

動部106は、気化された冷媒が所定の方向（すなわち、前記冷媒保存部102の逆方向）に移動できるように、複数のガイド118を備えうる。前記ガイド118は、前記相変化冷却器112の機械的な強度を上昇させる機能も有する。従って、機械的な強度に問題がない場合には、前記ガイド118を備えなくても良い。

【0026】

次いで、前記凝縮部108は、前記気状冷媒移動部106を介して移動してきた気状の冷媒が、再び凝縮されて液化される領域である。本実施形態によれば、前記凝縮部108は、前記蒸発部104と同じ平面上で、所定距離離れた位置に二段に分岐された環状に形成されている。図示するように、前記凝縮部108を前記分岐部に配置して二段に分岐させることにより、その間にファン120を設置することができる。設置された前記ファン120を回転させて前記凝縮部108の外気を所定方向に送風させれば、前記凝縮部108に到達した気状の冷媒が有する熱を容易に外部に放出させることができ、従って、冷媒は、凝縮されて液化される。

【0027】

本実施形態では、前記凝縮部108が形成された領域を二段に分岐させて全体的に環状に形成したが、分岐部のそれぞれを直線状に形成するか、または“ㄣ”字状に形成して、全体的にひし形に形成することも出来る（図13を参照）。このように形成された分岐部の間に前記ファン120を設置することにより、熱放出効率を向上させ得る構造を達成できる。

【0028】

一方、前記凝縮部108は、前記蒸発部104に形成された微細チャンネルと類似した複数の微細チャンネル（図示せず）を備えうる。このような凝縮部108の微細チャンネルは、後述するように、前記液状冷媒移動部110にも延びて形成され、更に、前記蒸発部側の液状冷媒移動部102にも延びて形成されうる。このような凝縮部108の微細チャンネルは、気状冷媒の凝縮を更に容易にし、凝縮された液状の冷媒が前記蒸発部側の液状冷媒移動部102の方向に移動させる表面張力を提供することにより、冷媒循環ループの完成を促進する。

【0029】

前記凝縮部108の微細チャンネルの深さは、前記蒸発部104の微細チャンネルより深く形成されることが好ましいが、これに限定されるものではない。その外にも、断面の形状や、断面積の変化、グループやノードの形成などに関して、前記蒸発部104の微細チャンネルに関するあらゆる事項が、前記凝縮部108の微細チャンネルにも同一に適用されうるため、その詳細な説明を省略する。

【0030】

また、熱放出の効果を更に向上させるために、前記凝縮部108の外部の相変化冷却器112に複数のフィン形成することもできる（図4ないし図6を参照）。前記フィンは、前記凝縮部108の外部に放射状に形成されるか、または、その他の所定の形状に形成されうる。このようなフィンの中に、前記ファン120によって送風される周りの空気が接触することにより、放熱効果を極大化させうる。また、後述するように、本発明の実施形態によっては、複数の相変化冷却器112を積層して使用することもできるが、この場合には、積層された相変化冷却器112の間にフィンを配置して、フィン内部での温度分布を均一にすることにより、冷却性能を更に向上させうる。

【0031】

更に、前記フィンがマイクロアクチュエータを備えるように形成される場合には、前記凝縮部108から外部に放出される熱を再活用して、周りの空気を循環させるように駆動させることもできる。また、前記フィンが熱電素子を備える微細構造に形成された場合には、前記凝縮部108から放出される熱を電氣的エネルギーに変換させて、微細駆動のためのエネルギーとして使用することもできる。

【0032】

更に、前記凝縮部108の体積を前記蒸発部104の体積より大きく形成することによ

り、広くなる表面的による追加的凝縮効果を達成することもできる。

【0033】

次いで、前記液状冷媒移動部110は、前記凝縮部108の外周側に形成されて、前記凝縮部108で凝縮された液状の冷媒が、前記蒸発部側の液状冷媒移動部102に移動する通路を形成する。図示するように、前記液状冷媒移動部110は、前記断熱部116によって前記気状冷媒移動部106、前記凝縮部108及び蒸発部104から断熱されて区分される。

【0034】

前記断熱部116は、前記相変化冷却器112内の所定位置に形成された内部隔壁の形態に構成するか、または、前記相変化冷却器112内の所定位置に密封された別途の内部空間の形態、または前記相変化冷却器112の上下を貫通するように開放されている形態に構成される。前記相変化冷却器112内に密封された内部空間の形態に形成される場合、前記断熱部116は、真空状態を維持するか、または空気などの断熱物質で満たされることもある。

【0035】

図示するように、前記液状冷媒移動部110は、前記相変化冷却器112の両側外周に沿って対称されるように形成することが好ましい。このような相変化冷却器112の外周に沿って対称的に形成される冷媒循環ループは、薄板の形態、すなわち、断面の縦横比の大きい場合、周りへの熱放出に非常に有利な構造であって、熱源から伝えられた熱を放射方向に拡散させることにより、広い面積を活用して周りへ放出させうる。

【0036】

また、このような両方向の冷媒循環ループは、前記冷却装置100の設置位置により重力の影響を受けて、何れか一方の液状冷媒移動部110での冷媒循環が円滑でない場合にも、他方の液状冷媒移動部110を介して冷媒を循環させうるといふ長所を有する。

【0037】

もちろん、前記のように、前記液状冷媒移動部110も、重力の影響をほとんど受けないための微細チャンネルを備えることができ、その微細チャンネル内には、前記冷媒保存部102に向う方向に複数のグルーブ（図示せず）を形成するなどの方法を使用できる。

【0038】

一方、前記蒸発部側の液状冷媒移動部102と前記液状冷媒移動部110との境界部分、及び前記凝縮部108と前記液状冷媒移動部110との境界部分に、液状冷媒の移動方向を規定するための複数のガイド（図示せず）を形成して、冷媒の流路が急激に旋回することにより発生する冷媒循環の抵抗を減少させることも可能である。

【0039】

以下、図3を参照すれば、図3は、図2のハイブリッド型の冷却装置100の分解斜視図である。図示するように、前記相変化冷却器112は、基板112a及び上板112bを備える。前記基板112a上に、図2を参照して前記の構造を後述する方法で形成し、外形が同じく形成された上板112bを接着させることが好ましい。実施形態によっては、上板112bの内部にも前記基板112aと同じ構造を形成できるということも言うまでもない。

【0040】

以下では、図4ないし図6を参照して本発明の他の実施形態に関して詳細に説明する。

【0041】

まず、図4Aは、本発明の第2実施形態によるハイブリッド型の冷却装置200の斜視図であり、図4Bは、図4Aのハイブリッド型の冷却装置200の凝縮部部分の拡大斜視図である。図示するように、本実施形態では、複数の相変化冷却器100a、100b及び100cが、上下複数層に配列される。外部の熱源からの熱は、例えば、図面の太い矢印の方向にそれぞれの相変化冷却器100a、100b及び100cの蒸発部に該当する領域に伝えられる。このために、前記相変化冷却器100a、100b及び100cの間に熱伝達物質を充填させることもできる。

【0042】

また、本実施形態では、各相変化冷却器100a、100b及び100cの凝縮部に対応する外側に、放射状に複数のフィン202を形成し、その中央空間にファン120が配置される。これにより、既存のヒートパイプモジュールとは違って、フィン内部での温度分布を均一に維持して冷却性能を極大化させうる。このような複数層構造のハイブリッド型の冷却装置200により、外部熱源の冷却効率を飛躍的に向上させうる。

【0043】

次いで、図5Aは、本発明の第3実施形態によるハイブリッド型の冷却装置220の斜視図であり、図5Bは、図5Aのハイブリッド型の冷却装置220の側面図である。図示するように、本実施形態による冷却装置220は、図4Aに示す実施形態の相変化冷却器100a、100b及び100c等の冷媒保存部及び蒸発部を備える部分を相互接合させて形成したものである。凝縮部を備える部分は、ファン120による送風の効果を極大化させるために、接合せずに分離させ、最下層及び中間層の相変化冷却器の側面構造は、それにより多少変形された。

【0044】

一方、本実施形態において、前記三層の相変化冷却器のそれぞれに属する蒸発部側の液状冷媒移動部及び蒸発部が相互独立的に形成される代わりに、相互共有されることも可能である。この場合には、蒸発部または気状冷媒移動部の所定位置から上下に分岐が形成される構造に形成される。蒸発部が共有される場合、蒸発部と気体移動部との間に各層の相変化冷却器に通じる流路（図示せず）が形成されて、蒸発部で気化された気体が各層に分岐されて移動する。

【0045】

次いで、図6Aは、本発明の第4実施形態によるハイブリッド型の冷却装置230の斜視図であり、図6Bは、図6Aのハイブリッド型の冷却装置230の側面図である。本実施形態では、図5Aに示す実施形態でのフィンのサイズを、最上層及び最下層の相変化冷却器の外側を外れないように調整した。このようにすることにより、冷却装置230の設置が容易になる。

【0046】

以上で説明した本発明の各実施形態のハイブリッド型の冷却装置を製作する方法は、現在公知された方法により製作されうるが、例えば、既に公知されたMIM（Metal Injection Molding）法や、半導体素子の製造工程を応用したMEMS（Micro Electro Mechanical System）法や、SAM（Self Assembled Monolayer）法を応用して製作できる。

【0047】

前記MIM方法によって製作する場合には、まず、前記相変化冷却器112の形状の陰刻された上下モールドを形成し、このモールドにそれぞれバインダとしてポリマーや金属粉末が混ざった溶融体をモールドに注入して成形し、成形物をモールドから分離させた後、溶剤及び熱処理でバインダを除去して、最終的に上下板をブレージングなどの金属接合技術を使用して接合する。

【0048】

あるいは、図2及び図3を参照して、半導体物質で製造する場合の具体的な製作方法の例を簡単に説明すれば、まず、相変化冷却器112の基板112aの表面をエッチングして蒸発部104及びその微細チャンネル、気状冷媒移動部106、凝縮部108及び液状冷媒移動部102、110などを形成する。その後、前記基板112aに対応して一定のパターンの形状が形成された上板112bを形成し、これらを互いに接着する。これらの接着方法の例としては、両者を相互接触させた後、両者に電圧を印加して陰極ボンディングを行える。次いで、前記蒸発部側の液状冷媒移動部102に隣接した相変化冷却器112の所定位置に形成された冷媒注入孔（図示せず）を通じて、真空状態で所定量の冷媒を注入し、前記冷媒注入孔を密封する。

【0049】

次いで、図7を参照すれば、図7は、本発明の第5実施形態に係るハイブリッド型の冷却装置700の平面断面図である。図示するように、本実施形態による冷却装置700の相変化冷却器712は、その分岐部の終端（点線で表示された部分）が相互連結されて、全体的に一つの閉環形状に形成されている。この場合にも、前記冷媒の循環ループは、図2を参照して前記の通りであり、その冷却原理及び効果も同じである。従って、それらの詳細に関しては、これを省略する。

【0050】

図7では、本実施形態の相変化冷却器712が、前記第1実施形態による相変化冷却器112に含まれたガイド118を備えていないと図示されているが、前記ガイド118は、その設計上の選択によって備えられてもよく、備えられていなくてもよいことは前記の通りである。

【0051】

次いで、図8を参照すれば、図8は、本発明の第6実施形態によるハイブリッド型の冷却装置800の平面断面図である。図示するように、本実施形態による冷却装置800において、外部熱源（図示せず）からの熱を吸収して、液状の冷媒を気化させる蒸発部104が相変化冷却器812の中央の付近に形成されて、分岐部に隣接するように配置されている。

【0052】

本実施形態によれば、気状の冷媒を凝縮させて液化させる凝縮部108と、凝縮されて液化された冷媒が、再び前記蒸発部104に向かって移動する液状冷媒移動部110とが前記分岐部を構成する。それにより、前記蒸発部104が、前記気状冷媒移動部106と前記分岐部との間に配置される。このような構造により、前記蒸発部104から気化された冷媒は、前記分岐部の反対側に移動し、次いで、ハウジングの外周に沿って前記分岐部まで到達する。前記分岐部の中空にはファン120が設置されて、周りの空気を循環させ、従って、分岐部に到達した気状の冷媒は、凝縮されて液化される。従って、本実施形態では、図示するように、気状冷媒が凝縮される凝縮部108が前記分岐部の外周側に形成される。

【0053】

特に、図示するように、本実施形態においては、前記蒸発部104と前記液状冷媒移動部110とを断熱させる断熱部を別途に形成せずとも、冷媒の循環には問題ない。すなわち、前記気状冷媒移動部106から流出された気状の冷媒は、結局、分岐部の分岐部に到達し、ここで、前記ファン120によって循環される空気により熱を奪われて凝縮される。

【0054】

次いで、液化された冷媒は、前記分岐部の外周に形成された凝縮部108及びその内周に形成された液状冷媒移動部110に沿って移動して、再び前記蒸発部104に帰還する。前記凝縮部108及び液状冷媒移動部110は、隔壁810によって区分されている。前記隔壁810は、設計上の選択によって断熱部の役割も行える。

【0055】

前記蒸発部104の分岐部側には、前記ファン120によって循環される周りの空気が持続的に接触するため、外部の熱源自体を直接冷却させる効果も達成される。

【0056】

本実施形態においても、前記分岐部の終端を相互間に連結する構造を有しうることには言うまでもない。また、本実施形態の相変化冷却器812にも、前記第1実施形態による相変化冷却器112の気状冷媒移動部106に備えられたガイド118が備えられていないと図示されているが、その設計上の選択により前記ガイド118を備えてもよく、備えなくてもよい。

【0057】

次いで、図9を参照すれば、図9は、本発明の第7実施形態によるハイブリッド型の冷却装置の平面断面図である。図示するように、本実施形態による冷却装置900の相変化冷

却器 9 1 2 は、分岐部が閉鎖された環状に形成されるが、その内部の冷媒が対称的に形成された循環ループを循環する代わりに、非対称的に一方向のみに循環する構造を有する。

【0058】

すなわち、前記相変化冷却器 9 1 2 は、その内部の一端に形成された蒸発部 1 0 4 と、前記蒸発部 1 0 4 で気化された冷媒が所定方向に移動する気状冷媒移動部 1 0 6 と、前記気状の冷媒が一側に流入されて凝縮され、凝縮された液状の冷媒が所定方向に移動して他端に流出される部分であって、中央に空間を有する環状の分岐部 1 0 8 と、前記分岐部 1 0 8 の他端と隣接して形成されるが、前記液状の冷媒が前記蒸発部 1 0 4 に向って移動し続ける液状冷媒移動部 1 0 2 と、を備える。前記蒸発部 1 0 4 と気状冷媒移動部 1 0 6 は、隔壁 1 1 6 によって前記液状冷媒移動部 1 0 2 から分離されている。前記隔壁 1 1 6 は、断熱機能を有する断熱部として形成しても良い。

【0059】

本実施形態によれば、前記冷媒の循環ループが非対称型であるという点と、外部熱源からの熱を前記蒸発部 1 0 4 の領域に吸収させるために、前記熱源がハウジングの中心部から多少外れて蒸発部の下部に配置されるという点とを除いては、前記第 1 実施形態の冷却装置 1 0 0 についての前記のあらゆる説明が同じく適用されるため、その詳細な説明を省略する。

【0060】

次いで、図 1 0 を参照すれば、図 1 0 は、本発明の第 8 実施形態によるハイブリッド型の冷却装置の平衡面図である。図示するように、本実施形態による冷却装置 1 0 0 の相変化冷却器 1 0 1 2 は、第 7 実施形態による相変化冷却器 9 1 2 の冷媒循環ループと逆方向の冷媒循環ループを有する。

【0061】

すなわち、冷媒を気化させる蒸発部 1 0 4 を分岐部に隣接した領域に形成し、気化された冷媒が前記分岐部 1 0 8 の逆方向に移動するように形成することで、気化された冷媒は、気状冷媒移動部 1 0 6 を通って前記分岐部 1 0 8 の一側に流入される。流入された冷媒は、前記分岐部 1 0 8 の中空に形成されたファン 1 2 0 による空気の循環によって凝縮されて液化される。液化された冷媒は、前記分岐部 1 0 8 を通って再び前記蒸発部 1 0 4 に流入される。

【0062】

本実施形態の場合にも、図 8 を参照して前記したように、前記蒸発部 1 0 4 が前記ファン 1 2 0 に近くに配置されるため、前記ファン 1 2 0 によって循環される周辺空気が、外部熱源自体を冷却させる効果も達成できる。また、前記外部熱源は、前記蒸発部 1 0 4 の下部に配置されることが好ましい。

【0063】

次いで、図 1 1 を参照すれば、図 1 1 は、本発明の第 9 実施形態によるハイブリッド型の冷却装置の平衡面図である。図示するように、本実施形態による冷却装置 1 1 0 0 は、それぞれの一端が所定の角度に曲がるように成形されて中空の分岐部の少なくとも一部を構成するように形成された一对の相変化冷却器 1 1 1 2 a、1 1 1 2 b を備える。本実施形態によれば、前記一对の相変化冷却器 1 1 1 2 a、1 1 1 2 b の曲がった部分が、設置時に分岐部を形成する。このように形成された分岐部の中空にも前記ファン 1 2 0 が設置される。

【0064】

図示するように、本実施形態による相変化冷却器 1 1 1 2 a、1 1 1 2 b のそれぞれは、ヒートパイプでありうる。この場合、一对のヒートパイプ 1 1 1 2 a 及び 1 1 1 2 b のそれぞれは、それ自体が相変化による冷却機能を保有しているため、外部の熱源からの熱を吸収して、これを放熱できる。しかし、本発明によれば、その一部、すなわち、凝縮が発生する部分（点線 1 0 8 で表示された部分）を所定角度に曲げて環状に成形し、その中央の空間にファン 1 2 0 を設置して、周りの空気を循環させることにより、従来のヒートパイプのそれぞれが有している放熱容量をはるかに超える放熱容量を具現できる。

【0065】

もちろん、前記一対の相変化冷却器1112a、1112bのそれぞれは、必ずしもヒートパイプである必要はない。この実施形態が図12Aに図示されている。図12Aは、本発明の第10実施形態によるハイブリッド型の冷却装置1200の平断面図である。本実施形態による冷却装置1200も、設置時に中央に空間を有する分岐部を構成する一対の相変化冷却器1212a、1212bと、前記一対の相変化冷却器1212a、1212bが構成する分岐部の中央空間に設置されたファン120と、を備える。しかし、本実施形態による前記相変化冷却器1212a、1212bのそれぞれは、その一側の端部の所定領域（本明細書では“一端”という）108、110が所定角度に曲がるように成形され、その内部に相変化する冷媒の循環ループが形成されるが、液状の冷媒が毛細管現象によって少なくとも一部に充填され、外部の熱源（図示せず）から伝えられた熱によって充填された液状の冷媒が気化される蒸発部104と、前記蒸発部104と隣接して形成されるが、気化された冷媒が前記一端108、110に向かって移動する気状冷媒移動部106と、少なくとも前記気状冷媒移動部106と隣接して形成されるが、前記一端の少なくとも一部を形成するように成形され、前記気状の冷媒が一側に流入されて凝縮される凝縮部108と、前記凝縮部108と隣接して形成されるが、前記一端の少なくとも一部を形成するように成形され、前記液状の冷媒が前記蒸発部104に向かって移動する液状冷媒移動部110及び前記蒸発部104と、前記液状冷媒移動部110の少なくとも一部を断熱させる断熱部106と、を備える構造を有する。

【0066】

一方、図12Bを参照すれば、図12Bは、本発明の第11実施形態によるハイブリッド型の冷却装置1200'の平断面図である。本実施形態では、図7に示す第5実施形態の場合のように、分岐部の終端が相互連結されている。この実施形態の場合にも、冷媒の循環は、前記第10実施形態の場合と同じである。

【0067】

従って、本実施形態による冷却装置1200、1200'は、図2及び図9に示す実施形態による冷却装置の長所を主に保有する。更に、本実施形態によれば、蒸発部が上下二つに分けられて形成されることにより、離れて設置された複数の熱源から伝えられる熱も放熱させようという長所を有する。また、前記第10実施形態及び第11実施形態による相変化冷却器のそれぞれの蒸発部を相互隣接した位置に形成させることにより、更に広い面積の熱源を放熱させることも可能である。もちろん、この場合には、蒸発部の位置変化により、他の内部構造の配置も対称的に変化する。

【0068】

一方、前記第10実施形態及び第11実施形態での蒸発部104を前記分岐部側に形成することにより、図8に示すような相変化冷却器800での効果を達成させることもできる。言い換えれば、この場合の冷却装置（図示せず）も、設置時に中央に空間を有する分岐部を構成する一対の相変化冷却器と、前記一対の相変化冷却器が構成する分岐部の中央の空間に設置されたファンと、を備える。しかし、この実施形態による前記相変化冷却器のそれぞれは、その一端が所定角度に曲がるように成形され、その内部に相変化する冷媒の循環ループが形成されるが、液状の冷媒が毛細管現象によって少なくとも一部に充填され、充填された液状の冷媒が外部の熱源から伝えられた熱によって気化される蒸発部と、前記蒸発部と隣接して形成されるが、気化された冷媒が前記曲がった一端の逆方向に向かって移動する気状冷媒移動部と、前記曲がった一端に隣接した領域に形成されるが、前記曲がった一端の少なくとも一部を形成するように成形され、前記気状の冷媒が一側に流入されて凝縮される凝縮部と、前記凝縮部と隣接して形成されるが、前記曲がった一端の少なくとも一部を形成するように成形され、前記液状の冷媒が前記蒸発部に向かって移動する液状冷媒移動部と、を備える。

【0069】

本実施形態によれば、図2及び図10に示す実施形態による冷却装置等の長所を主に保有する。更に、本実施形態によれば、蒸発部が上下二つに分けられて形成されることによ

り、離れて設置された複数の熱源から伝えられる熱も放熱させうるという長所を有する。また、前記実施形態による相変化冷却器のそれぞれの蒸発部を相互隣接した位置に形成させることにより、更に広い面積の熱源を放熱させることもできる。もちろん、この場合には、蒸発部の位置変化により他の内部構造の配置も対称的に変化する。

【0070】

前記図7ないし図12による冷却装置も、図2を参照して前記冷却装置100と同様に、複数の相変化冷却器を積層した構造に形成されうるとは言うまでもない。更に、前記分岐部には所定の形状を有する複数のフィンを設置して、冷却効率を上昇させ得る。

【0071】

また、前記相変化冷却器に備えられた凝縮部または液状冷媒移動部には、気状の冷媒がバブル状に備えられていてもよい。このようなバブルは、当然凝縮部の領域に更に多く備えられてもよく、図面では、これを区別するために、斜線領域と波線領域とで区分して示したが、その領域上の区分に限定されるものではないことは言うまでもない。

【0072】

また、前記凝縮部または液状冷媒移動部には、前記蒸発部に形成されたものと類似した微細チャンネルを形成して、凝縮された液状冷媒の移動を更に容易にすることもできる。

【0073】

次いで、図13Aないし図13Fを参照すれば、本発明による冷却装置の更に他の実施形態が示されている。図示するように、本発明による冷却装置の分岐部は、必ずしも円形の環状である必要はなく、直線状（図13Aまたは図13Dを参照）、終端が開放されたり閉鎖されたひし形（図13B、図13C、図13E及び図13Fを参照）に形成されることも可能である。従って、このような多様な分岐部の形状は、その設計的な選択事項に過ぎないため、本発明の技術的思想が分岐部の特定形状に限定されないことは言うまでもない。

【0074】

本発明は、以上の実施形態について詳細に説明したが、これに限定されるものではなく、当業者により多様に変形実施できることは言うまでもない。例えば、前記微細チャンネルを直線状に形成する実施形態を説明したが、これを曲線型に形成でき、前記断熱部116の形状も多様に形成でき、その寸法や形状も適切にデザインして使用できることは言うまでもない。

【産業上の利用可能性】

【0075】

本発明によれば、相変化時の潜熱による冷却と、送風及び対流による冷却とを併行できる。

【0076】

また、本発明によれば、各層のフィンとフィンとの間に複数の相変化冷却器を積層されるように配置して、フィンの冷却効率を極大化させて、既存の方式に比べて同じ面積のフィンを使用しても冷却性能を大きく向上させうる。

【0077】

また、本発明によれば、重力の影響に関係なく冷却性能を発揮できる小型のハイブリッド型の冷却装置を提供できる。

【0078】

また、本発明によれば、設置位置や場所に実質的な制限がない小型のハイブリッド型の冷却装置を提供できる。

【0079】

また、本発明によれば、蒸発部及び凝縮部の微細チャンネルが、その内部での表面張力を重力より大きくすれば、重力の影響をほとんど受けずに冷媒を自然循環させうるため、設置位置及び設置方法に制限がない。

【0080】

また、本発明によれば、断熱部により液状の冷媒移動部と気状の冷媒移動部とを熱的及

び物理的に分離させることにより、冷媒流動の安定性を図り、混入限界を抑制させることで冷媒の質量流量を増加させて、冷却効率を向上させた。

【0081】

また、本発明によれば、液状冷媒移動部を冷却装置の両側の外側に沿って配置し、両方向の循環ループより構成することにより、冷媒の過冷効果を上昇させ、重力水頭により一方の液状冷媒移動部への冷媒循環が行われない場合、反対側の液状冷媒移動部を冷媒の流動を円滑にして冷却効率が向上した。

【図面の簡単な説明】

【0082】

【図1】 通常のヒートパイプ型の冷却装置の一例を概略的に示す図面である。

【図2】 本発明の第1実施形態によるハイブリッド型の冷却装置の平断面図である。

【図3】 図2のハイブリッド型の冷却装置の分解斜視図である。

【図4A】 本発明の第2実施形態によるハイブリッド型の冷却装置の斜視図である。

【図4B】 図4Aのハイブリッド型の冷却装置の凝縮部部分の拡大斜視図である。

【図5A】 本発明の第3実施形態によるハイブリッド型の冷却装置の斜視図である。

【図5B】 図5Aのハイブリッド型の冷却装置の側面図である。

【図6A】 本発明の第4実施形態によるハイブリッド型の冷却装置の斜視図である。

【図6B】 図6Aのハイブリッド型の冷却装置の側面図である。

【図7】 本発明の第5実施形態によるハイブリッド型の冷却装置の平断面図である。

【図8】 本発明の第6実施形態によるハイブリッド型の冷却装置の平断面図である。

【図9】 本発明の第7実施形態によるハイブリッド型の冷却装置の平断面図である。

【図10】 本発明の第8実施形態によるハイブリッド型の冷却装置の平断面図である。

【図11】 本発明の第9実施形態によるハイブリッド型の冷却装置の平断面図である。

【図12A】 本発明の第10実施形態によるハイブリッド型の冷却装置の平断面図である。

【図12B】 本発明の第11実施形態によるハイブリッド型の冷却装置の平断面図である。

【図13A】 本発明のハイブリッド型の冷却装置の更に他の実施形態を示す平面図である。

【図13B】 本発明のハイブリッド型の冷却装置の更に他の実施形態を示す平面図である。

【図13C】 本発明のハイブリッド型の冷却装置の更に他の実施形態を示す平面図である。

【図13D】 本発明のハイブリッド型の冷却装置の更に他の実施形態を示す平面図である。

【図13E】 本発明のハイブリッド型の冷却装置の更に他の実施形態を示す平面図である。

【図13F】 本発明のハイブリッド型の冷却装置の更に他の実施形態を示す平面図である。

【符号の説明】

【0083】

100 ハイブリッド型の冷却装置

102 液状冷媒移動部

104 蒸発部

106 気状冷媒移動部

108 凝縮部

102、110 液状冷媒移動部

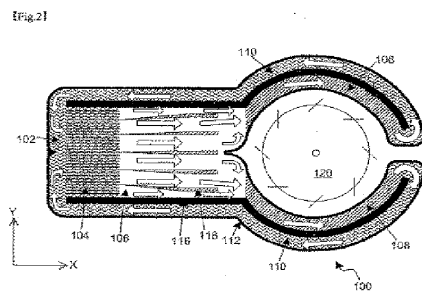
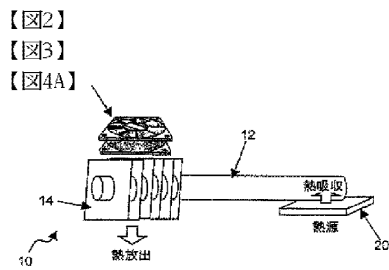
112 相変化冷却器

116 断熱部

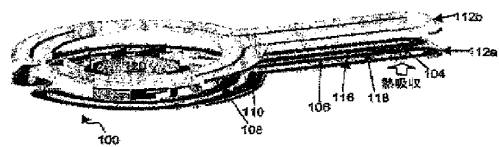
118 ガイド

120 ファン

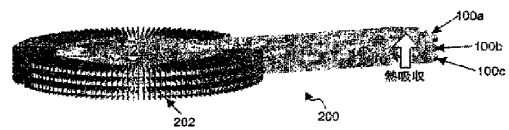
【図1】



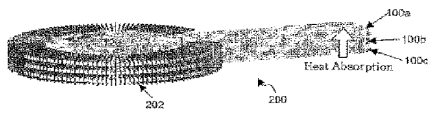
【Fig.3】



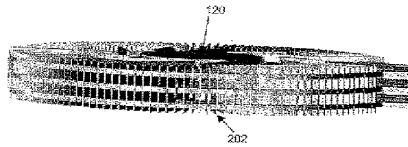
【Fig.4a】



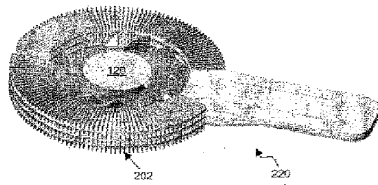
【Fig.4a】



【Fig.4b】



【Fig.5a】



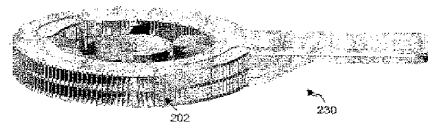
【Fig.5b】



【Fig.5b】



【Fig.6a】



【Fig.6b】

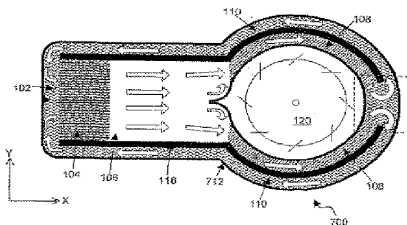


【Fig.5b】



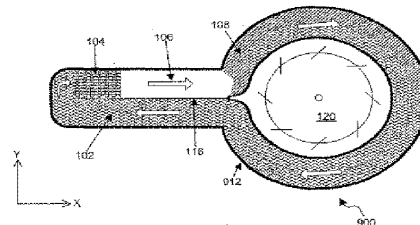
【図7】

【Fig.7】



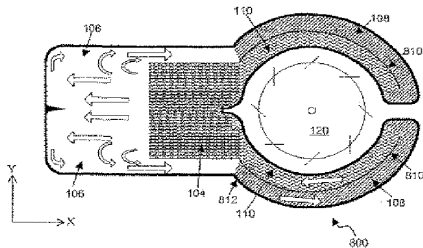
【図9】

【Fig.9】



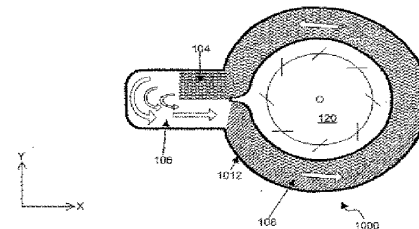
【図8】

【Fig.8】



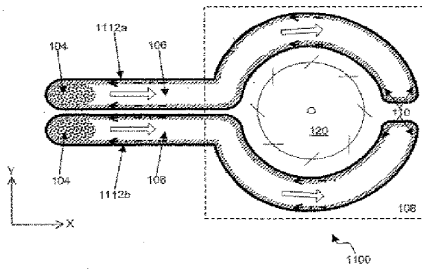
【図10】

【Fig.10】

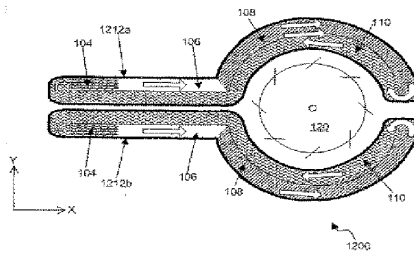


【図11】 【図11】

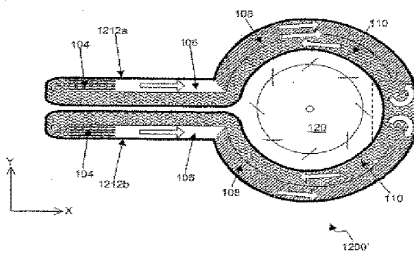
【Fig.11】



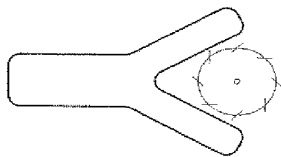
【Fig.12a】



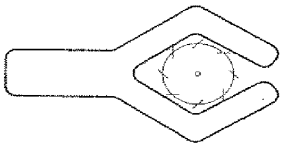
【Fig.12b】



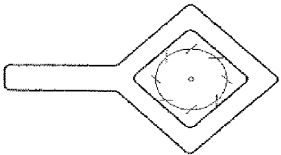
【Fig.13a】



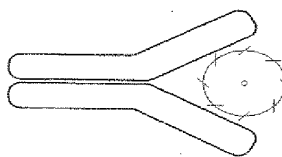
【Fig.13b】



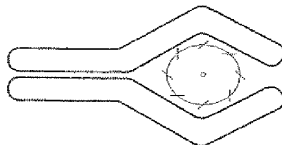
【Fig.13c】



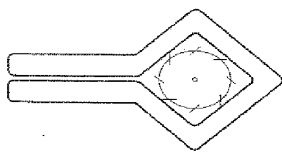
【Fig.13d】



【Fig.13e】



【Fig.13f】



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2003/002282

A. CLASSIFICATION OF SUBJECT MATTER		
IPC7 F25D 9/00		
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)		
IPC7 F25D		
Documentation searched other than minimum: documentation to the extent that such documents are included in the fields searched		
KR, JP : IPC as above		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 09-113058 A (Fuji electric Co. Ltd) 02 May 1997 See the whole document.	1 - 12
A	JP 11-063722 A (Daikin IND Ltd, Daikin plant kk) 05 May 1999 See the whole document.	1 - 12
A	JP 13-201233 A (Fujitsu general Ltd) 27 July 2001 See the whole document.	13 - 28
A	JP 07-318269 A (Mitsubishi cable ind Ltd) 8 December 1995 See the whole document.	13 - 28
A	JP 11-121816 A (Morikkasu kk. Seiko Seiki Co.Ltd) 30 April 1999 See the whole document.	13 - 28
☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.		
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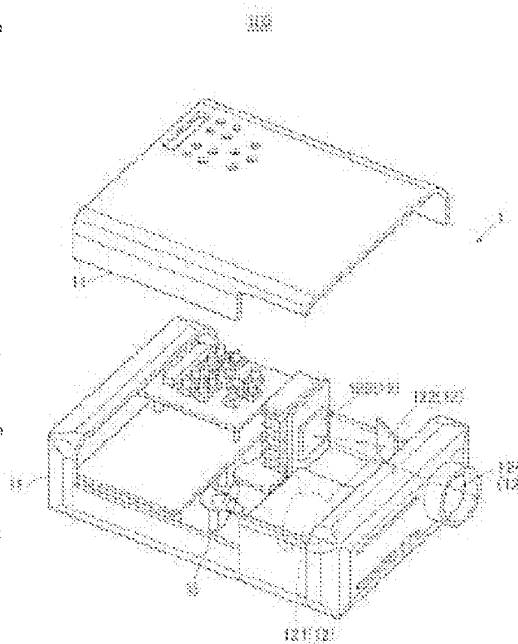
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PROJECTION TYPE VIDEO DISPLAY DEVICE

Inventor(s): NAGAO JUN ±
Applicant(s): FUNAI ELECTRIC CO ±
Classification: - international: G03B21/16; H05B37/02
 - european:
Application number: JP20050181413 20050622
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Abstract of JP2007003638 (A)

PROBLEM TO BE SOLVED: To provide a projection type video display device capable of efficiently cooling a light source lamp and excellent in handleability. ; SOLUTION: The projection type video display device such as a projector 100 includes: a timer for measuring cooling time when the light source lamp 121 is cooled by driving and rotating a cooling fan 13 under the control of a CPU until power supply from a power source part is interrupted after turning off the light source lamp 121, based on input of an instruction to shift to standby; the CPU for performing processing to calculate the average cooling time of the light source lamp until then, based on the cooling time measured by the timer whenever the light source lamp is turned off; a temperature sensor for detecting the temperature of the light source lamp, a timer for measuring the operating time of the light source lamp; and the CPU for adjusting the rotating speed of the cooling fan, based on rotating speed adjusting amount related to the average cooling time of the light source lamp, the temperature of the light source lamp and the operating time of the light source lamp and performing processing to drive and rotate the cooling fan according to the rotating speed and the average cooling time. ; COPYRIGHT: (C)2007, JPO&INPIT



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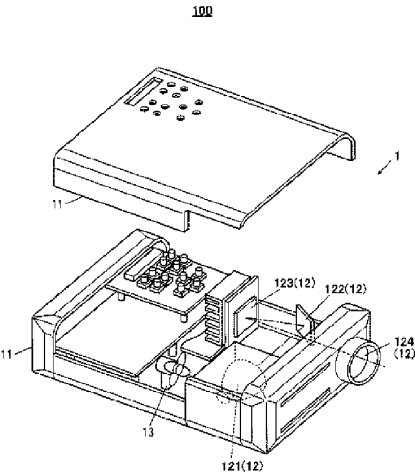
(54) 【発明の名称】 投射型映像表示装置

(57) 【要約】

【課題】光源ランプの冷却を効率良く行える使い勝手に優れた投射型映像表示装置を提供する。

【解決手段】スタンバイ移行指示の入力に基づいて、光源ランプ121の消灯後、電源部からの電力供給が遮断されるまでにCPUの制御下にて冷却用ファン13が回転駆動されて光源ランプ121が冷却される冷却時間を計時するタイマと、光源ランプが消灯される毎にタイマにより計時される冷却時間に基づいて、これまでの光源ランプの平均冷却時間を算出する処理を行うCPUと、光源ランプの温度を検出する温度センサと、光源ランプの使用時間を計時するタイマと、光源ランプの平均冷却時間、光源ランプの温度及び光源ランプの使用時間に係る回転速度調整量に基づいて冷却用ファンの回転速度を調整し、当該回転速度及び平均冷却時間に従って冷却用ファンを回転駆動させる処理を行うCPUとを備えるプロジェクター100である。

【選択図】 図1



【特許請求の範囲】

【請求項1】

光学像を形成するための光源ランプと、前記光源ランプを冷却する冷却用ファンと、前記冷却用ファンを回転駆動させるファン駆動制御手段と、前記ファン駆動制御手段に対して電力を供給する電力供給手段とを備える投射型映像表示装置であって、

前記光源ランプを消灯させて当該投射型映像表示装置をスタンバイモードに移行させるスタンバイ移行指示を出力するためのスタンバイモード指示手段と、

前記スタンバイモード指示手段から出力された前記スタンバイ移行指示の入力に基づいて、前記光源ランプの消灯後、前記電力供給手段から前記ファン駆動制御手段に対する電力供給が遮断されるまでに当該ファン駆動制御手段により前記冷却用ファンが所定の回転速度で回転駆動されて前記光源ランプが冷却される冷却時間を計時する冷却時間計時手段と、

前記光源ランプが消灯される毎に前記冷却時間計時手段により計時される前記冷却時間に基づいて、これまでの前記光源ランプの平均冷却時間を算出する平均時間算出手段と、

前記光源ランプの平均冷却時間と前記ファン駆動制御手段により回転駆動される前記冷却用ファンの回転速度の調整に係る平均冷却時間調整情報とを対応付けて記録する平均冷却時間調整情報記録手段と、

前記光源ランプの温度を検出する温度検出手段と、

前記光源ランプの温度と前記ファン駆動制御手段により回転駆動される前記冷却用ファンの回転速度の調整に係る温度調整情報とを対応付けて記録する温度調整情報記録手段と、

、

前記光源ランプの使用時間を計時する使用時間計時手段と、

前記光源ランプの使用時間と前記ファン駆動制御手段により回転駆動される前記冷却用ファンの回転速度の調整に係る使用時間調整情報とを対応付けて記録する使用時間調整情報記録手段と、

前記平均時間算出手段により算出された前記平均冷却時間に対応する前記平均冷却時間調整情報を前記平均冷却時間調整情報記録手段から取得する平均冷却時間調整情報取得手段と、

前記温度検出手段により検出された前記光源ランプの温度に対応する前記温度調整情報を前記温度調整情報記録手段から取得する温度調整情報取得手段と、

前記使用時間計時手段により計時された前記光源ランプの使用時間に対応する前記使用時間調整情報を前記使用時間調整情報記録手段から取得する使用時間調整情報取得手段と、を備え、

前記ファン駆動制御手段は、前記平均冷却時間調整情報取得手段により取得された前記平均冷却時間調整情報、前記温度調整情報取得手段により取得された前記温度調整情報、及び前記使用時間調整情報取得手段により取得された前記使用時間調整情報に基づいて前記冷却用ファンの回転速度を調整し、調整された前記回転速度、及び前記平均時間算出手段により算出された前記平均冷却時間に従って前記冷却用ファンを回転駆動させることを特徴とする投射型映像表示装置。

【請求項2】

光学像を形成するための光源ランプと、前記光源ランプを冷却する冷却用ファンと、前記冷却用ファンを回転駆動させるファン駆動制御手段と、前記ファン駆動制御手段に対して電力を供給する電力供給手段とを備える投射型映像表示装置であって、

前記光源ランプを消灯させて当該投射型映像表示装置をスタンバイモードに移行させるスタンバイ移行指示を出力するためのスタンバイモード指示手段と、

前記スタンバイモード指示手段から出力された前記スタンバイ移行指示の入力に基づいて、前記光源ランプの消灯後、前記電力供給手段から前記ファン駆動制御手段に対する電力供給が遮断されるまでに当該ファン駆動制御手段により前記冷却用ファンが所定の回転速度で回転駆動されて前記光源ランプが冷却される冷却時間を計時する冷却時間計時手段

と、

前記光源ランプが消灯される毎に前記冷却時間計時手段により計時される前記冷却時間に基づいて、これまでの前記光源ランプの平均冷却時間を算出する平均時間算出手段と、

前記光源ランプの平均冷却時間と前記ファン駆動制御手段により回転駆動される前記冷却用ファンの回転速度の調整に係る平均冷却時間調整情報とを対応付けて記録する平均冷却時間調整情報記録手段と、

前記平均時間算出手段により算出された前記平均冷却時間に対応する前記平均冷却時間調整情報を前記平均冷却時間調整情報記録手段から取得する平均冷却時間調整情報取得手段と、を備え、

前記ファン駆動制御手段は、前記平均冷却時間調整情報取得手段により取得された前記平均冷却時間調整情報に基づいて前記冷却用ファンの回転速度を調整し、調整された前記回転速度、及び前記平均時間算出手段により算出された前記平均冷却時間に従って前記冷却用ファンを回転駆動させることを特徴とする投射型映像表示装置。

【請求項3】

前記光源ランプの温度を検出する温度検出手段と、

前記光源ランプの温度と前記ファン駆動制御手段により回転駆動される前記冷却用ファンの回転速度の調整に係る温度調整情報とを対応付けて記録する温度調整情報記録手段と、

前記温度検出手段により検出された前記光源ランプの温度に対応する前記温度調整情報を前記温度調整情報記録手段から取得する温度調整情報取得手段と、を備え、

前記ファン駆動制御手段は、さらに、前記温度調整情報取得手段により取得された前記温度調整情報に基づいて、前記冷却用ファンの回転速度を調整することを特徴とする請求項2に記載の投射型映像表示装置。

【請求項4】

前記光源ランプの使用時間を計時する使用時間計時手段と、

前記光源ランプの使用時間と前記ファン駆動制御手段により回転駆動される前記冷却用ファンの回転速度の調整に係る使用時間調整情報とを対応付けて記録する使用時間調整情報記録手段と、

前記使用時間計時手段により計時された前記光源ランプの使用時間に対応する前記使用時間調整情報を前記使用時間調整情報記録手段から取得する使用時間調整情報取得手段と、を備え、

前記ファン駆動制御手段は、さらに、前記使用時間調整情報取得手段により取得された前記使用時間調整情報に基づいて、前記冷却用ファンの回転速度を調整することを特徴とする請求項2に記載の投射型映像表示装置。

【請求項5】

前記光源ランプの温度を検出する温度検出手段と、

前記光源ランプの温度と前記ファン駆動制御手段により回転駆動される前記冷却用ファンの回転速度の調整に係る温度調整情報とを対応付けて記録する温度調整情報記録手段と、

前記光源ランプの使用時間を計時する使用時間計時手段と、

前記光源ランプの使用時間と前記ファン駆動制御手段により回転駆動される前記冷却用ファンの回転速度の調整に係る使用時間調整情報とを対応付けて記録する使用時間調整情報記録手段と、

前記温度検出手段により検出された前記光源ランプの温度に対応する前記温度調整情報を前記温度調整情報記録手段から取得する温度調整情報取得手段と、

前記使用時間計時手段により計時された前記光源ランプの使用時間に対応する前記使用時間調整情報を前記使用時間調整情報記録手段から取得する使用時間調整情報取得手段と、を備え、

前記ファン駆動制御手段は、さらに、前記温度調整情報取得手段により取得された前記温度調整情報、及び前記使用時間調整情報取得手段により取得された前記使用時間調整情報

報に基づいて、前記冷却用ファンの回転速度を調整することを特徴とする請求項2に記載の【発明の詳細な説明】。

【技術分野】

【0001】

本発明は、冷却用ファンを回転駆動させて光源ランプの冷却を行う投射型映像表示装置に関する。

【背景技術】

【0002】

従来、プロジェクター等の投射型映像表示装置には、画像データに基づいて所定の光学像を形成するための光源ランプが搭載されている。

【0003】

かかる投射型映像表示装置にあつては、使用により光源ランプが発熱することから、当該光源ランプを冷却用ファンの回転により空冷するようになっている。具体的には、例えば、使用される光源ランプを識別し、識別された光源ランプに応じてその駆動電力や冷却用ファンの回転速度を変更するように構成された投射型映像表示装置が開発されている（例えば、特許文献1参照。）。また、ユーザにより光源ランプの所望の冷却条件が選択可能に構成された投射型映像表示装置も開発されている（例えば、特許文献2参照。）。

【特許文献1】特開2001-332394号公報

【特許文献2】特開2004-21103号公報

【発明の開示】

【発明が解決しようとする課題】

【0004】

ところで、光源ランプの冷却は、例えば、当該光源ランプの消灯後に冷却用ファンを所定の回転速度で少なくとも一定時間、例えば1分間回転駆動させることにより行われるようになっているが、投射型映像表示装置の使用状況によっては、光源ランプの冷却時間を一定時間確保できずに途中で電源が落とされてしまう場合もある。この場合、光源ランプの冷却を十分に行うことができないことから、当該光源ランプの寿命が短縮してしまうといった問題もある。

【0005】

また、かかる場合には、光源ランプの冷却が十分ではないことから、続けて投射型映像表示装置を使用する際に光源ランプを点灯させる所定操作を行っても、当該光源ランプを冷却するための冷却用ファンの回転駆動を所定時間行った後でないと、光源ランプの点灯を行うことができないようになっているものもある。

【0006】

このように、予め設定された一定の冷却時間を確保することができない場合には、光源ランプの冷却を十分に行うことができないだけでなく、その後の投射型映像表示装置の使い勝手が悪くなってしまうといった問題がある。

【0007】

なお、光源ランプの冷却を急速に行う上で、冷却用ファンの回転速度をより高速にすることが考えられるが、冷却用ファンの回転速度が高速になるほど騒音が大きくなってしまふといった問題もあるため、かかる問題も考慮して光源ランプの冷却を効率良く行うことを検討する必要がある。

【0008】

そこで、本発明の課題は、光源ランプの冷却を効率良く行うことができる使い勝手に優れる投射型映像表示装置を提供することである。

【課題を解決するための手段】

【0009】

上記課題を解決するため、請求項1に記載の発明は、

光学像を形成するための光源ランプと、前記光源ランプを冷却する冷却用ファンと、前記冷却用ファンを回転駆動させるファン駆動制御手段と、前記ファン駆動制御手段に対し

て電力を供給する電力供給手段とを備える投射型映像表示装置であって、

前記光源ランプを消灯させて当該投射型映像表示装置をスタンバイモードに移行させるスタンバイ移行指示を出力するためのスタンバイモード指示手段と、

前記スタンバイモード指示手段から出力された前記スタンバイ移行指示の入力に基づいて、前記光源ランプの消灯後、前記電力供給手段から前記ファン駆動制御手段に対する電力供給が遮断されるまでに当該ファン駆動制御手段により前記冷却用ファンが所定の回転速度で回転駆動されて前記光源ランプが冷却される冷却時間を計時する冷却時間計時手段と、

前記光源ランプが消灯される毎に前記冷却時間計時手段により計時される前記冷却時間に基づいて、これまでの前記光源ランプの平均冷却時間を算出する平均時間算出手段と、

前記光源ランプの平均冷却時間と前記ファン駆動制御手段により回転駆動される前記冷却用ファンの回転速度の調整に係る平均冷却時間調整情報とを対応付けて記録する平均冷却時間調整情報記録手段と、

前記光源ランプの温度を検出する温度検出手段と、

前記光源ランプの温度と前記ファン駆動制御手段により回転駆動される前記冷却用ファンの回転速度の調整に係る温度調整情報とを対応付けて記録する温度調整情報記録手段と、

前記光源ランプの使用時間を計時する使用時間計時手段と、

前記光源ランプの使用時間と前記ファン駆動制御手段により回転駆動される前記冷却用ファンの回転速度の調整に係る使用時間調整情報とを対応付けて記録する使用時間調整情報記録手段と、

前記平均時間算出手段により算出された前記平均冷却時間に対応する前記平均冷却時間調整情報を前記平均冷却時間調整情報記録手段から取得する平均冷却時間調整情報取得手段と、

前記温度検出手段により検出された前記光源ランプの温度に対応する前記温度調整情報を前記温度調整情報記録手段から取得する温度調整情報取得手段と、

前記使用時間計時手段により計時された前記光源ランプの使用時間に対応する前記使用時間調整情報を前記使用時間調整情報記録手段から取得する使用時間調整情報取得手段と、を備え、

前記ファン駆動制御手段は、前記平均冷却時間調整情報取得手段により取得された前記平均冷却時間調整情報、前記温度調整情報取得手段により取得された前記温度調整情報、及び前記使用時間調整情報取得手段により取得された前記使用時間調整情報に基づいて前記冷却用ファンの回転速度を調整し、調整された前記回転速度、及び前記平均時間算出手段により算出された前記平均冷却時間に従って前記冷却用ファンを回転駆動させることを特徴としている。

【0010】

請求項2に記載の発明は、

光学像を形成するための光源ランプと、前記光源ランプを冷却する冷却用ファンと、前記冷却用ファンを回転駆動させるファン駆動制御手段と、前記ファン駆動制御手段に対して電力を供給する電力供給手段とを備える投射型映像表示装置であって、

前記光源ランプを消灯させて当該投射型映像表示装置をスタンバイモードに移行させるスタンバイ移行指示を出力するためのスタンバイモード指示手段と、

前記スタンバイモード指示手段から出力された前記スタンバイ移行指示の入力に基づいて、前記光源ランプの消灯後、前記電力供給手段から前記ファン駆動制御手段に対する電力供給が遮断されるまでに当該ファン駆動制御手段により前記冷却用ファンが所定の回転速度で回転駆動されて前記光源ランプが冷却される冷却時間を計時する冷却時間計時手段と、

前記光源ランプが消灯される毎に前記冷却時間計時手段により計時される前記冷却時間に基づいて、これまでの前記光源ランプの平均冷却時間を算出する平均時間算出手段と、

前記光源ランプの平均冷却時間と前記ファン駆動制御手段により回転駆動される前記冷

却用ファンの回転速度の調整に係る平均冷却時間調整情報とを対応付けて記録する平均冷却時間調整情報記録手段と、

前記平均時間算出手段により算出された前記平均冷却時間に対応する前記平均冷却時間調整情報を前記平均冷却時間調整情報記録手段から取得する平均冷却時間調整情報取得手段と、を備え、

前記ファン駆動制御手段は、前記平均冷却時間調整情報取得手段により取得された前記平均冷却時間調整情報に基づいて前記冷却用ファンの回転速度を調整し、調整された前記回転速度、及び前記平均時間算出手段により算出された前記平均冷却時間に従って前記冷却用ファンを回転駆動させることを特徴としている。

【0011】

請求項3に記載の発明は、請求項2に記載の投射型映像表示装置において、

前記光源ランプの温度を検出する温度検出手段と、

前記光源ランプの温度と前記ファン駆動制御手段により回転駆動される前記冷却用ファンの回転速度の調整に係る温度調整情報とを対応付けて記録する温度調整情報記録手段と、

前記温度検出手段により検出された前記光源ランプの温度に対応する前記温度調整情報を前記温度調整情報記録手段から取得する温度調整情報取得手段と、を備え、

前記ファン駆動制御手段は、さらに、前記温度調整情報取得手段により取得された前記温度調整情報に基づいて、前記冷却用ファンの回転速度を調整することを特徴としている。

【0012】

請求項4に記載の発明は、請求項2に記載の投射型映像表示装置において、

前記光源ランプの使用時間を計時する使用時間計時手段と、

前記光源ランプの使用時間と前記ファン駆動制御手段により回転駆動される前記冷却用ファンの回転速度の調整に係る使用時間調整情報とを対応付けて記録する使用時間調整情報記録手段と、

前記使用時間計時手段により計時された前記光源ランプの使用時間に対応する前記使用時間調整情報を前記使用時間調整情報記録手段から取得する使用時間調整情報取得手段と、を備え、

前記ファン駆動制御手段は、さらに、前記使用時間調整情報取得手段により取得された前記使用時間調整情報に基づいて、前記冷却用ファンの回転速度を調整することを特徴としている。

【0013】

請求項5に記載の発明は、請求項2に記載の投射型映像表示装置において、

前記光源ランプの温度を検出する温度検出手段と、

前記光源ランプの温度と前記ファン駆動制御手段により回転駆動される前記冷却用ファンの回転速度の調整に係る温度調整情報とを対応付けて記録する温度調整情報記録手段と、

前記光源ランプの使用時間を計時する使用時間計時手段と、

前記光源ランプの使用時間と前記ファン駆動制御手段により回転駆動される前記冷却用ファンの回転速度の調整に係る使用時間調整情報とを対応付けて記録する使用時間調整情報記録手段と、

前記温度検出手段により検出された前記光源ランプの温度に対応する前記温度調整情報を前記温度調整情報記録手段から取得する温度調整情報取得手段と、

前記使用時間計時手段により計時された前記光源ランプの使用時間に対応する前記使用時間調整情報を前記使用時間調整情報記録手段から取得する使用時間調整情報取得手段と、を備え、

前記ファン駆動制御手段は、さらに、前記温度調整情報取得手段により取得された前記温度調整情報、及び前記使用時間調整情報取得手段により取得された前記使用時間調整情報に基づいて、前記冷却用ファンの回転速度を調整することを特徴としている。

【発明の効果】

【0014】

請求項1に記載の発明によれば、スタンバイモードに移行されて光源ランプの消灯後、電力供給手段からファン駆動制御手段に対する電力供給が遮断されるまでに当該ファン駆動制御手段により冷却用ファンが所定の回転速度で回転駆動されて光源ランプが冷却される冷却時間が計時され、光源ランプが消灯される毎に計時される冷却時間に基づいて、これまでの光源ランプの平均冷却時間が算出され、さらに、当該平均冷却時間に対応する、冷却用ファンの回転速度の調整に係る平均冷却時間調整情報が平均冷却時間調整情報記録手段から取得され、また、光源ランプの温度に対応する、冷却用ファンの回転速度の調整に係る温度調整情報が温度調整情報記録手段から取得され、また、光源ランプの使用時間に対応する、冷却用ファンの回転速度の調整に係る使用時間調整情報が使用時間調整情報記録手段から取得される。そして、これら平均冷却時間調整情報、温度調整情報及び使用時間調整情報に基づいて冷却用ファンの回転速度が調整され、当該回転速度、及び、算出された光源ランプの平均冷却時間に従って冷却用ファンが回転駆動するようになっている。即ち、ユーザによる使用状況及び光源ランプの使用状態を考慮して、これまでの光源ランプの平均冷却時間内で光源ランプの冷却を行うことができるように、冷却用ファンの回転速度を平均冷却時間調整情報、温度調整情報及び使用時間調整情報に基づいて適正に調整することができる。

【0015】

これにより、冷却用ファンの回転速度を必要以上に高速化することなく、光源ランプの冷却を効率良く行うことができる。加えて、当該冷却用ファンの回転速度の高速化に伴って発生する騒音が大きくなるのを防止して使い勝手に優れる投射型映像表示装置を提供することができる。

【0016】

請求項2に記載の発明によれば、スタンバイモードに移行されて光源ランプの消灯後、電力供給手段からファン駆動制御手段に対する電力供給が遮断されるまでに当該ファン駆動制御手段により冷却用ファンが所定の回転速度で回転駆動されて光源ランプが冷却される冷却時間が計時され、光源ランプが消灯される毎に計時される冷却時間に基づいて、これまでの光源ランプの平均冷却時間が算出され、さらに、当該平均冷却時間に対応する、冷却用ファンの回転速度の調整に係る平均冷却時間調整情報が平均冷却時間調整情報記録手段から取得される。そして、平均冷却時間調整情報に基づいて冷却用ファンの回転速度が調整され、当該回転速度、及び、算出された光源ランプの平均冷却時間に従って冷却用ファンが回転駆動するようになっている。即ち、ユーザによる使用状況を考慮して、これまでの光源ランプの平均冷却時間内で光源ランプの冷却を行うことができるように、冷却用ファンの回転速度を平均冷却時間調整情報に基づいて適正に調整することができる。

【0017】

これにより、冷却用ファンの回転速度を必要以上に高速化することなく、光源ランプの冷却を効率良く行うことができる。加えて、当該冷却用ファンの回転速度の高速化に伴って発生する騒音が大きくなるのを防止して使い勝手に優れる投射型映像表示装置を提供することができる。

【0018】

請求項3に記載の発明によれば、請求項2に記載の発明と同様の効果が得られるのは無論のこと、特に、光源ランプの温度に対応する、冷却用ファンの回転速度の調整に係る温度調整情報が温度調整情報記録手段から取得され、当該温度調整情報に基づいて、冷却用ファンの回転速度が調整されるようになっているので、冷却用ファンの回転速度の調整を光源ランプの使用状態を考慮してより適正に行うことができ、光源ランプの冷却をより効率良く行うことができる。

【0019】

請求項4に記載の発明によれば、請求項2に記載の発明と同様の効果が得られるのは無論のこと、特に、光源ランプの使用時間に対応する、冷却用ファンの回転速度の調整に係

る使用時間調整情報が使用時間調整情報記録手段から取得され、当該使用時間調整情報に基づいて、冷却用ファンの回転速度が調整されるようになっているので、冷却用ファンの回転速度の調整を光源ランプの使用状態を考慮してより適正に行うことができ、光源ランプの冷却をより効率良く行うことができる。

【0020】

請求項5に記載の発明によれば、請求項2に記載の発明と同様の効果が得られるのは無論のこと、特に、光源ランプの温度に対応する、冷却用ファンの回転速度の調整に係る温度調整情報が温度調整情報記録手段から取得され、また、光源ランプの使用時間に対応する、冷却用ファンの回転速度の調整に係る使用時間調整情報が使用時間調整情報記録手段から取得され、これら温度調整情報及び使用時間調整情報に基づいて、冷却用ファンの回転速度が調整されるようになっているので、冷却用ファンの回転速度の調整を光源ランプの使用状態を考慮してより適正に行うことができ、光源ランプの冷却をより効率良く行うことができる。

【発明を実施するための最良の形態】

【0021】

以下に、本発明について、図面を用いて具体的な態様を説明する。ただし、発明の範囲は、図示例に限定されない。

【0022】

図1は、本発明を適用した投射型映像表示装置の好適な一実施形態として例示するプロジェクター100を示す斜視図であり、図2は、プロジェクター100の要部構成を示すブロック図である。なお、図1にあっては、プロジェクター100を構成するプロジェクター本体1のケース体11（後述）を開放した状態を示し、また、リモートコントローラ2（後述）の図示は省略している。

【0023】

本発明に係るプロジェクター（投射型映像表示装置）100は、例えば、パーソナルコンピュータやビデオカメラ（図示略）等から入力された画像情報に基づいて画像を形成し、形成した画像を前方に設けられたスクリーン（図示略）などに拡大して投影する装置であり、具体的には、図1及び図2に示すように、プロジェクター本体1と、このプロジェクター本体1を遠隔操作するためのリモートコントローラ2（「リモコン」；図2参照）とを備えて構成されている。

【0024】

先ず、プロジェクター本体1について説明する。

【0025】

プロジェクター本体1は、ケース体11内に、画像（映像）を投影する投影部12と、投影部12に備わる光源ランプ121を冷却する冷却用ファン13と、光源ランプ121の温度を検出する温度センサ14と、リモコン2から送信された信号を受信する信号受信部15と、EEPROM16と、RAM17と、CPU18と、タイマ19と、各部に対する電源を供給するための電源部10等を備えている。

【0026】

投影部12は、例えば、高輝度の光を出射する光源ランプ121と、光源ランプ121から出射された光を反射する反射ミラー122と、反射ミラー122により反射された光が入射されるDMD（Digital Micromirror Device）123と、DMD123により反射された光が通過する光学レンズ124とを備えて構成されている。

【0027】

光源ランプ121は、例えば、メタルハライドランプや超高压水銀ランプ等から構成され、DMD123により光学変調される光を出射するものである。

【0028】

DMD123は、例えば、光源ランプ121から出射され反射ミラー122にて反射されることで入射された光を画像情報に応じて変調することにより光学像を形成する光学変調素子として機能する。

【0029】

光学レンズ124は、例えば、ズームレンズ等により構成され、DMD123によって変調された光（光学像）を集光してスクリーンなどに拡大投影するものである。

【0030】

温度センサ14は、例えば、光源ランプ121の近傍の所定位置（図示略）に配設されており、当該光源ランプ121の使用の際の温度を所定のタイミングで検出し、検出された温度に係る所定の温度情報をCPU18に対して出力するようになっている。

【0031】

冷却用ファン13は、例えば、光源ランプ121の近傍の所定位置に配設されており、CPU18の制御下にて回転駆動して、光源ランプ121を空冷するものである。具体的には、冷却用ファン13は、ユーザによるスタンバイ状態切替スイッチ22の操作に基づいてスタンバイモードに移行して光源ランプ121が消灯された後に、所定の回転速度で高速回転して光源ランプ121を冷却するようになっている（光源ランプ冷却処理）。

【0032】

ここで、本実施形態のプロジェクター100にあっては、電源部10からの電力供給が行われている状態では、冷却用ファン13は所定の回転速度で回転するようになっているが、本発明に係る冷却用ファン13による光源ランプ冷却処理（詳細後述）とは、光源ランプ121の消灯後に冷却用ファン13を所定時間、高速回転させる処理を言うものとする。

【0033】

なお、冷却用ファン13の配置や個数等は、適宜変更しても良い。

【0034】

信号受信部15は、リモコン2の信号送信部から送信された所定の信号を受信するものである。具体的には、信号受信部15は、例えばユーザによるリモコン2のスタンバイ状態切替スイッチ22の所定操作に基づいて当該リモコン2の信号送信部から送信されたスタンバイ移行指示信号等の所定の信号をアンテナ（図示略）等により受信するようになっている。

【0035】

また、信号受信部15は、受信された所定の信号をCPU18に対して出力するようになっている。

【0036】

タイマ19は、例えば、計時回路を備え、光源ランプ121の使用時間や光源ランプ121の冷却時間等を計時するものである。

【0037】

具体的には、タイマ19は、使用時間計時手段として、電源投入後に点灯された光源ランプ121の使用時間（点灯時間）を計時するようになっている。また、タイマ19は、冷却時間計時手段として、ユーザによるスタンバイ状態切替スイッチ22の操作に応じて信号送信部23から送信されたスタンバイ移行指示信号の信号受信部15による受信に基づいて、光源ランプ121の消灯後、電源部10からの電力供給が遮断されるまでにCPU18の制御下にて冷却用ファン13が回転駆動されて光源ランプ121が冷却される冷却時間を計時するようになっている。

【0038】

なお、タイマ19により計時された光源ランプ121の使用時間や光源ランプ121の冷却時間等に係る時間情報は、例えば、CPU18に対して出力され、当該CPU18の制御下にてEEPROM16の所定の格納領域内に格納されるようになっている。

【0039】

ここで、光源ランプ121の冷却時間が、所定の時間、例えば1分を越えた場合には、当該冷却時間は1分間であるとしてその情報が格納されるようになっている。また、光源ランプ121の冷却時間に係る情報は、例えば、タイマ19により計時された時間を積算した合計冷却時間情報として、タイマ19による計時回数を積算した合計回数情報とともに

にEEPROM16に格納されるようになっている。

【0040】

電源部10は、CPU18の制御下にて、当該プロジェクター本体1を構成する各部に電力を供給するものである。

【0041】

また、電源部10は、例えば、当該プロジェクター本体1の主電源のオン／オフ操作を行うための電源スイッチ101を備えている。即ち、電源スイッチ101のユーザによる所定操作に基づいて、当該プロジェクター本体1の電源がオンされると、電源部10から各部に電力が供給されることとなって、光源ランプ121、冷却用ファン13等が駆動するようになっている。一方、電源スイッチ101のユーザによる所定操作に基づいて、当該プロジェクター本体1の電源がオフされると、電源部10からの電力供給が遮断されるようになっている。

【0042】

なお、タイマ19によって電源部10からの電力供給が遮断されるまでの光源ランプ121の冷却時間を計時して、計時された冷却時間をEEPROM16等に格納する場合、これらの処理に係る電力は、電源部10からの電力供給が遮断された後であっても、例えばコンデンサ等の内部電源に蓄積された電気を利用することで行えるようになっている。

【0043】

CPU (Central Processing Unit) 18は、プロジェクター100の各部を統括的に制御するものであり、EEPROM16に記憶されている各種プログラムを読み出してRAM17の作業領域に展開し、当該プログラムに従って各種処理を実行するようになっている。

【0044】

具体的には、CPU18は、例えばリモコン2から送信されて信号受信部15により受信されたスタンバイ移行指示信号に基づいて、所定の制御プログラムを実行して、当該プロジェクター100をスタンバイモードに移行させて光源ランプ121を消灯させる処理の実行を制御するようになっている。その後、CPU18は、所定のプログラムの実行に基づいて、使用後の光源ランプ121を冷却用ファン13を回転駆動させることにより空冷する光源ランプ冷却処理の実行を制御するようになっている。

【0045】

なお、スタンバイモードとは、少なくとも光源ランプ121を消灯した状態とするモードであるが、これに限られるものではなく、電源部10からの電力供給を制御して他の各部の機能の実行も制限するようにしても良い。

【0046】

RAM (Random Access Memory) 17は、例えば、書き換え可能なメモリであり、CPU18の制御下にて記憶部から読み出されたプログラムや各種データ等の格納領域や作業領域等を構成している。

【0047】

EEPROM (Electrically Erasable and Programmable Read Only Memory) 16は、例えば、電氣的にデータの書きこみ、及び消去が可能な読み出し専用のメモリであり、CPU18の制御下にて実行される各種プログラム、各プログラムの処理に係るデータ等を記憶している。

【0048】

具体的には、EEPROM16は、例えば、ファン駆動制御プログラム16a、平均時間算出プログラム16b、平均冷却時間調整情報取得プログラム16c、温度調整情報取得プログラム16d、使用時間調整情報取得プログラム16e等を記憶している。

【0049】

ファン駆動制御プログラム16aは、CPU18の制御下にて冷却用ファン13を所定の回転速度で回転駆動させる処理に係る機能を実現させるためのプログラムである。即ち、電源スイッチ101のオン操作に基づいて電源部10からの電力供給が行われている状

態にあっては、CPU 18は、冷却用ファン13の回転駆動を制御して、当該冷却用ファン13を所定の速度で回転駆動させるようになっている。そして、リモコン2から出力されたスタンバイ移行指示がCPU 18に入力されると、CPU 18は、ファン駆動制御手段として、光源ランプ121を冷却させるために冷却用ファン13の回転速度をより高速に変更（調整）するようになっている。

【0050】

具体的には、CPU 18は、後述する平均冷却時間調整情報取得処理にて取得された回転速度調整量（平均冷却時間調整情報）に基づいて冷却用ファン13の回転速度を高速に調整して、調整された回転速度、及び平均時間算出処理にて算出された平均冷却時間に従って冷却用ファン13を回転駆動させるようになっている。

【0051】

また、冷却用ファン13の回転速度の調整において、CPU 18は、温度調整情報取得処理（後述）にて取得された回転速度調整量（温度調整情報）に基づいて冷却用ファン13の回転速度を調整するようになっている。さらに、CPU 18は、使用時間調整情報取得処理（後述）にて取得された回転速度調整量（使用時間調整情報）に基づいて冷却用ファン13の回転速度を調整するようになっている。

【0052】

平均時間算出プログラム16bは、CPU 18に、平均時間算出手段として、スタンバイモード移行後に光源ランプが消灯される毎にタイマ19により計時される光源ランプ121の冷却時間に基づいて、これまでの光源ランプ121の平均冷却時間を算出する平均冷却時間算出処理に係る機能を実現させるためのプログラムである。

【0053】

即ち、CPU 18による平均時間算出プログラム16bの実行に基づいて、EEPROM 16から光源ランプ121の冷却時間に係る情報としての合計冷却時間情報と合計回数情報を読み出して、合計冷却時間を合計回数で除算することにより、これまでの光源ランプ121の平均冷却時間を算出するようになっている。

【0054】

なお、平均冷却時間算出処理は、例えば、電源部10からの電力供給が開始された後、光源ランプ121が消灯されるまでに実行可能であれば如何なるタイミングで実行されても良い。

【0055】

平均冷却時間調整情報取得プログラム16cは、CPU 18に、平均冷却時間調整情報取得手段として、平均冷却時間算出処理にて算出された平均冷却時間に対応する回転速度調整量を平均冷却時間調整テーブル1から取得する平均冷却時間調整情報取得処理に係る機能を実現させるためのプログラムである。

【0056】

なお、平均冷却時間調整情報取得処理は、例えば、平均冷却時間算出処理後、光源ランプ121が消灯されるまでに実行可能であれば如何なるタイミングで実行されても良い。

【0057】

温度調整情報取得プログラム16dは、CPU 18に、温度調整情報取得手段として、温度センサ14により検出された光源ランプ121の温度に対応する回転速度調整量を温度調整テーブル2から取得する温度調整情報取得処理に係る機能を実現させるためのプログラムである。

【0058】

なお、温度調整情報取得処理は、例えば、平均冷却時間算出処理後、光源ランプ121が消灯されるまでに実行可能であれば如何なるタイミングで実行されても良い。

【0059】

使用時間調整情報取得プログラム16eは、CPU 18に、使用時間調整情報取得手段として、タイマ19により計時された光源ランプ121の使用時間に対応する回転速度調整量を使用時間調整テーブル3から取得する使用時間調整情報取得処理に係る機能を実

現させるためのプログラムである。

【0060】

なお、使用時間調整情報取得処理は、例えば、平均冷却時間算出処理後、光源ランプ 1 2 1 が消灯されるまでに実行可能であれば如何なるタイミングで実行されても良い。

【0061】

また、EEPROM 1 6 には、例えば、プロジェクター 1 0 0 による光源ランプ冷却処理にて用いられる平均冷却時間調整テーブル 1 (図 3 参照)、温度調整テーブル 2 (図 4 参照)、使用時間調整テーブル 3 (図 5 参照) が記憶されている。

【0062】

平均冷却時間調整テーブル 1 は、例えば、光源ランプ 1 2 1 の平均冷却時間と、当該平均冷却時間内に光源ランプ 1 2 1 を適正に冷却することができるようにして予め規定された冷却用ファン 1 3 の回転速度の調整に係る回転速度調整量(平均冷却時間調整情報)とが対応付けられたものである。ここで、EEPROM 1 6 は、平均冷却時間調整テーブル 1 を記録する平均冷却時間調整情報記録手段を構成している。

【0063】

温度調整テーブル 2 は、例えば、光源ランプ 1 2 1 の温度と、当該温度の光源ランプ 1 2 1 を適正に冷却することができるようにして予め規定された冷却用ファン 1 3 の回転速度の調整に係る回転速度調整量(温度調整情報)とが対応付けられたものである。ここで、EEPROM 1 6 は、温度調整テーブル 2 を記録する温度調整情報記録手段を構成している。

【0064】

使用時間調整テーブル 3 は、例えば、光源ランプ 1 2 1 の使用時間と、当該時間経過後の光源ランプ 1 2 1 を適正に冷却することができるようにして予め規定された冷却用ファン 1 3 の回転速度の調整に係る回転速度調整量(使用時間調整情報)とが対応付けられたものである。ここで、EEPROM 1 6 は、使用時間調整テーブル 3 を記録する使用時間調整情報記録手段を構成している。

【0065】

なお、平均冷却時間調整テーブル 1、温度調整テーブル 2 及び使用時間調整テーブル 3 に係る回転速度調整量とは、例えば、冷却用ファン 1 3 の最大回転速度を 1 0 0 とした場合の回転速度調整前の指標となる所定の回転速度(例えば、6 5 等)に対する回転速度の調整量を表したものである。

【0066】

即ち、平均冷却時間調整テーブル 1 にあっては、平均冷却時間が短くなる程、つまり、光源ランプ 1 2 1 の消灯後に電源オフされるまでの時間が短くなる程、回転速度調整量が大きくなって冷却用ファン 1 3 の回転速度をより高速に回転させるように調整することができるように規定されている。

【0067】

また、温度調整テーブル 2 にあっては、光源ランプ 1 2 1 の温度が高くなる程、回転速度調整量が大きくなって冷却用ファン 1 3 の回転速度をより高速に回転させるように調整することができるように規定されている。

【0068】

また、使用時間調整テーブル 3 にあっては、光源ランプ 1 2 1 の使用時間が長くなる程、回転速度調整量が大きくなって冷却用ファン 1 3 の回転速度をより高速に回転させるように調整することができるように規定されている。

【0069】

なお、平均冷却時間調整テーブル 1、温度調整テーブル 2 及び使用時間調整テーブル 3 に係る回転速度調整量の数値は、一例であって、これらに限定されるものではない。

【0070】

次に、リモコン 2 について説明する。

【0071】

リモコン2は、制御部21と、プロジェクター本体1をスタンバイモードに移行させるためのスタンバイ状態切替スイッチ22と、当該リモコン2の所定操作に基づいて出力される所定の信号を送信する信号送信部23等を備えている。

【0072】

制御部21は、例えば、CPU、メモリ等から構成されており、当該リモコン2の各部を統括的に制御するようになっている。

【0073】

スタンバイ状態切替スイッチ22は、ユーザによる所定操作に基づいて、当該プロジェクター100のスタンバイモードと画像投影モードとを切り替えるためのものであり、具体的には、当該スタンバイ状態切替スイッチ22が所定操作される毎にスタンバイモードに移行させるスタンバイ移行指示信号と、画像投影モードに移行させる指示信号とを交互に出力するようになっている。

【0074】

このように、スタンバイ状態切替スイッチ22は、スタンバイモード指示手段を構成している。

【0075】

信号送信部23は、例えば、ユーザによるスタンバイ状態切替スイッチ22や他の操作スイッチ（図示略）等の所定操作に基づいて、制御部21の制御下にてスタンバイ移行指示信号等の所定の信号を送信するようになっている。

【0076】

なお、リモコン2とプロジェクター本体1との情報通信は、例えば、無線通信方式にて行うようにしても良いし、有線通信方式にて行うようにしても良い。

【0077】

次に、プロジェクター100による光源ランプ冷却処理について、図6を参照して説明する。

【0078】

ここで、図6は、光源ランプ冷却処理に係る動作の一例を示すフローチャートである。

【0079】

以下に説明する光源ランプ冷却処理にあつては、当該プロジェクター100が所定回数使用されることで取得された光源ランプ121の冷却時間に係る情報（合計冷却時間情報及び合計回数情報）がEEPROM16の格納領域に予め格納された状態となっている。

【0080】

まず、ユーザによる電源スイッチ101の所定操作に基づいてプロジェクター100の電源が投入（オン）されると（ステップS1）、CPU18は、画像投影モードに移行させて、所定の制御プログラムを実行して投影部12の光源ランプ121を点灯させる制御を行うとともに、ファン駆動制御プログラム16aを実行して冷却用ファン13を所定の回転速度で回転駆動させる制御を行う（ステップS2）。ここで、光源ランプ121が点灯状態となることに基づいて、CPU18は、所定の制御プログラムを実行して、タイマ19を制御して光源ランプ121の使用時間の計時を開始させる（ステップS3）。

【0081】

また、CPU18は、EEPROM16から平均時間算出プログラム16bを読み出してRAM17に展開し、この平均時間算出プログラム16bの実行に基づいて、光源ランプ121の冷却時間に係る情報（合計冷却時間情報及び合計回数情報）から、これまでの光源ランプ121の平均冷却時間を算出する平均冷却時間算出処理を実行する（ステップS4）。

【0082】

続けて、CPU18は、EEPROM16から平均冷却時間調整情報取得プログラム16cを読み出してRAM17に展開し、この平均冷却時間調整情報取得プログラム16cの実行に基づいて、平均冷却時間算出処理にて算出された平均冷却時間に対応する回転速

度調整量を平均冷却時間調整テーブル 1 から取得する平均冷却時間調整情報取得処理を実行する（ステップ S 5）。

【0083】

そして、例えばプロジェクター本体 1 の投影部 1 2 を用いて画像投影が行われた後、ユーザによってリモコン 2 のスタンバイ状態切替スイッチ 2 2 が所定操作されると、制御部 2 1 は、所定の制御プログラムの実行に基づいて信号送信部 2 3 を制御して、スタンバイ移行指示信号をプロジェクター本体 1 に送信させる（ステップ S 6）。

【0084】

プロジェクター本体 1 にあっては、リモコン 2 から送信されたスタンバイ移行指示信号を信号受信部 1 5 により受信すると、CPU 1 8 は、所定の制御プログラムの実行に基づいて、光源ランプ 1 2 1 を消灯させるとともに、タイマ 1 9 を制御して光源ランプ 1 2 1 の使用時間の計時を停止させる（ステップ S 7）。

【0085】

続けて、CPU 1 8 は、EEPROM 1 6 から使用時間調整情報取得プログラム 1 6 e を読み出して RAM 1 7 に展開し、この使用時間調整情報取得プログラム 1 6 e の実行に基づいて、タイマ 1 9 により計時された光源ランプ 1 2 1 の使用時間に対応する回転速度調整量を使用時間調整テーブル 3 から取得する使用時間調整情報取得処理を実行する（ステップ S 8 1）。

【0086】

また、CPU 1 8 は、EEPROM 1 6 から温度調整情報取得プログラム 1 6 d を読み出して RAM 1 7 に展開し、この温度調整情報プログラムの実行に基づいて、温度センサ 1 4 から出力されて入力された温度情報に係る光源ランプ 1 2 1 の温度に対応する回転速度調整量を温度調整テーブル 2 から取得する温度調整情報取得処理を実行する（ステップ S 8 2）。

【0087】

次に、CPU 1 8 は、平均冷却時間調整情報取得処理、使用時間調整情報取得処理及び温度調整情報取得処理にて取得されたそれぞれの回転速度調整量を加算した値に基づいて冷却用ファン 1 3 の回転速度を設定して、設定された回転速度に従って冷却用ファン 1 3 の回転速度を高速として、平均冷却時間算出処理にて算出された光源ランプ 1 2 1 の平均冷却時間に従って当該冷却用ファン 1 3 を駆動させる（ステップ S 9）。

【0088】

また、ステップ S 7 にて、光源ランプ 1 2 1 が消灯されると、CPU 1 8 は、所定の制御プログラムを実行して、タイマ 1 9 による計時を開始させる（ステップ S 8 3）。

【0089】

そして、ユーザによる電源スイッチ 1 0 1 の所定操作に基づいて電力供給が遮断されると（ステップ S 1 0）、CPU 1 8 の制御下にて、タイマ 1 9 により計時された時間を光源ランプ 1 2 1 の冷却時間として EEPROM 1 6 に記憶させる（ステップ S 1 1）。

【0090】

なお、ステップ S 8 3 にて計時が開始された時間（光源ランプ 1 2 1 の冷却時間）が平均冷却時間以上となると、即ち、平均冷却時間を経過してもユーザによって電源スイッチ 1 0 1 等が操作されずに電力供給が遮断された状態となっていない場合には、CPU 1 8 は、所定の制御プログラムの実行に基づいて、冷却用ファン 1 3 の回転速度を通常状態に戻すようになっている。

【0091】

以上のように、本実施形態のプロジェクター 1 0 0 によれば、スタンバイモードに移行されて光源ランプ 1 2 1 の消灯後、電源部 1 0 からの電力供給が遮断されるまでに CPU 1 8 の制御下にて冷却用ファン 1 3 が回転駆動されて光源ランプ 1 2 1 が冷却される冷却時間がタイマ 1 9 により計時され、光源ランプ 1 2 1 が消灯される毎に計時される冷却時間に基づいて、これまでの光源ランプ 1 2 1 の平均冷却時間が算出され、さらに、当該平均冷却時間に対応する回転速度調整量が平均冷却時間調整テーブル 1 から取得され、ま

た、光源ランプ121の温度に対応する回転速度調整量が温度調整テーブル12から取得され、また、光源ランプ121の使用時間に対応する回転速度調整量が使用時間調整テーブル13から取得されるようになっている。そして、これらの回転速度調整量に基づいて冷却用ファン13の回転速度が設定され、当該回転速度、及び、算出された光源ランプ121の平均冷却時間に従って冷却用ファン13が駆動するようになっている。即ち、ユーザによる使用状況及び光源ランプ121の使用状態を考慮して、これまでの光源ランプ121の平均冷却時間内で光源ランプ121の冷却を行うことができるように、冷却用ファン13の回転速度を回転速度調整量に基づいて適正に調整することができる。

【0092】

これにより、冷却用ファン13の回転速度を必要以上に高速化することなく、光源ランプ121の冷却を効率良く行うことができる。加えて、当該冷却用ファン13の回転速度の高速化に伴って発生する騒音が大きくなるのを防止して使い勝手に優れるプロジェクター100を提供することができる。

【0093】

なお、本発明は、上記実施形態に限定されることなく、本発明の趣旨を逸脱しない範囲において、種々の改良並びに設計の変更を行っても良い。

【0094】

例えば、冷却用ファン13の回転速度を、光源ランプ121の平均冷却時間、温度及び使用時間を考慮して調整するようにしたが、これに限られるものではなく、少なくとも光源ランプ121の平均冷却時間に係る回転速度調整量に基づいて調整するような構成であれば、光源ランプ121の温度、使用時間のそれぞれに係る回転速度調整量を用いるか否かは適宜変更することができる。

【0095】

また、上記実施形態では、スタンバイモード指示手段としてのスタンバイ状態切替スイッチ22をリモコン2に設けるようにしたが、これに限られるものではなく、プロジェクター本体1に設けるようにしても良い。

【0096】

さらに、上記実施形態では、電力供給の遮断を電源スイッチ101の操作に基づいて行うようにしたが、電源プラグをコンセントから取り外すことで行うようにしても良い。

【0097】

また、投影部12の構成は、上記のものに限られるものではなく適宜変更しても良い。例えば、光源ランプ121から出射される光を、R（赤）、G（緑）、B（青）の何れかの単色光に切り替える回転式の分割カラーフィルタであるカラーホイールを設けるようにしても良い。

【図面の簡単な説明】

【0098】

【図1】本発明を適用した投射型映像表示装置の好適な一実施形態として例示するプロジェクターを示す斜視図である。

【図2】図1のプロジェクターの要部構成を示すブロック図である。

【図3】図1のプロジェクターによる光源ランプ冷却処理にて用いられる平均冷却時間調整テーブルを示す図である。

【図4】図1のプロジェクターによる光源ランプ冷却処理にて用いられる温度調整テーブルを示す図である。

【図5】図1のプロジェクターによる光源ランプ冷却処理にて用いられる使用時間調整テーブルを示す図である。

【図6】図1のプロジェクターによる光源ランプ冷却処理に係る動作の一例を示すフローチャートである。

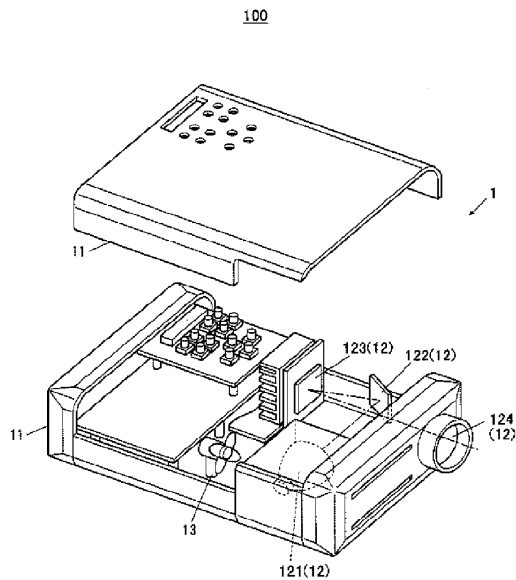
【符号の説明】

【0099】

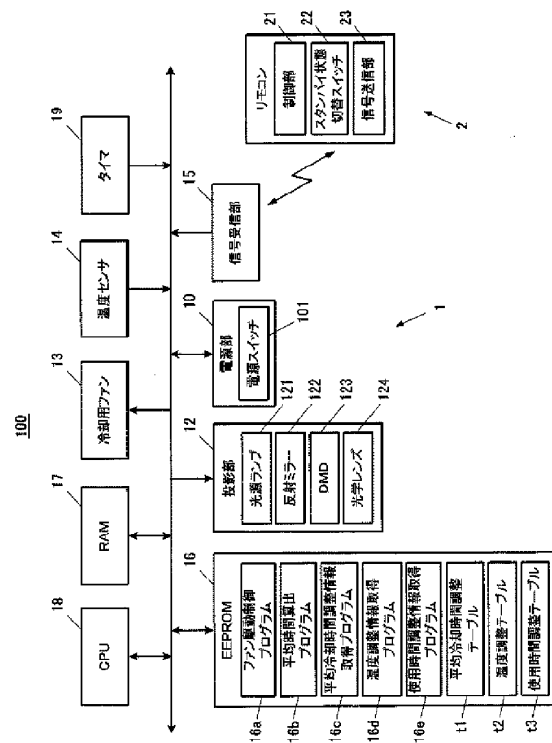
100 プロジェクター（投射型映像表示装置）

- 1 プロジェクター本体
 1 2 1 光源ランプ
 1 3 冷却用ファン
 1 4 温度センサ（温度検出手段）
 1 6 EEPROM（平均冷却時間調整情報記録手段、温度調整情報記録手段、使用時間調整情報記録手段）
 t 1 平均冷却時間調整テーブル
 t 2 温度調整テーブル
 t 3 使用時間調整テーブル
 1 8 CPU（ファン駆動制御手段、平均時間算出手段、平均冷却時間調整情報取得手段、温度調整情報取得手段、使用時間調整情報取得手段）
 1 9 タイマ（冷却時間計時手段、使用時間計時手段）
 1 0 電源部（電力供給手段）
 1 0 1 電源スイッチ
 2 リモートコントローラ
 2 2 スタンバイ状態切替スイッチ（スタンバイモード指示手段）

【図1】



【図2】



【図3】

t_1

平均冷却時間(s)	$0 < x \leq 30$	$30 < x \leq 40$	$40 < x \leq 50$	$50 < x \leq 60$
回転速度調整量	+15	+10	+5	± 0

【図4】

t_2

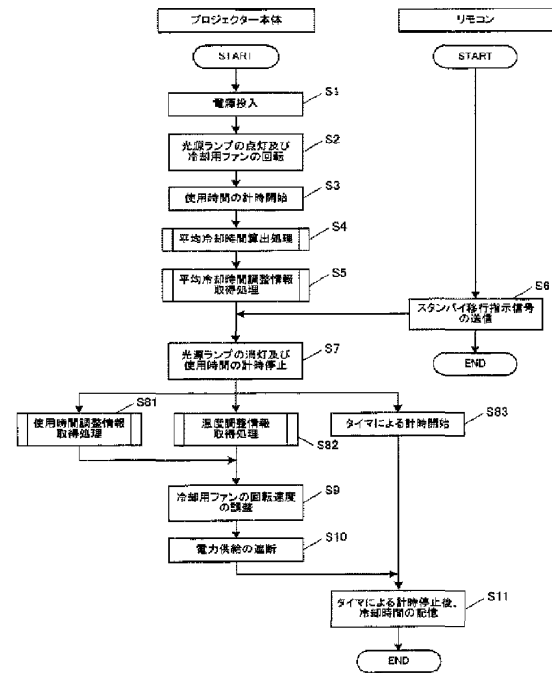
光源温度($^{\circ}\text{C}$)	$0 < y \leq 45$	$45 < y \leq 50$	$50 < y$
回転速度調整量	± 0	+5	+10

【図5】

t_3

光源使用時間(h)	$0 < z \leq 3$	$3 < z \leq 6$	$6 < z$
回転速度調整量	± 0	+5	+10

【図6】



(19)



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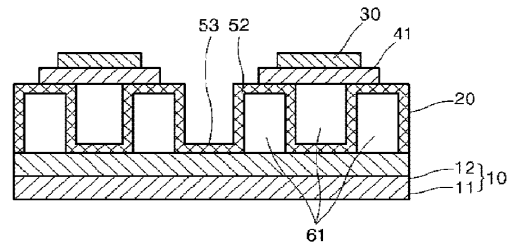
(51) Int. Cl **H01J 17/28**

(54) **PLASMA DISPLAY DEVICE WITH HEAT INSULATION UNIT INTERPOSED BETWEEN CHASSIS AND CIRCUIT BOARD SO AS TO PREVENT HEAT GENERATED FROM PLASMA DISPLAY PANEL FROM BEING TRANSFERRED TO CIRCUIT BOARD**

(57) Abstract:

PURPOSE: A plasma display device is provided to allow for a stable circuit operation by inserting a heat insulation unit into the space between the rear surface of a chassis and a circuit board such that heat generated from a plasma display panel is prevented from being transferred to the circuit board.

CONSTITUTION: A plasma display device comprises a plasma display panel(10); a chassis(20) disposed on the rear surface of the plasma display panel; a circuit board(30) disposed on the rear surface of the chassis; and a heat insulation unit interposed between the circuit board and the chassis. The heat insulation unit includes at least one heat insulation plate(41).



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● 서류명	특허출원서
● 권리구분	특허
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● 발명의 국문명칭	단열 수단을 구비하는 플라즈마 디스플레이 장치
● 발명의 영문명칭	Plasma display device comprising adiabatic means
● 출원인 명칭 특허고객번호	삼성에스디아이 주식회사 1-1998-001805-8
● 대리인 성명 대리인번호 포괄위임장특번호	이영필 9-1998-000334-6 1999-050326-4
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● 발명자 성명의 국문표기 성명의 영문표기 주민등록번호 우편번호 주소 국적	김세종 KIM,Se Jong 개인정보보호를 위해 비공개합니다. 개인정보보호를 위해 비공개합니다. 개인정보보호를 위해 비공개합니다. KR
성명의 국문표기 성명의 영문표기 주민등록번호 우편번호 주소 국적	우석균 WOO,Seok Gyun 개인정보보호를 위해 비공개합니다. 개인정보보호를 위해 비공개합니다. 개인정보보호를 위해 비공개합니다. KR
● 심사청구	청구
● 취지	특허법 제42조의 규정에 의한 출원, 특허법 제60조의 규정에 의한 출원심사를 청구합니다.대리인 이영필 (인)대리인 이해영 (인)
● 수수료 기본출원료 가산출원료 우선권 주장료 심사청구료	18 면 29,000 원 0 면 0 원 0 건 0 원 9 항 397,000 원





합계

426,000 원

☛ 첨부서류

개인정보보호를 위해 비공개합니다.

특허 명세서

☛ 요약서

요약

본 발명은 플라즈마 디스플레이 장치에 있어서, 플라즈마 디스플레이 패널로부터 발생하는 열이 회로기판으로 전달되는 것을 차단하여 회로 동작의 안전을 향상시킴과 아울러 플라즈마 디스플레이 패널로부터 발생하는 열의 방열을 증대시키는 것을 목적으로 하며, 이 목적을 달성하기 위하여 플라즈마 디스플레이 패널, 상기 플라즈마 디스플레이 패널의 배면에 배치되는 샤시, 상기 샤시의 배면에 배치되는 회로기판, 및 상기 회로기판과 상기 샤시의 사이에 위치하는 단열수단을 포함하며, 상기 샤시는 요철 형상으로 절곡된 것을 특징으로 하는 플라즈마 디스플레이 장치를 제공한다.

☛ 대표도

도 4

☛ 명세서

발명의 명칭

단열 수단을 구비하는 플라즈마 디스플레이 장치{Plasma display device comprising adiabatic means}

도면의 간단한 설명

- 도 1은 일반적인 플라즈마 디스플레이 장치의 일례를 개략적으로 나타낸 분리 사시도이고,
 도 2는 본 발명에 따른 플라즈마 디스플레이 장치의 일례를 개략적으로 나타낸 분리 사시도이고,
 도 3a는 본 발명에 따른 하나의 단열판을 구비하는 플라즈마 디스플레이 장치의 단면도이고,
 도 3b는 본 발명에 따른 두 개 이상의 단열판을 구비하는 플라즈마 디스플레이 장치의 단면도이고,
 도 4는 본 발명에 따른 요철 형상의 샤시를 구비하는 플라즈마 디스플레이 장치의 단면도이고,
 도 5a는 도 4의 플라즈마 디스플레이 장치에 있어서 세로 방향의 통풍구를 가지는 샤시의 사시도이며,
 도 5b는 도 4의 플라즈마 디스플레이 장치에 있어서 가로 방향의 통풍구를 가지는 샤시의 사시도이며,
 도 6a는 도 4의 플라즈마 디스플레이 장치에 있어서 샤시의 돌출부 양측면이 요철 모양으로 형성된 것을 나타낸 단면도이며,
 도 6b는 도 4의 플라즈마 디스플레이 장치에 있어서 샤시의 돌출부 양측면에 흰이 부착된 것을 나타낸 단면도이며,
 도 7은 도 4의 플라즈마 디스플레이 장치에 있어서 샤시의 돌출부가 사다리꼴 모양인 것을 나타낸 단면도이며,
 도 8은 바둑판 모양의 양각 돌출부 형상의 샤시의 일부 사시도이다.

* 도면의 주요부분에 대한 부호의 설명 *

- 10 : 플라즈마 디스플레이 패널 20 : 샤시
 30 : 회로기판 40 : 단열 수단
 52 : 돌출부 53 : 요입부
 54 : 요철 55 : 흰
 56 : 사다리꼴 형상의 요철 57 : 바둑판 형상의 양각 돌출부
 61 : 통풍홈

발명의 상세한 설명



**발명의 목적**

● 발명이 속하는 기술분야 및 그 분야의 종래기술

본 발명은 플라스마 디스플레이 장치에 관한 것으로서, 더욱 상세하게는 플라스마 디스플레이 패널(plasma display panel)로부터 발생하는 열이 패널을 구동하는 회로기판으로 전달되는 것을 차단하는 구조를 구비하는 플라스마 디스플레이 장치에 관한 것이다.

플라스마 디스플레이 장치는 가스 방전현상을 이용하여 화상을 표시하는 평판 디스플레이 장치로서, 표시 용량, 휘도, 콘트라스트, 잔상 및 시야각 등의 각종 표시 능력이 우수하며, 박형이고 대화면 표시가 가능하여 음극선관(CRT)을 대체할 수 있는 차세대 대형 평판 디스플레이 장치로서 각광을 받고 있다.

도 1에는 이러한 일반적인 플라스마 디스플레이 장치의 일례를 개략적으로 나타낸 분리 사시도가 도시되어 있다.

일반적으로 플라스마 디스플레이 장치는, 가스 방전을 이용하여 문자나 이미지를 표현하며 전면기판(11)과 배면기판(12)을 포함하는 플라스마 디스플레이 패널(10)과, 그 배면에 배치되는 사시(20), 및 사시(20)의 배면에 배치되며 플라스마 디스플레이 패널(10)을 구동하는 회로기판(30)을 구비한다.

일반적인 플라스마 디스플레이 장치에 있어서 열을 발생시키는 주요 구성 요소는 플라스마 디스플레이 패널(10)과 회로기판(30)이다. 플라스마 디스플레이 패널(10)에서 발생하는 열은 주로 열전도율이 높은 사시(20)로 전달되어 외부로 방출되는데, 그 일부는 회로기판(30)으로 전달된다. 회로기판(30)은 플라스마 디스플레이 패널(10)을 구동하는 구동소자(마도시)를 포함하며, 최근에는 구동회로의 신뢰성 및 생산성을 향상시키기 위하여 여러 가지의 반도체 소자를 하나의 기판에 집적한 하이브리드 집적회로(hybrid integrated circuit)를 사용하고 있는 추세이다. 상기 하이브리드 집적회로는 내부에 발열소자가 집중되어 있기 때문에, 구동 시 고열을 발생하게 된다. 이와 같이 발생된 열은 반도체 소자와 같은 회로부품의 구동 특성을 저하시킨다. 특히, 플라스마 디스플레이 장치는 음극선관과는 달리 좁은 공간에서 박형으로 화상을 형성하도록 구성되어 있기 때문에, 집적회로에서 발생한 열을 외부로 방출시키기 위한 별도의 냉각장치를 필요로 한다.

그런데, 상기와 같이 구성된 종래의 플라스마 디스플레이 장치에 있어서는 사시(20) 위에 회로기판(30)을 직접 접촉함으로써, 사시(20)가 플라스마 디스플레이 패널(10)에서 발생하는 열을 회로기판(30)에 직접 전달하는 매체가 되고 있다. 이러한 구조는 사시(20)의 방열을 방해하기 때문에 플라스마 디스플레이 패널(10) 잔상 등의 불량을 유발할 뿐만 아니라, 회로기판(30)으로 전달된 열이 회로에 영향을 주어 안정적인 회로 동작을 저해하게 함으로써, 신뢰성을 떨어뜨리는 문제점이 있었다.

● 발명이 이루고자 하는 기술적 과제

본 발명은 상기와 같은 문제점을 해결하기 위한 것으로, 본 발명의 목적은 사시의 배면과 회로기판 사이에 단열 수단을 삽입하여 플라스마 디스플레이 패널로부터 발생하는 열이 회로 기판으로 전달되는 것을 차단함으로써 안정적인 회로 동작을 가능하도록 하는 플라스마 디스플레이 장치를 제공하는데 있다. 본 발명의 다른 목적은 방열 능력이 우수한 요철 형상의 사시를 배치함으로써 플라스마 디스플레이 패널로부터 전달되는 열의 방출을 촉진하는 플라스마 디스플레이 장치를 제공하는데 있다.

발명(고안)의 구성 및 작용

상기와 같은 목적 및 그 밖의 다른 목적을 달성하기 위하여, 본 발명은 플라스마 디스플레이 패널, 상기 플라스마 디스플레이 패널의 배면에 배치되는 사시, 상기 사시의 배면에 배치되는 회로기판, 및 상기 회로기판과 상기 사시의 사이에 위치하는 단열 수단을 포함하는 플라스마 디스플레이 장치를 제공한다.

본 발명에 있어서 상기 단열 수단은 바람직하게는 적어도 하나의 단열판으로 이루어질 수 있다.

본 발명에 있어서 상기 사시는 바람직하게는 전면 또는 배면 중 적어도 어느 하나의 면에 요입부와 요철부가 교번하도록 요철 형상으로 절곡될 수 있다.

본 발명에 있어서 바람직하게는 상기 돌출부의 양측면에 요철부가 형성되도록 할 수 있다.

본 발명에 있어서 바람직하게는 상기 돌출부의 양측면에 다수의 환이 구비되도록 할 수 있다.

본 발명에 있어서 상기 돌출부와 상기 요입부는 바람직하게는 사다리꼴 형태가 될 수 있다.

이어서, 첨부된 도면들을 참조하여 본 발명의 바람직한 실시예를 상세히 설명한다.

도 2에는 본 발명의 바람직한 일 실시예에 따른 플라스마 디스플레이 장치의 개략적인 분리 사시도가 도시되어 있다. 도면을 참조하면, 플라스마 디스플레이 장치는, 가스 방전을 이용하여 문자나 이미지를 표현하며 전면기판(11)과 배면기판(12)을 포함하는 플라스마 디스플레이 패널(10)과, 그 배면에 배치되는





샤시(20), 및 샤시(20)의 배면에 배치되며 플라즈마 디스플레이 패널(10)을 구동하는 회로기판(30)을 구비하며, 추가적으로 샤시(20)와 회로기판(30) 사이에 단열 수단(40)이 삽입되어 있다. 단열 수단(40)은 도 3a에 도시된 바와 같이, 하나의 단열판(41) 모양으로 할 수도 있고, 도 3b에 도시된 바와 같이 회로기판(30)의 수를 고려하여 둘 이상의 단열판(41)으로 분리되어 삽입될 수 있다. 다수개의 단열판(41)을 삽입할 경우 단열판(41)과 샤시(20)와의 접촉 면적이 작아지므로, 샤시(20)의 방열 면적이 증가되어 샤시(20)의 방열 능력이 향상된다.

더욱이, 회로기판(30)과 샤시(20) 사이에 단열판(41)이 개재되므로, 플라즈마 디스플레이 패널(10)에서 발생된 열이 회로기판(30)으로 전달되는 것을 차단할 수 있어, 회로기판(30) 내에서 회로가 열에 의해 오동작되는 것을 방지할 수 있게 된다.

또한, 플라즈마 디스플레이 패널(41)은 플라즈마 디스플레이 장치의 주된 히트 소스(heat source)인 플라즈마 디스플레이 패널(10)과 회로기판(30)의 방열을 단열판(41)을 경계로 하여 독립적으로 수행하도록 할 수 있게 해주기 때문에, 플라즈마 디스플레이 장치의 설계자들의 방열 방법에 대한 설계 자유도가 증대된다.

샤시(20)는, 도 4에 도시된 바와 같이, 플라즈마 디스플레이 패널(10)로부터의 전달된 열의 방출을 촉진시키기 위해 요철 형상으로 절곡되어 있는 것이 바람직하다. 이와 같은 구성을 갖는 샤시(20)는 증가된 열전달 면적을 갖게 되어 방열 능력이 향상된다. 또한, 요철 형상을 갖는 샤시(20)의 경우, 송풍기(미도시)에 의한 강제 대류가 생성되어 방열될 때뿐만 아니라, 송풍기(미도시)없이 자연 대류에 의해서 방열될 경우에도, 샤시(20)로부터 열전달을 받은 온도가 상승한 공기가 요입부(53)와 돌출부(52)에 형성된 통풍홀(61)을 따라서 자연스럽게 흐르도록 해 주기 때문에 방열 능력이 향상된다.

도 5a에는 플라즈마 디스플레이 패널(10)의 세로 방향으로 통풍홀(61)이 형성된 요철 형상의 샤시(20)가 도시되어 있다. 샤시(20)로부터 열전달을 받은 공기는 온도가 상승하여 부력 효과에 의해 통풍홀(61)을 따라 위쪽으로 원활하게 방출될 수 있기 때문에 방열 능력을 증대시킨다. 또한, 요철 형상에 의해 증가된 열전달 면적과 통풍홀(61)에 의한 공기 유로는 샤시(20)의 방열 능력을 증대시킨다.

도 5b에는 플라즈마 디스플레이 패널(10)의 가로 방향으로 통풍홀(61)이 형성된 요철 형상의 샤시(20)가 도시되어 있다. 일반적으로 회로기판(30)과 플라즈마 디스플레이 패널(10)이 FPCB(flexible printed circuit board)(미도시)를 매개로 하여 연결되는데, FPCB는 샤시(20)의 상부측면 또는 하부측면을 통하여 연장된다. 만일 고온의 공기가 FPCB와 접촉하게 되면 열전달에 의해 FPCB에 형성되어 있는 회로와 FPCB에 실장된 전자기기에 악영향을 줄 수 있다. 따라서, 샤시(20)에 가로 방향으로 통풍홀(61)을 형성시키게 되면, 샤시(20)로부터 열전달을 받은 고온의 공기가 통풍홀(61)을 따라 샤시(20)의 좌우측 방향으로 배출되어, FPCB와의 직접적인 접촉을 하지 않으므로 FPCB가 안정적으로 작동할 수 있게 된다.

도 6a는 요철 형상의 샤시의 돌출부(52)에 요철(54)을 형성시킨 것을 나타낸다. 열전달 면적의 추가적인 증가로 방열 능력이 증대된다.

또한, 도 6b에 도시된 바와 같이 요철 형상의 샤시(20)의 돌출부(52)에 릿(fin)(55)을 설치함으로써 열전달 면적을 증가시켜 방열 능력을 증가시킬 수 있다.

도 7은 사다리꼴 형상의 요철(56)을 나타낸다. 사다리꼴 형상의 요철(56)의 경우도 사각형 형상의 요철처럼 열전달 면적이 증가할 뿐만 아니라, 열전달되는 통풍홀(61)의 유로가 매끄럽게 형성되기 때문에 방열 능력이 우수해진다.

도 8에는 바둑판 모양의 양각 돌출부(57)를 가진 샤시(20)의 일부 샤시도를 나타낸다. 바둑판 모양의 양각 돌출부(57)는 돌출된 부분으로 인하여 평판에 비해 열전달 면적이 증가하여 방열 능력이 향상된다. 또한, 통풍 유로가 플라즈마 디스플레이 패널(10)의 가로 방향뿐만 아니라 세로 방향으로도 형성되어, 샤시(20)로부터 열전달을 받은 고온의 공기가 외부로 원활하게 유출되므로 샤시(20)의 방열 능력을 증가시킨다.

발명(고안)의 효과

상술한 바와 같은 본 발명의 플라즈마 디스플레이 장치에 의하면 다음과 같은 효과가 있다.

첫째, 샤시와 회로기판 사이에 단열 수단을 삽입함으로써 플라즈마 디스플레이 패널로부터 발생하는 열이 회로기판에 전달되어 회로의 오동작이 발생하는 것을 억제한다.

둘째, 단열 수단의 삽입으로 플라즈마 디스플레이 패널로부터 발생하는 열과 회로기판에서 발생하는 열을 분리하여 독립적으로 방출시킬 수 있으므로, 설계자들의 방열 설계의 자유도가 증대된다.





셋째, 사시를 요철 형상으로 형성하여 열전달 면적을 증가시킴으로 방열 능력이 향상된다. 또한, 요철의 돌출부의 양측면에 요철부를 형성하거나 다수의 현을 설치함으로써 열전달 면적의 추가적인 증가로 방열 능력이 증대된다.

넷째, 사시에 요철 형상에 의한 뚫음통을 세로 방향으로 형성할 경우, 자연 대류에 의하여 사시로부터 열전달을 받은 고온의 공기가 원활하게 외부로 배출되므로, 열전달 효과가 증대되어 방열능력이 향상된다. 또한, 뚫음통을 가로 방향으로 형성할 경우, 사시의 상부측면 또는 하부측면에 위치하는 FPCB가 사시로부터 열전달을 받은 고온의 공기에 의해 악영향을 받는 것을 감소시킬 수 있다.

다섯째, 사시와 회로기판 사이에 단열수단을 개재시킴으로 인해 사시의 방열성이 떨어지는 것을 사시의 형상을 요철 형상으로 함으로써 방지 할 수 있다.

본 발명은 도면에 도시된 실시예를 참고로 설명되었으나 이는 예시적인 것에 불과하며, 본 발명이 속하는 기술 분야에서 통상의 지식을 가진 자라면 이로부터 다양한 변형 및 균등한 다른 실시예가 가능하다는 점을 이해할 것이다. 따라서, 본 발명의 진정한 기술적 보호 범위는 첨부된 특허청구범위의 기술적 사상에 의하여 정해져야 할 것이다.

◆ 청구의 범위

◆ 청구항 [1]

플라즈마 디스플레이 패널;

상기 플라즈마 디스플레이 패널의 배면에 배치되는 사시;

상기 사시의 배면에 배치되는 회로기판; 및

상기 회로기판과 상기 사시의 사이에 위치하는 단열 수단을 포함하는 것을 특징으로 하는 플라즈마 디스플레이 장치.

◆ 청구항 [2]

제1항에 있어서, 상기 단열 수단은 적어도 하나의 단열판으로 이루어진 것을 특징으로 하는 플라즈마 디스플레이 장치.

◆ 청구항 [3]

제1항에 있어서, 상기 사시는 전면 또는 배면 중 적어도 어느 하나의 면에 요입부와 돌출부가 교번하도록 요철 형상으로 절곡된 것을 특징으로 하는 플라즈마 디스플레이 장치.

◆ 청구항 [4]

제3항에 있어서, 상기 사시의 상기 요입부 및 상기 돌출부로 이루어진 뚫음구가 상기 플라즈마 디스플레이 패널의 가로 방향과 실질적으로 평행하도록 형성된 것을 특징으로 하는 플라즈마 디스플레이 장치.

◆ 청구항 [5]

제3항에 있어서, 상기 사시의 상기 요입부 및 상기 돌출부로 이루어진 뚫음구가 상기 플라즈마 디스플레이 패널의 세로 방향과 실질적으로 평행하도록 형성된 것을 특징으로 하는 플라즈마 디스플레이 장치.

◆ 청구항 [6]

제3항 내지 제5항 중 어느 한 항에 있어서, 상기 돌출부의 양측면에 요철부가 형성된 것을 특징으로 하는 플라즈마 디스플레이 장치.

◆ 청구항 [7]

제3항 내지 제5항 중 어느 한 항에 있어서, 상기 돌출부의 양측면에 다수의 현이 구비된 것을 특징으로 하는 플라즈마 디스플레이 장치.

◆ 청구항 [8]

제3항 내지 제5항 중 어느 한 항에 있어서, 상기 돌출부와 상기 요입부가 사다리꼴의 형상인 것을 특징으로 하는 플라즈마 디스플레이 장치.

◆ 청구항 [9]

제1항 또는 제2항에 있어서, 상기 사시는 배면에 바둑판 모양의 양각 돌출부를 구비하는 것을 특징으로 하는 플라즈마 디스플레이 장치.

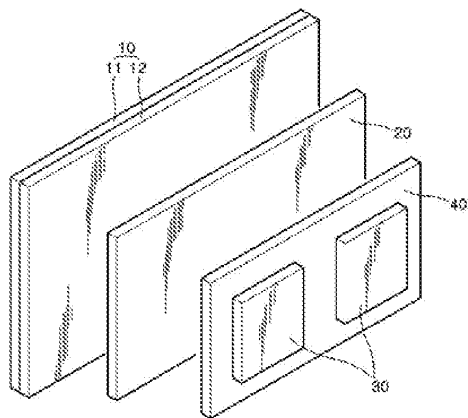
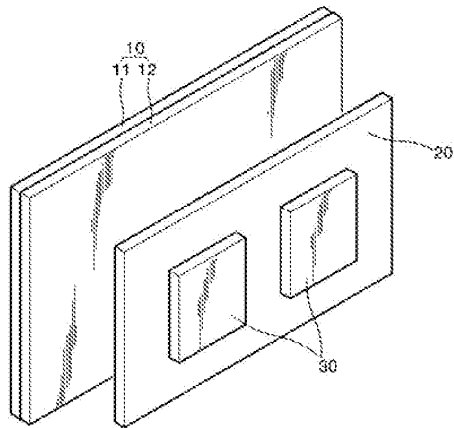


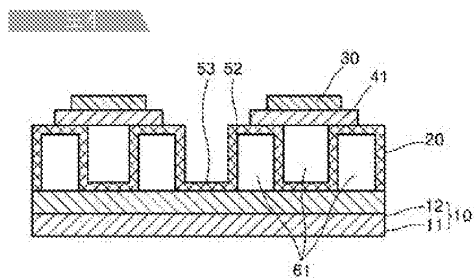
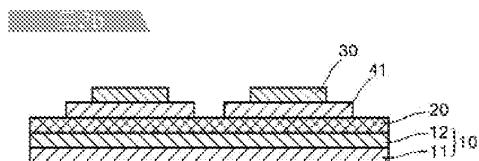
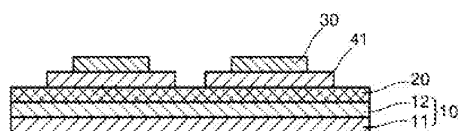


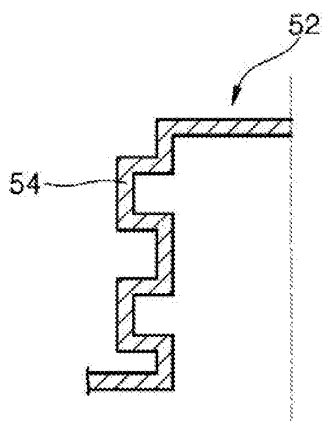
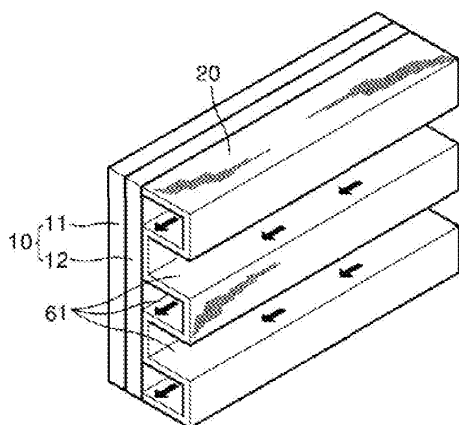
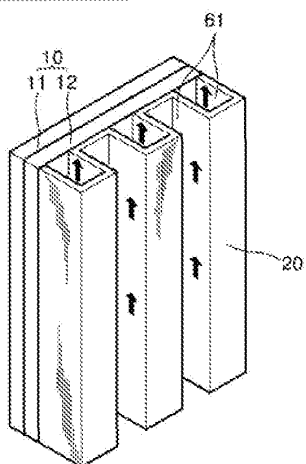
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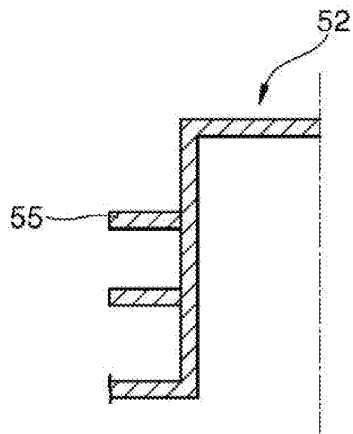




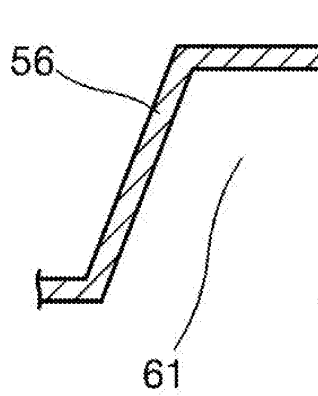




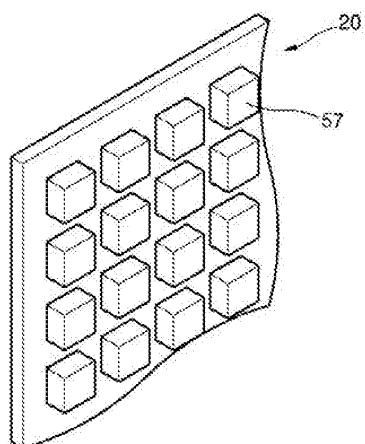
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Bibliographic data: KR20060016469 (A) — 2006-02-22**BACK LIGHT UNIT AND LIQUID CRYSTAL DISPLAY APPARATUS HAVING THE SAME****Inventor(s):** RA DONG GYUN [KR] ± (RA, DONG GYUN)**Applicant(s):** SAMSUNG ELECTRONICS CO LTD [KR] ± (SAMSUNG ELECTRONICS CO., LTD)**Classification:** - international: G02F1/13357
- cooperative: G02B6/0011; G02B6/0031; G02F1/133308;
G02F1/133385; G02F1/133603; G02F1/133604;
G02F2001/133628 [more](#)**Application number:** KR20040064922 20040818 [Global Dossier](#)**Priority number (s):** KR20040064922 20040818

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DESCRIPTION KR20060016469

BACKLIGHT UNIT AND LIQUID CRYSTAL DISPLAY DEVICE INCLUDING THE SAME

1 is an exploded perspective view of a backlight unit according to an embodiment of the present invention.

Fig. 2 is a plan view of the backlight unit of Fig. 1 from below. Fig.

3 is a side view for explaining the cooling process of the backlight unit of FIG.

4 is an exploded perspective view of a backlight unit according to another embodiment of the present invention.

5 is a plan view showing the backlight unit of FIG. 4 from below.

6 is a side view for explaining the cooling process of the backlight unit of FIG.

7 is an exploded perspective view of a backlight unit according to another embodiment of the present invention.

8 is a plan view showing the backlight unit of FIG. 7 from the bottom.

9 is a side view for explaining the cooling process of the backlight unit of FIG.

10 is an exploded perspective view of a backlight unit according to another embodiment of the present invention.

Fig. 11 is a plan view showing the backlight unit of Fig. 10 from below. Fig.

12 is a side view for explaining the cooling process of the backlight unit of FIG.

13 is an exploded perspective view showing a liquid crystal display device having the backlight unit of FIG.

14 is an exploded perspective view showing a liquid crystal display device having the backlight unit of Fig.

Description of the Related Art [0002]

100

: Plane light source device 110: reflector

112

: Coupling hole 120: Side wall

130

: Driving substrate 140: light emitting diode light source

[200]

200, 300: storage container 210, 310: bottom plate

[220]

220, 320: first side wall 230, 330: second side wall

[240]

240, 340: third side wall 250, 350: fourth side wall

[260]

260, 360: inner space 212, 312: through hole

[214]

214, 314: first drive circuit portions 222a, 322a, 332a, 342a, 352a: fan

[222]

222B, 322b, 332b, 342b, 352b: fans 224, 324:

[500]

500, 600: backlight unit 800, 900: liquid crystal display

820

: Optical sheet 840: Liquid crystal display panel

842

: Thin film transistor substrate 844: liquid crystal

846

: Color filter substrate 848: Driving module

860

: Chassis

BACKGROUND OF THE INVENTION 1. Field of the Invention The present invention relates to a backlight unit and a liquid crystal display including the same, and more particularly, to a backlight unit and a liquid crystal display including the same. In general, a liquid crystal display device displays an image using electrical and optical characteristics of a liquid crystal. The liquid crystal display device is advantageous in that it is very small in volume and light in weight compared to a CRT, and as a result, is widely used in portable computers, communication devices, liquid crystal TVs, and the

like. In order to control the liquid crystal, the liquid crystal display requires a liquid crystal control part for controlling the liquid crystal and a light supply part for supplying light to the liquid crystal. As the light supply part of the liquid crystal display device, a cold cathode fluorescent lamp (CCFL) having a rod shape or a light emitting diode (LED) having a dot shape is mainly used. The light emitting diode has the advantage of high color reproducibility. However, the light emitting diode generates a lot of heat due to its luminescent characteristics. Particularly, the light emitting diode has a lot of heat radiated backward from the liquid crystal display device, and the temperature of the storage container for storing the light emitting diode is extremely high. In order to prevent an increase in the temperature of the storage container, the storage container may include a heat sink having a metal material such as aluminum. However, even if the storage container includes the heat sink, the thickness and weight of the storage container increase, and the thickness and weight of the liquid crystal display also increase. Therefore, when the light emitting diode is used as a light supply part of a liquid crystal display device or when another device generating a lot of heat other than the light emitting diode is used as a light supply part, the temperature of the storage container may increase, And the weight increases. Accordingly, it is an object of the present invention to provide a backlight unit having an increased cooling effect and reduced thickness and weight. Another object of the present invention is to provide a liquid crystal display device having the aforementioned backlight unit.

In order to achieve the object of the present invention, the present invention provides a backlight unit including a light generating unit and a storage container. The light generating unit generates light. The storage container houses the light generating portion, and has an intake portion for sucking outside air and an exhaust portion for releasing internal air. In order to achieve another object of the present invention, the present invention provides a backlight unit including a light generating unit and a storage container. The light generating unit generates light. The storage container houses the light generating portion, and has an intake portion for sucking outside air and an exhaust portion for discharging internal air. In order to achieve another object of the present invention, the present invention includes a backlight unit and a liquid crystal display panel. The backlight unit includes a light generating unit for generating light, and a storage container for storing the light generating unit, an intake unit for sucking outside air, and an exhaust unit for emitting internal air. The liquid crystal display panel displays an image using light emitted from the light generating unit. In order to achieve another object of the present invention, the present invention includes a backlight unit and a liquid crystal display panel. The backlight unit includes a light generating unit for generating light, and a storage container for storing the light generating unit, an intake

unit for sucking outside air, and an exhaust unit for emitting internal air. The liquid crystal display panel displays an image using light emitted from the light generating unit. According to the present invention, the thickness and weight of the backlight unit are reduced, and the cooling effect is increased. Further, the brightness and the contrast ratio of the backlight unit are prevented from lowering. Hereinafter, a backlight unit and a liquid crystal display including the same according to preferred embodiments of the present invention will be described in detail with reference to the accompanying drawings, but the present invention is not limited or limited by the following embodiments. 1 is an exploded perspective view of a backlight unit according to an embodiment of the present invention, and FIG. 2 is a plan view showing a backlight unit of FIG. 1 from the bottom. Referring to FIGS. 1 and 2, the backlight unit 500 includes a surface light source device 100 and a storage container 200.

The surface light source device 100 includes a reflector 110, a side wall 120, a driving substrate 130, and a plurality of light emitting diode light sources 140. The reflection plate 110 has a rectangular flat plate shape and reflects downward light of the light emitted from the light emitting diode light sources 140 upward. A plurality of coupling holes 112 are formed in the reflection plate 110 so that the light emitting diode light source 140 can be coupled. The side wall 120 is formed at the edge of the reflector 110 so that the surface light source device 100 can be easily coupled to the storage container 200. In the present embodiment, the side wall 120 is formed at a pair of opposing edges of the reflection plate 110. The driving substrate 130 is arranged at a lower portion of the reflection plate 110. A driving power source is applied to the driving substrate 130 to light the light emitting diode light sources 140. The light emitting diode light sources 140 are arranged in a line on the driving substrate 130 and are coupled to the upper surface of the reflection plate 110 through the coupling holes 112. Preferably, the light emitting diode light sources 140 include a red light emitting diode R for generating red light, a green light emitting diode G for generating green light, and a blue light emitting diode B for generating blue light. The red light, the green light, and the blue light emitting diodes R, G, and B generate white light according to a predetermined combination ratio. For example, the ratio of the number of the red light emitting diode R, the number of the green light emitting diode G, and the number of the blue light emitting diode B may be 2: 1: 1 or 2: 2: 1. Further, the red light, the green light, and the blue light light emitting diodes R, G, and B may be disposed more than the numbers shown in FIG. Alternatively, the light emitting diode light sources 140 may include a white light emitting diode that generates white light. The storage container 200 houses the surface light source device 100. The storage container 200 includes a bottom plate 210, a first side wall 220, a second side wall 230, a third side wall 240 and a fourth side wall 250.

The bottom plate 210 has a rectangular plate shape and includes a first driving circuit 214 and a plurality of through holes 212. The first driving circuit portion 214 is disposed on the bottom plate 210 and drives the surface light source device 100. The through holes 212 are formed in a portion excluding the portion where the first driving circuit portion 214 is disposed, and are formed through the bottom plate 210. Through the through holes 212, air can be moved. In the present embodiment, the through - holes 212 serve as an intake unit in which external air is sucked. The first to fourth sidewalls 220, 230, 240, and 250 extend from the edges of the bottom plate 210 to form a storage space and an inner space, respectively. The first sidewall 220 is disposed at one edge of the bottom plate 210 and is preferably not perpendicular to the bottom plate 210. Specifically, the first side wall 220 is inclined outward with respect to the bottom plate 210. Alternatively, the first sidewall 220 may be perpendicular to the bottom plate 210. The second to fourth sidewalls 230, 240 and 250 are respectively disposed at the other edge portions of the bottom plate 210 and are perpendicular to the bottom plate 210. The second sidewall 230 is disposed adjacent to the first sidewall 220. The third sidewall 240 is disposed adjacent to the second sidewall 230 and faces the first sidewall 220. The fourth sidewall 250 is disposed adjacent to the first and third sidewalls 220 and 240 and opposes the second sidewall 230. The first sidewall 220 is formed with a plurality of fans 222a. The fans 222a are actuated to cause air to flow out of the internal space. Accordingly, the heat generated from the surface light source device 100 is transmitted to the outside from the inner space. In the present embodiment, the fans 222a function as an exhaust unit that emits internal air. The first sidewall 220 may further include a second driving circuit portion 224.

The second driving circuit portion 224 is disposed on the first sidewall 220 and includes components of the apparatus having the backlight unit 100 according to the present embodiment as a light supply part, And can be used for driving the liquid crystal display panel. Alternatively, the second driving circuit portion 224 may be disposed on the second to fourth sidewalls 230, 240, and 250. Meanwhile, the first to fourth sidewalls 220, 230, 240 and 250 may be coupled to the reflector 110 of the surface light source device 100 in a hook - like manner. Hereinafter, the cooling process of the backlight unit having the above - described structure will be described in detail with reference to the drawings. 3 is a side view for explaining the cooling process of the backlight unit of FIG. Referring to FIG. 3, the light emitting diode array substrate 110 of the surface light source device 100 is driven to generate heat. The temperature of the air staying in the internal space 260 between the surface light source device 100 and the storage container 200 is raised by the heat. The heated air is discharged to the outside of the backlight unit 500 by the plurality of fans 222a formed on the first sidewall 220. When the hot air is discharged to the outside of the backlight unit 1000, the pressure of the inner space 260 is lowered. Therefore, cold air, which is cooler than the hot air in the

inner space 260, flows from the outside of the backlight unit 500 through the through holes 212. Accordingly, the processes of releasing the high - temperature internal air and the low - temperature external air are continuously repeated, and as a result, the heat generated in the surface light source device 100 is cooled by the flow of air. Particularly, the cooling process according to the present embodiment is mainly performed by free convection of air. That is, the temperature of the air in the internal space 260 rises due to the heat generated in the surface light source device 100, and the high temperature air rises upward in the internal space 260 by the convection action. And is then discharged to the outside by the discharge ports 222a.

Then, the outside low - temperature air flows into the internal space 260 through the through - holes 212, and the temperature is raised by the heat generated in the surface light source device and is raised by the convection action . In this embodiment, the through holes are formed on the bottom plate, but the through holes may be additionally formed in the first to fourth sidewalls, and may be formed only in the first to fourth sidewalls . That is, the through - hole may be formed in at least one of the bottom plate and the first to fourth sidewalls. Also, in this embodiment, the fan is formed on the first sidewall, but the fan may be additionally formed on at least one of the bottom plate and the second to fourth sidewalls. Meanwhile, in the present embodiment, the surface light source device including the light emitting diode is used as a light generating portion, but an apparatus including another light source requiring cooling may also be applied as the light generating portion of the present invention. According to the present embodiment, the components that perform the cooling function directly are formed in the storage container of the backlight unit. Therefore, the thickness and weight of the backlight unit are reduced. In addition, the cooling effect is increased by the natural convection phenomenon according to the operation of the components. Thus, the luminance and contrast ratio of the backlight unit are prevented from lowering. 4 is an exploded perspective view of a backlight unit according to another embodiment of the present invention, and FIG. 5 is a plan view showing a backlight unit of FIG. 4 from the bottom. Referring to FIGS. 4 and 5, the backlight unit 600 includes the surface light source device 100 and the storage container 300. The planar light source device 100 employed in the present embodiment has the same structure and function as the planar light source device shown in FIG. 1, and thus a repetitive description thereof will be omitted. The storage container 300 houses the surface light source device 100. The storage container 300 includes a bottom plate 310, a first side wall 320, a second side wall 330, a third side wall 340 and a fourth side wall 350. The bottom plate 310 has a rectangular plate shape and includes a first driving circuit portion 314 and a plurality of through holes 312.

The first driving circuit portion 314 is disposed on the bottom plate 310 and drives the surface light source device 100. [The through holes 312 are formed in a portion excluding the portion where the first driving circuit portion 314 is disposed, and are formed through the bottom plate 310. Through the through holes 312, air can move. In the present embodiment, the through - holes 312 serve as an intake unit in which outside air is sucked. The first to fourth sidewalls 320, 330, 340, and 350 extend from the edges of the bottom plate 310, respectively, to form a storage space and an inner space. Each of the first to fourth sidewalls 320, 330, 340 and 350 is disposed at one edge of the bottom plate 310 and is preferably not perpendicular to the bottom plate 310. Specifically, the first to fourth sidewalls 320, 330, 340, and 350 are inclined outward with respect to the bottom plate 310. Alternatively, some or all of the first through fourth sidewalls 320, 330, 340, and 350 may be perpendicular to the bottom plate 310. The first to fourth sidewalls 320, 330, 340, and 350 are sequentially disposed adjacent to each other. The first sidewall 320 and the third sidewall 340 are opposed to each other and the second sidewall 330 and the fourth sidewall 350 are opposed to each other. A plurality of fans 322a, 332a, 342a, and 352a are formed on the first to fourth sidewalls 320, 330, 340, and 350, respectively. The fans 322a, 332a, 342a, and 352a are actuated to cause air to flow out of the interior space. Accordingly, the heat generated from the surface light source device 100 is transmitted to the outside from the inner space. In the present embodiment, the fans 322a, 332a, 342a, and 352a function as an exhaust unit that emits internal air. The first sidewall 320 may further include a second driving circuit portion 324. The second driving circuit portion 324 is disposed on the first sidewall 320 and includes components of the apparatus having the backlight unit 100 according to the present embodiment as a light supply part, And can be used for driving the liquid crystal display panel.

Alternatively, the second driving circuit portion 324 may be disposed on the second to fourth sidewalls 330, 340 and 350. Meanwhile, the first to fourth sidewalls 320, 330, 340 and 350 may be coupled to the reflector 110 of the surface light source device 100 in a hook - like manner. Hereinafter, the cooling process of the backlight unit having the above - described structure will be described in detail with reference to the drawings. 6 is a side view for explaining the cooling process of the backlight unit of FIG. Referring to FIG. 6, the driving substrate 130 of the surface light source device 100 is driven to generate heat. The temperature of the air staying in the internal space 360 between the surface light source device 100 and the storage container 300 is raised by the heat. The raised temperature of the air is discharged to the outside of the backlight unit 2000 by the plurality of fans 322a, 332a, 342a, and 352a formed on the first to fourth sidewalls 320, 330, 340, When the hot air is discharged to the outside of the backlight unit 2000, the pressure of the inner space 360 is lowered. Therefore, cold air, which is cooler than the hot air in the inner space 360, flows from the outside of the backlight unit 2000

through the through holes 312. Accordingly, the processes of releasing the high - temperature internal air and the low - temperature external air are continuously repeated, and as a result, the heat generated in the surface light source device 100 is cooled by the flow of air. In this embodiment, the through holes are formed on the bottom plate, but the through holes may be additionally formed in the first to fourth sidewalls, and may be formed only in the first to fourth sidewalls . That is, the through - hole may be formed in at least one of the bottom plate and the first to fourth sidewalls. Further, in this embodiment, the fan is formed on the first to fourth sidewalls, but the fan can be additionally formed on the bottom plate, and the fan can be formed on the bottom plate and the first to fourth side walls As shown in FIG.

That is, the fan may be formed on at least one of the bottom plate and the first to fourth sidewalls. Meanwhile, in the present embodiment, the surface light source device including the light emitting diode is used as a light generating portion, but an apparatus including another light source requiring cooling may also be applied as the light generating portion of the present invention. According to the present embodiment, the components that perform the cooling function directly are formed in the storage container of the backlight unit. In particular, the fans are formed in the various sidewalls of the storage container to further improve the cooling function. Therefore, the thickness and weight of the backlight unit are reduced. In addition, the cooling effect is increased by the natural convection phenomenon according to the operation of the components. Thus, the luminance and contrast ratio of the backlight unit are prevented from lowering. 7 is an exploded perspective view of a backlight unit according to another embodiment of the present invention, and Fig. 8 is a plan view showing a backlight unit of Fig. 7 from the bottom. In the third embodiment, elements having the same structure and function as the elements in the first embodiment are denoted by the same reference numerals, and a detailed description thereof will be omitted. Referring to FIGS. 7 and 8, a plurality of fans 222b are formed on the first sidewall 220. As shown in FIG. The fans 222b are operated to flow air from the outside to the inner space. Accordingly, the heat generated in the surface light source device 100 is cooled by the low - temperature air introduced from the outside. In the present embodiment, the fans 222b function as an intake unit for sucking outside air. In addition, the fans 222b act as a cooler for cooling the surface light source device 100 actively. Hereinafter, the cooling process of the backlight unit having the above - described structure will be described in detail with reference to the drawings. 9 is a side view for explaining a cooling process of the backlight unit of FIG. Referring to FIG. 9, the driving substrate 130 of the surface light source device 100 is driven to generate heat. The temperature of the air staying in the internal space 260 between the surface light source device 100 and the storage container 200 can be increased by the heat.

Here, the fans 222 b inject the outside air of the low temperature backlight unit 500 into the internal space 260 at a high speed. The injected outside air collides with a reflecting plate 110 where heat is generated to cool the reflecting plate 110. Meanwhile, since the outside air is introduced into the inside by the fans 222b, the internal pressure increases. Therefore, the air in the inner space 260 is discharged to the outside of the backlight unit 500 through the through holes 212. As a result, the inflow of the low - temperature external air and the high - temperature internal air are continuously repeated, and as a result, the heat generated in the surface light source 100 is cooled by the flow of air. Particularly, the cooling process according to the present embodiment is mainly performed by the forced convection phenomenon of the fans 222b functioning as the cooler. That is, the low - temperature external air introduced by the fans 222b collides with the surface light source device 100 generating heat at a high speed to cool the surface light source device 100. [Accordingly, the fans 222a according to the first embodiment have a passive function of discharging the hot air of the internal space 260 to the outside, whereas the fans 222b according to the present embodiment are active Function. Generally, heat transfer effect by forced convection is greater than heat transfer effect by natural convection phenomenon. Therefore, the cooling according to the present embodiment can be more effective. In the present embodiment, the through holes are formed on the bottom plate, but the through holes may be additionally formed in the first to fourth sidewalls, and may be formed only in the first to fourth sidewalls. That is, the through - hole may be formed in at least one of the bottom plate and the first to fourth sidewalls. Also, in this embodiment, the fan is formed on the first sidewall, but the fan may be additionally formed on at least one of the bottom plate and the second to fourth sidewalls. Meanwhile, in the present embodiment, the surface light source device including the light emitting diode is used as a light generating portion, but an apparatus including another light source requiring cooling may also be applied as the light generating portion of the present invention.

According to the present embodiment, the components that perform the cooling function directly are formed in the storage container of the backlight unit. Therefore, the thickness and weight of the backlight unit are reduced. In addition, the forced convection phenomenon in accordance with the operation of the above components increases the cooling effect. Thus, the brightness and contrast ratio of the backlight unit are prevented from lowering. 10 is an exploded perspective view of a backlight unit according to another embodiment of the present invention, and FIG. 11 is a plan view showing a backlight unit of FIG. 10 from below. In the fourth embodiment, elements having the same structure and function as the elements in the second embodiment are denoted by the same reference numerals, and a detailed description thereof will be omitted. Referring to FIGS. 10 and 11, a plurality of fans 322b, 332b, 342b, and 352b are formed

on the first to fourth sidewalls 320, 330, 340, and 350, respectively. The fans 322b, 332b, 342b, and 352b can cool the heat generated from the surface light source device 100 by sucking outside air at a low temperature. In the present embodiment, the fans 322b, 332b, 342b, and 352b function as an air intake unit for sucking outside air. In addition, the fans 322b, 332b, 342b, and 352b function as a cooler for actively cooling the surface light source device 100. [Hereinafter, the cooling process of the backlight unit having the above - described structure will be described in detail with reference to the drawings. 12 is a side view for explaining the cooling process of the backlight unit of FIG. Referring to FIG. 12, the driving substrate 130 of the surface light source device 100 is driven to generate heat. The temperature of the air staying in the internal space 360 between the surface light source device 100 and the storage container 300 can be increased by the heat. The fans 322b, 332b, 342b, and 352b inject outside air of the low temperature backlight unit 600 into the internal space 360 at a high speed. The injected outside air collides with a reflecting plate 110 where heat is generated to cool the reflecting plate 110.

Meanwhile, since the outside air is introduced into the inside by the fans 322b, 332b, 342b, and 352b, the internal pressure increases. Therefore, the air in the inner space 360 is discharged to the outside of the backlight unit 600 through the through holes 312. As a result, the inflow of the low - temperature external air and the high - temperature internal air are continuously repeated, and as a result, the heat generated in the surface light source 100 is cooled by the flow of air. In the present embodiment, the through holes are formed on the bottom plate, but the through holes may be additionally formed in the first to fourth sidewalls, and may be formed only in the first to fourth sidewalls. That is, the through - hole may be formed in at least one of the bottom plate and the first to fourth sidewalls. Further, in this embodiment, the fan is formed on the first to fourth sidewalls, but the fan can be additionally formed on the bottom plate, and the fan can be formed on the bottom plate and the first to fourth side walls As shown in FIG. That is, the fan may be formed on at least one of the bottom plate and the first to fourth sidewalls. Meanwhile, in the present embodiment, the surface light source device including the light emitting diode is used as a light generating portion, but an apparatus including another light source requiring cooling may also be applied as the light generating portion of the present invention. According to the present embodiment, the components that perform the cooling function directly are formed in the storage container of the backlight unit. In particular, the fans are formed in the various sidewalls of the storage container to further improve the cooling function. Therefore, the thickness and weight of the backlight unit are reduced. In addition, the forced convection phenomenon in accordance with the operation of the above components increases the cooling effect. Thus, the luminance and contrast ratio of the backlight unit are prevented from lowering. Liquid Crystal Display Device Embodiment 5 Fig. 13 is an exploded

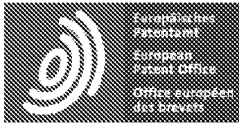
perspective view showing a liquid crystal display device having the backlight unit of Fig. 13, the liquid crystal display device 800 includes a backlight unit 500, a liquid crystal display panel 840, and a chassis 860.

The backlight unit 500 employed in this embodiment has the same structure and function as those of the backlight unit shown in FIG. 1, and thus a repetitive description thereof will be omitted. The liquid crystal display panel 840 displays an image using light emitted from the surface light source device 100. The liquid crystal display panel 840 includes a thin film transistor (TFT) substrate 842, a liquid crystal 844, a color filter substrate 846, and a driving module 848. The TFT substrate 842 includes a pixel electrode (not shown) arranged in a matrix form, a thin film transistor (not shown), a gate line (not shown) and a data line (not shown) for applying a driving voltage to each of the pixel electrodes. The color filter substrate 846 includes a color filter (not shown) arranged to face the pixel electrode formed on the TFT substrate 842, and a common electrode (not shown) formed on the color filter. The liquid crystal 844 is interposed between the TFT substrate 842 and the color filter substrate 846. The driving module 848 drives the liquid crystal display panel 840. Alternatively, the second driving circuit portion 224 may be disposed on one of the bottom plate 210 and the first to fourth side walls 220, 230, 240, and 250 to drive the liquid crystal display panel 840. The edge of the color filter substrate 846 is enclosed by the chassis 860 and a part of the chassis 860 is coupled to the storage container 200. The chassis 860 prevents breakage of the liquid crystal display panel 840 which is vulnerable to an external impact and prevents the liquid crystal display panel 840 from flowing. The liquid crystal display device 800 may further include an optical sheet 820 for improving luminance uniformity of the light emitted from the surface light source device 100. The optical sheet 820 may include a diffusion sheet, a prism sheet, a protective sheet, and the like. A middle chassis (not shown) may be further provided on the optical sheet 820. The middle chassis abuts the optical sheet 820 to press the optical sheet 820 toward the storage container 200 side.

According to the present embodiment, the components that perform the cooling function directly are formed in the storage container of the backlight unit. Therefore, the thickness and weight of the backlight unit are reduced. In addition, the cooling effect is increased by the natural convection phenomenon according to the operation of the components. Thus, the thickness and weight of the liquid crystal display including the backlight unit are reduced, the cooling effect is increased, and the luminance and contrast ratio are prevented from lowering. Embodiment 6 Fig. 14 is an exploded perspective view showing a liquid crystal display device having a backlight unit of Fig. 14, the liquid crystal display device 900 includes a backlight unit 600, a liquid crystal display panel 840, and a chassis 860. The liquid crystal display device according to this

embodiment has the same structure and function as those of the liquid crystal display device according to the fifth embodiment except for the backlight unit. Further, the backlight unit 600 employed in this embodiment has the same structure and function as the backlight unit shown in Fig. According to the present embodiment, the components that perform the cooling function directly are formed in the storage container of the backlight unit. Therefore, the thickness and weight of the backlight unit are reduced. Further, by the forced convection phenomenon according to the operation of the components, the cooling effect is increased. Thus, the thickness and weight of the liquid crystal display device including the backlight unit are reduced, the cooling effect is increased, and the decrease in luminance and contrast ratio is prevented.

As described above, according to the present invention, according to the present embodiment, the components that perform the cooling function directly are formed in the storage container of the backlight unit. Therefore, the thickness and weight of the backlight unit are reduced. Further, the natural convection phenomenon or the forced convection phenomenon caused by the operation of the above - mentioned components increases the cooling effect. Thus, the thickness and weight of the liquid crystal display including the backlight unit are reduced, the cooling effect is increased, and the luminance and contrast ratio are prevented from lowering. While the present invention has been described in connection with what is presently considered to be practical and exemplary embodiments, it is to be understood that the invention is not limited to the disclosed embodiments, but, on the contrary, It will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention.



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CLAIMS KR20060016469

1.

A light generating unit for generating light; And a storage container for storing the light generating part and including an intake part for sucking outside air and an exhaust part for releasing internal air.

2.

The backlight unit of claim 1, wherein the storage container includes a bottom plate and a plurality of side walls extending from an edge of the bottom plate to provide a storage space for accommodating the light generating unit.

3.

3. The apparatus of claim 2, wherein the sidewalls comprise a first sidewall, a second sidewall disposed adjacent the first sidewall, a third sidewall disposed adjacent the second sidewall and opposite the first sidewall, And a fourth sidewall disposed adjacent

the third sidewall and opposite the second sidewall.

4.

4. The air conditioner according to claim 3, wherein the intake portion includes at least one through - hole formed in at least one of the bottom plate and the first to fourth sidewalls, and the exhaust portion includes at least one of the bottom plate and the first to fourth sidewalls & Lt; / RTI & gt; wherein the backlight unit comprises at least one fan formed on at least one of the plurality of light sources.

5.

The backlight unit according to claim 4, wherein the through hole is formed through the bottom plate, and the fan is formed on the first side wall.

6.

The backlight unit according to claim 5, wherein the first side wall is inclined outward with respect to the bottom plate.

7.

The backlight unit according to claim 4, wherein the fan is formed on the first to fourth sidewalls, respectively.

8.

The backlight unit according to claim 2, further comprising a first driving circuit part disposed on one of the bottom plate and the side walls of the storage container to drive the light generating part.

9.

The backlight unit according to claim 1, wherein the light generating unit is a surface light source device.

10.

The backlight unit according to claim 9, wherein the surface light source device includes a light emitting diode light source.

11.

11. The backlight unit according to claim 10, wherein the surface light source device further comprises a reflector disposed between the storage container and the light emitting diode light source.

12.

A light generating unit for generating light; And a storage container for storing the light generating portion and including an intake portion for sucking outside air and an exhaust portion for discharging internal air.

13.

13. The apparatus of claim 12, wherein the containment vessel includes a bottom plate and a plurality of side walls extending from an edge of the bottom plate to provide a containment space for receiving the light generating unit, A second sidewall disposed adjacent to the first sidewall, a third sidewall disposed adjacent the second sidewall and opposite the first sidewall, and a second sidewall disposed adjacent the first and third sidewalls, Wherein the first side wall is a first side wall.

14.

14. The air conditioner of claim 13, wherein the exhaust unit includes at least one through hole formed in at least one of the bottom plate and the first to fourth sidewalls of the storage container, Wherein the at least one fan comprises at least one fan formed on at least one.

15.

15. The backlight unit according to claim 14, wherein the through - hole is formed through the bottom plate, and the fan is formed on the first side wall.

16.

16. The backlight unit according to claim 15, wherein the first side wall is inclined outward with respect to the bottom plate.

17.

14. The backlight unit of claim 13, further comprising a first driving circuit part disposed on one of the bottom plate and the sidewalls of the storage container to drive the light generating part.

18.

13. The backlight unit of claim 12, wherein the light generating unit is a surface light source device including a light emitting diode light source.

19.

19. The backlight unit of claim 18, wherein the surface light source device further comprises a reflector disposed between the storage container and the light emitting diode light source.

20.

A backlight unit including a light generating unit for generating light, and a storage container for storing the light generating unit and including an intake unit for sucking outside air and an exhaust unit for releasing internal air; And a liquid crystal display panel for displaying an image using light emitted from the light generating unit.

21.

21. The apparatus of claim 20, wherein the containment vessel includes a bottom plate and a plurality of sidewalls, wherein the intake section includes at least one through-hole formed through at least one of the bottom plate and the sidewalls, A bottom plate, and at least one fan formed on at least one of the side walls.

22.

22. The liquid crystal display of claim 21, wherein the through hole is formed through the bottom plate, and the fan is formed on a first sidewall of the sidewalls outwardly inclined with respect to the bottom plate.

23.

23. The liquid crystal display of claim 22, wherein the fan is formed on each of the side walls, and each of the side walls is inclined outward with respect to the bottom plate.

24.

21. The liquid crystal display of claim 20, wherein the light generating unit is a surface light source device including a light emitting diode light source.

25.

The liquid crystal display device according to claim 20, further comprising: a first driving circuit part disposed on one of the bottom plate and the sidewalls for driving the light generating part; and a second driving circuit part disposed on one of the bottom plate and the sidewalls And a second driving circuit unit arranged on the second substrate.

26.

26. The apparatus of claim 25, wherein the first driving circuit portion is disposed on a bottom plate of the storage container, and the second driving circuit portion is disposed on a first sidewall of the sidewalls that is inclined outward with respect to the bottom plate .

27.

A backlight unit including a light generating unit for generating light, and a storage container for storing the light generating unit and including an intake unit for sucking outside air and an exhaust unit for releasing internal air; And a liquid crystal display panel for displaying an image using light emitted from the light generating unit.

28.

28. The apparatus of claim 27, wherein the containment vessel includes a bottom plate and a plurality of sidewalls, wherein the exhaust section includes at least one through-hole formed through at least one of the bottom plate and the sidewalls, A bottom plate, and at least one fan formed on at least one of the side walls.

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(54) 백라이트 유닛 및 이를 포함하는 액정표시장치

요약

백라이트 유닛 및 이를 포함하는 액정표시장치가 개시된다. 백라이트 유닛은 광 발생부 및 수납 용기를 포함한다. 광 발생부는 광을 발생한다. 수납 용기는 광 발생부를 수납하고, 외부 공기가 흡입되는 흡기부 및 내부 공기를 방출하는 배기부가 형성된다. 이에 따라, 백라이트 유닛의 두께 및 무게가 감소되고, 냉각 효과가 증가된다.

대표도

도 1

색인어

백라이트 유닛, 냉각, 대류

명세서

도면의 간단한 설명

도 1은 본 발명의 일 실시예에 따른 백라이트 유닛의 분해 사시도이다.

도 2는 도 1의 백라이트 유닛을 하부에서 도시한 평면도이다.

도 3은 도 1의 백라이트 유닛의 냉각 과정을 설명하기 위한 측면도이다.

도 4는 본 발명의 다른 실시예에 따른 백라이트 유닛의 분해 사시도이다.

도 5는 도 4의 백라이트 유닛을 하부에서 도시한 평면도이다.

도 6은 도 4의 백라이트 유닛의 냉각 과정을 설명하기 위한 측면도이다.

도 7은 본 발명의 또 다른 실시예에 따른 백라이트 유닛의 분해 사시도이다.

도 8는 도 7의 백라이트 유닛을 하부에서 도시한 평면도이다.

도 9은 도 7의 백라이트 유닛의 냉각 과정을 설명하기 위한 측면도이다.

도 10는 본 발명의 또 다른 실시예에 따른 백라이트 유닛의 분해 사시도이다.

도 11는 도 10의 백라이트 유닛을 하부에서 도시한 평면도이다.

도 12는 도 10의 백라이트 유닛의 냉각 과정을 설명하기 위한 측면도이다.

도 13은 도 1의 백라이트 유닛을 갖는 액정표시장치를 나타내는 분해 사시도이다.

도 14는 도 7의 백라이트 유닛을 갖는 액정표시장치를 나타내는 분해 사시도이다.

<도면의 주요부분에 대한 부호의 설명>

100 : 면광원 장치 110 : 반사판

112 : 결합공 120 : 측벽

130 : 구동 기관 140 : 발광 다이오드 광원

200,300 : 수납 용기 210,310 : 바닥판

220,320 : 제1 측벽 230,330 : 제2 측벽

240,340 : 제3 측벽 250,350 : 제4 측벽

260,360 : 내부 공간 212,312 : 관통공

214,314 : 제1 구동 회로부 222a,322a,332a,342a,352a : 팬

222b,322b,332b,342b,352b : 팬 224,324 : 제2 구동 회로부

500,600 : 백라이트 유닛 800,900 : 액정표시장치

820 : 광학 시트 840 : 액정표시패널

842 : 박막 트랜지스터 기관 844 : 액정

846 : 필터필터 기관 848 : 구동 모듈

860 : 샤시

발명의 상세한 설명

발명의 목적

발명이 속하는 기술 및 그 분야의 종래기술

본 발명은 백라이트 유닛 및 이를 포함하는 액정표시장치에 관한 것으로서, 보다 상세하게는 냉각 효과를 향상시킬수 있는 백라이트 유닛 및 이를 포함하는 액정표시장치에 관한 것이다.

일반적으로, 액정표시장치는 액정의 전기적 특성 및 광학적 특성을 이용하여 영상을 디스플레이 한다. 상기 액정표시장치는 CRT 등에 비하여 부피가 매우 작고 무게가 가벼운 장점을 갖고, 그 결과 휴대용 컴퓨터, 통신 기기, 액정 TV 등에 널리 사용되고 있다.

상기 액정을 제어하기 위해, 상기 액정표시장치는 상기 액정을 제어하는 액정 제어 파트 및 상기 액정에 광을 공급하는 광 공급 파트를 필요로 한다. 상기 액정표시장치의 상기 광공급 파트로는 막대 형상을 갖는 냉음극선관 방식 램프(Cold Cathode Fluorescent Lamp, CCFL) 또는 도드 형상을 갖는 발광 다이오드(Light Emitting Diode, LED)가 주로 사용된다.

상기 발광 다이오드는 고색재현성의 장점을 갖는다. 그러나 상기 발광 다이오드는 발광 특성상 많은 열을 발생한다. 특히, 상기 발광 다이오드는 액정표시장치의 뒤로 발산되는 열이 많아, 상기 발광 다이오드를 수납하는 수납 용기의 온도가 매우 높다.

상기 수납 용기의 온도 증가를 방지하기 위해, 상기 수납 용기는 알루미늄과 같은 금속 재료를 갖는 히트 싱크(heat sink) 등을 포함할 수 있다. 그러나, 상기 수납 용기가 상기 히트 싱크를 포함하더라도, 상기 수납 용기의 두께 및 무게가 증가하여 액정표시장치의 두께 및 무게 또한 증가한다.

따라서, 상기 발광 다이오드를 액정표시장치의 광공급 파트로 사용하는 경우나, 상기 발광 다이오드 이외의 많은 열이 발생하는 다른 장치를 광공급 파트로 사용하는 경우, 상기 수납 용기의 온도가 증가하거나, 두께 및 무게가 증가한다.

발명이 이루고자 하는 기술적 과제

따라서, 본 발명의 일 목적은 냉각 효과가 증가되고, 두께 및 무게가 감소된 백라이트 유닛을 제공하는 것이다.

본 발명의 다른 목적은 상기한 백라이트 유닛을 갖는 액정표시장치를 제공하는 것이다.

발명의 구성 및 작용

이와 같은 본 발명의 일 목적을 구현하기 위하여 본 발명은 광 발생부 및 수납 용기를 포함하는 백라이트 유닛을 제공한다. 상기 광 발생부는 광을 발생한다. 상기 수납 용기는 상기 광 발생부를 수납하고, 외부 공기가 흡입되는 흡기부 및 내부 공기를 방출하는 배기부가 형성된다.

본 발명의 다른 목적을 구현하기 위하여 본 발명은 광 발생부 및 수납 용기를 포함하는 백라이트 유닛을 제공한다. 상기 광 발생부는 광을 발생한다. 상기 수납 용기는 상기 광 발생부를 수납하고, 외부 공기를 흡입하는 흡기부 및 내부 공기가 방출되는 배기부가 형성된다.

본 발명의 또 다른 목적을 구현하기 위하여 본 발명은 백라이트 유닛 및 액정표시패널을 포함한다. 상기 백라이트 유닛은 광을 발생하는 광 발생부 및 상기 광 발생부를 수납하고, 외부 공기가 흡입되는 흡기부 및 내부 공기를 방출하는 배기부가 형성된 수납 용기를 포함한다. 상기 액정표시패널은 상기 광 발생부로부터 출사되는 광을 이용하여 영상을 표시한다.

본 발명의 또 다른 목적을 구현하기 위하여 본 발명은 백라이트 유닛 및 액정표시패널을 포함한다. 상기 백라이트 유닛은 광을 발생하는 광 발생부 및 상기 광 발생부를 수납하고, 외부 공기를 흡입하는 흡기부 및 내부 공기가 방출되는 배기부가 형성된 수납 용기를 포함한다. 상기 액정표시패널은 상기 광 발생부로부터 출사되는 광을 이용하여 영상을 표시한다.

본 발명에 따르면, 백라이트 유닛의 두께 및 무게가 감소되고, 냉각 효과가 증가된다. 또한, 백라이트 유닛의 휘도 및 콘트라스트비(contrast ratio)의 저하를 방지한다.

이하, 첨부된 도면들을 참조하여 본 발명의 바람직한 실시예들에 따른 백라이트 유닛 및 이를 포함하는 액정표시장치에 대하여 상세하게 설명하지만, 본 발명이 하기 실시예들에 의해 제한되거나 한정되는 것은 아니다.

백라이트 유닛

실시예 1

도 1은 본 발명의 일 실시예에 따른 백라이트 유닛의 분해 사시도이고, 도 2는 도 1의 백라이트 유닛을 하부에서 도시한 평면도이다.

도 1 및 도 2를 참조하면, 백라이트 유닛(500)은 면광원 장치(100) 및 수납 용기(200)를 포함한다.

상기 면광원 장치(100)는 반사판(110), 측벽(120), 구동 기관(130) 및 복수의 발광 다이오드 광원(140)들을 포함한다.

상기 반사판(110)은 사각 평판 형상을 가지며, 상기 발광 다이오드 광원(140)들로부터 발생한 광 중 하방으로 향하는 광을 상방으로 반사한다. 상기 반사판(110)에는 상기 발광 다이오드 광원(140)이 결합될 수 있도록, 복수의 결합공(112)들이 형성된다.

상기 측벽(120)은 상기 반사판(110)의 에지부에 형성되어, 상기 면광원 장치(100)가 상기 수납 용기(200)와 용이하게 결합되도록 한다. 본 실시예에서, 상기 측벽(120)은 상기 반사판(110)의 대향하는 한 쌍의 에지부들에 형성된다.

상기 구동 기관(130)은 상기 반사판(110)의 하부에서 나란히 배열된다. 구동 전원이 상기 구동 기관(130)에 인가되어 상기 발광 다이오드 광원(140)들을 점등한다.

상기 발광 다이오드 광원(140)들은 상기 구동 기관(130) 상에 일렬로 배치되고, 상기 결합공(112)들을 관통하여 상기 반사판(110)의 상면에 위치하도록 결합된다. 바람직하게, 상기 발광 다이오드 광원(140)들은, 적색광을 발생하는 적색광 발광 다이오드(R), 녹색광을 발생하는 녹색광 발광 다이오드(G) 및 청색광을 발생하는 청색광 발광 다이오드(B)를 포함한다. 상기 적색광, 녹색광 및 청색광 발광 다이오드들(R,G,B)은 소정의 조합비에 의해 백색광을 발생한다. 예를 들어, 적색광 발광 다이오드(R), 녹색광 발광 다이오드(G) 및 청색광 발광 다이오드(B)의 개수의 비는 2:1:1, 또는 2:2:1로 구성될 수 있다. 또한, 상기 적색광, 녹색광 및 청색광 발광 다이오드들(R,G,B)은 도 1에 도시된 수보다 더 많이 배치될 수 있다. 이와는 달리, 상기 발광 다이오드 광원(140)들은 백색광을 발생하는 백색광 발광 다이오드를 포함할 수 있다.

상기 수납 용기(200)는 상기 면광원 장치(100)를 수납한다. 상기 수납 용기(200)는 바닥판(210), 제1 측벽(220), 제2 측벽(230), 제3 측벽(240) 및 제4 측벽(250)을 포함한다.

상기 바닥판(210)은 직사각형 평판의 형상을 갖고, 제1 구동 회로부(214) 및 복수의 관통공(212)들을 포함한다. 상기 제1 구동 회로부(214)는 상기 바닥판(210) 상에 배치되고, 상기 면광원 장치(100)를 구동한다. 상기 관통공(212)들은 상기 제1 구동 회로부(214)가 배치된 부분을 제외한 부분에 형성되고, 상기 바닥판(210)을 관통하여 형성된다. 상기 관통공(212)들을 통하여, 공기가 이동할 수 있다. 본 실시예에서, 상기 관통공(212)들은 외부 공기가 흡입되는 흡기부의 기능을 한다.

상기 제1 내지 제4 측벽들(220,230,240,250)은 상기 바닥판(210)의 에지부들로부터 각각 연장되어 수납 공간 및 내부 공간을 형성한다.

상기 제1 측벽(220)은 상기 바닥판(210)의 일 에지부에 배치되고, 바람직하게, 상기 바닥판(210)과 수직하지 않는다. 구체적으로, 상기 제1 측벽(220)은 상기 바닥판(210)에 대해서 외측으로 경사진다. 이와는 달리, 상기 제1 측벽(220)은 상기 바닥판(210)과 수직할 수 있다. 상기 제2 내지 제4 측벽들(230,240,250)은 상기 바닥판(210)의 다른 에지부들에 각각 배치되고, 상기 바닥판(210)과 수직한다. 상기 제2 측벽(230)은 상기 제1 측벽(220)과 인접하여 배치된다. 상기 제3 측벽(240)은 상기 제2 측벽(230)과 인접하여 배치되고, 상기 제1 측벽(220)과 대향한다. 상기 제4 측벽(250)은 상기 제1 및 제3 측벽들(220,240)과 인접하여 배치되고, 상기 제2 측벽(230)과 대향한다.

상기 제1 측벽(220)에는 복수의 팬(fan, 222a)들이 형성된다. 상기 팬(222a)들은 공기를 상기 내부 공간에서 외부로 유동시키도록 작동된다. 따라서, 상기 면광원 장치(100)에서 발생된 열은 상기 내부 공간에서 외부로 전달된다. 본 실시예에서, 상기 팬(222a)들은 내부 공기를 방출하는 배기부의 기능을 한다.

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상기 제1 측면(220)은 제2 구동 회로부(224)를 더 포함할 수 있다. 상기 제2 구동 회로부(224)는 상기 제1 측면(220) 상에 배치되고, 본 실시예에 따른 백라이트 유닛(100)을 광 공급 파트로 갖는 장치의 구성요소들, 예를 들면 액정표시장치의 액정표시패널을 구동하는 데에 사용될 수 있다. 이와는 달리, 상기 제2 구동 회로부(224)는 상기 제2 내지 제4 측면들 (230,240,250) 상에 배치될 수도 있다.

한편, 상기 제1 내지 제4 측면들(220,230,240,250)은 상기 전면원 장치(100)의 상기 반사판(110)과 후크 결합 등의 방식으로 결합될 수 있다.

이하, 상술한 구조를 갖는 상기 백라이트 유닛의 내각 파경을 도면을 참조하여 상세하게 설명한다.

도 3은 도 1의 백라이트 유닛의 내각 파경을 설명하기 위한 측면도이다.

도 3을 참조하면, 상기 전면원 장치(100)의 상기 발광 다이오드 어레이 기판(110)이 구동되어 열이 발생한다. 상기 열에

의해 상기 전면원 장치(100) 및 상기 수납 용기(200) 사이의 상기 내부 공간(260)에 채워지는 공기의 온도가 상승한다. 상기 온도가 상승된 공기는 상기 제1 측면(220)에 형성된 복수의 상기 백라이트 유닛(500)의 외부로

방출된다. 상기 고온의 공기가 상기 백라이트 유닛(1000)의 외부로 방출되면, 상기 내부 공간(260)의 압력이 낮아진다. 따라서, 상기 백라이트 유닛(500)의 외부로부터 상기 내부 공간(260)의 고온의 공기를 외부로 방출 및 저온의 공기를 유입 과정들이 계속적으로 반복되

고, 그 결과 상기 전면원 장치(100)에서 발생한 열은 공기의 흐름에 의하여 냉각된다.

특히, 본 실시예에 따른 내각 파경은 주로 공기의 자연 대류(free convection) 현상에 의해서 이루어진다. 즉, 상기 전면원

장치(100)에서 발생한 열에 의해, 상기 내부 공간(260)의 공기의 온도가 상승하고, 상기 고온의 공기는 대류 작용에 의해

상기 내부 공간(260)의 상방으로 상승하여 상기 팬(222a)들에 의해 외부로 방출된다. 이어서, 외부의 저온의 공기는 상기

관통공(212)들을 통하여 상기 내부 공간(260)으로 유입되고, 다시 상기 전면원 장치에서 발생한 열에 의해, 온도가 상승하

여 대류 작용에 의해 상승하게 되는 과정을 거친다.

본 실시예에서, 상기 관통공은 상기 반사판 상에 형성되지만, 상기 관통공은 상기 제1 내지 제4 측면들에 추가로 형성될 수

있고, 상기 제1 내지 제4 측면들에만 형성될 수도 있다. 즉, 상기 관통공은 반사판 및 상기 제1 내지 제4 측면들 중 어느 하

나 이상에 추가로 형성될 수 있다.

또한, 본 실시예에서, 상기 팬은 상기 제1 측면 상에 형성되지만, 상기 팬은 반사판 및 상기 제2 내지 제4 측면들 중 어느

하나 이상에 추가로 형성될 수 있다.

한편, 본 실시예에서, 상기 발광 다이오드를 포함하는 상기 전면원 장치가 광 발생부로 이용되지만, 내각이 요구되는 다른

평면을 포함하는 장치도 본 설명의 광 발생부로 적용될 수 있다.

또한, 본 설명의 다른 실시예에 따른 백라이트 유닛의 본체 사지도이고, 도 5는 도 4의 백라이트 유닛을 하부에서 도시한

평면도이다.

도 4 및 도 5를 참조하면, 백라이트 유닛(600)은 전면원 장치(100) 및 수납 용기(300)를 포함한다.

본 실시예에 채용된 상기 전면원 장치(100)는 도 1에 도시된 전면원 장치와 구조 및 기능이 동일하므로, 반복 설명은 생략

한다.

상기 수납 용기(300)는 상기 전면원 장치(100)를 수납한다. 상기 수납 용기(300)는 반사판(310), 제1 측면(320), 제2 측

면(330), 제3 측면(340) 및 제4 측면(350)을 포함한다.

상기 바닥판(310)은 직사각형 평판의 형상을 갖고, 제1 구동 회로부(314) 및 복수의 관통공(312)들을 포함한다. 상기 제1 구동 회로부(314)는 상기 바닥판(310) 상에 배치되고, 상기 면광원 장치(100)를 구동한다. 상기 관통공(312)들은 상기 제1 구동 회로부(314)가 배치된 부분을 제외한 부분에 형성되고, 상기 바닥판(310)을 관통하여 형성된다. 상기 관통공(312)들을 통하여, 공기가 이동할 수 있다. 본 실시예에서, 상기 관통공(312)들은 외부 공기가 흡입되는 흡기부의 기능을 한다.

상기 제1 내지 제4 측벽들(320,330,340,350)은 상기 바닥판(310)의 에지부들로부터 각각 연장되어 수납 공간 및 내부 공간을 형성한다.

상기 제1 내지 제4 측벽들(320,330,340,350)은 각각 상기 바닥판(310)의 일 에지부에 배치되고, 바람직하게, 상기 바닥판(310)과 수직하지 않는다. 구체적으로, 상기 제1 내지 제4 측벽들(320,330,340,350)은 상기 바닥판(310)에 대해서 외측으로 경사진다. 이와는 달리, 상기 제1 내지 제4 측벽들(320,330,340,350) 중 일부 또는 전부는 상기 바닥판(310)과 수직할 수 있다. 상기 제1 내지 제4 측벽들(320,330,340,350)은 차례로 서로 인접하여 배치된다. 상기 제1 측벽(320)과 상기 제3 측벽(340)은 서로 대향하고, 상기 제2 측벽(330)과 상기 제4 측벽(350)은 서로 대향한다.

상기 제1 내지 제4 측벽들(320,330,340,350)에는 각각 복수의 팬(322a,332a,342a,352a)들이 형성된다. 상기 팬(322a,332a,342a,352a)들은 공기를 상기 내부 공간에서 외부로 유동시키도록 작동된다. 따라서, 상기 면광원 장치(100)에서 발생한 열은 상기 내부 공간에서 외부로 전달된다. 본 실시예에서, 상기 팬(322a,332a,342a,352a)들은 내부 공기를 방출하는 배기부의 기능을 한다.

상기 제1 측벽(320)은 제2 구동 회로부(324)를 더 포함할 수 있다. 상기 제2 구동 회로부(324)는 상기 제1 측벽(320) 상에 배치되고, 본 실시예에 따른 백라이트 유닛(100)을 광 공급 파트로 갖는 장치의 구성요소들, 예를 들면 액정표시장치의 액정표시패널을 구동하는 데에 사용될 수 있다. 이와는 달리, 상기 제2 구동 회로부(324)는 상기 제2 내지 제4 측벽들(330,340,350) 상에 배치될 수도 있다.

한편, 상기 제1 내지 제4 측벽들(320,330,340,350)은 상기 면광원 장치(100)의 상기 반사판(110)과 후크 결합 등의 방식으로 결합될 수 있다.

이하, 상술한 구조를 갖는 상기 백라이트 유닛의 냉각 과정을 도면을 참조하여 상세하게 설명한다.

도 6은 도 4의 백라이트 유닛의 냉각 과정을 설명하기 위한 측면도이다.

도 6을 참조하면, 상기 면광원 장치(100)의 상기 구동 기판(130)이 구동되어 열이 발생한다. 상기 열에 의해 상기 면광원 장치(100) 및 상기 수납 용기(300) 사이의 상기 내부 공간(360)에 채류하는 공기의 온도가 상승한다. 상기 온도가 상승된 공기는 상기 제1 내지 제4 측벽들(320,330,340,350)에 형성된 복수의 팬(322a,332a,342a,352a)들에 의해서 상기 백라이트 유닛(2000)의 외부로 방출된다. 상기 고온의 공기가 상기 백라이트 유닛(2000)의 외부로 방출되면, 상기 내부 공간(360)의 압력이 낮아진다. 따라서, 상기 백라이트 유닛(2000)의 외부로부터 상기 내부 공간(360)의 고온의 공기보다 차가운 저온의 공기가 상기 관통공(312)들을 통하여 유입된다. 이에 따라, 고온의 내부 공기의 방출 및 저온의 외부 공기의 유입 과정들이 계속적으로 반복되고, 그 결과 상기 면광원 장치(100)에서 발생한 열은 공기의 흐름에 의하여 냉각된다.

본 실시예에서, 상기 관통공은 상기 바닥판 상에 형성되지만, 상기 관통공은 상기 제1 내지 제4 측벽들에 추가로 형성될 수 있고, 상기 제1 내지 제4 측벽들에만 형성될 수도 있다. 즉, 상기 관통공은 바닥판 및 상기 제1 내지 제4 측벽들 중 어느 하나 이상에 형성될 수 있다.

또한, 본 실시예에서, 상기 팬은 상기 제1 내지 제4 측벽들 상에 형성되지만, 상기 팬은 상기 바닥판에 추가로 형성될 수 있고, 상기 팬은 바닥판 및 상기 제1 내지 제4 측벽들 중 일부에만 형성될 수 있다. 즉, 상기 팬은 바닥판 및 상기 제1 내지 제4 측벽들 중 어느 하나 이상에 형성될 수 있다.

한편, 본 실시예에서, 상기 발광 다이오드를 포함하는 상기 면광원 장치가 광 발생부로 이용되지만, 냉각이 요구되는 다른 광원을 포함하는 장치도 본 발명의 광 발생부로 적용될 수 있다.

본 실시예에 따르면, 상기 백라이트 유닛의 상기 수납 용기에 직접 냉각 기능을 수행하는 구성 요소들이 형성된다. 특히, 상기 팬들이 상기 수납 용기의 여러 측벽들에 형성되어 상기 냉각 기능이 더욱 향상된다. 따라서, 상기 백라이트 유닛의 두께 및 무게가 감소된다. 또한, 상기 구성 요소들의 작동에 따른 상기 자연 대류 현상에 의해, 냉각 효과가 증가된다. 이에 따라, 상기 백라이트 유닛의 휘도 및 콘트라스트비의 저하를 방지한다.

실시예 3

도 7은 본 발명의 또 다른 실시예에 따른 백라이트 유닛의 분해 사시도이고, 도 8은 도 7의 백라이트 유닛을 하부에서 도시한 평면도이다. 제3 실시예에 있어서, 제1 실시예에서의 구성요소와 동일한 구조 및 기능을 갖는 구성요소에 대해서는 동일한 참조번호를 병기하고, 이들에 대한 구체적인 설명은 생략한다.

도 7 및 도 8을 참조하면, 복수의 팬(222b)들은 제1 측벽(220) 상에 형성된다. 상기 팬(222b)들은 공기를 외부에서 내부 공간으로 유동시키도록 작동된다. 따라서, 면광원 장치(100)에서 발생된 열은 상기 외부에서 유입된 상기 저온의 공기에 의해 냉각된다. 본 실시예에서, 상기 팬(222b)들은 외부 공기를 흡입하는 흡기부의 기능을 한다. 또한, 상기 팬(222b)들은 능동적으로 상기 면광원 장치(100)를 냉각시키는 냉각기의 기능을 한다.

이하, 상술한 구조를 갖는 상기 백라이트 유닛의 냉각 과정을 도면을 참조하여 상세하게 설명한다.

도 9는 도 7의 백라이트 유닛의 냉각 과정을 설명하기 위한 측면도이다.

도 9를 참조하면, 상기 면광원 장치(100)의 구동 기판(130)이 구동되어 열이 발생한다. 상기 열에 의해 상기 면광원 장치(100) 및 수납 용기(200) 사이의 상기 내부 공간(260)에 체류하는 공기의 온도가 상승할 수 있다. 여기서, 상기 팬(222b)들이 저온의 상기 백라이트 유닛(500)의 외부 공기를 고속으로 상기 내부 공간(260)으로 주입한다. 주입된 상기 외부 공기는 열이 발생하는 반사판(110)에 충돌하여 상기 반사판(110)을 냉각시킨다. 그 동안, 상기 팬(222b)들에 의해 상기 외부 공기가 내부로 유입되므로, 내부 압력이 증가한다. 따라서, 상기 내부 공간(260)의 공기는 관통공(212)들을 통하여 상기 백라이트 유닛(500)의 외부로 방출된다. 이에 따라, 상기 저온의 외부 공기의 유입 및 상기 고온의 내부 공기의 방출 과정들이 계속적으로 반복되고, 그 결과 상기 면광원 장치(100)에서 발생된 열은 공기의 흐름에 의하여 냉각된다.

특히, 본 실시예에 따른 냉각 과정은 주로 상기 냉각기의 기능을 하는 상기 팬(222b)들의 강제 대류(forced convection) 현상에 의해서 이루어진다. 즉, 상기 팬(222b)들에 의해 유입되는 상기 저온의 외부 공기는 열이 발생하는 상기 면광원 장치(100)에 고속으로 충돌하여 상기 면광원 장치(100)를 냉각시킨다. 따라서, 상술한 제1 실시예에 따른 팬(222a)들은 내부 공간(260)의 고온의 공기를 외부로 방출하는 소극적인 기능을 하는데 비하여, 본 실시예에 따른 상기 팬(222b)들은 적극적인 상기 냉각기의 기능을 한다. 일반적으로, 자연 대류 현상에 의한 열전달 효과보다 강제 대류 현상에 의한 열전달 효과가 더 크다. 따라서 본 실시예에 의한 냉각은 보다 효과적일 수 있다.

본 실시예에서, 상기 관통공은 바닥판 상에 형성되지만, 상기 관통공은 제1 내지 제4 측벽들에 추가로 형성될 수 있고, 상기 제1 내지 제4 측벽들에만 형성될 수도 있다. 즉, 상기 관통공은 상기 바닥판 및 상기 제1 내지 제4 측벽들 중 어느 하나 이상에 형성될 수 있다.

또한, 본 실시예에서, 상기 팬은 상기 제1 측벽 상에 형성되지만, 상기 팬은 바닥판 및 상기 제2 내지 제4 측벽들 중 어느 하나 이상에 추가로 형성될 수 있다.

한편, 본 실시예에서, 상기 발광 다이오드를 포함하는 상기 면광원 장치가 광 발생부로 이용되지만, 냉각이 요구되는 다른 광원을 포함하는 장치도 본 발명의 광 발생부로 적용될 수 있다.

본 실시예에 따르면, 상기 백라이트 유닛의 상기 수납 용기에 직접 냉각 기능을 수행하는 구성 요소들이 형성된다. 따라서, 상기 백라이트 유닛의 두께 및 무게가 감소된다. 또한, 상기 구성 요소들의 작동에 따른 상기 강제 대류 현상에 의해, 냉각 효과가 증가된다. 이에 따라, 상기 백라이트 유닛의 휘도 및 콘트라스트비 저하를 방지한다.

실시예 4

공개특허 10-2006-0016469

도 10은 본 발명의 또 다른 실시예에 따른 백라이트 유닛의 분해 사시도이고, 도 11은 도 10의 백라이트 유닛을 하부에서 도시한 평면도이다. 제2 실시예에 있어서, 구성요소와 동일한 구조 및 기능을 갖는 구성요소에 대해서 동일한 참조번호를 병기하고, 이들에 대한 구체적인 설명은 생략한다.

도 10 및 도 11을 참조하면, 복수의 펜(322b, 332b, 342b, 352b)들은 각각 제1 내지 제4 측면들(320, 330, 340, 350) 상에 형성된다. 상기 펜(322b, 332b, 342b, 352b)들은 상기 전면판(100)에서 발생된 열을 저온의 외부 공기를 흡입하여 냉각시킬 수 있다. 본 실시예에서, 상기 펜(322b, 332b, 342b, 352b)들은 외부 공기를 흡입하는 흡기부의 기능을 한다. 또한, 상기 펜(322b, 332b, 342b, 352b)들은 등동적으로 상기 전면판(100)을 냉각시키는 냉각기의 기능을 한다.

이하, 상술한 구조를 갖는 상기 백라이트 유닛의 냉각 과정을 도면을 참조하여 상세하게 설명한다.

도 12는 도 10의 백라이트 유닛의 냉각 과정을 설명하기 위한 측면도이다.

도 12를 참조하면, 상기 전면판(100)의 구동 기판(130)이 구동되어 열이 발생한다. 상기 열에 의해 상기 전면판 장치(100) 및 수납 용기(300) 사이의 내부 공간(360)에 채워지는 공기의 온도가 상승할 수 있다. 여기서, 상기 펜(322b, 332b, 342b, 352b)들이 저온의 상기 백라이트 유닛(600)의 외부 공기를 고속으로 상기 내부 공간(360)으로 주입한다. 주입된 상기 외부 공기는 열이 발생하여 반사판(110)에 충돌하여 상기 반사판(110)을 냉각시킨다. 그 동안, 상기 펜(322b, 332b, 342b, 352b)들이 외부 공기가 외부로 유입되므로, 내부 압력이 증가한다. 따라서, 상기 내부 공간(360)의 공기는 관통공(312)들을 통하여 상기 백라이트 유닛(600)의 외부로 방출된다. 이에 따라, 상기 저온의 외부 공기의 유입 및 상기 고온의 내부 공기의 방출 과정들이 계속적으로 반복되고, 그 결과 상기 전면판 장치(100)에서 발생한 열은 공기의 흐름에 의하여 냉각된다.

본 실시예에서, 상기 관통공은 바닥 상에 형성되지만, 상기 관통공은 제1 내지 제4 측면들에 추가로 형성될 수 있고, 상기 제1 내지 제4 측면들에만 형성될 수도 있다. 즉, 상기 관통공은 상기 바닥판 및 상기 제1 내지 제4 측면들 중 어느 하나 이상에 형성될 수 있다.

또한, 본 실시예에서, 상기 펜은 상기 제1 내지 제4 측면들 상에 형성되지만, 상기 펜은 상기 바닥판에 추가로 형성될 수 있고, 상기 펜은 바닥판 및 상기 제1 내지 제4 측면들 중 일부에만 형성될 수 있다. 즉, 상기 펜은 바닥판 및 상기 제1 내지 제4 측면들 중 어느 하나 이상에 형성될 수 있다.

한편, 본 실시예에서, 상기 발광 다이오드를 포함하는 상기 전면판 장치가 광 발생부로 이용되지만, 냉각이 요구되는 다른 광원은 포함하는 장치도 본 발명의 광 발생부로 적용될 수 있다.

본 실시예에 따르면, 상기 백라이트 유닛의 상기 수납 용기에 직접 냉각 기능을 수행하는 구성 요소들이 형성된다. 특히, 상기 펜들이 상기 수납 용기의 여러 측면들에 형성되어 상기 냉각 기능이 더욱 향상된다. 따라서, 상기 백라이트 유닛의 두께 및 무게가 감소된다. 또한, 상기 구성 요소들의 작동에 따른 상기 강제 대류 현상에 의해, 냉각 효과가 증가된다. 이에 따라, 상기 백라이트 유닛의 휘도 및 콘트라스트비의 저하를 방지한다.

백정표시장치

실시예 5

도 13은 도 1의 백라이트 유닛을 갖는 백정표시장치를 나타내는 분해 사시도이다.

도 13을 참조하면, 백정표시장치(800)는 백라이트 유닛(500), 백정표시패널(840) 및 사시(860)를 포함한다.

본 실시예에 채용된 상기 백라이트 유닛(500)은 도 1에 도시된 백라이트 유닛과 구조 및 기능이 동일하므로, 반복 설명은 생략한다.

상기 백정표시패널(840)은 면광원 장치(100)로부터 조사되는 광을 이용하여 영상을 표시한다. 상기 백정표시패널(840)은 박막 트랜지스터(thin film transistor, TFT) 기판(842), 액성(844), 컬러필터 기판(846) 및 구동 모듈(848)을 포함한다.

공개특허 10-2006-0016469

상기 TFT 기판(842)은 매트릭스 형태로 배치된 화소 전극(미도시), 각 상기 화소 전극에 구동 전압을 인가하는 박막 트랜지스터(미도시), 게이트 라인(미도시) 및 데이터 라인(미도시)을 포함한다.

상기 컬러필터 상에 형성된 공통전극(미도시)을 포함한다.

상기 액정(841)은 상기 TFT 기판(842)과 상기 컬러필터 기판(846) 사이에 개재된다.

상기 구동 모듈(848)은 상기 액정표시패널(840)을 구동한다. 이와는 달리, 상기 액정표시패널(840)을 구동하기 위하여 제2 구동 회로부(224)가 마더판(210) 및 제1 내지 제4 측벽(220,230,240,250)들 중 어느 하나 상에 배치될 수 있다.

상기 컬러필터 기판(846)의 예시부는 상기 표시(860)에 의하여 감싸여지고, 상기 표시(860)의 일부는 수납용기(200)에 결합된다. 상기 표시(860)는 외부 충격에 약한 상기 액정표시패널(840)의 깨짐을 방지하고, 상기 액정표시패널(840)의 유동을 방지한다.

상기 액정표시장치(800)는 상기 면광원 장치(100)로부터 출사된 상기 광의 휘도 균일성을 향상시키기 위한 광학 시트(820)를 더 포함할 수 있다. 상기 광학 시트(820)는 확산 시트, 프리즘 시트, 보호 시트 등을 포함할 수 있다.

상기 광학 시트(820)의 상측에는 미들 시트(미도시)가 더 구비될 수 있다. 상기 미들 시트는 상기 광학 시트(820)와 접하여 상기 광학 시트(820)를 상기 수납용기(200) 측으로 가압한다.

본 실시예에 따르면, 상기 액라이트 유닛의 상기 수납용기에 직접 냉각 기능을 수행하는 구성 요소들이 형성된다. 따라서, 상기 액라이트 유닛의 무게 및 무게가 감소된다. 또한, 상기 구성 요소들의 작동에 따른 상기 자연 대류 현상에 의해, 냉각 효과가 증가된다. 이에 따라, 상기 액라이트 유닛을 포함하는 액정표시장치의 무게 및 무게가 감소되고, 냉각 효과가 증가되며, 휘도 및 콘트라스트비의 저하를 방지한다.

실시예 6

도 11는 도 7의 액라이트 유닛을 갖는 액정표시장치를 나타내는 분해 사시도이다.

도 14를 참조하면, 액정표시장치(900)는 액라이트 유닛(600), 액정표시패널(840) 및 표시(860)를 포함한다.

본 실시예에 따른 액정표시장치는 액라이트 유닛을 제외하면, 제5 실시예에 따른 액정표시장치와 구조 및 기능이 동일하다. 또한, 본 실시예에 채용된 상기 액라이트 유닛(600)은 도 2에 도시된 액라이트 유닛과 구조 및 기능이 동일하다.

본 실시예에 따르면, 상기 액라이트 유닛의 수납용기에 직접 냉각 기능을 수행하는 구성 요소들이 형성된다. 따라서, 상기 액라이트 유닛의 무게 및 무게가 감소된다. 또한, 상기 구성 요소들의 작동에 따른 상기 자연 대류 현상에 의해, 냉각 효과가 증가된다. 이에 따라, 상기 액라이트 유닛을 포함하는 액정표시장치의 무게 및 무게가 감소되고, 냉각 효과가 증가되며, 휘도 및 콘트라스트비의 저하가 방지된다.

발명의 효과

이상에서 설명한 바와 같이, 본 발명에 따르면 본 실시예에 따르면, 액라이트 유닛의 수납용기에 직접 냉각 기능을 수행하는 구성 요소들이 형성된다. 따라서, 상기 액라이트 유닛의 무게 및 무게가 감소된다.

또한, 상기 구성 요소들의 작동에 따른 자연 대류 현상 또는 강제 대류 현상에 의해, 냉각 효과가 증가된다.

이에 따라, 상기 액라이트 유닛을 포함하는 액정표시장치의 무게 및 무게가 감소되고, 냉각 효과가 증가되며, 휘도 및 콘트라스트비의 저하를 방지한다.

앞서 설명한 본 발명의 상세한 설명에서는 본 발명의 바람직한 실시예를 참조하여 설명하였지만, 해당 기술분야의 숙련된 당업자 또는 해당 기술분야에 통상의 지식을 갖는 자라면 후술될 특허청구범위에 기재된 본 발명의 사상 및 기술 영역으로 부터 벗어나지 않는 범위 내에서 본 발명을 다양하게 수정 및 변경시킬 수 있음을 이해할 수 있을 것이다.

(57) 청구의 범위

청구항 1.

광을 발생하는 광 발생부; 및

상기 광 발생부를 수납하고, 외부 공기가 흡입되는 흡기부 및 내부 공기를 방출하는 배기부가 형성된 수납 용기를 포함하는 백라이트 유닛.

청구항 2.

제 1 항에 있어서, 상기 수납 용기는 바닥판 및 상기 바닥판의 에지부로부터 연장된 복수의 측벽들을 포함하여 상기 광 발생부를 수납하기 위한 수납 공간을 제공하는 것을 특징으로 하는 백라이트 유닛.

청구항 3.

제 2 항에 있어서, 상기 측벽들은 제1 측벽, 상기 제1 측벽과 인접하여 배치된 제2 측벽, 상기 제2 측벽과 인접하여 배치되며 상기 제1 측벽과 대향하는 제3 측벽, 및 상기 제1 및 제3 측벽과 인접하여 배치되며 상기 제2 측벽과 대향하는 제4 측벽을 포함하는 것을 특징으로 하는 백라이트 유닛.

청구항 4.

제 3 항에 있어서, 상기 흡기부는 상기 바닥판 및 상기 제1 내지 제4 측벽들 중 적어도 하나에 형성된 1개 이상의 관통공을 포함하고, 상기 배기부는 상기 바닥판 및 상기 제1 내지 제4 측벽들 중 적어도 하나에 형성된 1개 이상의 팬을 포함하는 것을 특징으로 하는 백라이트 유닛.

청구항 5.

제 4 항에 있어서, 상기 관통공은 상기 바닥판을 관통하여 형성되고, 상기 팬은 상기 제1 측벽에 형성된 것을 특징으로 하는 백라이트 유닛.

청구항 6.

제 5 항에 있어서, 상기 제1 측벽은 상기 바닥판에 대해서 외측으로 경사진 것을 특징으로 하는 백라이트 유닛.

청구항 7.

제 4 항에 있어서, 상기 팬은 상기 제1 내지 제4 측벽들 상에 각각 형성된 것을 특징으로 하는 백라이트 유닛.

청구항 8.

제 2 항에 있어서, 상기 광 발생부를 구동하기 위하여 상기 수납 용기의 바닥판 및 상기 측벽들 중 어느 하나 상에 배치된 제1 구동 회로부를 더 포함하는 것을 특징으로 하는 백라이트 유닛.

제 15 항에 있어서, 상기 바닥판에 대해서 외측으로 경사진 것을 특징으로 하는 배라이트 유닛.

청구항 16.

제 14 항에 있어서, 상기 관통공은 상기 바닥판을 관통하여 형성되고, 상기 펜은 상기 제1 측벽에 형성되는 것을 특징으로 하는 배라이트 유닛.

청구항 15.

제 13 항에 있어서, 상기 배기부는 상기 수납 용기의 상기 바닥판 및 상기 제1 내지 제4 측벽들 중 적어도 하나에 형성된 1 개 이상의 관통공을 포함하고, 상기 흡기부는 상기 바닥판 및 상기 측벽들 중 적어도 하나에 형성된 1 개 이상의 펜을 포함 하는 것을 특징으로 하는 배라이트 유닛.

청구항 14.

제 12 항에 있어서, 상기 수납 용기는 바닥판 및 상기 바닥판의 에지부로부터 연장된 복수의 측벽들을 포함하여 상기 광 받 채부를 수납하기 위한 수납 공간을 제공하고, 상기 측벽들은 제1 측벽, 상기 제1 측벽과 인접하여 배치된 제2 측벽, 상기 제2 측벽과 인접하여 배치되며 상기 제1 측벽과 대향하는 제3 측벽, 및 상기 제1 및 제3 측벽과 인접하여 배치되며 상기 제2 측벽과 대향하는 제4 측벽을 포함하는 것을 특징으로 하는 배라이트 유닛.

청구항 13.

광을 반사하는 광 발생부; 및
상기 광 발생부를 수납하고, 외부 공기를 도입하는 흡기부 및 내부 공기가 방출되는 배기부가 형성된 수납 용기를 포함하 는 배라이트 유닛.

청구항 12.

제 10 항에 있어서, 상기 면광원 장치는 상기 수납 용기 및 상기 반광 다이오드 광원 사이에 배치된 반사판을 더 포함하는 것을 특징으로 하는 배라이트 유닛.

청구항 11.

제 9 항에 있어서, 상기 면광원 장치는 반광 다이오드 광원을 포함하는 것을 특징으로 하는 배라이트 유닛.

청구항 10.

제 1 항에 있어서, 상기 광 발생부는 면광원 장치인 것을 특징으로 하는 배라이트 유닛.

청구항 9.

청구항 17.

제 13 항에 있어서, 상기 광 발생부를 구동하기 위하여 상기 수납 용기의 바닥판 및 상기 측벽들 중 어느 하나 상에 배치된 제1 구동 회로부를 더 포함하는 것을 특징으로 하는 백라이트 유닛.

청구항 18.

제 12 항에 있어서, 상기 광 발생부는 발광 다이오드 광원을 포함하는 면광원 장치인 것을 특징으로 하는 백라이트 유닛.

청구항 19.

제 18 항에 있어서, 상기 면광원 장치는 상기 수납 용기 및 상기 발광 다이오드 광원 사이에 배치된 반사판을 더 포함하는 것을 특징으로 하는 백라이트 유닛.

청구항 20.

광을 발생하는 광 발생부 및 상기 광 발생부를 수납하고, 외부 공기가 흡입되는 흡기부 및 내부 공기를 방출하는 배기부가 형성된 수납 용기를 포함하는 백라이트 유닛; 및

상기 광 발생부로부터 출사되는 광을 이용하여 영상을 표시하는 액정표시패널을 포함하는 액정표시장치.

청구항 21.

제 20 항에 있어서, 상기 수납 용기는 바닥판 및 복수의 측벽들을 포함하며, 상기 흡기부는 상기 바닥판 및 상기 측벽들 중 적어도 하나를 관통하여 형성된 1개 이상의 관통공을 포함하고, 상기 배기부는 상기 바닥판 및 상기 측벽들 중 적어도 하나에 형성된 1개 이상의 팬을 포함하는 것을 특징으로 하는 액정표시장치.

청구항 22.

제 21 항에 있어서, 상기 관통공은 상기 바닥판을 관통하여 형성되고, 상기 팬은 상기 측벽들 중 상기 바닥판에 대해서 외측으로 정사진 제1 측벽에 형성되는 것을 특징으로 하는 액정표시장치.

청구항 23.

제 22 항에 있어서, 상기 팬은 상기 측벽들에 각각 형성되고, 상기 측벽들은 각각 상기 바닥판에 대해서 외측으로 정사진 것을 특징으로 하는 액정표시장치.

청구항 24.

제 20 항에 있어서, 상기 광 발생부는 발광 다이오드 광원을 포함하는 면광원 장치인 것을 특징으로 하는 액정표시장치.

청구항 25.

조원

제 27 항에 있어서, 상기 수납 용기는 바닥판 및 복수의 측벽들을 포함하며, 상기 배기부는 상기 바닥판 및 상기 측벽들 중 적어도 하나를 관통하여 형성된 1개 이상의 관통공을 포함하고, 상기 흡기부는 상기 바닥판 및 상기 측벽들 중 적어도 하나에 형성된 1개 이상의 팬을 포함하는 것을 특징으로 하는 액정표시장치.

청구항 28.

상기 광 발생부로부터 출사되는 광을 이용하여 영상화 영상을 표시하는 액정표시패널을 포함하는 액정표시장치.
형성된 수납 용기를 포함하는 백라이트 유닛; 및
광을 발생하는 광 발생부 및 상기 광 발생부를 수납하고, 외부 용기를 흡입하는 흡기부 및 내부 용기가 방출되는 배기부가

청구항 27.

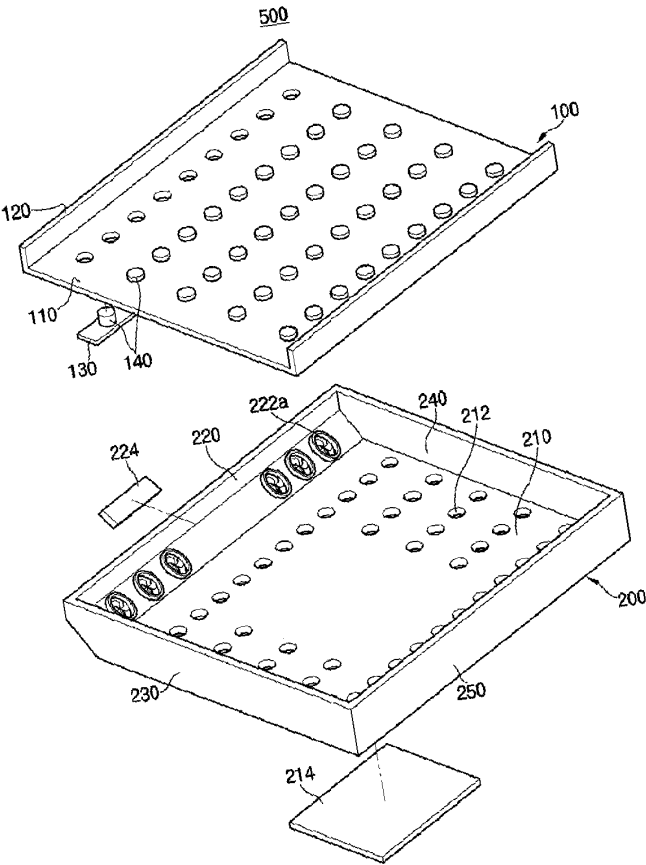
제 25 항에 있어서, 상기 제1 구동 회로부는 상기 수납 용기의 바닥판에 배치되고, 상기 제2 구동 회로부는 상기 측벽들 중 상기 바닥판에 대해서 외측으로 경사진 제1 측벽에 배치된 것을 특징으로 하는 액정표시장치.

청구항 26.

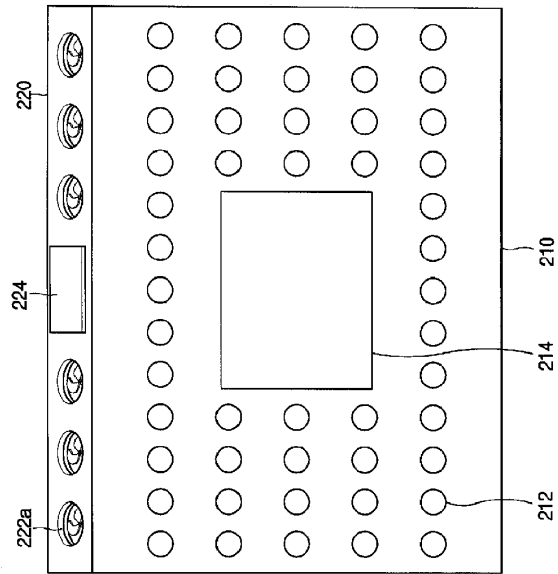
제 20 항에 있어서, 상기 광 발생부를 구동하기 위하여 상기 바닥판 및 상기 측벽들 중 어느 하나에 배치된 제1 구동 회로 부 및 상기 액정표시패널을 구동하기 위하여 상기 바닥판 및 상기 측벽들 중 어느 하나에 배치된 제2 구동 회로부를 더 포함하는 것을 특징으로 하는 액정표시장치.

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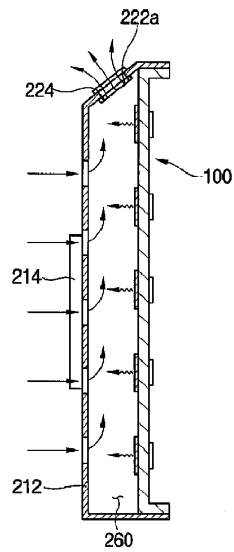
도면1



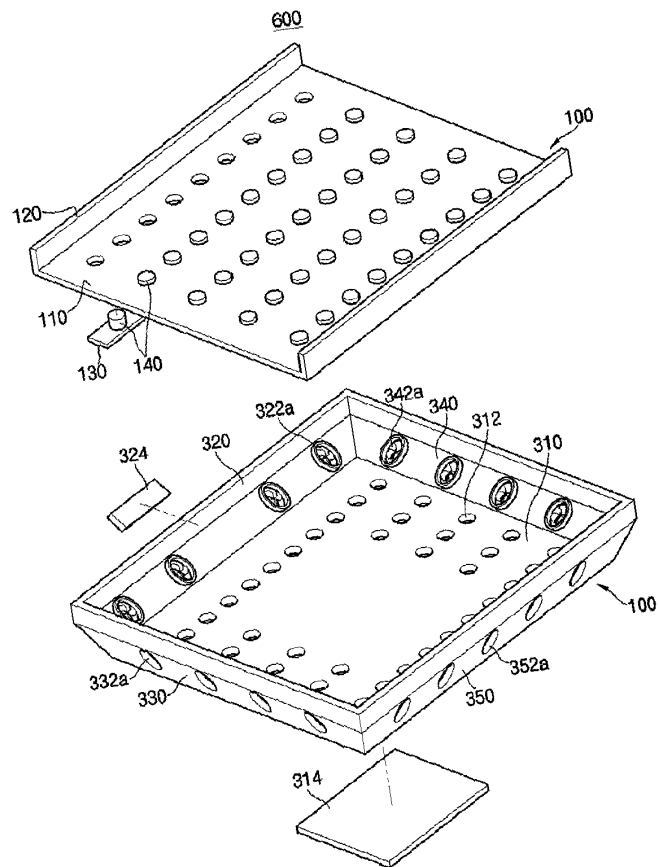
도면2

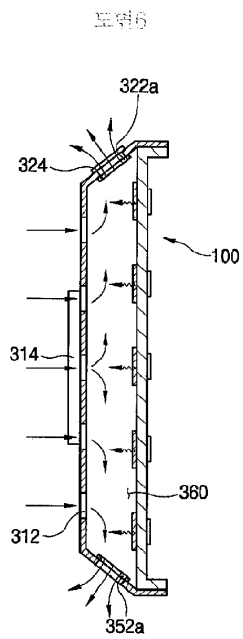
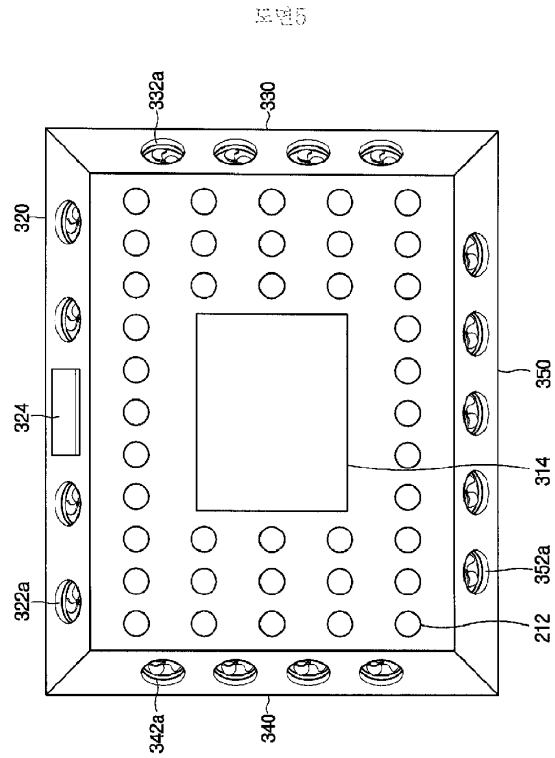


도면3



도면4





도면7

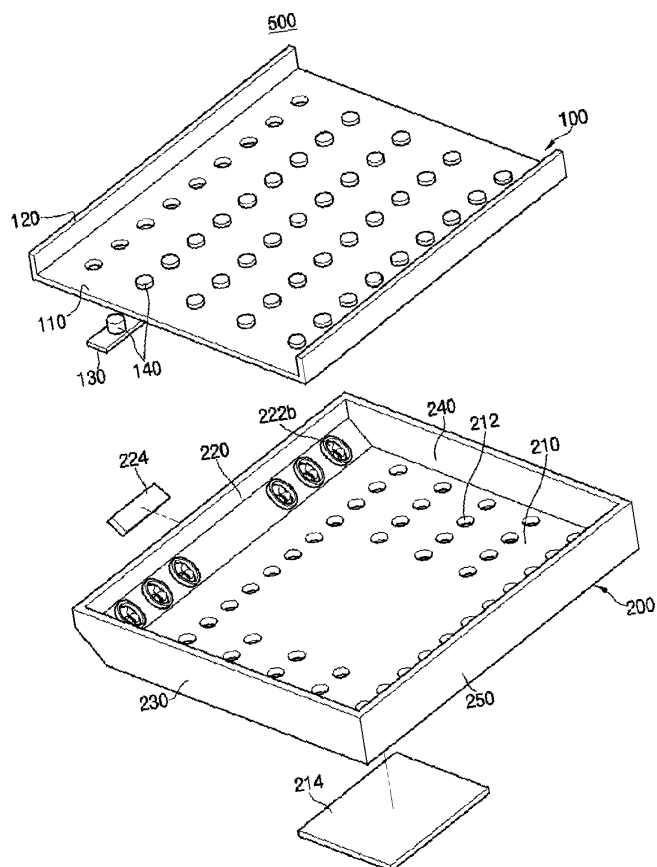


FIG. 8

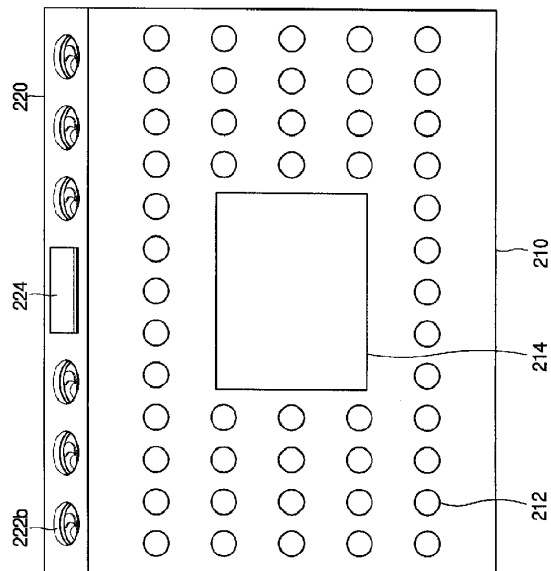
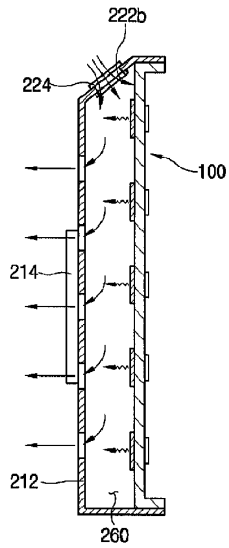
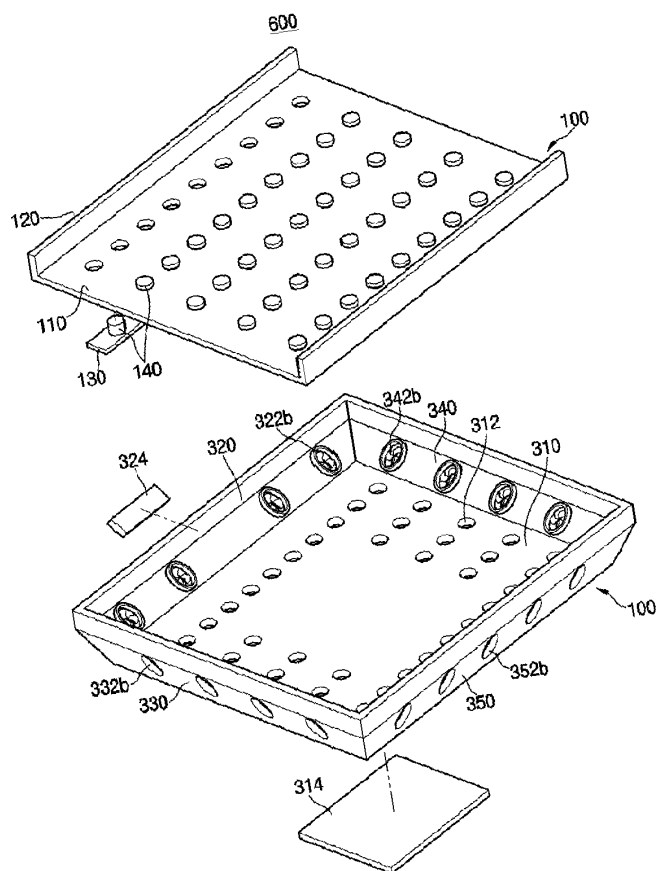


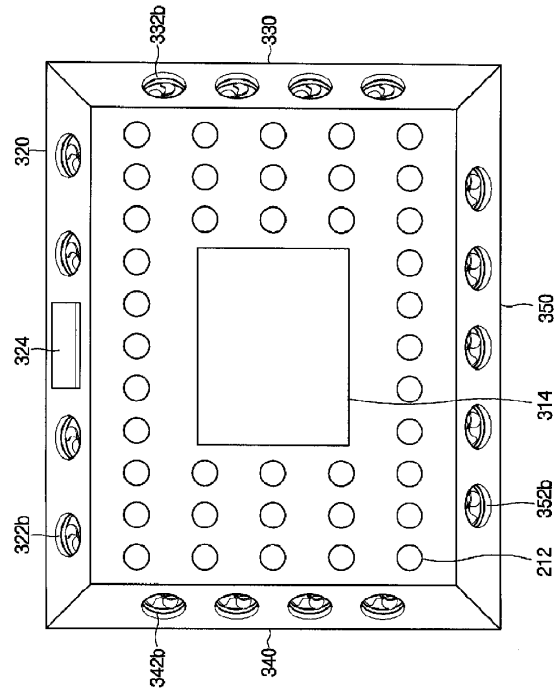
FIG. 9



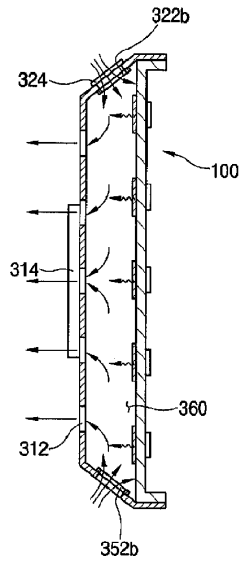
도면10



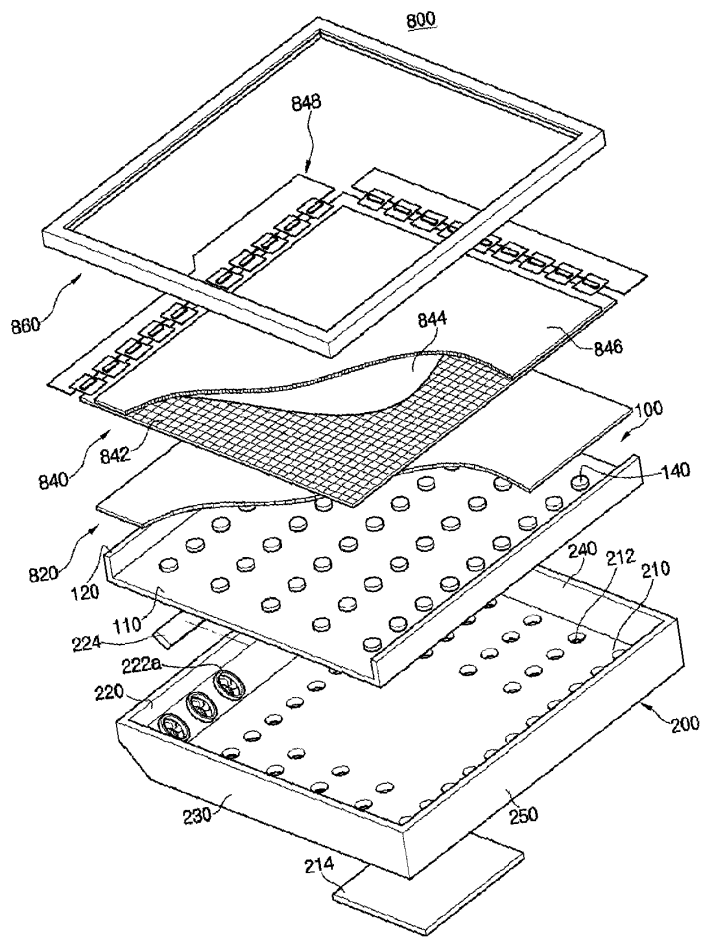
도면11



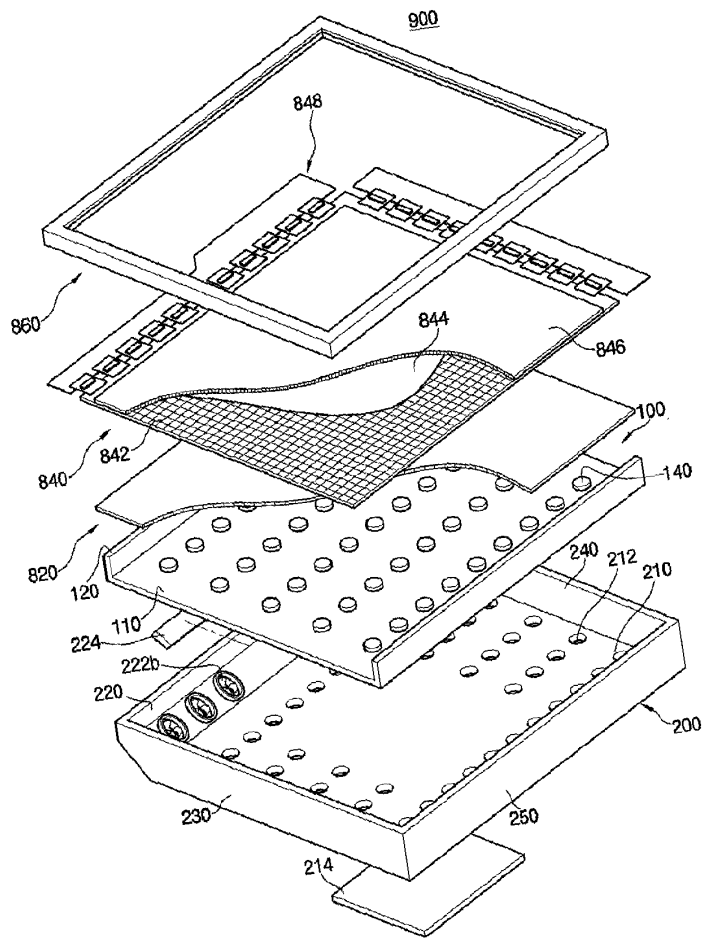
도면12



도면13



도면14



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[Continued on next page]

(54) Title: MODULAR DISTRIBUTED COMPONENTS FOR LED BACKLIGHT

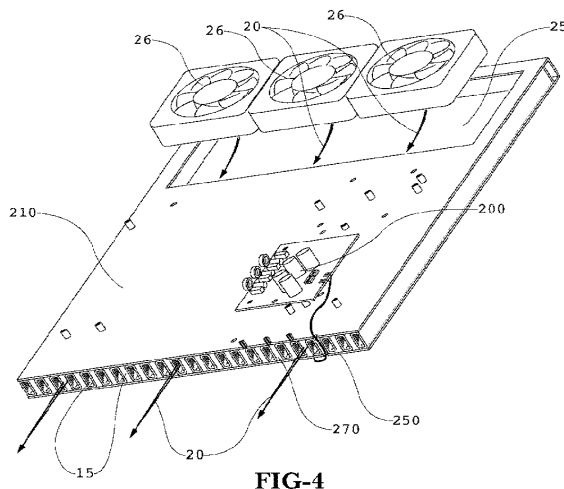


FIG-4

(57) Abstract: A system for powering an LED backlight where power assemblies have electrical communications ran through pass through apertures in a mounting plate and LED backlight panel. A channel may be defined between the mounting plate and the LED backlight panel (or optional thermal plate attached to the rear portion of the LED backlight panel). Sub-channels can be created within the channel which are defined by ribs which connect between the mounting plate and the LED backlight panel (or optional thermal plate attached to the rear portion of the LED backlight panel). Cooling air can be prevented from entering one or more specific sub-channels so that electrical connections can pass through the mounting plate, LED backlight panel, and sub-channel without the risk of cooling air contaminates entering one of the pass through apertures.

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Modular Distributed Components for LED Backlight

Inventor: William Dunn

Technical Field

[0001] Exemplary embodiments generally relate to electrical systems for LCD backlights.

Background of the Art

[0002] Electronic displays are now being used indoors and outdoors for a variety of different purposes. Some of these displays have also grown substantially in size and are now found in sizes over 55 inches in diagonal. Specifically for liquid crystal displays (LCD), as the backlight increases in size there is also an increase in power that is required to drive the backlight. Also, as the backlight increases in size it generates more heat which, especially in an outdoor environment (sometimes with high ambient temperatures), can become a concern.

[0003] **FIGURE 1** illustrates one of the previous approaches for powering and controlling an LED backlight for a large LCD display. A typical LED backlight may be divided into several sections (panels) where each section (either a single panel or several panels) is powered by its own power circuit. A typical power circuit usually contains several electronic components, including a power module and inductors. Previously, it was thought that power modules and inductors should be grouped separately, with the resulting connections for the LEDs being routed around the edge (perimeter or periphery) of the backlight. Thus, as shown in Figure 1, several power modules 100 have electrical connections 110 running to a grouping of inductors 150. Electrical connections 160 then travel around the edge of the backlight and connect with each LED panel.

[0004] It has been found that the previous method results in a large amount of electrical connectors (wiring) with a substantial amount of assembly time in order to route and connect all of the wiring.

Summary of the Exemplary Embodiments

[0005] Exemplary embodiments group the power module and inductors for various sections of the backlight together, resulting in power assemblies. The power assemblies are placed in a relatively close spatial relationship with the sections of the backlight that these components actually correspond with. The electrical connections between the power assemblies and LEDs are preferably passed through a mounting panel and the backlight.

[0006] In some embodiments there may be a flow of cooling air which passes immediately behind the backlight. This cooling air may be drawn from the surrounding ambient environment and may contain various contaminants, including dust, pollen, dirt, water vapor, smoke, etc. In these embodiments, the electrical connections may also pass through a sealed channel (or sub-channel) within the path of the cooling air so that there will be little or no contamination of the backlight or rear housing. In other words, the cooling air would preferably not be permitted to enter the cavities which contain the backlight or the power modules, video cards, hard drives, etc.

[0007] 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

[0008] 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:

[0009] **FIGURE 1** is a rear view of one of the previous approaches for powering and controlling an LED backlight for a large LCD display;

[0010] **FIGURE 2** is a section view of a first embodiment;

[0011] **FIGURE 3** is a section view of a second embodiment;

[0012] **FIGURE 4** is a rear perspective section view of an embodiment using a plurality of ribs between the backlight and the panel for mounting the power modules;

[0013] **FIGURE 5** is a front perspective section view of an embodiment using a plurality of ribs between the backlight and the panel for mounting the power modules;

[0014] **FIGURE 6** is a rear perspective section view showing electrical connectors passing through a sub-channel; and

[0015] **FIGURE 7** is a rear view of an exemplary embodiment for powering and controlling an LED backlight.

Detailed Description

[0016] **FIGURE 2** provides a sectional view of an exemplary embodiment. Several power assemblies 200 (preferably power modules with the associated inductors) have their electrical connections 225 (ex. conduction lines) passing through a mounting panel 210 and connected to the backlight 250. The backlight 250 in this embodiment includes a plurality of illumination devices 32 which are mounted on a plurality of panels 30 and 31. In an exemplary embodiment, the illumination devices 32 would be LEDs and the panels 30 and 31 would be a PCB and more preferably a metal core PCB. The connection with the backlight 250 may be on the front or rear of the backlight 250.

[0017] **FIGURE 3** provides a sectional view of another embodiment. Again, Several power assemblies 200 (preferably power modules with the associated inductors) have their electrical connections 225 passing through a mounting panel 210 and connected to the backlight 250. In this embodiment, a cooling channel 270 is placed immediately behind the backlight 250. An optional thermally conductive plate 280 may be in thermal communication with the backlight 250 so that heat from the backlight 250 may be transferred to the thermal plate 280. Alternative embodiments may simply allow the cooling air 20 to contact the rear surface of the backlight 250 (without using an additional thermal plate 280). A path of cooling air 20 may be directed along the cooling channel 270 so that heat from the thermal plate 280 (or backlight 250 if thermal plate 280 is not used) may be transferred to the cooling air 20 and removed from the display.

[0018] When using the cooling channel 270, the pass through apertures 290 (locations where the electrical connections 225 pass through the mounting panel 210, thermal plate 280, and/or backlight 250) may provide an opportunity for contaminants which are present within the cooling air 20 to enter the display housing or the backlight. This may be undesirable, as it may cause damage to the display components or affect

the image quality of the display. Thus, it may be desirable to seal the pass through apertures 290 to ensure that contaminants do not enter the display housing or backlight areas of the display. This may be accomplished by using grommets, which are typically comprised of a soft plastic where they are designed to fit tightly around the electrical connections. Alternatively, or in addition to the grommets, the pass-through points 290 may be sealed with a sealant, for example silicon, glues, or caulk-type material. Still alternatively, a sealed sub-channel can be provided within the main cooling channel 270 which would allow the electrical connections to pass through without the fear of contamination from the cooling air 20. The sealed sub-channel may reduce the assembly time for the display as grommets would not have to be inserted nor would each pass-through point require sealant (although it could be used if desired).

[0019] **FIGURE 4** is a rear perspective section view of an embodiment using a plurality of ribs 15 between the backlight 250 and the mounting panel 210. The plurality of ribs 15 may define a number of sub-channels within the main cooling channel 270 defined between the backlight 250 and the mounting panel 210. A power assembly 200 is shown attached to the mounting panel 210. In an exemplary embodiment, the mounting panel 210 would provide a gaseous and contaminate barrier between the side containing the ribs 15 and the side containing the power assembly 200 and any other relatively sensitive electronic components. If the plate 210 provides an adequate barrier, ambient air may be ingested as cooling air 20 and the risk of contaminants entering the side of the plate 210 containing the sensitive electronic components may be reduced or eliminated.

[0020] Figure 4 also provides one example of an inlet aperture 25 which accepts the cooling air 20 and directs it along the ribs 15. One or more fans 26 may be used to draw the air 20 into the inlet aperture 25 and through the ribs 15. In some embodiments, the air 20 may be air conditioned before it is directed along the ribs 15. In some embodiments, the inlet aperture 25 may contain a filter in order to remove any particulate from the air 20. Although shown adjacent to the inlet aperture 25, the fans 26 could alternatively be placed adjacent to an outlet aperture, or adjacent to both the inlet and outlet apertures.

[0021] One or more of the sub-channels created by the ribs 15 may be sealed to allow the electrical connections for the power modules to pass through, without risking contamination from the cooling air 20. The ribs 15 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, a honeycomb cross-section, or any combination or mixture of these. The ribs 15 are preferably thermally conductive and in thermal communication with the backlight 25, but this is not required. In an exemplary embodiment, the ribs 15 would be metallic.

[0022] **FIGURE 5** is a front perspective section view of an embodiment using a plurality of ribs 15 within the channel defined between the backlight 250 and the mounting panel 210. The backlight 250 in this embodiment includes a plurality of illumination devices 32 which are mounted on a plurality of panels 30 and 31. In an exemplary embodiment, the illumination devices 32 would be LEDs and the panels 30 and 31 would be a PCB and more preferably a metal core PCB. On the surface of the panels 30 and 31 which faces the ribs 15 there may be a thermal plate 280. In an exemplary embodiment, the thermal plate 280 would be metallic and more preferably aluminum. It is preferred that the ribs 15 are in thermal communication with the thermal plate 280. Cooling air 20 may again be forced along the ribs 15 in order to remove heat from the backlight assembly 250. Of course, this could also occur through natural convection.

[0023] **FIGURE 6** is a section view showing electrical connections 225 passing through a sub-channel 18 which is defined by the space enclosed by the ribs 16 and 17, thermal plate 280, and mounting panel 210. The electrical connections 225 may enter the sub-channel 18 though pass-through apertures 290. The electrical connections 225 may establish electrical communication between the backlight 250 and the power assembly 200. The electrical connections 225 connect with the backlight 250 at connection point 300 while connecting with the power assembly 200 at connection point 310. In this embodiment, the portion of the inlet aperture which is adjacent to sub-channel 18 may be blocked so that cooling air cannot enter the sub-channel 18. This prevents any contaminants which may be present within the cooling air from entering

either of the pass-through apertures 290. Thus, as long as the sub-channel 18 is properly sealed from the adjacent sub-channels, blocking the inlet of the channel 18 may reduce the risk of contaminants from the cooling air entering the pass-through points 290 and sensitive portions of the display. The sub-channel 18 may be blocked by using any type of blocking device/method including but not limited to: placing a plug (plastic, rubber, fabric, or any combination) at the entrance of the sub-channel, blocking the entrance with adhesive, blocking the entrance with double-sided tape or adhesive-backed substrate, welding a cover plate to cover the entrance, and attaching a cover plate with mechanical fasteners or adhesives.

[0024] FIGURE 7 is a rear view of an exemplary embodiment for powering and controlling an LED backlight for a large LCD. A plurality of power supplies 400 with the associated inductors 410 (i.e. power assemblies) have electrical connections 450 (ex. conduction lines) passing through a mounting panel 210 and connected to the backlight. The exemplary designs herein allow for a backlight to be connected with power assemblies using only a minimal amount of wiring as well as a minimal amount of assembly time. Furthermore, the exemplary embodiments ensure that a clean, contaminate free environment is maintained between the LED controlling electronics and the LED backlight.

[0025] It should be noted that although 4 power assemblies are shown, embodiments may use more or less than 4 power assemblies with any particular arrangement. The size and type of display/backlight may control the actual number of power assemblies used.

[0026] Further, it should be noted that the drawings herein are not necessarily drawn to scale. For the sake of simplicity and clarity, some components may be shown enlarged or simplified for explanatory purposes.

[0027] 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 embodiments 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 system for powering a LED backlight comprised of several backlight panels, the system comprising:
 - a mounting panel placed adjacent to the LED backlight;
 - a power module in electrical communication with at least one backlight panel and attached to the mounting panel;
 - further power modules in electrical communication with the remaining backlight panels and attached to the mounting panel; and
 - wherein the electrical communication is provided by conduction lines which pass through both the mounting panel and the LED backlight.
2. The LED backlight powering system of claim 1 further comprising:
 - a thermally conductive plate attached to the LED backlight; and
 - a fan positioned to draw cooling air across the thermally conductive plate.
3. The LED backlight powering system of claim 1 further comprising:
 - a cooling channel defined by the space between the LED backlight and the mounting plate; and
 - a fan positioned to force cooling air through the cooling channel.
4. The LED backlight powering system of claim 3 further comprising:

a sub-channel within the cooling channel and containing the conduction lines.

5. The LED backlight powering system of claim 4 further comprising:

a blocking device placed within the sub-channel to block cooling air from passing through the sub-channel.

6. A LED backlight system comprising:

a printed circuit board (PCB) having a front and rear side;

a plurality of LEDs on the front side of the PCB;

a mounting plate adjacent to the rear side of the PCB;

an electrical power assembly mounted to the mounting plate;

a first pass through aperture located on the PCB;

a second pass through aperture located on the mounting plate; and

electrical connections between the power assembly and LEDs which pass through the first and second pass through apertures.

7. The LED backlight system of claim 6 further comprising:

a thermally conductive plate attached to the rear side of the PCB; and

a fan positioned to force cooling air over the thermally conductive plate.

8. The LED backlight system of claim 6 further comprising:

a cooling channel defined by the space between the rear side of the PCB and the mounting plate; and

a fan positioned to draw cooling air through the cooling channel.

9. The LED backlight system of claim 8 further comprising:

a sub-channel within the cooling channel and containing the first and second pass through holes and electrical connections.

10. The LED backlight system of claim 9 wherein:

the sub-channel is defined by the rear side of the PCB, mounting plate, and a pair of ribs which connect between the rear side of the PCB and mounting plate.

11. The LED backlight system of claim 9 further comprising:

a blocking device placed within the sub-channel to block cooling air from passing through the sub-channel.

12. The LED backlight system of claim 10 wherein:

the pair of ribs are thermally conductive and in thermal communication with the rear side of the PCB.

13. A LED backlight system comprising:
- a plurality of LEDs mounted on a substrate having a front and rear side;
 - a mounting plate spaced apart from the rear side of the substrate and substantially parallel to the substrate;
 - a plurality of ribs interposed between the mounting plate and rear side of the substrate and in thermal communication with the substrate;
 - a fan positioned to draw cooling air between the plate and substrate and along the ribs;
 - an electrical power assembly mounted to the mounting plate;
 - a first pass through aperture located on the substrate;
 - a second pass through aperture located on the mounting plate; and
 - electrical connections between the power assembly and LEDs which pass through the first and second pass through apertures.
14. The LED backlight system of claim 13 wherein:
- the substrate is a metal core printed circuit board.
15. The LED backlight system of claim 13 wherein:
- the ribs are metallic.
16. The LED backlight system of claim 13 further comprising:
- one rib which contains a hollow cross-section that is aligned with the first and second pass through apertures so that the electrical connections may pass through the hollow cross-section of the rib.
17. The LED backlight system of claim 13 wherein:

the first and second apertures are located between a pair of ribs.

18. The LED backlight system of claim 17 further comprising:

a blocking device placed between the pair of ribs which contain the first and second apertures to prevent cooling air from passing through.

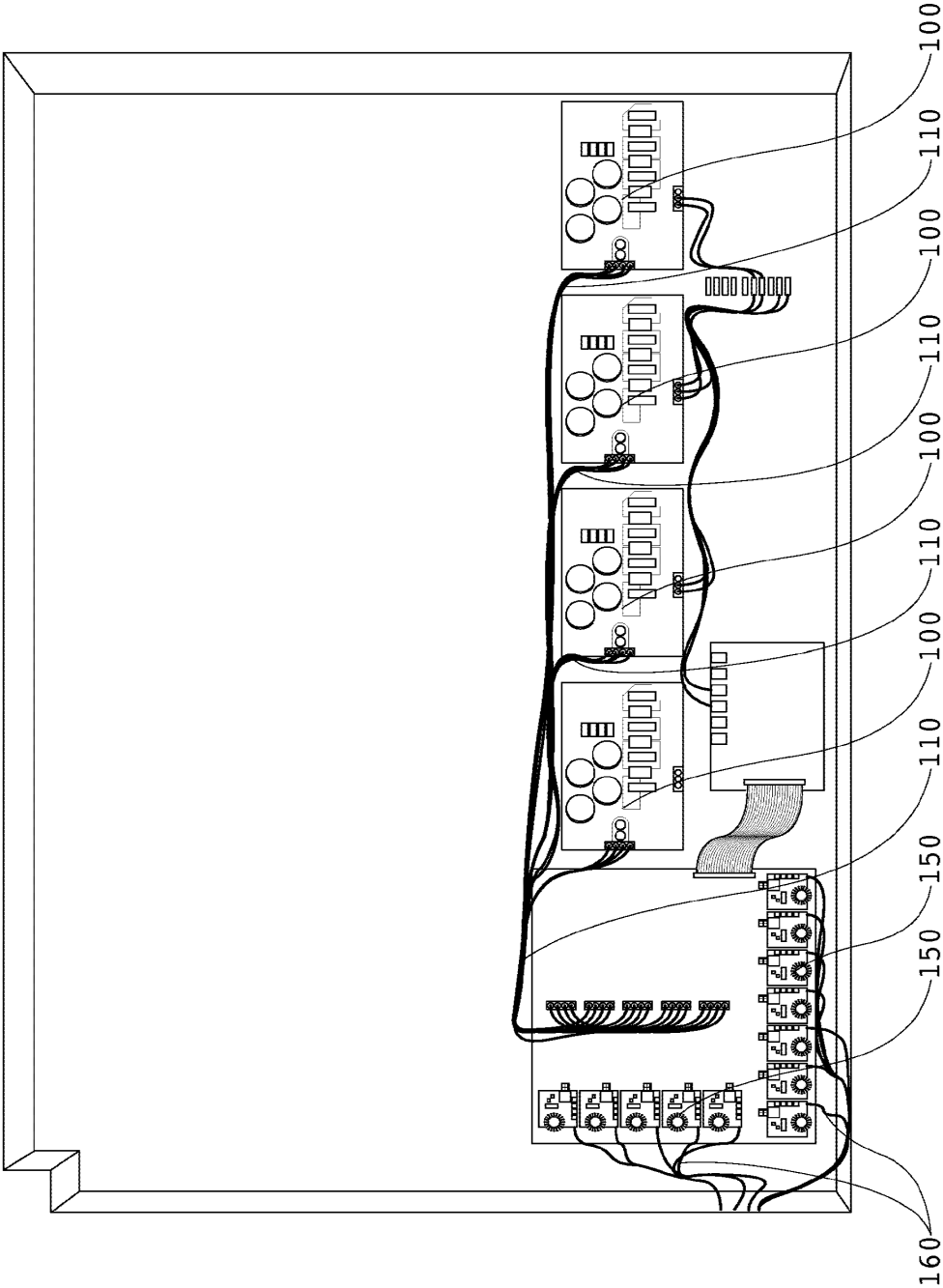


FIG-1 PRIOR ART

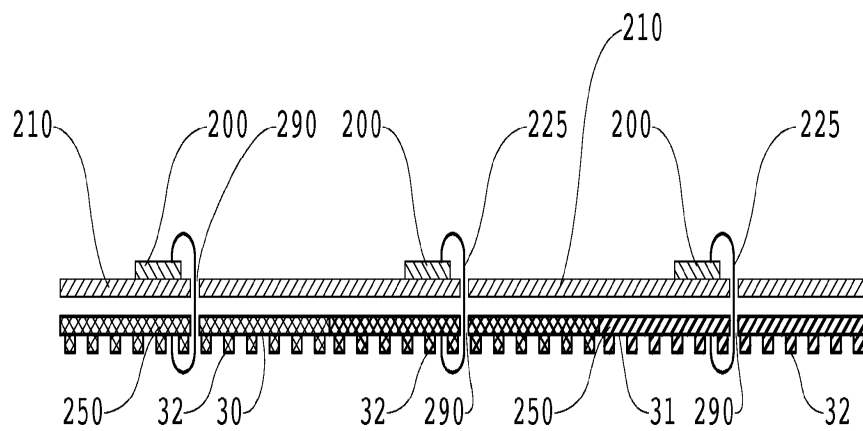


FIG-2

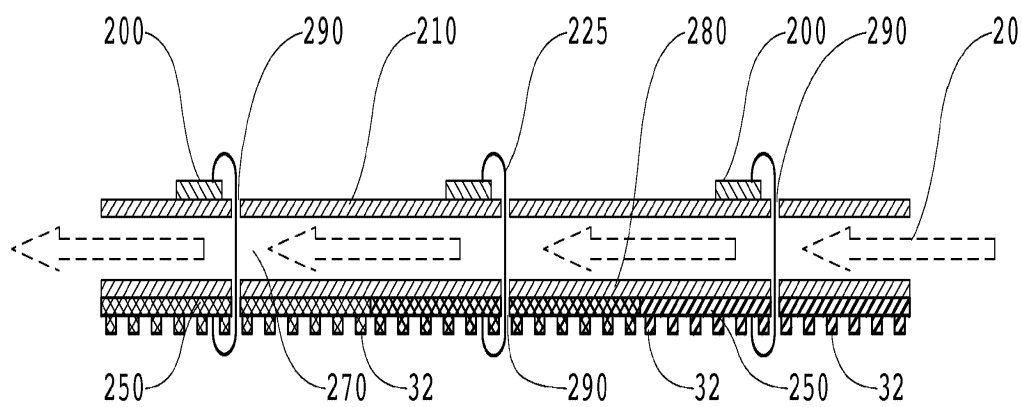


FIG-3

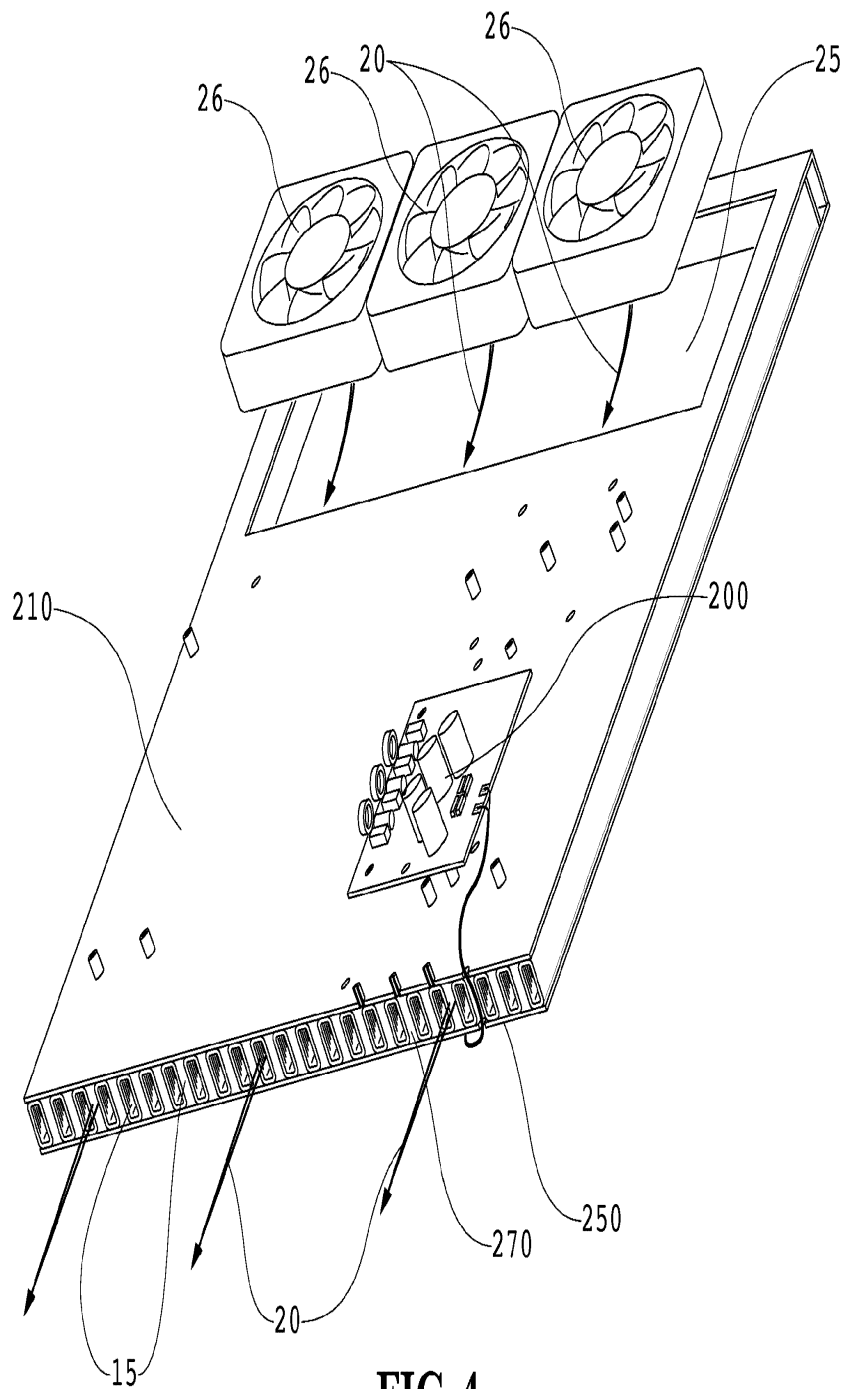


FIG-4

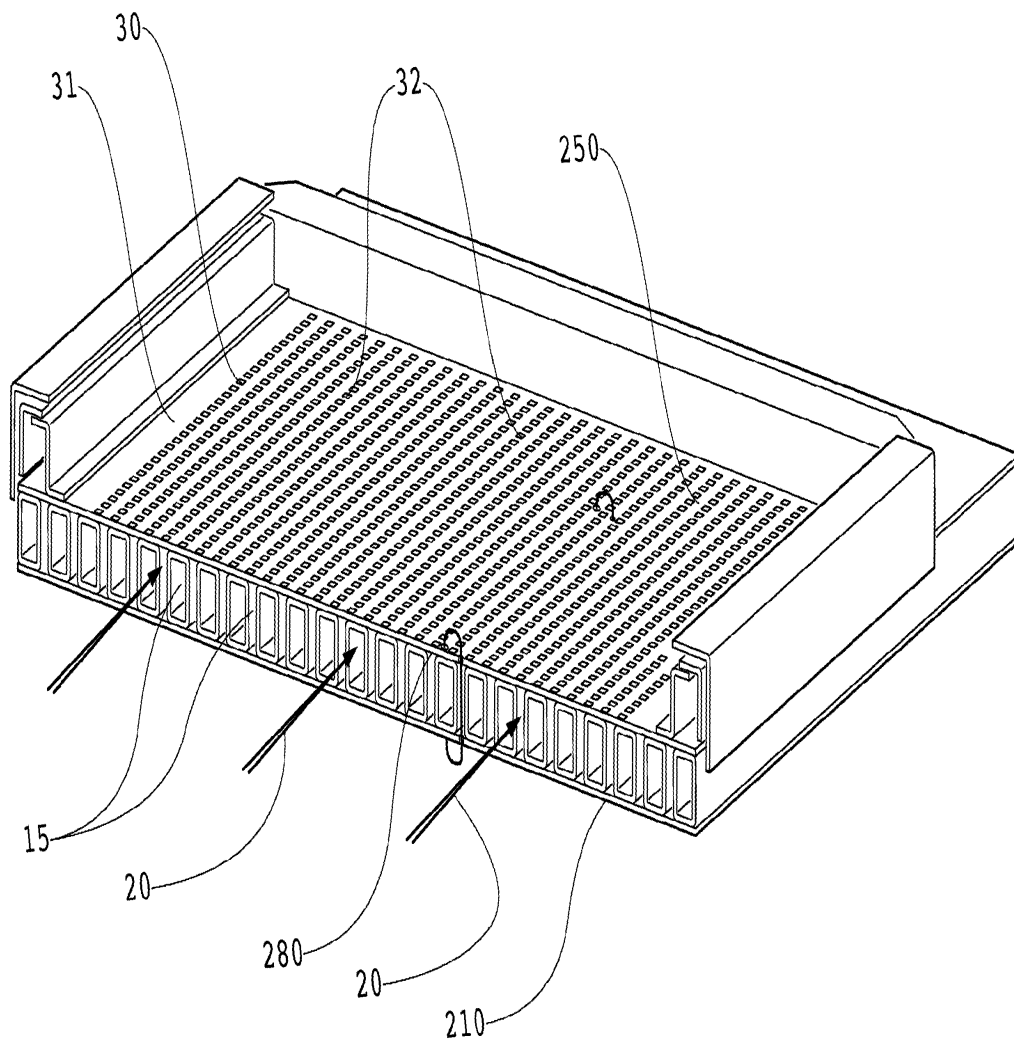


FIG-5

FIG-6

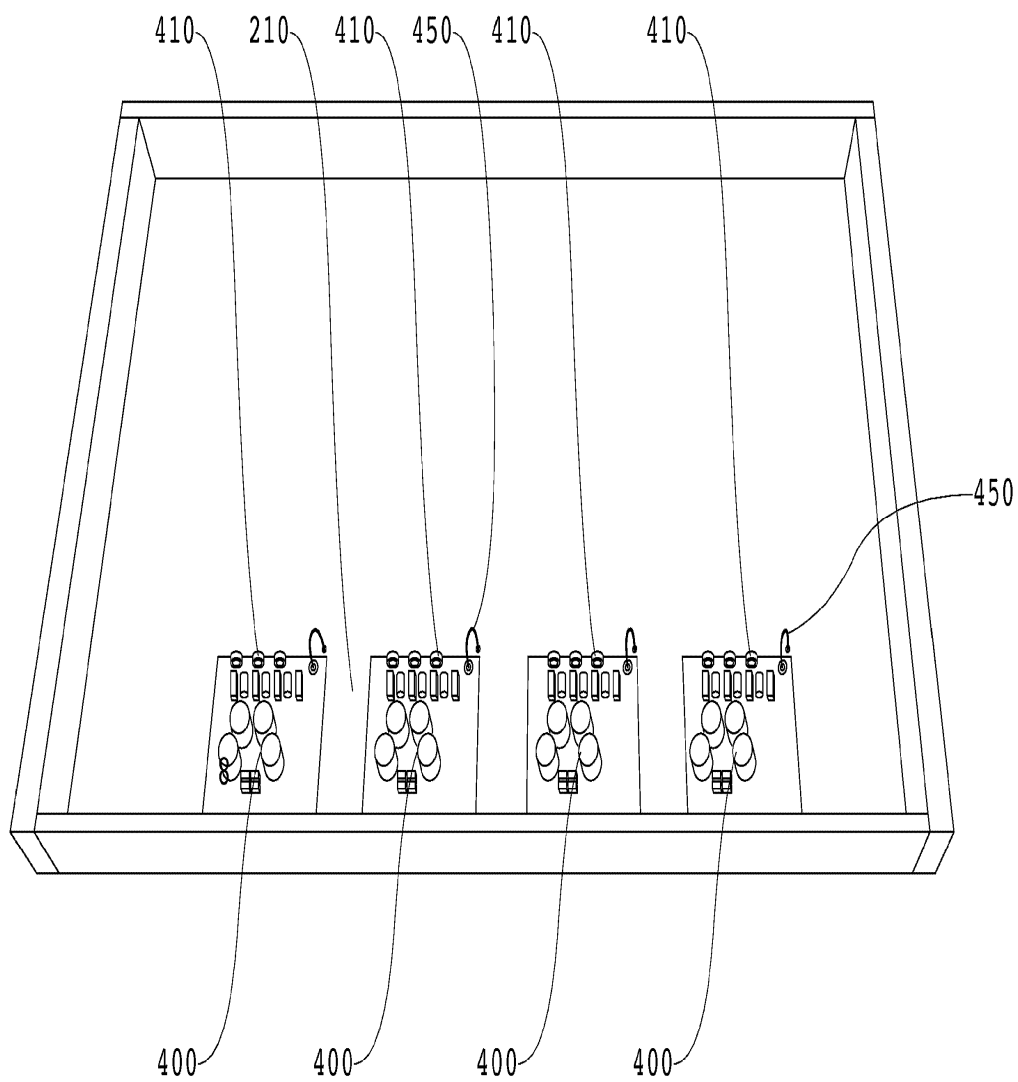


FIG-7

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- (72) **Inventors; and**
- (75) **Inventors/Applicants (for US only):** SCHUCH, John [US/US]; 1600 Union Hill Road, Alpharetta, GA 30005 (US). DE LAET, Rick [CA/US]; 1600 Union Hill Road, Alpharetta, GA 30005 (US).
- (74) **Agents:** STANDLEY, Jeffrey, S. et al.; Standley Law Group LLP, 6300 Riverside Drive, Dublin, OH 43017 (US).

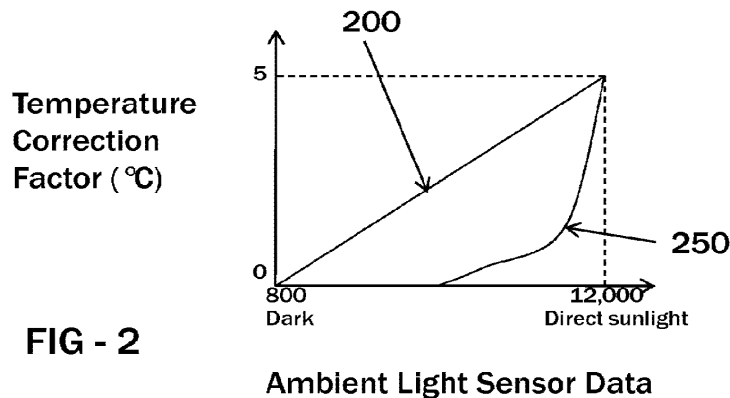
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(54) **Title:** APPARATUS AND METHOD FOR REDUCING THE THERMAL INERTIA OF AN ELECTRONIC DISPLAY



(57) **Abstract:** An apparatus and method for reducing the thermal inertia of an electronic display based on the amount of ambient light present. An ambient light sensor is used to measure the amount of ambient light which is contacting the display. To anticipate a temperature rise and lower the thermal inertia of the display, the fan speed is increased when high ambient light levels are measured at the exterior of the display but prior to a substantial increase in temperature. The ambient light sensor data may be used to apply a temperature correction factor to a temperature sensor within the display. Alternatively, the ambient light sensor data may be used to apply a fan speed correction factor to a desired fan speed (calculated based on a temperature sensor within the display).

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Apparatus and Method for Reducing the Thermal Inertia of an Electronic Display

Inventors: John Schuch and Rick De Laet

Technical Field

[0001] Exemplary embodiments generally relate to systems and methods for anticipating a temperature rise in an electronic display and reducing the thermal inertia of the display.

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 electronic displays which may be used in high ambient temperatures and/or in direct sunlight. Some modern displays may move some type of cooling gas with a fan assembly, either circulating within the display (closed loop) or passing through the display (ingested/exhausted or open loop). Typical designs would measure the temperature within the display and engage the cooling fans once the temperatures within the display reach a predetermined threshold. However, it has been found that electronic displays typically have a large amount of thermal inertia and large amounts of power are required to reverse the increase in temperature and cool the display. In other words, it is much harder and requires much more energy to cool the display once the temperature within the display has actually risen. Energy consumption has become a major concern with large electronic displays and it is desirable to limit and/or reduce their overall energy consumption as much as possible without effecting its performance.

[0006] Thus, it is now desirable to predict when and to what extent the display will rise in temperature, and preemptively engage the cooling fans so that the cooling gas can begin flowing and mitigate any potential rise in temperature.

Summary of the Exemplary Embodiments

[0007] Thus, it has been discovered that the exposure of the front display surface and/or housing to sunlight is a typical cause of many internal temperature rises within the display. This discovery has led to a potential relationship between a measurement of the amount of ambient light and a potential temperature rise within the display. The exemplary embodiments herein use the data from an ambient light sensor in order to apply a correction factor to the actual temperature data and/or the fan speeds in order to anticipate a rise in temperature and reduce its impact on the display.

[0008] The temperature sensors may be placed in one or more places within the display. Typically, the temperature sensors are placed in close proximity to one or more components that are known to increase in heat during operation (especially in high ambient temperatures and/or direct sunlight). In some embodiments, the temperature sensors are placed within or near the image assembly, on or in close proximity to one or more power modules, and/or near the backlight (if using a display type that requires a backlight, ex. liquid crystal displays). The fans are typically oriented so that they can force or draw cooling gas over these components (as well as others). The fans, temperature sensors, and ambient light sensor may be in electrical communication with a microprocessor (or other appropriate electronic control) so that a correction factor can be applied to the data from the temperature sensors so that the system 'thinks' it has already increased in temperature. Alternatively, the microprocessor could simply direct the fans to increase in speed depending on the data from the ambient light sensor.

[0009] 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

[0010] 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:

[0011] **FIGURE 1A** shows an electrical block diagram for an exemplary display which contains a basic embodiment of the cooling system.

[0012] **FIGURE 1B** shows an electrical block diagram for an exemplary display which contains an embodiment of the cooling system for cooling a LCD.

[0013] **FIGURE 2** shows a pair of example graphical relationships between the ambient light sensor data and the temperature correction factor.

[0014] **FIGURE 3** shows a pair of example graphical relationships between the corrected temperature sensor data and the fan speed.

[0015] **FIGURE 4** shows a flow chart for the logic in operating an exemplary system or the steps in practicing an exemplary method.

[0016] **FIGURE 5** shows a pair of example graphical relationships between the representative temperature sensor data and the fan speed.

[0017] **FIGURE 6** shows a pair of example graphical relationships between the ambient light sensor data and a fan speed correction factor.

[0018] **FIGURE 7** shows a flow chart for the logic in operating another exemplary system or the steps in practicing another exemplary method.

Detailed Description

[0019] **FIGURE 1A** shows an electrical block diagram for an exemplary display 100 which contains an embodiment of the cooling system. In this embodiment, an electronic image assembly 10 is placed behind a front display panel 12 (which may be used to protect the electronic image assembly 10 from damage). The electronic image assembly 10 shown here could be used with any type of electronic assembly for generating an image, including but not limited to: LCD, organic light-emitting diode (OLED), plasma, light emitting polymer (LEP), LED, or electroluminescent display.

[0020] An ambient light sensor 15 may be placed near the front portion of the display relatively close to the front display panel 12. The electronic image assembly 10 and the ambient light sensor 15 may be in electrical communication with a signal backplane 31. A display controller assembly 24 may be electrical communication with the signal backplane 31 and may contain several electronic components for controlling the various operations of the display.

[0021] A power backplane 20 may be in electrical communication with the signal backplane 31. One or more power modules 22 may be in electrical communication with the power backplane 20. In some embodiments, the signal backplane and power backplane may be combined into a single backplane to provide various electrical connections and communication to portions of the display. In other embodiments, there may be more backplanes in addition to the signal and power backplanes shown in this

embodiment. In this embodiment, because there is electrical communication between the signal backplane 31 and the power backplane 20, components which are shown as being in electrical communication with either backplane could easily be shown or described as in electrical communication with the other backplane. The backplane designs which are shown are simply a suggestion and are not required.

[0022] A fan assembly 40 may be placed in electrical communication with the power backplane 20. The fan assembly 40 may be positioned so that it can force cooling gas over one or more components that are known to increase in heat during operation (especially in high ambient temperatures and/or direct sunlight). A temperature sensor 35 may be placed in electrical communication with the signal backplane 31. The temperature sensor 35 may also be positioned so that it can measure the temperature of one or more components that are known to increase in heat during operation (especially in high ambient temperatures and/or direct sunlight). A power input 28 may be connected to the power backplane 20 in order to supply power to the display.

[0023] The display controller assembly 24 may include several different components including, but not limited to a video receiving unit, decompressor, buffer, timing and control board, and display interface board (DIB). The display controller assembly 24 may also include a microprocessor or CPU for performing the logic to operate the exemplary embodiments herein. Thus, the temperature sensor 35, fan assembly 40, and ambient light sensor 15 may be in electrical communication with a microprocessor or CPU (located within the display controller assembly 24).

[0024] A video input 25 accepts the video data from a video source and may connect to the signal backplane 31 or may connect directly to the display controller assembly 24.

[0025] FIGURE 1B shows an electrical block diagram for an exemplary display 110 which contains an embodiment of the cooling system for cooling a LCD. In this embodiment, a backlight 60 is placed behind a liquid crystal assembly 50. One or more temperature sensors 30 are placed on or near the backlight 60 and in electrical communication with the signal backplane 31. Further, one or more temperature sensors 36 are placed on or near the power modules 22. In this embodiment, a first fan assembly 42 is placed to force or draw cooling gas over the backlight 60. Also in this embodiment, a second fan assembly is placed to force or draw cooling gas over the power modules 22. Because the power modules 22 and the backlight 60 may increase in temperature as well as cool in different manners, it may be advantageous to use individual fan assemblies to cool each component, as shown here.

[0026] FIGURE 2 shows a pair of example graphical relationships between the ambient light sensor data and the temperature correction factor. Thus, in one embodiment of the system and method, the ambient light sensor data is used to calculate a temperature correction factor, which can be used to modify the actual temperature sensor data. As shown in Figure 2, a linear relationship 200 may be used to calculate a temperature correction factor from a given value for the ambient light sensor data. For the linear relationship 200, the temperature correction factor increases linearly as the ambient light sensor data increases. Alternatively, a non-linear relationship 250 may be used to represent this data. The precise relationship may be

selected depending on the particular electronic display and its desired operating conditions. The precise relationship can be determined through experimentation or simply by selecting a min/max and using linear interpolation. In general, as the amount of ambient light increases it becomes more likely that the internal components of the display will also increase in temperature. Accordingly, as the amount of ambient light increases a larger temperature correction factor is applied to the temperature sensor.

[0027] FIGURE 3 shows a pair of example graphical relationships between the corrected temperature sensor data and the fan speed. The term 'corrected temperature data' is used here to represent the values which result from applying the temperature correction factors to the actual temperature data (i.e. modifying the actual temperature data by the correction factor. This could be done by any mathematic operation. In a basic embodiment, the temperature correction factors may simply be added to the actual temperature data). The fan speed can be adjusted in a number of ways depending on the corrected temperature data. Here, a linear relationship 300 is shown where the fan speed increases linearly as the corrected temperature increases. Further, a non-linear relationship 350 can also be used to represent the desired fan speeds for each corrected temperature. In general, the fan speeds increase as the corrected temperature data increases. The precise relationship can be determined through experimentation and/or theory or simply by selecting a min/max and using linear interpolation. It should be noted that the values for the x and y axis on both Figure 2 and Figure 3 were simply selected as examples and should not be used to imply that the operating conditions would only occur within these values or that an exemplary system could only handle data values within this range.

[0028] FIGURE 4 shows a flow chart for the logic in operating an exemplary system or the steps in practicing an exemplary method. Initially, the data from the temperature sensor(s) and ambient light sensor is collected. As discussed in reference to Figures 1A-1B above, there may be several temperature sensors located in several places throughout the display. When multiple temperature sensors are used, an average value may be calculated from the various sensors or a maximum value may be selected as the representative data for the system (herein 'representative temperature data'). Based on the data from the ambient light sensor, a temperature correction factor may be selected. The temperature correction factor may be selected by using one of the relationships shown and described in reference to Figure 2, or anything similar. Next, the selected temperature correction factor may be applied to the representative temperature measurement. In general, the temperature correction factor is added or multiplied to the representative temperature measurement in order to create the corrected temperature data. As shown in Figure 2, for some values of the ambient light sensor data, the temperature correction factor may be zero. Obviously, in this case there is no requirement that the temperature correction factor is applied to the representative temperature data since the correction factor is zero and this step may not be performed.

[0029] Once a corrected temperature value has been calculated, the fan speed may be selected based on this corrected value. The fan speed may be selected based on one of the relationships discussed in reference to Figure 3 above. Thus, the temperature correction factor may cause the fan to run at a higher speed given the higher amount of ambient light that is contacting the display. The higher fan speeds

can be used to increase the cooling ability of the display prior to letting the heat from the ambient light transfer into the interior of the display. By preemptively engaging the fans at a higher speed, the temperature increase due to high ambient light levels can be slowed or eliminated in an efficient manner, reducing the power consumption of the display and the wear/tear on fans and other electronics.

[0030] **FIGURE 5** shows a pair of example graphical relationships between the representative temperature sensor data and the fan speed. Here, this graphical relationship is similar to that of Figure 3 with the notable exception that the fan speed is dependent upon the actual representative temperature data and not the corrected temperature data. Again, the fan speed can be adjusted in a number of ways depending on the representative data from the temperature sensor(s). Here, a linear relationship 500 may be used where the desired fan speed increases linearly as the temperature increases. Further, a non-linear relationship 550 can also be used to represent the desired fan speeds for each temperature measurement. In general, the desired fan speeds increase as the temperatures increase. The precise relationship can be determined through experimentation or simply by selecting a min/max and using linear interpolation.

[0031] **FIGURE 6** shows a pair of example graphical relationships between the ambient light sensor data and a fan speed correction factor. Thus, in this embodiment a fan speed correction factor is used instead of a temperature correction factor. The fan speed correction factor may simply be a percentage of the desired fan speed (determined above in reference to Figure 5). Thus, when the ambient light values are high, it may be desirable to increase the fan speed by 20%-30%. In one example, the

fan speed correction factor increases linearly 600 as the ambient light sensor data increases. In another example, the fan speed correction factor increases non-linearly 650 as the ambient light sensor data increases.

[0032] It should again be noted that the values for the x and y axis on both Figure 5 and Figure 6 were simply selected as examples and should not be used to imply that the operating conditions would only occur within these values or that an exemplary system could only handle data values within this range.

[0033] **FIGURE 7** shows a flow chart for the logic in operating another exemplary system or the steps in practicing another exemplary method. Initially, the data from the temperature sensor(s) is collected. As discussed in reference to Figures 1A-1B and 4 above, there may be several temperature sensors located in several places throughout the display. When multiple temperature sensors are used, an average value may be calculated from the various sensors or a maximum value may be selected as the representative data for the system (herein 'representative temperature data'). Based on the representative temperature data, a desired fan speed may be selected. The desired fan speed may be selected by using one of the relationships shown and described in reference to Figure 5. Next, the data from the ambient light sensor is gathered and used to determine a fan speed correction factor. The fan speed correction factor may be selected by using one of the relationships shown and described in reference to Figure 6. Finally, the fan speed correction factor may be applied to the desired fan speed to account for the high levels of ambient light (provided that the fan speed correction factor is greater than 0%).

[0034] As shown in Figure 1B, there may be multiple fan assemblies placed throughout the display. In these embodiments, there may be a control system for each fan assembly or even each fan. Further, each control system may have independent parameters. Thus, in reference to Figure 1B, the logic which controls fan assembly 42 for cooling the backlight 60 may be different than the logic which controls fan assembly 43 for cooling the power modules 22.

[0035] Any number of gaseous matters may be used as the cooling gas described herein. The cooling gas may be circulating around the display, ingested into the display and exhausted, and/or circulated through the display. In some embodiments, the cooling gas may be ambient air which is ingested into the display. In some embodiments, the cooling gas may be ambient air which has been air conditioned prior to being ingested into the display.

[0036] 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 embodiments 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

What is claimed is:

1. An apparatus for reducing the thermal inertia of a component within an electronic display where an ambient light sensor is used to measure ambient light contacting the display, a temperature sensor is used to measure the temperature of the component, and a fan is used to force cooling gas over the component, characterized by:

a microprocessor in electrical communication with the ambient light sensor, fan, and temperature sensor and adapted to increase the speed of the fan when a substantial increase in ambient light levels is measured but prior to a substantial increase in temperature measurement.

2. The apparatus of claim 1 wherein:

the microprocessor applies a fan speed correction factor to the fan in response to ambient light measurements.

3. The apparatus of claim 1 wherein:

the microprocessor applies a temperature correction factor to the temperature sensor data in response to ambient light measurements.

4. The apparatus of claim 1 wherein:

the component having a reduction in thermal inertia is a backlight.

5. An electronic display assembly comprising:

an electronic image assembly;

a backplane in electrical communication with the electronic image assembly;

an ambient light sensor producing a signal;

a power module in electrical communication with the backplane;

a fan placed to force cooling gas over the power module;

a temperature sensor producing a signal and placed to measure the temperature
of the power module; and

a microprocessor which receives the ambient light sensor signal and
temperature sensor signal and uses both signals to control the speed of
the fan.

6. The electronic display of claim 5 wherein:

the electronic image assembly is a backlit liquid crystal display.

7. The electronic display of claim 5 wherein:

the electronic image assembly is a OLED display.

8. The electronic display of claim 7 further comprising:

a second fan placed to force cooling gas over the backlight.

9. The electronic display of claim 8 further comprising:

a second temperature sensor producing a signal and placed to measure the temperature of the backlight.

10. The electronic display of claim 9 wherein:

the microprocessor also receives the second temperature sensor signal and uses the ambient light sensor signal and second temperature sensor signal to control the speed of the second fan.

11. The electronic display of any one of claims 5-10 wherein:

the ambient light sensor is positioned to measure the ambient light contacting the electronic image assembly.

12. A method for reducing the thermal inertia of an electronic display, the method comprising the steps of:

- measuring the ambient light contacting the display;
- measuring a temperature within the display;
- selecting a temperature correction factor based on the ambient light measurement;
- applying the temperature correction factor to the temperature measurement to produce corrected temperature data;
- selecting a fan speed based on the corrected temperature data; and
- driving the cooling fan at the selected fan speed.

13. The method of claim 12 wherein:

- the temperature measurement is performed near a power module which powers the electronic display.

14. The method of claim 12 wherein:

- the temperature measurement is performed near a backlight component of the electronic display.

15. A method for reducing the thermal inertia of an electronic display, the method comprising the steps of:

measuring a temperature within the display;

selecting a desired fan speed based on the temperature measurement;

measuring the ambient light contacting the display;

selecting a fan speed correction factor based on the ambient light measurement;

applying the fan speed correction factor to the desired fan speed to produce a corrected fan speed; and

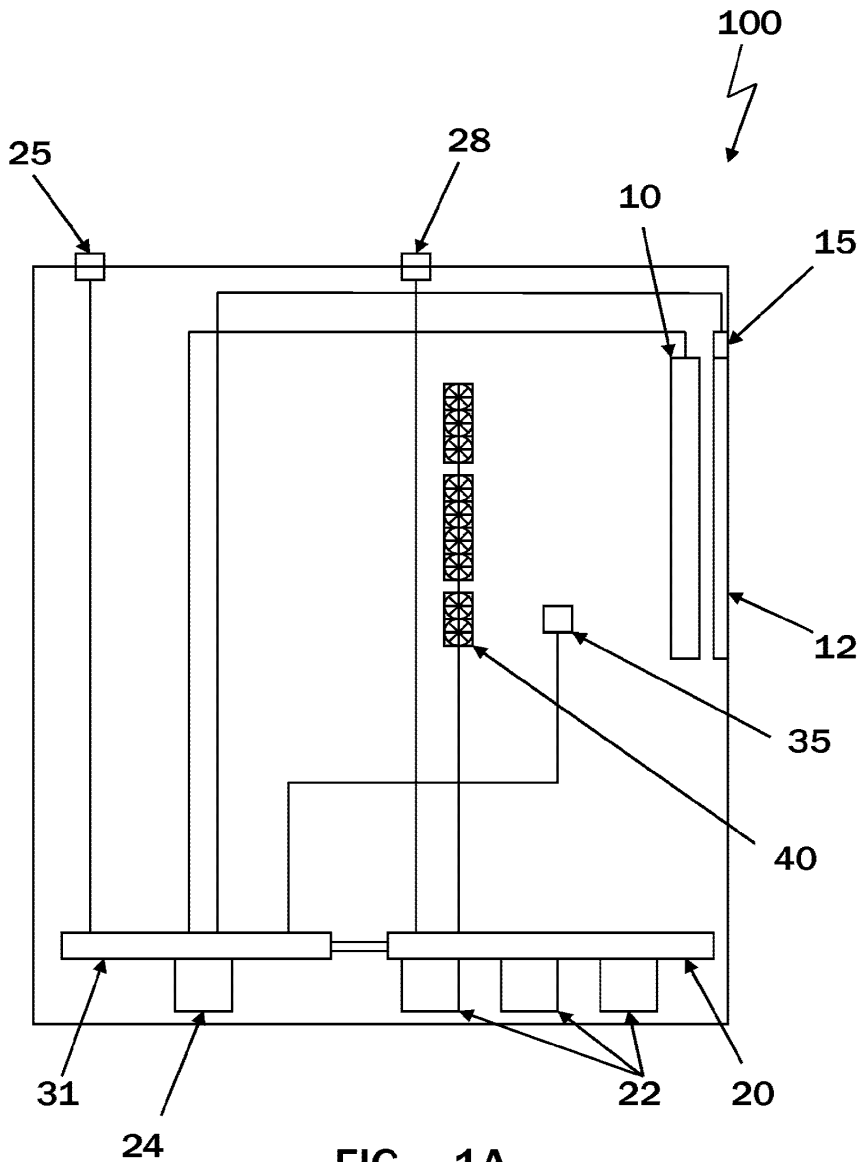
driving the cooling fan at the corrected fan speed.

16. The method of claim 15 wherein:

the temperature measurement is performed near a power module which powers the electronic display.

17. The method of claim 15 wherein:

the temperature measurement is performed near a backlight component of the electronic display.



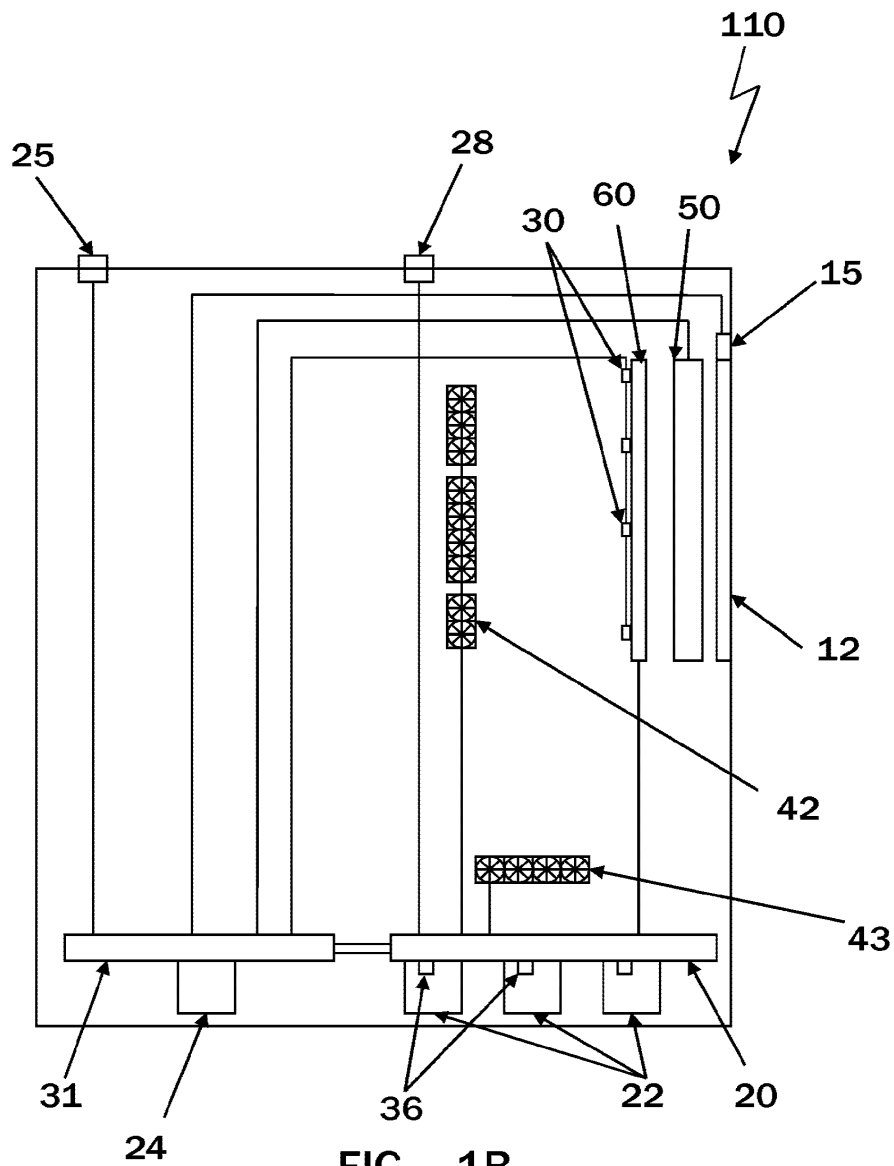


FIG - 1B

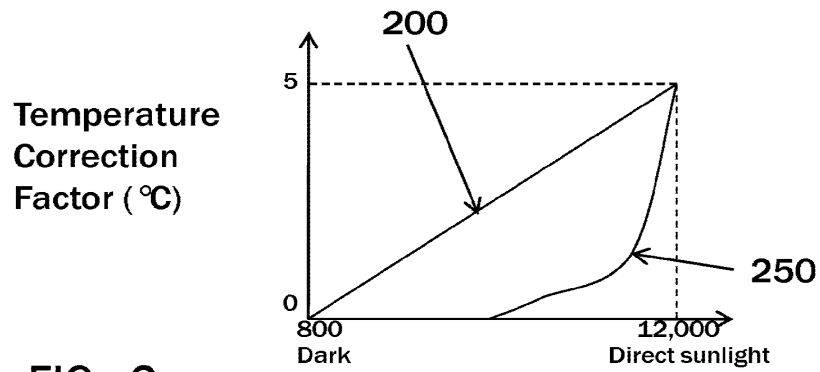


FIG - 2

Ambient Light Sensor Data

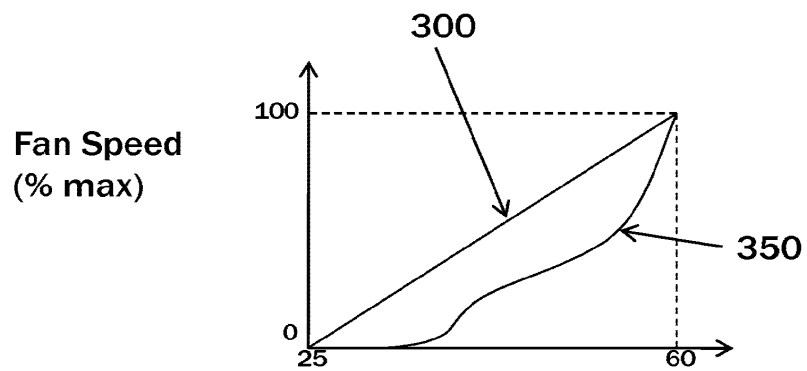
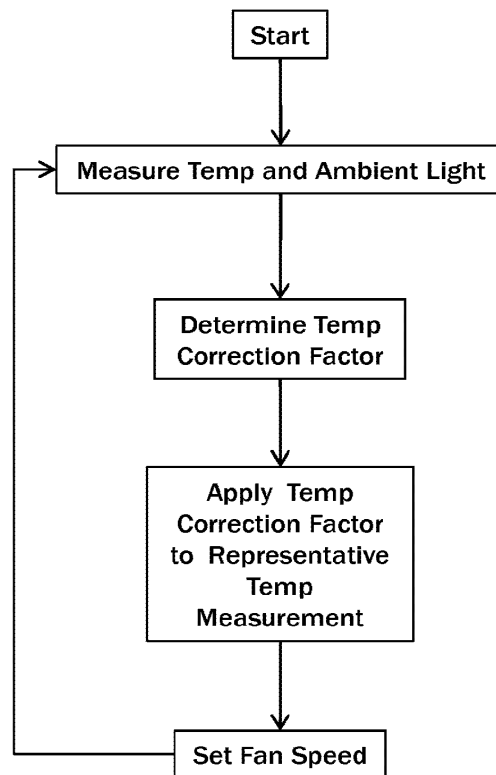
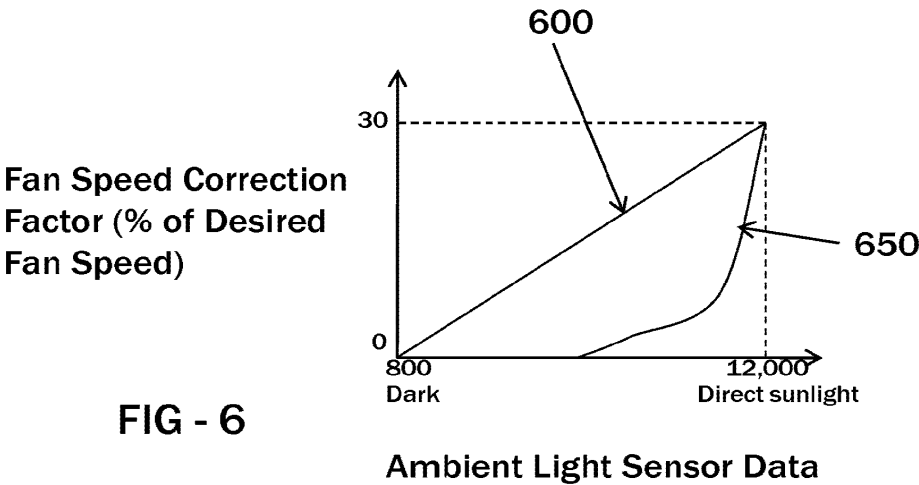
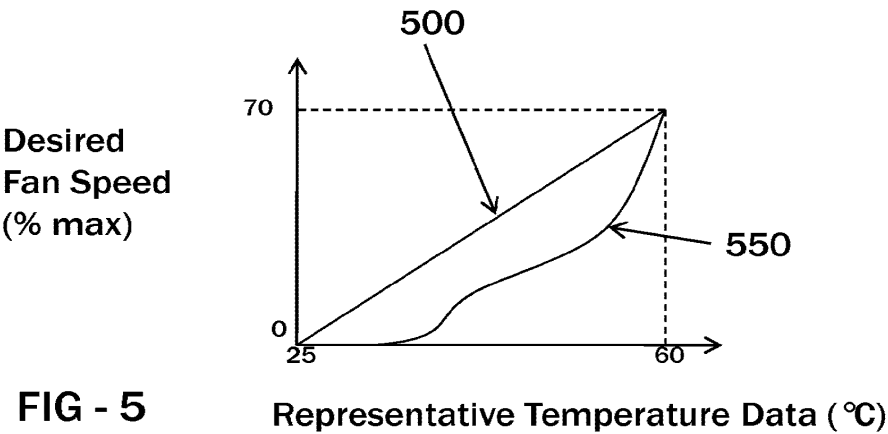


FIG - 3

Corrected Temperature Data (°C)

**FIG - 4**



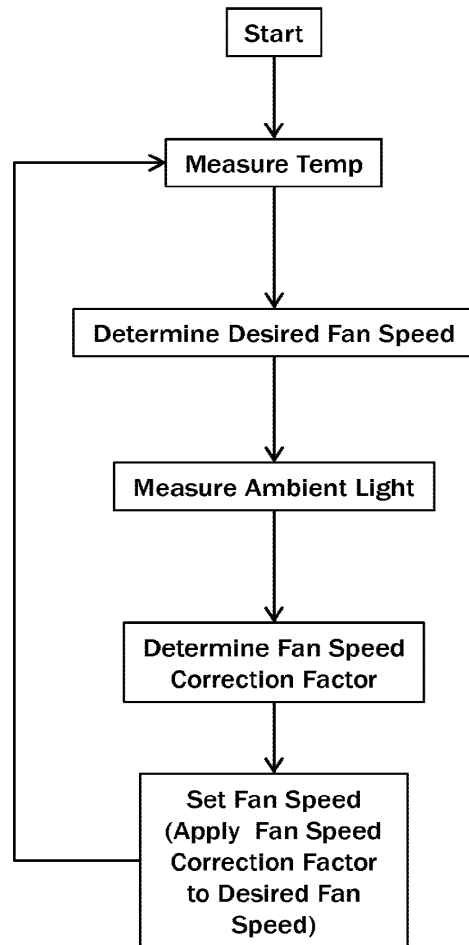


FIG - 7

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(54) Title: SYSTEM AND METHOD FOR THERMALLY CONTROLLING AN ELECTRONIC DISPLAY WITH REDUCED NOISE EMISSIONS

(57) Abstract: An assembly for cooling an electronic image assembly having a rear channel placed behind the image assembly and a heat exchanger for accepting ambient air. The system contains a first fan placed within the heat exchanger to force ambient air through the heat exchanger and the rear channel. A second fan may be used to force circulating gas through an interior portion of the display housing and through the heat exchanger in order to transfer heat to the ingested ambient air.

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SYSTEM FOR THERMALLY CONTROLLING AN ELECTRONIC DISPLAY WITH REDUCED NOISE EMISSIONS

Inventors: William Dunn, Tim Hubbard, and Ware Bedell

Cross-Reference to Related Applications

[0001] This application claims priority to U.S. Application No. 13/211,887 filed on August 17, 2011, herein incorporated by reference in its entirety. This application claims priority to U.S. Application No. 61/375,470 filed on August 20, 2010, herein incorporated by reference in its entirety. This application is a continuation-in-part of U.S. Application No. 13/100,580 filed on May 4, 2011, herein incorporated by reference in its entirety. This application is also a continuation-in-part of U.S. Application No. 13/100,556 filed on May 4, 2011, herein incorporated by reference in its entirety. This application is also a continuation-in-part of U.S. Application No. 12/905,704 filed on October 15, 2010, herein incorporated by reference in its entirety.

Technical Field

[0002] Exemplary embodiments generally relate to cooling systems and in particular to cooling systems for electronic displays.

Background of the Art

[0003] 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.

[0004] 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.

[0005] 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.

[0006] 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.

[0007] 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

[0008] Exemplary embodiments may 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. Circulating gas may also be used to remove heat from internal electronic assemblies. 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.

[0009] 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.

[0010] 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 (or between two separate heat exchangers), 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 electronic 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. In an exemplary embodiment, a single fan assembly can be used to drive the ambient gas through both the heat exchanger(s) and behind the electronic image assembly.

[0011] 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.

[0012] 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

[0013] 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:

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

[0015] FIGURE 1B provides a rear perspective view of an exemplary embodiment of the electronic display.

[0016] FIGURE 2 provides a rear perspective view similar to that shown in Figure 1B where the rear cover has been removed.

[0017] FIGURE 3 provides a perspective sectional view along the A-A section line shown in Figure 1B.

[0018] FIGURE 4 provides a perspective sectional view along the B-B section line shown in Figure 1B.

[0019] FIGURE 5 provides a perspective sectional view of insert C shown in Figure 4.

[0020] FIGURE 6 provides a perspective sectional view of one embodiment of the cross through plate.

[0021] FIGURE 7 provides an exploded perspective view of one embodiment of the heat exchanger.

[0022] 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).

[0023] 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.

[0024] FIGURE 10 provides a rear perspective view of an embodiment using a single fan assembly to control the flow of ambient gas, the embodiment shown with the rear cover removed.

[0025] FIGURE 11A provides a perspective sectional view of the embodiment from Figure 10 based on section line 11A-11A shown in Figure 10.

[0026] FIGURE 11B provides a perspective sectional view of insert B from Figure 11A.

Detailed Description

[0027] 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.

[0028] 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.

[0029] 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, 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.

[0030] 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.

[0031] 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.

[0032] 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.

[0033] 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.

[0034] 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.

[0035] 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.

[0036] 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.

[0037] 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).

[0038] Optionally, ambient gas 210 may also be ingested into the display through inlet aperture 24. 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 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 and combines them into a single flow and exhausts it out of the exit aperture 25. 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. 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.

[0039] 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.

[0040] **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

contaminates 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.

[0041] An electronic image assembly 50 may be placed behind the front plate 10. A plurality of channels 60 may be placed behind (preferably immediately 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 immediately 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 on the rear portion of the electronic image assembly 50 so that heat can easily transfer to this plate and be removed by the ambient gas 210.

[0042] 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 embodiment, heat which accumulates on the rear portion of the electronic image assembly 50 may be transferred throughout the channels 60 and removed by ambient gas 210.

[0043] **FIGURE 4** provides a perspective sectional view along the B-B section line shown in Figure 1B. In this view, the path of the circulating gas 250 can also be observed. The space between the front plate 10 and the electronic image assembly 50 may define a front channel 251, through which the circulating gas 250 may travel in order to remove any accumulation of heat on the front surface of the electronic image assembly 50. The circulating gas 250 is preferably then directed into the heat exchanger 45 where heat may be transferred from the circulating gas 250 to the ambient gas 200. Upon exiting the heat exchanger 45, the circulating gas 250 may be

re-directed into the front channel 251. The circulating gas 250 may also be directed over various electronic components 7 so that heat may be transferred from the electronic components 7 to the circulating gas 250. The electronic components 7 could be any one of the following but not limited to: power modules, heat sinks, capacitors, motors, microprocessors, hard drives, AC/DC converters, transformers, or printed circuit boards.

[0044] Also shown in this sectional view is the path of the ambient gas 210 travelling down one of the channels 60 directly behind the electronic image assembly 50. In this embodiment, the ambient gas 210 is forced out of the first manifold 30, across the channels 60, and into the second manifold 35 by manifold fan assembly 211. As shown in this Figure, the paths of the ambient gas 210 and the circulating gas 250 will likely cross, but it is preferable to keep the two gases from mixing (as the ambient gas 210 may contain particulate or contaminants while the circulating gas 250 can remain substantially free of particulate and contaminants). It may be preferable to keep the circulating gas 250 from having particulate or contaminants because it travels in front of the electronic image assembly 50. Thus, to keep the image quality from being impaired, it may be desirable to keep the circulating gas 250 clean and prevent it from mixing with the ambient gas 210.

[0045] **FIGURE 5** provides a perspective sectional view of insert C shown in Figure 4. As noted above, if practicing an embodiment which uses ambient gas 210 as well as the circulating gas 250, the pathways of the two gases may need to cross over one another and it may be desirable to prohibit them from mixing to prevent contamination of sensitive portions of the display. Here, cross through plate 500 allows the pathways of the two gases to cross over one another without letting them mix together. The cross through plate 500 in this embodiment contains a series of voids which pass through the plate. A first series of voids 550 passes through the cross through plate 500 and allows ambient gas 210 to travel from the first manifold 30 into the channels 60 which run behind the electronic image assembly 50. A second series of voids 525 pass through the cross through plate 500 in a direction substantially perpendicular to that of the first series of voids 550. The second series of voids 525 allows the circulating gas to exit the front channel 251, cross over the ambient gas 210, and continue towards the heat

exchanger 45. In this embodiment, a circulating gas fan assembly 255 is used to draw the circulating gas 250 through the front channel 251 and through the heat exchanger 45. Much like the other fan assemblies shown and described here, the circulating gas fan assembly 255 could be placed anywhere within the display, including but not limited to the entrance/exit of the heat exchanger 45 or the entrance/exit of the front channel 251.

[0046] FIGURE 6 provides a perspective sectional view of one embodiment of the cross through plate 500. In this embodiment, the cross through plate 500 is comprised of a plurality of hollow blocks 503 sandwiched between a top plate 501 and bottom plate 502 with sections of the plates 501 and 502 removed to correspond with the hollow sections of the blocks 503. A portion of the top plate 501 has been removed to show the detail of the hollow blocks 503, first series of voids 550, and second series of voids 525. The cross through plate 500 could take on any number of forms and could be constructed in a number of ways. Some other embodiments may use a solid plate where the first and second series of voids 550 and 525 are cut out of the solid plate. Other embodiments could use two sets of hollow blocks where the hollow sections are perpendicular to each other and the blocks are fastened together. Still other embodiments could use a design similar to those that are taught below for the heat exchanger 45, for example any type of cross-flow heat exchanger design could be used.

[0047] FIGURE 7 provides an exploded perspective view of one embodiment of the heat exchanger 45. In this view, the heat exchanger fan assembly 46 is shown removed from its mounted position within the heat exchanger 45. In this embodiment, the heat exchanger 45 is divided into two portions 47 and 48 where the fan assembly 46 is placed between the two portions 47 and 48. While the fan assembly 46 can be placed anywhere so that it draws ambient gas 200 through the heat exchanger 45, it has been found that placing the fan assembly 46 between the two portions of the heat exchanger can provide a number of benefits. First, the volumetric flow rate of the ambient gas 200 through the heat exchanger is high, which results in better cooling capabilities for the heat exchanger 45. Second, the noise produced by the fan assembly 46 can be drastically reduced because the surrounding portions 47 and 48 of

the heat exchanger 45 essentially act as a muffler for the fan assembly 46. In this embodiment, portion 48 is thinner and longer than portion 47. This was done in order to free up more space within the housing so that additional electronic components could fit within the housing (adjacent to portion 48). This design may be preferable when it is desirable to create the largest possible heat exchanger 45 (for maximum cooling abilities). This is of course not required, and other embodiments may have portions which are of equal width and length. Also, although this embodiment uses the fan assembly 46 to drive the ambient gas 200, other embodiments could use a fan assembly placed within the heat exchanger to drive the circulating gas 250 instead and drive the ambient gas 200 with another fan assembly (possibly placed within the heat exchanger or located at the entrance/exit of the heat exchanger).

[0048] The ambient gas 200 travels through a first pathway (or plurality of pathways) of the heat exchanger 45 while the circulating gas 250 travels through a second pathway (or plurality of pathways) of the heat exchanger 45. Although not required, it is preferable that the circulating gas 250 and ambient gas 200 do not mix. This may prevent any contaminants and/or particulate that is present within the ambient gas 200 from harming the interior of the display. In a preferred embodiment, the heat exchanger 45 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 45 may be a cross-flow, parallel flow, or counter-flow heat exchanger. In an exemplary embodiment, the heat exchanger 45 would be comprised of a plurality of stacked layers of thin plates. The plates may have a corrugated, honeycomb, or tubular design, where a plurality of channels/pathways/tubes 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, ambient gas or circulating gas may enter an exemplary heat exchanger only through plates whose channels or pathways travel parallel to the path of the gas. Because the plates are alternated, the circulating gas and ambient gas 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). In other words,

an exemplary heat exchanger would have at least a first gas pathway for ambient gas and at least a second gas pathway for circulating gas, where the two pathways are substantially perpendicular and adjacent to each other and do not allow the ambient gas and circulating gas to mix.

[0049] In an alternative design for a heat exchanger, an open channel may be placed in between a pair of corrugated, honeycomb, or tubular plates. The open channel may travel in a direction which is perpendicular to the pathways of the adjacent plates. This open channel 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 pathways in the adjacent plates. Thus, gas entering the heat exchanger in a first direction may travel through the open channel (parallel to the strips or tape). Gas which is entering in a second direction (substantially perpendicular to the first direction) would travel through the pathways of the adjacent plates).

[0050] 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.

[0051] An exemplary heat exchanger may have plates where the sidewalls have a relatively low thermal resistance so that heat can easily be exchanged between the two gases. A number 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 and would work with these embodiments. 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 a small sidewall 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 plastic may be used for each plate layer where they are stacked together in alternating fashion (i.e. each adjacent plate has channels which travel in a direction perpendicular to the surrounding plates).

[0052] FIGURE 8 provides a perspective sectional view of another embodiment which uses a flow of circulating gas 350 through the backlight cavity of a liquid crystal display (LCD) 300. In this embodiment, a LCD 300 and an associated backlight 320 are used as the electronic image assembly. A backlight wall 330 may be placed between the LCD 300 and the backlight 320 in order to enclose the area and create a backlight cavity. Typically, the backlight cavity is closed to prevent contaminants/particulate from entering the backlight cavity and disrupting the optical/electrical functions of the backlight 320. However, as discussed above the exemplary embodiments may use a clean gaseous matter for the circulating gases which could now be used to ventilate the backlight cavity in order to cool the backlight 320 and even the rear portion of the LCD 300. An opening 340 can be placed in the backlight wall 330 to allow circulating gas 350 to flow through the backlight cavity. A fan assembly 360 may be used to draw the circulating gas 350 through the backlight cavity. In an exemplary embodiment there would be an opening on the opposing backlight wall (on the opposite side of the display as shown in this figure) so that circulating gas 350 could easily flow through the backlight cavity.

[0053] FIGURE 9 provides a perspective sectional view of an exemplary embodiment which uses a flow of circulating gas 350 through the backlight cavity in addition to the flow of circulating gas 250 between the LCD 300 and front plate 10. Circulating gas fan assembly 255 may be placed so that it can draw circulating gas 350 through the backlight cavity as well as circulating gas 250 between the LCD 300 and the front plate 10. As discussed above, the circulating gases 250 and 350 are preferably forced through the heat exchanger 45 (not shown in this figure) so that they may be cooled by the ambient gas 200 (also not shown in this figure).

[0054] Also shown in Figure 9 is the optional additional flow of ambient gas 210 which may travel immediately behind the backlight 320. Once travelling through the first manifold 30, the ambient gas 210 may pass through the channels 60 in order to

remove heat from the backlight 320 and even the channels 60 themselves (if they are thermally conductive). The manifold fan assembly 211 may be used to draw the ambient gas 210 into the first manifold 30 and through the channels 60. Again, the cross though plate 500 may be used to allow the circulating gases 350 and 250 to cross paths with the ambient gas 210 without letting the two gases mix.

[0055] In an exemplary embodiment, the backlight 320 would contain a plurality of LEDs mounted on a thermally conductive substrate (preferably a metal core PCB). On the surface of the thermally conductive substrate which faces the channels 60 there may be a thermally conductive front plate which may be in thermal communication with the channels 60. In an exemplary embodiment, the thermally conductive plate would be metallic and more preferably aluminum.

[0056] **FIGURE 10** provides a rear perspective view of an embodiment 1000 using a single fan assembly 1050 to control the flow of ambient gas. The embodiment 1000 is shown here with the rear cover removed. In this figure, the main display assembly is still within the exterior display housing 1001. Similar to some of the embodiments describe above, a circulating gas fan assembly 1105 may be used to draw circulating gas 1106 into and through the heat exchanger 1100. Further, another circulating gas fan assembly 1205 may be used to draw circulating gas 1106 through heat exchanger 1200. The circulating gas 1106 may also be used to extract heat from various electrical components 1109.

[0057] An ambient gas fan assembly 1050 may be used to draw ambient gas into the inlet aperture 1009 and exhaust the ambient gas out of an exit aperture 1010. The ambient gas preferably travels through the heat exchangers 1200 and 1100 as well as the channel behind the electronic image assembly (if used). The section line 11A-11A is shown cutting horizontally through the display embodiment 1000.

[0058] **FIGURE 11A** provides a perspective sectional view of the embodiment from Figure 10 based on section line 11A-11A shown in Figure 10. For clarity, the exterior housing 1001 has been removed. Once the circulating gas 1106 has traveled through the heat exchangers 1200 and 1100, it may then be directed between the front transparent plate 1500 and the electronic image assembly 1600. After passing between the front transparent plate 1500 and the electronic image assembly 1600, the

circulating gas 1106 may then return to the heat exchangers 1200 and 1100. In this embodiment, fan assembly 1050 is used to control the flow of ambient gas 1055 and 1056. Ambient gas 1055 is directed through the heat exchangers 1200 and 1100 while ambient gas 1056 is directed behind the electronic image assembly 1600.

[0059] FIGURE 11B provides a perspective sectional view of insert B from Figure 11A. The channel 1700 may be defined by the space between the rear surface or portion of the electronic image assembly 1600 and a plate which is substantially parallel to the rear surface or portion of the electronic image assembly 1600. The channel 1700 may also contain ribs which are also thermally conductive and preferably in thermal communication with the electronic image assembly 1600. By placing the fan assembly 1050 so as to direct the ambient gas within the channel 1700 and the heat exchangers 1200 and 1100 simultaneously, several improvements can be achieved, including but not limited to: increased air flow, less fan noise, and a less expensive/lighter assembly. In this embodiment, the paths for ambient gas 1055 and ambient gas 1056 are substantially parallel to one another.

[0060] As noted above, many electronic image assemblies (especially LEDs, LCDs, and OLEDs) may have performance properties which vary depending on temperature. When 'hot spots' are present within an image 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 image assembly (sometimes containing a backlight assembly) can be distributed (somewhat evenly) throughout the channels 60 and thermally-conductive surfaces to remove hot spots and cool the backlight and/or electronic image assembly.

[0061] The circulating gases and ambient gases can be any number of gaseous matters. In some embodiments, air may be used as the gas for all. Preferably, because the circulating gases may travel in front of the image assembly and/or within the backlight cavity, they should be substantially clear, so that they will not affect the appearance of the image to a viewer. The circulating gases should also preferably 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/or damage to the internal electronic components. It may sometimes be preferable to keep ambient

gases from having contaminants as well. Filters may be used to help reduce the particulate within ambient gases. Filters could be placed near the inlet apertures so that ambient gases could be drawn through the filter. However, in an exemplary embodiment the display may be designed so that contaminants could be present within the ambient gases but this will not harm the display. In these embodiments, the heat exchanger, manifolds, channels, and any other pathway for ambient or circulating gas should be 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 gases, 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.

[0062] The cooling system 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.

[0063] It is to be understood that the spirit and scope of the disclosed embodiments provides for the cooling of many types of displays. By way of example and not by way of limitation, embodiments may be used in conjunction with any of the following electronic image assemblies: 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 thin panel electronic image assembly. 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 full color, flat panel OLED displays. Exemplary embodiments may also utilize large (55 inches or more) LED backlit, high definition 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) where thermal stability of the display may be at risk.

[0064] As is well known in the art, electronic displays can be oriented in a portrait manner or landscape manner and either can be used with the embodiments herein. Although circulating gas may be shown traveling clockwise or counterclockwise, either orientation may be used with any of the embodiments herein. Similarly, although ambient gas may be shown travelling from top-bottom, bottom-top, left-right, or right-left, any arrangement can be used. Further, it should be understood that the figures herein are not necessarily drawn to scale, and some components may be enlarged for clarity and explanatory purposes.

[0065] 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 embodiments 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. An assembly for cooling an electronic image assembly within a housing having an inlet aperture for ambient gas, exit aperture for ambient gas, and internal cavity for circulating gas, the assembly comprising:
 - a first portion of a heat exchanger which accepts ambient gas from the inlet aperture;
 - a second portion of a heat exchanger which accepts ambient gas from the first portion;
 - a channel placed behind the electronic image assembly and in gaseous communication with the inlet and exit apertures;
 - an first fan positioned between the first and second portions which forces ambient gas through the first portion, second portion, and the channel;
 - and
 - a second fan which forces circulating gas through the internal cavity and at least one of the heat exchanger portions.
2. The cooling assembly of claim 1 wherein:
 - the first fan also draws ambient gas through the inlet aperture.
3. The cooling assembly of claim 2 wherein:
 - the first fan also pushes ambient gas through the exit aperture.
4. The cooling assembly of claim 1 further comprising:
 - an electronic component placed within the path of the circulating gas.
5. The cooling assembly of claim 4 wherein:
 - the electronic component is a power module.

6. The cooling assembly of claim 1 wherein:
the heat exchanger portions are comprised of corrugated layers.
7. The cooling assembly of claim 1 wherein:
the heat exchanger portions are cross-flow heat exchanger portions.
8. An electronic display assembly comprising:
a housing having an inlet aperture and exit aperture for ambient gas;
an electronic image assembly within the housing;
a transparent front plate in front of the electronic image assembly, the space between the transparent front plate and the electronic image assembly defining a front channel;
a rear plate placed behind the electronic image assembly, the space between the rear plate and the electronic image assembly defining a rear channel;
a heat exchanger in gaseous communication with the front channel, the heat exchanger comprising two portions, each portion having first and second gas pathways, where the first gas pathways are in gaseous communication with the inlet and exit apertures and the second gas pathways are in gaseous communication with the channel;
an ambient gas fan assembly placed between the two portions of the heat exchanger to force ambient gas through the first gas pathways and through the rear channel; and
a circulating gas fan assembly positioned to force circulating gas through the front channel and the second gas pathways.
9. The electronic display assembly of claim 8 further comprising:
a power module placed within the path of the circulating gas.

10. The electronic display assembly of claim 8 wherein:
the electronic image assembly is a liquid crystal display.
11. The electronic display assembly of claim 8 wherein:
the electronic image assembly is an OLED display.
12. The electronic display assembly of claim 8 wherein:
the heat exchanger is a cross-flow heat exchanger comprised of corrugated layers.
13. The electronic display assembly of claim 8 further comprising:
a plurality of ribs placed within the channel and in thermal communication with the electronic image assembly.
14. The electronic display assembly of claim 13 wherein:
the ribs are metallic.
15. The electronic display assembly of claim 13 wherein:
the ribs are placed in conductive thermal communication with the electronic image assembly.

16. The electronic display assembly of claim 13 wherein:

the ribs have a rectangular cross-section.

17. A thermally-controlled liquid crystal display (LCD) assembly comprising:

a housing having an inlet aperture and exit aperture for ambient gas;
a LED backlight having a rear surface and placed within the housing;
a liquid crystal display (LCD) having a front surface and placed in front of the
LED backlight and within the housing;
a transparent front plate in front of the LCD, the space between the transparent
front plate and the LCD defining a front channel;
a rear plate placed behind the rear surface of the LED backlight;
a plurality of ribs placed between the rear plate and LED backlight, the space
between the rear plate, LED backlight, and ribs defining a plurality of rear
channels;
a heat exchanger having a first gas pathway in gaseous communication with the
front channel, and a second gas pathway in gaseous communication with
the inlet and exit apertures;
an ambient gas fan assembly placed within the heat exchanger to force ambient
gas into the inlet aperture, through the second gas pathway and the rear
channels, and out of the exit aperture; and
a circulating gas fan assembly positioned to force circulating gas through the
front channel and the first gas pathways.

18. The LCD assembly of claim 17 further comprising:

a power module placed within the path of the circulating gas.

19. The LCD assembly of claim 17 wherein:

the heat exchanger is a cross-flow heat exchanger comprised of corrugated layers.

20. The LCD assembly of claim 17 wherein:

the ribs are metallic.

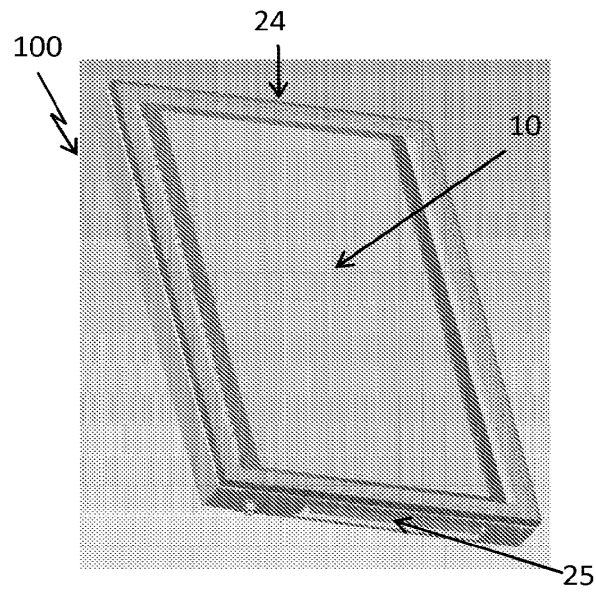


FIG - 1A

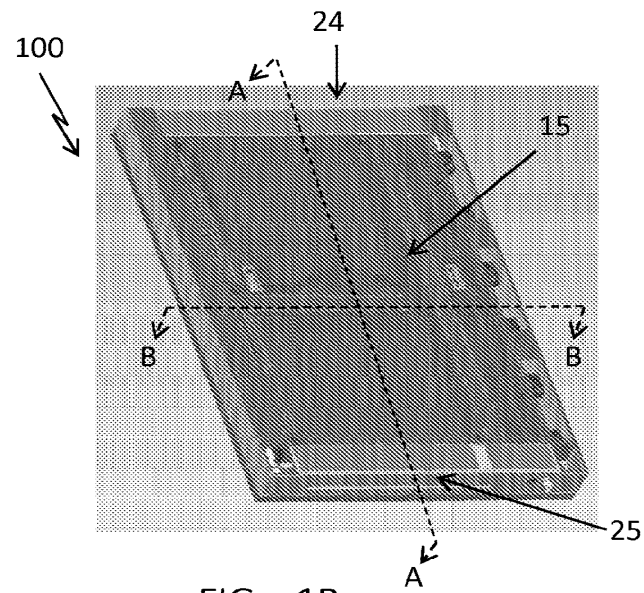


FIG - 1B

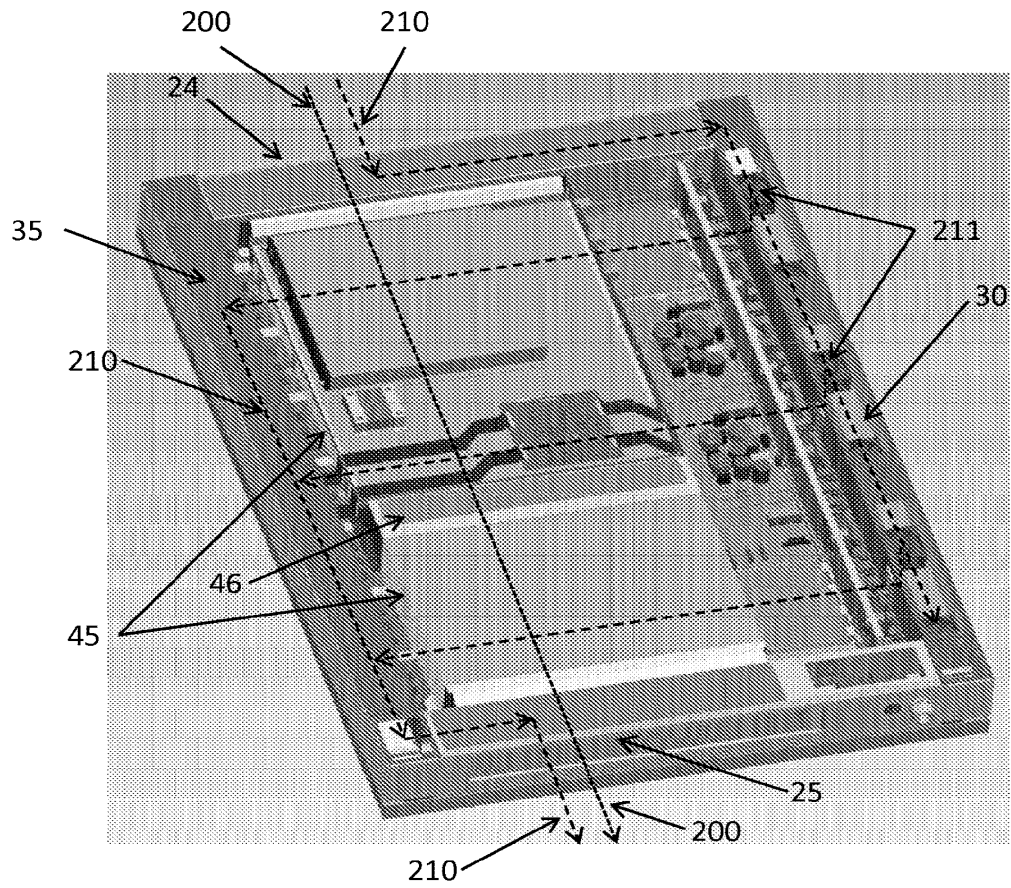


FIG - 2

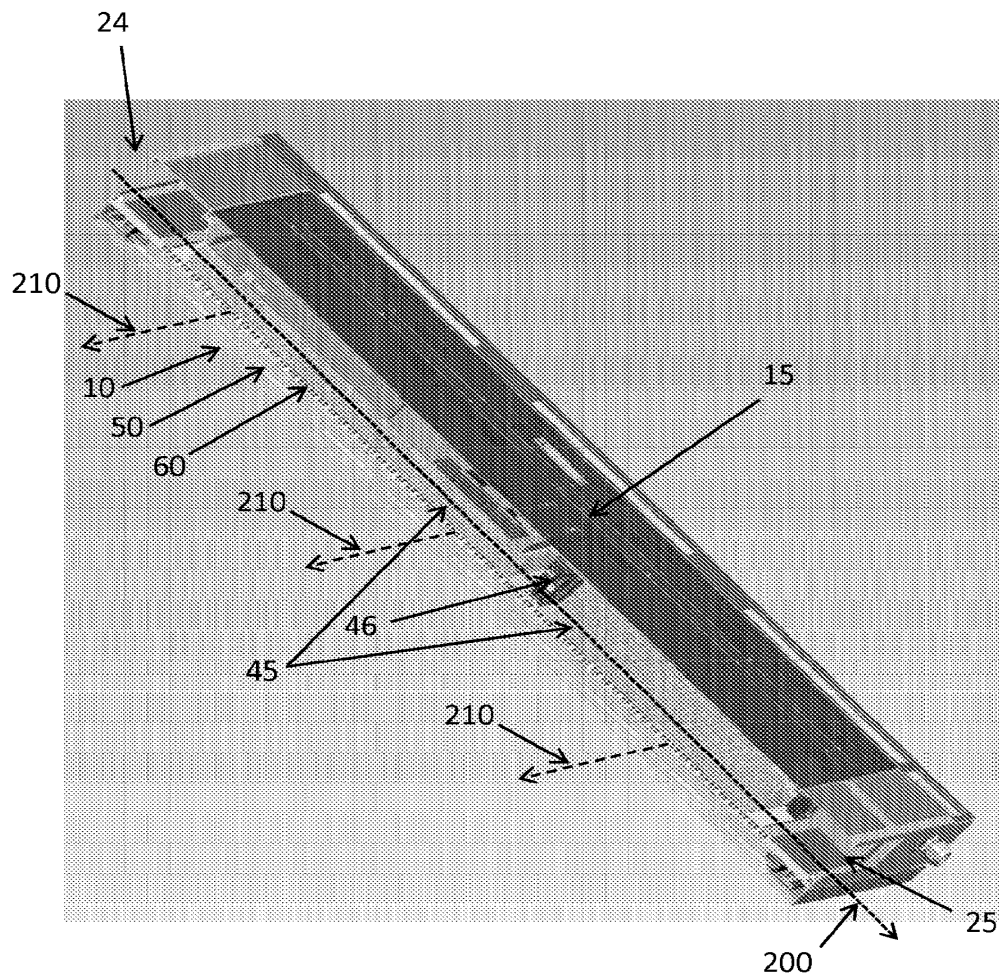


FIG - 3

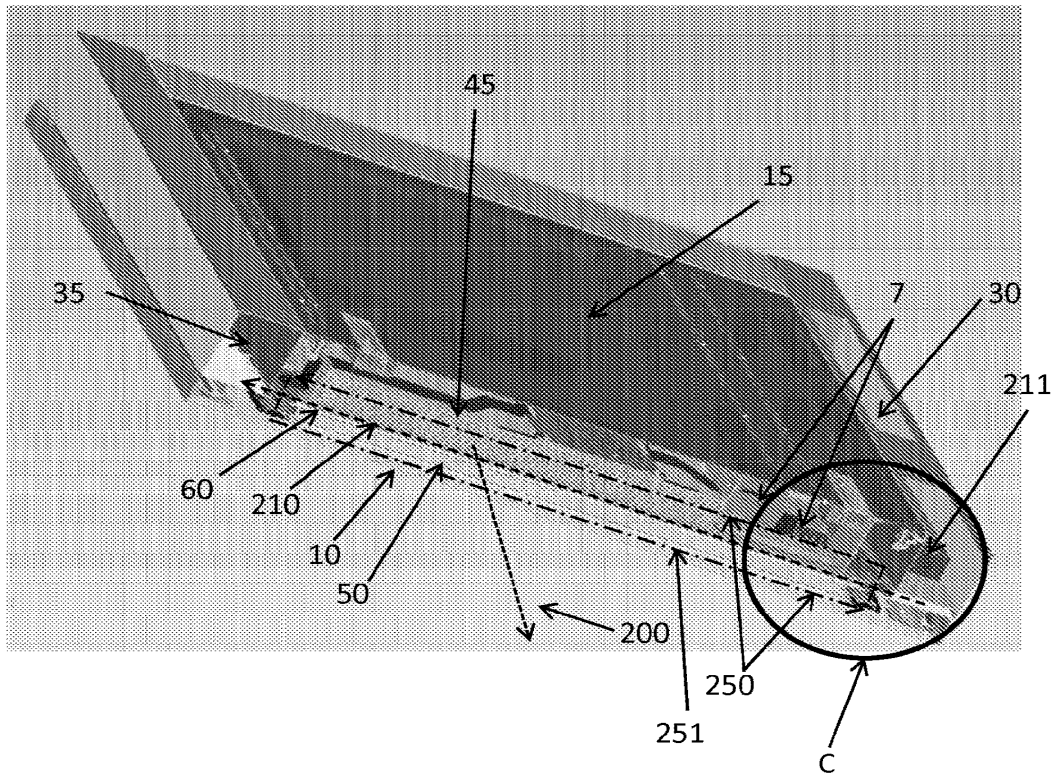


FIG - 4

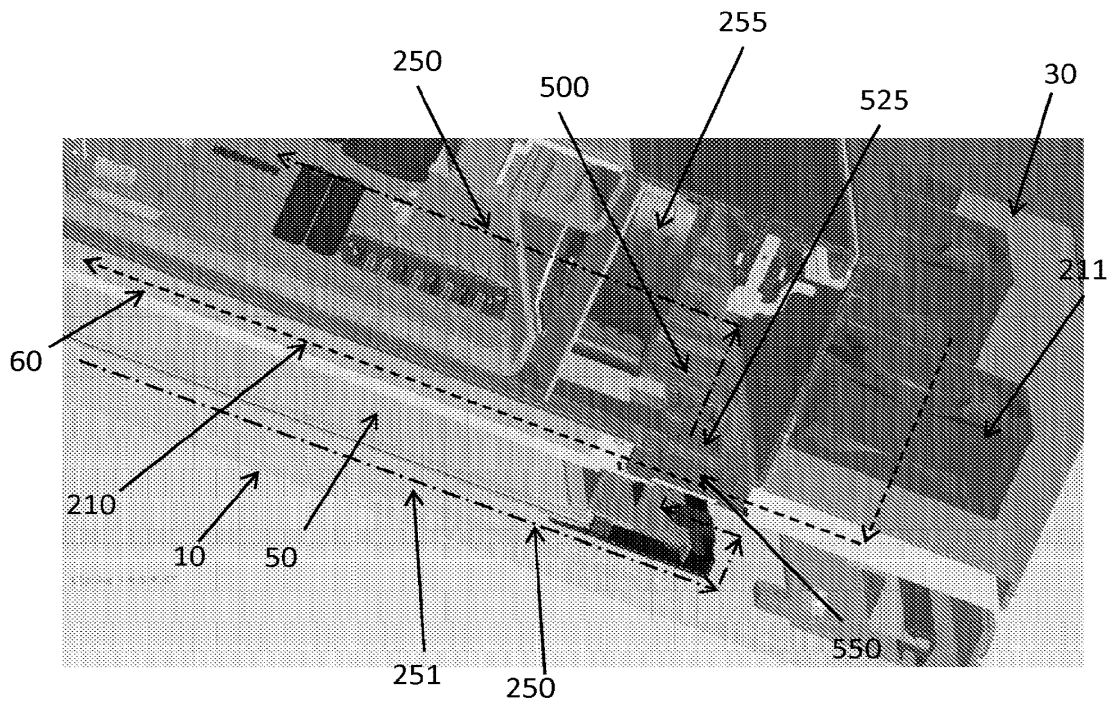


FIG - 5

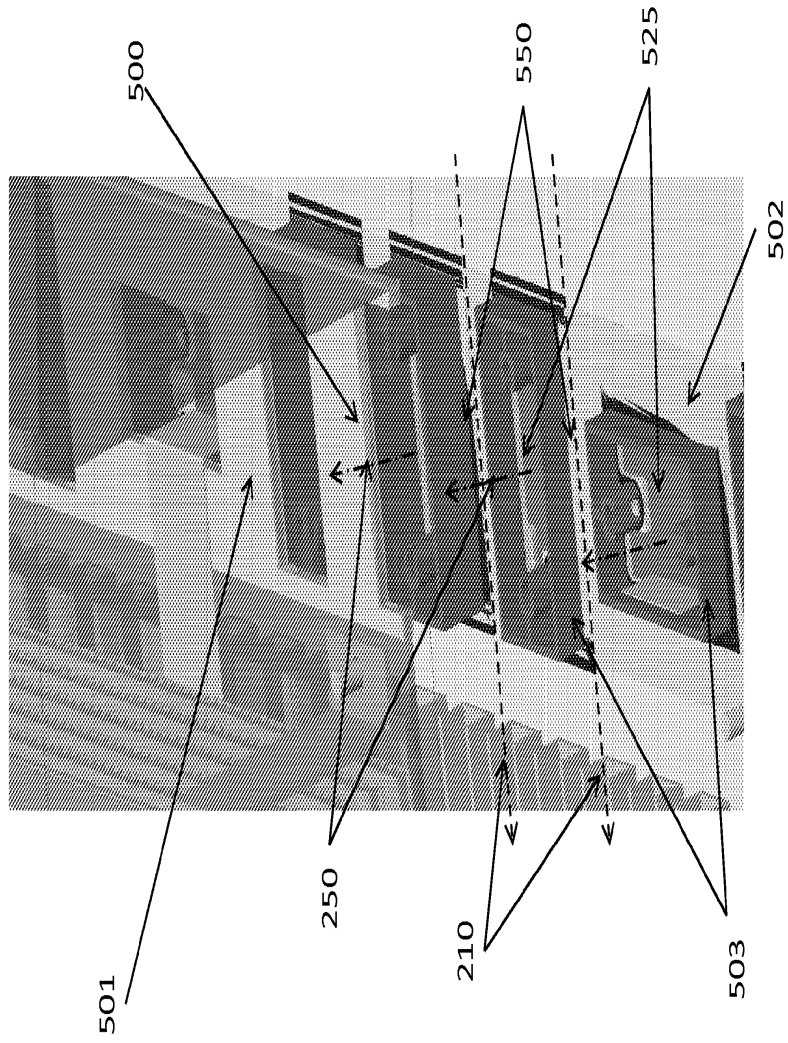


FIG - 6

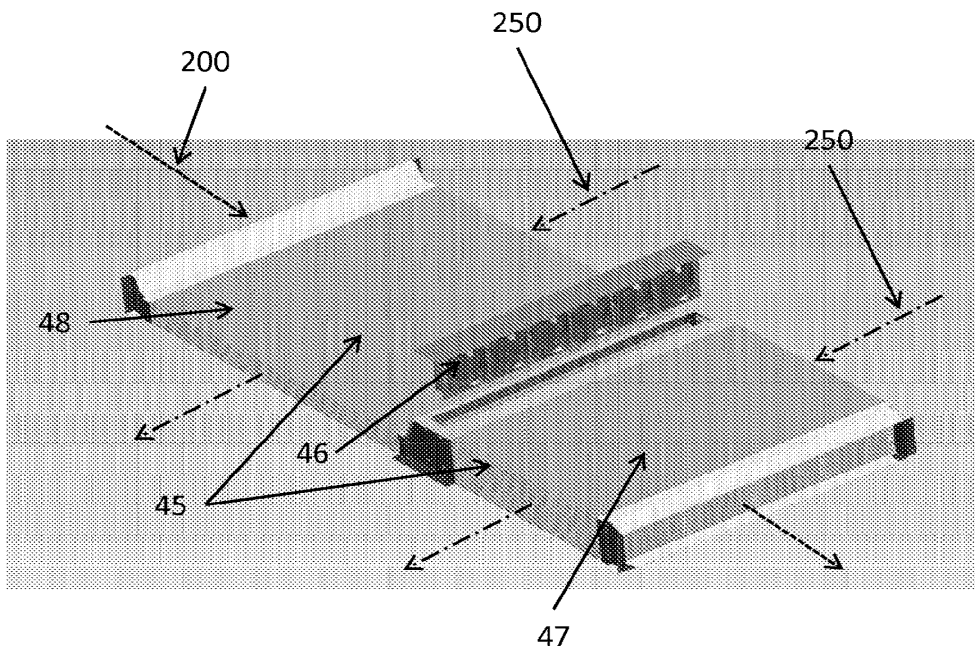


FIG - 7

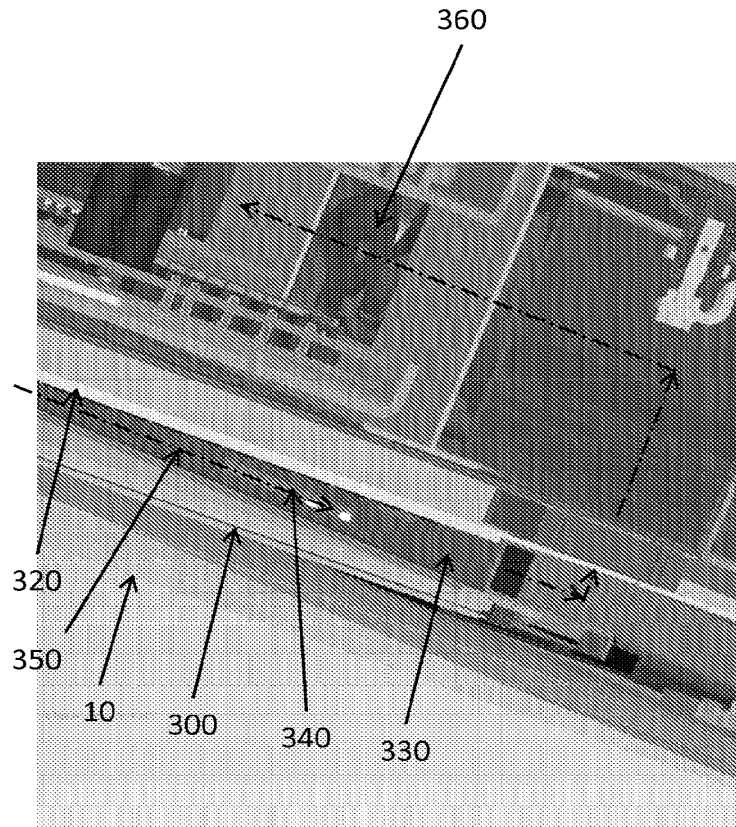


FIG - 8

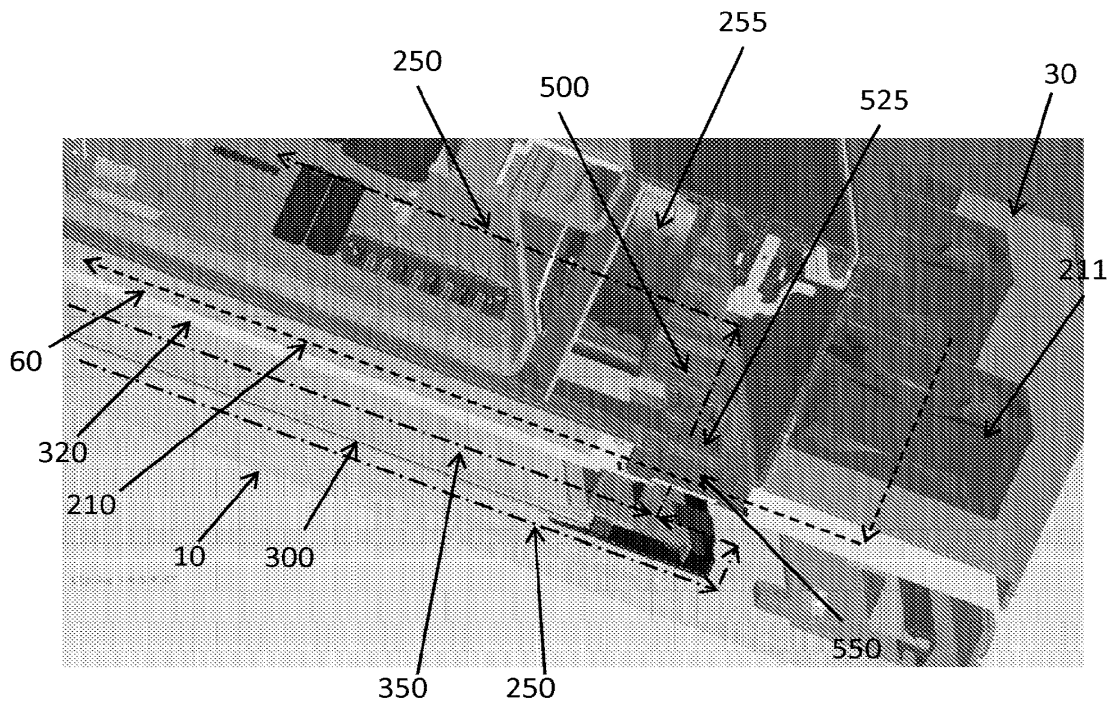
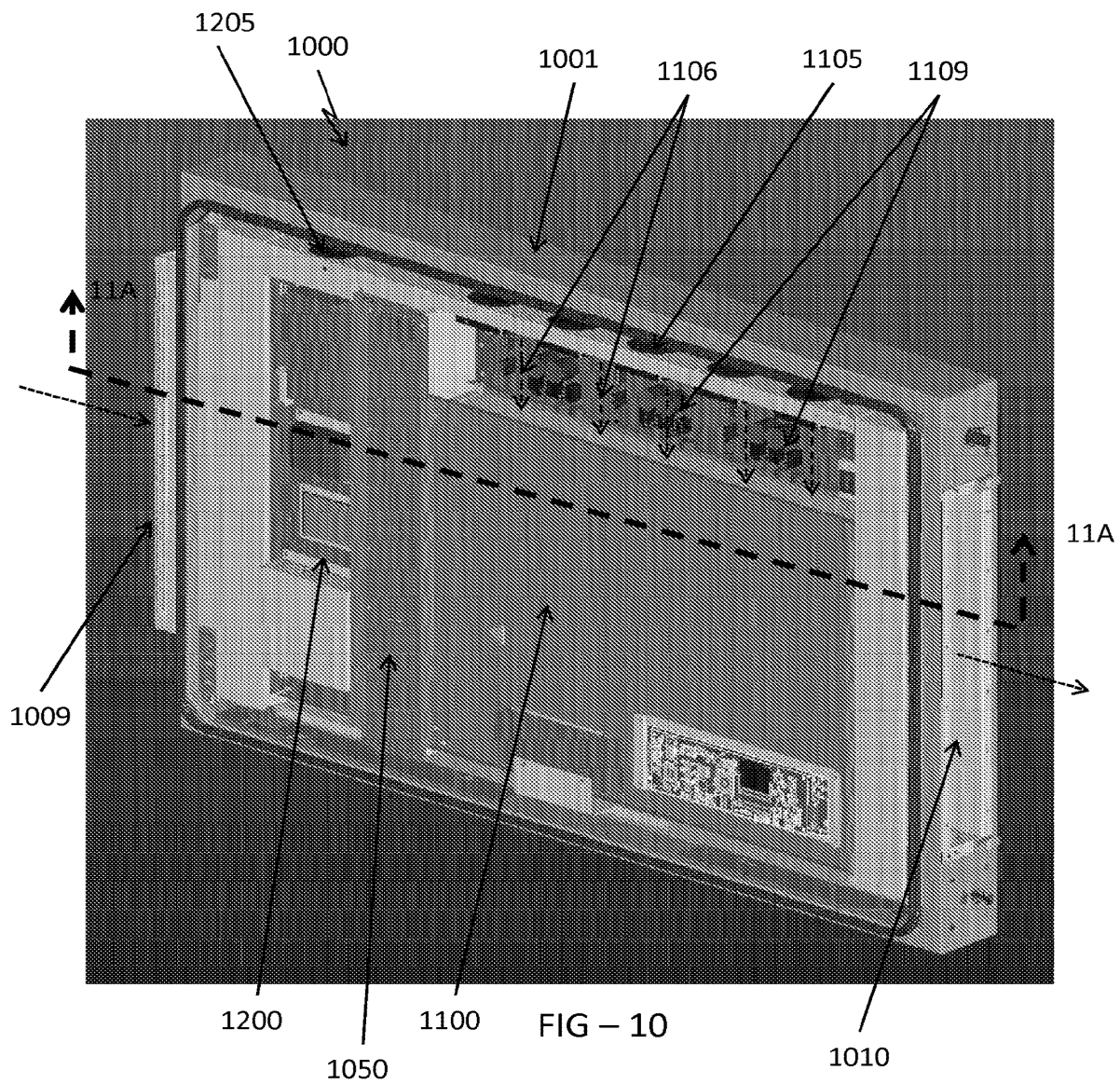
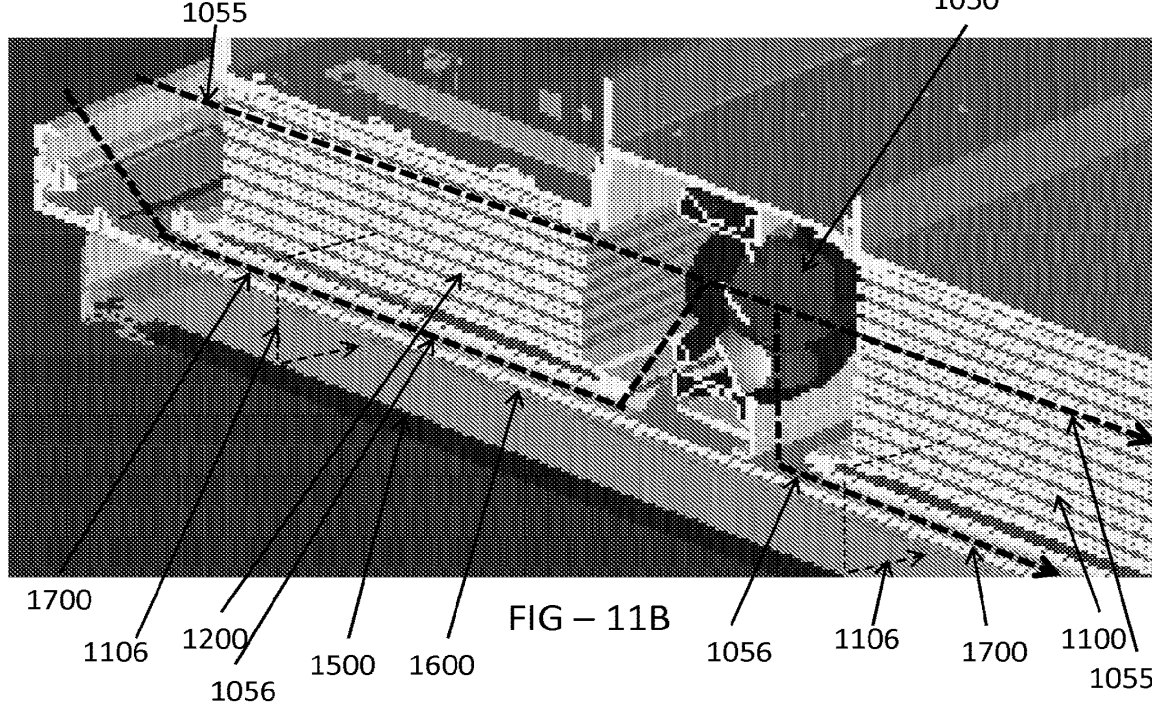
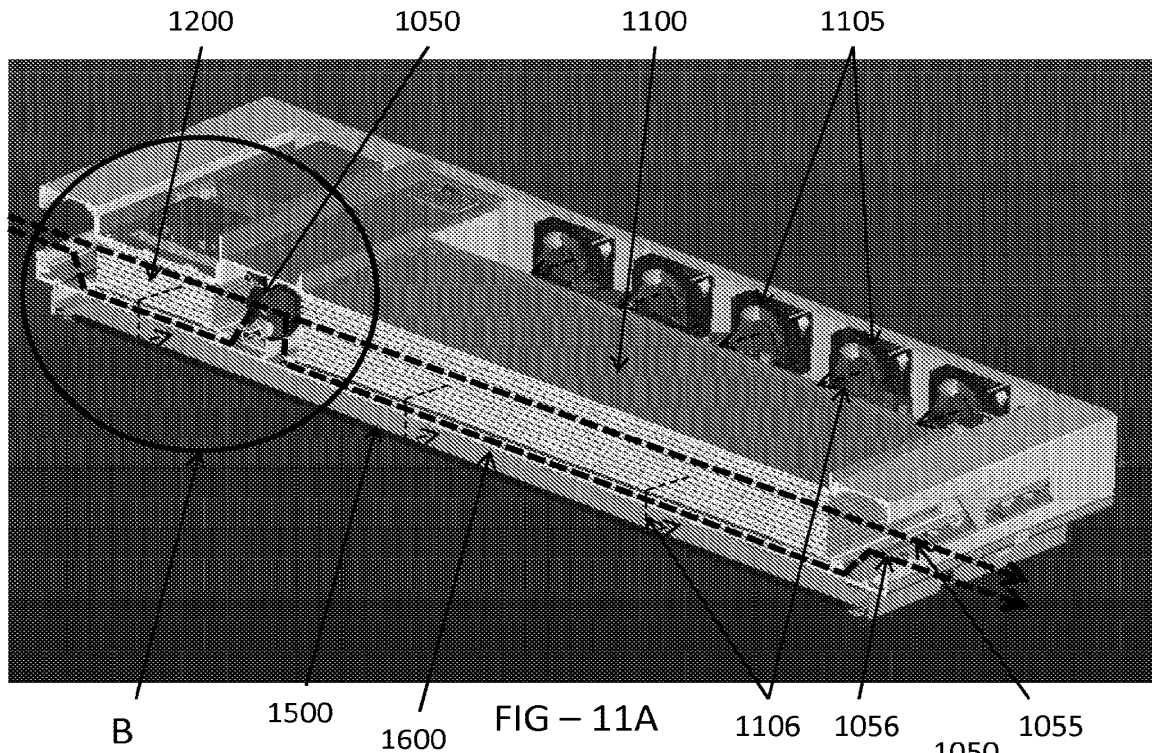


FIG - 9





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(54) Title: HEAT EXCHANGE ASSEMBLY FOR AN ELECTRONIC DISPLAY

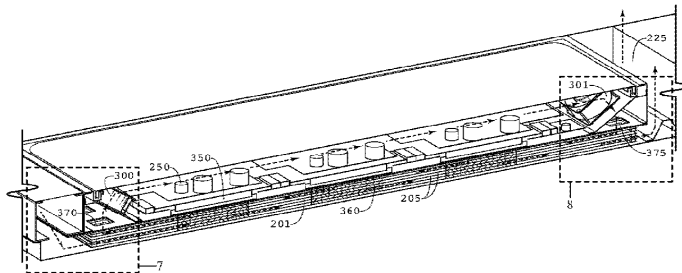


FIG. 6

(57) Abstract: The exemplary embodiments disclosed herein provide a heat exchanger assembly for cooling power module bricks, having a plurality of heat exchanger layers where a top layer is in conductive thermal communication with the power module brick. A series of metallic plates are preferably positioned within each heat exchanger layer and are preferably aligned with the power module brick. A circulating fan may be positioned to force circulating gas across the power module brick and through the heat exchanger. An external air fan may be positioned to force external air through the heat exchanger. Pass through junctions may be positioned near edges of the heat exchanger to permit the circulating gas to cross paths with the external air without allowing the two gas flows to mix with one another.

WO 2014/149773 A1

HEAT EXCHANGE ASSEMBLY FOR AN ELECTRONIC DISPLAY

Cross-Reference to Related Applications

[0001] This application claims priority to co-pending US Provisional Application No. 61/791,421 filed on March 15, 2013 and herein incorporated by reference in its entirety.

Technical Field

[0002] The disclosed embodiments of the present invention relate to an assembly for removing the heat generated by an electronic display.

Background of the Art

[0003] Electronic displays are now being used in outdoor environments where high ambient temperatures and direct solar loading can cause the display to malfunction due to excess heat.

Summary of the Exemplary Embodiments of the Invention

[0004] The exemplary embodiments disclosed herein provide a heat exchanger assembly for cooling power module bricks, having a plurality of heat exchanger layers where a top layer is in conductive thermal communication with the power module brick. A series of metallic plates are preferably positioned within each heat exchanger layer and are preferably aligned with the power module brick. A circulating fan may be positioned to force circulating gas across the power module brick and through the heat exchanger. An external air fan may be positioned to force external air through the heat exchanger. Pass through junctions may be positioned near edges of the heat exchanger to permit the circulating gas to cross paths with the external air without allowing the two gas flows to mix with one another.

[0005] This and other unmet advantages are provided by the device and method described and shown in more detail below.

Brief Description of the Drawings

[0006] A better understanding of the disclosed embodiments will be obtained from a reading of the following detailed description and the set of accompanying drawings.

[0007] FIGURE 1 provides a perspective view of an exemplary electronic display assembly.

[0008] FIGURE 2 provides a perspective view of the electronic display subassembly after being removed from the assembly shown in Figure 1.

[0009] FIGURE 3 provides a perspective view of the electronics and power subassembly after being removed from the assembly shown in Figure 1 and illustrates the horizontal section line 6-6.

[0010] FIGURE 4 provides an exploded view of the electronics and power subassembly shown in Figure 3.

[0011] FIGURE 5 provides a perspective view of the electronics and power subassembly shown in Figure 3 after removing the cover doors.

[0012] FIGURE 6 provides a section view of the electronics and power subassembly shown in Figure 3, taken along the section line 6-6.

[0013] FIGURE 7 provides a detailed section view of DETAIL 7, shown in Figure 6 where a second section has been taken vertically through the center of the pass through junctions.

[0014] FIGURE 8 provides a detailed section view of DETAIL 8, shown in Figure 6 where a second section has been taken vertically through the center of the pass through junctions.

Detailed Description of a Preferred Embodiment

[0015] 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.

[0016] 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.

[0017] 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.

[0018] 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.

[0019] 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.

[0020] 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.

[0021] 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.

[0022] FIGURE 1 provides a perspective view of an exemplary electronic display assembly having a housing containing an electronic display subassembly 100 and an electronics and power subassembly 150. In an exemplary embodiment, the housing would have two separate flows of external air flowing through the housing. The first is shown in this figure where external air is ingested at the apertures 50 and is exhausted from the aperture 75.

[0023] FIGURE 2 provides a perspective view of the electronic display subassembly 100 after being removed from the assembly shown in Figure 1. The electronic display 120 preferably has a pathway for external air running behind the display 120, this would provide the second flow of external air for an exemplary embodiment. In an exemplary embodiment, the inlet apertures 170 are positioned above the display and are in

gaseous communication with a gap 140 behind the display, which ultimately connects with an exhaust aperture 180 positioned below the display. The gap 140 may be created by placing a surface or plate 140 behind the rear surface of the electronic display 120. One or more fans 110 may be positioned to draw the external air through the inlet 170, gap 140, and exhaust 180.

[0024] The electronic display can be any variety of electronic display 120, including but not limited to liquid crystal display (LCD), LED, OLED, plasma, electroluminescent polymers, field emission display, and laser video displays. In an exemplary embodiment the electronic display 120 would comprise an LED backlit LCD where the rear surface of the electronic display 120 would be the rear surface of the LED backlight.

[0025] FIGURE 3 provides a perspective view of the electronics and power subassembly 150 after being removed from the assembly shown in Figure 1 and illustrates the horizontal section line 6-6. A pair of inlet apertures 220 are preferably in gaseous communication with the inlet apertures 50 in the housing to supply external air to the assembly. This ingested external air is preferably exhausted through the exhaust aperture 225, which aligns with the exhaust aperture 75 in the housing.

[0026] FIGURE 4 provides an exploded view of the electronics and power subassembly 150 shown in Figure 3. A first plenum enclosure is preferably created by the plenum walls 281, heat exchanger 201, and front cover 265. A second plenum enclosure is preferably created by the plenum walls 282, heat exchanger 202, and front cover 266. One or more power assemblies or power modules 250 may be placed within the first plenum enclosure. One or more electronic assemblies 260 may be placed within the second plenum enclosure. In an exemplary embodiment, the two plenum enclosures are substantially sealed, and do not accept external air, dust, or other contaminants other than the flow of external air described herein (which preferably would not enter the plenum enclosures, but would only flow through the heat exchangers 201 and 202 as described below).

[0027] Further, in an exemplary embodiment, the power modules 250 would be considered high voltage / high power electronics while the electronic assemblies 260 would be considered low voltage / low power electronics and these would be isolated

into their own respective plenums. Generally speaking, the electronic assemblies 260 would include, but would not be limited to: hard drives, video players, microprocessors, wireless/satellite antennas, and CPU's. A wiring conduit 275 may provide wiring access into the plenums but should be substantially sealed so as not to allow contaminants or external air to enter the plenum through the wiring conduit 275. The wiring conduit 275 may provide the electrical communication between the low power and high power electronics and also between the low/high power electronics and the electronic display 120.

[0028] FIGURE 5 provides a perspective view of the electronics and power subassembly shown in Figure 3 after removing the cover doors 265 and 266. A fan 310 may be placed in the inlet tube to draw the external air through the inlets, heat exchanger, and exhaust aperture 225. Alternatively, a fan 312 could be placed near the exhaust aperture 225. In some embodiments, both fans 310 and fan 312 may be used. In the first plenum, fans 300 and 301 are used to force a closed loop circulating gas through the plenum and heat exchanger 201. In the second plenum, fans 302 and 303 are used to force a closed loop circulating gas through the plenum and heat exchanger 202. Of course, in some embodiments only a single fan for each closed loop of circulating gas may be used rather than the pairing of fans shown herein.

[0029] FIGURE 6 provides a section view of the electronics and power subassembly 150 shown in Figure 3, taken along the section line 6-6. Each power module 250 is preferably placed in conductive thermal communication with the heat exchanger 201. In an exemplary embodiment, the power brick 350 is preferably in conductive thermal communication with the heat exchanger 201, which is comprised of a plurality of layers 205, where the space in between each layer defines a gaseous pathway. In an exemplary embodiment, a metallic plate 360 is preferably placed between each layer 205 of the heat exchanger 201, and is positioned adjacent to the areas containing a power brick 350. The layers 205 of the heat exchanger 201 may be metallic or plastic (sometimes corrugated plastic or corrugated metal as shown in the Figures) or any combination of these materials. The heat exchangers 201 and 202 are preferably counterflow heat exchangers.

[0030] In an exemplary embodiment, the length and width of the metallic plates 360 are substantially the same as the length and width of the power bricks 350, however this is not required. Ideally, a series of metallic plates 360 may be aligned with each brick 350, such that a layer 205 of the heat exchanger is placed between the brick 350 and the first plate 360, as well as between each subsequent plate 360. While it may not be necessary to place a metallic plate 360 between every heat exchanger layer 205, this may be done in an exemplary embodiment. Each metallic plate 360 may be sandwiched between the layers 205 and may be held in place with adhesive.

[0031] The external air is forced through the heat exchanger 201 and exhausted out of the exhaust aperture 225. In this way, heat from the power module 250 may be transferred to the brick 350 and eventually to the plates 360 and heat exchanger layers 205 through conductive heat transfer. The external air removes heat from these assemblies as it passes through the heat exchanger 201.

[0032] Additionally, closed loop circulating gas is also travelling through the pathways of the heat exchanger 201, where the gas pathways may be defined as the space between heat exchanger layers 205. The layers 205 may be spaced apart based on the thickness of the plates 360, and held with this spacing once assembled around the plates 360. In this embodiment, the closed loop of circulating gas is forced around the closed loop by the pair of fans 301 and 301. The loop may be described as beginning at fan 301, traversing the pass through junction 375, travelling through the heat exchanger 201, traversing the pass through junction 370, passing the fan 300, and travelling across the power modules 250 before returning to the fan 301. The gas pathways alternate, where a pathway accepting circulating gas would be adjacent to a pathway accepting external air which is in turn adjacent to another pathway accepting circulating gas. Preferably, the circulating gas and external air are not permitted to mix with one another. However, as the two gases travel through their pathways, heat from the circulating gas can be transferred to the external air and removed from the display housing through the exhaust.

[0033] The opposing heat exchanger 202 is setup in a similar fashion as the heat exchanger 201 described above. The only difference would be that heat exchanger 202 would not contain the bricks 350, which are generally not used for the low power/voltage

electronics 260. However, the metallic plates 360 may be used in the heat exchanger 202, in order to pull heat from the electronics 260 into the heat exchanger 202 for removal by the external air.

[0034] FIGURE 7 provides a detailed section view of DETAIL 7, shown in Figure 6, where a second section has been taken vertically through the center of the pass through junctions. Here, the details of an exemplary pass through junction 370 are shown. Generally, the pass through junction 370 is placed near the end of the heat exchanger 201. Initially, note the blocking elements 212 which are positioned within each pathway 206 which contains the closed loop circulating gas. These blocking elements 212 run the entire length of the heat exchanger 201, to prohibit external air from entering the circulating gas pathways. Also note the cutout opening 371 in the heat exchanger which preferably passes through several, if not every layer 205 of the heat exchanger. While a blocking element 212 may be placed adjacent to the opening 371 on the end of the heat exchanger, the opposing side of the opening 371 is preferably free of any blocking so that the pathways 215 which accept circulating gas can provide gaseous communication through the opening 371 to continue the circulating closed loop path.

[0035] A series of donut gaskets 210 may be placed within each pathway 206 which accepts external air, such that the donut gasket 210 substantially surrounds and seals off the pathway 206 from the opening 371. In this way, external air traveling through the heat exchanger is permitted to flow through the pathway 206, but is not permitted to enter the opening 371 or mix with the circulating gas. The donut gaskets 210 do not preferably run the entire length of the heat exchanger, but would only surround the openings 371, which could be any shape but are typically found as rectangles, squares, circles, ovals, or some combination of these. The interior dimensions of the donut gaskets 210 preferable match that of the cutout 371. However, the exterior dimensions of the donut gaskets 210 can vary.

[0036] Although not required, it is preferable that the donut gaskets 210 are comprised of a compressible material, preferably an elastomer or rubber of some type, but soft and compressible materials have been found to provide acceptable results. In some embodiments, the donut gaskets 210 can simply comprise a sheet of compressible

material having a void removed from the center, where that void can have any shape, including but not limited to any polygon, circle, or oval shape. Preferably, the donut gaskets 210 would have a continuous perimeter surrounding the void, which is preferably aligned with the opening 371, so that external air is not permitted to enter the opening 371, but can still travel through the pathway 206.

[0037] FIGURE 8 provides a detailed section view of DETAIL 8, shown in Figure 6, where a second section has been taken vertically through the center of the pass through junctions. Here, the details of an exemplary opposing pass through junction 375 are shown. Again, the opposing pass through junction 375 is preferably placed near the end/edge of the heat exchanger 201. Also, again note the blocking elements 212 which are positioned within each pathway 206 which contains the closed loop circulating gas. These blocking elements 212 run the entire length of the heat exchanger 201, to prohibit external air from entering the circulating gas pathways. Also note the cutout opening 376 in the heat exchanger which preferably passes through several, if not every layer 205 of the heat exchanger. While a blocking element 212 may be placed adjacent to the opening 376 on the end of the heat exchanger, the opposing side of the opening 376 is preferably free of any blocking so that the pathways 206 which accept circulating gas can provide gaseous communication through the opening 376 to continue the circulating closed loop path.

[0038] A series of donut gaskets 210 may again be placed within each pathway 206 which accepts external air, such that the donut gasket 210 substantially surrounds and seals off the pathway 206 from the opening 376. In this way, external air traveling through the heat exchanger is permitted to flow through the pathway 206, but is not permitted to enter the opening 371 or mix with the circulating gas. Here, the external air would travel around the donut gasket 210, eventually exiting the heat exchanger and exhausting out of the exhaust aperture 225.

[0039] An angled redirection plate 400 is preferably placed after the heat exchanger and adjacent to the exhaust aperture 225 in order to change the direction of the external air approximately 90 degrees, or in other words to direct it towards the exhaust aperture 225.

[0040] Another pair of pass through junctions with their own gasket donuts and blocking elements are preferably used for the opposing side of the assembly, which houses the electronics 260. The design could be substantially the same, however in some embodiments it may be possible to use a smaller heat exchanger or perhaps one with fewer layers, as there may be less heat generated by the electronics 260 when compared to the power modules 250. There could also be fewer fans used on this side of the assembly as well.

[0041] It should be noted that the term circulating gas does not require a 'pure' gas but could be any gaseous matter (which could of course be a mixture of various types of gases and even small amounts of contaminate, but the circulating gas would preferably have only a minimal amount of contaminants, and most preferably would be free of particulate and contaminants).

[0042] Having shown and described a preferred embodiment of the invention, 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. Thus, 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

What is claimed is:

1. A heat exchanger assembly for cooling power modules having bricks, the assembly comprising:
 - a plurality of heat exchanger layers where a top layer is placed in conductive thermal communication with the power module brick; and
 - a metallic plate positioned between each heat exchanger layer and adjacent to the power module brick.
2. The heat exchanger assembly of claim 1 further comprising:
 - an external air fan positioned to force external air through the heat exchanger layers.
3. The heat exchanger assembly of claim 1 wherein:
 - the power module brick is in conductive thermal communication with the top layer of the heat exchanger, and where the top layer of the heat exchanger is also in conductive thermal communication with the metallic plate.
4. The heat exchanger assembly of claim 2 further comprising:
 - blocking elements placed between alternating pairs of layers to define closed loop pathways where the blocking elements are placed along opposing edges of the heat exchanger;
 - a cutout placed near the edges of the heat exchanger which contain the blocking elements;
 - a donut gasket surrounding each cutout and placed only within pathways which are not closed loop pathways; and
 - a closed loop fan positioned to force a closed loop of circulating gas through the closed loop pathways, both cutouts, and along the power modules.
5. The heat exchanger assembly of claim 4 wherein:

the blocking elements run the entire length of the heat exchanger.

6. The heat exchanger of claim 4 wherein:
the external air is not permitted to mix with the circulating gas.
7. The heat exchanger of claim 1 wherein:
the heat exchanger layers are comprised of corrugated plastic.
8. The heat exchanger of claim 1 wherein:
the heat exchanger layers are comprised of metal.
9. A heat exchanger assembly for cooling power modules having bricks, the assembly comprising:
a plurality of heat exchanger layers placed within a plenum where an outer layer is placed in conductive thermal communication with the power module brick;
a plurality of gaseous pathways defined by the space between each layer where the pathways alternate between carrying air from outside of the plenum (external air pathway) and a closed loop gas (circulating gas pathway);
a metallic plate positioned within each pathway and adjacent to the power module brick;
an external air fan positioned to force external air through the external air pathways; and
a circulating fan positioned to force circulating gas through the circulating gas pathways.
10. The heat exchanger assembly of claim 9 wherein:
the circulating gas travels in a closed loop and does not mix with the external air.
11. The heat exchanger assembly of claim 9 wherein:

the power module brick is in conductive thermal communication with the outer layer of the heat exchanger, and where the outer layer of the heat exchanger is also in conductive thermal communication with the metallic plate.

12. The heat exchanger assembly of claim 9 further comprising:
blocking elements placed within entrances to the circulating gas pathways.
13. The heat exchanger assembly of claim 12 further comprising:
a cutout passing through several layers of the heat exchanger and placed adjacent to the blocking elements; and
a gasket sounding the cutout and placed only within external air pathways.
14. The heat exchanger assembly of claim 9 further comprising:
blocking elements placed along edges of the circulating gas pathways.
15. An assembly for cooling an electronic display having high power electrical assemblies and low power electrical assemblies, the cooling assembly comprising:
a first sealed plenum containing the high power electrical assemblies and a first heat exchanger;
a first circulating fan positioned for force circulating gas through the first heat exchanger and across the high power electrical assemblies;
a second sealed plenum containing the low power electrical assemblies and a second heat exchanger;
a second circulating fan positioned to force circulating gas through the second heat exchanger and across the low power electrical assemblies;
a first external fan positioned to draw external air through the first heat exchanger; and
a second external fan positioned to draw external air through the second heat exchanger.

16. The cooling assembly of claim 15 wherein the first heat exchanger comprises:
a plurality of heat exchanger layers where a top layer is placed in conductive thermal communication with the high power electrical assemblies.
17. The cooling assembly of claim 16 further comprising:
a metallic plate positioned between each heat exchanger layer and aligned with each of the high power electrical assemblies.
18. An assembly for cooling an electronic display having a power module brick and a video player, the cooling assembly comprising:
a housing containing the electronic display, power module brick, and a video player;
a first inlet aperture along an edge of the housing;
a second inlet aperture along an edge of the housing opposing the first inlet aperture;
an exhaust aperture placed near a center of the housing;
a portion of the housing which is placed behind the electronic display to define a gap;
a display fan positioned to force external air through the gap;
a first sealed plenum containing the power module brick and a first heat exchanger;
a first circulating fan positioned for force circulating gas through the first heat exchanger and across the power module brick;
a second sealed plenum containing the video player and a second heat exchanger;
a second circulating fan positioned to force circulating gas through the second heat exchanger and across the video player;
a first external fan positioned to draw external air through the first inlet aperture, first heat exchanger, and exhausted through the exhaust aperture;

a second external fan positioned to draw external air through the second inlet aperture, second heat exchanger, and exhausting out of the exhaust aperture; and
a series of metallic plates positioned within the first heat exchanger and substantially aligned with the power module brick.

19. The cooling assembly of claim 18 wherein the first heat exchanger comprises:
a plurality of heat exchanger layers where a top layer is placed in conductive thermal communication with the power module brick.
20. The cooling assembly of claim 19 further comprising:
a metallic plate positioned between each heat exchanger layer and adjacent to the power module brick.

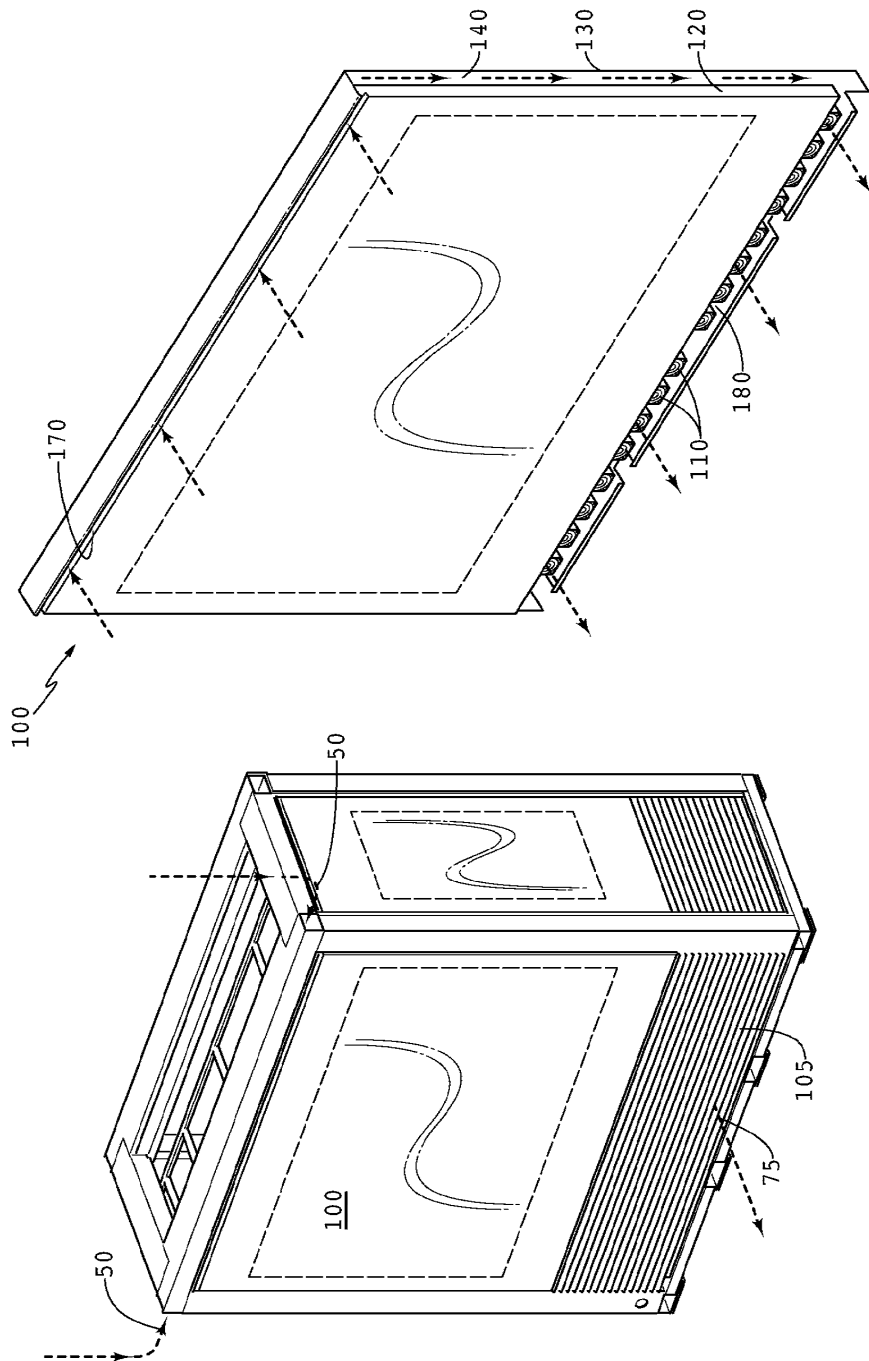
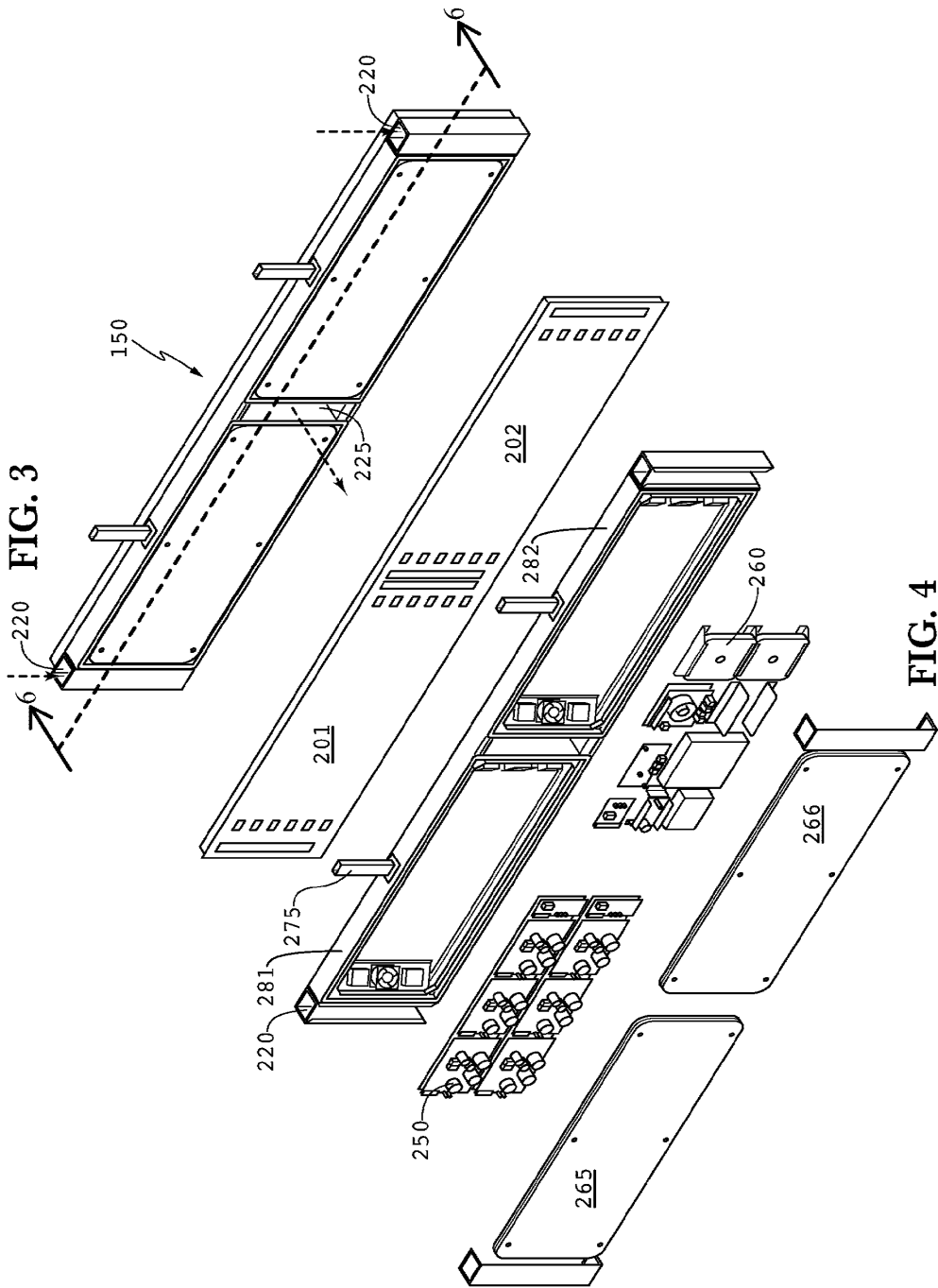


FIG. 2

FIG. 1



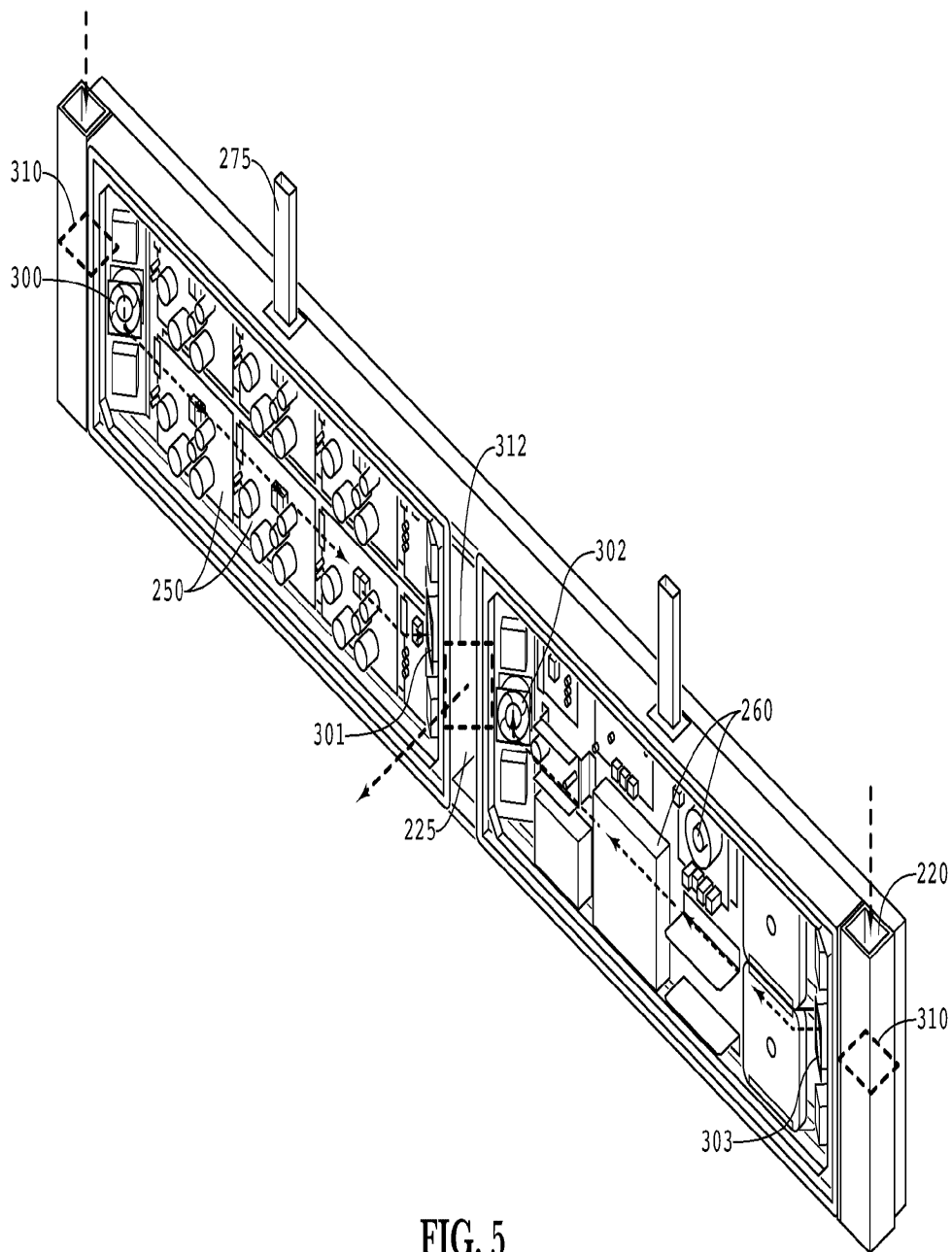


FIG. 5

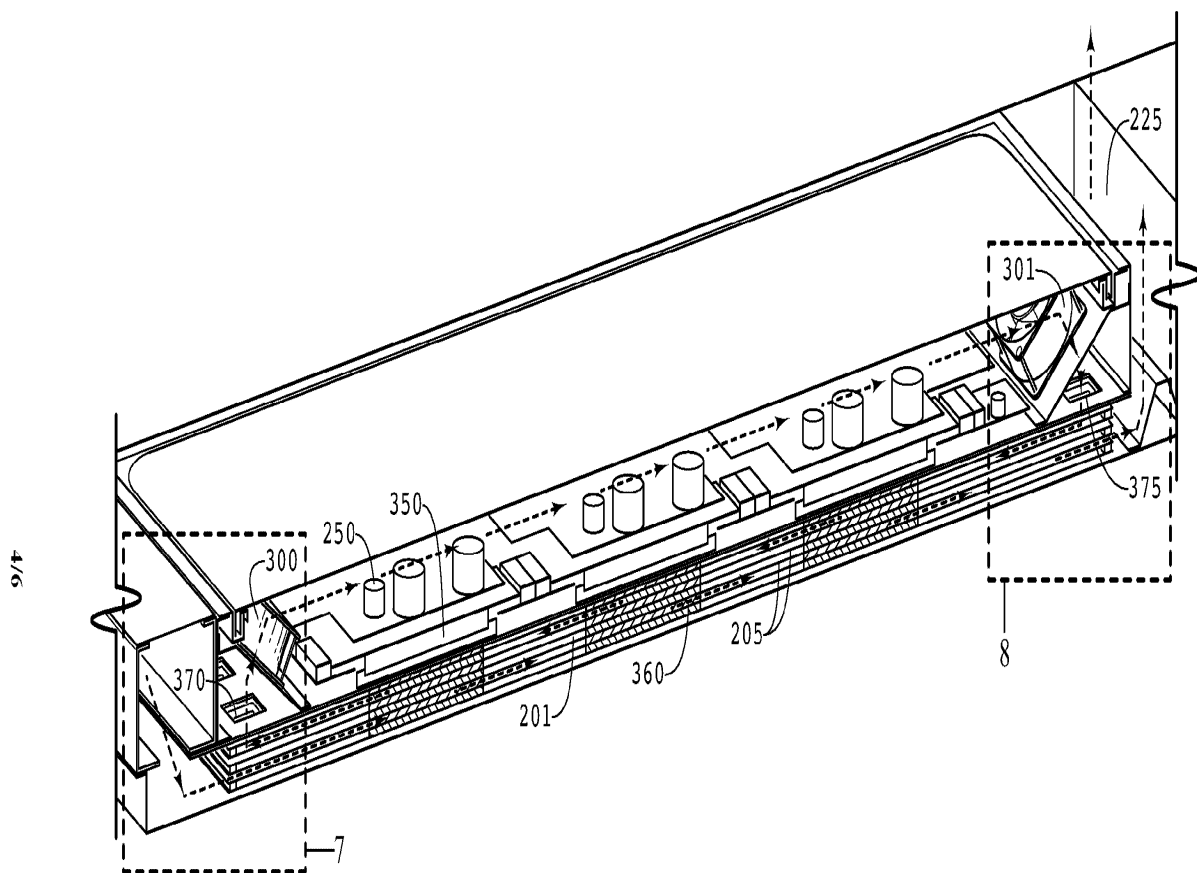


FIG. 6

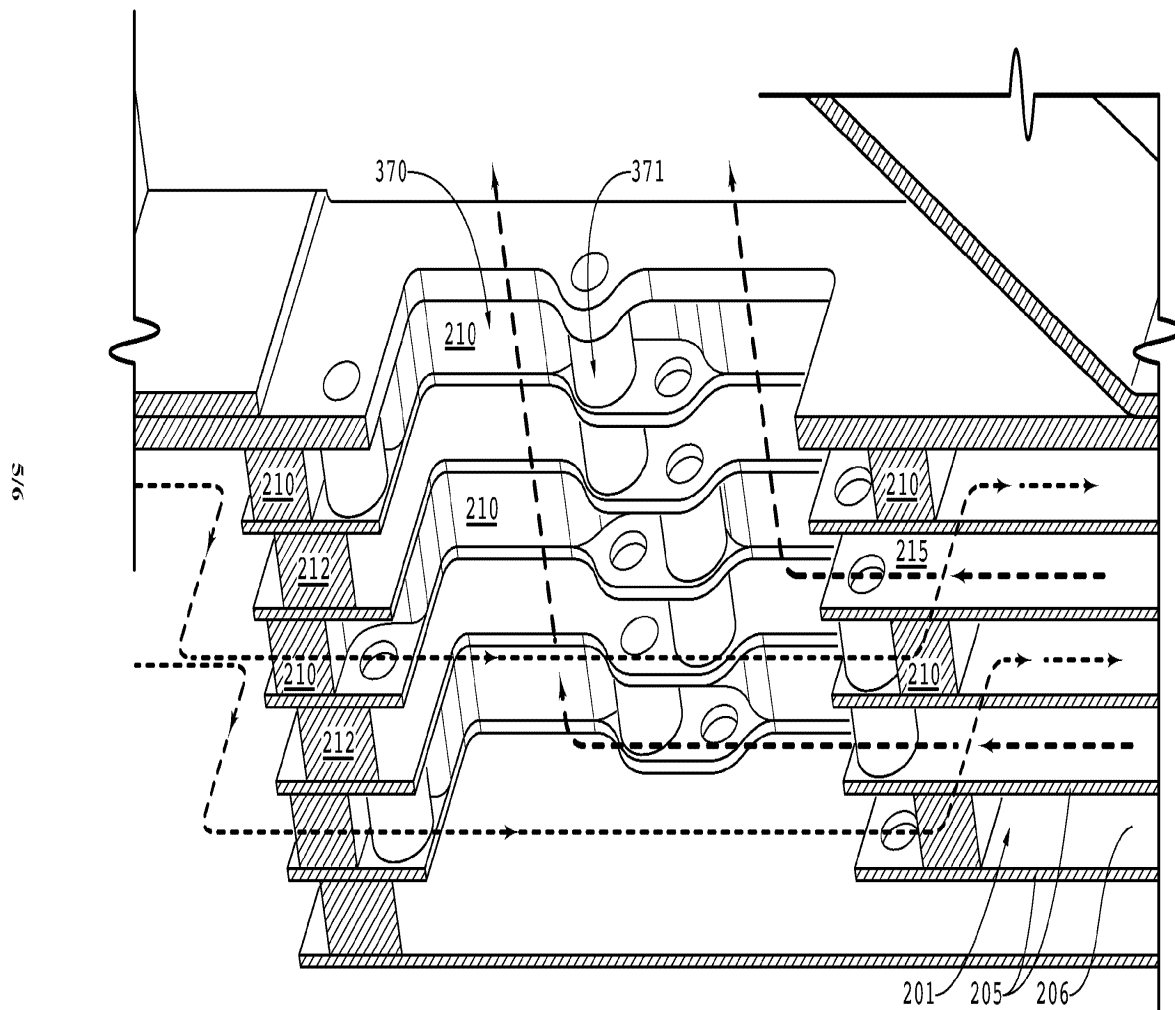


FIG. 7

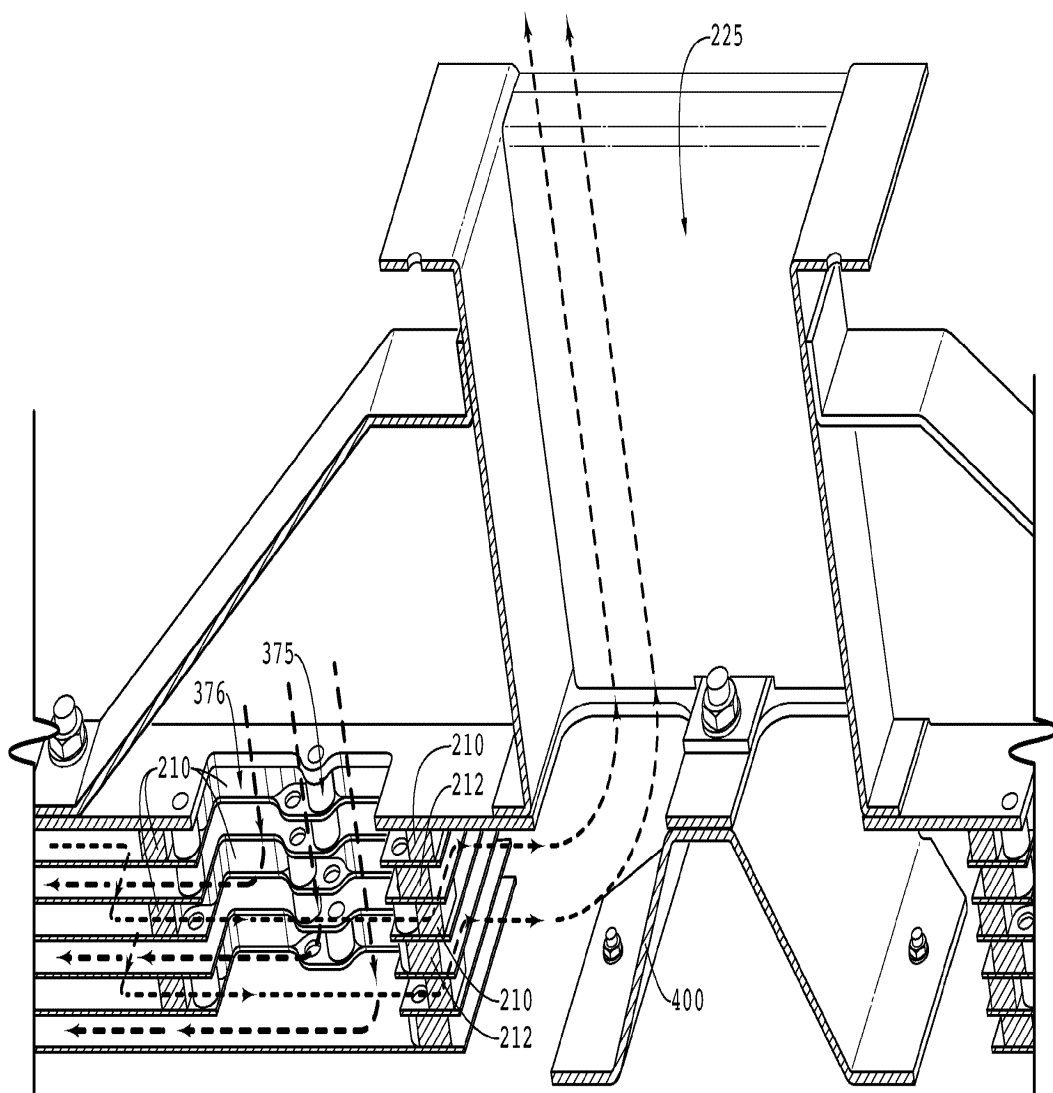


FIG. 8

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 14/20850

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - H05K 7/20 (2014.01)

USPC - 361/679.46, 704

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(8) - H05K 7/20 (2014.01)

USPC - 361/679.46, 704

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC - 349/161; 361/679.47, 679.48, 679.49, 679.5, 679.54, 688-691, 694-697, 701, 702, 707, 709, 710, 715Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
Patbase; Google (Patents; Scholar; Web); Espacenet; Search Terms: air, ambient, batter*, between, blow*, brick*, closed, communicat*, conduct*, cool*, cutout*, donut*, exchang*, external*, fan*, gasket*, heat*, hole*, intermediate*, layer*, loop*, metal*, mix*, multi*, opening*, o-ring*, path*, plate*, plural*, power*, seal*, stack*, thermal*, thro

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X		1-3, 7-12, 14
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Y	US 2011/0085301 A1 (Dunn) 14 April 2011 (14.04.2011), entire document, especially Figs. 3A-3C, para [0026], [0032]-[0034]	4-6, 13
Y	US 2002/0148600 A1 (Bosch et al.) 17 October 2002 (17.10.2002), para [0039]-[0040]	4-6
Y	US 2009/0120629 A1 (Ashe) 14 May 2009 (14.05.2009), Fig. 22, para [0200]	13
A	US 2011/0261523 A1 (Dunn et al.) 27 October 2011 (27.10.2011), Figs. 2-6, para [0023]-[0026]	1-14

☐ Further documents are listed in the continuation of Box C.

* Special categories of cited documents:

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

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

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

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

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

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

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

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

"&" document member of the same patent family

Date of the actual completion of the international search

23 July 2014 (23.07.2014)

Date of mailing of the international search report

25 AUG 2014

Name and mailing address of the ISA/US

Mail Stop PCT, Attn: ISA/US, Commissioner for Patents

P.O. Box 1450, Alexandria, Virginia 22313-1450

Facsimile No. 571-273-3201

Authorized officer:

Lee W. Young

PCT Helpdesk: 571-272-4300

PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 14/20850

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:
--- See extra sheet ---

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-14

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

Form PCT/ISA/210 (continuation of first sheet (2)) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 14/20850

Continuation of Box No. III - Observations where unity of invention is lacking

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I: Claims 1-14, directed to a heat exchanger assembly including a plurality of heat exchanger layers.

Group II: Claims 15-20, directed to an assembly for cooling an electronic display including first and second sealed plenums containing first and second heat exchangers.

The inventions listed as Groups I and II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

Special Technical Features

The inventions of Group I do not include the special technical feature of a first sealed plenum containing a first heat exchanger and a second sealed plenum containing a second heat exchanger as required by Group II.

The inventions of Group II do not include the special technical feature of a plurality of heat exchanger layers and a metallic plate positioned adjacent to the power module brick as required by Group I.

Common Technical Features

Groups I and II share the technical features of a heat exchanger within a plenum, an external fan, and a circulating fan, however these shared technical features do not represent a contribution over the prior art as being anticipated by US 2011/0085301 A1 (Dunn) which discloses a heat exchanger (para [0005], 'heat exchanger may be used to transfer heat from the circulating gas to the ambient gas') in a plenum (41, para [0024]), an external fan (60, Fig. 1; para [0018]) and a circulating fan (50, Fig. 1; para [0018]).

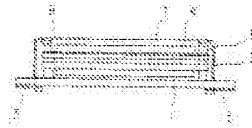
Therefore, Groups I-II lack unity under PCT Rule 13 because they do not share a same or corresponding technical feature.

LIQUID CRYSTAL DISPLAY DEVICE

Publication number: JP3153212 (A)
Publication date: 1991-07-01
Inventor(s): KOBAYASHI SHICHIRO; SEKI TERUO; AOYAMA NAOFUMI; SAKUMA TOSHIYUKI
Applicant(s): HITACHI LTD
Classification:
- **international:** **G02F1/1333; G02F1/1345; G02F1/13; G02F1/13;** (IPC1-7): G02F1/1333; G02F1/1345
- **European:**
Application number: JP19890291285 19891110
Priority number(s): JP19890291285 19891110

Abstract of JP 3153212 (A)

PURPOSE:To sufficiently take an EMI countermeasure by forming a transparent conductive film which is connected to a metallic shielding case and the earth pattern of a driving circuit board over the nearly entire surface of a transparent substrate on the side of the screen side of a liquid crystal display part(LCD). **CONSTITUTION:**The transparent conductive film 7 is formed on the nearly entire surface of the transparent substrate of an LCD 4 for compensation air ranged on the display side of a display LCD 1, and this transparent conductive film 7 is connected electrically in the path of conductive rubber 8, the metallic shielding case 2, the earth pattern 5 of PCB, and an external earth in order. The earth level is held on the screen of the LCD, so the entire screen of the LCD can be shielded. Namely, the flanks of the LCDs 1 and 4 are shielded by the metallic shield case 2 held at the earth level similarly and the screen of the LCD is shielded by the transparent conductive film 7. Consequently, the EMI countermeasure can be taken completely.



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⑨ 日本国特許庁(JP)

⑪ 特許出願公開

⑫ 公開特許公報(A) 平3-153212

⑤ Int. Cl.⁵

識別記号

庁内整理番号

⑬ 公開 平成3年(1991)7月1日

G 02 F 1/1333
1/1345

8806-2H
9018-2H

審査請求 未請求 請求項の数 1 (全3頁)

⑭ 発明の名称 液晶表示装置

⑯ 特 願 平1-291285

⑰ 出 願 平1(1989)11月10日

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内
⑱ 発 明 者 佐 久 間 敏 幸 千葉県茂原市早野3300番地 株式会社日立製作所茂原工場
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⑳ 代 理 人 弁理士 小川 勝男 外1名

明 細 書

1. 発明の名称

液晶表示装置

2. 特許請求の範囲

1. 表示用LCDと、少なくとも上記表示用LCDの側面周囲を覆う金属シールドケースと、上記表示用LCDの駆動回路基板とを具備する液晶表示装置において、上記LCDを構成する表示側の透明基板自体、または別の透明基板のほぼ全面に透明導電膜が設けられ、上記金属シールドケースが上記透明導電膜に電気的に接続され、かつ該金属シールドケースが上記駆動回路基板のアースパターンに電気的に接続されていることを特徴とする液晶表示装置。

3. 発明の詳細な説明

[産業上の利用分野]

本発明は、液晶表示装置に係り、特に、液晶表示装置におけるEMI(電磁波妨害:エレクトロマグネティックインタフィアレンス(Electro Magnetic Interference))対策に関する。

[従来の技術]

第2図は、従来の液晶表示装置を示す図で、(a)は平面図、(b)は正面図、(c)は(a)のII-II断面図である。

1は表示用LCD(液晶表示部)、2は金属シールドケース、3はPCB(プリント回路基板)、4は補償用LCD(LCD画面のバックを白くするためのもの)、5はPCB3に形成されたアースパターン、6は損傷防止用の絶縁膜である。LCD1、4はそれぞれ、寸法の違う上部透明ガラス基板と下部透明ガラス基板とが重ね合わせられ、その間に液晶が封止されている。

すなわち、従来の装置におけるEMI対策は、LCD1、4の側面の周囲に配置され、これらを覆う額縁状の金属シールドケース2をPCB3のアースパターン5に接続して行っている。アースパターン5は外部アースに接続されている。

従来の液晶表示装置は、例えば特開昭62-100736号公報、特開昭62-170940号公報等に記載されている。

〔発明が解決しようとする課題〕

従来の装置では、LCDの側面周囲に関しては、EMI対策がなされているが、LCD画面上に関してはなされていなかった。

本発明の目的は、EMI対策を十分施すことができる液晶表示装置を提供することにある。

〔課題を解決するための手段〕

上記の課題を解決するために、本発明は、表示用LCDと、少なくとも上記表示用LCDの側面周囲を覆う金属シールドケースと、上記表示用LCDの駆動回路基板とを具備する液晶表示装置において、上記LCDを構成する表示側の透明基板自体、または別の透明基板（例えば補償用LCD）のほぼ全面に透明導電膜が設けられ、上記金属シールドケースが上記透明導電膜に電気的に接続され、かつ該金属シールドケースが上記駆動回路基板のアースパターンに電気的に接続されていることを特徴とする。

上記全面に設けた透明導電膜と、金属シールドケースとは例えば導電性ゴムを介して接続する。

2→PCB3のアースパターン5→図示しない外部アースの経路で電気的に接続されている。従って、LCD画面上をアースレベルに保つことができるので、LCDの画面全体をシールドすることができる。すなわち、LCD1、4の側面は、同様にアースレベルに保たれた金属シールドケース2により、また、LCD画面上は透明導電膜7によりシールドされ、EMI対策を完全に施すことができる。

なお、表示用LCD1の一方の透明ガラス基板には画素電極としてのパターン化された透明導電膜（図示せず）が、他方の透明ガラス基板には共通画素電極としての透明導電膜（図示せず）が全面に設けられている。本実施例の補償用LCD4は、この表示用LCD1の上記パターン化された透明画素電極をただ全面に設けるという変更により作製することができる。さらに、導電性ゴム8は補償用LCD4の透明ガラス基板の損傷防止にも役立つ。導電性ゴム8は金属シールドケース2で圧縮されている。

〔作用〕

本発明の液晶表示装置では、LCD画面側の透明基板のほぼ全面に、金属シールドケース・駆動回路基板のアースパターンに接続された透明導電膜が形成され、LCD画面上をアースレベルに保つことができるので、LCDの画面全体をシールドすることができ、EMI対策に有効である。

〔実施例〕

第1図は、本発明の一実施例の液晶表示装置を示す図で、(a)は平面図、(b)は正面図、(c)は(a)のI-I断面図である。

7は補償用LCDの透明ガラス基板の全面に設けたインジウム－チン－オキサイド（ITO膜：ネサ膜）等から成る透明導電膜、8は透明導電膜7と金属シールドケース2とを接続する導電性ゴムである。

本実施例の液晶表示装置では、表示用LCD1の表示側に配置された補償用LCD4の透明基板のほぼ全面に透明導電膜7が形成され、この透明導電膜7は、導電性ゴム8→金属シールドケース

以上、本発明の実施例を具体的に説明したが、本発明は上記実施例に限定されるものではなく、その要旨を逸脱しない範囲において種々変更可能であることは勿論である。例えば、上記実施例では、透明導電膜7を補償用LCD4の透明ガラス基板の全面に設けたが、表示側に配置した他の透明基板の全面に設けてもよく、さらに、補償用LCDを設けず、表示用LCDの透明ガラス基板の表示側に設けても本発明による効果を得ることができる。

また、第1図においては、表示用LCDを下側に、補償用LCDを上側に配置する構造になっているが、この配置を逆にして上側に表示用LCDを、下側に補償用LCDを配置した場合にも本発明を適用することができる。この場合は、上側に配置された表示用LCDの上側の基板の外側を透明導電膜で覆い、この透明導電膜をアースすればよい。

〔発明の効果〕

以上説明したように、本発明によれば、LCD

側面周囲のみならず、LCD画面上もアースレベルに保つことができるので、シールド効果が大きく、EMI対策を十分施すことができる。

4. 図面の簡単な説明

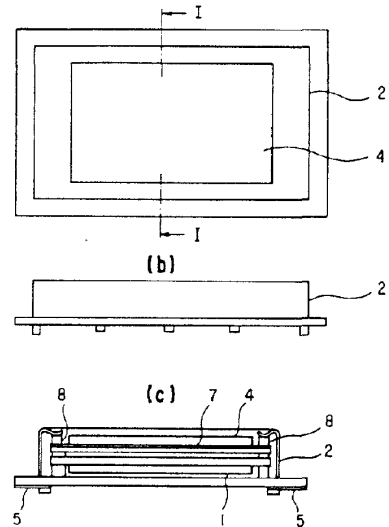
第1図(a)、(b)、(c)は、それぞれ本発明の一実施例の液晶表示装置を示す平面図、正面図、(a)のI-I断面図、第2図(a)、(b)、(c)は、それぞれ従来の液晶表示装置を示す平面図、正面図、(a)のII-II断面図である。

- 1…表示用LCD
- 2…金属シールドケース
- 3…PCB（プリント回路基板）
- 4…補償用LCD
- 5…PCBに形成されたアースパターン
- 6…損傷防止用の絶縁膜
- 7…透明導電膜
- 8…導電性ゴム

代理人弁理士 小川 勝 男

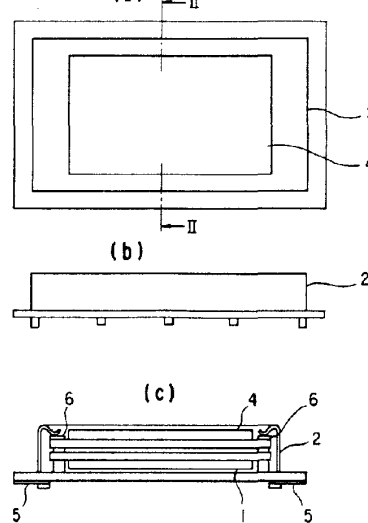


第1図



- 1…表示用LCD
- 2…金属シールドケース
- 3…PCB（プリント回路基板）
- 4…補償用LCD
- 5…PCBに形成されたアースパターン
- 7…透明導電膜
- 8…導電性ゴム

第2図



- 1…表示用LCD
- 2…金属シールドケース
- 3…PCB（プリント回路基板）
- 4…補償用LCD
- 5…PCBに形成されたアースパターン
- 6…損傷防止用の絶縁膜



Espacenet

Bibliographic data: KR100666961 (B1) — 2007-01-10

BACK LIGHT APPARATUS

Inventor(s): KIM TAE SOO [KR] ±
Applicant(s): PHICOM CORP [KR] ±
Classification: - international: **G02F1/13357**
- European:
Application number: KR20050075759 20050818
Priority number(s): KR20050075759 20050818
Also published as: JP2007053078 (A) CN1916734 (A) CN100409080 (C)

Abstract of KR100666961 (B1)

A backlight unit is provided to minimize the brightness variation of light applied to an object to be tested, thereby accurately identifying defects of the object to be tested, by partially controlling the reflective amount of light reflected from a reflective plate. A light source(110) emits a light to an object to be tested. A reflective plate(120) reflects the light emitted from the light source to the object to be tested. A brightness controlling member (130) is provided on the reflective plate. The brightness controlling member partially controls the amount of light reflected from the reflective plate, thereby making the brightness of light applied to the object to be tested uniform. The brightness controlling member corresponds to brightness holes, which are formed in the reflective plate.

Last updated: 14.03.2012 Worldwide Database 5.7.38; 92p



(19)대한민국특허청(KR)
(12) 등록특허공보(B1)

(51) 。 Int. Cl.
G02F 1/13357 (2006.01)

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김원준

심사관 : 장정태

전체 청구항 수 : 총 10 항

(54) 백 라이트 장치

(57) 요약

본 발명은 백 라이트 장치에 관한 것으로서, 피검사체를 조명하기 위한 백 라이트 장치에 있어서, 피검사체로 광을 발산하는 광원과, 광원으로부터 발산하는 광을 피검사체로 반사시키는 반사판과, 반사판에 마련되어 반사판의 광반사량을 부분적으로 보정함으로써 피검사체에 조사되는 광의 휘도가 균일하도록 하는 휘도보정수단을 포함한다. 따라서, 본 발명은 반사판의 광반사량을 용이하게 부분적으로 보정함으로써 광원의 특성이나 배열에 의해 필연적으로 발생하는 피검사체에 조사되는 광의 휘도 편차를 최소화하여 뛰어난 휘도 균일성을 가지도록 하고, 검사장비가 높은 휘도를 요구하더라도 이로 인해 광원으로부터 발생하는 열을 장치 내부에 정체됨이 없이 신속하고도 효과적으로 방출시킴으로써 피검사체가 온도로 인해 변형이 발생하는 것을 최소화함과 아울러 장비의 에러 발생을 방지하는 효과를 가지고 있다.

도 1

도 2

특허청구의 범위

청구항 1.

삭제

청구항 2.

피검사체를 검사를 위해 조명하는 백 라이트 장치에 있어서,

상기 피검사체로 광을 발산하는 광원과,

상기 광원으로부터 발산하는 광을 상기 피검사체로 반사시키는 반사판과,

상기 반사판에 마련되어 상기 반사판의 광반사량을 부분적으로 보정함으로써 상기 피검사체에 조사되는 광의 휘도가 균일하도록 하는 휘도보정수단을 포함하며,

상기 휘도보정수단은,

상기 반사판에 형성되어 광을 통과시키는 휘도보정홀인 것

을 특징으로 하는 백 라이트 장치.

청구항 3.

피검사체를 검사를 위해 조명하는 백 라이트 장치에 있어서,

상기 피검사체로 광을 발산하는 광원과,

상기 광원으로부터 발산하는 광을 상기 피검사체로 반사시키는 반사판과,

상기 반사판에 마련되어 상기 반사판의 광반사량을 부분적으로 보정함으로써 상기 피검사체에 조사되는 광의 휘도가 균일하도록 하는 휘도보정수단을 포함하며,

상기 휘도보정수단은,

상기 반사판에 부착되어 광을 흡수하는 휘도보정시트인 것

을 특징으로 하는 백 라이트 장치.

청구항 4.

제 2 항에 있어서,

상기 휘도보정홀은,

다수로 이루어지며, 상기 반사판의 가장자리로부터 중심으로 갈수록 조밀하게 분포되는 것

을 특징으로 하는 백 라이트 장치.

청구항 5.

제 2 항에 있어서,

상기 휘도보정홀은,

다수로 이루어지며, 상기 반사판의 가장자리로부터 중심으로 갈수록 직경 또는 폭이 증가하는 것

을 특징으로 하는 백 라이트 장치.

청구항 6.

제 2 항에 있어서,

상기 휘도보정홀은,

다수로 이루어지며, 상기 반사판의 가장자리로부터 중심으로 갈수록 간격이 작아지는 것

을 특징으로 하는 백 라이트 장치.

청구항 7.

제 2 항 또는 제 3 항에 있어서,

상기 광원 및 상기 반사판이 설치되며, 온도차이로 인해 발생하는 고온부분에 흡입구를, 저온부분에 방출구를 각각 형성하는 케이스와,

상기 흡입구 및 상기 방출구를 통해 공기를 각각 흡입 및 방출시키도록 상기 케이스에 설치되는 흡입팬 및 방출팬

을 더 포함하는 백 라이트 장치.

청구항 8.

제 2 항에 있어서,

상기 휘도보정홀을 통해 상기 광원에 냉각을 위한 공기를 송풍하도록 상기 휘도보정홀에 인접하도록 설치되는 냉각팬

을 더 포함하는 백 라이트 장치.

청구항 9.

제 3 항에 있어서,

상기 휘도보정시트는,

다수로 이루어지며, 상기 반사판의 가장자리로부터 중심으로 갈수록 조밀하게 분포되는 것

을 특징으로 하는 백 라이트 장치.

청구항 10.

제 3 항에 있어서,

상기 휘도보정시트는,

다수로 이루어지며, 상기 반사판의 가장자리로부터 중심으로 갈수록 직경 또는 폭이 증가하는 것을 특징으로 하는 백 라이트 장치.

청구항 11.

제 3 항에 있어서,

상기 휘도보정시트는,

다수로 이루어지며, 상기 반사판의 가장자리로부터 중심으로 갈수록 간격이 작아지는 것

을 특징으로 하는 백 라이트 장치.

명세서

발명의 상세한 설명

발명의 목적

발명이 속하는 기술 및 그 분야의 종래기술

본 발명은 백 라이트 장치에 관한 것으로서, 보다 상세하게는 피검사체에 대한 휘도의 균일성을 향상시킴으로써 피검사체에 대한 정확한 검사가 가능하도록 하며, 열을 신속하고도 효과적으로 배출시킴으로써 열로 인한 휘도의 편차 증가, 피검사체나 주변부품에 대한 손상을 방지하는 백 라이트 장치에 관한 것이다.

일반적으로, LCD(liquid crystal display) 패널 등과 같은 피검사체에 발생된 결함을 검사하는 장비는 피검사체에 광을 조사함으로써 피검사체 또는 피검사체에 존재하는 결함과 충돌한 광의 회절, 산란, 반사, 또는 투과에 의하여 LCD 패널과 같은 피검사체에서 결함을 찾아낼 수 있도록 하기 위해 중요한 요소인 백 라이트 장치가 마련된다.

이러한 종래의 LCD 패널 등과 같은 검사장비에 사용되는 백 라이트 장치를 첨부된 도면을 참조하여 설명하면 다음과 같다.

도 1은 종래의 기술에 따른 백 라이트 장치를 도시한 분해사시도이다. 도시된 바와 같이, 종래의 백 라이트 장치(10)는 케이스(11)와, 케이스(11)에 램프반침대(12)에 의해 병렬로 배열되도록 설치되어 피검사체를 향하여 광을 발산하는 다수의 램프(13)와, 램프(13)의 하측에 설치되어 램프(13)로부터 발산되는 광을 반사하는 반사판(14)과, 케이스(11)에 형성되는 개구(11a)를 통해 냉각을 위한 공기를 순환시키는 팬(15)을 포함한다. 또한, 케이스(11) 내측에 안정기(16)가 설치된다.

이와 같은 종래의 기술에 따른 백 라이트 장치(10)는 램프(13)에 의해 발산되는 광이 확산판(1)을 통해서 상판(2)을 통과하여 LCD 패널 등과 같은 피검사체로 조사된다. 이 때, 램프(13)로부터 발산되는 광은 반사판(14)에 의해 반사되어 피검사체로 조사된다.

이러한 종래의 백 라이트 장치(10)는 정확한 검사를 위하여 높은 휘도를 요구하고 있음에도 불구하고, 램프(13)의 특성 또는 배열에 따라 피검사체에 조사되는 광의 휘도 편차가 필연적으로 발생하게 되며, 이로 인해 피검사체에서 중심부분과 가장자리부분간의 휘도 편차가 25%를 상회하는 문제점을 가지고 있었다.

휘도 편차가 필연적으로 발생하는 이유를 보다 자세하게 설명하면 먼저, 종래의 백 라이트 장치(10)는 케이스(11)를 포함하여 구성부품들의 색상이 보통 흑색으로 이루어지는데, 광을 잘 흡수하는 흑색의 특성으로 인해 피검사체에 조사되는 광의 휘도는 중심부분보다 케이스(11)측인 가장자리부분이 낮게 된다.

그리고, 케이스(11) 내부에 마련된 고온인 램프(13)의 열을 배출하기 위하여 케이스(11) 측면에 팬(15)이 설치되어 있으나, 팬(15)이 케이스(11)내의 중심 부근에 대한 열을 외부로 제대로 배출시키지 못함으로써 케이스(11)내의 중심에 배치된 램프(13)의 온도가 케이스(11)내의 가장자리에 배치된 램프(13)의 온도보다 높아지게 된다. 따라서 온도가 높을수록 휘도가 높아지는 램프(13)의 특성으로 인해 케이스(11)내의 중심에 배치되는 램프(13)는 온도가 높아져서 높은 휘도를 가지고, 이와는 반대로 케이스(11)내의 가장자리에 배치되는 램프(13)는 온도가 낮아져서 낮은 휘도를 가지게 된다.

즉, 케이스(11)의 색상 및 케이스(11) 내부에 배치된 램프(13)의 온도 차이에 의한 원인에 의하여 피검사체로 제공되는 광의 휘도가 기준보다 가장자리 부근은 더 낮아지고, 중심 부근은 더 높아지게 되어 피검사체에 조사되는 광의 휘도 편차는 더욱 증가되는 문제점이 있었다.

이와 같이, 피검사체에 조사되는 광의 휘도 편차가 큰 값을 가지게 됨으로써 피검사체의 특정부분에 대한 검사가 제대로 이루어지지 않게 되며, 이로 인해 피검사체의 결점을 정확하게 판단하기 어려워 불량인 피검사체를 정상으로 판정하거나, 검사장비의 에리를 유발하여 정상적인 피검사체를 불량으로 판정하는 등 검사 작업에 많은 문제점을 발생시키고 있다.

특히, LCD 패널 검사장비는 암실에서 사용됨으로써 본체 대부분의 색상이 흑색이기 때문에 램프(13)로부터 발산되는 광을 잘 흡수하므로 피검사체에 대한 휘도 편차를 더욱 가중시키며, 이러한 장비 특성으로 인해 피검사체에서의 휘도 균일성이 한층 요구되고 있는 실정이다.

이러한 문제를 해결하기 위하여 다수의 램프(13)를 여러 영역으로 분할함으로써 각 영역에 대한 휘도를 조절하는 방법에 의해 원하는 휘도 균일성을 유지시키고 있으나, 각각의 영역 분할을 위해 길이가 짧은 램프를 사용하게 됨으로써 많은 개수의 램프(13)가 소요될 뿐만 아니라 안정기(16)의 개수도 늘어나서 장비의 크기, 사용 전력, 램프의 교체 회수 등이 크게 늘어날 뿐만 아니라 고열을 발생시키게 되며, 휘도 조절 작업이 번거롭다는 등 여러 가지 문제를 가지게 되었다.

또한, 종래의 백 라이트 장치(10)는 피검사체의 정확한 검사를 위해 피검사체와의 거리가 한정됨으로써 피검사체에 열이 쉽게 전달되어 휘게 됨으로써 변형에 따른 불량을 초래하며, 주변의 구성부품에 고온으로 인한 악영향을 초래함으로써 검사 작업의 정확성과 장비의 가동률을 저하시키고 있다. 이러한 문제점 해결을 위해 팬(15)을 구비하고 있으나, 케이스(11)내의 중심부분에 대한 열을 외부로 제대로 배출하지 못하며, 특히 반사판(14)이 내측 공기의 흐름에 장애가 됨으로써 열 배출을 더욱 어렵게 하였다.

이러한 문제점들을 해결함으로써 높은 휘도를 유지하면서도 고온에 의한 영향을 최소화할 수 있는 백 라이트 장치의 개발이 필요하게 되었다.

또한, 현재의 백 라이트 장치로는 대형화 장비에 대응할 때 휘도 편차가 더욱 증가하게 되는 문제점이 있었으나, 이러한 장비 특성으로 인해 피검사체에서의 휘도 균일성이 한층 요구되고 있는 실정이다.

발명이 이루고자 하는 기술적 과제

본 발명은 상술한 종래의 문제점을 해결하기 위한 것으로서, 본 발명의 목적은 피검사체에 대한 휘도의 균일성을 향상시킴으로써 피검사체에 대한 정확한 검사가 가능하도록 하며, 열을 신속하고도 효과적으로 배출시킴으로써 열로 인한 휘도의 편차 증가, 피검사체나 주변부품에 대한 손상을 방지하는 백 라이트 장치를 제공하는데 있다.

이와 같은 목적을 실현하기 위한 본 발명은, 피검사체를 조명하기 위한 백 라이트 장치에 있어서, 피검사체로 광을 발산하는 광원과, 광원으로부터 발산하는 광을 피검사체로 반사시키는 반사판과, 반사판에 마련되어 반사판의 광반사량을 부분적으로 보정함으로써 피검사체에 조사되는 광의 휘도가 균일하도록 하는 휘도보정수단을 포함하는 것을 특징으로 한다.

발명의 구성

이하, 본 발명의 가장 바람직한 실시예를 첨부한 도면을 참조하여 본 발명의 기술분야에서 통상의 지식을 가진 자가 용이하게 실시할 수 있도록 더욱 상세히 설명하기로 한다.

도 2는 본 발명의 제 1 실시예에 따른 백 라이트 장치를 도시한 분해 사시도이다. 도시된 바와 같이, 본 발명에 따른 백 라이트 장치(100)는 LCD 패널 등과 같은 피검사체에 존재하는 결함을 검사하는 검사장비에 설치되어 피검사체에 광을 조사함으로써 회전, 산란, 반사, 투과 등 광의 여러 가지 성질에 의해 피검사체에 존재하는 결함을 검출하도록 하는 장치로서, 광을 발산하는 광원(110)과, 광을 반사시키는 반사판(120)과, 반사판(120)에 마련되는 휘도보정수단(130)을 포함한다.

광원(110)은 장시간의 수명을 가지는 발광다이오드(Light Emitting Diode, "LED"라고도 함), 또는 노이즈와 열의 방출이 적은 냉음극형광램프(Cold Cathode Fluorescent Lamp, "CCFL"라고도 함), 또는 고휘도 구현이 가능한 열음극형광램프(Hot Cathode Fluorescent Lamp "HCFL"이라고도 함), 또는 고휘도 구현과 함께 높은 휘도 균일성을 가지는 외부전극형광램프(External Electrode Fluorescent Lamp, "EEFL"라고도 함) 등이 사용될 수 있는데, 본 실시예에서 직관형광램프를 사용하였다.

광원(110)은 양단에 마련되는 미도시된 단자가 커넥터(111)에 의해 접속됨으로써 나란하게 다수로 배열된다.

반사판(120)은 광원(110)으로부터 발산하는 광을 피검사체로 반사시키며, 광원(110)의 일측, 예컨대, 하측에 인접하도록 위치한다. 또한, 반사판(120)은 스테인레스틸 또는 알루미늄 재질로 제작되며, 광원(110)으로부터 발산되는 광을 효율적으로 반사하기 위하여 상면에 반사필름이 적층될 수 있다.

한편, 광원(110)과 반사판(120)의 설치를 위하여 케이스(150)가 마련된다.

케이스(150)는 광원(110)과 반사판(120)이 설치되기 위하여 케이스(150) 내측에 다수의 고정포스트(153)가 수직되게 형성되고, 이 고정포스트(153)에 반사판(120)과 광원(110)의 커넥터(111)가 미도시된 볼트나 스크루 등으로 고정된다. 또한, 반사판(120)과 커넥터(111)는 고정포스트(153)에 볼트나 스크루 등으로 고정되기 위하여 고정홀(121)과 고정부(112)가 각각 형성된다. 한편 케이스(110)는 내측에 다수의 안정기(154)가 설치된다.

휘도보정수단(130)은 반사판(120)에 마련되어 광원(110)으로부터 조사되어 반사판(120)으로부터 반사되는 광량을 부분적으로 보정함으로써 피검사체에 조사되는 광의 휘도가 균일하도록 한다.

휘도보정수단(130)은 도 2 및 도 3에 도시된 본 실시예에서 반사판(120)에 형성되어 광을 통과시키는 휘도보정홀이다.

휘도보정홀(130)은 피검사체에 도달하는 광의 휘도가 주변에 비해 높은 부분에 마주보도록 반사판(120)에 형성되며, 광원(110)의 광을 통과시킴으로써 반사판(120)의 부분적인 광 반사량을 줄인다.

휘도보정홀(130)은 효율적인 반사판(120)의 광반사량 부분 조절을 위하여 다수로 이루어지며, 광원(110)의 배열 등에 따른 구조적 특성으로 인해 중심부분이 가장자리에 비해 휘도가 높은 점을 감안하여 도 2 및 도 3에서 도시된 바와 같이, 반사판(120)의 가장자리로부터 중심으로 갈수록 조밀하게 분포되거나, 도 5에 도시된 바와 같이, 반사판(120)의 가장자리로부터 중심으로 갈수록 직경 또는 폭이 증가하거나, 도 6에 도시된 바와 같이, 반사판(120)의 가장자리로부터 중심으로 갈수록 간격이 작아지도록 형성된다.

한편, 케이스(150)는 광원(110)의 특성 및 배열 등에 따라 발생하는 온도차이로 인해 발생하는 고온부분에 흡입구(151)를 형성하고, 저온부분에 방출구(152)를 각각 형성하고 있다. 본 실시예에서는 케이스(150)에서 광원(110)의 측부와 마주보는 측면이 광원(110)을 전기적, 기계적으로 연결하는 커넥터(111)가 위치하는 측면에 비해 고온이므로, 케이스(150)는 광원(110)의 측부와 마주보는 측면에 다수의 흡입구(151)를, 커넥터(111)가 위치하는 측면에 다수의 방출구(152)를 각각 형성한다.

케이스(150)의 흡입구(151) 및 방출구(152)에는 공기를 흡입 및 방출시키기 위하여 흡입팬(160) 및 방출팬(170)이 각각 설치된다. 즉, 도 3에서 도시된 바와 같이, 흡입팬(160)은 외부의 공기를 흡입구(151)를 통해 흡입함으로써 케이스(150) 내의 고온부분을 통과하도록 하며, 방출팬(170)은 내부의 가열된 공기를 저온부분을 거쳐서 방출구(152)를 통해 외부로 방출시킨다.

한편, 광원(110)과 케이스(150)의 중심부분에 대한 직접적인 냉각을 통해 케이스(150)내의 온도를 효율적으로 낮추기 위한 냉각팬(180)을 더 포함할 수 있다.

냉각팬(180)은 휘도보정홀(130)을 통해 광원(110)에 냉각을 위한 공기를 송풍하도록 휘도보정홀(130)에 인접하도록 케이스(150)의 바닥면에 설치된다. 따라서, 도 4에 도시된 바와 같이, 냉각팬(180)에 의해 송풍되는 공기가 휘도보정홀(130)을 통해 광원(110)에 직접적으로 송풍됨으로써 광원(110)으로 인한 온도의 상승을 최대한 억제하며, 반사판(120)에 의한 공기의 흐름에 영향을 받지 않아 케이스(150)내, 특히 중심부분에 대한 냉각 효율을 향상시킨다.

휘도보정홀(130)을 통해 공기를 송풍할 수 있도록 냉각팬(180) 이외에도 펌핑력이나 압력에 의해 공기를 분사하는 에어 노즐 등과 같은 다양한 송풍수단이 이용될 수 있다.

이와 같은 구조로 이루어진 본 발명의 제 1 실시예에 따른 백 라이트 장치(100)의 작용을 설명하면 다음과 같다.

LCD 패널 등과 같은 피검사체 검사를 위해 광원(110)으로부터 발산되는 광과 반사판(120)으로부터 반사되는 광이 피검사체로 조사되며, 이 때, 피검사체에서의 휘도가 높은 부분에 상응하는 위치에 형성되는 휘도보정홀(130)을 통해 광원(110)으로부터 발산되는 광이 통과함으로써 반사판(120)의 반사량을 부분적으로 보정하게 되며, 이로 인해 피검사체에 조사되는 광의 휘도가 균일하도록 한다.

또한, 도 3에서 도시된 바와 같이, 흡입팬(160)에 의해 외부의 공기를 흡입구(151)를 통해 흡입하여 케이스(150)내의 고온부분, 즉 광원(110)에서 열의 방출이 심한 부분으로 직접적으로 통과하도록 함으로써 고온부분이 1차적으로 냉각되도록 하며, 방출팬(170)에 의해 내부의 가열된 공기를 저온부분, 즉 광원(110)에서 열의 방출이 적은 커넥터(111) 연결부위로 통과시켜서 방출구(152)를 통해 외부로 방출시킴으로써 저온부분을 2차적으로 냉각시킨다. 이로 인해 케이스(150)의 고온부분과 저온부분간의 온도 편차를 줄이게 되며, 이로 인해 온도의 불균일성으로 인해 유발되는 광원(110)의 휘도 편차를 최소화할 수 있다.

도 4에 도시된 바와 같이, 냉각팬(180)에 의해 송풍되는 공기는 휘도보정홀(130)을 통해 광원(110)에 직접적으로 송풍되며, 이로 인해 광원(110)으로 인한 온도상승을 신속하고도 효율적으로 억제하며, 반사판(120)이 공기의 흐름을 방해하지 않게 됨으로써 케이스(150)내, 특히 중심부분에 대한 냉각 효율이 뛰어나도록 한다.

또한, 휘도보정홀(130)은 반사판(120)의 가장자리로부터 중심으로 갈수록 조밀하게 분포되거나, 직경 또는 폭이 증가하거나, 간격이 작아지도록 형성됨으로써 광원(110)의 배열 등에 따른 구조적 특성으로 인한 중심부분의 고휘도 문제를 효과적으로 해결할 수 있다.

도 7은 본 발명의 제 2 실시예에 따른 백 라이트 장치를 도시한 분해 사시도이다. 도시된 바와 같이, 본 발명의 제 2 실시예에 따른 백 라이트 장치(200)는 제 1 실시예(100)와 마찬가지로 광원(110)과, 반사판(120)과, 휘도보정수단(140)을 포함하고 있을 뿐만 아니라 케이스(150), 흡입팬(160) 및 방출팬(170)을 더 포함하고 있다. 따라서, 제 1 실시예(100)와 동일한 부분은 그 설명을 생략하기로 하고, 차이점에 대해서 상세히 설명하기로 하겠다.

본 실시예에 따른 휘도보정수단(140)은 반사판(120)에 부착되어 광을 흡수하는 휘도보정시트이다.

휘도보정시트(140)는 광을 흡수하기 위해서 검은 색으로 제작됨이 바람직하며, 필름과 같은 얇은 형상뿐만 아니라 플레이트와 같은 비교적 두꺼운 형상으로 제작될 수 있으며, 평면 형상은 원형, 타원형, 다각형, 그 밖에 직선과 곡률이 혼합될 수 있다. 또한, 휘도보정시트(140)는 반사판(120)에 착탈이 가능하도록 부착되기 위하여 부착면에 접착층을 가질 수 있다.

휘도보정시트(140)는 이전 실시예의 휘도보정홀(130)(도 2 및 도 3 등에 도시)과 마찬가지로 반사판(120)의 광반사량을 효과적으로 부분 조절하기 위하여 다수로 이루어지며, 광원(110)의 배열 등에 따른 구조적 특성으로 인해 중심부분이 가장자리에 비해 휘도가 높기 때문에 이를 반영하기 위하여 반사판(120)의 가장자리로부터 중심으로 갈수록 조밀하게 분포되거나, 직경 또는 폭이 증가하거나, 간격이 작아지도록 형성된다.

한편, 본 발명의 제 2 실시예(200) 뿐만 아니라 이전의 실시예(100)에 따른 휘도보정수단(130,140)을 피검사체에 요구되는 휘도 뿐만 아니라 정해진 편차이내의 휘도 균일성을 만족시키도록 형성 내지 부착시키기 위하여 반사판(120)에 마련되는 휘도보정수단(130,140)의 규격, 개수, 위치 등은 휘도 및 휘도 편차를 시뮬레이션할 수 있는 컴퓨터 프로그램을 사용함으로써 반사판(120)에 마련되는 휘도보정수단(130,140)의 적절한 규격, 개수, 위치 등을 1차적으로 구하게 되며, 이러한 데이터에 의한 휘도보정수단(130,140)이 실제로 마련되는 반사판(120)을 검사상비에 사용하여 피검사체의 여러 부분에 대한 휘도의 실측값들에 따라 최종적으로 휘도보정수단(130,140)의 규격, 개수, 반사판(120)에서의 위치를 구하게 된다.

이와 같은 구조를 가지는 본 발명의 제 2 실시예에 따른 백 라이트 장치(200)의 작용을 설명하면 다음과 같다.

광원(110)으로부터 발산되는 광은 도 8에서 도시된 바와 같이, 반사판(120)에 의해 반사되어 피검사체로 조사되나, 휘도 보정시트(140)에 도달하는 광은 흡수됨으로써 반사판(120)의 광반사량을 부분적으로 조정 내지 보정한다. 따라서, 이러한 휘도보정시트(140)가 피검사체에서 휘도가 비교적 높은 부분에 상응하는 위치에 마련됨으로써 피검사체에서 휘도가 비교적 높은 부분으로 조사되는 광의 양을 줄이게 됨으로써 피검사체에 조사된 광의 휘도를 전체적으로 균일하도록 한다.

발명의 효과

상술한 바와 같이, 본 발명에 따른 백 라이트 장치는 반사판의 광반사량을 용이하게 부분적으로 조정함으로써 광원의 특성이나 배열에 의해 필연적으로 발생하는 피검사체에 조사되는 광의 휘도 편차를 최소화하여 뛰어난 휘도 균일성을 가지도록 하고, 이로 인해 광원의 개수, 사용 전력, 유지 비용 등을 절감시키며, 검사장비가 피검사체의 결점을 정확하게 판별할 수 있도록 함으로써 피검사체의 불량여부를 제대로 판단하도록 하는 효과를 가지고 있다.

또한, 검사장비가 높은 휘도를 요구하더라도 이로 인해 광원으로부터 발생하는 열을 장치 내부에 정체가 없이 신속하고도 효과적으로 방출시킴으로써 피검사체가 온도로 인해 변형이 발생하는 것을 최소화하여 피검사체의 품질을 유지시키고, 주변부품이 열로 인해 손상되거나 에러를 유발시키는 방지하는 효과를 가지고 있다.

이상에서 설명한 것은 본 발명에 따른 백 라이트 장치를 실시하기 위한 하나의 실시예에 불과한 것으로서, 본 발명은 상기한 실시예에 한정되지 않고, 이하의 특허청구범위에서 청구하는 바와 같이 본 발명의 요지를 벗어남이 없이 당해 발명이 속하는 분야에서 통상의 지식을 가진 자라면 누구든지 다양한 변형 실시가 가능한 범위까지 본 발명의 기술적 정신이 있다고 할 것이다.

도면의 간단한 설명

도 1은 종래의 백 라이트 장치를 도시한 사시도이고,

도 2는 본 발명의 제 1 실시예에 따른 백 라이트 장치를 도시한 분해 사시도이고,

도 3은 본 발명의 제 1 실시예에 따른 백 라이트 장치를 도시한 평면도이고,

도 4는 도 3의 A-A'선에 따른 단면도이고,

도 5는 본 발명의 제 1 실시예에 따른 백 라이트 장치의 휘도보정홀의 다른 실시예를 도시한 평면도이고,

도 6은 본 발명의 제 1 실시예에 따른 백 라이트 장치의 휘도보정홀의 또 다른 실시예를 도시한 평면도이고,

도 7은 본 발명의 제 2 실시예에 따른 백 라이트 장치를 도시한 분해 사시도이고,

도 8은 본 발명의 제 2 실시예에 따른 백 라이트 장치의 작용을 도시한 요부확대도이다.

< 도면의 주요 부분에 대한 부호의 설명 >

110 : 광원 111 : 커넥터

112 : 고정부 120 : 반사판

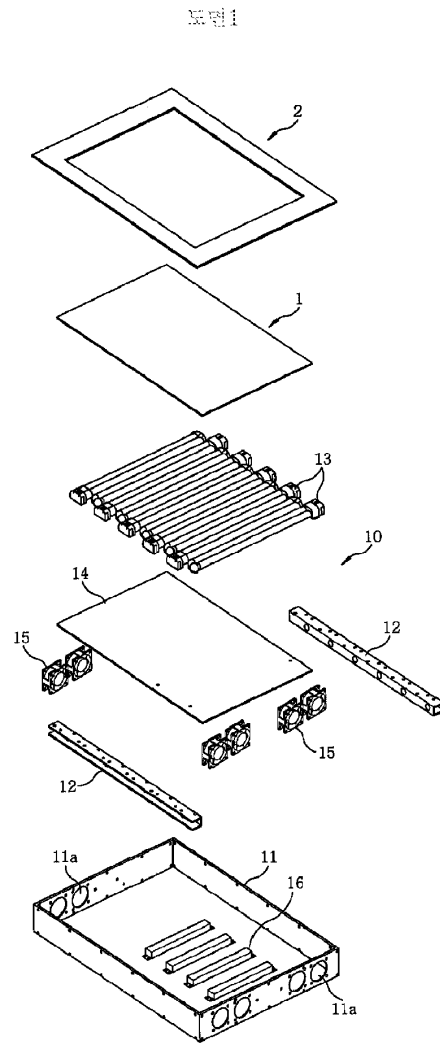
130,140 : 휘도보정수단 (130 : 휘도보정홀, 140 : 휘도보정시트)

150 : 케이스 151 : 흡입구

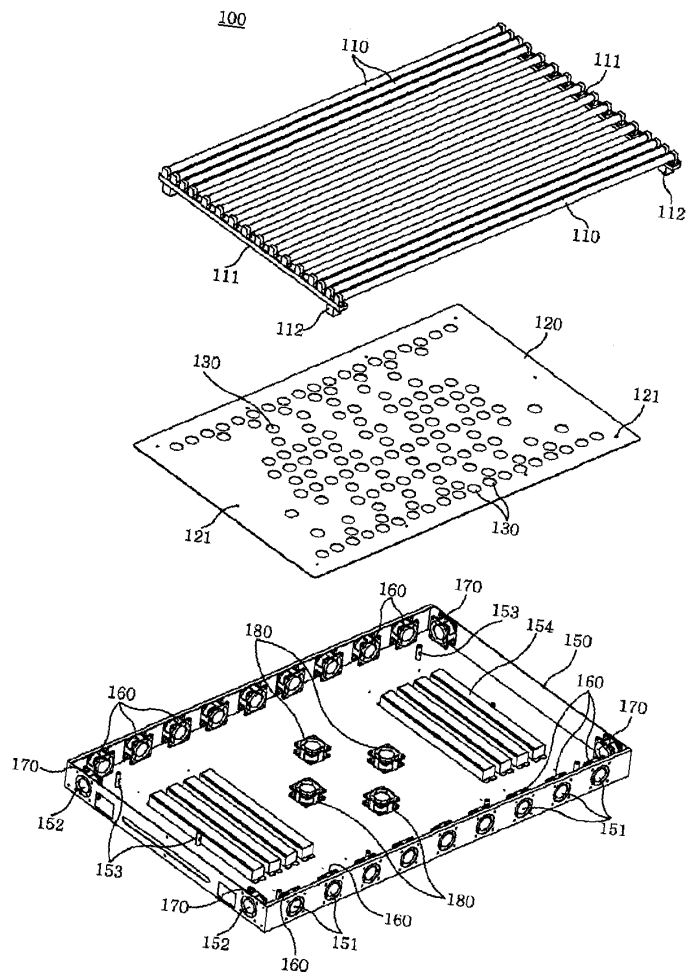
152 : 방출구 160 : 흡입팬

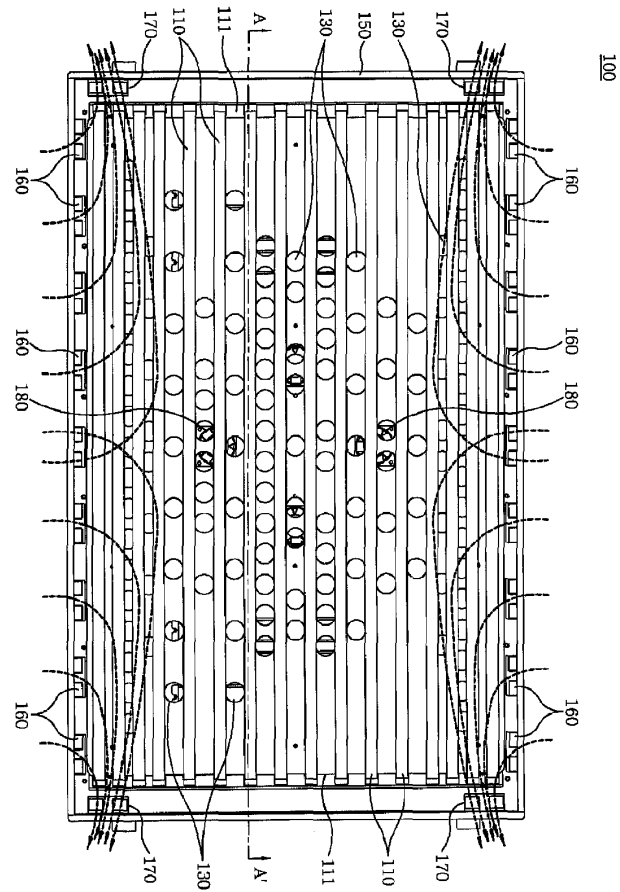
170 : 방출팬 180 : 냉각팬

본원

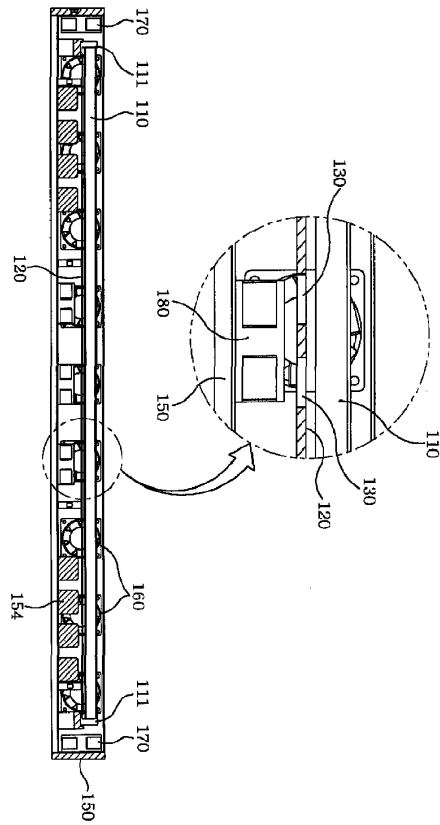


도면2

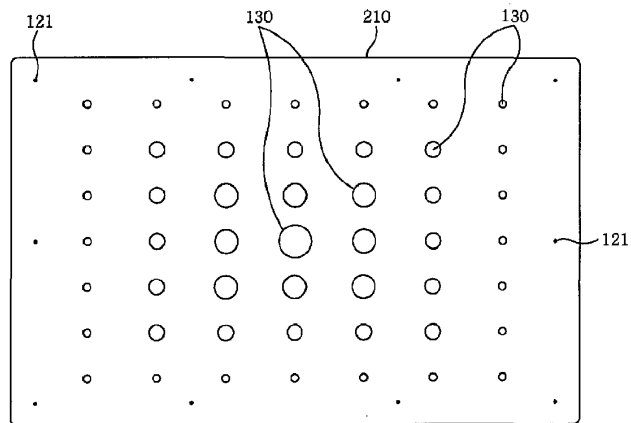




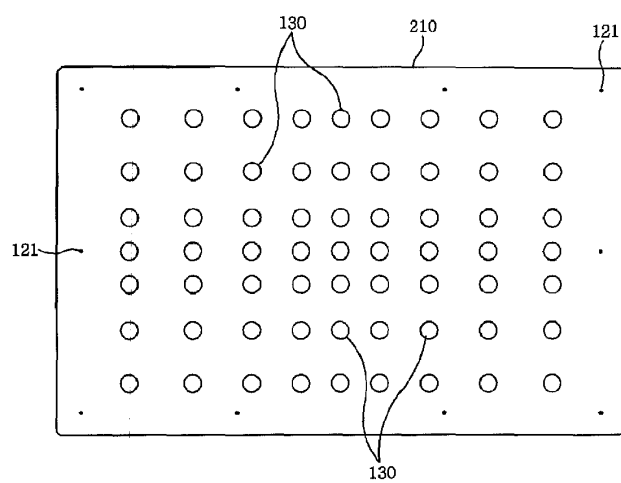
도면4



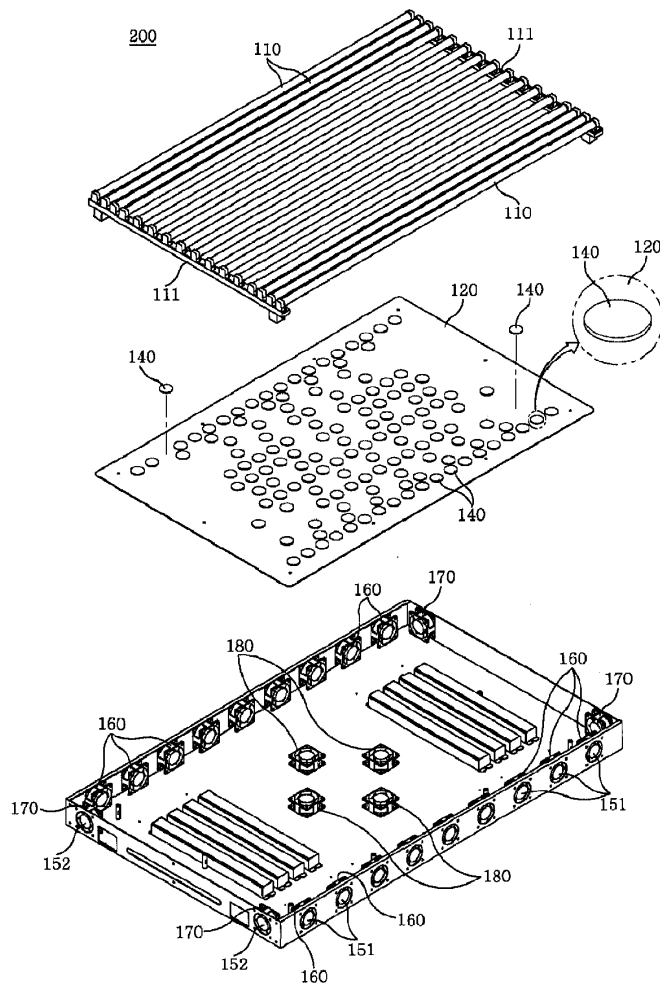
도면5



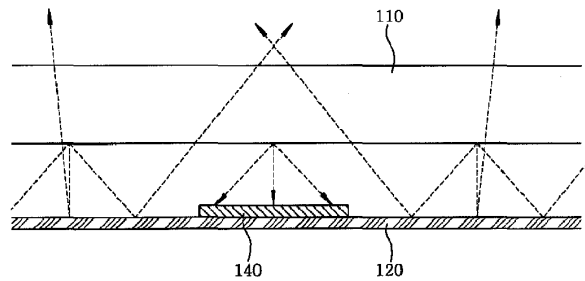
도면6



도면7



도면8

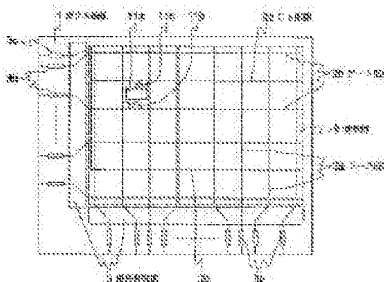


LIQUID CRYSTAL DISPLAY DEVICE

Publication number: JP11160727 (A)
Publication date: 1999-06-18
Inventor(s): NAKABASHI TERUHISA; NAKAYAMA AKIO
Applicant(s): ADVANCED DISPLAY KK
Classification:
- **international:** **G02F1/136; G02F1/1368; G02F1/13; (IPC1-7): G02F1/136**
- **European:**
Application number: JP19970330174 19971201
Priority number(s): JP19970330174 19971201

Abstract of JP 11160727 (A)

PROBLEM TO BE SOLVED: To provide a liquid crystal device(LCD) with which electromagnetic waves radiating from a peripheral circuit or back light to a liquid crystal display panel can be remarkably reduced and the structure of the LCD is not complicated due to countermeasures for electro-magnetic interference(EMI).
SOLUTION: This display device is provided with a first transparent substrate, a second transparent substrate opposed to the first transparent substrate, a liquid crystal display panel containing liquid crystal material held between the said first and second transparent substrates, and back light arranged on the surface of the liquid crystal display panel for radiating light to the liquid crystal display panel. On one surface of the first transparent substrate, switching elements are formed in the form of matrix and two kinds of wirings for supplying electric signals to the switching elements are provided so as to mutually cross at right angles. In this case, a transparent conductive film 5 is formed over the part provided at the outer peripheral part of a display part 9 of the first transparent substrate between the two kinds of wirings.



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(11)特許出願公開番号

【特許請求の範囲】

【請求項1】 第1の透明基板、該第1の透明基板に対向する第2の透明基板、および前記第1の透明基板と第2の透明基板とのあいだに挟持される液晶材料を含んでなる液晶表示パネルと、該液晶表示パネル表面に配置され、液晶表示パネルに光を放射するバックライトとを含んでなり、前記第1の透明基板表面のうち液晶材料に接する側の面上に、スイッチング素子がマトリクス状に形成され、かつ、該スイッチング素子に電気信号を供給する2種類の配線が互いに直交するように設けられてなる液晶表示装置であって、前記2種類の配線のうち第1の透明基板の表示部の外周部に設けられる部分の上方に透明導電膜が形成されてなる液晶表示装置。

【請求項2】 前記透明導電膜の材料がITOである請求項1記載の液晶表示装置。

【請求項3】 前記透明導電膜が前記2種類の配線の一端部に接続されることにより外部接続端子として機能する請求項1記載の液晶表示装置。

【請求項4】 第1の透明基板、該第1の透明基板に対向する第2の透明基板、および前記第1の透明基板と第2の透明基板とのあいだに挟持される液晶材料を含んでなる液晶表示パネルと、該液晶表示パネル表面に配置され、液晶表示パネルに光を放射するバックライトとを含んでなる液晶表示装置であって、前記第1の透明基板表面のうち液晶材料に接する側の面上に透明導電膜が形成され、該透明導電膜の上方にスイッチング素子がマトリクス状に形成され、かつ、該スイッチング素子に電気信号を供給する2種類の配線が互いに直交するように設けられてなる液晶表示装置。

【請求項5】 前記透明導電膜の材料がITOである請求項4記載の液晶表示装置。

【請求項6】 第1の透明基板、該第1の透明基板に対向する第2の透明基板、および前記第1の透明基板と第2の透明基板とのあいだに挟持される液晶材料を含んでなる液晶表示パネルと、該液晶表示パネル表面に配置され、液晶表示パネルに光を放射するバックライトとを含んでなる液晶表示装置であって、前記第1の透明基板表面のうち液晶材料に接する側の面上に第1の透明導電膜が形成され、該第1の透明導電膜の上方にスイッチング素子がマトリクス状に形成され、かつ、該スイッチング素子に電気信号を供給する2種類の配線が互いに直交するように設けられ、さらに前記2種類の配線のうち第1の透明基板の表示部の外周部に設けられる部分の上方に第2の透明導電膜が形成されてなる液晶表示装置。

【請求項7】 前記第1の透明導電膜および第2の透明導電膜の材料がITOである請求項6記載の液晶表示装置。

【請求項8】 前記第1の透明導電膜が前記2種類の配線の一端部に接続されることにより外部接続端子として機能する請求項6記載の液晶表示装置。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、液晶表示装置などの平面型表示装置用のアクティブマトリクス型装置の駆動回路やバックライトなどで発生した電磁波により生じるEMI (electro magnetic interference) に対する対策を施した液晶表示装置に関する。

【0002】

【従来の技術】従来の液晶表示装置（以下、「LCD」ともいう）は、液晶表示パネルと、該液晶表示パネルを挟持する2枚の偏光板と、該偏光板を介して液晶表示パネルに光を放射するバックライトと、前記液晶表示パネルに電気信号を供給する駆動回路とからなる。

【0003】前記液晶表示パネルは、第1の透明基板と第2の透明基板と液晶材料とを含んでなる。前記液晶表示パネルは、第1の透明基板を第2の透明基板に一定の間隙を保持しつつ対向させた状態にし、第1の透明基板の周縁部を第2の透明基板の周縁部に貼着したのち、前記間隙に液晶材料に注入することにより形成される。従来のLCDの一例であるアクティブマトリクス型LCDの液晶表示パネルの表示部はマトリクス状に形成された画素からなる。各画素には、液晶材料を駆動するための電界を発生するための透明電極と、薄膜トランジスタ（以下、「TFT」という）などのスイッチング素子とが設けられる。駆動回路から出力された電気信号は、スイッチング素子を介して各画素の透明電極に印加される。前記駆動回路は、走査信号を出力する駆動回路（以下、「走査駆動回路」という）とデータ信号を出力する駆動回路（以下、「データ駆動回路」という）とからなる。走査信号およびデータ信号は、それぞれゲート配線およびソース配線を介してスイッチング素子に印加される。

【0004】一般に、アクティブマトリクス型LCDは、高視野角および高コントラストなどの特徴を有し、AV (audio-visual) およびOA (office automation) 用のLCDに広く用いられている。

【0005】前記アクティブマトリクス型LCDの構造や製法は、特開平8-6069号公報に開示されている。この種のアクティブマトリクス型LCDにおける電磁干渉 (electro magnetic interference (EMI)) 対策としては、駆動回路から出力される電気信号の立ち上がり部分または立ち下がり部分を鈍らせるようにし、高調波の発生を抑制したり、最近では、液晶表示パネルの表示面に透光性の電磁波シールド板などを設け、表示面から射出される電磁波が前記シールド板にて遮断されるようにしたりして、電磁波を低減している。なお、シールド板による遮断を行ったLCDの一例は、特開昭62-229179号公報に開示されている。

【0006】前述のように、従来のEMI対策が施されたLCDでは、シールド板を固定するための構成を液晶

表示パネルに設けることが必要で、しかも、この構成が複雑になったり、シールド板の固定取り付け作業が、煩雑になったり、シールド板による干渉縞で画面が見づらくなるという問題があった。

【0007】また、第1の透明基板表面にTFT、透明電極、ゲート配線およびソース配線などが設けられてなる基板（以下、「アクティブマトリクス基板」という）自体には、これといったEMI対策は施されていない。

【0008】図11は、従来のアクティブマトリクス基板の一例を示す説明図である。図11において、1は、第1の透明基板であるガラス基板、2aはソース配線、2bは、ゲート絶縁膜（図示せず）を介してソース配線に直交するゲート配線、2cは、ゲート絶縁膜を介してソース配線2aに直交し、かつ、補助容量を形成するためのコモン信号が印加されるCs配線、3aはソース配線2aに接続された外部接続端子（以下、「ソース外部接続端子」という）、3bはゲート配線2bに接続された外部接続端子（以下、「ゲート外部接続端子」という）、3cはCs配線2cに接続された外部接続端子（以下、「Cs外部接続端子」という）、4はテーパー配線部、9は、ガラス基板1の表示部、11aは透明電極、11bは、走査信号が所定の電圧値になっているときのみデータ信号を透明電極11aに印加するTFT（等価的に示されている）、11cは、光リーク電流やフィールドスルーによる影響を防止する補助容量、12は周辺端子部を示す。前記ソース外部接続端子3a、ゲート外部接続端子3bは、データ駆動回路および走査駆動回路の出力端子をソース配線2aおよびゲート配線2bに接続するための端子であり、前記周辺端子部12とはガラス基板1の表示部9の外周部のうち、ソース配線2a、ゲート配線2bおよびCs配線2cの一端部と、前記ソース外部接続端子3a、ゲート外部接続端子3bおよびCs外部接続端子3cとが形成される部分をいう。なお、Cs配線2cのうちゲート配線2bと交差する箇所は、絶縁膜を介してゲート配線2bと交差する。したがって、コモン信号はCs外部接続端子3cを介してCs配線2cのみに印加される。また、テーパー配線部4は、ソース配線2aおよびゲート配線2bのうち、データ駆動回路および走査駆動回路を形成する際にパッケージとしてTCP（tape carrier package）を使用していることに対応してテーパー状に形成されている部分である。なお、図11には、ソース配線2aが8本のみ、ゲート配線2bが4本のみ、Cs配線2cが2本のみ示されており、透明電極11a、TFT11bおよび補助容量11cは画素分のみ示されているが、それぞれ数はこれに限られない。また、2本のソース配線2aおよび2本のゲート配線2bによって区切られる1つの領域が1つの画素である。

【0009】従来のアクティブマトリクス基板の周辺端子部に設けられたゲート配線およびソース配線の上層に

はゲート絶縁膜やDC（直流電流）カット用の絶縁膜（以下、単に「DCカット絶縁膜」という）が形成されているだけであり、駆動回路などの周辺回路やバックライトなどからの電磁波により生じるEMIへの影響が大きい。

【0010】

【発明が解決しようとする課題】前述のように、従来のLCDによれば、周辺回路やバックライトからの電磁波によりEMIが悪化したり、EMIを低減するためにLCDの構造が複雑化するという問題が生じる本発明はかかる問題を解決するためになされたもので、周辺回路やバックライトなどから液晶表示パネルへの電磁波を大幅に低減し、EMI対策のためにLCDの構造を複雑化することがなく、容易に電磁波を低減し、EMIを改善することができるアクティブマトリクス基板を用いた液晶表示装置を提供することを目的とする。

【0011】

【課題を解決するための手段】本発明の液晶表示装置は、第1の透明基板、該第1の透明基板に対向する第2の透明基板、および前記第1の透明基板と第2の透明基板とのあいだに挟持される液晶材料を含んでなる液晶表示パネルと、該液晶表示パネル表面に配置され、液晶表示パネルに光を放射するバックライトとを含んでなり、前記第1の透明基板表面のうち液晶材料に接する側の面上に、スイッチング素子がマトリクス状に形成され、かつ、該スイッチング素子に電気信号を供給する2種類の配線が互いに直交するように設けられてなる液晶表示装置であって、前記2種類の配線のうち第1の透明基板の表示部の外周部に設けられる部分の上方に透明導電膜が形成されてなるものである。

【0012】また、前記透明導電膜の材料がITOである。

【0013】また、前記透明導電膜が前記2種類の配線の一端部に接続されることにより外部接続端子として機能するものである。

【0014】本発明の液晶表示装置は、第1の透明基板、該第1の透明基板に対向する第2の透明基板、および前記第1の透明基板と第2の透明基板とのあいだに挟持される液晶材料を含んでなる液晶表示パネルと、該液晶表示パネル表面に配置され、液晶表示パネルに光を放射するバックライトとを含んでなる液晶表示装置であって、前記第1の透明基板表面のうち液晶材料に接する側の面上に透明導電膜が形成され、該透明導電膜の上方にスイッチング素子がマトリクス状に形成され、かつ、該スイッチング素子に電気信号を供給する2種類の配線が互いに直交するように設けられてなるものである。

【0015】また、前記透明導電膜の材料がITOである。

【0016】本発明の液晶表示装置は、第1の透明基板、該第1の透明基板に対向する第2の透明基板、およ

び前記第1の透明基板と第2の透明基板とのあいだに挟持される液晶材料を含んでなる液晶表示パネルと、該液晶表示パネル表面に配置され、液晶表示パネルに光を放射するバックライトとを含んでなる液晶表示装置であって、前記第1の透明基板表面のうち液晶材料に接する側の面上に第1の透明導電膜が形成され、該第1の透明導電膜の上方にスイッチング素子がマトリクス状に形成され、かつ、該スイッチング素子に電気信号を供給する2種類の配線が互いに直交するように設けられ、さらに前記2種類の配線のうち第1の透明基板の表示部の外周部に設けられる部分の上方に第2の透明導電膜が形成されてなるものである。

【0017】また、前記第1の透明導電膜および第2の透明導電膜の材料がITOである。

【0018】また、前記第1の透明導電膜が前記2種類の配線の一端部に接続されることにより外部接続端子として機能するものである。

【0019】

【発明の実施の形態】つぎに、本発明の液晶表示装置の実施の形態について説明する。

【0020】本発明の液晶表示装置の実施の形態においては、アクティブマトリクス基板が、ゲート配線およびソース配線のうち第1の透明基板の表示部の外周部に設けられる部分（すなわち、テーパー配線部）の上方に形成される透明導電膜、および／または第1の透明基板表面のうち液晶材料に接する側の面上に形成される透明導電膜を含んでなる。2つの透明導電膜は、いずれも液晶表示パネルから電磁波を遮断するために設けられる。

【0021】透明導電膜をテーパー配線部の上方に形成するばあい、透明導電膜とゲート配線およびソース配線とのあいだには絶縁膜が形成される。なお、該絶縁膜は、透明導電膜と、絶縁膜の下方に形成されるものとのあいだで導通をとる箇所を除いて透明導電膜の全表面に形成される。このばあい、前記絶縁膜を形成したのち、透明導電膜となる膜をガラス基板の上方全体に成膜し、当該膜を従来からのパターンエッチング法を用いてエッチングし、テーパー配線部の上方に透明導電膜を形成する。なお、前記エッチングの際に、透明導電膜となる膜をゲート配線の端部、ソース配線の端部およびCs配線の端部の上方にも残すことにより、ゲート外部接続端子、ソース外部接続端子およびCs外部接続端子が形成される。該ゲート外部接続端子、ソース外部接続端子およびCs外部接続端子が形成される箇所の絶縁膜はあらかじめ除去されている。

【0022】また、透明導電膜を第1の透明基板表面に形成するばあい、当該透明導電膜表面に絶縁膜が形成されたのちTFT、ゲート配線およびソース配線などからなるTFTアレイが形成される。なお、前記透明導電膜表面に形成される絶縁膜は透明導電膜の全表面に形成される。

【0023】さらに、5枚マスク構造のアクティブマトリクス基板を形成するばあい、表示用の透明電極をパターンニングする際、同時に電磁波遮断用の透明導電膜をテーパー配線部の上方にパターンニングする。なお、前記5枚マスク構造のアクティブマトリクス基板は、ガラス基板上に、ゲート配線と、ゲート絶縁膜と、TFTの一部を構成するシリコンと、ソース配線およびドレイン配線と、保護絶縁膜と、該保護絶縁膜に形成されたコンタクトホールを介して前記ソース配線およびドレイン配線に電気的に接続される外部接続端子としてのITO膜とを順次設けることにより形成される。さらに、アクティブマトリクス基板の他の例としては、6枚マスク構造のアクティブマトリクス基板がある。該6枚マスク構造のアクティブマトリクス基板は、ガラス基板上に、ゲート配線と、ゲート絶縁膜と、TFTの一部を構成するシリコンと、前記ソース配線およびドレイン配線に電気的に接続される外部接続端子としてのITO膜と、保護絶縁膜と、該保護絶縁膜に形成されたコンタクトホールを介して外部接続端子に電気的に接続されるソース配線およびドレイン配線と、DCカット絶縁膜とを設けることにより形成される。LCDおよび該LCDの基本的な製法などについては、特開平8-6069号公報に開示されている。

【0024】

【実施例】つぎに、本発明の液晶表示装置の実施例について図面を参照しつつ説明する。

【0025】実施例1．図面を参照しつつ、本発明の液晶表示装置の実施例1について説明する。

【0026】図1は、本発明の液晶表示装置の実施例1にかかわるアクティブマトリクス基板の一例を示す説明図である。図1において、図11と同一の箇所は同じ符号を用いて示す。さらに、5は、ITO(indium tin oxide)などからなる透明導電膜を示す。

【0027】透明導電膜5は電磁波を遮断するために形成される。さらに、透明導電膜5は、ソース配線2aおよびゲート配線2bのテーパー配線部の上方に形成される。図示されていないが、ソース配線2aおよびゲート配線2bと透明導電膜5とのあいだには、ゲート絶縁膜などの絶縁膜が形成されている。該絶縁膜は、透明導電膜5と、絶縁膜下部に形成されるものとのあいだで導通をとる箇所を除いて、ガラス基板1の全面に形成される。なお、前記導通をとる箇所の例としては、透明導電膜5のうちソース外部接続端子、ゲート外部接続端子またはCs外部接続端子として利用される部分の下部に位置する箇所がある。

【0028】図2は、図1のアクティブマトリクス基板のうちテーパー配線部および該テーパー配線部の周辺部を示す拡大断面説明図である。図2において、図1と同一の箇所は同じ符号を用いて示す。さらに、6は、ゲート絶縁膜などの絶縁膜を示す。なお、図2には、ソース配線

2aのテーパ配線部および該テーパ配線部の周辺部が示されている。

【0029】図2に示されるように、テーパ配線部の上方には、ITO、 In_2O_3 または SnO_2 などの透明導電材料を用いて電磁波遮断用の透明導電膜5が形成される。前記透明導電膜5により、バックライトや周辺回路から送出される方形波などが原因となって、LCDを構成するあらゆる回路および配線などから放出される電磁波が透明導電膜5により遮断される。したがって、バックライトや周辺回路から液晶表示パネルへの電磁波を低減することができる。

【0030】また、電磁波を透明導電膜5を介してグラウンド（接地面）へ落としてもよい。図3は、本発明の液晶表示装置の実施例1にかかわる液晶表示パネルおよび該液晶表示パネルの周辺部の一例を示す説明図である。図3において、図1および図2と同一の箇所は同じ符号を用いて示す。さらに、10は、液晶表示パネルを支持する金属フレーム、11は金属製導線、21はアクティブマトリクス基板、22は第2の透明基板、23は液晶材料、24は、第1の透明基板の周縁部を第2の透明基板の周縁部に貼着する際に使用されるシール材を示す。金属製導線11は、透明導電膜5と金属フレーム10とを電気的に接続するために設けられる。なお、実際は液晶表示パネルを挟持するように2枚の偏光板が設けられるが、図3では省略されており図示されていない。

【0031】図3に示される構造においては、バックライトや周辺回路から発生している電磁波は、透明導電膜5から、金属製導線11および金属フレーム10を経てグラウンドへ落とされる。したがって、バックライトや周辺回路から液晶表示パネルへの電磁波を大幅に低減し、EMIを改善することができる。さらに、図3に示される構造を採用することで、EMI対策のためにLCDの構造が複雑化することを抑制できる。

【0032】実施例2、つぎに、本発明の液晶表示装置の実施例2について図面を参照しつつ説明する。

【0033】図4は、本発明の液晶表示装置の実施例2にかかわるアクティブマトリクス基板の一例を示す説明図である。図4において、図1と同一の箇所は同じ符号を用いて示す。図4に示されるように、ガラス基板の全面に透明導電膜5が設けられる。図示されていないが、ソース配線2aおよびゲート配線2bと透明導電膜5とのあいだには、ゲート絶縁膜などの絶縁膜が形成されている。該絶縁膜は透明導電膜5の全面に形成される。

【0034】図5は、図4のアクティブマトリクス基板のうちテーパ配線部および該テーパ配線部の周辺部を示す拡大断面説明図である。図5において、図4と同一の箇所は同じ符号を用いて示す。さらに、6は、ゲート絶縁膜などの絶縁膜、7は、ゲート配線、ソース配線、TFTおよび透明電極を含んでなるTFTアレイを示す。なお、図5には、ガラス基板のうちゲート配線およびソ

ース配線が形成されていない箇所が示されている。

【0035】本実施例においては、透明導電膜5は、LCDを製造する工程のうち、アクティブマトリクス基板のTFTアレイを形成する工程（以下、「アレイ工程」という）の第1番目の工程において形成される。

【0036】また、電磁波を透明導電膜5を介してグラウンド（接地面）へ落としてもよい。図6は、本発明の液晶表示装置の実施例2にかかわる液晶表示パネルおよび該液晶表示パネルの周辺部の一例を示す説明図である。図6において、図4および図5と同一の箇所は同じ符号を用いて示す。さらに、10は、液晶表示パネルを支持する金属フレーム、11は金属製導線、22は第2の透明基板、23は液晶材料、24は、第1の透明基板の周縁部を第2の透明基板の周縁部に貼着する際に使用されるシール材を示す。金属製導線11は、透明導電膜5と金属フレーム10とを電気的に接続するために設けられる。なお、実際は液晶表示パネルを挟持するように2枚の偏光板が設けられるが、図6では省略されており図示されていない。

【0037】図6に示される構造においては、透明導電膜5と金属製導線11とを電気的に接続するために、絶縁膜6に少なくとも1つの開口部を設ける。その結果、バックライトや周辺回路から発生している電磁波は、透明導電膜5から、金属製導線11および金属フレーム10を経てグラウンドへ落とされる。したがって、バックライトや周辺回路から液晶表示パネルへの電磁波を大幅に低減し、EMIを改善することができる。さらに、図6に示される構造を採用することで、EMI対策のためにLCDの構造が複雑化することを抑制できる。

【0038】実施例3、つぎに、本発明の液晶表示装置の実施例3について図面を参照しつつ説明する。

【0039】図7は、本発明の液晶表示装置の実施例3にかかわるアクティブマトリクス基板の一例を示す説明図である。図8は、図7のアクティブマトリクス基板のうち周辺端子部を示す部分拡大説明図である。図8(a)は周辺端子部を示す平面説明図であり、図8(b)は図8(a)のA-A線断面説明図である。図7および図8において、図1および図2と同一の箇所は同じ符号を用いて示す。さらに、13は、絶縁膜6（図8(b)にのみ示される）に設けられた開口部である。図8には、周辺端子部のうちソース配線が形成される部分が示されている。なお、図8(a)に示される電位 $V_{\times}$ は、ソース外部接続端子として形成された透明導電膜5に所定の電位 $V_{\times}$ が印加できることを示し、電位 $V_{\times}$ は、通常、ソース外部接続端子に印加される電位を示す。さらに、矢印Bで示される方向には表示部があり、矢印Cで示される方向には、液晶表示パネルを製造するあいだ、ソース外部接続端子とゲート外部接続端子とのあいだの電位差をなくし、静電気によるTFT素子などの破壊を防ぐために設けられたショートリングがある。

【0040】図7および図8に示されるように、透明導電膜5は、テーパー配線部の上部に設けられるとともに、さらにソース外部接続端子を形成する箇所にも形成され、ソース外部接続端子として機能する。図8に示されるように、透明導電膜5は開口部13においてソース配線2aと電氣的に接続される。開口部13は、絶縁膜6の所定の箇所をたとえばドライエッチング法によりエッチングすることにより形成される。

【0041】実施例3によれば、電磁波を透明導電膜5により遮断してバックライトや周辺回路から液晶表示パネルへの電磁波を低減することができる。

【0042】実施例4、つぎに、本発明の液晶表示装置の実施例4について図面を参照しつつ説明する。

【0043】図9は、本発明の液晶表示装置の実施例4にかかわるアクティブマトリクス基板の一例を示す説明図である。図10は、図9のアクティブマトリクス基板のうちソース配線が形成されるテーパー配線部および該テーパー配線部の周辺部を示す拡大断面説明図である。図9および図10において、図1および図2と同一の箇所は同じ符号を用いて示す。さらに、図9および図10において、5aは、ガラス基板1全面に形成される第1の透明導電膜、5bは、ソース配線2aおよびゲート配線2bの上方に形成される第2の透明導電膜、6aは、第1の透明導電膜5a上に形成される第1の絶縁膜、6bは、第2の透明導電膜5bとソース配線2aおよびゲート配線2bとのあいだに形成される第2の絶縁膜、13は、第2の絶縁膜6bに設けられた開口部を示す。第1の絶縁膜6aは、図5に示される絶縁膜6と同一のものであり、第2の絶縁膜6bは、図2に示される絶縁膜6と同一のものである。

【0044】実施例4においては、実施例2と同様に、ガラス基板1の全面に第1の透明導電膜5a（図9には図示されていない）が設けられる。さらに、実施例1と同様に、テーパー配線部の上方に第2の透明導電膜5bが設けられる。なお、実施例3と同様に、第2の透明導電膜5bがソース外部接続端子を形成する箇所にも形成され、ソース外部接続端子として機能する。

【0045】図9および図10に示される構造においては、2層の透明導電膜（第1の透明導電膜5aおよび第2の透明導電膜5b）を設けることにより、実施例1および実施例2と比較してさらに電磁波を遮断することができる。

【0046】また、図示されていないが、実施例1と同様に、金属製導線11（図3参照）を設けてもよい。金属製導線を設けることにより、バックライトや周辺回路から発生している電磁波を、第2の透明導電膜5aから、金属製導線11および金属フレーム10（図3参照）を経てグラウンドへ落とすことができる。したがって、バックライトや周辺回路から液晶表示パネルへの電磁波を大幅に低減し、EMIを改善することができる。そ

の結果、EMI対策のためにLCDの構造が複雑化することを抑制できる。

【0047】

【発明の効果】本発明によれば、透明導電膜を設けて電磁波を遮断することにより、周辺回路やバックライトなどから液晶表示パネルへの電磁波を大幅に低減することができる。さらに、透明導電膜を金属製導線に電氣的に接続することにより電磁波を除去することができるので、EMI対策のためにLCDの構造を複雑化することなく、容易に電磁波を低減することができる。

【図面の簡単な説明】

【図1】本発明の液晶表示装置の実施例1にかかわるアクティブマトリクス基板の一例を示す説明図である。

【図2】図1のアクティブマトリクス基板のうちテーパー配線部および該テーパー配線部の周辺部を示す拡大断面説明図である。

【図3】本発明の液晶表示装置の実施例1にかかわる液晶表示パネルおよび該液晶表示パネルの周辺部の一例を示す説明図である。

【図4】本発明の液晶表示装置の実施例2にかかわるアクティブマトリクス基板の一例を示す説明図である。

【図5】図4のアクティブマトリクス基板のうちテーパー配線部および該テーパー配線部の周辺部を示す拡大断面説明図である。

【図6】本発明の液晶表示装置の実施例2にかかわる液晶表示パネルおよび該液晶表示パネルの周辺部の一例を示す説明図である。図6において、図4および図5と同一の箇所は同じ符号を用いて示す。

【図7】本発明の液晶表示装置の実施例3にかかわるアクティブマトリクス基板の一例を示す説明図である。

【図8】図7のアクティブマトリクス基板のうち周辺端子部を示す部分拡大説明図である。

【図9】本発明の液晶表示装置の実施例4にかかわるアクティブマトリクス基板の一例を示す説明図である。

【図10】図9のアクティブマトリクス基板のうちテーパー配線部および該テーパー配線部の周辺部を示す拡大断面説明図である。

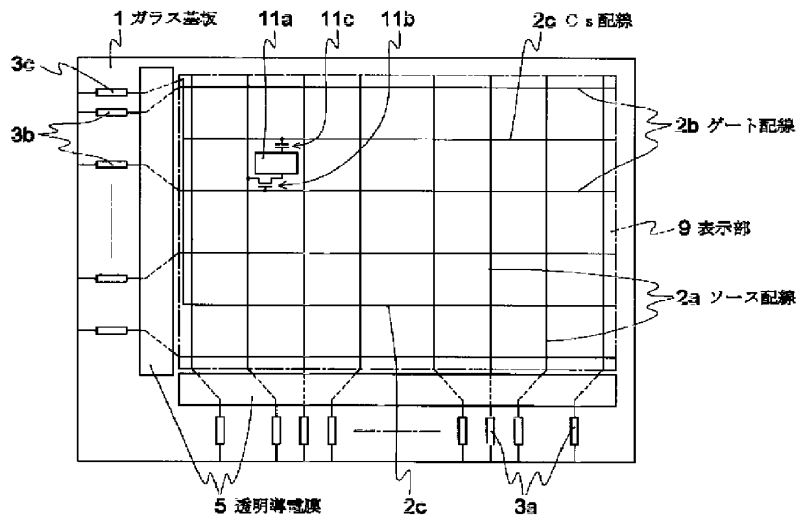
【図11】従来のアクティブマトリクス基板の一例を示す説明図である。

【符号の説明】

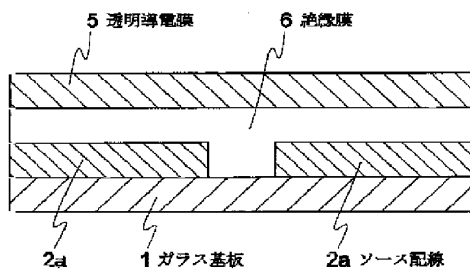
- 1 ガラス基板
- 2a ソース配線
- 2b ゲート配線
- 2c Cs配線
- 3a ソース外部接続端子
- 3b ゲート外部接続端子
- 3c Cs外部接続端子
- 4 テーパー配線部
- 5 透明導電膜
- 9 表示部

1.2 周辺端子部

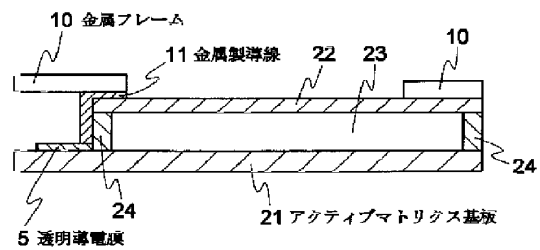
【図1】



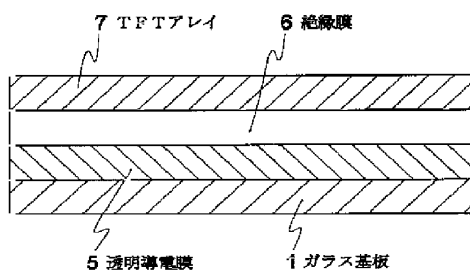
【図2】



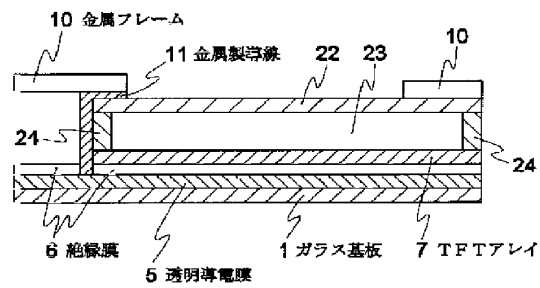
【図3】



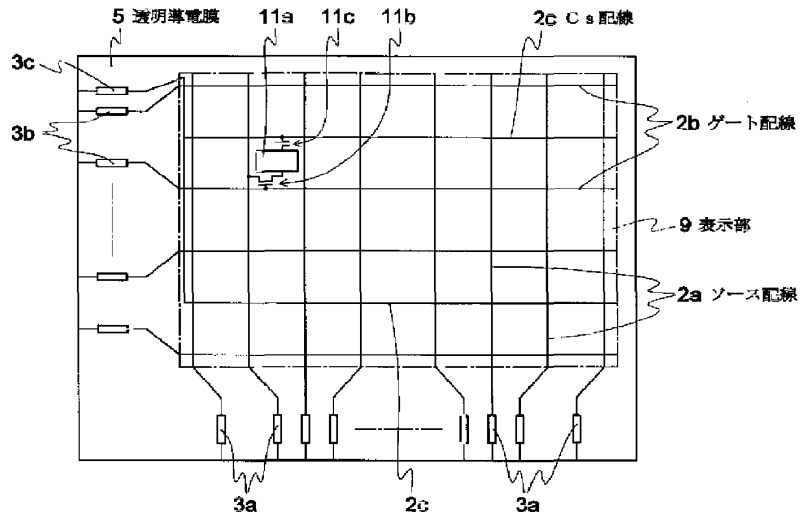
【図5】



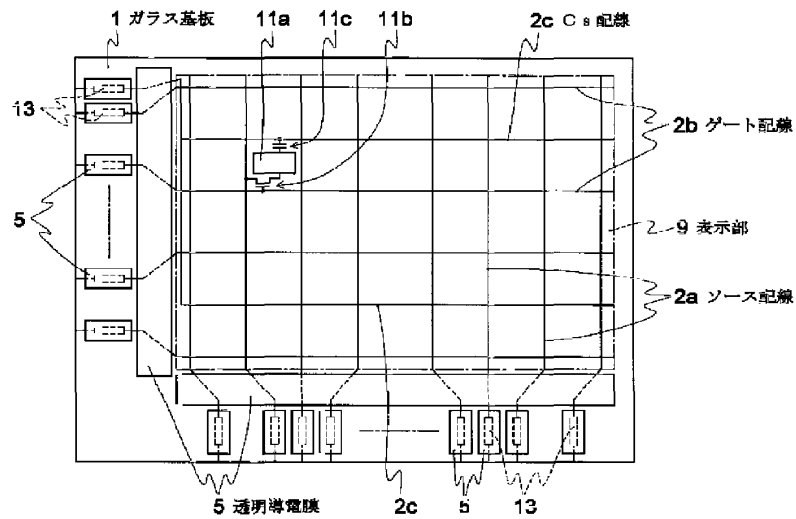
【図6】



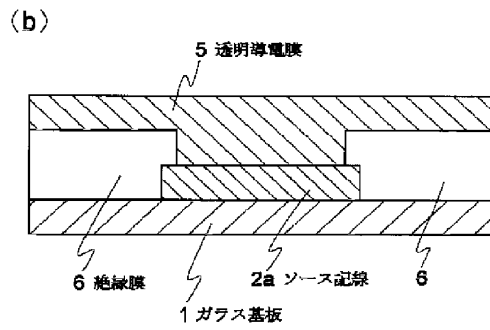
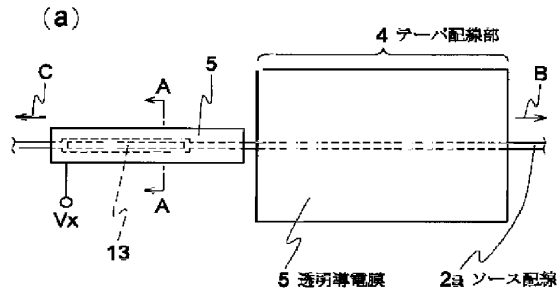
【図4】



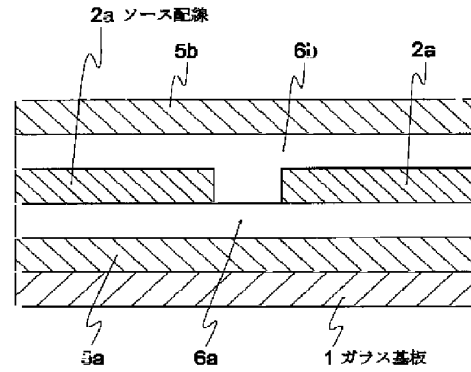
【図 7】



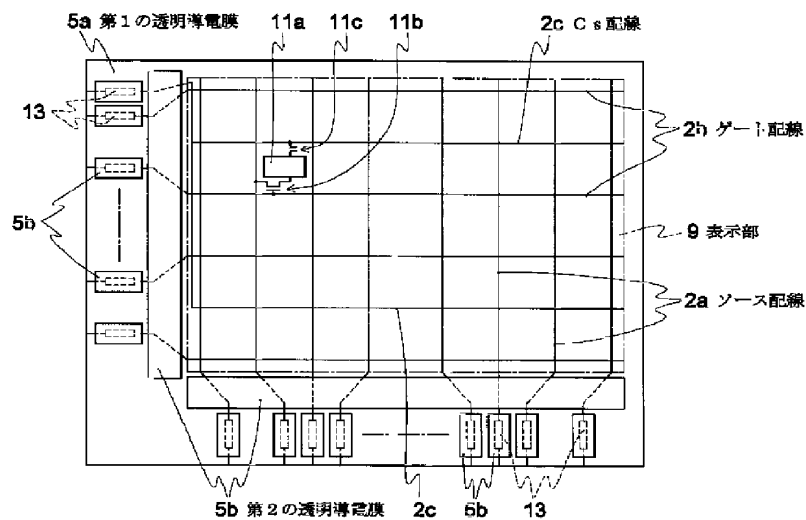
【図8】



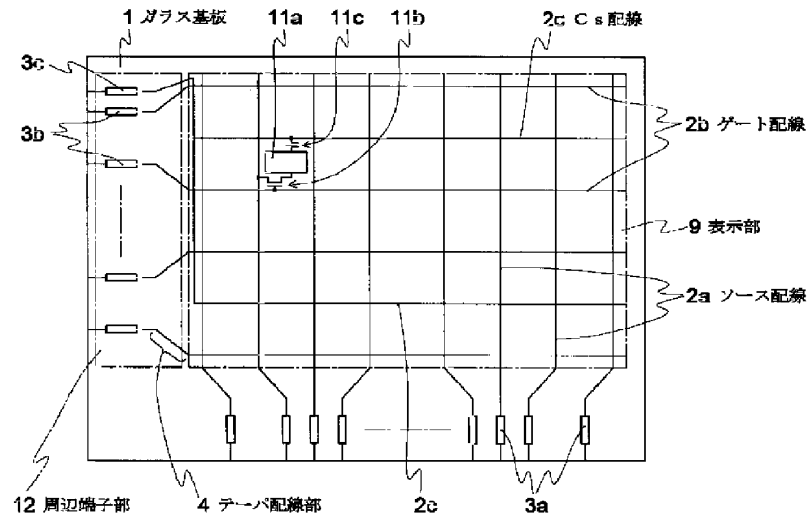
【図10】



【例9】



【 1 1】





Espacenet

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DISPLAY DEVICE

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Classification: - **international:** **G02F1/13; G02F1/1335; G02F1/13357; G09F9/00;**
(IPC1-7): G02F1/13; G02F1/1335; G09F9/00
- **cooperative:**

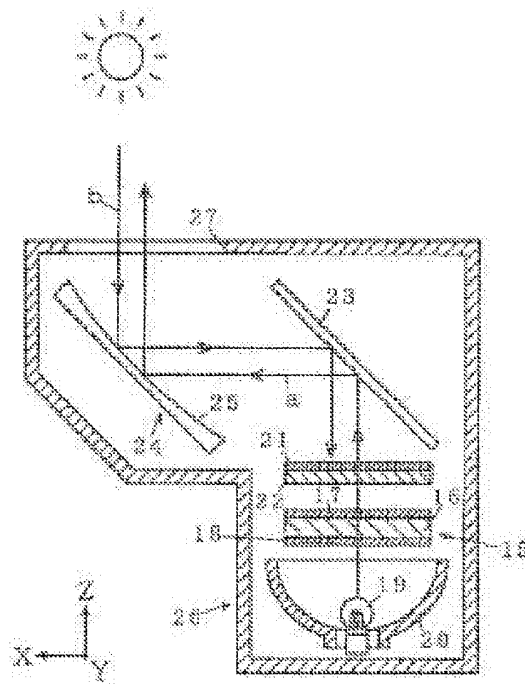
Application number: JP19980308014 19981029 Global Dossier

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Abstract of JP2000131682 (A)

PROBLEM TO BE SOLVED: To provide a liquid crystal display device suppressing a temp. rise of a liquid crystal cell and obtaining a proper contrast ratio. SOLUTION: A liquid crystal display element 15 is provided with a liquid crystal cell 16, a first front side polarizing member 17 arranged on the front of the liquid crystal 16 and a rear side polarizing member 18 arranged on the back of the liquid crystal cell 16. A second front side polarizing member 21 having a polarization direction of a nearly equal direction to the first front side polarizing member 17 and arranged on the front of the liquid crystal display element 15 is provided.



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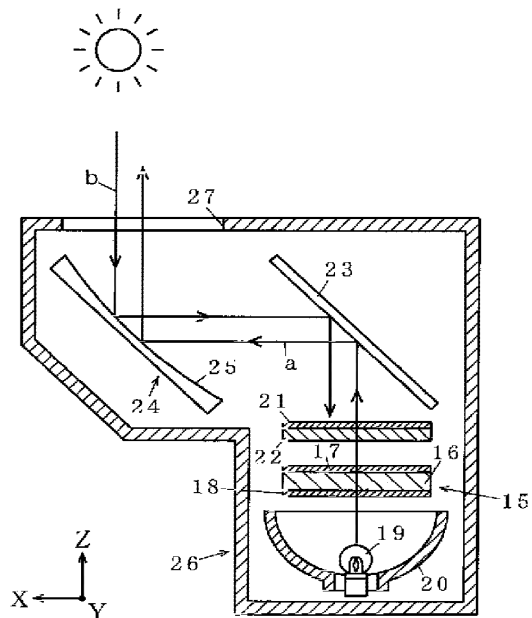
GG23 HH02

(54) 【発明の名称】 表示装置

(57) 【要約】

【課題】 液晶セルの温度上昇を抑制し適正なコントラスト比が得られる液晶表示装置を提供する。

【解決手段】 液晶表示素子 15 は、液晶セル 16 と、液晶セル 16 の前面に配設される第一の前側偏光部材 17 と、液晶セル 16 の後面に配設される後側偏光部材 18 とを有する。第一の前側偏光部材 17 と略同じ方向の偏光方向を有し液晶表示素子 15 の前方に配設される第二の前側偏光部材 21 を設ける。



【特許請求の範囲】

【請求項1】 一対の透光性基板に液晶を封入した液晶セルと前記液晶セルの前面に配設される第一の前側偏光部材と前記液晶セルの後面に配設される後側偏光部材とを有する液晶表示素子と、前記第一の前側偏光部材と略同じ方向の偏光方向を有し前記液晶表示素子の前方に配設される第二の前側偏光部材と、を有することを特徴とする表示装置。

【請求項2】 請求項1に記載の表示装置において、前記第二の前側偏光部材は反射型偏光フィルムであることを特徴とする表示装置。

【請求項3】 一対の透光性基板に液晶を封入した液晶セルと前記液晶セルの前面に配設される前側偏光部材と前記液晶セルの後面に配設される後側偏光部材とを有する液晶表示素子を有する表示装置であって、前記前側偏光部材は反射型偏光フィルムであることを特徴とする表示装置。

【請求項4】 一対の透光性基板に液晶を封入した液晶セルと前記液晶セルの前方に設けられる前側偏光部材と前記液晶セルの後方に設けられる後側偏光部材とを有する液晶表示素子を有する表示装置であって、前記前側偏光部材は前記液晶セルから所定間隔をあけて配置されることを特徴とする表示装置。

【請求項5】 請求項4に記載の表示装置において、前記前側偏光部材は反射型偏光フィルムであることを特徴とする表示装置。

【請求項6】 請求項4または請求項5に記載の表示装置において、前記液晶表示素子の後方に配設され前記液晶表示素子を照明する光源を有し、前記後側偏光部材は前記液晶セルから所定間隔をあけて配置されることを特徴とする表示装置。

【請求項7】 請求項1乃至請求項6の何れかに記載の表示装置において、前記液晶表示素子の表示像を拡大する光学部材を有することを特徴とする表示装置。

【請求項8】 請求項1乃至請求項7の何れかに記載の表示装置において、前記液晶表示素子は、赤(R)または緑(G)の画素よりも多数の青(B)の画素を有することを特徴とする表示装置。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、液晶表示素子を有する表示装置に関するものである。

【0002】

【従来の技術】従来より、図6及び図7に示すような車両用表示装置1がある。斯かる車両用表示装置1は、液晶表示素子2、光源3及びリフレクタ4をケース5に収容したものであり、車両のダッシュボード6に埋設されている。この車両用表示装置1はフロントガラス7に表示像aを投影し運転者8に虚像9を視認させるものであり、一般にヘッドアップディスプレイと称されている。

液晶表示素子2は透明電極膜を付けた一対の透光性基板に液晶を封入した液晶セル10の前後面に前側偏光板11、後側偏光板12を貼り合わせたものである。前側偏光板11の偏光方向(Y軸方向)と後側偏光板12の偏光方向(X軸方向)とは垂直になっている。液晶表示素子2は受光型表示素子であり、液晶表示素子2の後方に光源3及びこの光源3の光を反射させるリフレクタ4を設け液晶表示素子2を後方から照明し、良好な視認性を得るようにしている。

【0003】

【発明が解決しようとする課題】液晶セル10内の液晶の粘性は温度によって変化するため、適正なコントラスト比が得られるように駆動電圧を調整している。例えば、ケース5内に温度センサを取付けて、この温度センサの出力に基いて、液晶セル10の温度が高いときは駆動電圧を下げ、温度が低いときは駆動電圧を上げるように構成している。しかし、液晶セル10の温度が著しく上昇すると駆動電圧を調整しても所望のコントラスト比が得られない。ところが、ケース5の開口13から太陽光bが入射する場合があります。前側偏光板11が太陽光bを吸収して発熱しこの熱が液晶セル10に伝わり、液晶セル10の温度が過度に上昇してしまう虞があった。特に、表示像aを拡大する凸レンズ等の光学部材14が設けられた表示装置では、光学部材14により太陽光bが前側偏光板11の狭い範囲に集められるため温度上昇が著しい。本発明は、液晶セルの温度上昇を抑制し適正なコントラスト比が得られる表示装置を提供するものである。

【0004】

【課題を解決するための手段】本発明は、前記課題を解決するため、一対の透光性基板に液晶を封入した液晶セルと前記液晶セルの前面に配設される第一の前側偏光部材と前記液晶セルの後面に配設される後側偏光部材とを有する液晶表示素子と、前記第一の前側偏光部材と略同じ方向の偏光方向を有し前記液晶表示素子の前方に配設される第二の前側偏光部材と、を有するものである。

【0005】また、本発明は、前記第二の前側偏光部材は反射型偏光フィルムであるものである。

【0006】また、本発明は、一対の透光性基板に液晶を封入した液晶セルと前記液晶セルの前面に配設される前側偏光部材と前記液晶セルの後面に配設される後側偏光部材とを有する液晶表示素子を有する表示装置であって、前記前側偏光部材は反射型偏光フィルムであるものである。

【0007】また、本発明は、一対の透光性基板に液晶を封入した液晶セルと前記液晶セルの前方に設けられる前側偏光部材と前記液晶セルの後方に設けられる後側偏光部材とを有する液晶表示素子を有する表示装置であって、前記前側偏光部材は前記液晶セルから所定間隔をあけて配置されるものである。

【0008】また、本発明は、前記前側偏光部材は反射型偏光フィルムであるものである。

【0009】また、本発明は、前記液晶表示素子の後方に配設され前記液晶表示素子を照明する光源を有し、前記後側偏光部材は前記液晶セルから所定間隔をあけて配置されるものである。

【0010】また、本発明は、前記液晶表示素子の表示像を拡大する光学部材を有するものである。

【0011】また、本発明は、前記液晶表示素子は、赤（R）または緑（G）の画素よりも多数の青（B）の画素を有するものである。

【0012】

【発明の実施の形態】以下、本発明をヘッドアップディスプレイに適用した一実施の形態を添付の図面に基いて説明する。なお、図1、図3及び図4においては紙面と垂直な方向をY軸方向、紙面の横方向をX軸方向、紙面の縦方向をZ軸方向として説明する。図1及び図2は第一の実施の形態を示す図であり、この第一の実施の形態は請求項1、請求項2及び請求項7に対応する。

【0013】15は液晶表示素子であり、この液晶表示素子15は一对の透光性基板に液晶が封入された液晶セル16、前側偏光板17（第一の前側偏光部材）及び後側偏光板18（後側偏光部材）からなるものである。前側偏光板17の偏光方向はY軸方向となっており、後側偏光板18の偏光方向はX軸方向となっている。19はランプ（光源）であり、このランプ19は液晶表示素子15の後方に配設され液晶表示素子15を照明する。20はリフレクタであり、このリフレクタ20はランプ19が発する光を液晶表示素子15に反射させる。リフレクタ20はおわん形となっている。

【0014】21は反射型偏光フィルム（第二の前側偏光部材）である。この反射型偏光フィルム21は例えば商品名「HMF（Heat Management Filter）」（住友スリーエム株式会社製）からなるものである。反射型偏光フィルム21の偏光方向は前側偏光板17の偏光方向と同じ方向（Y軸方向）となっている。反射型偏光フィルム21はガラス基板22に貼着され、液晶表示素子15の前方に配設されている。

【0015】23は平面反射鏡であり、この平面反射鏡23は液晶表示素子15に対して略45度の角度で配置されており表示像aを後述する凹面反射鏡に反射させる。24は凹面反射鏡（光学部材）であり、この凹面反射鏡24は表示像aを車両のフロントガラス（図示しない）に向けて反射させる。凹面反射鏡24の反射面25は凹面となっており、表示像aを拡大することができる。26はケースであり、このケース26には表示像aを出射する開口27が形成されている。液晶表示素子15、ランプ19、リフレクタ20、反射型偏光フィルム21、平面反射鏡23及び凹面反射鏡24はケース26に収容される。

【0016】次に、図2を用いて反射型偏光フィルム21の作用を説明する。反射型偏光フィルム21はY軸方向の光を通過させ、X軸方向の光を反射させる。つまり、通常の偏光板は偏光方向（Y軸方向）と直交する方向（X軸方向）の光を吸収するが、反射型偏光フィルム21はX軸方向の光を反射することができる。従って、太陽が略真上にある時は太陽光bがケース26の開口27から入射し凹面反射鏡25及び平面反射鏡23に反射されて液晶表示素子15に照射されるが、太陽光bは反射型偏光フィルム21に吸収されることがない。反射型偏光フィルム21に反射された光は、平面反射鏡23及び凹面反射鏡25に反射され、開口27からケース26に射出される。

【0017】そして、反射型偏光フィルム21を通過した太陽光bは、Y軸方向の偏光であるので、前側偏光板17を通過し液晶セル16内で90度振じられてX軸方向の偏光となり、後側偏光板18も通過する。従って、太陽光bは各偏光板17、18に吸収されることがなく、液晶セル16の温度は上昇しない。一方、液晶表示素子15の前側偏光板17の偏光方向と反射型偏光フィルム21の偏光方向とは同じ方向（Y軸方向）となっているため、表示像aは反射型偏光フィルム21を通過できる。

【0018】なお、第二の前側偏光部材は通常の偏光板であっても良いが、X軸方向の光を吸収し発熱するため、この熱によりケース26内の空気が暖められて液晶セル16の温度が上がるので、第二の前側偏光部材は反射型偏光フィルム21が望ましい。

【0019】図3は第二の実施の形態を示す図であり、この第二の実施の形態は請求項3及び請求項7に対応する。第一の実施の形態と同一の箇所には同一の符号を付しその詳細な説明を省略する。

【0020】液晶表示素子28は、液晶セル16の後面に後側偏光板18を貼着し前面に反射型偏光フィルム21を貼着したものである。29は凸レンズ（光学部材）であり、この凸レンズ29は表示像aを拡大させることができる。太陽が略真上にある時は太陽光bがケース26の開口27から入射し、液晶表示素子28に照射されるが、第一の実施の形態と同様に反射型偏光フィルム21の作用により、太陽光bは各偏光板17、18に吸収されることがなく、液晶セル16の温度は上昇しない。反射型偏光フィルム21に反射された光は、開口27からケース26に射出される。

【0021】図4は第三の実施の形態を示す図であり、この第三の実施の形態は請求項4、請求項5、請求項6及び請求項7に対応する。第一、第二の実施の形態と同一の箇所には同一の符号を付しその詳細な説明を省略する。

【0022】液晶表示素子30は、反射型偏光フィルム21、ガラス基板22、液晶セル16、後側偏光板18

及びガラス基板31からなるものである。後側偏光板18はガラス基板30に貼着され、液晶セル16から所定間隔d1をあけて配置されている。反射型偏光フィルム21はガラス基板22に貼着され、液晶セル16から所定間隔d2をあけて配置されている。太陽が略真上にある時は太陽光bがケース26の開口27から入射し、液晶表示素子30に照射されるが、第一の実施の形態と同様に反射型偏光フィルム21の作用により、太陽光bは反射型偏光フィルム21、後側偏光板18に吸収されることがなく、液晶セル16の温度は上昇しない。

【0023】後側偏光板18の偏光方向はX軸方向であり、X軸方向の光を通過させY軸方向の光を吸収する。ランプ19の光はX軸及びY軸方向の光を含んでいるため、後側偏光板18はY軸方向の光を吸収し発熱するため、この熱によりケース26内の空気が暖められるが、後側偏光板18は液晶セル16から所定間隔d1をあけて配置されており液晶セル16に接していないため、液晶セル16の温度上昇は僅かである。

【0024】なお、前側偏光部材は通常の偏光板であっても良いが、X軸方向の光を吸収し発熱するため、この熱によりケース26内の空気が暖められて液晶セル16の温度が上がるので、前側偏光部材は反射型偏光フィルム21が望ましい。

【0025】以上述べた各実施の形態によれば、太陽光bに因る液晶セル16の温度上昇を緩和することができ、液晶表示素子15、28、30の適正なコントラストを得ることができる。特に、表示像aを拡大するため凹面反射鏡24または凸レンズ29等の光学部材を設けた表示装置において、太陽光bが光学部材により集光されるため、本発明を適用することが効果的である。なお、本明細書において、「前方」とは表示像aが進む向きを意味する。前側偏光部材は液晶表示素子15の前方に配置すれば良く、例えば第一の実施の形態において、反射型偏光フィルム21（第二の前側偏光部材）を平面反射鏡23と凹面反射鏡24との間に配置しても良い。

【0026】また、一般にランプ19の光は青色の光が弱いため、図5に示すように、液晶表示素子15、28、30には、赤（R）または緑（G）の画素よりも2倍の青（B）の画素を設けることが望ましい。

【0027】

【発明の効果】本発明は、一対の透光性基板に液晶を封

入した液晶セルと前記液晶セルの前面に配設される第一の前側偏光部材と前記液晶セルの後面に配設される後側偏光部材とを有する液晶表示素子と、前記第一の前側偏光部材と略同じ方向の偏光方向を有し前記液晶表示素子の前方に配設される第二の前側偏光部材と、を有するものであり、液晶セルの温度上昇を抑制し適正なコントラスト比を得ることができる。

【0028】また、本発明は、一対の透光性基板に液晶を封入した液晶セルと前記液晶セルの前面に配設される前側偏光部材と前記液晶セルの後面に配設される後側偏光部材とを有する液晶表示素子を有する表示装置であって、前記前側偏光部材は反射型偏光フィルムであるものであり、液晶セルの温度上昇を抑制し適正なコントラスト比を得ることができる。

【0029】また、本発明は、一対の透光性基板に液晶を封入した液晶セルと前記液晶セルの前方に設けられる前側偏光部材と前記液晶セルの後方に設けられる後側偏光部材とを有する液晶表示素子を有する表示装置であって、前記前側偏光部材は前記液晶セルから所定間隔をあけて配置されるものであり、液晶セルの温度上昇を抑制し適正なコントラスト比を得ることができる。

【図面の簡単な説明】

【図1】本発明の第一の実施の形態を示す断面図。

【図2】同上第一の実施の形態を示す要部斜視図。

【図3】本発明の第二の実施の形態を示す断面図。

【図4】本発明の第三の実施の形態を示す断面図。

【図5】本発明の液晶表示素子の画素の説明図。

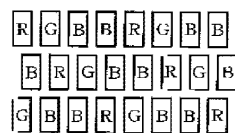
【図6】従来例を示す側面図。

【図7】同上従来例を示す断面図。

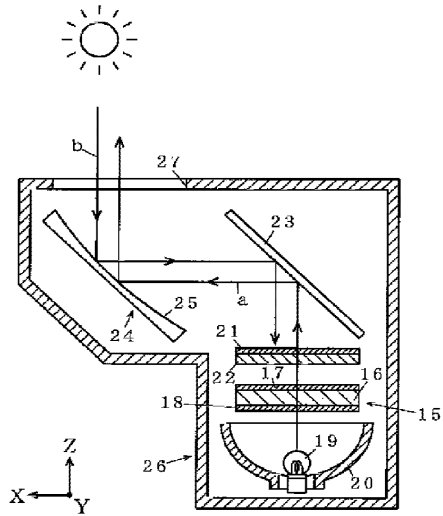
【符号の説明】

- 15 液晶表示素子
- 16 液晶セル
- 17 前側偏光板（第一の前側偏光部材）
- 18 後側偏光板（後側偏光部材）
- 19 ランプ（光源）
- 21 反射型偏光フィルム（第二の前側偏光部材）
- 24 凹面反射鏡（光学部材）
- 28 液晶表示素子
- 29 凸レンズ（光学部材）
- a 表示像

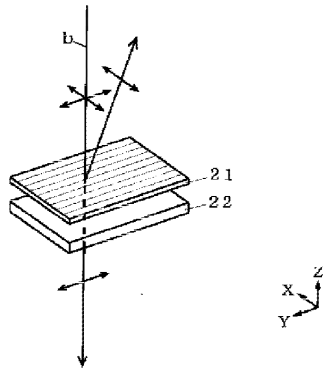
【図5】



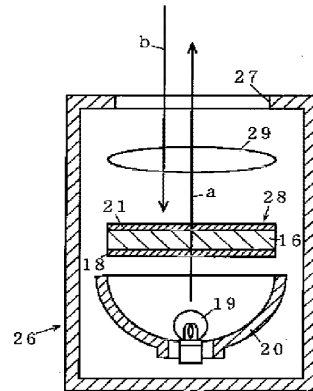
【図1】



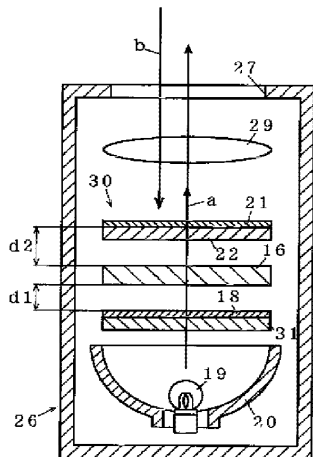
【図2】



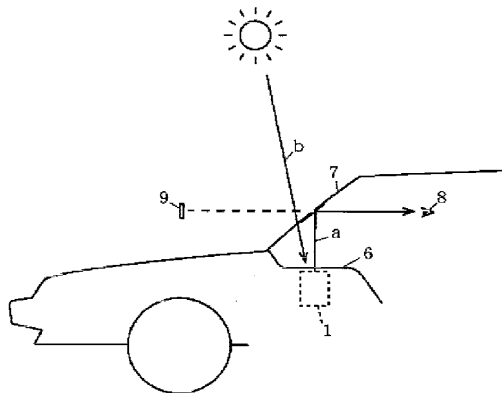
【図3】



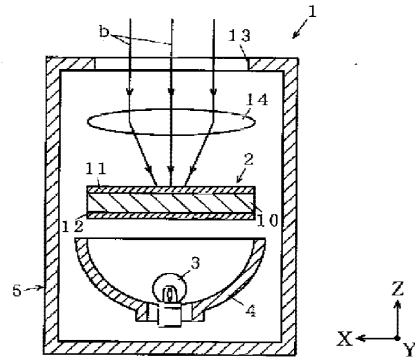
【図4】



【図6】



【図7】



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IMAGE DISPLAY DEVICE

Inventor(s): NOTO ATSUSHI ± (NOTO ATSUSHI)

Applicant(s): FUJITSU GENERAL LTD ± (FUJITSU GENERAL LTD)

Classification: - **international:** *H04N5/64; H05K7/20*; (IPC1-7): H04N5/64; H05K7/20
- **cooperative:**

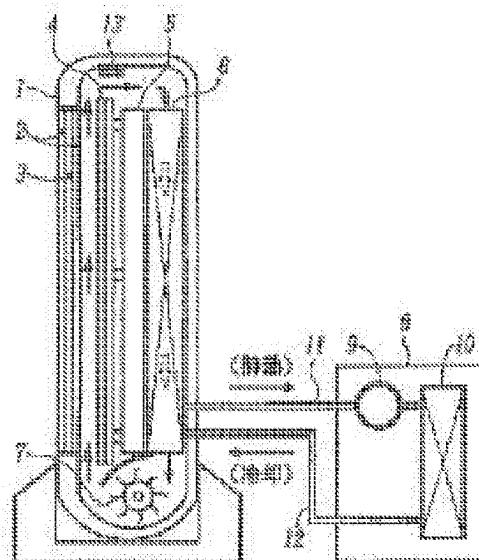
Application number: JP19960124236 19960520 Global Dossier

Priority number(s): JP19960124236 19960520

Abstract of JPH09307257 (A)

PROBLEM TO BE SOLVED: To prevent the leaking of an unusual sound caused by the plasma discharge of a PDP at low voltage to the outside of a housing, to suppress temperature rise by cooling the PDP, and to exhibit full performance.

SOLUTION: A housing 1 is formed in required film thickness of synthetic resin, etc., the front of the housing 1 is formed by double reinforced glass 2, a void 3 is provided, and the dew concentration generated by the cooling of the housing is prevented. Ventilating space is provided on the front side of the PDP 4, refrigeration cycle cooling unit 6 is provided behind a circuit board, and a ventilating fan 7 is provided on the lower part. The cooling unit is connected to a heat dissipating unit 8 by two refrigerant pipes 11 and 12, the heated refrigerant is compressed by a compressor 9, heat is radiated by a heat radiator 10, and cooled refrigerant is sent to the cooler by a refrigerant pipe 12. The air cooled by the cooling unit is circulated in the housing by an air blasting fan as shown by the arrows, and the PDP and the circuit board are cooled.



A temperature sensor 13 is provided in the housing, and the refrigerant cycle and the air blasting fan are operated when air is in the temperature higher than required.

(19) 日本国特許庁 (J P)

(12) 公開特許公報 (A)

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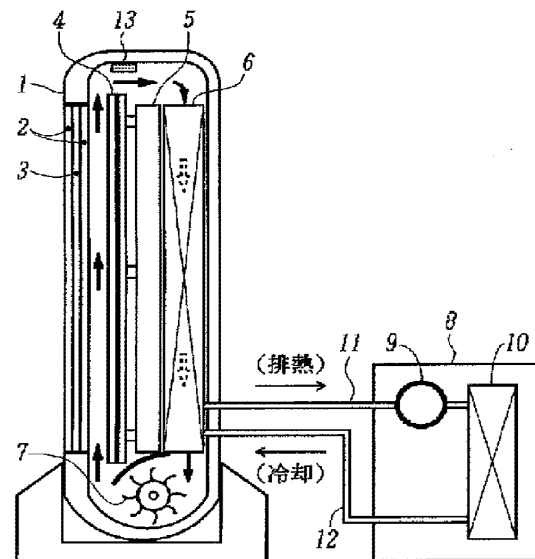
通ゼネラル内

(54) 【発明の名称】 映像表示装置

(57) 【要約】

【課題】 低圧下でのPDPのプラズマ放電に起因する異音の筐体外への漏出を防止し、PDPを冷却し温度上昇を抑え、性能をフルに発揮させる。

【解決手段】 筐体1は合成樹脂等で所要の肉厚に形成し、前面は二重の強化ガラス2で構成し、空隙3を設け、筐体内の冷却に伴う結露を防止する。PDP4の前面側に通風空間を設け、背面の回路基板5の背後に冷凍サイクルの冷却器6を配設し、下方に送風ファン7を設ける。冷却器は2本の冷媒配管11、12で排熱ユニット8に接続し、コンプレッサ9で冷却器よりの暖められた冷媒を圧縮し、放熱器10で放熱させ、冷えた冷媒を冷媒配管12で冷却器に送る。冷却器で冷却された空気を送風ファン7で筐体内を矢印のように循環させ、PDPおよび回路基板等を冷却する。筐体内に温度センサ13を設け、所要温度以上の場合に冷凍サイクルおよび送風ファンを運転する。



【特許請求の範囲】

【請求項1】 密閉された筐体内に、プラズマディスプレイパネルと、冷却器と放熱器とで構成される冷凍サイクルの冷却器と、送風ファンとを配設し、前記冷凍サイクルの放熱器を筐体外に配設し、前記冷却器による冷気にてプラズマディスプレイパネルを冷却するようにした映像表示装置。

【請求項2】 前記冷却器をプラズマディスプレイパネルの背面側に配設し、前記送風ファンを冷却器の下方に配設し、前記筐体とプラズマディスプレイパネルの前面との間に通風空間を設け、送風ファンの回転により、冷却器で冷却された空気が前記通風空間の下端に向けて送風され、通風空間を通った空気が通風空間の上端より冷却器に向かう循環経路を形成するようにした請求項1記載の映像表示装置。

【請求項3】 前記筐体は、断熱性を有する合成樹脂材で形成すると共に、プラズマディスプレイパネルの映像表示面に対向する部分を強化ガラスの二重構造とし、強化ガラス間に空隙を設け、筐体内の冷却によるガラス面への結露を防止するようにした請求項1または請求項2記載の映像表示装置。

【請求項4】 前記筐体内に温度センサを配設し、筐体内の温度が所要温度以上の場合に前記冷凍サイクルおよび送風ファンの運転を行うようにした請求項1、請求項2または請求項3記載の映像表示装置。

【請求項5】 密閉された筐体内にプラズマディスプレイパネルおよび送風ファンを配設すると共に、筐体外に冷凍装置を付設し、筐体および冷凍装置の間を二本の通風管で連結し、一方の通風管で冷凍装置より冷却された空気を筐体内に送り、前記送風ファンにより筐体内を循環させ、他方の通風管で筐体内で温められた空気が冷却装置に戻されるようにし、プラズマディスプレイパネルを冷却するようにした映像表示装置。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明はプラズマディスプレイパネル（PDP）を用いた映像表示装置に係り、冷却装置を付設して筐体内を冷却し、PDPの性能低下を抑制し、輝度・コントラストを改善するものに関する。

【0002】

【従来の技術】PDPは同一画面サイズの陰極線管に比べて奥行きが薄いので、駆動回路等を搭載した回路基板をPDPの背面に取付けることにより筐体の奥行きを大幅に短縮できる。しかし、PDPはプラズマ放電で発熱し、この熱でPDP自体の温度が上昇し、同時に回路基板が暖められる。PDPは、温度上昇により蛍光体の発光効率が下り、輝度が低下し、温度上昇を抑えるべく点灯時間を制限すればさらに輝度が低下するという問題があり、また、回路基板の温度上昇で駆動回路部品の信頼性が低下するため、温度定格の余裕のある部品を使用し

なければならぬという問題がある。

【0003】このため、PDPを用いた映像表示装置ではPDPの放熱に重きを置き、例えば、図2に示す如く、PDP4の背面の回路基板5の背後に軸流ファン21等を設け、筐体22の底部等から外気を吸入し、PDP4と回路基板5との間、あるいは回路基板5の背後を通し、筐体背面の通風孔23から筐体外に排出し、PDP4および回路基板5を冷却するようにしている。なお、PDP4の前面には外光の反射防止等のため光学フィルタ24を配設するので、この光学フィルタ24を熱伝導のよい材料を使用すれば有効な放熱手段となるが、人の手等が触れた場合に熱く感じないようにする必要があり、このような理由もあって光学フィルタ24を熱伝導のよくないプラスチック材で構成しているのが現状であり、光学フィルタ24による放熱効果は期待できない。

【0004】PDP4は、2枚のガラス基板で密閉された空間にキセノンガス等を封入し、電極間の放電でキセノンガス等の分子を励起し、紫外線を発生させ、この紫外線で内部に塗布されている蛍光物質を励起し、可視光領域の光を発光するものであるが、この放電（プラズマ放電）によりキセノンガス等の体積が膨張し、ガラス基板が振動し、異音を発生する。ガラス基板間の密閉空間の気圧は略数十分の1気圧程度であり、低地では2枚のガラス基板が大気圧により押圧されるので振動が抑えられ、異音はさほど気にならないレベルであるが、PDPを気圧の低い状態、例えば、飛行中の航空機内あるいは高地等で動作させた場合、ガラス基板外からの押圧力が相対的に低下するためガラス基板は振動しやすい状態となり、異音のレベルが高くなる。

【0005】

【発明が解決しようとする課題】本発明はこのような点に鑑み、映像表示装置の筐体を密閉式とし、異音の漏出レベルを低減させ、筐体内に冷凍サイクルの冷却器および送風ファンを設け、冷凍サイクルの放熱器を筐体外に配設し、冷却器で冷却された空気を送風ファンにより筐体内を循環させ、PDPを冷却し、PDPの性能をフルに発揮させるようにすることにある。

【0006】

【課題を解決するための手段】本発明は上述の課題を解決するため、密閉された筐体内に、PDPと、冷却器と放熱器とで構成される冷凍サイクルの冷却器と、送風ファンとを配設し、前記冷凍サイクルの放熱器を筐体外に配設し、前記冷却器による冷気にてPDPを冷却するようにした映像表示装置を提供するものである。

【0007】

【発明の実施の形態】本発明による映像表示装置では、筐体を断熱性を有する合成樹脂材で密閉構造に形成し、内部にPDPと冷却器と送風ファンとを配設し、この冷却器とで冷凍サイクルを構成する放熱器を筐体外に配設し、冷却器はPDPの背面側に配置し、送風ファンを冷

却器の下方に配置し、筐体前面のPDPの映像表示面に
対向する部分を強化ガラスの二重構造とし、ガラス部分
を含む筐体前部とPDPとの間に通風空間を設け、送風
ファンの回転により、冷却器で冷却された空気が前記通
風空間の下端に向けて送風され、通風空間を通った空気
が通風空間の上端より冷却器に向かう循環経路を形成す
るようにし、筐体内に温度センサを設け、筐体内の温度
が所要温度以上に上昇した場合、冷凍サイクルおよび送
風ファンを運転し、PDPの温度を下げ、PDPを最良
の状態で作動させるようにする。

【0008】

【実施例】以下、図面に基づいて本発明による映像表示
装置の実施例を詳細に説明する。図1は本発明による映
像表示装置の一実施例の要部側断面図である。図におい
て1は筐体で、合成樹脂材等で形成する。2は強化ガラ
スで、二重構造とし、中間に空隙3を設ける。4はPDP、5はPDP4の駆動回路等を配設した回路基板で、
PDP4の背面に取付けられる。6は冷却器、7は送風
ファン、8は排熱ユニット、排熱ユニット8内の9はコン
プレッサ、10は放熱器、11および12は冷媒配管で、こ
れら冷却器6、コンプレッサ9、放熱器10、冷媒配管11
および12により冷凍サイクルを構成する。13は温度セン
サで、筐体1内の温度を検出する。

【0009】次に、本発明による映像表示装置の動作を
説明する。PDP4は映像信号に基づく回路基板5から
の信号で駆動され、プラズマ放電によりガラス基板内に
封入されたキセノンガス等の分子を励起し、紫外線を発
生させ、内部に塗布されている蛍光物質を励起し、可視
光領域の光を発光し、映像を表示する。筐体1は合成樹
脂材により所要の肉厚に形成し、前面部に強化ガラス2
(二重構造)を用いて密閉構造とし、PDP4等の保持
に必要な強度を得ると同時に断熱性を持たせるようにす
る。強化ガラス2を用いるのは、外部から強い衝撃が加
わった場合にガラスが破損し破片が飛散しないようにす
るためであり、この部分(強化ガラス)にプラスチック
等を用いないのは、例えば、航空機の機内、あるいは標
高の高い場所等に設置する場合に外気圧と筐体内の気圧
の差で変形する(膨らむ)ことがないようにするためで
ある。なお、強化ガラス2を2枚用いて空隙3を作るの
は、筐体1内の冷却により外気との温度差でガラスに結
露を生じないようにするためである。

【0010】PDP4は、筐体1および強化ガラス2と
の間に適宜の幅の通風空間を設けて取付ける。冷却器6
は回路基板5の背後に配設し、冷媒配管11および12で排
熱ユニット8と接続する。そして、排熱ユニット8内の
コンプレッサ9で冷媒を高圧高圧に圧縮し、放熱器10に
送り、外気との熱交換(排熱)により凝縮液化させ、冷
媒配管12で筐体1内に送り、図示しないキャピラリチュ
ーブ等で減圧した後、冷却器6により筐体1内の空気と
接交換(吸熱)を行い、筐体1内の空気を冷却する。熱

交換により低圧ガスとなった冷媒は冷媒配管11によりコ
ンプレッサ9に戻る。冷却器6で冷却された空気は送風
ファン7により矢印の向きに送風され、PDP4の前面
の通風空間を通り、PDP4の発熱で暖められ(PDP
4の温度を下げ)、PDP4の上端を通り冷却器6に入
る。そして、再び冷却器6で冷却され、送風ファン7に
より送風されるという循環経路を形成する。なお、送風
ファン7は、例えば、クロスフローファンを使用し、P
DP4の全幅に満遍なく冷風を送るようにする。

【0011】筐体1内の天井部等に温度センサ13を取付
け、筐体1内の温度を検出し、所要の温度以上になった
場合に前記冷凍サイクルおよび送風ファン7を運転する
ようにする。なお、上記では、冷凍サイクルは冷却器
6、コンプレッサ9および放熱器10等で構成する冷媒圧
縮式の例で説明したが、液体アンモニア等を高圧下で加
熱し、冷却器に送り蒸発させ、この蒸発熱で筐体1内の
空気を冷却する吸収式冷凍サイクルで構成してもよい。
この方式はコンプレッサ9を用いないのでコンプレッサ
の運転による騒音対策を要しない利点がある。

【0012】上記では、冷凍サイクルの冷却器を筐体内
に配設する例で説明したが、コンプレッサ、放熱器と共
に冷却器も筐体外に設置し、この冷却装置と筐体との間
を2本の通風管で接続し、一方の通風管で冷却装置より
筐体内に冷気を送り、この冷気を送風ファンにより筐体
内で循環させ、暖められた空気を他方の通風管で冷却装
置に戻すようにしてもよい。

【0013】上述のように、また、冷凍サイクルを設け
て筐体内を冷却することによりPDP4の温度上昇が抑
制され、蛍光体の発光効率が低下しないので高輝度の映
像を表示でき、回路基板の温度上昇が抑制されるので駆
動回路等の部品の信頼性が向上する。また、筐体1を密
閉構造とすることにより、PDP4のプラズマ放電に伴
って発生する異音の筐体外への漏出レベルが低減され、
平地に比べて気圧の低い状態、例えば、飛行中の航空機
の中あるいは高地に設置した場合でもPDPの異音は殆
ど気にならないものとなる。

【0014】

【発明の効果】以上に説明したように、本発明による映
像表示装置によれば、冷凍サイクルを設けて筐体内を冷
却するので、PDPの温度上昇が抑制され、蛍光体の発
光効率が低下しないので高輝度の映像を表示でき、回路
基板の温度上昇が抑制されるので駆動回路等の部品の信
頼性が向上する。また、筐体を密閉構造にしたのでPDP
のプラズマ放電に起因する異音の筐体外への漏出レベ
ルが低減され、平地に比べて気圧の低い状態、例えば、
飛行中の航空機の中あるいは高地に設置した場合でもP
DPの異音は殆ど気にならないものとなる。

【図面の簡単な説明】

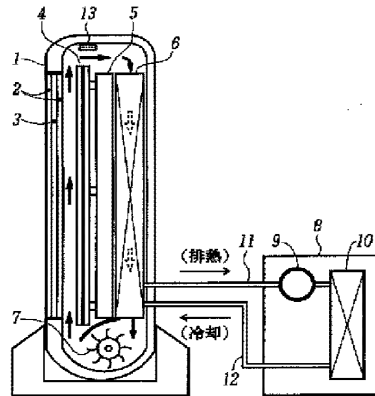
【図1】本発明による映像表示装置の一実施例の要部側
断面図である。

【図2】従来の映像表示装置の一例の要部側断面図である。

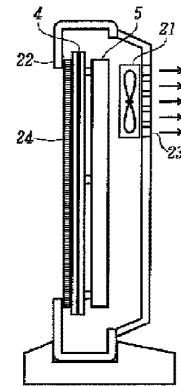
【符号の説明】

- | | |
|----------------------|--------------------|
| 1 筐体 | 5 回路基板 |
| 2 強化二重ガラス | 6 冷却器 |
| 4 プラズマディスプレイパネル（PDP） | 7 送風ファン（クロスフローファン） |
| | 9 コンプレッサ |
| | 10 放熱器 |

【図1】



【図2】



Disclaimer:

This English translation is produced by machine translation and may contain errors. The JIPO, the INPIT, and those who drafted this document in the original language are not responsible for the result of this translation.

Notes:

1. Untranslatable words are replaced with asterisks ("***").
2. Texts in the figures are not translated and shown as it is.

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Examiner: Last updated 01/15/2012 / Priority: 1. Mechanical engineering

CLAIM + DETAILED DESCRIPTION

[Claim(s)]

[Claim 1]A condensator of a refrigerating cycle which comprises a plasma display panel, and a condensator and a radiator in a sealed housing, A display unit which allocates a blower fan, allocates a radiator of the aforementioned refrigerating cycle out of a housing, and cooled a plasma display panel in cold by the aforementioned condensator.

[Claim 2]Allocate the aforementioned condensator in the tooth-back side of a plasma display panel, allocate the aforementioned blower fan under the condensator, provide ventilation space between the aforementioned housing and a front face of a plasma display panel, and with rotation of a blower fan, The display unit according to claim 1 with which air for which air cooled with a condensator was ventilated towards a lower end of the aforementioned ventilation space, and which passed along ventilation space formed a circulating route which faces to a condensator from an upper bed of ventilation space.

[Claim 3]Form the aforementioned housing with a synthetic resin material which has adiathermancy, and it makes a portion which counters a graphic display side of a plasma display panel dual structure of tempered glass, The display unit according to claim 1 or 2 which provides a cavity between tempered glass and prevented dew condensation to a glass surface by cooling in a housing.

[Claim 4]Claim 1 which allocated a temperature sensor in the aforementioned housing, and was made to perform operation of the aforementioned refrigerating cycle and a blower fan when temperature in a housing was more than required temperature, the display unit according to claim 2 or 3.

[Claim 5]Allocate a plasma display panel and a blower fan in a sealed housing, and. Attach a refrigerating plant out of a housing and between a housing and refrigerating plants is connected with two ventilation pipes, A display unit which air cooled from a refrigerating plant with one ventilation pipe is sent in a housing, inside of a housing is circulated with the aforementioned blower fan, and air which was able to be warmed within a housing with a ventilation pipe of another side is returned to a cooling system, and cooled a plasma display panel.

[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention relates to the display unit which used the plasma display panel (PDP), attaches a cooling system, cools the inside of a case, controls the degradation of PDP, and relates to what improves brightness contrast.

[0002]

[Description of the Prior Art]Since depth is thin compared with the cathode-ray tube of the same screen size, PDP can shorten the depth of a case substantially by attaching to the tooth back of PDP the circuit board in which the drive circuit etc. were carried. However, PDP generates heat by plasma discharge, the temperature of the PDP itself rises with this heat, and a circuit board is warmed simultaneously. Since the luminous efficacy of a fluorescent substance gets down by a rise in heat, luminosity falls, PDP has the problem that luminosity falls further if lighting times are restricted in order to suppress a rise in heat, and the reliability of a driving circuit part article falls by the rise in heat of a circuit board, There is a problem that the generous parts of temperature rating must be used.

[0003]For this reason, in the display unit using PDP, weight is put on heat dissipation of PDP, For example, as shown in drawing 2, axial fan 21 grade is provided behind the circuit board 5 of the tooth back of PDP4, The open air is inhaled from the pars basilaris ossis occipitalis of the case 22, etc., and he discharges between PDP4 and the circuit boards 5 or the back of the circuit board 5 from the ventilating hole 23 on through and the tooth back of a housing out of a housing, and is trying to cool PDP4 and the circuit board 5. If a good material of heat conduction is used, will become an effective radiation means, but since the light filter 24 is allocated in the front face of PDP4 for the antireflection of outdoor daylight, etc. [this light filter 24] The actual condition is it being necessary to make it not feel hotly, when people's hand etc. touch, and there being such a Reason, and constituting the light filter 24 from a plastic material which is not good as for heat conduction, and the radiating effect by the light filter 24 cannot be expected.

[0004]Although PDP4 encloses xenon gas etc. with space sealed with two glass substrates, molecules, such as xenon gas, are excited by inter-electrode electric discharge, ultraviolet rays are generated, the fluorescent substance applied to the inside by these ultraviolet rays is excited and light is emitted in the light of a light range, Volume, such as xenon gas, expands by this electric discharge (plasma discharge), a glass substrate vibrates, and an allophone is generated. The atmospheric pressure of a closed space between glass substrates is about 1 atmosphere of abbreviated several 10 minutes, since two glass substrates are pressed by the atmospheric pressure, vibration is suppressed and an allophone is a level which is not worried so much in lowlands, but. When operating PDP at the high ground within the state, for example, the airplane under flight, where an atmospheric pressure is low, etc., since the thrust from the outside of a glass substrate declines relatively, a glass substrate will be in the state of being easy to vibrate, and the level of an allophone will become high.

[0005]

[Problem to be solved by the invention]This invention makes the housing of a display unit a direct vent type in view of such a point, and the break-through level of an allophone is reduced, The condensator and blower fan of a refrigerating cycle are provided in a housing, the radiator of a refrigerating cycle is allocated out of a housing, the inside of a housing is circulated for the air cooled with the condensator with a blower fan, PDP is cooled, and it is in making it make full demonstrate the engine performance of PDP.

[0006]

[Means for solving problem]In order that this invention may solve above-mentioned problem, in the sealed housing PDP, The condensator of the refrigerating cycle which comprises a condensator and a radiator, and a blower fan are allocated, the radiator of the aforementioned refrigerating cycle is allocated out of a housing, and the display unit which cooled PDP in the cold by the aforementioned condensator is provided.

[0007]

[Mode for carrying out the invention]In the display unit by this invention, a housing is formed in sealed structure with the synthetic resin material which has adithermancy, Allocate PDP, a condensator, and a blower fan in an inside, and the radiator which constitutes a refrigerating cycle from this condensator is allocated out of a housing, Arrange a condensator to the tooth-back side of PDP, and it arranges a blower fan under the condensator, Make into the dual structure of tempered glass the portion which counters the graphic display side of PDP of the front face of a housing, provide ventilation space between the housing anterior part and PDP containing a square, and with rotation of a blower fan, The air cooled with the condensator is ventilated towards the lower end of the aforementioned ventilation space, and air passing through ventilation space forms the circulating route which faces to a condensator from the upper bed of ventilation space, When a temperature sensor is formed in a housing and the temperature in a housing rises more than required temperature, a refrigerating cycle and a blower fan are operated, the temperature of PDP is lowered, and it is made to operate PDP in the best state.

[0008]

[Working example]Hereafter, based on Drawings, the working example of the display unit by this invention is described in detail. Drawing 1 is an important section sectional side elevation of one working example of the display unit by this invention. In a figure, 1 is a housing and is formed with a synthetic resin material etc. 2 is tempered glass, considers it as dual structure and forms the cavity 3 in the middle. It is the circuit board in which 4 allocated PDP in and five allocated the drive circuit of PDP4, etc., and is attached to the tooth back of PDP4. A condensator and 7, nine in an exhaust heat unit and the exhaust heat unit 8, 6 is refrigerant piping and, as for a compressor and 10, a blower fan and 8 constitute [a radiator, and 11 and 12] a refrigerating cycle by these condensators 6, the compressor 9, the radiator 10, and the refrigerant piping 11 and 12. 13 is a temperature sensor and detects the temperature in the housing 1.

[0009]Next, operation of the display unit by this invention is explained. PDP4 is driven by the signal from the circuit board 5 based on a video signal, it excites molecules, such as xenon gas enclosed by plasma discharge in the glass substrate, generates ultraviolet rays, excites the fluorescent substance applied to the inside, emits light in the light of a light range, and displays an image. The housing 1 is formed in necessary wall thickness with a synthetic resin material, uses the tempered glass 2 (dual structure) for the front part, makes it sealed structure, and it gives adithermancy at the same time it obtains intensity required for maintenance of PDP4 grade. The tempered glass 2 is used in order to damage glass and to keep a fragment from dispersing, when a strong shock is added from the outside.

A plastic etc. are not used for this portion (tempered glass) in order to make it there be nothing that is transformed with a difference of outdoor air pressure and an atmospheric pressure in a housing (it swells), when installing in the inside of a plane of an airplane, or a place where altitude is high for example. The cavity 3 is made using the tempered glass 2 two sheets in order not to produce dew condensation on glass in a temperature gradient with the open air by cooling in the housing 1.

[0010]PDP4 provides and attaches the ventilation space of proper width between the housing 1 and the tempered glass 2. The condensator 6 is allocated behind the circuit board 5, and is connected with the exhaust heat unit 8 by the refrigerant piping 11 and 12. And a refrigerant is compressed into high temperature high pressure by the compressor 9 in the exhaust heat unit 8, After sending to the radiator 10, making it condensate-ize by heat exchange (exhaust heat) with the open air, sending in the housing 1 by the refrigerant piping 12 and decompressing with the capillary tube etc. which are not illustrated, the condensator 6 performs air and ***** (endoergic) in the housing 1, and air in the housing 1 is cooled. The refrigerant which became low pressure gas by heat exchange returns to the compressor 9 by the refrigerant piping 11. The air cooled with the condensator 6 is ventilated by direction of an arrow head with the blower fan 7, passes along the ventilation space of the front face of PDP4, is warmed by generation of heat of PDP4 (it is lowering about the temperature of PDP4), and goes into the condensator 6 through the upper bed of PDP4. And it is again cooled with the condensator 6 and the circulating route of being ventilated with the blower fan 7 is formed. A cross flow fan is used for the blower fan 7, and it sends a cold blast to the overall width of PDP4 uniformly, for example.

[0011]The temperature sensor 13 is attached to the ceiling part in the housing 1, etc., the temperature in the housing 1 is detected, and when it becomes more than a necessary temperature, the aforementioned refrigerating cycle and the blower fan 7 are operated. Above, although the example of the refrigerant compression equation constituted from the condensator 6, the compressor 9, and radiator 10 grade explained the refrigerating cycle, it heats liquid ammonia etc. under high voltage, is sent to a condensator, evaporates it, and may consist of absorption type refrigeration cycles which cool air in the housing 1 with this evaporation heat. Since this system does not use the compressor 9, it has an advantage which does not require the measure against noise by operation of a compressor.

[0012]Although the example allocated in a housing explained the condensator of the refrigerating cycle above, Also install a condensator out of a housing with a compressor and a radiator, and between this cooling system and housing is connected with two ventilation pipes, Cold is sent in a housing from a cooling system with one ventilation pipe, this cold is circulated within a housing with a blower fan, and it may be made to return the warmed air to a cooling system with the ventilation pipe of another side.

[0013]As mentioned above, since the rise in heat of PDP4 is controlled and the luminous efficacy of a fluorescent substance does not fall by providing a refrigerating cycle and cooling the inside of a housing, a high-intensity image can be displayed, and since the rise in heat of a circuit board is controlled, the reliability of parts, such as a drive circuit, improves. By making the housing 1 into sealed structure, the break-through level to the outside of the housing of an allophone by which it is generated in connection with the plasma discharge of PDP4 is reduced, and even when it installs in the inside of the state, for example, the airplane under flight, where an atmospheric pressure is low, or high ground, compared with the flat ground, the allophone of PDP is hardly worried.

[0014]

[Effect of the Invention]Since according to the display unit by this invention a refrigerating cycle is provided and the inside of a housing is cooled as explained above, The rise in heat of PDP is controlled, since the luminous efficacy of a fluorescent substance does not fall, a high-intensity image can be displayed, and since the rise in heat of a circuit board is controlled, the reliability of parts, such as a drive circuit, improves. Since the housing was made into sealed structure, even when the break-through level to the outside of the housing of the allophone resulting from the plasma discharge of PDP is reduced and it installs in the inside of the state, for example, the airplane under flight, where an atmospheric pressure is low, or high ground, compared with the flat ground, the allophone of PDP is hardly worried.

[Translation done.]

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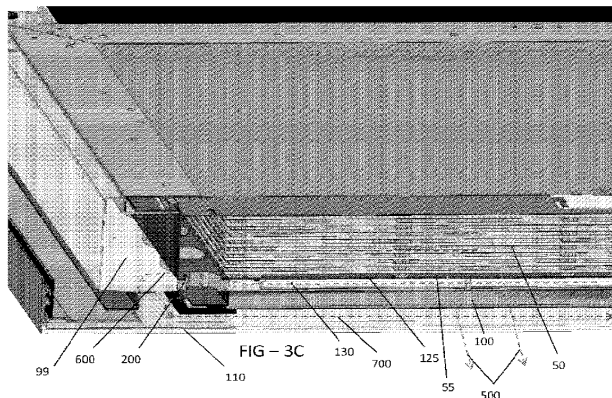
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(54) Title: COOLING SYSTEM FOR AN ELECTRONIC DISPLAY



(57) Abstract: The exemplary embodiments herein provide a system for cooling an electronic display where a plate is positioned behind the electronic display, the space between the plate and the electronic display defining a first channel. A first fan is preferably positioned to force a first flow of external air through the first channel. A heat exchanger is preferably positioned adjacent to the plate where the space between the heat exchanger and the plate defines a second channel; and a second fan is preferably positioned to force a second flow of external air through the second channel and through the heat exchanger. A continuous heat sink may be placed within the first channel. Pass through gaskets may be used to ensure the external air may cross paths with the circulating gas without permitted the external air and circulating gas to mix.

WO 2014/150036 A1

COOLING SYSTEM FOR AN ELECTRONIC DISPLAY

Inventors: William Dunn, Tim Hubbard, Ryan DeMars

Cross-Reference to Related Applications

[0001] This application claims priority to U.S. Application No. 61/791,390 filed on March 15, 2013, which is herein incorporated by reference in its entirety.

Technical Field

[0002] Exemplary embodiments generally relate to cooling systems and in particular to cooling systems for electronic displays.

Background of the Art

[0003] 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.

[0004] 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.

[0005] 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.

Summary of the Exemplary Embodiments

[0006] Exemplary embodiments use a combination of circulating gas and external air in order to adequately cool an electronic display. Circulating gas may be used to remove heat from the front of the image assembly. Because the gas is only circulating within the display, it can remain free of particulate and contaminants and will not harm the display.

[0007] External air may be ingested into the display in order to cool the circulating gas. The external air and the circulating gas may be drawn through a heat exchanger which will allow the heat to transfer from the circulating gas to the external air, preferably without letting the external air and circulating gases mix with one another. An exemplary embodiment would use a cross-flow or counter-flow heat exchanger. An additional flow of external air can be drawn across the rear surface of the electronic display to remove heat from the rear portion of the electronic display. When using a

LCD as the electronic image assembly, this additional flow of external air can be used to remove heat from the rear portion of the backlight for the LCD.

[0008] If using the additional external air pathway behind the electronic display, a manifold may be used to collect the external air along an edge of the display and distribute this into a number of smaller flows. The fans for driving this additional external air pathway can be placed within the manifold in order to reduce the noise emitted by the fans and provide an even distribution of external air across the display.

[0009] 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

[0010] 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:

[0011] **FIGURE 1** provides a rear perspective view of an exemplary electronic display assembly and illustrating the horizontal section line 3-3 and vertical section line 5-5.

[0012] **FIGURE 2** provides a rear perspective view of the embodiment shown in Figure 1 where the rear cover has been removed.

[0013] **FIGURE 3A** provides a perspective section view taken along the section line 3-3 of Figure 1 and showing Details 3B and 3C.

[0014] **FIGURE 3B** provides a detailed section view of Detail 3B shown in Figure 3A.

[0015] **FIGURE 3C** provides a detailed section view of Detail 3C shown in Figure 3A.

[0016] **FIGURE 4** provides a top planar view of an exemplary pass through gasket.

[0017] **FIGURE 5** provides a planar section view taken along the vertical section line 5-5 shown in Figure 1 and indicates Detail 6.

[0018] **FIGURE 6** provides a detailed planar section view of Detail 6 shown in Figure 5 and indicates Detail 7 as well as section line 8-8.

[0019] **FIGURE 7** provides a detailed planar section view of Detail 7 shown in Figure 6.

[0020] **FIGURE 8** provides a perspective section view taken along section line 8-8 shown in Figure 6.

[0021] **FIGURE 9** provides a perspective view of an exemplary embodiment for a corrugated heat sink.

Detailed Description

[0022] 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.

[0023] 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.

[0024] 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.

[0025] 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.

[0026] 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.

[0027] 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.

[0028] **FIGURE 1** provides a rear perspective view of an exemplary electronic display assembly and illustrating the horizontal section line 3-3 and vertical section line 5-5. A housing 7 is preferably used to contain the assembly and may utilize a rear cover 5 to provide access to the display assembly when removed.

[0030] **FIGURE 2** provides a rear perspective view of the embodiment shown in Figure 1 where the rear cover 5 has been removed. A first flow of external air 500 is

shown passing through a heat exchanger 500, driven by fans 40. Although fans 40 are shown drawing external air 500 through the heat exchanger, fans 40 could also be positioned to push external air 500 through the heat exchanger. Other embodiments could of course use fans to both push and pull through the heat exchanger, or fans in addition to the ones shown here. A second flow of external air is shown being forced by fans 25 and 20 to flow into a first manifold 98 across the rear portion of the electronic display assembly, down a second manifold 99, and eventually exhausted out of an exhaust aperture at the bottom of the display. A plurality of electronic assemblies 51 for controlling and powering the electronic display is shown within the housing 7 cavity. The electronic assemblies 51 could be any one of the following but not limited to: power modules, video players, wireless/satellite receivers, hard drives, microprocessors, capacitors, motors, microprocessors, hard drives, AC/DC converters, transformers, or printed circuit boards.

[0031] FIGURE 3A provides a perspective section view taken along the section line 3-3 of Figure 1 and showing Details 3B and 3C.

[0032] FIGURE 3B provides a detailed section view of Detail 3B shown in Figure 3A. A plurality of circulating fans 30 are used to force circulating gas 700 across the electronic assemblies 51 and through the heat exchanger 50, as well as between the front transparent plate 110 and the electronic display 100, forming a closed loop. The circulating gas 700 passes through the opening within the pass through gasket 200 while the external air 600 travels around the pass through gasket, substantially ensuring that the external air 600 and circulating gas 700 do not mix.

[0033] The flow of external air 600 is shown traversing the first manifold 98 and passing by the cross through gasket 200 in order to enter a channel which runs behind the electronic display 100. The channel is preferably defined as the space between the rear surface of the electronic display 100 and a plate 125. A preferably corrugated and preferably continuous heat sink 130 is ideally placed within the channel in order to facilitate the conductive transfer of heat from the electronic display 100 to the continuous heat sink 130, to be removed by convection with the external air 600.

[0034] The heat exchanger 50 preferably contains a plurality of layers which define channels which contain either circulating gas 700 or external air 500. Preferably, the circulating gas 700 is not permitted to mix with the external air 500 or the external air 600. In an exemplary embodiment, another channel 55 is defined by the space between the plate 125 and the heat exchanger 50 and would contain the external air 500. Preferably, the flow of external air 500 through channel 55 is perpendicular to the flow of external air 600 passing through the gap between the rear surface of the electronic display 100 and the plate 125.

[0035] **FIGURE 3C** provides a detailed section view of Detail 3C shown in Figure 3A. The flow of external air 600 travels through the channel and again passes around the pass through gasket 200 to enter the second manifold 99, eventually being directed out of an exhaust aperture. The circulating gas 700 is shown exiting the heat exchanger 50 and passing through the opening within the pass through gasket 200 and then between the front transparent plate 110 and the electronic display 100.

[0036] **FIGURE 4** provides a top planar view of an exemplary pass through gasket 200. As shown the opening within the gasket 200 is defined by a pair of sides 210

which are substantially planar and parallel to the flow of the circulating gas 700. The opening also contains a pair of sides 220 which are curved outwardly from a common centerline passing through the sides 210. Generally, the cross sectional thickness of the gasket 200 is relatively constant. Also, preferably the gasket 200 is a continuous element surrounding the opening. The external air 600 impacts the curved sidewall (having a similar shape and offset from the curved sides 220) and travels around the curved sidewall until it passes parallel to the sidewall 210 and curves around the opposing curved sidewall until resuming a more laminar flow. Preferably, the circulating gas 700 curves around the curved sides 220 when entering/exiting the gasket 200.

[0037] FIGURE 5 provides a planar section view taken along the vertical section line 5-5 shown in Figure 1 and indicates Detail 6. This figure illustrates the flow of external air 500 which enters the housing through an inlet aperture, passes through the heat exchanger 50 and channel 55, eventually exiting the housing through an exhaust aperture.

[0038] FIGURE 6 provides a detailed planar section view of Detail 6 shown in Figure 5 and indicates Detail 7 as well as section line 8-8. Here, the section line 8-8 cuts directly through the corrugated heat sink 130.

[0039] FIGURE 7 provides a detailed planar section view of Detail 7 shown in Figure 6. Here, the corrugated heat sink 130 preferably alternates between contacting the rear surface of the electronic display 100 and the plate 125, defining a series of alternating channels (one channel defined by the heat sink 130 and the rear surface of the electronic display 100, and the second channel defined by the heat sink 130 and the plate 125).

[0040] **FIGURE 8** provides a perspective section view taken along section line 8-8 shown in Figure 6. As shown, the external air 600 is forced by the fans 25 and 20 to enter the housing and travel down the first manifold until passing by a pass through gasket 200 and across the corrugated heat sink 130 until passing by another pass through gasket 200 and entering the second manifold to be exhausted out of the housing. Of course, some embodiments may not utilize both fans 25 and 20 but may only utilize one or the other. Some embodiments may use more fans in addition to fans 25 and 20.

[0041] **FIGURE 9** provides a perspective view of an exemplary embodiment for a corrugated heat sink.

[0042] Some embodiments may use glass as the transparent front plate 110. Exemplary embodiments may use two pieces of glass laminated with index-matching optical adhesive. Some front plates 110 may provide other utility such as anti-reflection or polarizing functions.

[0043] In a preferred embodiment, the heat exchanger 50 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 50 may be a cross-flow, parallel flow, or counter-flow heat exchanger. In an exemplary embodiment, the heat exchanger 50 would be comprised of a plurality of stacked layers of thin plates. The plates may have a corrugated, honeycomb, or tubular design, where a plurality of channels/pathways/tubes 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, external air or circulating gas may enter an exemplary heat exchanger only through plates whose channels or pathways travel parallel to the path of the gas. Because the plates are alternated, the circulating gas and external air 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).

[0044] In an alternative design for a heat exchanger, an open channel may be placed in between a pair of corrugated, honeycomb, or tubular plates. The open channel may travel in a direction which is perpendicular to the pathways of the adjacent plates. This open channel 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 pathways in the adjacent plates. Thus, gas entering the heat exchanger in a first direction may travel through the open channel (parallel to the strips or tape). Gas which is entering in a second direction (substantially perpendicular to the first direction) would travel through the pathways of the adjacent plates).

[0045] 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.

[0046] An exemplary heat exchanger may have plates where the sidewalls have a relatively low thermal resistance so that heat can easily be exchanged between the two