 강판으로 할 필요가 없어지기 때문에, 재료비가 절감되는 장점을 얻을 수도 있다.

도면의 간단한 설명

도 1은 본 발명에 따른 평면 디스플레이 기기의 사시도.

도 2는 본 발명의 평면 디스플레이 기기에서 백커버 상면의 일부를 제거한 부분 절개 사시도.

도 3은 도 1의 I-I' 선의 단면도.

도 4는 횡류팬 임펠러와 모터등이 제거된 상태의 평면 디스플레이 기기의 사시도.

도 5는 도 4의 II-II'의 단면도.

도 6은 본 발명에 따른 평면 디스플레이 기기의 냉각장치의 작용을 설명하기 위한 평면 디스플레이 기기의 배면도.

도 7은 본 발명의 제 2 실시예에 따른 평면 디스플레이 기기의 사시도.

도 8은 본 발명의 제 2 실시예에서 백커버의 상면부가 제거된 상태에서 그 내부를 도시한 평면 디스플레이 기기의 사시도.

도 9는 본 발명의 제 2 실시예에 따른 냉각장치의 작용을 설명하는 도면.

<도면의 주요 부분에 대한 부호의 설명>

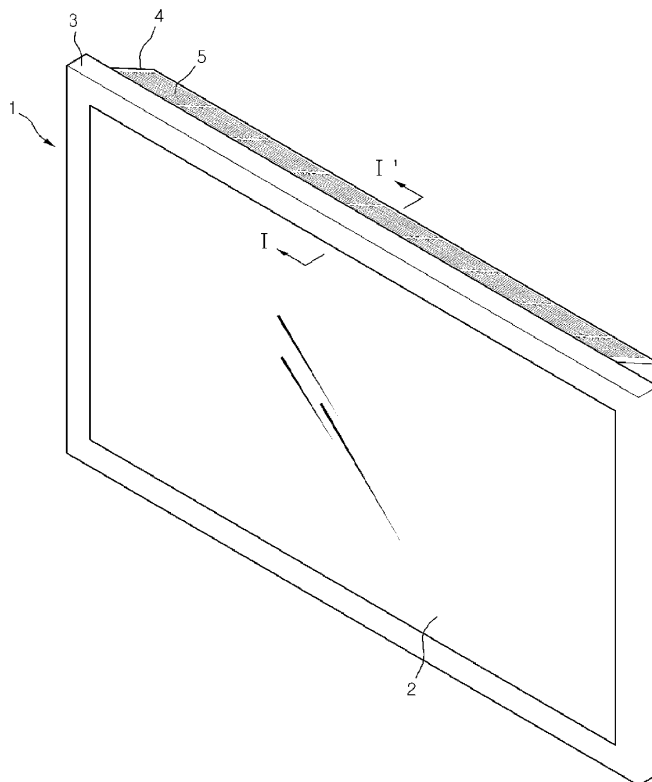
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3 : 프론트 커버 4 : 백 커버

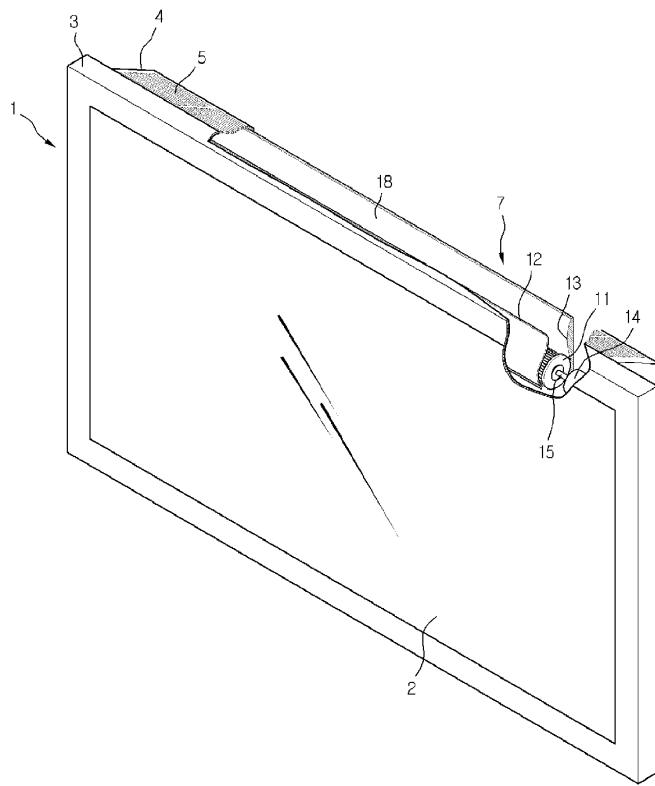
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도면

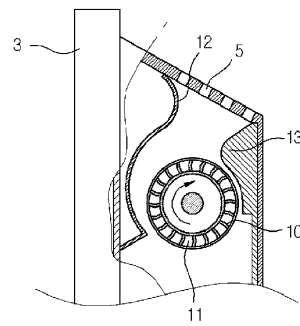
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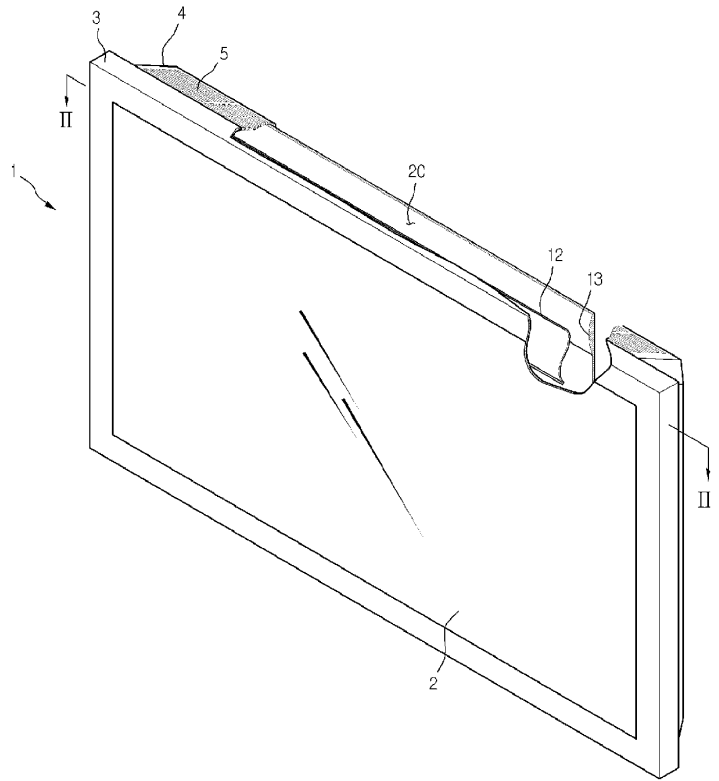
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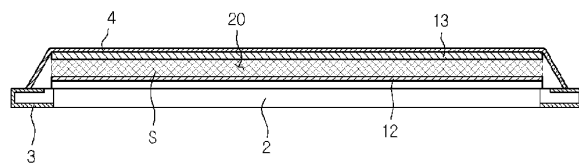
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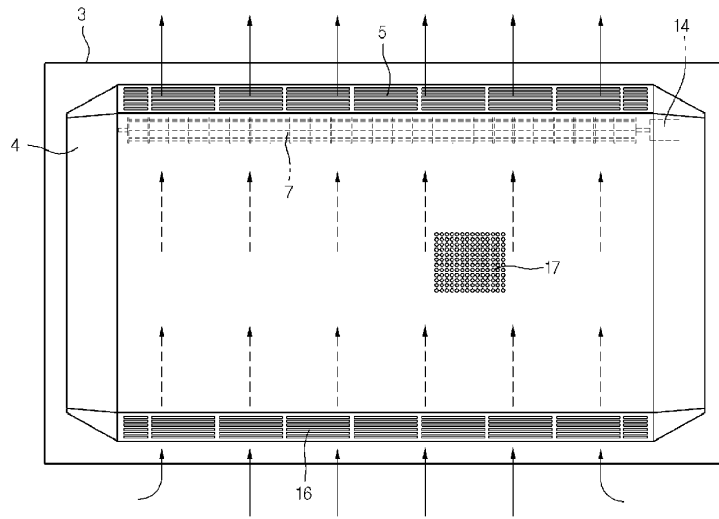
도면4



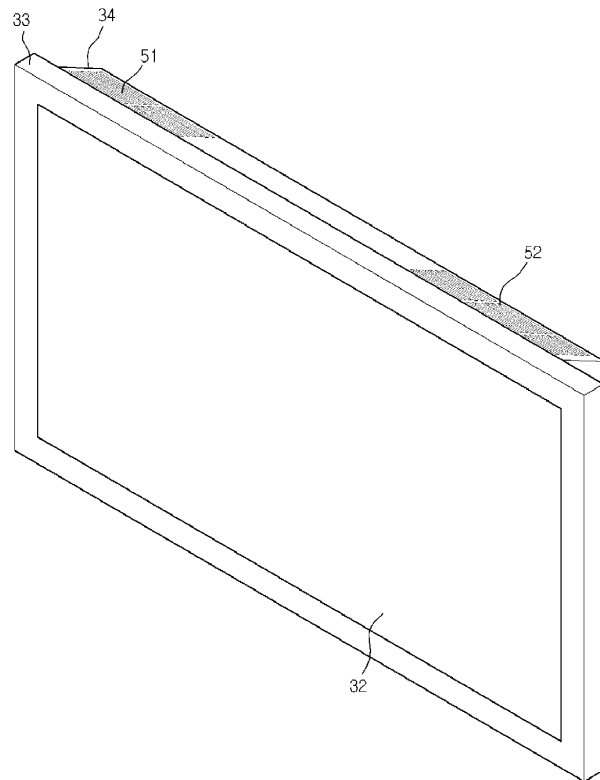
도면5



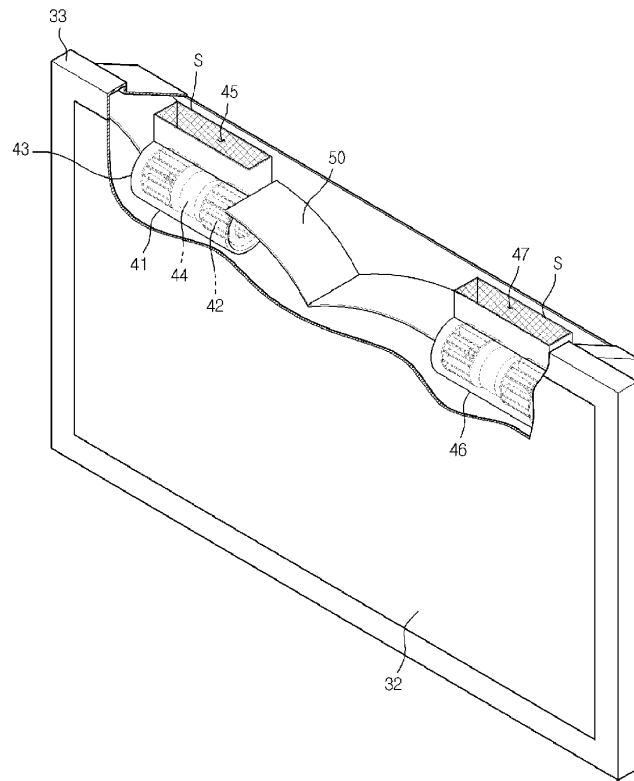
도면6



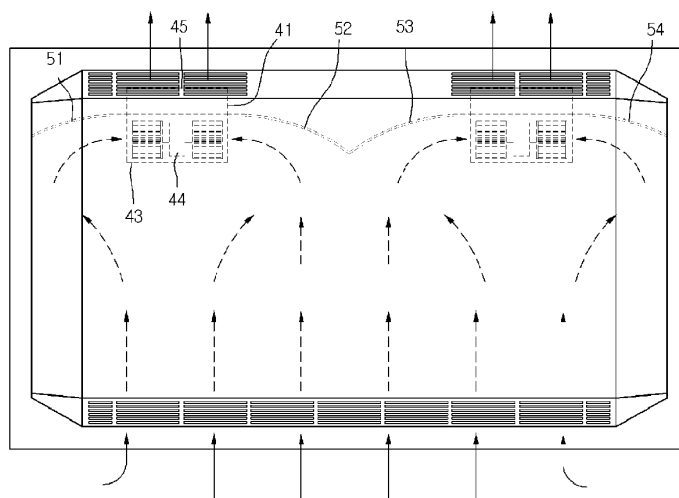
도면7



도면8



도면9





KOREAN PATENT ABSTRACTS

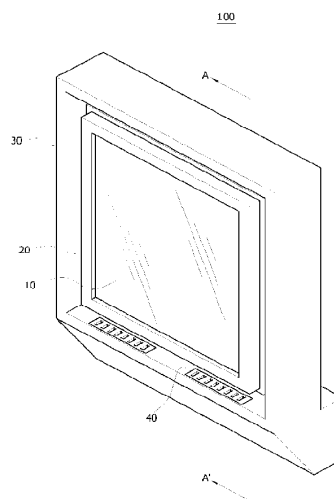
(11) Publication number: **1020070070675 A**(43) Date of publication of application: **04.07.2007**(21) Application number: **1020050133483**(71) Applicant: **NAUTILUS HYOSUNG INC.**(22) Date of filing: **29.12.2005**(72) Inventor: **CHOI, CHANG WOO
LEE, CHEUL YONG**(51) Int. Cl: **G02F 1/13 (2006.01);**(54) **LCD COOLING MODULE AND AN AUTOMATIC TELLER MACHINE USING THE SAME, PARTICULARLY FOR PREVENTING DETERIORATION OF AN LCD**

(57) Abstract:

PURPOSE: An LCD cooling module, and an automatic teller machine using the same are provided to minimize a failure of an LCD by preventing deterioration of the LCD by cooling the LCD, thereby improving the management efficiency of the automatic teller machine.

CONSTITUTION: An LCD(10) displays image information. An LCD housing(30) is formed in a box shape with an open front for forming a containing space inside, wherein the LCD is embedded in the containing space with a front of the LCD exposed. An intake fan is installed at the LCD housing for cooling the LCD. The intake fan inhales air at a rear of the LCD housing and sends air to the containing space of the LCD housing.

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System for cooling an electronic image assembly

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(54) Title: SYSTEM FOR COOLING AN ELECTRONIC IMAGE ASSEMBLY

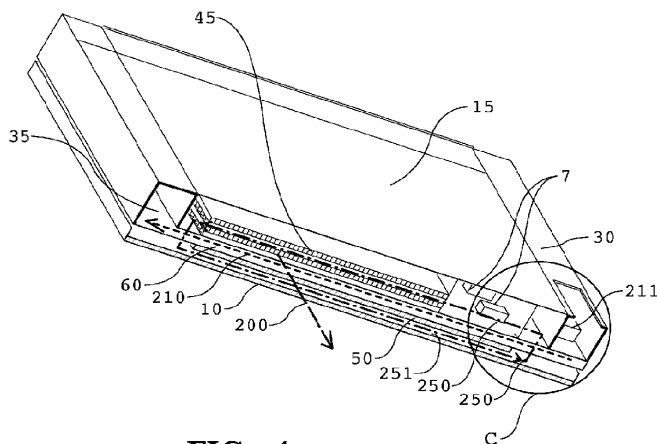


FIG - 4

(57) Abstract: A system for cooling an electronic image assembly. One embodiment of the system contains a plurality of channels placed behind the electronic image assembly and preferably in conductive thermal communication with the image assembly. Ambient gas is ingested into the display housing and directed to a manifold which distributes the ambient gas to the plurality of channels. Another embodiment of the system uses a heat exchanger with an internal fan assembly. Circulating gas may also be used to cool a front portion of the electronic image assembly or any other internal cavity of the electronic display housing. The circulating gas may be drawn through a heat exchanger so that heat may be transferred to an ambient gas. The heat exchanger may have an internal fan assembly for drawing ambient air through the heat exchanger and exhausting it out of the display housing.

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SYSTEM FOR COOLING AN ELECTRONIC IMAGE ASSEMBLY

Inventors: Tim Hubbard and William Dunn

Technical Field

[0001] Exemplary embodiments generally relate to cooling systems and in particular to cooling systems for electronic displays.

Background of the Art

[0002] Improvements to electronic displays now allow them to be used in outdoor environments for informational, advertising, or entertainment purposes. While displays of the past were primarily designed for operation near room temperature, it is now desirable to have displays which are capable of withstanding large surrounding environmental temperature variations. For example, some displays are capable of operating at temperatures as low as -22F and as high as 113 F or higher. When surrounding temperatures rise, the cooling of the internal display components can become even more difficult.

[0003] Additionally, modern displays have become extremely bright, with some backlights producing 1,000-2,000 nits or more. Sometimes, these illumination levels are necessary because the display is being used outdoors, or in other relatively bright areas where the display illumination must compete with other ambient light. In order to produce this level of brightness, illumination devices and electronic displays may produce a relatively large amount of heat.

[0004] Still further, in some situations radiative heat transfer from the sun through a front display surface can also become a source of heat. In some locations 800-1400 Watts/m² or more through such a front display surface is common. Furthermore, the market is demanding larger screen sizes for displays. With increased electronic display screen size and corresponding front display surfaces, more heat will be generated and more heat will be transmitted into the displays.

[0005] Exemplary modern displays have found some effective means for cooling the displays including circulating a closed loop of gas around the display and drawing ambient gas through the display so that the closed loop of gas may be cooled (as well

as portions of the electronic display). Various thermal communications have been discovered which can transfer heat away from the sensitive electronic components and out of the display. Heat exchangers were found to produce an excellent means for transferring heat between the closed loop of gas and the ambient gas. However, previous designs for moving the gas through the display have been found to generate an undesirable amount of noise emission from the display as well as thermal gradients where portions of the display were cooled but others remained warm.

[0006] When using LCD displays, it was found that backlights were often a source of heat and it was desirable to move gas across the rear surface of the backlight in order to cool it. While desirable, it was thought that the front surface of the backlight could not be cooled for fear that the backlight cavity would become contaminated with dust, dirt, or other particulate.

Summary of the Exemplary Embodiments

[0007] Exemplary embodiments use a combination of circulating gas and ambient gas in order to adequately cool an electronic display. Circulating gas may be used to remove heat from the front of the image assembly. When using a LCD as the electronic image assembly, circulating gas may also be used to remove heat from the backlight cavity of the LCD. Because the gas is only circulating within the display, it can remain free of particulate and contaminants and will not harm the display.

[0008] Ambient gas may be ingested into the display in order to cool the circulating gas. The ambient gas and the circulating gas may be drawn through a heat exchanger which will allow the heat to transfer from the circulating gas to the ambient gas, preferably without letting the ambient and circulating gases mix with one another. An exemplary embodiment would use a cross-flow heat exchanger. An additional flow of ambient gas can be drawn across the rear surface of the image assembly to remove heat from the rear portion of the image assembly. When using a LCD as the electronic image assembly, this additional flow of ambient gas can be used to remove heat from the rear portion of the backlight for the LCD.

[0009] In order to reduce noise emissions, the fans which drive the ambient and/or circulating gas through the heat exchanger may be placed within the heat exchanger,

which can then act as a muffler and reduce the noise emitted by the fans. Further, if using the additional ambient gas pathway behind the image assembly, a manifold may be used to collect the ambient gas along an edge of the display and distribute this into a number of smaller flows. The fans for driving this additional ambient gas pathway can be placed within the manifold in order to reduce the noise emitted by the fans and provide an even distribution of ambient gas across the display.

[0010] It has been found that ingesting ambient gas from the top or bottom edge of the display is preferable as these edges are not typically observable to the viewer. However, when ingesting ambient gas from the top or bottom of a portrait-oriented display, it has been found that as the cool ambient gas travels across the rear portion of the electronic image assembly and accepts heat it increases in temperature. Once the cooling air reaches the opposite edge (either top or bottom), it may have increased in temperature substantially and may no longer provide adequate cooling to the opposing portion of the display. Thus, the manifolds herein allow for cool ambient air to adequately cool the entire electronic image assembly in an even manner and reduce any 'hot spots' within the electronic image assembly.

[0011] The foregoing and other features and advantages will be apparent from the following more detailed description of the particular embodiments of the invention, as illustrated in the accompanying drawings.

Brief Description of the Drawings

[0012] A better understanding of an exemplary embodiment will be obtained from a reading of the following detailed description and the accompanying drawings wherein identical reference characters refer to identical parts and in which:

[0013] FIGURE 1A provides a front perspective view of an exemplary embodiment of the electronic display.

[0014] FIGURE 1B provides a rear perspective view of an exemplary embodiment of the electronic display.

[0015] FIGURE 2 provides a rear perspective view similar to that shown in Figure 1B where the rear cover has been removed.

[0016] FIGURE 3 provides a perspective sectional view along the A-A section line shown in Figure 1B.

[0017] FIGURE 4 provides a perspective sectional view along the B-B section line shown in Figure 1B.

[0018] FIGURE 5 provides a perspective sectional view of insert C shown in Figure 4.

[0019] FIGURE 6 provides a perspective sectional view of one embodiment of the cross through plate.

[0020] FIGURE 7 provides an exploded perspective view of one exemplary embodiment of the heat exchanger and fan assembly.

[0021] FIGURE 8 provides a perspective sectional view of another embodiment which uses a flow of circulating gas through the backlight cavity of a liquid crystal display (LCD).

[0022] FIGURE 9 provides a perspective sectional view of an exemplary embodiment which uses a flow of circulating gas through the backlight cavity in addition to the flow of circulating gas between the LCD and front plate.

Detailed Description

[0023] The invention is described more fully hereinafter with reference to the accompanying drawings, in which exemplary embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the exemplary embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. In the drawings, the size and relative sizes of layers and regions may be exaggerated for clarity.

[0024] It will be understood that when an element or layer is referred to as being "on" another element or layer, the element or layer can be directly on another element or layer or intervening elements or layers. In contrast, when an element is referred to as being "directly on" another element or layer, there are no intervening elements or layers present. Like numbers refer to like elements throughout. As used herein, the term "and/or" includes any and all combinations of one or more of the associated listed items.

[0025] It will be understood that, although the terms first, second, third, etc., may be used herein to describe various elements, components, regions, layers and/or sections, these elements, components, regions, layers and/or sections should not be limited by these terms. These terms are only used to distinguish one element, component, region, layer or section from another region, layer or section. Thus, a first element, component, region, layer or section discussed below could be termed a second element, component, region, layer or section without departing from the teachings of the present invention.

[0026] Spatially relative terms, such as "lower", "upper" and the like, may be used herein for ease of description to describe the relationship of one element or feature to another element(s) or feature(s) as illustrated in the figures. It will be understood that the spatially relative terms are intended to encompass different orientations of the device in use or operation, in addition to the orientation depicted in the figures. For example, if the device in the figures is turned over, elements described as "lower" relative to other elements or features would then be oriented "upper" relative the other elements or features. Thus, the exemplary term "lower" can encompass both an orientation of above and below. The device may be otherwise oriented (rotated 90 degrees or at other orientations) and the spatially relative descriptors used herein interpreted accordingly.

[0027] The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the invention. As used herein, the singular forms "a", "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "comprises" and/or "comprising," when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof.

[0028] Embodiments of the invention are described herein with reference to cross-section illustrations that are schematic illustrations of idealized embodiments (and intermediate structures) of the invention. As such, variations from the shapes of the illustrations as a result, for example, of manufacturing techniques and/or tolerances, are

to be expected. Thus, embodiments of the invention should not be construed as limited to the particular shapes of regions illustrated herein but are to include deviations in shapes that result, for example, from manufacturing.

[0029] For example, an implanted region illustrated as a rectangle will, typically, have rounded or curved features and/or a gradient of implant concentration at its edges rather than a binary change from implanted to non-implanted region. Likewise, a buried region formed by implantation may result in some implantation in the region between the buried region and the surface through which the implantation takes place. Thus, the regions illustrated in the figures are schematic in nature and their shapes are not intended to illustrate the actual shape of a region of a device and are not intended to limit the scope of the invention.

[0030] Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. It will be further understood that terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.

[0031] FIGURE 1A provides a front perspective view of an exemplary embodiment of the electronic display 100. A transparent front plate 10 is placed on the front portion of the display to protect the internal components and allow the images produced by the display 100 to be seen. Some embodiments may use glass as the transparent front plate 10. Exemplary embodiments may use two pieces of glass laminated with index-matching optical adhesive. Some front plates 10 may provide other utility such as anti-reflection or polarizing functions. An inlet aperture 24 and exit aperture 25 may be provided in the housing so that the display 100 can accept ambient gas for cooling the display 100.

[0032] FIGURE 1B provides a rear perspective view of an exemplary embodiment of the electronic display 100. A rear cover 15 may be used to provide access to the internal components of the display 100.

[0033] **FIGURE 2** provides a rear perspective view similar to that shown in Figure 1B where the rear cover 15 has been removed. Ambient gas 200 may be ingested into the display through the inlet aperture 24 and pass through a heat exchanger 45 and exit the display through the exit aperture 25. The ambient gas 200 may be drawn into the display and forced through the heat exchanger 45 using heat exchanger fan assembly 46. An exemplary placement for the heat exchanger fan assembly 46 is discussed further below, but in many embodiments the fan assembly 46 can be placed near the inlet aperture 24 and/or exit aperture 25 and may or may not be placed within the heat exchanger 45 (as shown in Figure 2).

[0034] Optionally, ambient gas 210 may also be ingested into the display through inlet aperture 24 (or a separate inlet aperture). Ambient gas 210 may then be directed through a first manifold 30 which travels along the edge of the display. The first manifold 30 accepts the single larger inlet flow of ambient gas 210 and distributes it into a plurality of smaller flows (channels 60) across the display. A second manifold 35 may be placed along the opposite edge of the display as the first manifold 30. The second manifold 35 accepts the plurality of smaller flows (channels 60) and combines them into a single flow and exhausts it out of the exit aperture 25 (or a separate exit aperture). In this embodiment, a manifold fan assembly 211 is used to draw the ambient gas 210 into the inlet aperture 24 and force the ambient gas 210 across the display. For this particular embodiment, the manifold fan assembly 211 is placed within the first manifold 30 and is used to draw the ambient gas 210 into the display as well as distribute the single flow into a plurality of smaller flows (channels 60). This is not required however, as some embodiments may place the manifold fan assembly 211 in the second manifold 35, or within both the first and second manifolds 30 and 35.

[0035] The first and second manifolds 30 and 35 may be placed along any opposing edges of the display. However, it is preferable that the first and second manifolds 30 and 35 are placed along the vertical edges of the display with the channels 60 travelling horizontally. Other embodiments may place the first and second manifolds 30 and 35 along the horizontal edges of the display with the channels 60 travelling vertically.

[0036] While both flows of ambient gas may be used in an exemplary embodiment, there is no requirement that they are both used. Some embodiments may use only

ambient gas 200 or ambient gas 210. Also, if using both flows of ambient gas 200 and ambient gas 210 there is no requirement that they share the same inlet and exit apertures. Thus, there may be separate inlet and exit apertures for the two flows of ambient gas.

[0037] **FIGURE 3** provides a perspective sectional view along the A-A section line shown in Figure 1B. Again, ambient gas 200 may be ingested into the display through the inlet aperture 24 and pass through a heat exchanger 45 and exit the display through the exit aperture 25. The ambient gas 200 may be drawn into the display and forced through the heat exchanger 45 using heat exchanger fan assembly 46. Obviously, the inlet aperture 24 may contain a filter or other coverings so that contaminants, insects, garbage, and/or water/fluids cannot easily be ingested into the display. However, an exemplary embodiment would not be damaged if the ambient gas 200 contained contaminants as they would only pass through the heat exchanger 45 which may not be susceptible to damage from particulate or contaminants. Exit aperture 25 may also contain some type of covering to ensure that contaminants and/or insects could not enter the display.

[0038] An electronic image assembly 50 may be placed behind the front plate 10. A plurality of channels 60 may be placed behind the electronic image assembly 50. Ambient gas 210 may be forced through the channels 60 after travelling through the first manifold 30 (not shown here). The flow of ambient gas 210 behind the electronic image assembly 50 may be used to remove any buildup of heat from the rear portion of the electronic image assembly 50. It may be preferable to have a thermally conductive surface/plate on the rear portion of the electronic image assembly 50 so that heat can easily transfer to this surface/plate and be removed by the ambient gas 210.

[0039] The channels 60 can take on any number of forms. Although shown in this embodiment with a square cross-section this is not required. Other embodiments may contain channels 60 with I-beam cross-sections, hollow square cross-sections, hollow rectangular cross-section, solid rectangular or solid square cross-sections, 'T' cross-sections, 'Z' cross-sections, a honeycomb cross-section, or any combination or mixture of these. The channels 60 are preferably thermally conductive and also preferably in thermal communication with the electronic image assembly 50. Thus, in a preferred