

SISTEMA E MÉTODO PARA CONTROLE TÉRMICO DE UM VISOR
ELETRÔNICO

Campo Técnico

As modalidades de exemplo geralmente se referem a
5 sistemas de aquecimento / resfriamento para visores
eletrônicos.

Antecedentes da Técnica

Os visores eletrônicos tipicamente são usados em
ambientes internos com temperatura controlada. Embora a
10 temperatura circundando o visor pudesse ser relativamente
estável (próxima da temperatura ambiente), os componentes
do visor podem gerar uma grande quantidade de calor. Caso
não removido apropriadamente, este calor poderia danificar
o visor ou encurtar seu tempo de vida. Os sistemas de
15 transferência de calor condutivos e convectivos
tradicionalmente têm sido usados para a remoção de calor de
componentes eletrônicos em um visor através de tantas
paredes laterais quanto possível do visor. Embora esses
sistemas de transferência de calor tenham desfrutado de uma
20 medida de sucesso no passado, os visores eletrônicos de
hoje em dia requerem capacidades de resfriamento (e, em
alguns casos, um aquecimento) ainda maiores .

Os visores eletrônicos modernos agora estão sendo
usados em ambientes externos, bem como em outras situações
25 em que a temperatura circundante pode se estender acima e
abaixo da temperatura ambiente. Além da transferência de
calor do ar circundante, a transferência de calor radiativa
do Sol através de uma superfície de visor também pode se
tornar um fator importante. Em algumas aplicações e
30 localizações, 200 Watts ou mais de potência através de uma

superfície de visor como essa são comuns. Mais ainda, o mercado está demandando visores às vezes de alta definição maiores e mais brilhantes. Com o tamanho de visor eletrônico aumentado, mais calor será absorvido a partir do Sol e mais calor será transmitido para os visores. Para competir com a luz ambiente do Sol, bem como com reflexões circundando as superfícies, os visores devem produzir mais luz, o que também tipicamente resulta em mais calor gerado pelo visor e/ou seu conjunto de luz traseira.

Ainda, em algumas aplicações, a temperatura pode cair abaixo da temperatura ambiente. Alguns componentes de um visor eletrônico podem funcionar mal, ou podem ser permanentemente destruídos pela exposição a essas temperaturas baixas. Por exemplo, a performance do material de cristal líquido em um visor de cristal líquido (LCD) pode ser afetada por temperaturas baixas.

Sumário das Modalidades de Exemplo

As modalidades de exemplo podem conter um ou mais recursos de controle térmico mostrados aqui. Uma pluralidade de recursos de controle térmico é mostrada, e estes recursos podem ser utilizados sozinhos ou em qualquer combinação. A combinação precisa de recursos dependeria das necessidades de resfriamento / aquecimento em particular do visor em questão, o que também dependeria do tipo de visor, do tamanho do visor e de seu ambiente em particular. As modalidades podem ser praticadas em qualquer forma de visor eletrônico, incluindo, mas não limitando: LCD, diodo emissor de luz (LED), diodo emissor de luz orgânico (OLED), visor de emissão de campo (FED), tubo de raios catódicos (CRT), plasma, e visores de projeção. Uma modalidade de

exemplo seria praticada com visores de LED.

Um recurso térmico se refere a um sistema de resfriamento de gás isolado. O sistema de resfriamento de gás preferencialmente é um laço fechado que inclui uma primeira câmara de gás que compreende uma placa anterior transparente e uma segunda câmara de gás compreendendo um pleno de resfriamento. A primeira câmara de gás é anterior a e co-extensiva com a face visível do visor eletrônico. A placa anterior transparente pode ser regulada à frente da superfície de visor eletrônico, definindo a profundidade da primeira câmara de gás. Um ventilador de câmara de resfriamento, ou um meio equivalente, pode estar localizado no pleno de resfriamento, e pode ser usado para a propulsão de um gás em torno do laço de câmara de resfriamento de gás isolado. Conforme o gás atravessa a primeira câmara de gás, ele contata a superfície de visor eletrônico, absorvendo o calor da superfície de visor. Devido ao fato de o gás e as superfícies relevantes da primeira câmara de gás serem transparentes, a qualidade da imagem permanece excelente. Após o gás ter atravessado a primeira câmara de gás transparente, o gás pode ser dirigido para o pleno de resfriamento traseiro, onde ele é resfriado.

Um outro recurso térmico pode utilizar o sistema de gás isolado como um dispositivo de aquecimento, ao invés ou além de suas capacidades de resfriamento. Um sistema de aquecimento de gás isolado também seria um sistema de laço fechado com uma primeira câmara de gás anterior à superfície de visor e uma segunda câmara compreendendo um aquecimento pleno ou um resfriamento / aquecimento pleno. Os elementos de aquecimento podem ser posicionados no

pleno, de modo a se aquecer o gás na segunda câmara. Conforme o gás é forçado para a primeira câmara, ele pode transferir seu calor para a superfície do visor. O gás então pode retornar para o pleno para um outro ciclo de aquecimento. O pleno pode funcionar como um pleno de resfriamento apenas, um pleno de aquecimento apenas ou um pleno de combinação de aquecimento / resfriamento; tudo dependendo do visor em particular e de seu ambiente de operação em particular.

10 Algumas modalidades podem colocar componentes eletrônicos usados para operação do visor eletrônico no pleno da câmara de gás isolada. Os componentes eletrônicos podem incluir, mas não estão limitados a: transformadores, placas de circuito, processadores, resistores, capacitores, 15 baterias, motores, suprimentos de potência, dispositivos de iluminação, fiação e chicotes de fiação, e comutadores. Se o pleno estiver sendo utilizado como um pleno de resfriamento, o gás de resfriamento no pleno ainda pode ajudar no resfriamento dos componentes eletrônicos, o que naturalmente gerará calor durante uma operação. Ainda, se o 20 pleno estiver sendo utilizado como uma fonte de calor para o visor, o calor natural dos componentes eletrônicos também poderá aquecer o gás no pleno, reduzindo-se a quantidade de energia a qual precisa ser aplicada aos elementos de 25 aquecimento.

Um polarizador linear pode ser usado em algumas modalidades para se reduzir adicionalmente o carregamento solar sobre o visor eletrônico. Este polarizador pode ser usado em combinação com a câmara de gás isolada, ou pode 30 simplesmente ser posicionado anterior ao visor eletrônico

com um espaço de isolamento entre o polarizador e o visor. O espaço de isolamento reduz a quantidade de calor que é transferida entre o polarizador e o visor.

Alguns visores eletrônicos, tais como LCDs, por exemplo, requerem um conjunto de luz traseira para a produção de uma imagem sobre a superfície de visor. Os conjuntos de luz traseira são tipicamente uma fonte grande de calor para o visor. Assim, algumas modalidades podem utilizar um sistema de convecção constrito para resfriamento da unidade de luz traseira para o visor. O sistema de convecção restrito pode compreender uma placa de convecção restrita, a qual é posicionada em grande proximidade com o conjunto de luz traseira, de modo a se definir um espaço. O gás é forçado através do espaço, de modo a se facilitar um resfriamento mais eficiente do conjunto de luz traseira. Em algumas modalidades, uma parede do pleno pode constituir a placa de convecção restrita.

Algunas modalidades também podem utilizar um dispositivo de cortina de ar, o qual força o ar (aquecido ou frio) sobre a superfície externa do conjunto de visor.

Finalmente, algumas modalidades podem usar um conjunto de fluido, o qual contata um fluido contra a superfície de visor, de modo a resfriá-la. O fluido pode ser uma forma substancialmente clara de fluido resfriante, o qual é bombeado através de uma cavidade anterior, a qual inclui a superfície de visor.

Breve Descrição dos Desenhos

Um melhor entendimento das modalidades de exemplo será obtido a partir de uma leitura da descrição detalhada a

seguir e dos desenhos associados, onde caracteres de referência idênticos se referem a partes idênticas, e nos quais:

a FIGURA 1 é uma vista em perspectiva de uma modalidade de exemplo em conjunto com um visor eletrônico de exemplo.

A FIGURA 2 é uma vista em perspectiva explodida de uma modalidade de exemplo que mostra os componentes do sistema de resfriamento de gás isolado.

10 A FIGURA 3 é uma vista em plano de topo de uma modalidade de exemplo da câmara de resfriamento.

A FIGURA 4 é uma vista em perspectiva dianteira de uma modalidade da câmara de resfriamento isolada, particularmente da superfície anterior transparente da primeira câmara de gás.

A FIGURA 5 é uma vista em perspectiva posterior de uma modalidade da câmara de resfriamento isolada, mostrando componentes elétricos opcionais posicionados no pleno.

A FIGURA 6 é uma vista em perspectiva posterior de uma modalidade da câmara de resfriamento isolada que mostra recursos de superfície que podem ser incluídos no pleno.

A FIGURA 7 é uma vista em plano de topo de uma modalidade de exemplo da câmara de resfriamento que mostra os recursos de superfície que podem ser incluídos no pleno.

25 A FIGURA 8 é uma vista em perspectiva dianteira de uma modalidade da câmara de resfriamento isolada com módulos termoelétricos incluídos.

A FIGURA 9 é uma vista em plano de topo de uma modalidade de exemplo da câmara de resfriamento com módulos termoelétricos incluídos.

A FIGURA 10 é uma vista em perspectiva explodida de uma modalidade de exemplo que mostra os componentes do sistema de resfriamento de gás isolado.

5 A FIGURA 11 é uma vista em plano de topo de uma modalidade de exemplo da câmara de aquecimento.

A FIGURA 12 é uma vista em perspectiva posterior de uma modalidade da câmara de aquecimento, que mostra os componentes elétricos e os elementos de aquecimento opcionais.

10 As FIGURAS 13 e 14 são vistas em seção transversal de modalidades de exemplo para a utilização de um polarizador linear com o sistema de gás isolado e um espaço de isolamento.

15 As FIGURAS 15A e 15B são vistas laterais de modalidades de exemplo do sistema de resfriamento de convecção restrito com uma placa de convecção restrita.

A FIGURA 16 é uma vista em plano de topo de uma modalidade de exemplo em que o pleno de resfriamento é utilizado como a placa de convecção restrita.

20 As FIGURAS 17A a 17C são vistas em seção transversal de modalidades em que o pleno de resfriamento é utilizado como a placa de convecção restrita.

A FIGURA 18 é uma vista em plano dianteiro de um visor que utiliza um dispositivo de cortina de ar.

25 A FIGURA 19 é uma vista em seção transversal de um visor que utiliza um dispositivo de cortina de ar.

A FIGURA 20 é uma ilustração que mostra os componentes para um visor resfriado a líquido.

Descrição Detalhada

30 É para ser entendido que o espírito e o escopo das

modalidades mostradas incluem o controle térmico de visores, incluindo, mas não limitando, LCDs. Para fins de explanação simples, as modalidades podem ser descritas com respeito aos componentes para visores de LCD. A título de exemplo e não a título de limitação, as modalidades podem ser usadas em conjunto com visores selecionados dentre LCD, diodo emissor de luz (LED), diodo emissor de luz orgânico (OLED), visor de emissão de campo (FED), tubo de raios catódicos (CRT), plasma, e visores de projeção. Mais ainda, as modalidades podem ser usadas com visores de outros tipos, incluindo aqueles ainda não descobertos. Em particular, é contemplado que as modalidades podem ser bem adequadas para uso com visores de OLED de tela plana de cor plena. Ainda, é particularmente contemplado que as modalidades podem ser usadas com visores de LED de alta definição relativamente grandes. Embora as modalidades descritas aqui sejam bem adequadas para ambientes exteriores, elas também podem ser apropriadas para aplicações em ambiente interno (por exemplo, ambientes de fábrica, resfriadores / congeladores, etc.), onde uma estabilidade térmica do visor pode estar em risco.

Sistema de Resfriamento de Gás Isolado

Conforme mostrado na FIGURA 1, quando o visor é exposto a elementos externos, a temperatura dentro do visor pode variar grandemente sem algum tipo de dispositivo de resfriamento. Como tal, o visor pode não funcionar apropriadamente ou pode ter um intervalo de vida grandemente reduzido. Uma luz do Sol direta é especialmente problemática, pelo fato de causar aumentos na temperatura interna do visor.

Na Figura 1, a área de exibição do visor eletrônico mostrada inclui uma câmara de gás estreita que é anterior a e co-extensiva com a superfície de visor eletrônico. O visor mostrado também é equipado com um dispositivo de cortina de ar opcional 114. O dispositivo de cortina de ar 114 é discutido em detalhes abaixo. Opcionalmente, o visor pode ter uma blindagem de reflexão 119, para mitigação da luz do Sol sobre a superfície do visor. Adicionalmente, em ambientes externos, o alojamento 70 preferencialmente é de uma cor a qual reflete a luz do Sol.

Conforme mostrado na FIGURA 2, uma modalidade de exemplo do visor eletrônico 10 inclui uma câmara de resfriamento de gás isolada 20 contida em um alojamento de visor 70. Uma primeira câmara de gás transparente é definida por espaçadores 100 e pela placa dianteira transparente 90. Uma segunda placa dianteira transparente 130 pode ser laminada à placa dianteira 90, para ajudar a evitar uma ruptura da placa dianteira 90 e proteger o interior do visor. A câmara de resfriamento 20 circunda uma pilha de visor 80 e o conjunto de luz traseira associado 140.

O visor 10 pode incluir meios para o resfriamento de um gás contido na segunda câmara de gás. Este meio pode incluir um ou mais ventiladores 60, os quais podem ser posicionados na base do alojamento de visor 70. Os ventiladores 60 podem ingerir ar de resfriamento e forçar o ar ingerido mais frio sobre pelo menos uma superfície externa de um pleno de resfriamento posterior 45. Se desejado, um condicionador de ar (não mostrado) também pode ser utilizado para resfriamento do ar o qual contata a

superfície externa do pleno 45. Alternativamente, os ventiladores 60 podem simplesmente ingerir ar ambiente.

Com referência à FIGURA 3, as modalidades da câmara de resfriamento de gás isolado 20 podem compreender um laço
5 fechado, o qual inclui uma primeira câmara de gás 30 e uma segunda câmara de gás 40. A primeira câmara de gás inclui uma placa transparente 90. A segunda câmara de gás compreende um pleno de resfriamento 45. O termo "gás isolado" se refere ao fato de o gás na câmara de
10 resfriamento de gás isolado 20 ser essencialmente isolado do ar exterior no alojamento do visor. Devido ao fato de a primeira câmara de gás 30 ser posicionada em frente à superfície de visor eletrônico 85, o gás deve ser substancialmente livre de pó ou de outros contaminantes que
15 poderiam afetar negativamente a imagem do visor. Um filtro opcional (não mostrado) pode ser utilizado para ajudar na prevenção de que contaminantes e pó entrem na primeira câmara de gás 30.

O gás isolado pode ser praticamente qualquer gás
20 transparente, por exemplo, ar normal, nitrogênio, hélio ou qualquer outro gás transparente. O gás preferencialmente é incolor, de modo a não afetar a qualidade da imagem. Mais ainda, a câmara de resfriamento de gás isolado 20 não necessariamente precisa ser hermeticamente selada do ar
25 exterior. É suficiente que o gás na câmara seja isolado até a extensão em que poeira e contaminantes não possam substancialmente entrar na primeira câmara de gás.

Na configuração de laço fechado mostrada na FIG. 3, a primeira câmara de gás 30 está em comunicação gasosa com a
30 segunda câmara de gás 40. Um ventilador de câmara de

resfriamento 50 pode ser provido no pleno de resfriamento 45 e utilizado para a propulsão de gás em torno da câmara de resfriamento de gás isolado 20. A primeira câmara de gás 30 inclui pelo menos um vidro dianteiro 90 montado na
5 frente de uma superfície de visor eletrônico 85.

Com referência à FIGURA 4, a placa dianteira 90 pode ser regulada à frente da superfície de visor eletrônico 85 pelos membros de espaçamento 100. Os membros de espaçamento 100 definem a profundidade da passagem de canal estreita na
10 frente da superfície de visor eletrônico 85. Os membros de espaçamento 100 podem ser independentes, ou, alternativamente, podem ser integrais com algum outro componente do dispositivo (por exemplo, integral com a placa dianteira 90). A superfície de visor eletrônico 85,
15 os membros de espaçamento 100 e a placa dianteira 90 transparente definem uma primeira câmara de gás 30. A câmara 30 está em comunicação gasosa com o pleno 45 através da abertura de entrada 110 e de uma abertura de saída 120.

Conforme mostrado na Fig. 3, uma superfície posterior
20 da primeira câmara de gás 30 preferencialmente compreende a superfície de visor eletrônico 85 da pilha de visor 80. Conforme o gás isolado na primeira câmara de gás 30 atravessa o visor, ele contata a superfície de visor eletrônico 85. O contato do gás de resfriamento diretamente
25 com a superfície de visor eletrônico 85 melhora a transferência de calor convectivo a partir da superfície de visor eletrônico 85. Em modalidades de exemplo, a superfície de visor eletrônico 85 compreende a superfície posterior da primeira câmara de gás 30. Assim sendo, o
30 termo "superfície de visor eletrônico" se refere à

superfície dianteira de um visor eletrônico típico (na ausência das modalidades mostradas aqui).

Em uma modalidade de exemplo, a superfície de visor eletrônico 85, a placa dianteira 90 e uma segunda placa
5 dianteira opcional 130 podem ser compreendidas por um substrato de vidro. Contudo, nem a superfície de visor nem a placa dianteira transparente 90, nem a segunda placa dianteira transparente opcional 130 precisam ser necessariamente de vidro. Assim, o termo "vidro" pode ser
10 usado aqui de forma intercambiável com o termo placa, mas um material de vidro não é requerido de forma alguma. Ainda, a superfície de visor eletrônico 85 não tem que compreender a parede de superfície posterior do compartimento de gás dianteiro 30. Uma placa adicional pode
15 ser usada. Contudo, pela utilização da superfície de visor eletrônico 85 como a parede de superfície posterior do compartimento de gás 30, pode haver menos superfícies sujeitas a um impacto da luz visível viajando através do visor. Mais ainda, o dispositivo será mais leve e mais
20 barato para o fabricante.

Embora a modalidade mostrada utilize a superfície de visor eletrônico 85, certas modificações e/ou revestimentos (por exemplo, revestimentos anti-refletivos) podem ser adicionados à superfície de visor eletrônico 85 ou a outros
25 componentes do sistema, de modo a se acomodar o gás resfriante ou para a melhoria da performance ótica do dispositivo. Na modalidade mostrada, a superfície de visor eletrônico 85 pode ser a placa de vidro dianteira de uma pilha de visor de cristal líquido (LCD). Contudo,
30 praticamente qualquer superfície de visor pode ser adequada

para as modalidades do presente sistema de resfriamento. Embora não requerido, é preferível permitir que o gás de resfriamento na primeira câmara de gás 30 contate a superfície de visor eletrônico 85 diretamente. Desta forma, a transferência convectiva de calor dos componentes de visor para o gás circulante pode ser maximizada.

Com referência à Fig. 4, a placa dianteira 90 da primeira câmara de gás 30 é transparente e é posicionada anterior à superfície de visor eletrônico 85. As setas mostradas representam o movimento do gás isolado através da primeira câmara de gás 30. Conforme mostrado, o gás isolado atravessa a primeira câmara de gás 30 em uma direção horizontal. Embora o sistema de resfriamento 20 possa ser projetado para mover o gás em uma direção horizontal ou uma vertical, é preferível propelir o gás em uma direção horizontal. Desta forma, se poeira ou contaminantes realmente entrarem na primeira câmara de gás 30, eles tenderão a cair para o fundo da câmara 30 fora da área visível do visor. O sistema pode mover o ar da esquerda para a direita ou, alternativamente, da direita para a esquerda. Após o gás atravessar a primeira câmara de gás 30, ele sai através da abertura de saída 120. A abertura de saída 120 define a junção de entrada no pleno e resfriamento traseiro 45.

A FIGURA 5 mostra um esquema do pleno de resfriamento (ilustrado como transparente para explanação). Um ou mais ventiladores 50 no pleno podem prover a força necessária para se mover o gás isolado através da câmara de resfriamento de gás isolado. Ao passo que a primeira câmara de gás 30 foi projetada para coletar calor a partir da

superfície 85 do visor, a segunda câmara de gás 40 é projetada para extração do calor do gás e remoção do calor da câmara de resfriamento 20. A segunda câmara 40 pode ter vários contornos e recursos para a acomodação das estruturas internas em uma dada aplicação de visor eletrônico.

Se desejado, vários componentes eletrônicos 200 podem ser posicionados em qualquer lugar por toda a segunda câmara de gás 40. Os componentes eletrônicos 200 podem incluir, mas não estão limitados a: transformadores, placas de circuito, processadores, resistores, capacitores, baterias, motores, suprimentos de potência, dispositivos de iluminação, fiação e chicotes de fiação, e comutadores. Estes componentes podem ser montados diretamente nas paredes da câmara ou suportados em hastes ou colunas 209. Assim, o pleno de resfriamento pode ser projetado não apenas para extrair calor da primeira câmara de gás 30, mas também para resfriamento destes vários componentes eletrônicos 200. (Adicionalmente, conforme discutido abaixo, se o sistema de gás isolado for usado para aquecimento do visor, os componentes eletrônicos poderão ajudar no aquecimento do gás isolado.)

Com referência, agora, às FIGURAS 6 e 7, vários recursos de superfície 150 podem ser adicionados para melhoria da dissipação de calor do pleno 45. Estes recursos de superfície 150 provêm mais área superficial para a irradiação de calor a partir do gás na segunda câmara de gás 40. Estes recursos 150 podem ser posicionados em numerosas localizações na superfície do pleno 45.

Com referência, agora, às FIGURAS 8 e 9, um ou mais

módulos termoeletrônicos 160 podem ser posicionados em pelo menos uma superfície do pleno 45, para resfriamento adicional do gás contido na segunda câmara de gás 40. Os módulos termoeletrônicos 160 podem ser usados independentemente ou em conjunto com os recursos de superfície 150. Alternativamente, os módulos termoeletrônicos 160 podem ser usados para aquecimento do gás no pleno se o sistema de gás isolado for utilizado para aquecimento de um visor em um ambiente frio.

10 A FIGURA 10 mostra um método de exemplo para remoção de calor no gás contido no pleno posterior 45. O ventilador 60 pode ser posicionado para inferir ar e soprar aquele ar através das superfícies anterior e posterior do pleno 45. Novamente, o ventilador 60 pode ingerir ar condicionado para o alojamento de visor 70 ou pode simplesmente inferir ar do ambiente circundante. Mais ainda, nesta configuração, o ventilador 60 também pode forçar o ar diante dos componentes que geram calor do visor eletrônico (por exemplo, a pilha de visor 80 e o conjunto de luz traseira 140) para melhoria adicional da capacidade de resfriamento do visor inteiro. Deve ser notado que esta modalidade pode ser combinada com o método de resfriamento de convecção restrita discutido em detalhes abaixo. O ar de exaustão aquecido pode sair através de uma ou mais aberturas 179 localizadas no alojamento de visor 70.

Sistema de Aquecimento de Gás Isolado

Conforme mencionado acima, o sistema de gás isolado pode ser utilizado também para aquecer o visor eletrônico. Com referência às FIGURAS 11 e 12, os elementos de aquecimento 220 podem estar localizados na segunda câmara

de gás 40 e operar para o aquecimento do gás conforme ele
passar através da segunda câmara de gás 40. Estes elementos
de aquecimento podem ser qualquer um dos elementos de
aquecimento mais comumente disponíveis ou módulos
5 termoelétricos. Muitas vezes, estes elementos são
simplesmente um material o qual contém uma resistência
elétrica alta, e, assim, gera calor quando uma corrente
flui através dele. Os elementos de aquecimento podem ser,
mas não estão limitados a qualquer um dos seguintes: fio ou
10 fita de níquel-cromo, trilhas de metal / cerâmica impressas
com tela depositadas sobre placas de metal isolado com
cerâmica (geralmente aço), CalRod (tipicamente, uma bobina
fina de fio de níquel-cromo em um aglutinante de cerâmica,
selada dentro de uma carcaça de metal tenaz), lâmpada de
15 calor, e coeficiente térmico positivo (PTC) de cerâmica de
resistência.

Conforme discutido acima, o pleno 45 pode conter
componentes elétricos 200, os quais acionam e controlam o
visor eletrônico. Os componentes elétricos podem ser
20 qualquer um dos seguintes: transformadores,
microprocessadores, placas de circuito impresso,
suprimentos de potência, resistores, capacitores, motores,
chicotes de fiação e conectores. As conexões elétricas para
os componentes elétricos 200 podem passar através de uma
25 parede do pleno 45. Os componentes elétricos 200 podem
estar localizados em qualquer lugar no pleno 45. Os
componentes elétricos 200 podem ser montados na superfície
posterior ou anterior do pleno e podem ser montados
diretamente sobre a superfície do pleno ou podem ser
30 suspensos por colunas de montagem, de modo que o gás possa

passar em torno do componente.

Enquanto o visor está operacional, o sistema de resfriamento de gás isolado pode passar continuamente. Contudo, se desejado, um sensor de temperatura (não
5 mostrado) e um comutador (não mostrado) podem ser incorporados no visor eletrônico. Assim, um termostato pode ser usado para detectar quando temperaturas atingiram um valor de limite predeterminado e o sistema de gás isolado pode ser seletivamente engajado quando a temperatura no
10 visor atingir um valor predeterminado. Os limites predeterminados de temperatura podem ser selecionados, e o sistema pode ser configurado para aquecimento, resfriamento ou ambos aquecimento e resfriamento do visor, para se manter vantajosamente o visor em uma faixa de temperatura
15 aceitável.

Polarizador Linear com Espaço isolante Opcional

A FIGURA 13 é uma vista em seção transversal de uma outra modalidade de exemplo para um outro recurso de controle térmico. No arranjo mostrado, a placa dianteira 90
20 e uma segunda placa dianteira 130 pode ser compreendida por vidro e podem ser laminadas em conjunto. Os primeiro e segundo painéis dianteiros 130 e 90 podem ser fixados um no outro com uma camada de adesivo ótico de índice combinado 201 para a formação de uma unidade de vidro dianteiro 206.
25 A pilha de visor 80 pode compreender um conjunto de cristal líquido 212 interposto entre um polarizador dianteiro 216 e um polarizador traseiro 214. Em outras modalidades, a pilha de visor 80 pode ser qualquer outro tipo de montagem para qualquer outro tipo de visor eletrônico. O espaço entre a
30 pilha de visor 80 e a unidade de vidro dianteira 206 define

um espaço isolante 300. O espaço isolante 300 serve para a separação térmica da unidade de vidro dianteira 206 da pilha de LCD 80. Esta separação térmica localiza o calor na unidade de vidro dianteira, ao invés de permitir um carregamento solar da pilha de LCD. Se usado em combinação com o sistema de gás isolado, o espaço isolante 300 pode compreender a primeira câmara de gás 30. Em outras modalidades, o espaço isolante 300 pode ser usado sem o sistema de gás isolado simplesmente como uma camada de isolamento a partir do ar ambiente, bem como um carregamento solar.

O segundo painel dianteiro pode ter uma primeira superfície 202 e uma segunda superfície 208. A primeira superfície 202 pode ser exposta aos elementos, enquanto a segunda superfície 208 pode ser fixada à primeira placa dianteira 90 pelo adesivo ótico de índice combinado 201. A primeira placa dianteira 90 pode ter uma terceira superfície 209 e uma quarta superfície 204. A terceira superfície 209 pode ser fixada à segunda placa dianteira 130 pelo adesivo ótico de índice combinado 201, enquanto a quarta superfície pode ser diretamente adjacente ao espaço isolante 300. Em algumas modalidades, para diminuição do carregamento solar da pilha de visor 80 e melhoria da qualidade da imagem visível, um revestimento anti-refletivo pode ser aplicado à primeira superfície 202 e à quarta superfície 204. Em outras modalidades, o revestimento anti-refletivo pode ser aplicado a pelo menos uma dentre a primeira, a segunda, a terceira ou a quarta superfície 202, 208, 209 e 204, respectivamente.

A FIGURA 14 é uma vista em seção transversal de uma

outra modalidade de exemplo da unidade de vidro dianteira 206. No arranjo mostrado, a unidade de vidro dianteira 206 compreende uma segunda placa dianteira 130, uma camada de adesivo ótico de índice combinado 201, um polarizador linear 400, e uma primeira placa dianteira 90. O polarizador linear 400 pode ser ligado a pelo menos uma dentre as primeira, segunda, terceira e quarta superfícies 202, 208, 209 e 204, respectivamente. O polarizador linear 400 pode ser alinhado com o polarizador dianteiro 209 encontrado na pilha de LCD 85. A inclusão de um polarizador linear 400 na unidade de vidro dianteira 206 diminui mais a carga solar sobre a pilha de visor 80. A redução do carregamento solar pode reduzir significativamente a temperatura inicial do visor eletrônico. O polarizador linear 300 também pode causar uma redução na reflexão especular da unidade de vidro dianteira 206 e da pilha de visor 80. Conforme discutido acima, se usado em combinação com o sistema de gás isolado, o espaço isolante 300 pode compreender a primeira câmara de gás 30. Em outras modalidades, o espaço isolante 300 pode ser usado sem o sistema de gás isolado simplesmente como uma camada de isolamento a partir do ar ambiente, bem como um carregamento solar. Novamente, deve ser notado que a pilha de visor 80 pode ser uma pilha de LCD, mas também pode ser qualquer outro tipo de visor eletrônico.

Também deve ser notado que a segunda placa dianteira 130 não é requerida. As modalidades podem utilizar apenas a primeira placa dianteira 90 com um polarizador linear afixado à superfície posterior ou anterior da placa dianteira 90. Uma camada anti-refletiva também pode ser

afixada à superfície anterior ou posterior da placa dianteira 90. A placa dianteira 90 pode ser revenida para uma resistência adicional, caso se use apenas a placa dianteira 90 sem a segunda placa dianteira 130.

5 **Convecção Restrita**

Alguns tipos de visores eletrônicos requerem um conjunto de luz traseira, de modo a gerarem uma imagem sobre uma tela visível. Os LCDs são um tipo de visor que requer um conjunto de luz traseira. Outros tipos de visores, tais como visores de plasma e OLEDs, não requerem um conjunto de luz traseira, já que eles geram luz por si mesmos. Contudo, estes tipos de visores ainda geram uma quantidade significativa de calor. Assim, na descrição precedente, o sistema de convecção restrita será descrito com respeito a um conjunto de luz traseira, mas deve ser notado que as modalidades podem ser praticadas com outros tipos de visores. Portanto, quando uma luz traseira ou conjuntos de luz traseira são discutidos, estes conjuntos também poderiam ser as superfícies traseiras de outros visores gerando calor, e o sistema de convecção restrita facilitaria um resfriamento mais eficiente destes visores alternativos. Também deve ser notado que as Figuras 15A a 15B e as Figuras 17A a 17C não são necessariamente desenhadas em escala. A relação entre os elementos pode ser exagerada para fins explanatórios.

A FIGURA 15A mostra uma vista em seção transversal da luz traseira 140 com a placa de convecção restrita 300, o espaço entre os dois recursos definindo um espaço estreito 305. As dimensões do espaço podem variar, dependendo de vários fatores, incluindo o tamanho do visor, suas

condições de operação, o tipo de conjunto de luz traseira e seu material de superfície posterior, e o número e a potência aplicada aos vários ventiladores de convecção restrita. Algumas modalidades de exemplo podem utilizar uma
5 distância de espaço de aproximadamente 0,635 a 8,89 cm (0,25 a 3,5 polegadas). Outras modalidades podem utilizar um espaço ligeiramente maior. Foi descoberto que forçar o ar através deste espaço 305 aumenta a capacidade de resfriamento da luz traseira 140. Um ou mais ventiladores
10 de convecção restrita 310 podem ser usados para se puxar o ar através do espaço 305. A FIGURA 15B mostra uma vista em seção transversal de uma outra modalidade para o sistema de convecção restrita, onde um ou mais ventiladores de convecção restrita 310 empurram o ar através do espaço 305.

15 A FIGURA 16 mostra uma vista de topo do sistema de gás isolado, conforme discutido acima. A linha de seção transversal 17-17 é mostrada passando através do sistema de gás isolado.

As FIGURAS 17A a 17C mostram vistas em seção
20 transversal da seção 17-17 que é mostrada na Figura 16. Com referência, primeiramente, à Figura 17A, em direção à dianteira do visor está a primeira câmara de gás 30, a qual se confina contra o visor eletrônico 80. Anterior à primeira câmara de gás 30 está a placa dianteira 90. Em
25 direção à traseira do visor, a luz traseira 140 é posicionada em grande proximidade com a segunda câmara de gás 40. Neste arranjo, a parede externa da segunda câmara de gás 40 pode funcionar como a placa de convecção restrita. Esta modalidade não utiliza um ventilador de
30 convecção restrita, mas, ao invés disso, usa o ventilador

60, o qual ingerirá ar a partir do exterior do alojamento de visor e o forçará sobre as superfícies da segunda câmara de gás 40. Conforme citado acima, este ar pode simplesmente ser o ar ambiente ou, alternativamente, este ar pode vir de
5 uma unidade de condicionamento (não mostrada). Para facilitação do fluxo de ar entre a luz traseira 140 e a câmara de resfriamento 40, um dispositivo de guia 320 pode ser usado.

Com referência, agora, à Figura 17B, a câmara de
10 resfriamento 40 contém um recurso de guia 41, o qual é usado em combinação com o dispositivo de guia 320 para facilitar o fluxo de ar entre a luz traseira e a câmara de resfriamento. A Figura 17C mostra uma outra modalidade, onde o ventilador externo 60 e o ventilador de convecção
15 restrita 310 são usados. Esta modalidade também poderia utilizar uma versão dos dispositivos de guia mostrados nas Figuras 17A e 17B.

A luz traseira 140 pode compreender uma placa de circuito impresso (PCB) com uma pluralidade de luzes
20 montadas no lado voltado para o visor eletrônico 80. As luzes na luz traseira podem ser qualquer uma das seguintes: LEDs, diodos emissores de luz orgânicos (OLEDs), visor de emissão de campo (FED), polímero emissor de luz (LEP), ou luzes de eletroluminescência orgânicas (OEL). Em uma
25 modalidade de exemplo, a luz traseira 140 de modo ideal teria um nível baixo de resistência térmica entre o lado voltado para o visor eletrônico 80 e o lado voltado para a segunda câmara de gás. Para a realização deste nível baixo de resistência térmica, a luz traseira 140 pode ser
30 construída usando-se a tecnologia de placa de circuito

impresso (PCB) para a transferência adicional de calor para longe das luzes. A superfície traseira da luz traseira 140 também pode ser metálica, ou algum outro material termicamente condutivo, para melhoria adicional das propriedades de transferência de calor convectivo. A superfície pode mesmo ter uma pluralidade de recursos de superfície, tais como aletas, para a melhoria adicional das propriedades de transferência de calor convectivo. O ventilador convectivo restritivo 310 então pode enviar o ar aquecido para fora de uma exaustão 179 (mostrada na Figura 2), de modo que possa sair do alojamento de visor inteiramente.

Enquanto o visor está operacional, o ventilador externo 60 e o ventilador de convecção restritiva 310 podem funcionar continuamente. Contudo, se desejado, um sensor de temperatura (não mostrado) e um comutador (não mostrado) podem ser incorporados no visor eletrônico. Este termostato efetivo pode ser usado para se detectar quando temperaturas atingiram um valor de limite predeterminado. Em um caso como esse, os vários ventiladores podem ser seletivamente engajados, quando a temperatura no visor atingir um valor predeterminado. Os limites predeterminados podem ser selecionados e o sistema pode ser configurado com um termostato (não mostrado) para vantajosamente se manter o visor em uma faixa de temperatura aceitável. Isto pouparia custos de energia, bem como o tempo de vida útil dos dispositivos.

Cortina de Ar

Além dos vários recursos de controle térmico discutidos acima, um dispositivo de cortina de ar também

pode ser usado. O dispositivo de cortina de ar pode ser usado sozinho ou em combinação com qualquer um dos outros recursos de controle térmico discutidos acima.

5 A FIGURA 18 mostra um visor eletrônico 10, que tem um alojamento 70 e uma placa dianteira 90. Os defletores de ar 114 para a cortina de ar podem ser vistos como uma linha interrompida na figura. A linha de seção transversal 19-19 também pode ser vista nesta figura.

10 A FIGURA 19 mostra a vista em seção transversal a partir da linha 19-19 mostrada na Figura 18. Esta figura mostra a circulação de ar através do alojamento 70, quando os ventiladores 60 são atuados. Conforme discutido acima, os ventiladores 60 ingerem ar para o alojamento 70 através da entrada 51. Este ar pode ser o ar ambiente, ou,
15 alternativamente, pode ser o ar condicionado. O fluxo de ar ingerido é mostrado como a seta 111. Uma vez no interior do alojamento de visor 70, o ar pode fluir para cima ao longo da seta de fluxo 121. Este ar pode ser utilizado com qualquer um dos recursos de controle térmico mencionado.
20 Por exemplo, este ar pode ser usado para resfriamento do gás isolado na segunda câmara (pleno), ou pode ser usado com o sistema de convecção restrita descrito acima.

Para fins explicativos, os detalhes dos componentes internos do visor foram omitidos desta figura, e apenas uma
25 cavidade 61 é mostrada. Deve ser notado que a cortina de ar pode ser praticada com qualquer tipo de visor eletrônico e com qualquer combinação dos recursos de controle térmico descritos acima. Vários recursos internos (não mostrados) podem ser colocados na cavidade 61 para direcionamento do
30 ar para os defletores 114. O ar ingerido pode continuar

através da cavidade 61 ao longo da seta 121, até atingir os defletores 114, os quais podem dirigir o ar contra a superfície de visor externa. Esta superfície externa pode ser a primeira placa dianteira 90 ou, alternativamente, 5 qualquer uma das placas dianteiras adicionais as quais são descritas em detalhes acima (por exemplo, a segunda placa dianteira 130).

Assim, a cortina de ar pode ser usada como uma exaustão para o resfriamento de componentes internos do visor. Alternativamente, o ar frio da cortina de ar pode ser usado para resfriamento adicional da superfície externa dianteira do visor, a qual pode ser submetida a um carregamento solar significativo ou uma transferência de calor do ar quente ambiente.

15 Sistema de Resfriamento de Fluido

A FIGURA 20 é um esquema explicativo de um outro recurso de controle térmico. Conforme pode ser apreciado a partir do desenho, o sistema de resfriamento 22 inclui vários componentes em comunicação de fluido. 20 Preferencialmente, isto pode ser realizado pela conexão dos componentes com uma série de tubos ou canos (ilustrados conceitualmente como linhas pontilhadas). Os componentes do sistema de resfriamento 22 incluem um tanque de reservatório 37, uma bomba 47 e uma câmara de resfriamento 4 em comunicação de fluido. Preferencialmente, o sistema 25 também inclui um filtro 83 e um radiador 72, também em comunicação de fluido. Opcionalmente, o sistema também pode incluir uma unidade de ventilador 94. Contudo, a unidade de ventilador opcional preferencialmente não está em 30 comunicação de fluido com os outros componentes.

O tanque de reservatório 37 mantém o volume primário de fluido resfriante e provê uma área superficial para a condução de calor para longe do fluido, enquanto ele está contido no tanque 37. O tanque tem pelo menos duas
5 aberturas, uma janela de saída 13 e uma janela de retorno 14. Opcionalmente, o tanque de reservatório inclui uma janela de ventilação 66. A bomba 47 faz com que o fluido resfriante se mova através do sistema 22. Conforme pode ser apreciado por aqueles versados na técnica, a bomba 47 pode
10 estar localizada em várias localizações ao longo do percurso de fluido resfriante com resultados adequados. Contudo, de modo a se minimizar uma curvatura de placas 44 e 128, é preferível posicionar a bomba 47 após a câmara de resfriamento 4, de modo que a bomba realmente puxe o
15 resfriante líquido a partir do fundo até o topo da câmara de resfriamento 4. Se a bomba for assim posicionada, o engajamento da bomba criará uma área de baixa pressão no topo da câmara de resfriamento 4. Desta forma, o fluido flui através da câmara de resfriamento 4 de acordo com as
20 setas. Devido à "natureza escorregadia" de certos fluidos resfriantes, a bomba 47 preferencialmente é uma bomba de deslocamento positivo.

De modo a se criar o fluxo de fluido resfriante através da câmara de resfriamento, uma linha by-pass com
25 uma válvula 634 pode ser provida. A linha de by-pass provê uma rota de by-pass para o fluido resfriante se desviar da câmara de resfriamento 4. A válvula 634 é adaptada para facilitar o controle sobre a quantidade de fluido resfriante desviado pela linha de by-pass. A linha de by-
30 pass e a válvula 634 permitem que uma porção predeterminada

do fluido resfriante seja desviada a partir do fluxo dirigido para a câmara de resfriamento 4 e, desse modo, facilitar o controle sobre a vazão através da câmara de resfriamento em si. Desta forma, a vazão através da câmara
5 de resfriamento pode ser regulada.

Conforme alguém versado na técnica apreciará, outros métodos e dispositivos também podem ser usados para a regulação do fluxo através da câmara de resfriamento. Por exemplo, o tamanho e a velocidade de bomba da bomba 47
10 podem ser otimizados para uma dada aplicação. Alternativamente, uma bomba de velocidade variável também pode ser usada. Preferencialmente, a bomba de velocidade variável pode estar em comunicação elétrica com pelo menos um transdutor de pressão (não mostrado). Preferencialmente,
15 um transdutor de pressão pode ser posicionado a montante da câmara de resfriamento 4, e um outro transdutor de pressão pode ser posicionado a jusante da câmara de resfriamento 4. A informação de pressão provida por pelo menos um transdutor de pressão pode ser utilizada para a regulação
20 da velocidade de operação da bomba de velocidade variável. Dessa forma, a vazão através da câmara de resfriamento 4 pode ser ajustada para manutenção de pressões apropriadas no dispositivo. A manutenção de pressões apropriadas na câmara de resfriamento 4 é importante para prevenção de uma
25 deformação ou de uma ruptura do vidro do visor.

Um filtro opcional 83 pode ser adicionado para remoção de uma contaminação no fluido. Preferencialmente, um radiador 72 e uma unidade de ventilador 94 também podem ser incluídas para a provisão de uma estabilidade térmica ainda
30 maior. Opcionalmente, uma torneira (não mostrada) pode ser

provida, para a facilitação do processo de enchimento e esvaziamento do fluido resfriante do sistema.

Em operação, o fluido sai do tanque de reservatório 37 a partir de uma janela de saída 13 a qual pode estar localizada no tanque 37. No seu caminho até a câmara de resfriamento 4, o fluido passa através do filtro opcional 83. A partir do filtro 83, o fluido em seguida entra na câmara de resfriamento 4 através da entrada 98 de coletor 59. O resfriamento de fluido viaja para cima através do compartimento de fluido da câmara de resfriamento 4 na direção indicada (linhas tracejadas). O fluido resfriante sai da câmara de resfriamento 4 através da saída 99 do coletor superior 60. Preferencialmente, o fluido então é recebido por um radiador opcional 72. Enquanto viaja através do radiador opcional 72, uma unidade de ventilador opcional 94 pode forçar o ar diante do radiador 72 para ajudar na transferência de calor para longe do fluido resfriante. A bomba 47, a qual pode ser posicionada após o radiador 72, pode puxar o fluido em direção ao tanque de reservatório. O fluido é recebido no tanque de reservatório 37 através da janela de retorno 14. Preferencialmente, a janela de retorno 14 pode ser disposta em uma localização que seja relativamente distante da janela de saída 13, de modo a se permitir ao fluido retornando a oportunidade máxima de se resfriar, antes de sair do tanque de reservatório 37 através da janela 13.

Se desejado, as unidades de ventilador podem estar localizadas na base do alojamento 75 imediatamente atrás da câmara de resfriamento 4 de visor 15. As unidades de ventilador podem prover um fluxo laminar de ar através do

interior do alojamento 75. Preferencialmente, o fluxo de ar pode ser dirigido através de pelo menos uma superfície externa do tanque de reservatório 37. Conforme descrito acima, o fluxo de exaustão de ar finalmente pode ser
5 redirecionado para a superfície de câmara de resfriamento 44 por meio de um sistema de cortina de ar opcional 114.

Se desejado, um sensor de temperatura (não mostrado) e um comutador (não mostrado) podem ser incorporados no visor eletrônico. O sensor de temperatura pode ser usado para se
10 detectar quando as temperaturas atingiram um valor de limite predeterminado. Em um caso como esse, a bomba pode ser seletivamente engajada, quando a temperatura no visor chegar a um valor predeterminado. Os limites predeterminados podem ser selecionados e o sistema pode ser
15 configurado com um termostato (não mostrado) para vantajosamente se manter o visor em uma temperatura relativamente constante, ou pelo menos em uma faixa de temperaturas aceitáveis. Alternativamente, para se evitar a necessidade de um termostato, a bomba 47 pode rodar
20 continuamente, quando o visor eletrônico estiver operacional.

REIVINDICAÇÕES

1. Sistema de controle térmico para um visor eletrônico (10) que tem uma pilha de visor eletrônico (80) com uma superfície de visor (85) e um conjunto de luz traseira (140), o sistema caracterizado pelo fato de compreender:

uma primeira câmara de gás (30) posicionada anterior à superfície de visor eletrônico (85) da pilha de visor eletrônico (80), a referida primeira câmara de gás (30) tendo uma entrada (110), uma saída (120) e uma superfície externa (45);

uma segunda câmara de gás (40) em comunicação gasosa com a entrada (110) e a saída (120) da referida primeira câmara de gás (30) e posicionada posterior à pilha de visor eletrônico (80), a referida segunda câmara de gás (40) tendo superfícies anteriores e posteriores externas;

um ou mais ventiladores de câmara (50) na referida segunda câmara de gás (40) e configurados para propulsão do gás em torno das primeira e segunda câmaras de gás (30; 40); e

um ou mais ventiladores (60; 310) posicionados e configurados para forçarem o ar externo entre a pilha de visor (80) e a superfície anterior na segunda câmara de gás (40).

2. Sistema, de acordo com a reivindicação 1, caracterizado pelo fato de que o um ou mais ventiladores (60; 310) empurram ar entre a pilha de visor (80) e a superfície anterior da segunda câmara de gás (40).

3. Sistema, de acordo com a reivindicação 1, caracterizado pelo fato de que um ou mais dos componentes

eletrônicos (200) para operação do pilha de visor eletrônico (80), está(ão) contido(s) na referida segunda câmara de gás (40).

4. Sistema, de acordo com a reivindicação 1, caracterizado pelo fato de ainda compreender um ou mais recursos de superfície (150) em uma superfície externa da segunda câmara de gás.

5. Sistema, de acordo com a reivindicação 1, caracterizado pelo fato de ainda compreender um meio para aquecimento de gás o qual está contido na segunda câmara de gás (40).

6. Sistema, de acordo com a reivindicação 5, caracterizado pelo fato de ainda compreender o meio para aquecimento de gás, o qual está contido na segunda câmara de gás (40) compreender um ou mais elementos de aquecimento (220) localizados na segunda câmara de gás (40).

7. Sistema, de acordo com a reivindicação 1, caracterizado pelo fato de que uma superfície externa da segunda câmara de gás (40) está posicionada em grande proximidade com o conjunto de luz traseira (140), o espaço entre o conjunto de luz traseira (140) e a superfície externa anterior da segunda câmara de gás (40) definindo um espaço (305), e o um ou mais ventiladores (60), (310) forçando o ar externo através do referido espaço (305).

8. Sistema, de acordo com qualquer uma das reivindicações 1, 2, 3, 4 ou 7, caracterizado pelo fato de ainda compreender um dispositivo de cortina de ar (114) adaptado para forçar o ar através da superfície externa da referida primeira câmara de gás (30).

9. Sistema, de acordo com qualquer uma das reivindicações 1, 2, 3, 4, 7 ou 8, caracterizado pelo fato de ainda compreender um polarizador linear (216) posicionado anterior à referida primeira câmara de gás (30).

5 10. Sistema, de acordo com qualquer uma das reivindicações 1, 2, 3, 4, 5, 6, 7, 8 ou 9, caracterizado pelo fato de que o um ou mais ventiladores (60), (130) são posicionados e configurados para puxar ar externo entre a pilha de visor (80) e a superfície externa anterior da
10 segunda câmara de gás (40).

11. Sistema, de acordo com qualquer uma das reivindicações 1, 2, 3, 4, 5, 6, 7, 8, 9 ou 10, caracterizado pelo fato de que o um ou mais ventiladores (60), (130) são posicionados e configurados para empurrar ar externo entre
15 a pilha de visor (80) e a superfície externa anterior da segunda câmara de gás (40).

12. Sistema, de acordo com uma das reivindicações 1, 2, 3, 4, 7, 8, 9, 10 ou 11, caracterizado pelo fato de que o ar externo é condicionado antes de ser forçado entre a pilha de visor (80) e a superfície externa anterior da segunda câmara
20 de gás (40).

13. Visor eletrônico controlado termicamente, caracterizado pelo fato de compreender:

uma pilha de visor (80);
25 um conjunto de luz traseira (140) posicionado posterior à referida pilha de visor eletrônico (80) e tendo uma superfície posterior;

uma placa de convecção restrita (300) em grande proximidade com a superfície posterior do referido conjunto
30 de luz traseira (140), o espaço entre a placa de convecção

restrita (300) e a superfície posterior do conjunto de luz traseira (140) definindo um espaço (305);

um ou mais ventiladores de convecção restrita (60), (130) adaptados para aspirarem ar externo através do referido
5 espaço (305);

uma primeira placa de vidro anti-refletivo (90) posicionada anterior à referida pilha de visor (80), o espaço entre a referida primeira placa de vidro anti-refletivo (90) e a referida pilha de visor (80) definindo um espaço de
10 isolamento (300);

um polarizador linear (216) posicionado posterior à referida primeira placa de vidro anti-refletivo (90); e

uma segunda placa de vidro anti-refletivo (130) posicionada anterior à referida primeira placa de vidro anti-refletivo (90).
15

14. Visor, de acordo com a reivindicação 13, caracterizado pelo fato de ainda compreender:

um dispositivo de cortina de ar (114) adaptado para forçar o ar sobre a segunda placa de vidro anti-refletivo
20 (130).

15. Visor, de acordo com qualquer uma das reivindicações 13 ou 14, caracterizado pelo fato de o referido conjunto de luz traseira (140) compreender:

uma placa de circuito impresso (PCB) com uma superfície
25 anterior e uma posterior;

uma pluralidade de LEDs afixados à superfície anterior da referida PCB; e

um revestimento metálico aplicado à superfície posterior da referida PCB.

16. Visor, de acordo com qualquer uma das reivindicações 13, 14 ou 15, caracterizado pelo fato de o visor compreender adicionalmente:

uma primeira câmara de gás (30) compreendendo o referido
5 espaço de isolamento (300) e tendo uma entrada (110) e uma saída (120),

uma segunda câmara de gás (40) em comunicação gasosa com a entrada (110) e a saída (120) da referida primeira câmara de gás (30) e posicionada posterior à superfície de
10 visor eletrônico (80), a referida segunda câmara de gás (40) tendo superfícies anterior e posterior; e

um ou mais ventiladores da câmara (50) localizados na referida segunda câmara de gás (40) e configurados para a propulsão de gás em torno das primeira e segunda câmaras de
15 gás (30), (40), em que o gás contido na segunda câmara de gás (40) será resfriado pelo aspirador de ar externo através do espaço (305) pelo um ou mais ventiladores de convecção restrita (60), (130).

17. Método para controle térmico de uma pilha de visor eletrônico (80) que tem uma superfície de visor (85),
20 caracterizado pelo fato de compreender as etapas de:

prover o sistema de controle térmico definido na reivindicação 1;

forçar um gás isolado através da primeira câmara de gás
25 (30) do sistema de controle térmico;

transferir calor da superfície de visor eletrônico (85) para o gás isolado;

dirigir o gás isolado para a segunda câmara de gás (40) do sistema de controle térmico;

resfriar o gás isolado na segunda câmara de gás (40) ao forçar ar externo entre a pilha de visor (80) e a superfície anterior da segunda câmara de gás (40), se um resfriamento for desejado; e

5 reintroduzir o gás isolado na primeira câmara de gás (30).

18. Método, de acordo com a reivindicação 17, caracterizado pelo fato de a etapa de resfriamento compreender as etapas de:

10 transferência de calor do gás isolado para as paredes da segunda câmara de gás (40);

forçar o ar sobre as paredes da segunda câmara de gás (40); e

15 transferência do calor das paredes da segunda câmara de gás (40) para o ar.

19. Método, de acordo com a reivindicação 17, caracterizado pelo fato de ainda compreender a etapa de:

aquecimento do gás isolado na segunda câmara de gás (40), caso um aquecimento seja desejado.

20 20. Método, de acordo com qualquer uma das reivindicações 17, 18 ou 19, caracterizado pelo fato de ainda compreender as etapas de:

25 localizar uma placa de convecção restrita (300) posterior ao conjunto de luz traseira (140), a área entre a placa de convecção restrita (300) e o conjunto de luz traseira (140) definindo um espaço (305); e

forçar o ar externo através do referido espaço (305) de modo a refrigerar o conjunto de luz traseira (140).

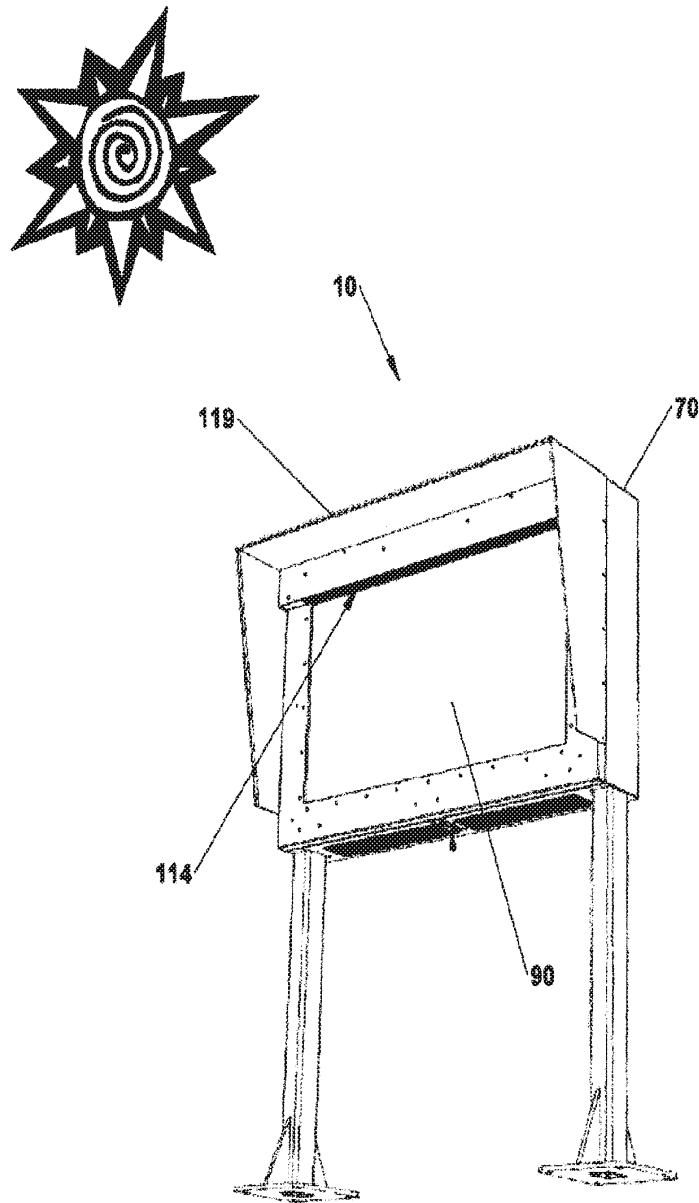


Fig. 1

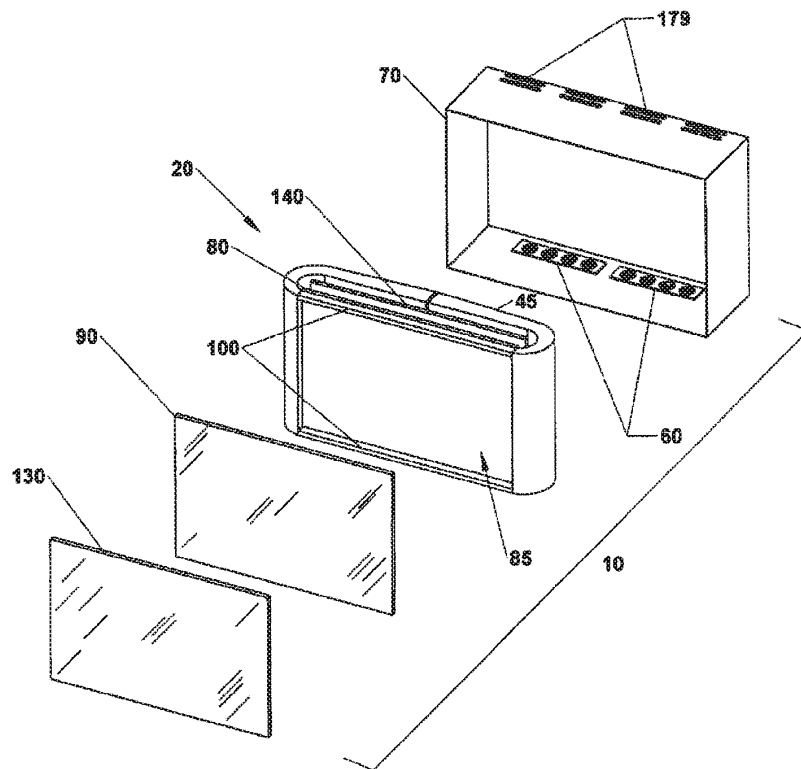


Fig.2

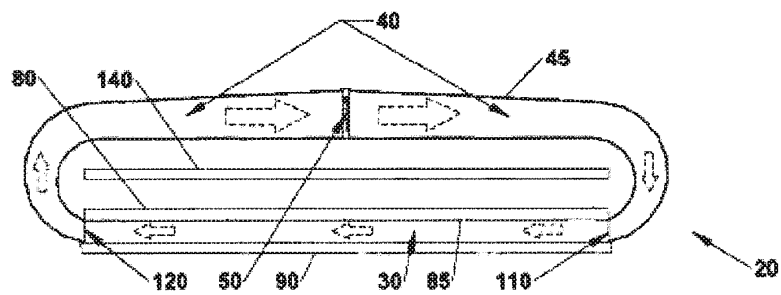


Fig. 3

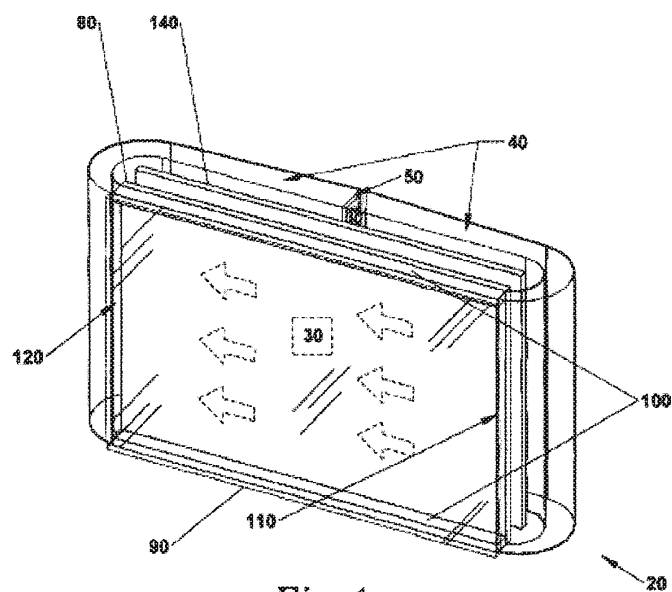


Fig. 4

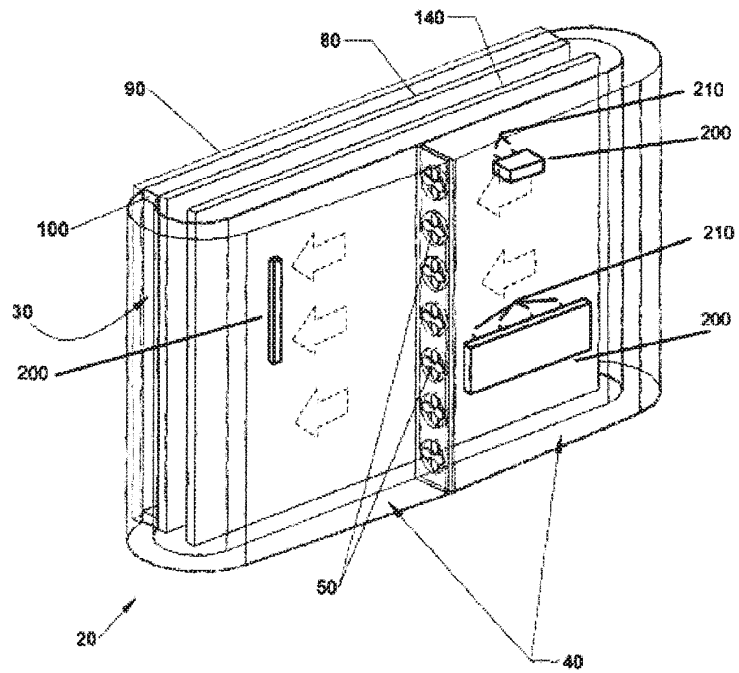


Fig. 5

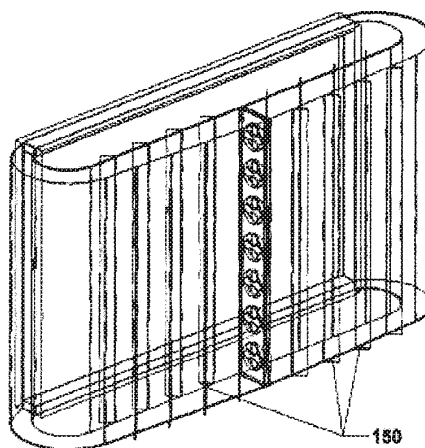


Fig. 6

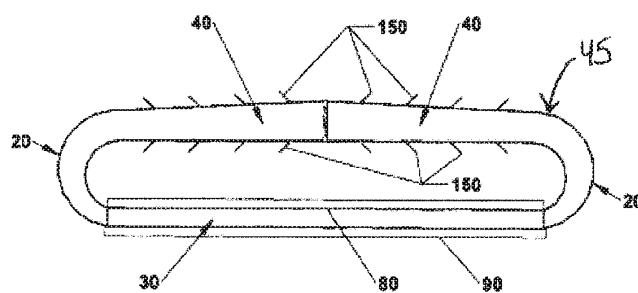


Fig. 7

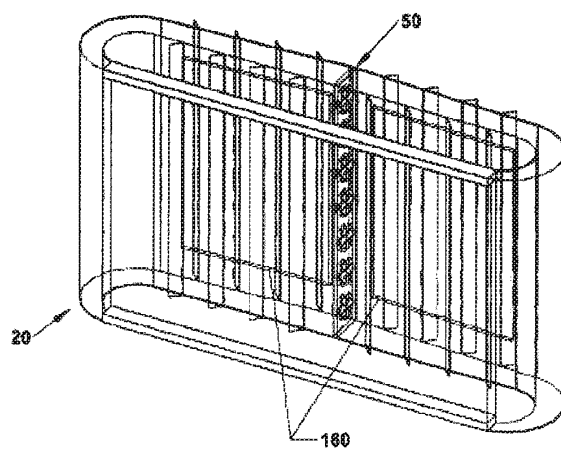


Fig. 8

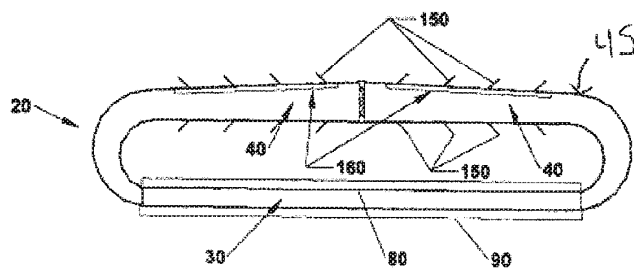


Fig. 9

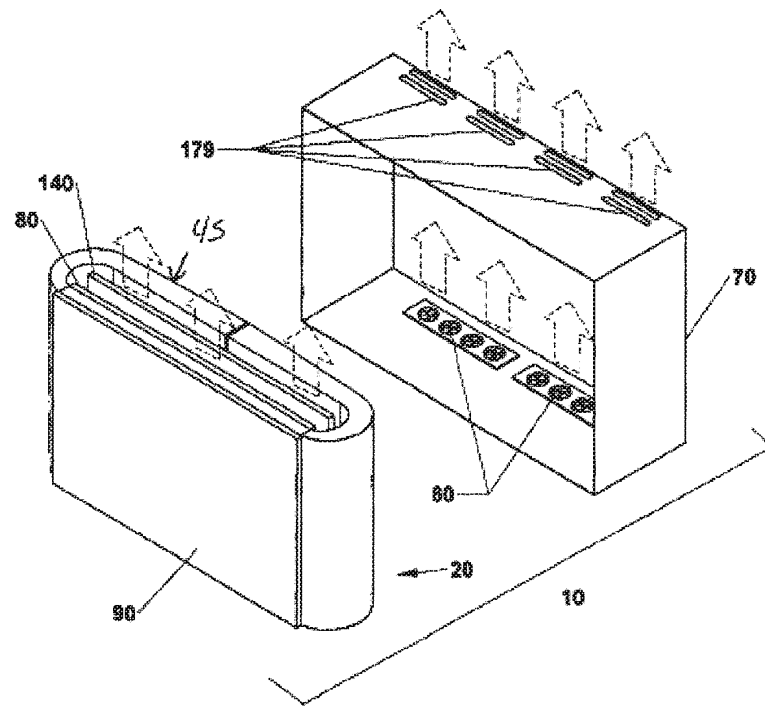


Fig. 10

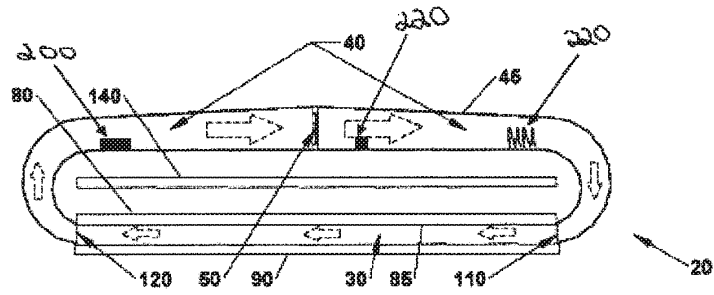


Fig. 11

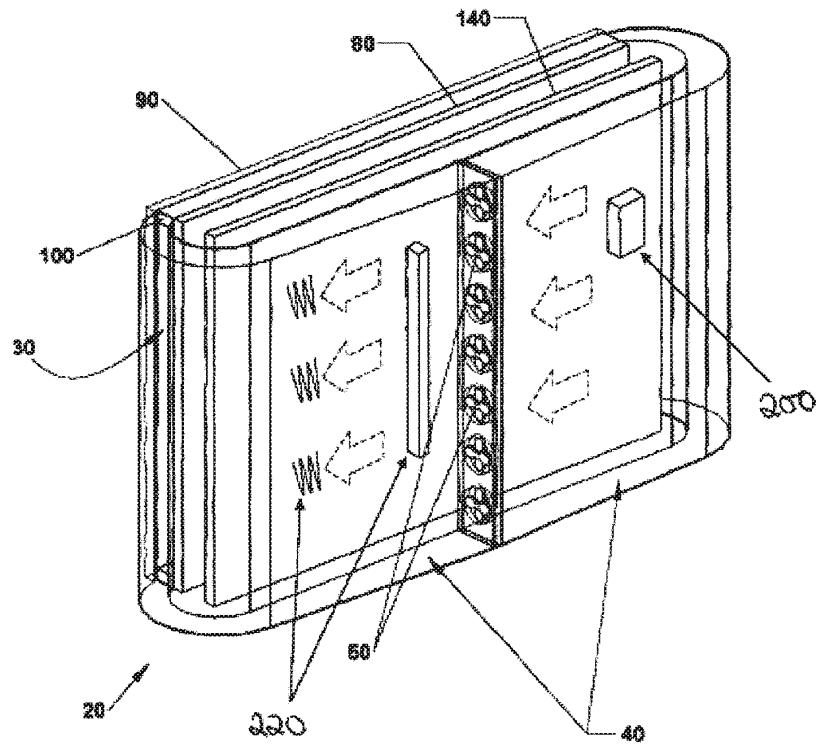
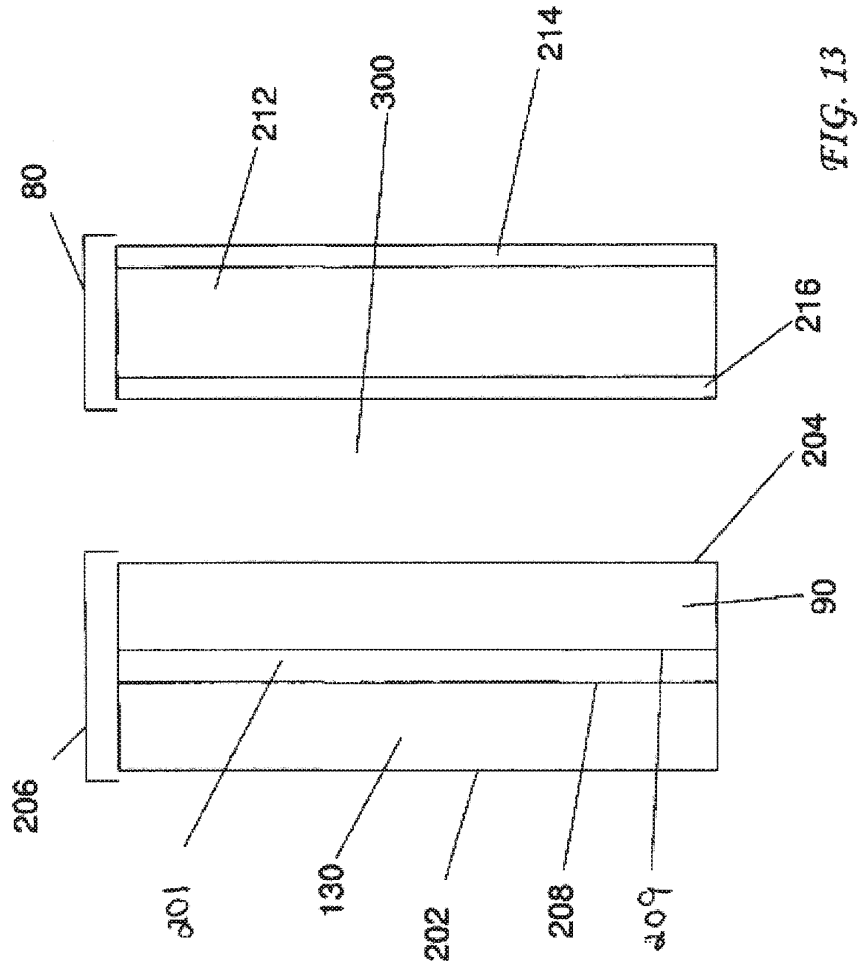
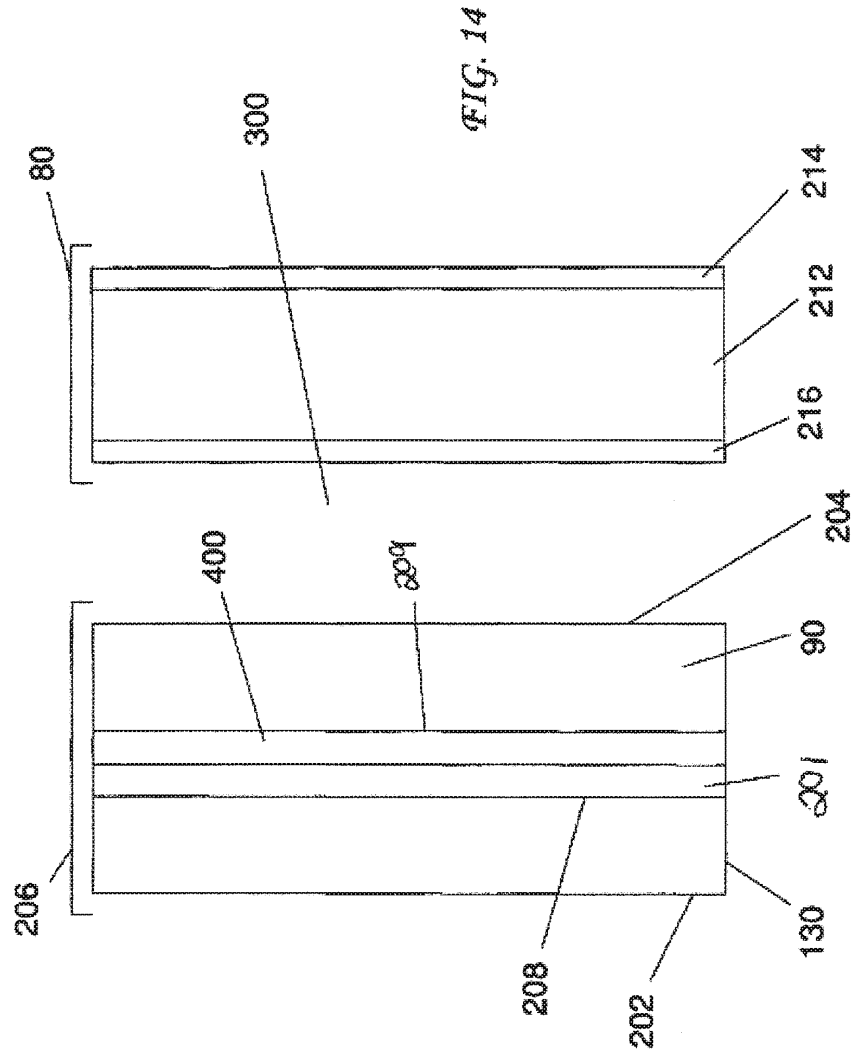


Fig. 12





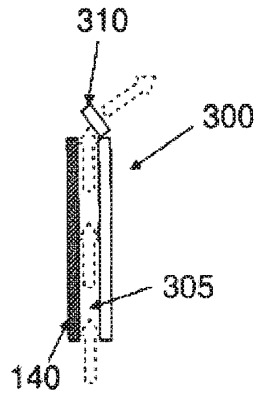


Fig. 15A

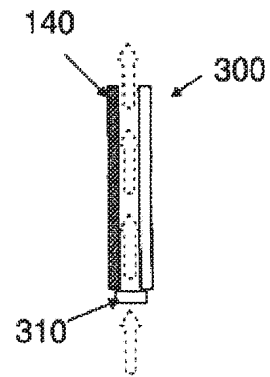


Fig. 15B

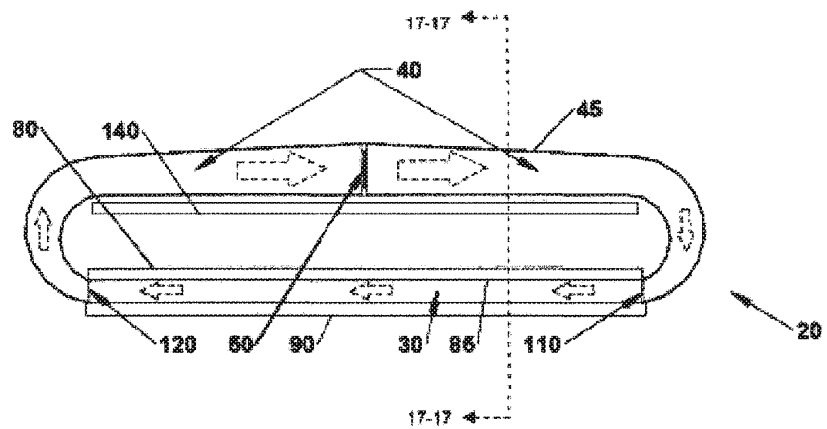


Fig. 16

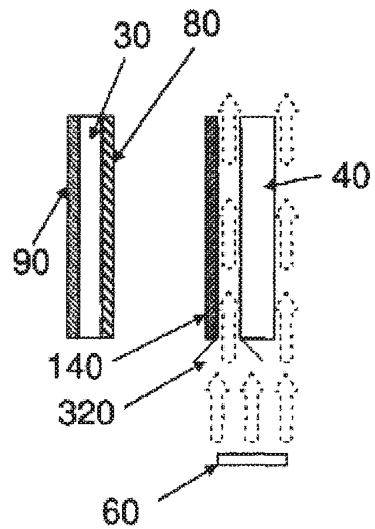


Fig. 17A

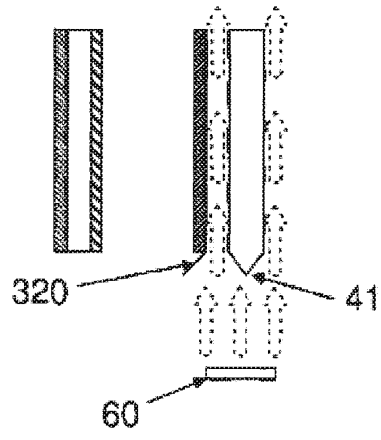


Fig. 17B

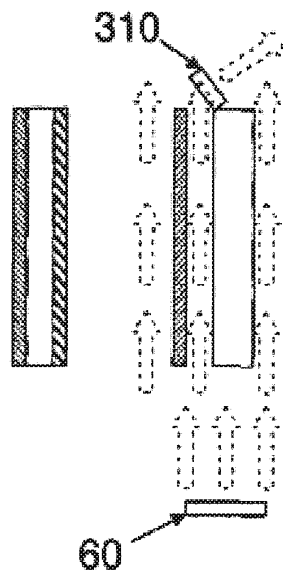
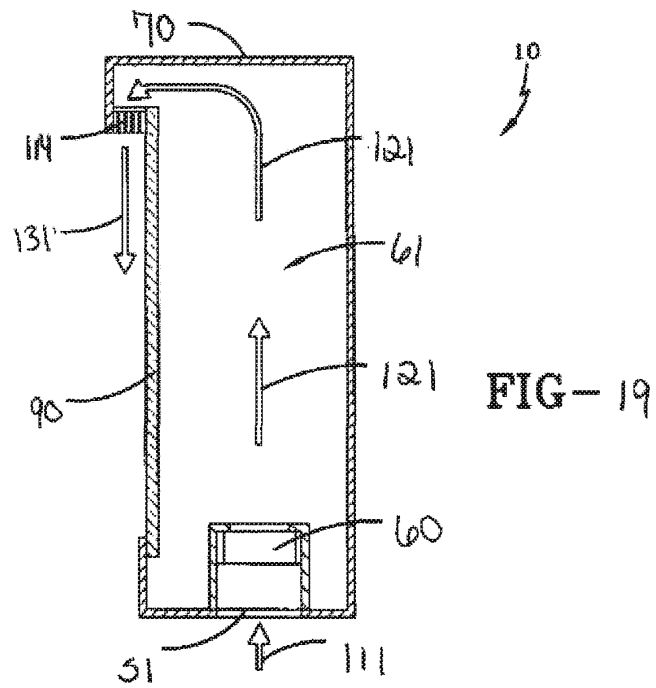
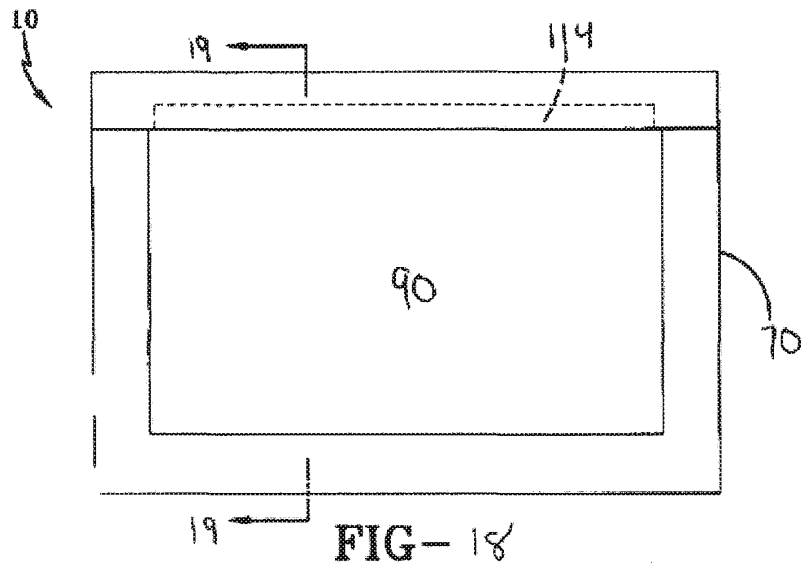


Fig. 17C

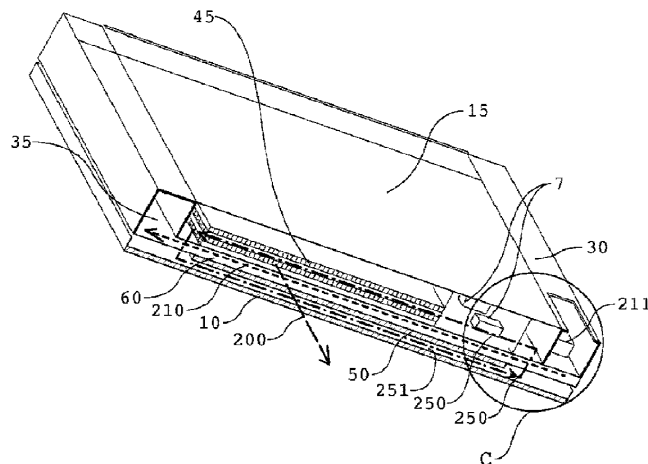




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(72) Inventeurs/Inventors:
HUBBARD, TIM, US;
DUNN, WILLIAM, US
(73) Propriétaire/Owner:
MANUFACTURING RESOURCES INTERNATIONAL,
INC., US
(74) Agent: GASTLE AND ASSOCIATES

(54) Titre : SYSTEME DE REFROIDISSEMENT D'UN ENSEMBLE AFFICHAGE ELECTRONIQUE
(54) Title: SYSTEM FOR COOLING AN ELECTRONIC IMAGE ASSEMBLY



(57) **Abrégé/Abstract:**

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

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(71) Applicant (for all designated States except US): MANUFACTURING RESOURCES INTERNATIONAL, INC. [US/US]; 1600 Union Hill Road, Alpharetta, GA 30005 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): HUBBARD, Tim [US/US]; 1600 Union Hill Road, Alpharetta, GA 30005 (US). DUNN, William [US/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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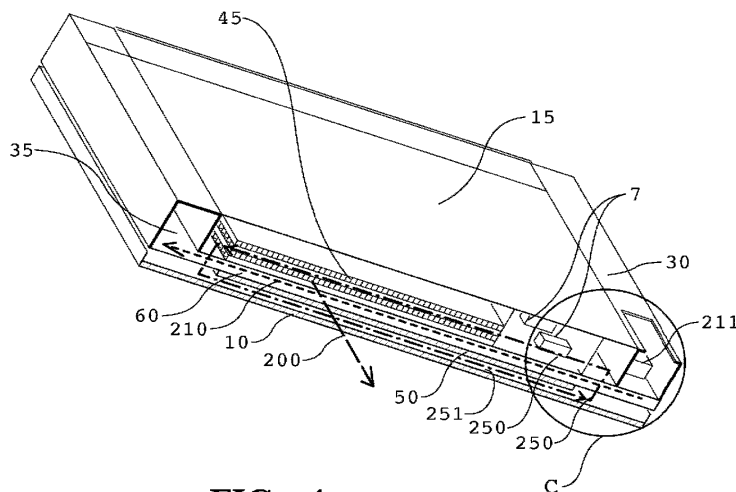


FIG - 4

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

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SYSTEM FOR COOLING AN ELECTRONIC IMAGE ASSEMBLY

Inventors: Tim Hubbard and William Dunn

Technical Field

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

Background of the Art

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

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

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

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

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

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

Summary of the Exemplary Embodiments

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

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

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

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

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

[0011] In an aspect, there is provided 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 comprises a first portion of a heat exchanger which accepts ambient gas from the inlet aperture. A second portion of a heat exchanger accepts ambient gas from the first portion. A first fan is positioned between the first and second portions which pulls ambient gas through the first portion and pushes ambient gas through the second portion. A second fan forces circulating gas through the internal cavity and at least one of the heat exchanger portions. A plurality of channels is placed behind the electronic image assembly, each channel having an inlet and exit. A first manifold is in gaseous communication with the inlet of each channel. A second manifold is in gaseous communication with the exit of each channel. A third fan is positioned to force ambient gas through the channels.

[0012] In another aspect, there is provided a system for cooling an electronic image assembly with ambient gas. The system comprises a plurality of channels placed behind the electronic image assembly. Each channel has an inlet and exit. A first

manifold is in gaseous communication with the inlet of each channel. A second manifold is in gaseous communication with the exit of each channel. A fan is positioned to force ambient gas through the channels.

[0013] In another aspect, there is provided an electronic display assembly comprising a housing. An electronic image assembly is contained within the housing and has a pair of opposing edges. An inlet aperture is provided in the housing for accepting ambient gas. An exhaust aperture is provided in the housing for exhausting ambient gas. A plurality of channels is placed behind the electronic image assembly. A first manifold is placed along one of the opposing edges which accepts ambient gas from the inlet aperture and distributes ambient gas to the plurality of channels. A second manifold is placed along the opposite edge as the first manifold which accepts ambient gas from the channels and directs it towards the exhaust aperture. A fan is provided which forces the ambient gas through the channels.

[0014] In another aspect, there is provided an electronic display assembly comprising a housing having a top portion, bottom portion, and a pair of vertical edges. An electronic image assembly is contained within the housing. An inlet aperture is provided in the housing for accepting ambient gas. An exhaust aperture is provided in the housing for exhausting ambient gas. A plurality of metallic channels are placed behind and in conductive thermal communication with the electronic image assembly. A first manifold is placed along one of the vertical edges which accepts ambient gas from the inlet aperture and distributes ambient gas to the plurality of channels. A second manifold is placed along the opposite vertical edge as the first manifold which accepts ambient gas from the channels and directs it towards the exhaust aperture. A plurality of fans are provided within the first manifold which draw the ambient gas into the inlet aperture and through the channels.

[0015] In another aspect, there is provided 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 comprises a first portion of a heat exchanger positioned to accept ambient gas from the inlet aperture. A second portion of a heat exchanger is positioned to accept ambient gas from the first portion. A first fan is positioned between the first and second portions to pull ambient

gas through the first portion and push ambient gas through the second portion. A second fan is positioned to force circulating gas through the internal cavity and at least one of the heat exchanger portions. A plurality of channels are placed behind the electronic image assembly, each channel having an inlet and exit. A first manifold is in gaseous communication with the inlet of each channel. A second manifold is in gaseous communication with the exit of each channel. A third fan is positioned to force ambient gas through the channels.

[0016] In another aspect, there is provided a system for cooling an electronic image assembly with ambient gas, the system comprising a plurality of channels placed behind the electronic image assembly. Each channel has an inlet and exit. A first manifold is in gaseous communication with the inlet of each channel. A second manifold is in gaseous communication with the exit of each channel. A fan is positioned to force ambient gas through the channels. A front plate is placed in front of the electronic image assembly, the space between the front plate and the electronic image assembly defining a front channel. A circulating fan is positioned to force circulating gas through the front channel. A pass through plate has a first pathway for ambient gas travelling through the plurality of channels behind the electronic image assembly and a second pathway for circulating gas travelling through the front channel.

[0017] In another aspect, there is provided an electronic display assembly comprising a housing. An electronic image assembly is contained within the housing and having a pair of opposing edges. An inlet aperture is in the housing for accepting ambient gas. An exhaust aperture is in the housing for exhausting ambient gas. A plurality of channels placed behind the electronic image assembly. A first manifold is placed along one of the opposing edges to accept ambient gas from the inlet aperture and distribute ambient gas to the plurality of channels. A second manifold is placed along the opposite edge as the first manifold to accept ambient gas from the channels and direct it toward the exhaust aperture. A fan is positioned to force the ambient gas through the channels. A transparent front plate is placed in front of the electronic image assembly, the space between the front plate and the electronic image assembly defining a front channel. A circulating fan is positioned to force circulating gas through the front channel. A first pass through plate is adjacent to the first manifold and a second pass

through plate adjacent to the second manifold, each pass through plate having a first pathway for ambient gas travelling through the plurality of channels behind the electronic image assembly and a second pathway for circulating gas travelling through the front channel.

[0018] In another aspect, there is provided an electronic display assembly comprises a housing having a top portion, bottom portion, a pair of vertical edges, and an internal cavity for circulating gas. An electronic image assembly is contained within the housing. An inlet aperture is in the housing for accepting ambient gas. An exhaust aperture is in the housing for exhausting ambient gas. A plurality of metallic channels is placed behind and in conductive thermal communication with the electronic image assembly. A first manifold is placed along one of the vertical edges to accept ambient gas from the inlet aperture and distribute ambient gas to the plurality of channels. A second manifold is placed along the opposite vertical edge as the first manifold to accept ambient gas from the channels and direct it toward the exhaust aperture. At least a first fan within the first manifold is positioned to draw the ambient gas into the inlet aperture and through the channels. Also provided is a heat exchanger comprising a first portion and a second portion, the first portion adapted to receive ambient gas from the inlet aperture, and the second portion adapted to receive ambient gas from the first portion. At least a second fan is positioned between the first and second portions of the heat exchanger to pull ambient gas through the first portion and push ambient gas through the second portion. At least a third fan positioned to force circulating gas through the internal cavity and at least one of the heat exchanger portions.

[0019] In another aspect, there is provided a method for cooling an electronic image assembly comprising the steps of: circulating a closed loop of circulating gas around the electronic image assembly directing a flow of ambient air through a first manifold; allowing the flow of ambient air to cross the flow of circulating gas without allowing the two to mix; directing the flow of ambient air behind the electronic image assembly; and directing the flow of ambient air through a second manifold.

[0020] In another aspect, there is provided a method for cooling an electronic image assembly having a pair of opposing edges and contained within a housing, the method comprising the steps of: positioning a circulating fan within the housing to cause a

closed loop of circulating gas to flow around the electronic image assembly; placing a first manifold along one of the opposing edges of the electronic image assembly; placing a second manifold along the opposite edge of the electronic image assembly as the first manifold; placing a plurality of channels behind the electronic image assembly, where each channel is in gaseous communication with the first and second manifolds; and positioning an ambient air fan within the housing to cause a flow of ambient air through the first manifold, channels, and second manifold without allowing the ambient air to mix with the circulating gas.

[0021] In another aspect, there is provided a method for cooling an electronic image assembly contained within a housing which encloses a first and second manifold along opposing edges of the housing, the method comprising the steps of placing a first pass through plate adjacent to the first manifold; placing a second pass through plate adjacent to the second manifold; circulating a closed loop of circulating gas around the electronic image assembly and through the first and second pass through plates; and directing a flow of ambient air through the first manifold, through the first pass through plate, behind the electronic image assembly, through the second pass through plate, and through the second manifold.

[0022] In another aspect, there is provided an apparatus comprising an electronic image assembly and a housing assembly containing the electronic image assembly. A first fan is affixed to the housing assembly to force circulating gas through a first zone of the interior of the housing assembly. A second fan is affixed to the housing assembly to cause a flow of ambient gas from outside the housing assembly to pass through a second zone of the interior of the housing assembly. A structure is positioned within the housing assembly to allow the circulating gas to cross the flow of the ambient gas while substantially prohibiting the circulating gas from mixing with the ambient gas.

[0023] In another aspect, there is provided an apparatus comprising an electronic image assembly and a housing assembly containing the electronic image assembly. A first fan is affixed within the housing assembly to force circulating gas through a first zone of the housing assembly. A second fan is affixed within the housing to cause a flow of ambient gas through a second zone of the housing assembly. Also provided is a structure having a first series of voids adapted to accept the circulating gas and a

second series of voids adapted to accept the ambient gas, wherein the first series of voids is oriented substantially perpendicular to the second series of voids.

[0024] In another aspect, there is provided an apparatus comprising an electronic image assembly. A first fan is positioned to force circulating gas around the electronic image assembly in a closed loop. A second fan is positioned to cause a first flow of ambient gas. A first structure is positioned on a first side of the electronic image assembly to allow the circulating gas to cross the flow of the ambient gas without permitting the circulating gas to substantially mix with the ambient gas. A second structure is positioned on a second side of the electronic image assembly to allow the circulating gas to cross the flow of the ambient gas without permitting the circulating gas to substantially mix with the ambient gas. A heat exchanger is positioned to accept both the circulating gas and the ambient gas without permitting the circulating gas to substantially mix with the ambient gas.

[0025] In another aspect, there is provided an apparatus comprising an electronic image assembly and a housing assembly containing the electronic image assembly. A first fan is connected to the housing assembly and adapted to circulate gas in a first path through an interior of the housing assembly. A second fan is connected to the housing assembly and adapted to cause ambient gas from outside the housing assembly to circulate in a second path through the interior of the housing assembly. A structure is positioned within the housing assembly and configured to allow the gas in the first path to cross over the ambient gas in the second path.

[0026] In another aspect, there is provided an apparatus comprising an electronic image assembly and a housing assembly containing the electronic image assembly. A first fan is connected to the housing assembly and adapted to circulate gas in a first path through the housing assembly. A second fan connected to the housing assembly and adapted to cause ambient gas to circulate in a second path through the housing assembly. A structure comprises a first series of voids configured to accept the gas in the first path and a second series of voids configured to accept the ambient gas in the second path, wherein the first series of voids is oriented substantially perpendicular to the second series of voids.

[0027] In another aspect, there is provided an apparatus comprising an electronic image assembly. A first fan is adapted to circulate gas around the electronic image assembly in a first path. A second fan is adapted to circulate a first flow of ambient gas. A first structure on a first side of the electronic image assembly is configured to allow the gas in the first path to cross over the first flow of ambient gas. A second structure on a second side of the electronic image assembly is configured to allow the gas in the first path to cross over the first flow of ambient gas. A heat exchanger configured to accept the gas in the first path and a second flow of ambient gas.

[0028] 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

[0029] 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:

[0030] FIGURE 1A provides a front perspective view of an exemplary embodiment of the electronic display.

[0031] FIGURE 1B provides a rear perspective view of an exemplary embodiment of the electronic display.

[0032] FIGURE 2 provides a rear perspective view similar to that shown in Figure 1B where the rear cover has been removed.

[0033] FIGURE 3 provides a perspective sectional view along the A-A section line shown in Figure 1B.

[0034] FIGURE 4 provides a perspective sectional view along the B-B section line shown in Figure 1B.

[0035] FIGURE 5 provides a perspective sectional view of insert C shown in Figure 4.

[0036] FIGURE 6 provides a perspective sectional view of one embodiment of the cross through plate.

[0037] FIGURE 7 provides an exploded perspective view of one exemplary embodiment of the heat exchanger and fan assembly.

[0038] 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).

[0039] FIGURE 9 provides a perspective sectional view of an exemplary embodiment which uses a flow of circulating gas through the backlight cavity in addition to the flow of circulating gas between the LCD and front plate.

Detailed Description

[0040] 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.

[0041] 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.

[0042] 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.

[0043] 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.

[0044] 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.

[0045] 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.

[0046] 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.

[0047] 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.

[0048] 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.

[0049] 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.

[0050] 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).

[0051] Optionally, ambient gas 210 may also be ingested into the display through inlet aperture 24 (or a separate inlet aperture). Ambient gas 210 may then be directed through a first manifold 30 which travels along the edge of the display. The first manifold 30 accepts the single larger inlet flow of ambient gas 210 and distributes it into a plurality of smaller flows (channels 60) across the display. A second manifold 35 may be placed along the opposite edge of the display as the first manifold 30. The second manifold 35 accepts the plurality of smaller flows (channels 60) and combines them into a single flow and exhausts it out of the exit aperture 25 (or a separate exit aperture). In this embodiment, a manifold fan assembly 211 is used to draw the ambient gas 210 into the inlet aperture 24 and force the ambient gas 210 across the display. For this particular embodiment, the manifold fan assembly 211 is placed within the first manifold 30 and is used to draw the ambient gas 210 into the display as well as distribute the single flow into a plurality of smaller flows (channels 60). This is not required however, as some embodiments may place the manifold fan assembly 211 in the second manifold 35, or within both the first and second manifolds 30 and 35.

[0052] The first and second manifolds 30 and 35 may be placed along any opposing edges of the display. However, it is preferable that the first and second manifolds 30 and 35 are placed along the vertical edges of the display with the channels 60 travelling horizontally. Other embodiments may place the first and second manifolds 30 and 35 along the horizontal edges of the display with the channels 60 travelling vertically.

[0053] 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.

[0054] FIGURE 3 provides a perspective sectional view along the A-A section line shown in Figure 1B. Again, ambient gas 200 may be ingested into the display through the inlet aperture 24 and pass through a heat exchanger 45 and exit the display through the exit aperture 25. The ambient gas 200 may be drawn into the display and forced through the heat exchanger 45 using heat exchanger fan assembly 46. Obviously, the

inlet aperture 24 may contain a filter or other coverings so that contaminants, insects, garbage, and/or water/fluids cannot easily be ingested into the display. However, an exemplary embodiment would not be damaged if the ambient gas 200 contained contaminants as they would only pass through the heat exchanger 45 which may not be susceptible to damage from particulate or contaminants. Exit aperture 25 may also contain some type of covering to ensure that contaminants and/or insects could not enter the display.

[0055] An electronic image assembly 50 may be placed behind the front plate 10. A plurality of channels 60 may be placed behind the electronic image assembly 50. Ambient gas 210 may be forced through the channels 60 after travelling through the first manifold 30 (not shown here). The flow of ambient gas 210 behind the electronic image assembly 50 may be used to remove any buildup of heat from the rear portion of the electronic image assembly 50. It may be preferable to have a thermally conductive surface/plate on the rear portion of the electronic image assembly 50 so that heat can easily transfer to this surface/plate and be removed by the ambient gas 210.

[0056] 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. Preferably, the channels 60 are metallic and even more preferably aluminum. Further, in an exemplary embodiment the channels 60 are in conductive thermal communication with the electronic image assembly 50.

[0057] 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. In this way, the heat exchanger 45 and the front channel 251 are placed in gaseous communication with each other.

[0058] 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.

[0059] Also shown in this sectional view is the path of the ambient gas 210 travelling down one of the channels 60 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. In other words, each channel 60 preferably has an inlet which is in gaseous communication with the first manifold 30 as well as an exit which is in gaseous communication with the second manifold 35. As shown in this Figure, the paths of the ambient gas 210 and the circulating gas 250 may 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.

[0060] 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.

[0061] 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. Thus, an exemplary cross through plate 500 contains two gaseous pathways where the two pathways do not allow the gaseous matter to mix. Here, the first gas pathway would be 525 while the second gas pathway would be 550.

[0062] FIGURE 7 provides an exploded perspective view of one exemplary embodiment of the heat exchanger 45 and fan assembly 46. In this view, the fan

assembly 46 is shown removed from its mounted position within the fan housing 51. In this embodiment, the heat exchanger 45 is divided into two portions 47 and 48 where the fan housing 51 is used to provide a gaseous communication between the two portions 47 and 48. Here, 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 reduced because the surrounding portions 47 and 48 of the heat exchanger 45 essentially act as a muffler for the fan assembly 46.

[0063] 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). As shown, the fan housing 51 may be used to connect two portions of a heat exchanger which may be of different lengths. As shown, portion 48 of the heat exchanger is thinner than the fan housing 51. In an alternative embodiment, both portions 48 and 47 may be thinner than the fan assembly 46 such that a fan housing 51 may be used to provide a sealed gaseous communication between the two portions, even though they are both thinner than the fan assembly 51. This design may be preferable when it is desirable to create the largest possible heat exchanger 45 (for maximum cooling abilities) even though space is limited. 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). Some exemplary embodiments may place fans within the heat exchanger 45 to drive both the ambient gas 200 and circulating gas 250.

[0064] 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).

[0065] 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).

[0066] 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.

[0067] 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).

[0068] 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 enclose the area between the LCD 300 and the backlight 320 in order to 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. In this way, the backlight cavity is placed in gaseous communication with the heat exchanger 45.

[0069] 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 through the front channel 251 (the area defined between the LCD 300 and front plate 10). Circulating fan assembly 255 may be placed so that it can draw circulating gas 350 through the backlight cavity as well as circulating gas 250 through the front channel 251. 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). In this way, both the front channel 251 and the backlight cavity are placed in gaseous communication with the heat exchanger 45.

[0070] Also shown in Figure 9 is the optional additional flow of ambient gas 210 which may travel immediately behind the electronic image assembly (in this embodiment 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 through 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.

[0071] 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 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 and the thermal communication between the channels 60 and the backlight 320 would be conductive thermal communication.

[0072] 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.

[0073] The circulating gases 250 and 350, ambient gas 200, and optional ambient gas 210 can be any number of gaseous matters. In some embodiments, air may be used as the gas for all. As well known by those of ordinary skill in the art, air typically contains some amount of water vapor. It should be noted that the use of the term 'gas' herein does not designate pure gas and that it is specifically contemplated that any of the gaseous matters described herein may contain some amount of impurities including but not limited to water vapor. Preferably, because the circulating gases 250 and 350 may travel in front of the image assembly and backlight respectively, they should be substantially clear, so that they will not affect the appearance of the image to a viewer. The circulating gases 250 and 350 should also preferably be substantially free of contaminants and/or particulate 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 200 and 210 from having contaminants as well. Filters may be used to help reduce the particulate within ambient gases 200 and 210. Filters could be placed near the inlet aperture 24 so that ambient gases 200 and/or 210 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 200 and 210 but this will not harm the display. In these embodiments, the heat exchanger 45, manifolds 30 and 35, channels 60, 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,

ambient air may be ingested for the ambient gases 200 and 210, even if the ambient air contains contaminants or particulate. This can be particularly beneficial when the display is used in outdoor environments or indoor environments where contaminants are present in the ambient air.

[0074] 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.

[0075] It is to be understood that the spirit and scope of the disclosed embodiments provides for the cooling of many types of electronic image assemblies. As used herein, the term 'electronic image assembly' is any electronic assembly for creating an image. At this time this, these are 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 thin/flat 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 a concern.

[0076] 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.

[0077] 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 positioned to accept ambient gas from the inlet aperture;
 - a second portion of a heat exchanger positioned to accept ambient gas from the first portion;
 - a first fan positioned between the first and second portions to pull ambient gas through the first portion and push ambient gas through the second portion;
 - a second fan positioned to force circulating gas through the internal cavity and at least one of the heat exchanger portions;
 - a plurality of channels placed behind the electronic image assembly, each channel having an inlet and exit;
 - a first manifold in gaseous communication with the inlet of each channel;
 - a second manifold in gaseous communication with the exit of each channel; and
 - a third fan positioned to force ambient gas through the channels.
2. A system for cooling an electronic image assembly with ambient gas, the system comprising:
 - a plurality of channels placed behind the electronic image assembly, each channel having an inlet and exit;
 - a first manifold in gaseous communication with the inlet of each channel;
 - a second manifold in gaseous communication with the exit of each channel;
 - a fan positioned to force ambient gas through the channels;
 - a front plate placed in front of the electronic image assembly, the space between the front plate and the electronic image assembly defining a front channel;
 - a circulating fan positioned to force circulating gas through the front channel; and

a pass through plate having a first pathway for ambient gas travelling through the plurality of channels behind the electronic image assembly and a second pathway for circulating gas travelling through the front channel.

3. The cooling system of claim 2 wherein:
the channels are in thermal communication with the electronic image assembly.
4. The cooling system of claim 2 or 3 wherein:
the first and second manifolds are placed along a pair of vertical edges of the electronic image assembly.
5. The cooling system of any of claims 2 to 4 wherein:
the fan is placed within either the first or second manifold.
6. The cooling system of any of claims 2 to 5 wherein:
the channels have a rectangular cross-section.
7. The cooling system of any of claims 2 to 6 wherein:
the channels are arranged in horizontal rows.
8. The cooling system of any of claims 2 to 7 wherein:
the channels are metallic.
9. The cooling system of any of claims 2 to 8 wherein:
the first and second gas pathways are substantially perpendicular.
10. The cooling system of any of claims 2 to 9 wherein:
the first and second gas pathways do not allow the ambient gas and circulating gas to mix.
11. The cooling system of any of claims 2 to 10 wherein:

the pass through plate is positioned adjacent to the first manifold.

12. An electronic display assembly comprising:
 - a housing;
 - an electronic image assembly contained within the housing and having a pair of opposing edges;
 - an inlet aperture in the housing for accepting ambient gas;
 - an exhaust aperture in the housing for exhausting ambient gas;
 - a plurality of channels placed behind the electronic image assembly;
 - a first manifold placed along one of the opposing edges to accept ambient gas from the inlet aperture and distribute ambient gas to the plurality of channels;
 - a second manifold placed along the opposite edge as the first manifold to accept ambient gas from the channels and direct it toward the exhaust aperture;
 - a fan positioned to force the ambient gas through the channels;
 - a transparent front plate placed in front of the electronic image assembly, the space between the front plate and the electronic image assembly defining a front channel;
 - a circulating fan positioned to force circulating gas through the front channel; and
 - a first pass through plate adjacent to the first manifold and a second pass through plate adjacent to the second manifold, each pass through plate having a first pathway for ambient gas travelling through the plurality of channels behind the electronic image assembly and a second pathway for circulating gas travelling through the front channel.
13. The electronic display assembly of claim 12 wherein:
 - the fan is placed within the first manifold.
14. The electronic display assembly of claim 12 or 13 wherein:
 - the housing contains a top and bottom portion;
 - the inlet aperture is located at the top portion of the housing; and

the exhaust aperture is located at the bottom portion of the housing.

15. The electronic display assembly of any of claims 12 to 14 wherein:
the first and second manifolds are oriented vertically; and
the plurality of channels are oriented horizontally.
16. The electronic display assembly of any of claims 12 to 15 wherein:
the channels are in conductive thermal communication with the electronic image assembly.
17. The cooling system of any of claims 12 to 16 wherein:
the first and second gas pathways are substantially perpendicular.
18. An electronic display assembly comprising:
a housing having a top portion, bottom portion, a pair of vertical edges, and an internal cavity for circulating gas;
an electronic image assembly contained within the housing;
an inlet aperture in the housing for accepting ambient gas;
an exhaust aperture in the housing for exhausting ambient gas;
a plurality of metallic channels placed behind and in conductive thermal communication with the electronic image assembly;
a first manifold placed along one of the vertical edges to accept ambient gas from the inlet aperture and distribute ambient gas to the plurality of channels;
a second manifold placed along the opposite vertical edge as the first manifold to accept ambient gas from the channels and direct it toward the exhaust aperture;
at least a first fan within the first manifold positioned to draw the ambient gas into the inlet aperture and through the channels;

a heat exchanger comprising a first portion and a second portion, said first portion adapted to receive ambient gas from the inlet aperture, and said second portion adapted to receive ambient gas from the first portion;
at least a second fan positioned between the first and second portions of the heat exchanger to pull ambient gas through the first portion and push ambient gas through the second portion; and
at least a third fan positioned to force circulating gas through the internal cavity and at least one of the heat exchanger portions.

19. The electronic display assembly of claim 18 wherein:
the electronic image assembly is a liquid crystal display.
20. The assembly of claim 1 wherein:
the channels are in thermal communication with the electronic image assembly.
21. The assembly of claim 1 or 20 wherein:
the first and second manifolds are placed along a pair of vertical edges of the electronic image assembly.
22. The assembly of any of claims 1 to 21 wherein:
the third fan is placed within either the first or second manifold.
23. The assembly of any of claims 1 to 22 wherein:
the channels have a rectangular cross-section.
24. The assembly of any of claims 1 to 23 wherein:
the channels are arranged in horizontal rows.
25. The assembly of any of claims 1 to 24 wherein:
the channels are metallic.

26. The assembly of any of claims 1 to 25 wherein:
the assembly is configured not to allow ambient gas in the channels to mix with
the circulating gas.
27. The assembly of any of claims 1 to 26 wherein:
the assembly is configured not to allow the ambient gas that is pushed through
the second portion of the heat exchanger to mix with the circulating gas.
28. The electronic display assembly of any of claims 12 to 17 wherein:
the electronic image assembly is a liquid crystal display.
29. The electronic display assembly of any of claims 12 to 17, and 28 wherein:
the first and second gas pathways do not allow the ambient gas and circulating
gas to mix.
30. The electronic display assembly of claim 18 or 19 wherein:
the inlet aperture is located at the top portion of the housing; and
the exhaust aperture is located at the bottom portion of the housing.
31. The electronic display assembly of any of claims 18, 19, and 30 wherein:
the channels are oriented horizontally.
32. The electronic display assembly of any of claims 18, 19, 30, and 31 wherein:
the channels have a rectangular cross-section.
33. The electronic display assembly of any of claims 18, 19, and 30 to 32 wherein:
the channels are arranged in horizontal rows.
34. The electronic display assembly of any of claims 18, 19, and 30 to 33 wherein:
the electronic display assembly is configured not to allow ambient gas in the
channels to mix with the circulating gas.

35. The electronic display assembly of any of claims 18, 19, and 30 to 34 wherein:
the electronic display assembly is configured not to allow the ambient gas that is
pushed through the second portion of the heat exchanger to mix with the
circulating gas.
36. A method for cooling an electronic image assembly comprising the steps of:
circulating a closed loop of circulating gas around the electronic image assembly;
directing a flow of ambient air through a first manifold;
allowing the flow of ambient air to cross the flow of circulating gas without
allowing the two to mix;
directing the flow of ambient air behind the electronic image assembly; and
directing the flow of ambient air through a second manifold.
37. The method of claim 36 wherein:
the circulating gas travels in front of the electronic image assembly and behind
the electronic image assembly.
38. The method of claim 36 or 37 wherein:
the step of allowing the flow of ambient air to cross the flow of circulating gas is
performed by a pass through plate.
39. The method of any of claims 36 to 38 wherein:
the manifolds travel lengthwise down vertical sides of the electronic image
assembly.
40. The method of any of claims 36 to 39 wherein:
the step of directing the flow of ambient air behind the electronic image assembly
is performed by a plurality of channels which are placed behind the electronic
image assembly, where the channels are in gaseous communication with the
first and second manifolds.

41. The method of any of claims 36 to 40 further comprising the steps of:
forcing the circulating gas through a first set of pathways in a heat exchanger,
and
forcing the ambient air through a second set of pathways in said heat exchanger.
42. The method of claim 41 wherein:
the step of forcing the circulating gas through the heat exchanger is performed
by a circulating fan, and
the step of forcing the ambient air through the heat exchanger is performed by
an ambient air fan.
43. The method of any of claims 36 to 42 wherein:
the closed loop of circulating gas travels in front of the electronic image
assembly, between a transparent front plate and a front surface of the
electronic image assembly.
44. The method of claim 40 wherein:
the channels are placed in conductive thermal communication with the electronic
image assembly.
45. A method for cooling an electronic image assembly having a pair of opposing
edges and contained within a housing, the method comprising the steps of:
positioning a circulating fan within the housing to cause a closed loop of
circulating gas to flow around the electronic image assembly;
placing a first manifold along one of the opposing edges of the electronic image
assembly;
placing a second manifold along the opposite edge of the electronic image
assembly as the first manifold;
placing a plurality of channels behind the electronic image assembly, where each
channel is in gaseous communication with the first and second manifolds;
and

positioning an ambient air fan within the housing to cause a flow of ambient air through the first manifold, channels, and second manifold without allowing the ambient air to mix with the circulating gas.

46. The method of claim 45 wherein:
the circulating gas travels in front of the electronic image assembly and behind the electronic image assembly.
47. The method of claim 45 or 46 further comprising the steps of:
positioning a first pass through plate adjacent to the first manifold; and
positioning a second pass through plate adjacent to the second manifold.
48. The method of claim 47 wherein:
the first and second pass through plates accept both ambient air as well as circulating gas but do not permit the two to mix.
49. The method of any of claims 45 to 48 further comprising the steps of:
forcing the circulating gas through a first set of pathways in a heat exchanger,
and
forcing the ambient air through a second set of pathways in said heat exchanger.
50. The method of any of claims 45 to 49 wherein:
the closed loop of circulating gas travels in front of the electronic image assembly, between a transparent front plate and a front surface of the electronic image assembly.
51. The method of any of claims 45 to 50 wherein:
the channels are placed in conductive thermal communication with the electronic image assembly.

52. A method for cooling an electronic image assembly contained within a housing which encloses a first and second manifold along opposing edges of the housing, the method comprising the steps of:
placing a first pass through plate adjacent to the first manifold;
placing a second pass through plate adjacent to the second manifold;
circulating a closed loop of circulating gas around the electronic image assembly and through the first and second pass through plates; and
directing a flow of ambient air through the first manifold, through the first pass through plate, behind the electronic image assembly, through the second pass through plate, and through the second manifold.
53. The method of claim 52 further comprising the steps of:
forcing the circulating gas through a first set of pathways in a heat exchanger,
and
forcing the ambient air through a second set of pathways in said heat exchanger.
54. The method of claim 52 or 53 wherein:
the closed loop of circulating gas travels in front of the electronic image assembly, between a transparent front plate and a front surface of the electronic image assembly.
55. The method of any of claims 52 to 54 further comprising the steps of:
further directing the ambient air through a plurality of channels which are placed in conductive thermal communication with the electronic image assembly.
56. An apparatus comprising:
an electronic image assembly and a housing assembly containing said electronic image assembly;
a first fan affixed to said housing assembly to force circulating gas through a first zone of the interior of said housing assembly;

a second fan affixed to said housing assembly to cause a flow of ambient gas from outside said housing assembly to pass through a second zone of the interior of said housing assembly; and
a structure positioned within said housing assembly to allow the circulating gas to cross the flow of the ambient gas while substantially prohibiting the circulating gas from mixing with the ambient gas.

57. The apparatus of claim 56 wherein:
the flow of ambient gas is adapted to travel behind the electronic image assembly.
58. The apparatus of claim 56 or 57 further comprising:
a plurality of channels placed behind the electronic image assembly, each channel having an inlet and exit and positioned to accept ambient gas.
59. The apparatus of claim 58 further comprising:
a first manifold in gaseous communication with the inlet of each channel; and
a second manifold in gaseous communication with the exit of each channel.
60. The apparatus of any of claims 56 to 59 wherein:
the structure comprises a first series of voids adapted to accept the circulating gas and a second series of voids adapted to accept the ambient gas.
61. The apparatus of any of claims 56 to 60 wherein:
the structure comprises a first and second series of voids where the first series of voids are oriented substantially perpendicular to the second series of voids.
62. The apparatus of any of claims 56 to 61 wherein:
the flow of ambient gas is adapted to cross the closed loop of circulating gas at a right angle.

63. The apparatus of claim 58 or 59 wherein:
the channels are in thermal communication with the electronic image assembly.
64. The apparatus of claim 59 wherein:
the first and second manifolds are placed along a pair of vertical edges of the
electronic image assembly.
65. An apparatus comprising:
an electronic image assembly and a housing assembly containing said electronic
image assembly;
a first fan affixed within the housing assembly to force circulating gas through a
first zone of said housing assembly;
a second fan affixed within the housing to cause a flow of ambient gas through a
second zone of said housing assembly; and
a structure having
a first series of voids adapted to accept the circulating gas and
a second series of voids adapted to accept the ambient gas;
wherein the first series of voids is oriented substantially perpendicular to the
second series of voids.
66. The apparatus of claim 65 further comprising:
a front channel placed in front of the electronic image assembly where the
circulating gas is adapted to travel through the front channel.
67. The apparatus of claim 65 or 66 further comprising:
a plurality of channels placed behind the electronic image assembly, each
channel having an inlet and exit and positioned to ambient gas.
68. The apparatus of claim 67 further comprising:
a first manifold in gaseous communication with the inlet of each channel behind
the electronic image assembly; and

a second manifold in gaseous communication with the exit of each channel behind the electronic image assembly.

69. The apparatus of any of claims 65 to 68 wherein:
the structure does not permit the circulating gas to substantially mix with the ambient gas.
70. The apparatus of any of claims 65 to 69 further comprising:
a heat exchanger positioned to accept the circulating gas in addition to a second flow of ambient gas.
71. An apparatus comprising:
an electronic image assembly;
a first fan positioned to force circulating gas around the electronic image assembly in a closed loop;
a second fan positioned to cause a first flow of ambient gas;
a first structure positioned on a first side of the electronic image assembly to allow the circulating gas to cross the flow of the ambient gas without permitting the circulating gas to substantially mix with the ambient gas;
a second structure positioned on a second side of the electronic image assembly to allow the circulating gas to cross the flow of the ambient gas without permitting the circulating gas to substantially mix with the ambient gas;
and
a heat exchanger positioned to accept both the circulating gas and the ambient gas without permitting the circulating gas to substantially mix with the ambient gas.
72. The apparatus of claim 71 further comprising:
a first manifold positioned adjacent to the first pass through plate; and
a second manifold positioned adjacent to the second pass through plate.

73. The apparatus of claim 71 or 72 wherein:
the first and second structure each comprise a first series of voids positioned to accept the circulating gas and a second series of voids positioned to accept the ambient gas.
74. The apparatus of any of claims 71 to 73 wherein:
the first and second structure each comprise a first and second series of voids where the first series of voids are oriented substantially perpendicular to the second series of voids.
75. An apparatus comprising:
an electronic image assembly;
a housing assembly containing said electronic image assembly;
a first fan connected to said housing assembly and adapted to circulate gas in a first path through an interior of said housing assembly;
a second fan connected to said housing assembly and adapted to cause ambient gas from outside said housing assembly to circulate in a second path through said interior of said housing assembly; and
a structure positioned within said housing assembly and configured to allow the gas in said first path to cross over the ambient gas in said second path.
76. The apparatus of claim 75 wherein said second fan is adapted to circulate the ambient gas in said second path, which goes behind the electronic image assembly.
77. The apparatus of claim 75 or 76 further comprising a plurality of channels behind said electronic image assembly, each said channel having an inlet and an exit and configured to accept ambient gas.
78. The apparatus of claim 77 further comprising:

a first manifold in gaseous communication with said inlet of each said channel;
and
a second manifold in gaseous communication with said exit of each said channel.

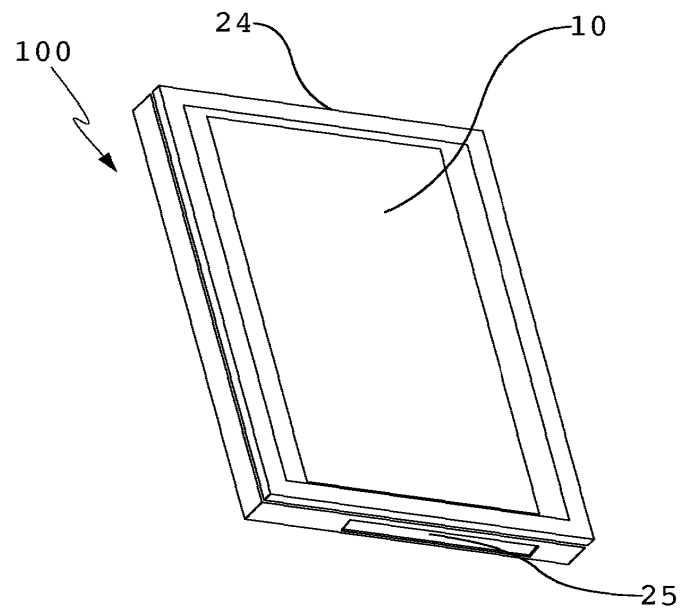
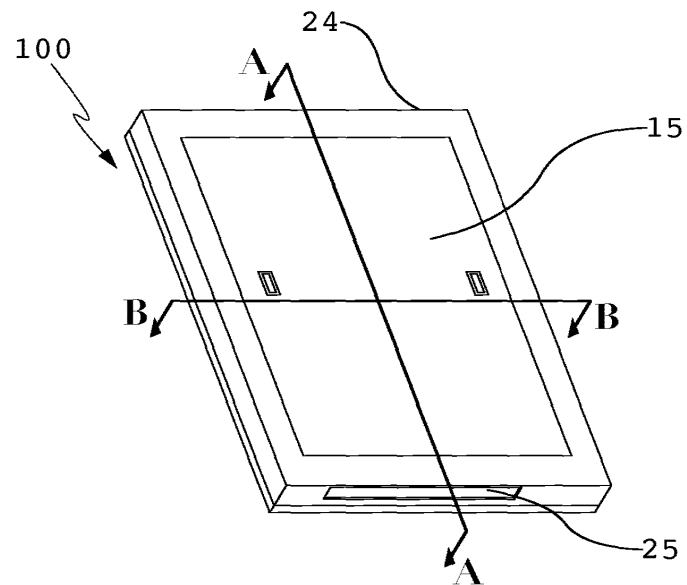
79. The apparatus of claim 78 wherein said first manifold and said second manifold are respectively placed along a pair of vertical edges of said electronic image assembly.
80. The apparatus of any of claims 77 or 79 wherein said channels are in thermal communication with said electronic image assembly.
81. The apparatus of any of claims 75 to 80 wherein said structure comprises a first series of voids configured to accept the gas in said first path and a second series of voids configured to accept the ambient gas in said second path.
82. The apparatus of any of claims 75 to 81 wherein said structure comprises a first and a second series of voids wherein said first series of voids are oriented substantially perpendicular to said second series of voids.
83. The apparatus of any of claims 75 to 82 wherein said first path crosses over said second path at a right angle.
84. An apparatus comprising:
an electronic image assembly;
a housing assembly containing said electronic image assembly;
a first fan connected to said housing assembly and adapted to circulate gas in a first path through said housing assembly;
a second fan connected to said housing assembly and adapted to cause ambient gas to circulate in a second path through said housing assembly; and

a structure comprising a first series of voids configured to accept the gas in said first path and a second series of voids configured to accept the ambient gas in said second path;
wherein said first series of voids is oriented substantially perpendicular to said second series of voids.

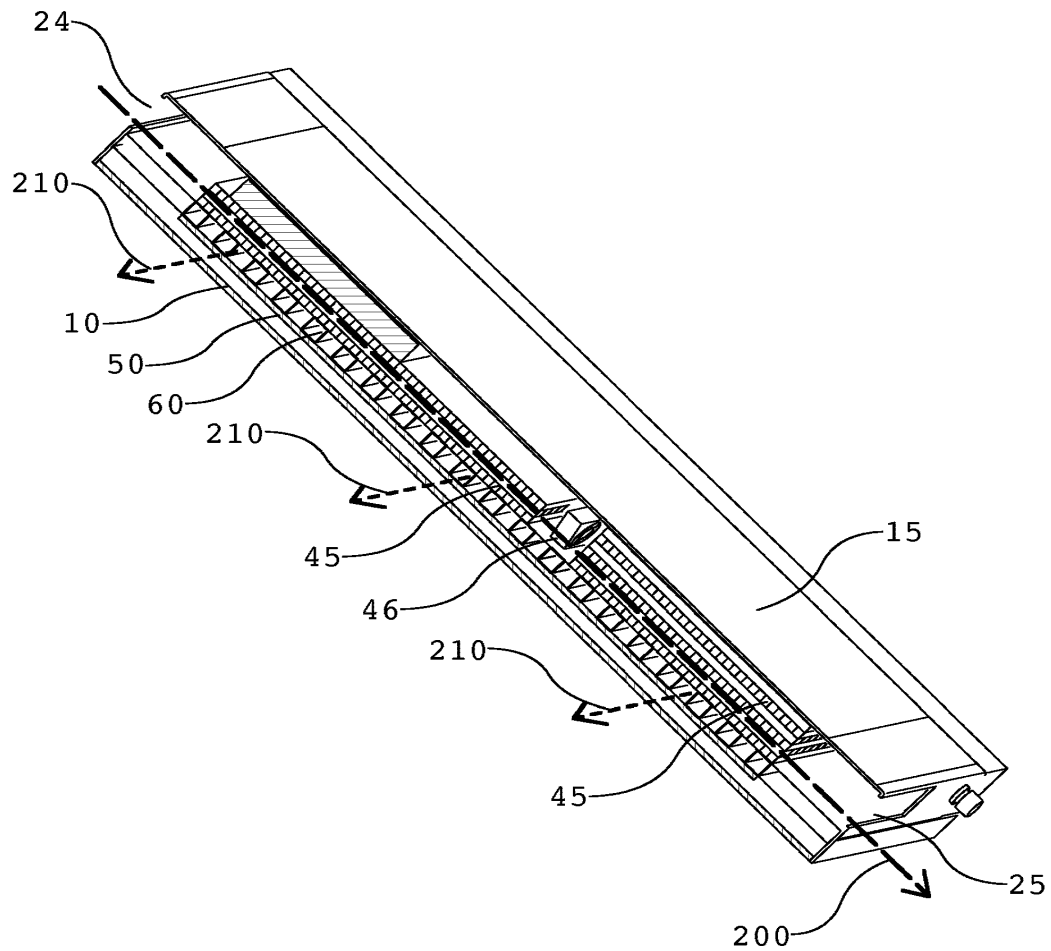
85. The apparatus of claim 84 further comprising a channel in front of said electronic image assembly such that said first fan is adapted to circulate the gas in said first path through said front channel.
86. The apparatus of claim 84 or 85 further comprising a plurality of channels behind said electronic image assembly, each said channel having an inlet and an exit configured to accept ambient gas.
87. The apparatus of claim 86 further comprising:
a first manifold in gaseous communication with said inlet of each said channel behind said electronic image assembly; and
a second manifold in gaseous communication with said exit of each said channel behind said electronic image assembly.
88. The apparatus of any of claims 84 to 87 wherein said structure is configured to substantially separate the gas in said first path from the ambient gas in said second path.
89. The apparatus of any of claims 84 to 88 further comprising a heat exchanger configured to accept the gas in said first path in addition to a second flow of ambient gas.
90. An apparatus comprising:
an electronic image assembly;

a first fan adapted to circulate gas around said electronic image assembly in a first path;
a second fan adapted to circulate a first flow of ambient gas;
a first structure on a first side of said electronic image assembly configured to allow the gas in said first path to cross over the first flow of ambient gas;
a second structure on a second side of said electronic image assembly configured to allow the gas in said first path to cross over the first flow of ambient gas; and
a heat exchanger configured to accept the gas in said first path and a second flow of ambient gas.

91. The apparatus of claim 90 further comprising:
a first manifold adjacent to said first structure; and
a second manifold adjacent to said second structure.
92. The apparatus of claim 90 or 91 wherein said first structure and said second structure each comprise a first series of voids configured to accept the gas in said first path and a second series of voids configured to accept the first flow of ambient gas.
93. The apparatus of claim 90 to 92 wherein said first structure and said second structure each comprise a first series of voids and a second series of voids such that said first series of voids is oriented substantially perpendicular to said second series of voids.
94. The apparatus of any of claims 90 to 93 wherein said first structure and said second structure are each configured to substantially separate the gas in said first path from the first flow of ambient gas.

**FIG - 1A****FIG - 1B**



**FIG - 3**

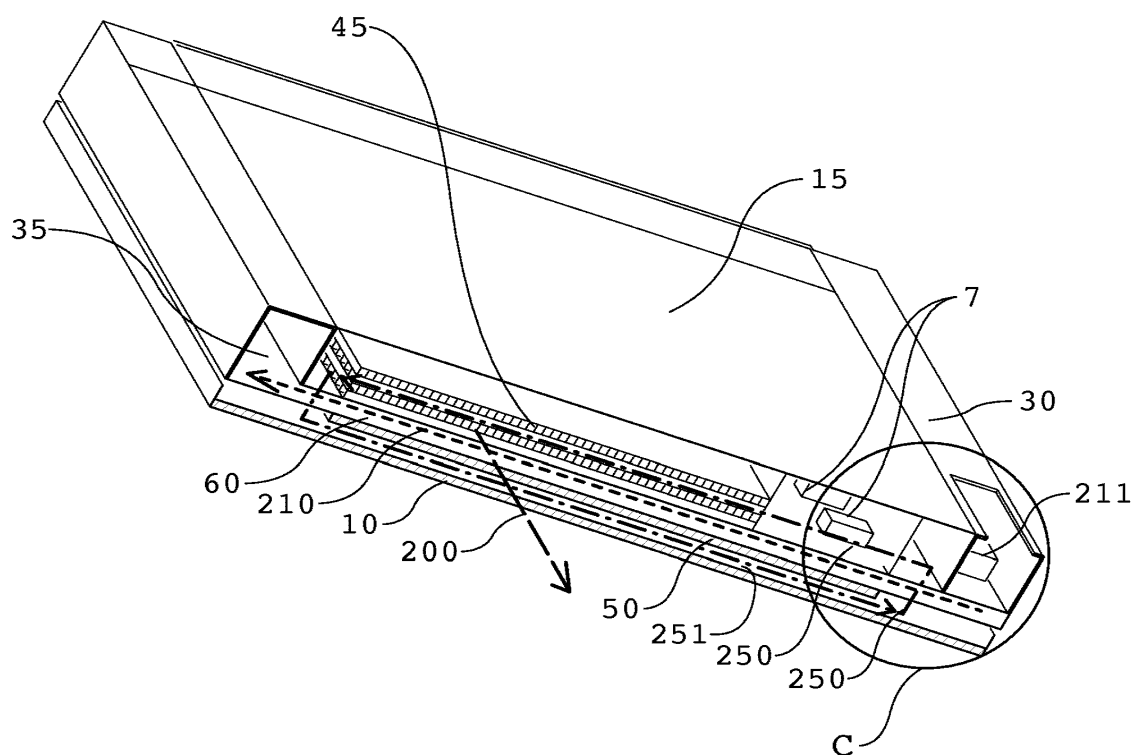


FIG - 4

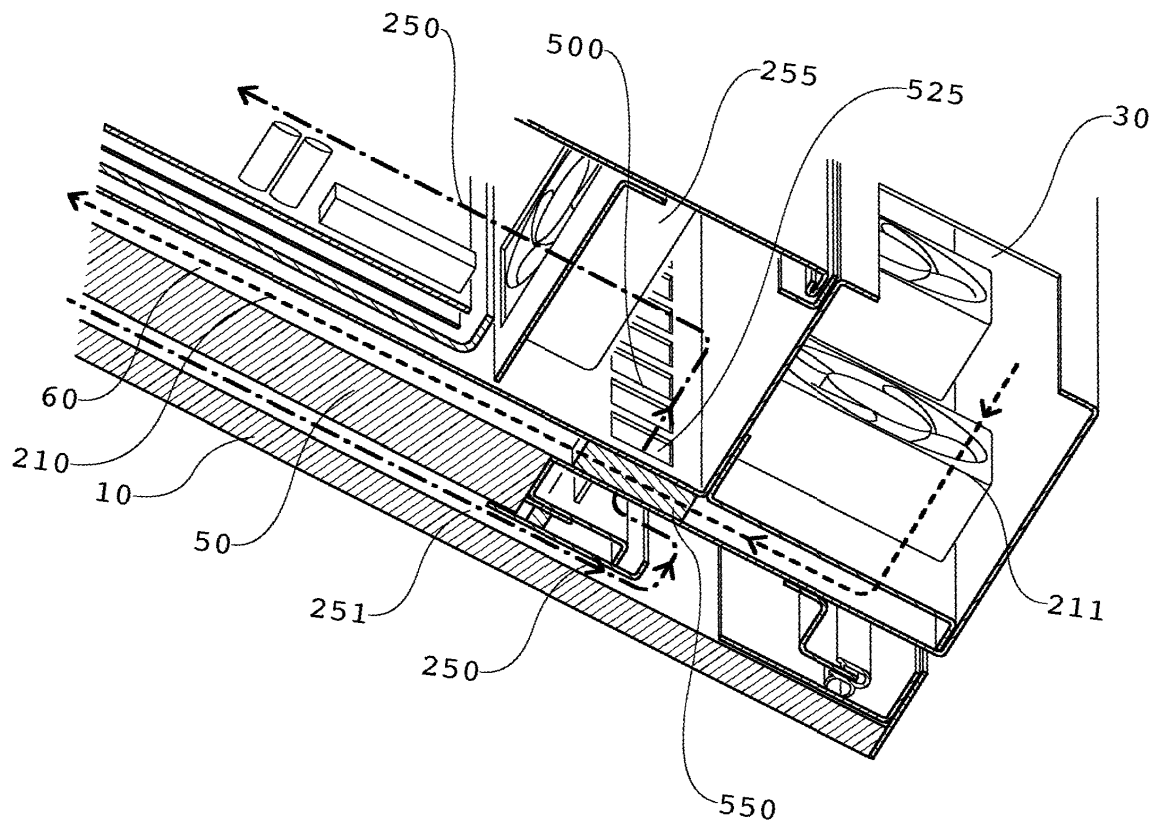


FIG - 5

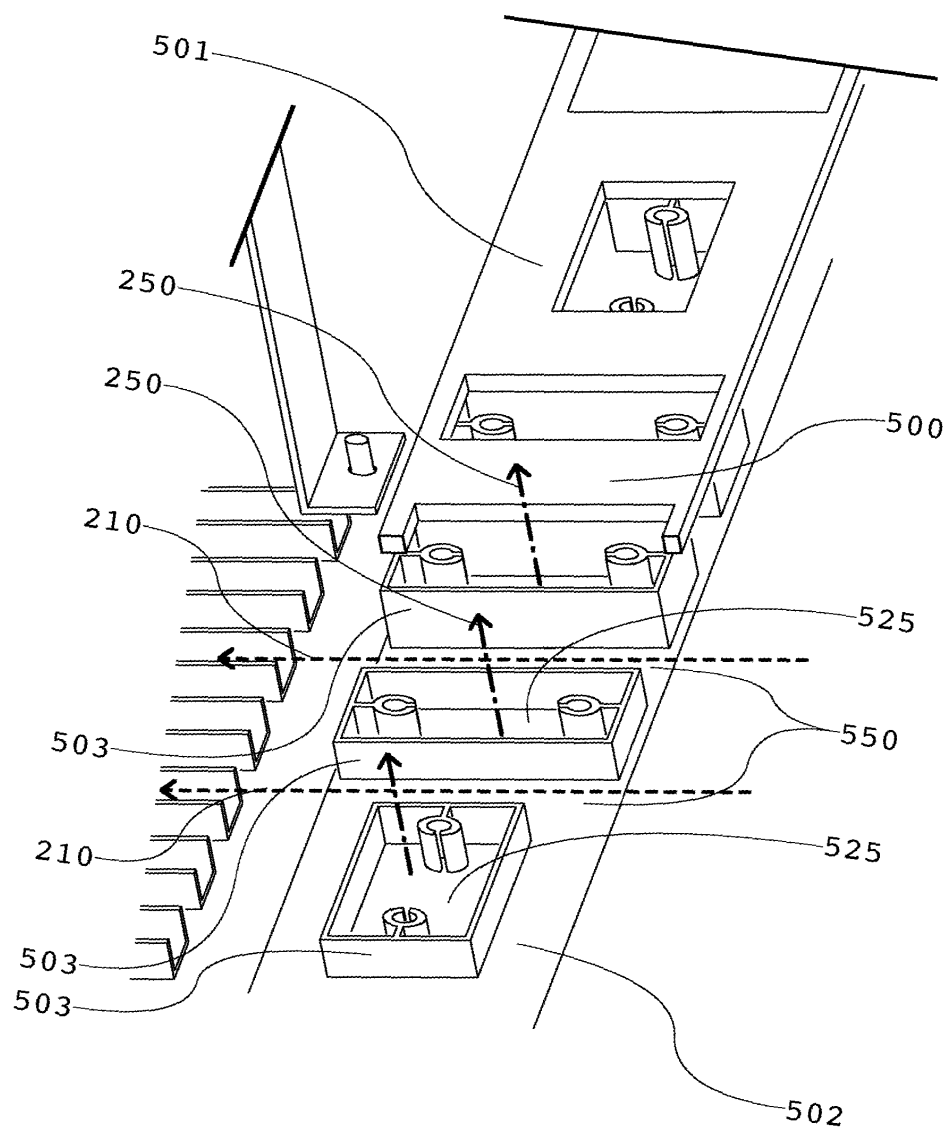
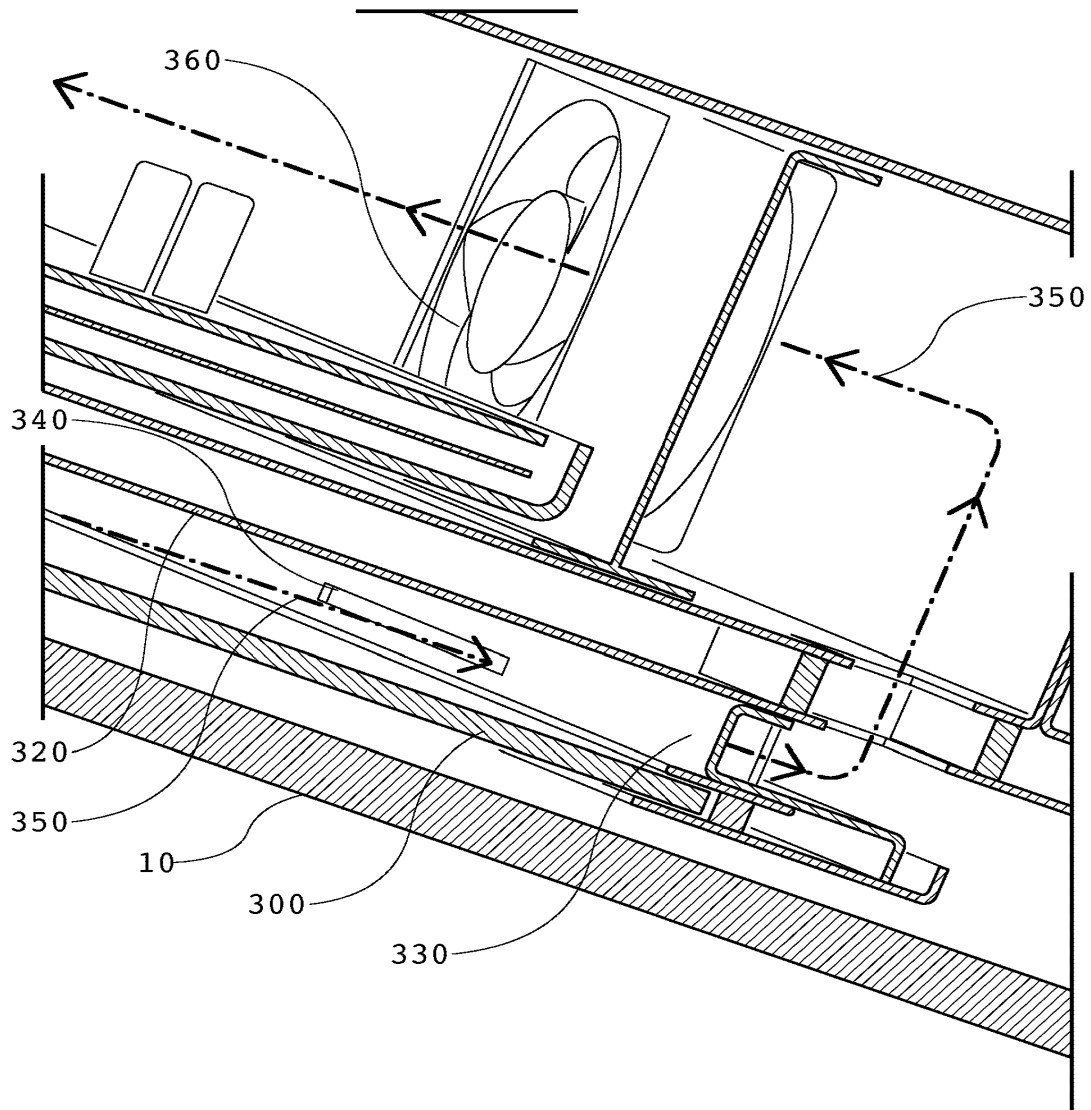


FIG - 6

**FIG - 8**

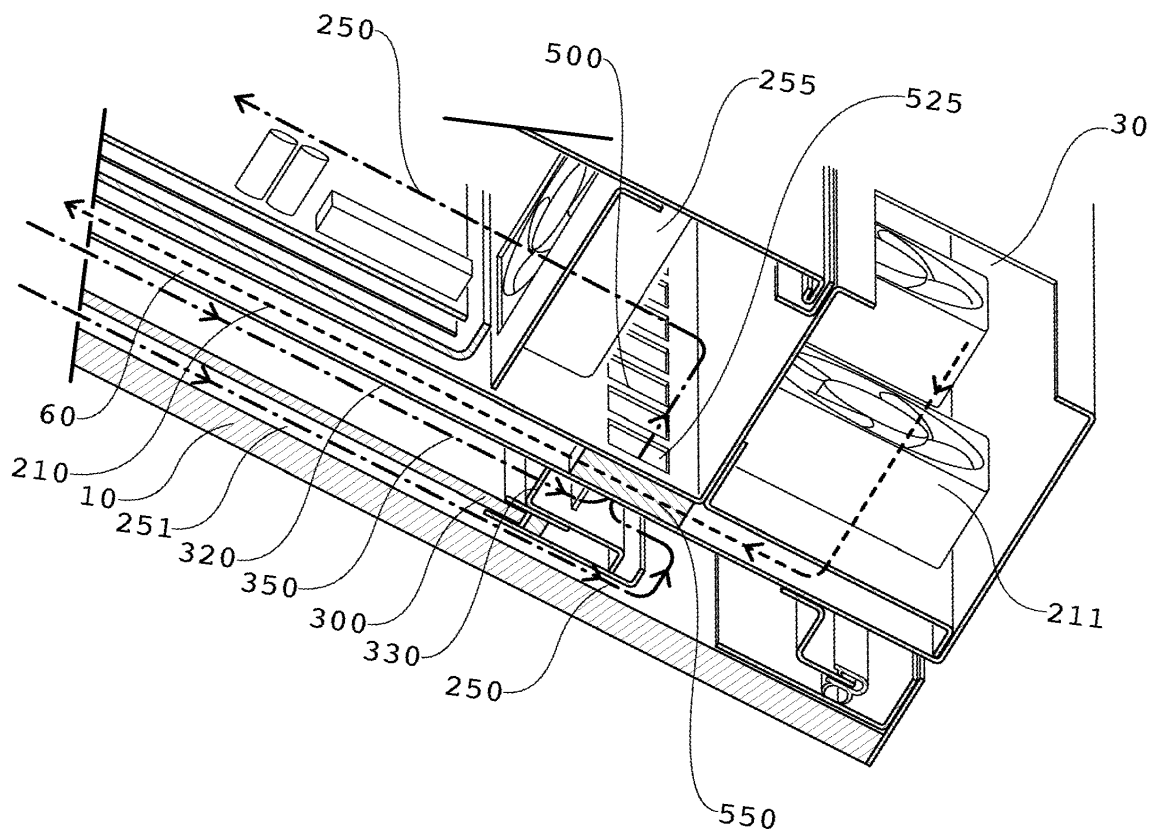
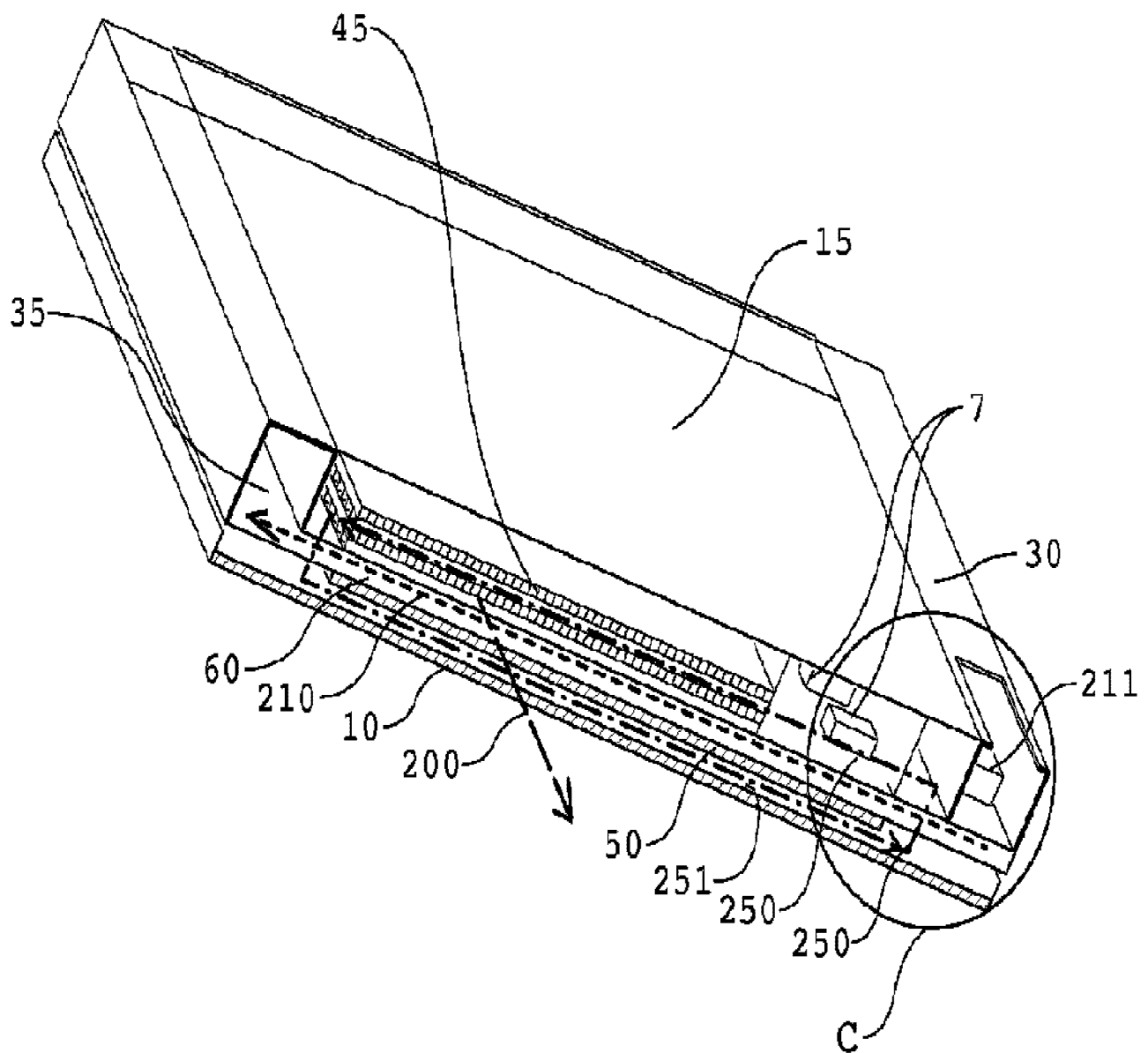


FIG - 9





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(54) **HYBRID REAR COVER AND MOUNTING BRACKET FOR ELETRONIC DISPLAY**

HYBRIDE RÜCKABDECKUNG UND MONTAGEHALTERUNG FÜR ELEKTRONISCHE ANZEIGE
COUVERCLE ARRIÈRE HYBRIDE ET SUPPORT DE MONTAGE POUR DISPOSITIF D’AFFICHAGE
ÉLECTRONIQUE

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(73) Proprietor: **Manufacturing Resources
International, Inc.
Alpharetta, GA 30005 (US)**

(72) Inventors:
• **DUNN, William**
Alpharetta, GA 30005 (US)
• **DIAZ, Marcos**
Alpharetta, GA 30005 (US)
• **AZEVEDO, Kyle**
Alpharetta, GA 30005 (US)

(74) Representative: **FRKelly**
27 Clyde Road
Dublin D04 F838 (IE)

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EP 3 117 693 B1

SEC et al. v. MRI
SEC Exhibit 1022.1354
IPR2023-00221

Description

Technical Field

[0001] Embodiments generally relate to systems for installing and cooling electronic displays mounted to a vertical surface.

Background of the Art

[0002] Electronic displays are sometimes used in outdoor environments or other areas where the surrounding temperatures may be high or there may be other sources of heat such as solar loading causing the temperatures within the display to rise. However, some portions of the display can be difficult to cool as simply ingesting ambient air into some portions of the display can introduce dust and contaminates into sensitive portions of the display, which can lead to premature failures. Further, it is now desirable to provide an improved system for installing large electronic displays in public area. KR20020057425 discloses a device for adjusting the angle of a wall mounted display apparatus. US 2013/270975 discloses a replaceable glass panel for an electronic display.

Summary of the Exemplary Embodiments

[0003] The invention is defined in the appended claims. A system and method for mounting an electronic display is disclosed herein. A rear cover mounting bracket may contain a rear plate and a sidewall which surrounds a perimeter of the plate. A plurality of mounting holes may be placed within the plate to allow fastening the rear plate to a vertical surface. An electronic display assembly module may contain a thermal plate where the attachment of the rear cover mounting bracket to the module creates a plenum which can house one or more electronic components. In a preferred embodiment, the rear plate contains a pair of hooks and the module contains a pair of corresponding cylinders which can be engaged with the hooks so that the module can hang from the hooks.

[0004] The foregoing and other features and advantages of the present invention will be apparent from the following more detailed description of the particular embodiments, as illustrated in the accompanying drawings.

Brief Description of the Drawings

[0005] 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:

FIGURE 1 is a rear perspective view of an exemplary electronic display assembly module showing Detail A.

FIGURE 2 is a detailed rear perspective view of De-

tail A shown in Figure 1.

FIGURE 3 is a front perspective view of an exemplary hybrid rear cover and mounting bracket, once fastened to a vertical surface and connected to service wiring.

FIGURE 4 is a detailed front perspective view of Detail B shown in Figure 3.

FIGURE 5 is a detailed front perspective view of Detail C shown in Figure 3.

FIGURE 6 is a front perspective view of the exemplary method for attaching the electronic display assembly module to the hybrid rear cover and mounting bracket.

FIGURE 7 is a front elevation view of the hybrid rear cover and mounting bracket once assembled with the electronic display assembly module and indicating the section line A-A.

FIGURE 8 is a partial section view taken along the section line A-A and showing the top portion of the assembly.

FIGURE 9 is a partial section view taken along the section line A-A and showing the bottom portion of the assembly.

Detailed Description

[0006] 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.

[0007] 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.

[0008] Embodiments of the invention are described herein with reference to 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.

[0009] 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.

[0010] FIGURE 1 is a rear perspective view of an exemplary electronic display assembly module 500 showing Detail A. A thermal mounting sheet 81 is placed behind the electronic display and contains a plurality of electrical assemblies 40 which includes a power module but may also include video players, hard drives, microprocessors, printed circuit boards, and input/output electronics. A narrow channel 120 is preferably defined by the space between the thermal sheet 81 and the rear surface of the electronic display. External air 100 may be forced through the channel 120 by fan 80, which can then extract heat from both the rear surface of the electronic display as well as the thermal mounting sheet 81.

[0011] A gasket 90 is preferably attached to the thermal mounting sheet 81 and surrounds a portion of the perimeter of the thermal mounting sheet 81. When combined with the hybrid rear cover mounting bracket 550, the gasket 90 and sheet 81 define a gaseously-sealed plenum 91 which may contain the electrical assemblies 40. One or more fans 75/77 may cause the air within the plenum 91 to circulate around. Preferably, a pair of dividing walls 83/85 are used to define a loop around the plenum 91 which passes through only one of the dividing walls (here 83). In an exemplary embodiment, dividing wall 83 is perpendicular to dividing wall 85. Even more preferably, dividing wall 80 is arranged horizontally and contains the fan(s) while dividing wall 85 is connected to the end of dividing wall 83 but is arranged vertically and does not contain a fan. For exemplary airflow, it has been discovered that placing the first fan 75 near the center of the display assembly and the second fan 77 near the perimeter of the display assembly, causes a pair of circulating gas loops 215 and 200 respectfully. Preferably, the plenum 91 is sealed so that external air cannot enter the plenum 91 (and preferably prevents air, or any other gaseous matter with or without particulate, from exiting the plenum 91).

[0012] A plurality of input/output electrical connections 25 are preferably placed at the top of the module 500 and underneath a water guard 35. Also, a pair of mounting pins 50 and 51 are arranged at the top of the module 500. A trio of latches 120, 122, 125 are preferably arranged at the bottom of the module 500, although embodiments can be practiced within one or two latches only. Also shown in this figure are the attachment brackets 900 and 910 for gas springs 250 or other supporting resistive elements.

[0013] FIGURE 2 is a detailed rear perspective view of Detail A shown in Figure 1. Here, the details of the mounting pin (or rod or cylinder) 51 may be observed. In this embodiment, this can be described as a cylinder which travels horizontally and may be divided by two locating walls 53 (closest to the perimeter of the module 500) and 54 (closest to the center of the module 500). The cylinder can then be identified by the mounting portion 55 (located between walls 53/54) and the interior portion 52 (starting at the wall 54 and travelling towards the center of the module 500). The mounting pins can be solid or hollow and are preferably cylindrical.

[0014] FIGURE 3 is a front perspective view of an exemplary hybrid rear cover and mounting bracket 550 (herein cover/bracket 550), once fastened to a vertical surface and connected to service wiring 281. The cover/bracket 500 preferably contains a substantially flat rear plate 220 with a sidewall 225 which surrounds the plate 220. A plurality of mounting holes 275 are preferably placed near the top of the cover/bracket 500 while another plurality of mounting holes 276 are placed near the bottom of the cover/bracket 500. In this way, the cover/bracket 500 can easily be mounted on a vertical surface where the service wiring 281 can be routed through the sidewall 225 and into a junction box 280 by a designated electrician. A second service line 283 may also exit the junction box 280 and could run to a second display module, allowing several cover/brackets to be installed and wired together in a daisy chain fashion. Generally, this electrical work requires permits, licenses, and/or approval by an electrical inspector. With this exemplary embodiment, this work can be completed and approved before the electronic display modules 500 are even shipped to the location.

[0015] A pair of gas springs 250 or other resistive device may be attached to the rear plate 220 and correspond with the attachment plates 900/910 on the electronic display module 500. A trio of latches 130, 132, and 135 may be placed at the bottom of the cover/bracket 550 and correspond to the latches 120, 122, and 125 on the module 500 respectively. Of course, as noted above, only a single latch or a pair of latches may be used in some embodiments. A pair of mounting hooks 300 and 301 are preferably placed at the top of the cover/bracket 550 and correspond to the mounting pins 50 and 51 respectively. Preferably, the hook 300 would wrap around a portion of the circumference of the mounting portions 55, where the hook 300 is stabilized laterally between the walls 54 and 53.

[0016] FIGURE 4 is a detailed front perspective view of Detail B shown in Figure 3. A fitting 285 may permit conduit (not shown) to seal with the sidewall 225 and allow the service wire 281 to pass through the sidewall 225 to meet the junction box 280.

[0017] FIGURE 5 is a detailed front perspective view of Detail C shown in Figure 3.

[0018] FIGURE 6 is a front perspective view of the exemplary method for attaching the electronic display as-

sembly module 500 to the hybrid rear cover and mounting bracket 550. Once the cover/bracket 550 has been mounted to a vertical surface (and preferably after the service wiring has been ran to the junction box) the module 500 may hang from the interaction of the hooks 300/301 with the pins 51/50. At this point the bottom of the module 500 can be rotated outwardly so that the gas springs 250 can be attached to the module 500. Once these are attached, the hooks 300/301 remain within the pins 51/50 but the bottom of the module 500 is held away from the cover/bracket 550 so that the module 500 can be electrically connected with the junction box 280. Once the module 500 is electrically connected, the bottom of the module 500 is rotated towards the cover/bracket 550 until the latches at the bottom of the two assemblies can be engaged.

[0019] FIGURE 7 is a front elevation view of the hybrid rear cover and mounting bracket 550 once assembled with the electronic display assembly module 500 and indicating the section line A-A.

[0020] FIGURE 8 is a partial section view taken along the section line A-A and showing the top portion of the assembly. When the latches at the bottom of the two assemblies engage, the gasket 90 is preferably compressed against the rear plate 220 to define the plenum 91. A front cover transparent plate 410 is preferably placed in front of the electronic display and a flow of external air 100 is shown travelling behind the electronic display and through the channel 120. Although any type of flat panel electronic display could be used, this particular embodiment uses an LCD display 400 with a direct LED backlight 430. Thus, in this embodiment, the channel 120 is defined between the rear surface of the LED backlight 430 and the thermal mounting plate 81. However, alternative embodiments may utilize any type of flat panel electronic display, including but not limited to plasma, OLED, electroluminescent polymers, or similar where the channel 120 is defined between the rear surface of these displays and the thermal plate 81.

[0021] FIGURE 9 is a partial section view taken along the section line A-A and showing the bottom portion of the assembly. The fan 80 is preferably positioned to draw the external air 100 through the channel 120, along the rear portion of the backlight 430 (or electronic display), and exhausted out of the bottom of the assembly. Of course, the external air 100 could also be ingested at the bottom and exhausted out of the top. The fan 80 is preferably placed within a cavity defined between the backlight 430 and the rear plate 220 and is preferably not immediately adjacent to the exhaust port on the housing, although this is not required. Generally speaking, a portion 201 of the housing may connect between the rear surface of the backlight 430 (or electronic display) and the rear plate 220, where the fan 80 is mounted on this portion 201 of the housing.

[0022] 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. 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 scope 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 mounting an electronic display to a vertical surface comprising:

a rear cover mounting bracket (550) having a rear plate (220) and sidewall (225) which surrounds a perimeter of the rear plate (220);

a plurality of mounting holes (275/276) placed within the rear plate (220) which allow the rear cover mounting bracket (550) to be fastened to the vertical surface and

an electronic display module (500); **characterized in that** the electronic display module (500) comprises a power module (40) and a thermal plate (81), wherein the electronic display assembly module (500) is attached to the rear cover mounting bracket (550) so that it defines a sealed plenum (91) between the thermal plate (81) and the rear plate (220); and wherein the power module (40) is placed within the sealed plenum (91).

2. The system of claim 1 wherein: the mounting holes (275/276) are placed outside of the sealed plenum (91).

3. The system of claim 1 further comprising:

a channel (120) defined by the space between the electronic display (400) of the electronic display module (500) and the thermal plate (81); and

a fan (80) positioned to draw external air through the channel (120) where the external air is not permitted to enter the sealed plenum (91).

4. The system of any preceding claim further comprising:

a fan (75/77) positioned within the sealed plenum (91) to force circulating air over the power supply (40), where the sealed plenum (91) is sealed so that external air cannot enter the sealed plenum (91) and other gaseous matter is prevented from exiting the sealed plenum (91).

5. The system of any one of claims 1 to 4, further comprising:

a pair of hooks (300 and 301) attached to the rear plate (220); and
a pair of mounting pins (50 and 51) attached to the electronic display assembly module (500) which fit within the hooks (300 and 301) and allow the electronic display assembly module (500) to hang from the hooks (300 and 301).

6. The system of claim 5 further comprising: a latch (130/132/135) having a first portion attached to the electronic display assembly module (500) and a corresponding second portion attached to the rear cover mounting bracket (550).

Patentansprüche

1. System zum Montieren einer elektronischen Anzeige an einer vertikalen Oberfläche, umfassend:

eine Rückabdeckungsmontagehalterung (550) mit einer Rückplatte (220) und einer Seitenwand (225), die einen Umfang der Rückplatte (220) umgibt;
eine Vielzahl von Montagelöchern (275/276), die innerhalb der Rückplatte (220) platziert sind, die das Befestigen der Rückabdeckungsmontagehalterung (550) an der vertikalen Oberfläche ermöglichen, und
ein elektronisches Anzeigemodul (500); **dadurch gekennzeichnet, dass** das elektronische Anzeigemodul (500) ein Leistungsmodul (40) und eine thermische Platte (81) umfasst, wobei das elektronische Anzeigeanordnungsmodul (500) an der Rückabdeckungsmontagehalterung (550) angebracht ist, sodass es zwischen der thermischen Platte (81) und der Rückplatte (220) einen abgedichteten Raum (91) definiert; und wobei das Leistungsmodul (40) innerhalb des abgedichteten Raums (91) platziert ist.

2. System nach Anspruch 1, wobei:
die Montagelöcher (275/276) außerhalb des abgedichteten Raums (91) platziert sind.

3. System nach Anspruch 1, ferner umfassend:

einen Kanal (120), der durch den Abstand zwischen der elektronischen Anzeige (400) des elektronischen Anzeigemoduls (500) und der thermischen Platte (81) definiert ist; und
einen Lüfter (80), der positioniert ist, um Außenluft durch den Kanal (120) zu ziehen, wobei die Außenluft nicht in den abgedichteten Raum (91) eintreten darf.

4. System nach einem der vorangehenden Ansprüche,

ferner umfassend:

einen Lüfter (75/77), der innerhalb des abgedichteten Raums (91) positioniert ist, um zirkulierende Luft über die Leistungsversorgung (40) zu zwingen, wobei der abgedichtete Raum (91) abgedichtet ist, sodass Außenluft nicht in den abgedichteten Raum (91) eintreten kann und verhindert wird, dass andere gasförmige Materie aus dem abgedichteten Raum (91) austritt.

5. System nach einem der Ansprüche 1 bis 4, ferner umfassend:

ein Paar Haken (300 und 301), die an der Rückplatte (220) angebracht sind; und
ein Paar Montagestifte (50 und 51), die an dem elektronischen Anzeigeanordnungsmodul (500) angebracht sind und in die Haken (300 und 301) passen und ermöglichen, dass das elektronische Anzeigeanordnungsmodul (500) an den Haken (300 und 301) hängen kann.

6. System nach Anspruch 5, ferner umfassend:
eine Verriegelung (130/132/135) mit einem an dem elektronischen Anzeigeanordnungsmodul (500) angebrachten ersten Abschnitt und einem an der Rückabdeckungsmontagehalterung (550) angebrachten entsprechenden zweiten Abschnitt.

Revendications

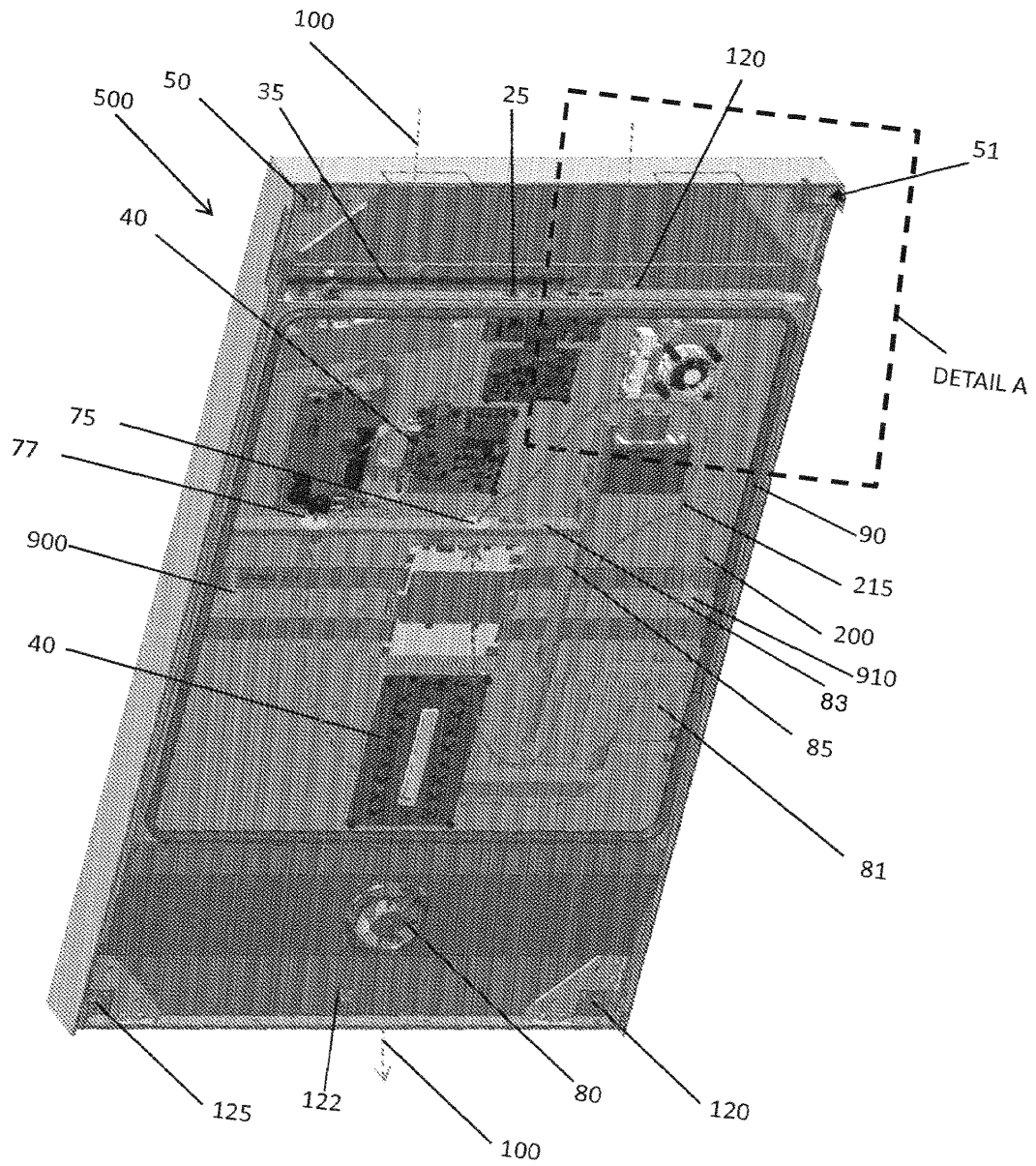
1. Système de montage d'un dispositif d'affichage électronique sur une surface verticale comportant :

un support de montage de couvercle arrière (550) ayant une plaque arrière (220) et une paroi latérale (225) qui entoure un périmètre de la plaque arrière (220) ;
une pluralité de trous de montage (275/276) placés à l'intérieur de la plaque arrière (220) qui permet de fixer le support de montage de couvercle arrière (550) sur la surface verticale et un module de dispositif d'affichage électronique (500) ;
caractérisé en ce que le module de dispositif d'affichage électronique (500) comporte un module d'alimentation (40) et une plaque thermique (81), dans lequel le module d'assemblage de dispositif d'affichage électronique (500) est attaché au support de montage de couvercle arrière (550) de telle sorte qu'il définit un plénum scellé (91) entre la plaque thermique (81) et la plaque arrière (220) ; et dans lequel le module d'alimentation (40) est placé à l'intérieur du plénum scellé (91).

2. Système selon la revendication 1, dans lequel :

les trous de montage (275/276) sont placés à l'extérieur du plénum scellé (91).

3. Système selon la revendication 1, comportant par ailleurs :
 - un canal (120) défini par l'espace entre le dispositif d'affichage électronique (400) du module de dispositif d'affichage électronique (500) et la plaque thermique (81) ; et
 - un ventilateur (80) positionné pour aspirer de l'air extérieur au travers du canal (120) où l'air extérieur n'est pas autorisé à rentrer dans le plénum scellé (91).
4. Système selon l'une quelconque des revendications précédentes, comportant par ailleurs :
 - un ventilateur (75/77) positionné à l'intérieur du plénum scellé (91) pour forcer de l'air circulant au-dessus de l'alimentation électrique (40), le plénum scellé (91) étant scellé de telle sorte que de l'air extérieur ne peut pas rentrer dans le plénum scellé (91) et toute autre matière gazeuse ne peut pas sortir du plénum scellé (91).
5. Système selon l'une quelconque des revendications 1 à 4, comportant par ailleurs :
 - une paire de crochets (300 et 301) attachés sur la plaque arrière (220) ; et
 - une paire de goupilles de montage (50 et 51) attachées sur le module d'assemblage de dispositif d'affichage électronique (500) qui s'adaptent dans les crochets (300 et 301) et permettent de suspendre le module d'assemblage de dispositif d'affichage électronique (500) aux crochets (300 et 301).
6. Système selon la revendication 5, comportant par ailleurs :
 - un verrou (130/132/135) ayant une première partie attachée sur le module d'assemblage de dispositif d'affichage électronique (500) et une deuxième partie correspondante attachée sur le support de montage de couvercle arrière (550).



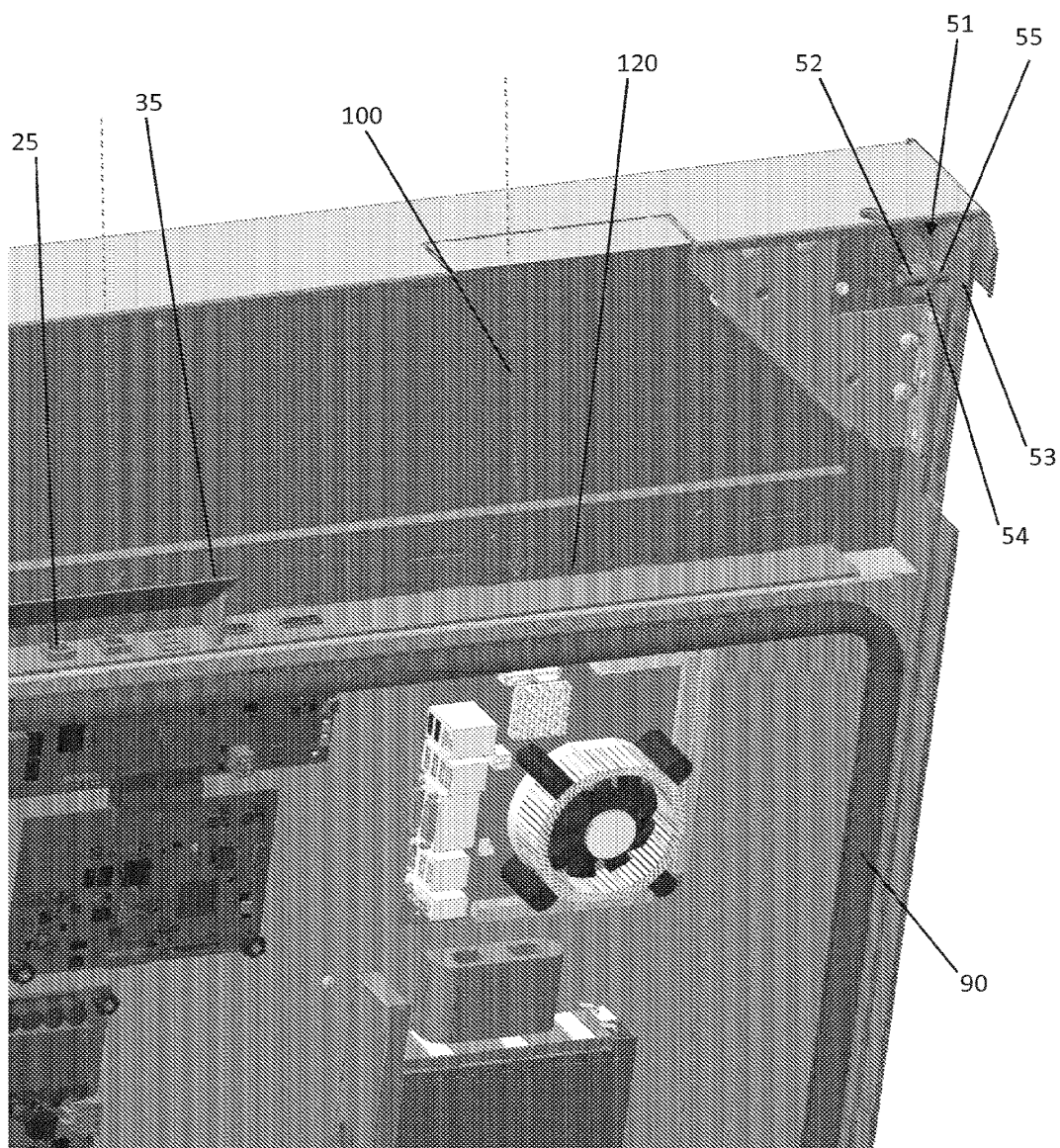
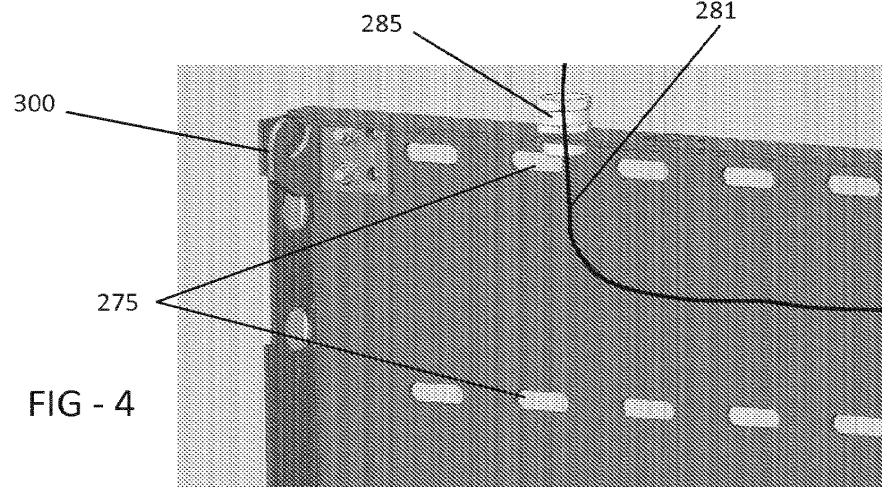
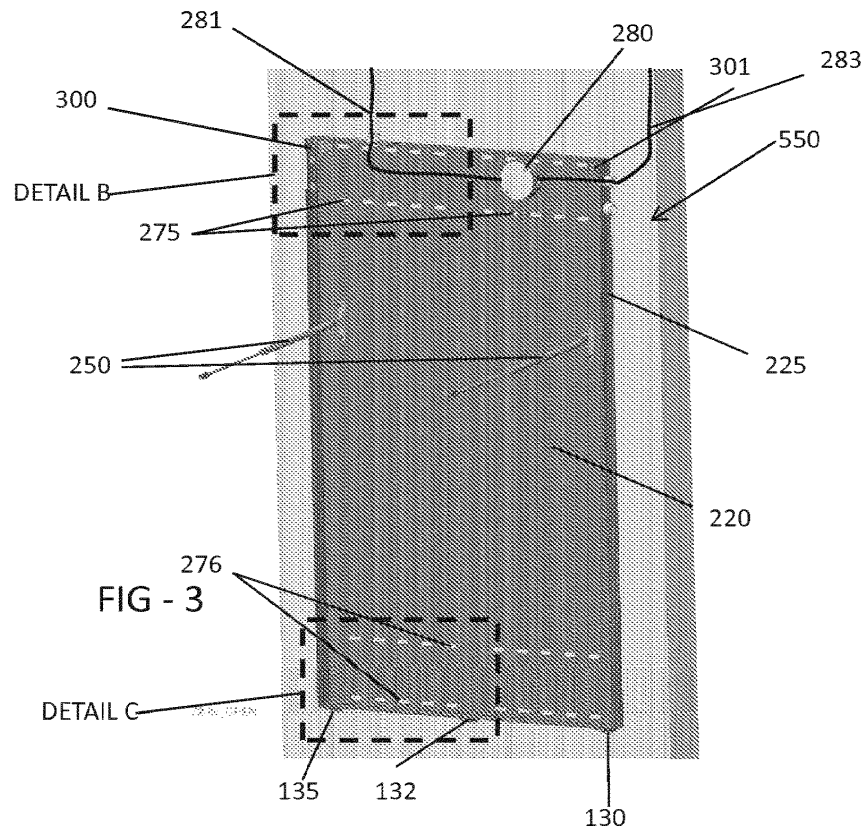
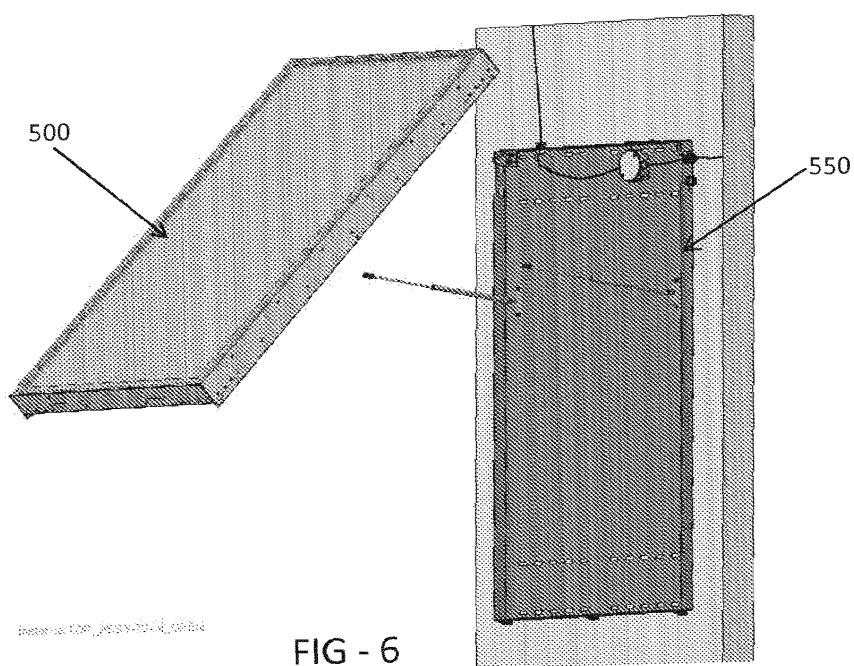
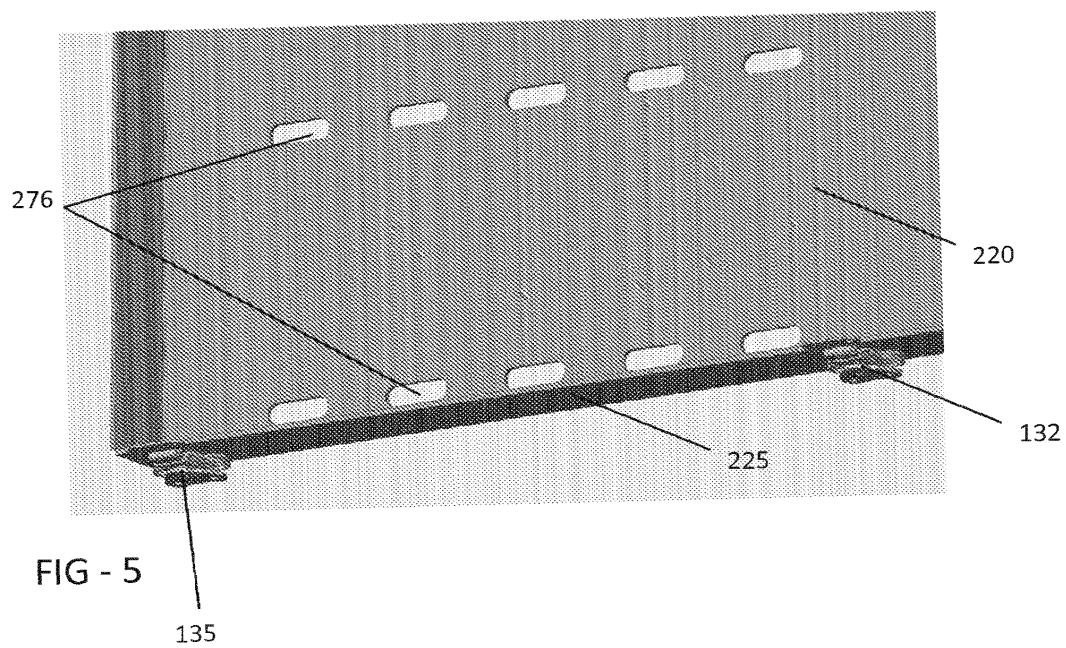


FIG - 2





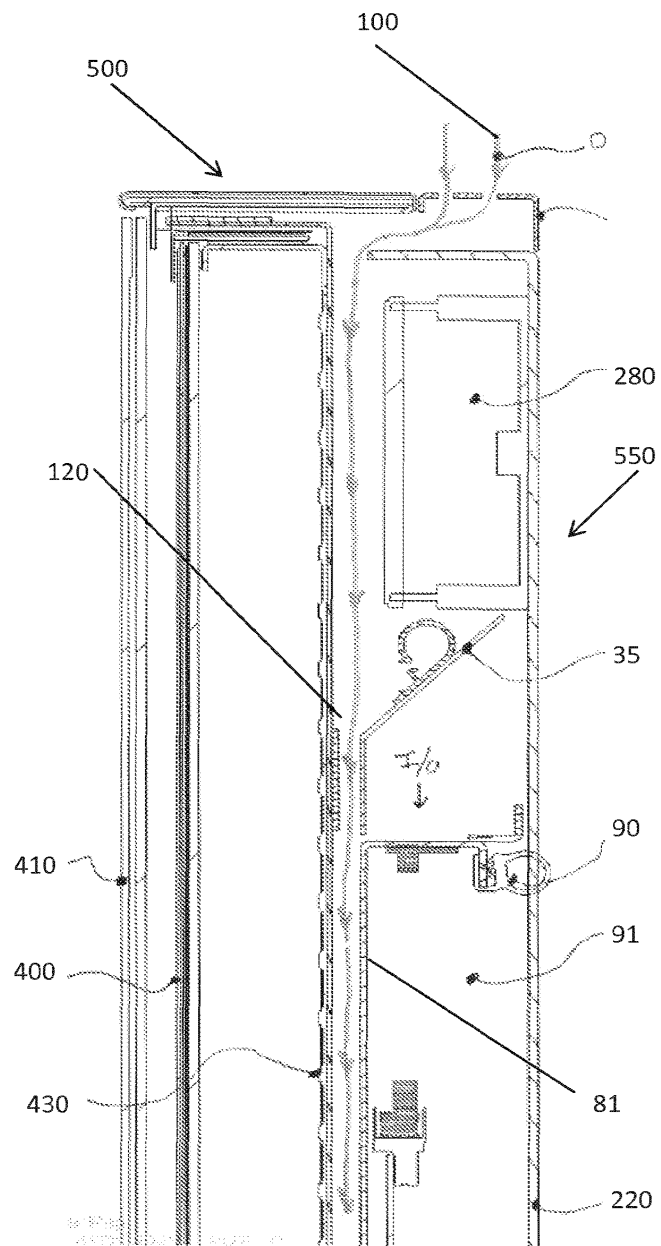
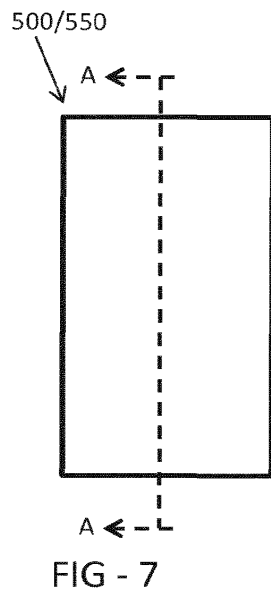
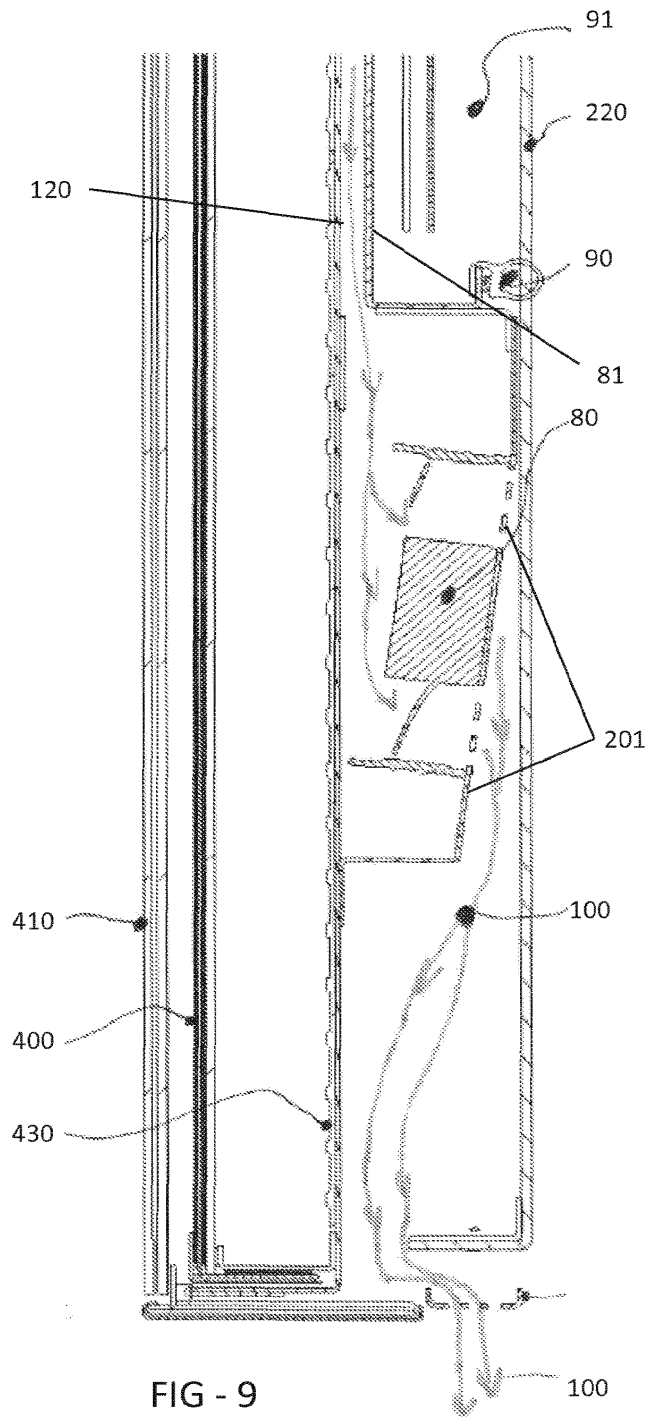


FIG - 8



REFERENCES CITED IN THE DESCRIPTION

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Perimeter ventilation system for electronic display

Inventor(s): 德马尔斯·瑞安

Applicant(s): 制造资源国际公司

Classification: - international: F21V29/60; G02F1/1335; H05K7/20
 - cooperative: H05K7/20972

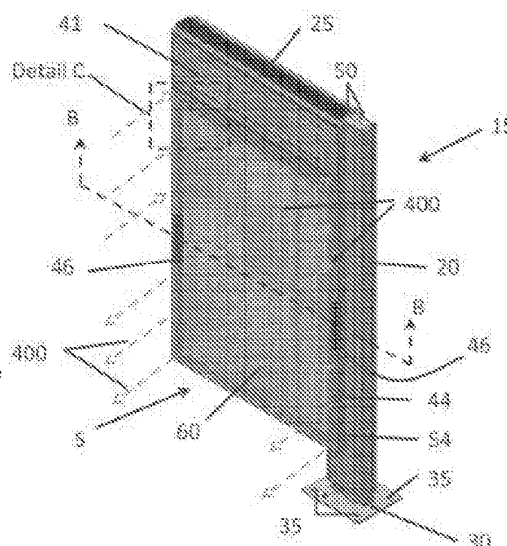
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 US2019208674 (A1) US9723765 (B2) WO2016133852 (A1) less

Abstract of CN107251671 (A)

The exemplary embodiments herein provide an electronic display assembly having an electronic display surrounded by a front panel and a housing. An ingestion gap may be placed near a portion of the perimeter of the front panel while an exhaustion gap may be placed near an opposing portion of the perimeter of the front panel. A buffer zone may be defined between the ingestion gap and the exhaustion gap. A fan may be positioned to draw open loop fluid into the ingestion gap, through a channel behind the electronic display, and out of the exhaustion gap. This fan may also draw open loop fluid through an optional heat exchanger. A circulating fan may force circulating air through an optional heat exchanger.



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发明人：德马尔斯·瑞安

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专利权人：制造资源国际公司

地址：美国佐治亚州

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授权公告号：CN 107251671 B

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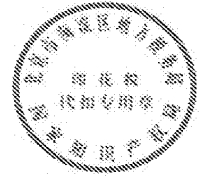
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申请人：

制造资源国际公司

发明人：

德马尔斯·瑞安



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(73)专利权人 制造资源国际公司
地址 美国佐治亚州

(72)发明人 德马尔斯·瑞安

(74)专利代理机构 北京思格颂知识产权代理有限公司 11635
代理人 王申

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审查员 肖响

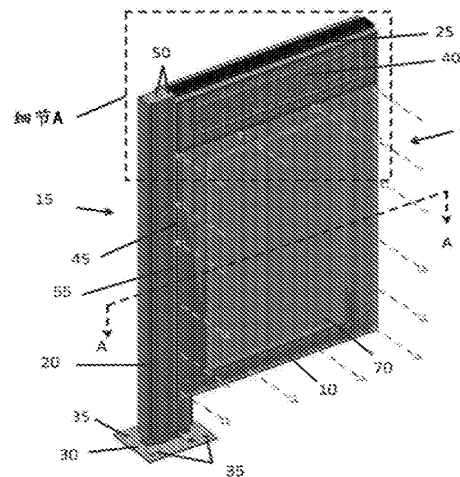
权利要求书2页 说明书10页 附图30页

(54)发明名称

电子显示器周边通风系统

(57)摘要

本发明的示例性实施例提供了一种电子显示组件,其具有由前面板和外壳包围的电子显示器。注入间隙可以放置在前面板的周边的一部分附近,而排气间隙可以放置在前面板的周边的相对部分附近。可以在注入间隙和排气间隙之间限定缓冲区。风扇可以被定位成带动开环流体进入注入间隙,穿过电子显示器之后的通道,并排出排气间隙。该风扇还可以带动开环流体穿过可选的热交换器。循环风扇可以迫使循环空气穿过可选的热交换器。



1. 一种电子显示组件,包括:

电子显示器;

围绕所述电子显示器的壳体 and 前面板;

沿着所述前面板周边的水平和垂直部分定位的用于注入开环流体的注入间隙;

沿着所述前面板周边的水平和垂直部分定位的排气间隙;

位于所述电子显示器之后的通道;

用于使开环流体从注入间隙行进到所述通道的第一气体路径;

用于使开环流体从所述通道行进到所述排气间隙的第二气体路径;

被定位从而引起所述开环流体流动的风扇;

位于所述注入间隙与所述排气间隙之间的缓冲区;以及

位于所述缓冲区中的中央隔膜。

2. 根据权利要求1所述的电子显示组件,其中进一步包括:

第一侧通道,被垂直定位并形成所述第一气体路径的至少一部分;以及

第二侧通道,被垂直定位并形成所述第二气体路径的至少一部分。

3. 根据权利要求2所述的电子显示组件,其中进一步包括:通道隔膜,位于所述第一侧通道中。

4. 根据权利要求3所述的电子显示组件,其中,所述通道隔膜实质上防止所述开环流体的垂直流动。

5. 根据权利要求1所述的电子显示组件,其中,所述注入间隙及所述排气间隙面向所述电子显示器的主动观察者。

6. 一种电子显示组件,包括:

电子显示器;

用于所述电子显示器的壳体;

注入间隙,在所述壳体上被定位为面向所述电子显示器的主动观察者;

排气间隙,在所述壳体上被定位为面向所述电子显示器的主动观察者;

通道,位于所述电子显示器之后;

第一侧通道,被垂直定位并允许所述注入间隙与所述通道之间的气体连通;

第二侧通道,被垂直定位并允许所述通道与所述排气间隙之间的气体连通;

风扇,被定位从而引起开环流体流动进入所述注入间隙,穿过所述第一侧通道,穿过所述通道,穿过所述第二侧通道,并排出所述排气间隙;

位于所述注入间隙与所述排气间隙之间的缓冲区;以及

位于与所述缓冲区相同的垂直高度的中央隔膜。

7. 根据权利要求6所述的电子显示组件,其中进一步包括:通道隔膜,位于所述第一侧通道中。

8. 根据权利要求6所述的电子显示组件,其中进一步包括:

热交换器,具有用于开环流体的第一路径以及用于循环气体的第二路径;以及

循环风扇,被定位以迫使循环气体穿过所述热交换器。

9. 根据权利要求6所述的电子显示组件,其中,所述通道被LED背光与板之间的空间所限定。

10. 根据权利要求6所述的电子显示组件, 其中,
所述注入间隙位于所述组件的第一垂直半部上, 而所述排气间隙位于所述组件的相对的垂直半部上。

11. 根据权利要求6所述的电子显示组件, 其中进一步包括:

门腔, 位于所述电子显示器之后, 用于从所述第一侧通道接收开环流体, 并将其引导向位于所述电子显示器之后的所述通道。

12. 一种电子显示组件, 包括:

电子显示器;

基本上围绕所述电子显示器的壳体和前面板;

注入间隙, 位于所述电子显示器的垂直中心的上方, 并位于所述前面板和所述壳体之间;

排气间隙, 位于所述电子显示器的垂直中心的下方, 并位于所述前面板和所述壳体之间;

热交换器, 具有用于开环流体的第一路径和用于循环气体的第二路径;

循环风扇, 被定位以迫使所述循环气体穿过所述热交换器;

中央隔膜, 位于所述注入间隙与所述排气间隙之间, 且靠近所述电子显示器的垂直中心;

风扇, 被定位从而引起开环流体流动进入所述注入间隙, 穿过所述热交换器, 并离开所述排气间隙;

第一侧通道, 被垂直定位并允许所述注入间隙与所述热交换器之间的气体连通;

第二侧通道, 被垂直定位并允许所述热交换器与所述排气间隙之间的气体连通;

位于所述第一侧通道中的第一侧通道隔膜; 以及

位于所述第二侧通道中的第二侧通道隔膜。

13. 根据权利要求12所述的电子显示组件, 其中, 所述第一侧通道隔膜和所述第二侧通道隔膜实质上阻止开环流体的垂直流动。

电子显示器周边通风系统

[0001] 相关申请的交叉引用

[0002] 本申请要求2015年2月17日提交的美国申请号14/624,268的优先权,其全部内容通过引用并入本文。

技术领域

[0003] 本发明的实施例一般涉及用于电子显示器的安装和冷却系统。

背景技术

[0004] 电子显示器有时用于室外环境或其他周围温度可能较高的区域,或者可能会有其他热源(如太阳能负载)导致显示器内的温度升高。然而,显示器的某些部分可能难以冷却,因为仅是简单地将环境空气注入到显示器的某些部分可能会将灰尘和污染物引入显示器的敏感部分,这可能导致过早的故障。

发明内容

[0005] 示例性实施例可以包括显示组件和自立显示器外壳。显示组件可以安装在自立显示壳体内。显示组件可以包括沿着前面板的周边定位的注入间隙以及沿着前面板的周边的相对部分定位的排气间隙。可以放置一风扇迫使开环流体经由电子显示器之后的通道进入注入间隙并排出排气间隙。

[0006] 可以使用相同的风扇或附加的风扇来强制开环流体通过任选的热交换器。也可以使用另外的循环风扇来使闭环流体循环通过热交换器。

[0007] 可以在注入间隙和排气间隙之间放置缓冲区,并且优选地包含一个或多个隔膜,其基本上限制或禁止一旦注入到壳体中的开环流体的垂直流动。隔膜通常水平放置在显示组件的垂直中心附近(尽管不是必需的)。

附图说明

[0008] 除了上述特征之外,通过以下对附图和示例性实施例的描述,本发明的其它方面将是显而易见的,其中跨越多个视图的相同附图标记表示相同或等同的特征,并且其中:

[0009] 图1是容纳在自立外壳中的电子显示组件的示例性实施例的前透视图,并表示出剖面线A-A和细节A。

[0010] 图2是图1所示实施例的正视图,并表示细节N。

[0011] 图3是图2所示的细节N的详细正视图。

[0012] 图4是图1的示例性实施例的后透视图,并表示剖面线B-B和细节C。

[0013] 图5是图1所示的细节A的前透视图,前面板被拆下。

[0014] 图6是图1所示的示例性实施例的后透视图,其中后面板已被移除,并表示细节D和细节E。

[0015] 图7是沿图1的剖面线A-A截取的顶部透视剖视图,并表示细节F。

- [0016] 图8是图7所示的细节F的顶部平面剖视图。
- [0017] 图9是沿图4的剖面线B-B截取的底部透视剖视图,并表示细节K。
- [0018] 图10是图9所示的细节K的底部平面剖视图,并表示细节L。
- [0019] 图11是图1所示的示例性实施例的前视平面图,并表示剖面线F-F,G-G和H-H。
- [0020] 图12A是沿图11的剖面线F-F截取的顶部平面剖视图,并表示细节O和细节P。
- [0021] 图12B是沿图11的剖面线G-G截取的顶部平面剖视图,并表示细节Q。
- [0022] 图12C是沿图11的剖面线H-H截取的顶部平面剖视图,并表示细节R。
- [0023] 图13A是图12A中的细节O的俯视图详细剖视图。
- [0024] 图13B是图12B中的细节Q的俯视图详细剖视图。
- [0025] 图13C是图12C中的细节R的俯视图详细剖视图。
- [0026] 图14是图12A中的细节P的俯视详细剖视图。
- [0027] 图15是图6所示的细节D的后透视图,其中的自立显示外壳被拆除。
- [0028] 图16是后面板的图4所示细节C的前透视图,与周围部件隔离显示。
- [0029] 图17是图10所示的细节L的底部平面剖视图。
- [0030] 图18是图6所示的细节E的后透视图,其中的审计自立显示外壳被拆除。
- [0031] 图19A是图1的组件的后透视图,其中的自立显示外壳被拆除,并表示细节S。
- [0032] 图19B是图1的组件的前透视图,自立显示外壳和前面板被拆除,并表示细节T。
- [0033] 图20是图19A所示的细节S的后透视细节视图。
- [0034] 图21是图19B所示的细节T的前透视细节视图。
- [0035] 图22是沿图4的剖面线B-B截取的底部透视剖视图。
- [0036] 图23是图1的组件的前透视图,仅示出后面板,自立显示壳体 and 显示组件的与所有其它周围部件隔离的选择部分。
- [0037] 图24是图1的组件的俯视图,仅显示后面板以及显示组件的与所有其他周围部件隔离的选择部分,并表示细节M。
- [0038] 图25是图23所示的细节M的前透视图。
- [0039] 图26A是隔膜的前透视图,仅示出了自立显示器壳体和显示组件的与所有其它周围部件隔离的选择部分。
- [0040] 图26B是隔膜的另一前透视图,再次仅示出了自立显示壳体和显示组件的与所有其它周围部件隔离的选择部分。

具体实施方式

- [0041] 在下文中将参考附图更全面地描述本发明,在附图中示出了本发明的示例性实施例。然而,本发明可以以许多不同的形式实施,并且不应被解释为限于本文阐述的示例性实施例。而是提供这些实施例,使得本公开将是彻底和完整的,并且将向本领域技术人员充分地传达本发明的范围。在附图中,为了清楚起见,层和区域的尺寸和相对尺寸可能被夸大。
- [0042] 本文使用的术语仅用于描述特定实施例的目的,而不意在限制本发明。如本文所使用的,单数形式“a”,“an”和“the”也旨在包括复数形式,除非上下文另有明确指示。将进一步理解,当在本说明书中使用时,术语“包括”和/或“包括”指定所述特征,整体,步骤,操作,元件和/或部件的存在,但不排除存在或添加一个或多个其它特征,整体,步骤,操作,元

件,组件和/或其组合。

[0043] 本文参照作为本发明的理想化实施例(和中间结构)的示意图的说明来描述本发明的实施例。因此,作为例如制造技术和/或公差的图示结果的形状变化是可预期的。因此,本发明的实施例不应被解释为限于本文所示的区域的特定形状,而是包括例如由制造导致的形状偏差。

[0044] 除非另有定义,本文使用的所有术语(包括技术和科学术语)具有与本发明所属领域的普通技术人员通常理解的相同的含义。还将进一步理解,诸如常用词典中定义的术语应被解释为具有与其在相关领域的背景下的含义一致的意义,并且不会以理想化或过度正式的方式解释,除非明确如此定义。

[0045] 图1是电子显示组件5(以下也称为“组件”)的示例性实施例。电子显示组件5包括可以覆盖组件5的大部分前表面的前面板10。前面板10可以是透明的并且位于电子显示器70的前面,电子显示器70优选地固定在前面板10的后面。在示例性实施例中,前面板10是触摸屏。周边壁55可围绕前面板10。

[0046] 自立显示器壳体15可以围绕组件5并且可以被配置为允许将组件5附接到地面。在示例性实施例中,自立显示壳体15可以是标记形状。在另外的其它实施例中,自立显示壳体15的尺寸和构造可以被集成到总线遮蔽物中。

[0047] 自立显示壳体15可以包括柱20,上梁25和基部30。在示例性实施例中,基部30可以包括如圆形孔等允许如螺栓等紧固件穿过的选择孔35,从而将基部30固定在地面上。所示的孔35的数量和位置仅仅是一个例子。柱20的底部可以被埋置从而将自立显示器固定在地面上。在一些实施例中,这可以通过将柱20的所述底部部分打碎在混凝土中来实现。自立显示壳体15和相关部件可以由诸如不锈钢或铝等金属构成。

[0048] 上光束25还可以包括覆盖上光束25的一侧的大部分的二级显示器40。在示例性实施例中,该二级显示器40是液晶显示器(LCD)。在其他实施例中,二级显示器40可以是静态显示器,其包括诸如背光的照明装置和用于容纳诸如海报的静态显示器的空腔。

[0049] 一对细长构件50可以从柱20的顶部延伸。细长构件50可以被配置为进一步将自立显示壳体15从而将组件5固定就位。可以考虑任何数量和形状的细长构件50。在示例性实施例中,这些细长构件50的尺寸和构造可以与公共汽车候车亭一体化。

[0050] 如后续图中更详细地讨论的,组件5还可以包括在周边壁55和前面板10之间的间隙45,该间隙被配置为允许诸如环境空气的流体流入和流出组件5。在示例性实施例中,组件5可以被构造成使得组件5的上半部允许流体进入,而组件5的下半部分允许排出所述流体,如流动线所示。这只是一个例子,因为其它实施例可被配置为使得组件5的上半部分允许排出流体,同时组件5的下半部分允许所述流体进入。

[0051] 图2和图3示出了间隙45沿着组件5的周边延伸,并进一步用放大的交叉阴影区域进行显示,以显示细节。间隙45还可以包括缓冲区46。缓冲区46可以优选是在不允许外部空气流动的间隙45的注入和排出部分之间的区域。在其他实施例中,缓冲区46可以基本上限制外部空气的流动。在示例性实施例中,间隙45被定位在围绕前面板10的周边,但是在缓冲区46内不会找到。在示例性实施例中,缓冲区46位于显示组件5的垂直中心线附近,并且通常在组件的右侧有一个第一缓冲区,在组件的左侧有一个第二缓冲区。

[0052] 在图4中,组件5还可以包括覆盖组件5的大部分后表面的后面板60。后周边壁54可

围绕后面板60的侧面。在示例性实施例中,后周边壁54可以与周边壁55基本相同。上梁25还可以包括类似于二级显示器40的三级显示器41,其可以包含背光和图形。可以在后面板60的后面放置诸如背光的照明单元。空腔可以位于后面板60的后表面后面,并且可以被配置为容纳放置在后面板60内或后面的静态显示器,例如海报。在替代实施例中,电子显示组件(例如LCD)可以放置在后面板60的后面。

[0053] 如后续图中更详细地讨论的,类似于图1,组件5还可以包括位于后周边壁54和后面板60之间的后间隙44,其被配置成允许诸如环境空气的流体流入和流出组件5。在示例性实施例中,组件5可被构造使得组件5的上半部允许流体进入,而组件5的下半部分允许排出所述流体,如流动线所示(但这可以颠倒)。

[0054] 在本发明的示例性实施例中,开环流体400的注入和排出可以不沿着后间隙44的选择部分(例如上边缘和下边缘)发生。在其他实施例中,开环流体400的注入和排出可以沿着整个后间隙44进行,除了缓冲区46之外。

[0055] 图5示出了去除的前面板10,揭示了可以固定在前面板10后面和周边壁55内的电子显示器70。组件5还可以包括位于电子显示器70上方的一系列进气孔65,在显示器70和二级显示器40之间。所示出的进气孔口65仅仅是示例性的,可以考虑任何数量和形状的进气孔口65。进气孔65可以被配置为便于将流体(例如环境空气)注入到在电子显示器70后面流动的开环中。一对侧内部通道21和22可以运行在电子显示器70的每一边的大部分长度。

[0056] 图6示出了去除的后面板60,露出固定在后面板60后面的内部后面板80。内部后面板80可以覆盖组件5的大部分后表面。组件可以包含一系列后进气孔75位于内部后板80上方,有时位于后周边壁54内。所示的后进气孔75仅仅是示例性的,可以考虑任何数量和形状的所述孔75。如后续图中将更详细地解释的,孔75可以被配置为便于注入开环流体。

[0057] 类似地,组件5还可以包括位于内部后面板80下方并且有时位于后周边壁54内的一系列后排气孔85。所示的后排气孔85仅仅是示例性的,可以考虑任何数量和形状的后排气孔85。如将在下面的附图中更详细地解释的,后排气孔85可以构造成为便于开环流体的排气。可选的风扇81可以固定在内部后面板80后面和后排气孔85之上。风扇81可以被配置成控制开环流体的流动。可以考虑任何数量的风扇81。在其他实施例中,风扇81可以位于沿着开环流动路径的任何数量的位置处,或者位于进气孔75与排气孔85之间的任何位置。

[0058] 图7和图8示出了组件5和自立显示壳体15的下半部分。侧梁90可以位于柱20的相对侧上,并且可以运行组件5的长度的大部分。侧梁90可以由金属构成并且被构造成为组件5提供结构支撑和刚性。电子室16可以放置在组件5的内部。可选的热交换器100可以固定在电子室16内或附近。在示例性实施例中,热交换器100可以是横流式热交换器,但也可以使用其他类型的热交换器,特别是逆流热交换器等。一系列电子部件105也可以固定在电子室16内。如将在下面的附图中更详细地说明的那样,诸如外部空气的开环流体400可循环通过热交换器100。闭环流体,例如循环气体700可以循环通过电子空腔,以及在电子部件105上并通过热交换器100。

[0059] 如后续图中将更详细地解释的,在该实施例中,开环流体400可以经由间隙45和可选的后间隙44排出组件5。如流线所示,开环流体可以遵循之字形路径从右侧通道19排出组件5。或者,可以利用且明确地考虑其他路线形状。

[0060] 当使用液晶显示器作为电子显示器70时,背光源106可以放置在电子显示器70的

后面,并且优选地是直接点亮的LED背光,但是可以在示例性实施例中使用其他照明源。板104或其他基本上平面的物体可以被放置在背光源106的后面,以便形成用于接受开环流体400的通道102。优选地,通道102被密封以防止开环流体400进入显示组件的其它部分,特别是电子室16。

[0061] 图9和图10示出了组件5和自立显示壳体15的上半部分,其分别类似于图7和图8所示的下半部分,除了一对可选的加强件110之外。在随后的附图中将更详细地解释可选的加强件110。如在下面的附图中将更详细地解释的,在该实施例中,开环流体400可经由间隙45和可选的后间隙44进入组件5。如流线所示,开环流体400可以遵循之字形路径到达右侧通道19。可选地,可以利用且明确考虑其他路线形状。

[0062] 图11是图1的组件的前视平面图,表示剖面线F-F,G-G,H-H。

[0063] 图12A和图12B示出了如在下面的附图中将更详细说明的那样,一对通道隔膜130和中央隔膜140优选地基本上水平放置在组件5的垂直中心线附近,但实施例可以也将它们放置在组件5的顶部或底部附近,远离垂直中心线。

[0064] 在该实施例中,图12A示出了被指定为开环流体400的入口的间隙45(和可选的后间隙44)的区域。

[0065] 这些图中还示出了,以及图12C是风扇81,其被定位成使开环流体400流入间隙45(和可选的后间隙44)的部分,其通常如进入环境空气(过滤或未过滤),沿着左侧内部通道21(进气通道),跨过/穿过通道102,沿着右侧内部通道22下降,并且从间隙45的部分(和可选的后部44)中排出间隙,其用作流体400的排气。应当注意,左侧和右侧内部通道21和22是可选的,因为替代实施例将包括开环流体400的以下路径:进入间隙45(和可选的后间隙44),其通常用于环境空气(过滤或未过滤)的入口中,跨过/穿过通道102,并从间隙45(和可选的后间隙44)的部分排出,用作流体400的排气。

[0066] 图12C是沿图11的剖面线H-H截取的顶部剖视图。在该实施例中,该图示出了被指定为开环流体400的排气的间隙45(和可选的后间隙44)的区域。

[0067] 图13A示出了经由后间隙44注入开环流体400。开环流体400可以经由孔122穿过可选的门加强件115。

[0068] 图13B示出了在可选缓冲区46的区域内的组件的示例性实施例。在该实施例中,缓冲区46可以包括基本上在间隙45(和可选的后间隙44)附近或之内的区域,其包含沿着开环流体400的路径放置的一个或多个流体阻挡塞,使得其不能以任何实质的量通过。在示例性实施例中,缓冲区46将与中央隔膜140一起包含通道隔膜130,但是一些实施例将仅使用通道隔膜130(如果该实施例不允许流体400流过门加强件)。在一些实施例中,缓冲区46不是将通道隔膜130放置在左侧通道18和左侧通道19内,而是可以包含位于间隙44附近或端部处的插塞。一般来说,缓冲区是水平的且放置在组件5的垂直中心线附近,尽管它可以放置在组件5的顶部或底部附近。

[0069] 值得注意的是,缓冲区46应该存在于组件5的两个侧面以及组件5的前部和后部(如果使用后部间隙44),使得缓冲区46阻挡组件5的左右两侧的前间隙45(和后间隙44)的一部分。

[0070] 图13C示出了经由后间隙44对开环流体400的排出。开环流体400可以经由孔122穿过门加强件115。

[0071] 应当注意,尽管图13A-13C示出了后间隙44,但是在示例性实施例中,前间隙45具有与后间隙44相似的取向。这里未示出,因为它将基本上是重复的。

[0072] 图14示出了间隙45和后间隙44的组合区域,如交叉阴影区域所示。在示例性实施例中,在缓冲区46的外部,交叉阴影区域允许开环流体400进入或离开间隙45(和可选的后间隙44)。

[0073] 图15示出了与自立显示壳体15隔离的组件5。门加强件120可以紧紧地固定在前面板10的后面。在一些实施例中,门加强件120可以固定到前面板10的后表面。门加强件120可以基本上延伸到前面板10的周边。门加强件120可以由适当刚性的金属或其他材料构成,从而为组件5提供结构刚度和强度。门加强件120可以包括允许开环流体400流动的一系列孔125。所示的门加强件孔125仅仅是示例性的。可以考虑任何数量和形状的孔125。

[0074] 图16以隔离方式示出了后面板60。在示例性实施例中,后门加强件115可以固定在后面板60的周边边缘周围,从而构成后面板60。门腔17可以由后面板60、后门加强件115的内表面和内部后面板80(图中未示出)之间的空间限定。经由后间隙44注入的开环流体400可以被认为开环流体400b,其穿过后门加强件115经由孔122进入门腔17。所示的孔122仅仅是示例性的,可以考虑任何数量和形状的孔。细长构件形式的可选加强件110可基本延伸后面板60的长度。可选的加强件110可由金属、聚合物或其它适当刚性的材料构成,以便向后面板60提供结构刚度和强度。可选的加强件110可以包括一系列孔135,其便于开环流体400b流过任选的加强件110。所示的可选加强件110和孔135仅仅是示例性的,可以考虑任选数量和形状的可选加强件110和孔135。

[0075] 在门腔17中行进的开环流体400的部分被称为开环流体400b。如图所示,开环流体400b可以途经内部面板80的后面并且经由进气孔75被注入,从而被引向通道102。在示例性实施例中,流体400b将流过进气孔75并被引导到左侧通道18,其将流体400b分配在通道102上,并从右侧通道19排出。

[0076] 图17通过流动线图示出开环流体400a通过组件5的前部和后部的循环。开环流体可以经由间隙45被注入,经由孔125行进穿过门加强件120,并且垂直地穿过右侧通道19,有时由右侧内部通道22和侧梁90限定。类似地,开环流体400a可以经由后间隙44,经由孔122穿过门加强件115,并经由孔135穿过可选的加强件110,并进入右侧通道19。在组件5的相对侧上,类似的路线可以是由由此开环流体最终进入左侧通道18,有时由左侧内部通道21和柱20限定。

[0077] 相反的基本相同的流动路径可以用于在组件5的相对端上的开环流体的排出。再次,在示例性实施例中,注入发生在组件5的上半部分中,而排出发生在组件5的下半部分中。在其他实施例中,注入发生在组件5的下半部分而排出发生在上半部分中。在其它实施例中,注入可以在右侧进行,而排出在左侧进行,缓冲区46放置在组件的顶部和底部边缘,以防止两个流动路径的交叉吸入。

[0078] 图18示出了经由间隙45和后间隙44注入之后开环流体400的示例性流动路径。经由后间隙44注入的开环流体400可以沿着可选的门加强件110之间的门腔17行进,并可以被称作开环流体400b。然后,开环流体400b可以沿着后内部面板80垂直行进并且经由后部进气孔75被注入。开环流体400的其它部分可以沿着左侧通道18和右侧通道19行进,并被称作开环流体400a。在垂直穿过侧通道18和19行进之后,开环流体400a可以在所述通道的顶部

行进并且经由进气孔75被注入。类似地,开环流体400可以经由间隙45注入,行进穿过前面板10下的门加强件孔125,并经由进气孔65被注入。

[0079] 图19A示出了图1的组件的后透视图,与自立显示器15隔离并表示细节S。

[0080] 图19B示出了图1的组件的前透视图,与自立显示器15隔离并表示细节T。

[0081] 图20示出了在右侧通道19中行进的开环流体400的部分被称为开环流体400a。开环流体400a可以在右侧通道19内行进,越过右侧内部通道22的顶部并进入进气孔75。

[0082] 图21类似于图20但是从前视图示出,示出了在左侧通道18中行进的开环流体400的部分被称为开环流体400a。开环流体400a可以在左侧通道18内行进,越过左侧内部通道21的顶部并进入进气孔65。

[0083] 图22是沿图4的剖面线B-B截取的底部透视截面图。一旦开环流体400a/400b经由各种进气孔75和65被注入,其被组合,然后在开口流体400的行进穿过热交换器100的开环气体路径的第一部分与开环流体400的引导穿过通道102的第二部分之间进行分配。

[0084] 一个或多个循环风扇32用于迫使循环气体700跨过电子部件并穿过热交换器100的闭环气体通道以及电子显示器70与前面板10之间,以形成闭环。在该实施例中,循环气体700穿过通行垫圈200中的开口,同时开环流体400围绕通行垫圈行进,基本上确保开环流体400和循环气体700不混合。然而,这种设计可以被颠倒,其中循环气体700围绕通行垫圈200行进,而外部空气400穿过通行垫圈200。

[0085] 示出了开环流体400的流动的一部分横过左侧内部通道21并穿过通行垫圈200,以便进入在电子显示器70后面(这里在背光源106后面)延伸的通道102。通道102优选地被定义为电子显示器70的后表面(此后在背光源106之后)与板104之间的空间。理想地,优选波纹状并且优选地连续的散热器放置在通道内,以便于将热从电子显示器101传导到连续散热器,通过与开环流体400的对流而被去除。

[0086] 热交换器100优选地包含多个层,其限定包含循环气体700或开环流体400的通道。优选地,循环气体700不允许与开环流体400混合。

[0087] 开环流体400的流动行进穿过通道102,并且再次绕过通行垫圈200进入左侧内部通道22,最终被引导出间隙45的部分(以及可选的后间隙44),其已经被指定用于排出液体400。在该实施例中,循环气体700被示出为离开热交换器100并穿过通行垫圈200中的开口,然后穿过电子显示器70与前面板10之间。

[0088] 在优选实施例中,热交换器100可以为交叉流动热交换器。然而,许多类型的热交换器是已知的,并且可以与本文的任何实施例一起使用。热交换器100可以是交叉流动,平行流动或逆流式热交换器。在示例性实施例中,热交换器100可由多个层叠的薄板组成。板可以具有波纹状,蜂窝状或管状的设计,其中多个通道/路径/管道沿着板向长度方向延伸。板可以堆叠,使得路径的方向与每个相邻的板交替,使得每个板的路径基本上垂直于相邻板的路径。因此,外部空气或循环气体可以仅穿过其通道或路径并平行于气体路径行进的板进入示例性的热交换器。由于板是交替的,循环气体和开环流体可以在彼此相邻的板行进,并且可以在两种气体之间传递热量而不混合气体本身(如果热交换器被充分密封,这是优选的)。

[0089] 在用于热交换器的替代设计中,开放通道可以放置在一对波纹状、蜂窝状或管状板之间。开放通道可以沿着垂直于相邻板的通路的方向行进。可以通过在垂直于相邻板中

的路径的方向上在板的两个相对边缘之间运行两条材料或带(特别是非常粘合带(VHB))来创建该开放通道。因此,沿第一方向进入热交换器的气体可以穿过开放通道(平行于条带或带)。进入第二方向(基本上垂直于第一方向)的气体将穿过相邻板的路径)。

[0090] 其他类型的横流式热交换器可以包括多个管,其包含第一气体并垂直于第二气体的路径行进。当第二气体流过含有第一气体的管道时,两种气体之间的热量被交换。显然,存在许多类型的横流式热交换器,并且任何类型可与本文的实施例一起使用。

[0091] 示例性的热交换器可以具有板,其中侧壁具有相对低的热阻,使得热量可以容易地在两种气体之间交换。可以使用许多材料来制造热交换器。所使用的材料最好是耐腐蚀,抗腐蚀,重量轻且价廉。金属通常用于热交换器,因为它们的高导热性并且可以与这些实施例一起使用。然而,已经发现塑料和复合材料也可以满足电子显示器的热条件。示例性实施例将利用聚丙烯作为构造用于热交换器的板的材料。已经发现,虽然聚丙烯可能看起来像是不良的热导体,但相对于小的侧壁厚度的大量表面积会导致总体的热阻较低。因此,示例性的热交换器将由塑料制成,从而会产生薄而轻的显示组件。具体地,波纹塑料可以用于每个板层,其中它们以交替的方式堆叠在一起(即,每个相邻的板具有沿垂直于周围板的方向行进的通道)。

[0092] 在示例性实施例中,电子显示器70可以是直接LED背光点亮的LCD,其中LED背光将包含安装在导热基板(优选为金属芯PCB)上的多个LED。LED背光源的后表面优选地包含导热板,该导热板可以与通道102导通并热连通。

[0093] 循环气体700和开环流体400可以是任何数量的气态物质。在一些实施例中,空气可以用作所有的气体。优选地,由于循环气体700在电子显示器70的前面行进,所以基本上可以明确的是它不会影响图像对观看者的外观。循环气体700还应优选基本上不含污染物和/或颗粒(例如灰尘,污垢,花粉,水蒸气,烟雾等),以防止对图像质量的不利影响和/或对内部电子元件的损坏。一般来说,示例性实施例将利用环境空气作为开环流体400。

[0094] 冷却系统可以连续运行。然而,如果需要,温度感测装置可以并入电子显示器内以检测何时温度达到预定的阈值。在这种情况下,当显示器中的温度达到预定值时,可以选择性地接合各种冷却风扇。可以选择预定阈值,并且可以将系统配置为有利地将显示器保持在可接受的温度范围内。典型的恒温器组件可用于完成此任务。热电偶可用作温度感测装置。

[0095] 图23至图25示出了中央隔膜140,其优选地基本上水平定位并且在组件5的垂直中心线附近,但是实施例也可以将它们放置在组件5的顶部或底部附近,远离大致上沿着后面板60的前表面的中线延伸的垂直中心线。右通道隔膜130基本上沿着自立显示壳体15的右侧内边缘的中线延伸,使得其大致与中央隔膜140对齐。类似地,左通道隔膜130可以固定在组件5的左侧内部边缘上,使得它与中央隔膜140对齐。

[0096] 中央隔膜140,右通道隔膜130和左通道隔膜130(以下统称为“水平隔件”)可以构造基本上将门腔17分为上半部和下半部。水平隔件可以被构造使得其在门腔17的上半部和下半部之间形成基本上气密的密封。可选地,水平分隔件还可以包括可膨胀材料,例如聚氨酯泡沫,与水平隔件一起在上半部和下半部之间提供气密密封。在示例性实施例中,中央隔膜140可以由足够柔性的材料(例如聚合物)构成,以在门腔17中形成气密密封。在替代实施例中,中央隔膜140可由刚性材料构成。在示例性实施例中,右通道隔膜130和左通道隔

膜130可以是刚性的。

[0097] 在示例性实施例中,开环流体400可以经由组件5的上半部中的间隙45(和可选的后间隙44)注入。所述开环流体400a可以沿着右侧通道19行进,直到所述流体的一部分到达右通道隔膜130并被阻止超出。类似地,开环流体400a可以沿着左侧通道18行进,直到所述流体的一部分到达左侧通道隔膜130。如上述图所示,开环流体的所述部分可以被迫沿相反方向垂直返回并且分别循环穿过右侧通道19和左侧通道18的上半部分,直到最后经由进气孔65和75被注入。

[0098] 在类似的方式中,沿着门腔17行进的开环流体400b可以垂直行进,直到所述流体400b的一部分到达中央隔膜140并被阻止超过。以这种方式,已经被注入(但没有穿过热交换器100或通道102)的流体400b不能与已经行进穿过热交换器100或通道102的流体400b混合,并且需要被排出间隙45(和可选的后间隙44)。

[0099] 如先前图中所讨论的,开环流体400可循环穿过可选的热交换器100,最终经由排气孔85排出。开环流体400然后可以最终返回到右侧通道19或左侧通道18并垂直行进。右通道隔膜130和左通道隔膜130可以分别防止所述开环流体超过组件5的中线,从而防止组件5的每一半的开环流体变混合。也就是说,尚未经由进气孔65和75注入的开环流体可以不与已经经由所述进气孔65和75注入的开环流体混合。遇到右侧隔膜130和左侧隔膜130的开环流体可以被迫在相反方向上垂直返回,直到最终从组件5经由间隙45(和可选的后间隙44)排出。

[0100] 图26A和图26B示出了通道隔膜130的示例性实施例。在这样的实施例中,通道隔膜141的一部分可以是可调节的,使得(如果需要的话)开环流体400a的一部分可以被允许通过通道隔片130,从而允许注入和排出开环流体之间实现有限量的混合。在这种实施例中,通道隔膜142的第二部分可以是静态的,使得它们可以不被调节并且提供基本上气密的密封,使得注入和排出开环流体不会被混合。在其他实施例中,通道隔片130的整体可以是可调节的。在其他实施例中,通道隔片130的整体可以是静态的。

[0101] 应当理解,所公开的实施例的精神和范围提供了许多类型的显示器的冷却。作为示例而不是限制,实施例可以与以下任何电子图像组件结合使用:LCD(所有类型),发光二极管(LED),有机发光二极管(OLED),场发射显示器(FED),发光聚合物(LEP),有机电致发光(OEL),等离子体显示器以及任何其它薄板电子图像组件。此外,实施例可以与其他类型的显示器一起使用,包括尚未发现的那些。特别地,预期该系统可以非常适合用于全彩色平板OLED显示器。示例性实施例还可以利用大型(55英寸或更多)LED背光,高分辨率液晶显示器(LCD)。虽然本文描述的实施例非常适合于户外环境,但是它们也可适用于显示器的热稳定性可能处于危险中的室内应用(例如工厂/工业环境,温泉,更衣室)。

[0102] 如本领域众所周知的,电子显示器可以以纵向或横向方式定向,并且可以与本文的实施例一起使用。

[0103] 还应当注意,附图中示出的各种冷却回路可以以水平或垂直布置示出,但是应当清楚地理解为可以根据特定实施例来反转或改变。因此,开环可以水平或垂直并且沿顺时针或逆时针方向运行。此外,开环也可以是水平的或垂直的,并且可以从左到右,从右到左,从上到下,或从底到顶。

[0104] 已经示出和描述了本发明的优选实施例,本领域技术人员将认识到,可以进行许

多变化和修改来影响所描述的发明,并且仍在所要求保护的发明的范围内。另外,上述指示的许多元件可以被改变或替换,这些元件将提供相同的结果并落入所要求保护的发明的精神内。因此,仅由权利要求书所表示的范围限制本发明。

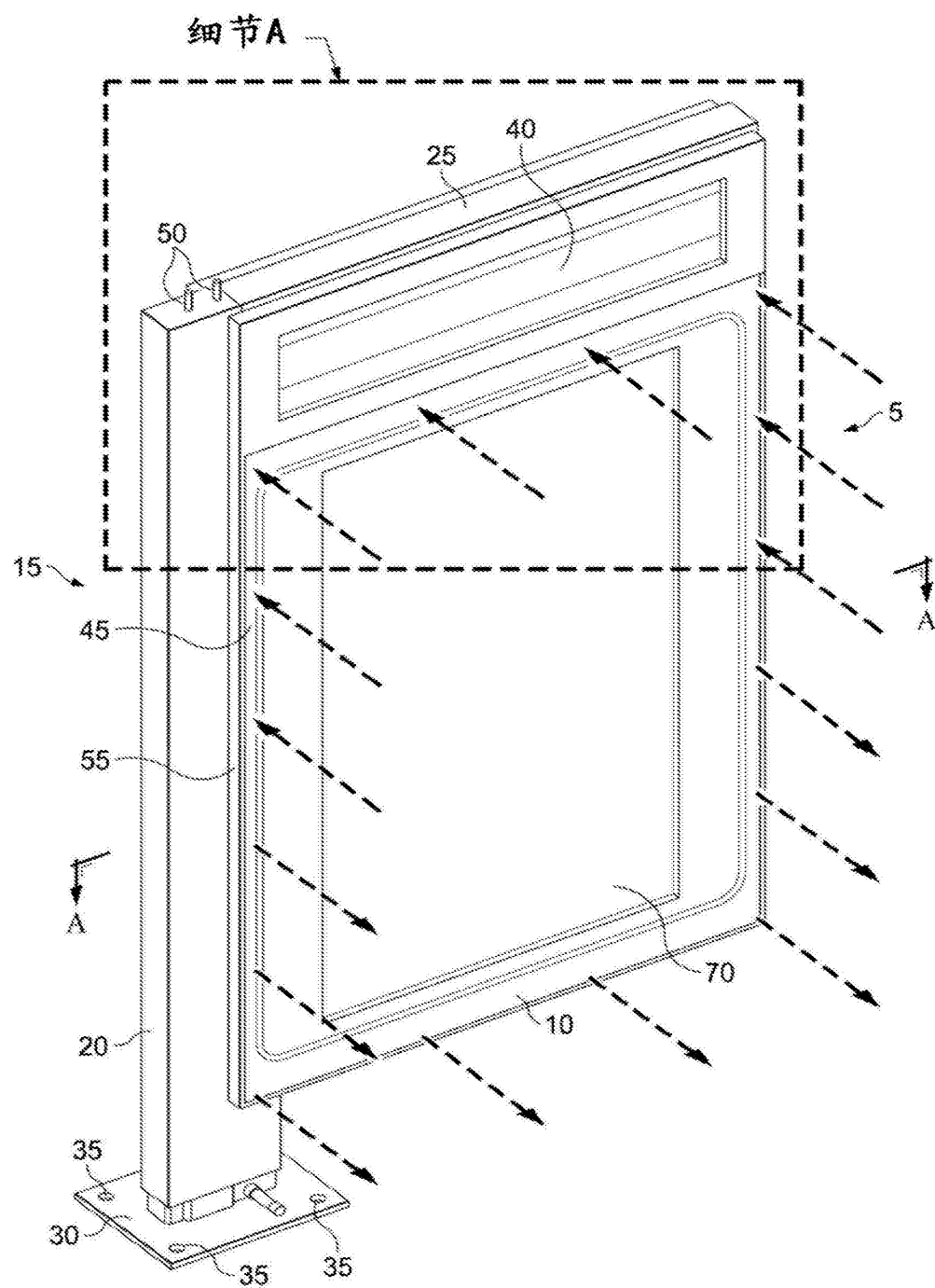


图 1

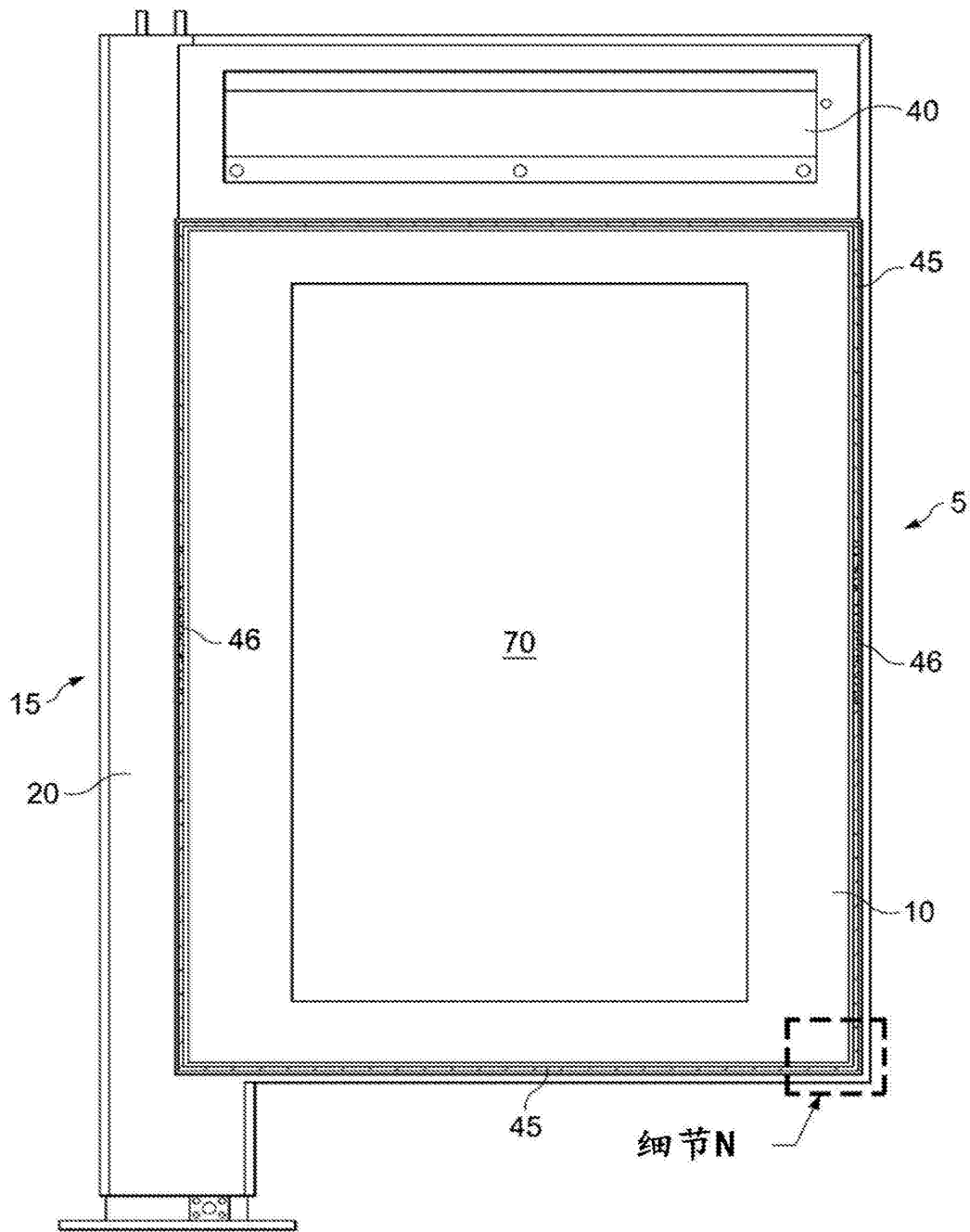


图2

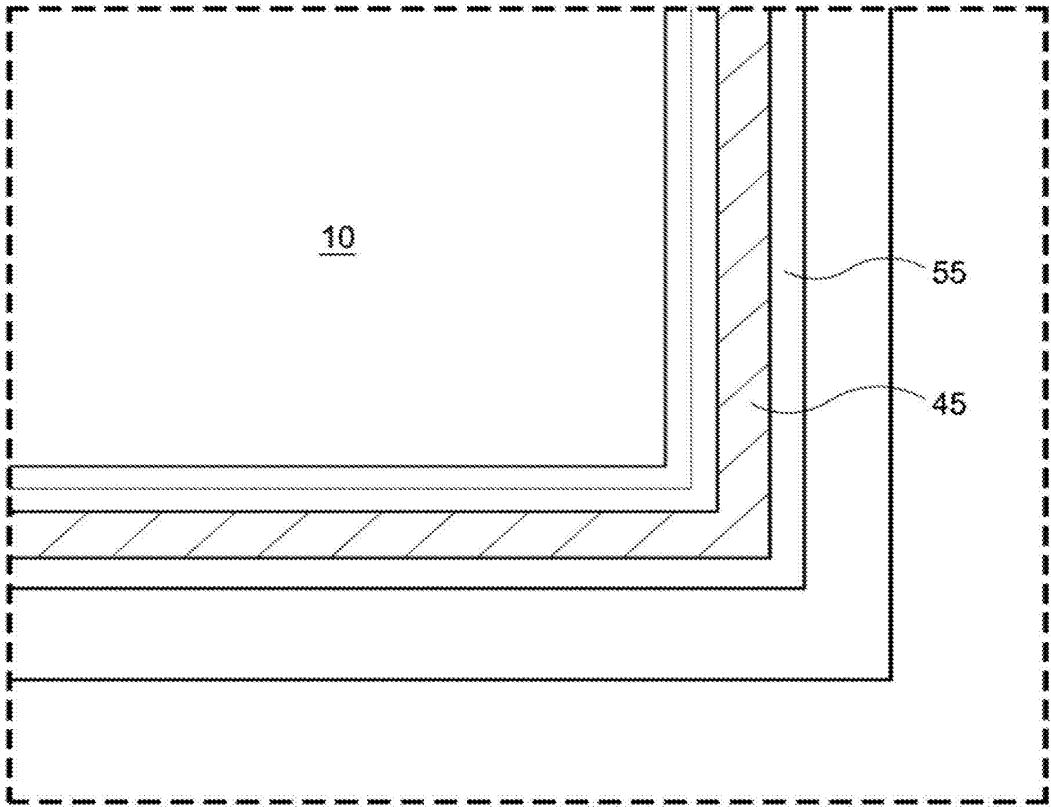


图3

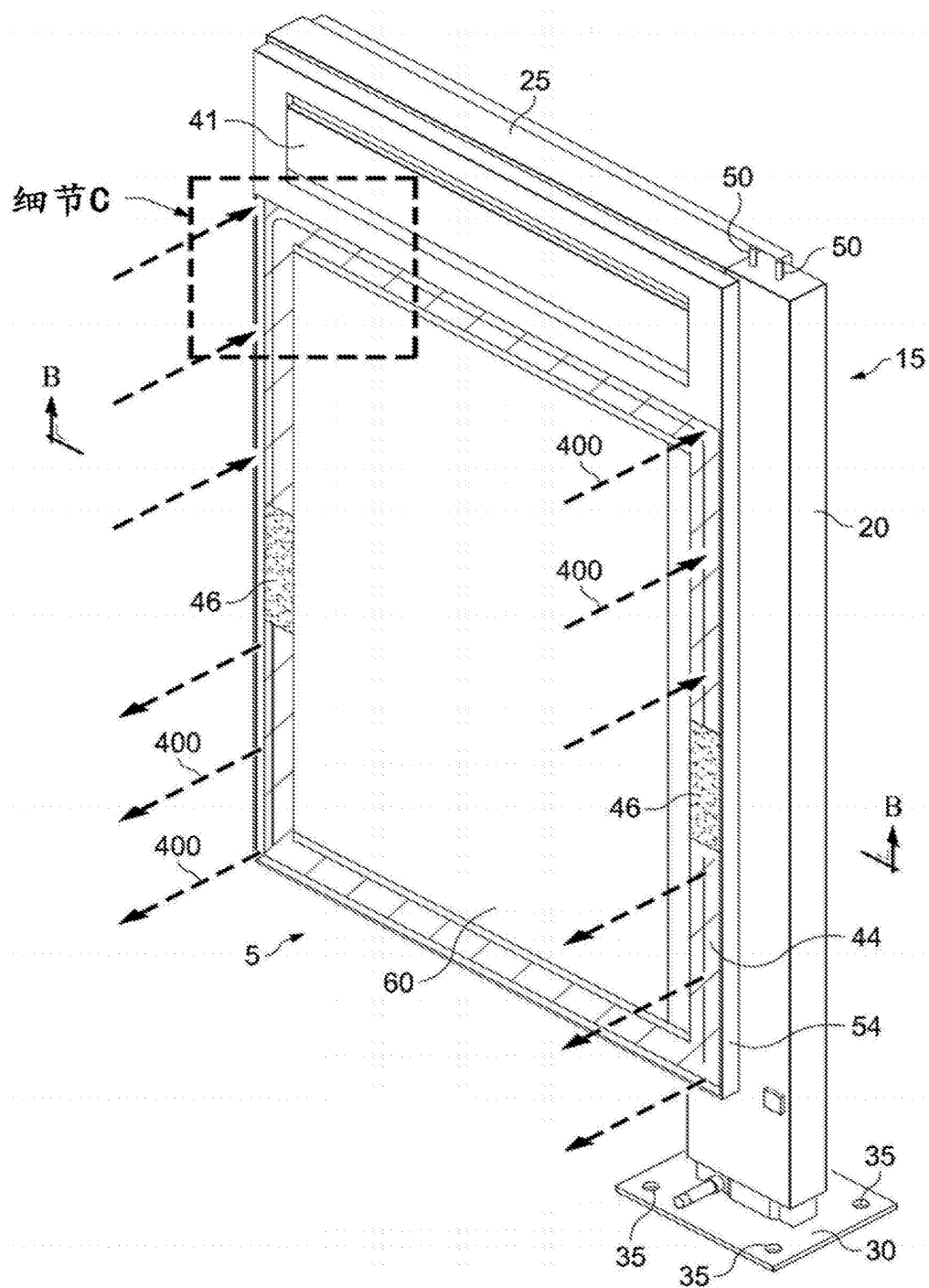


图4

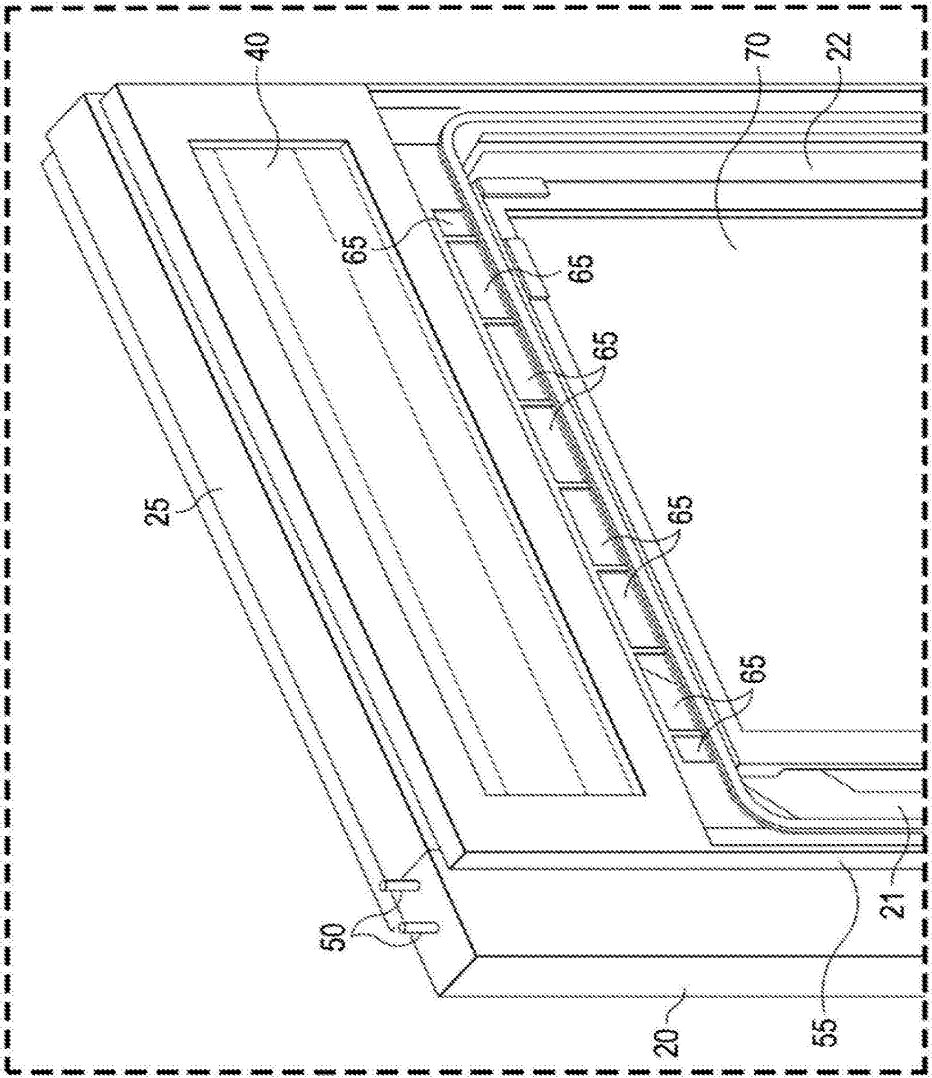


图5

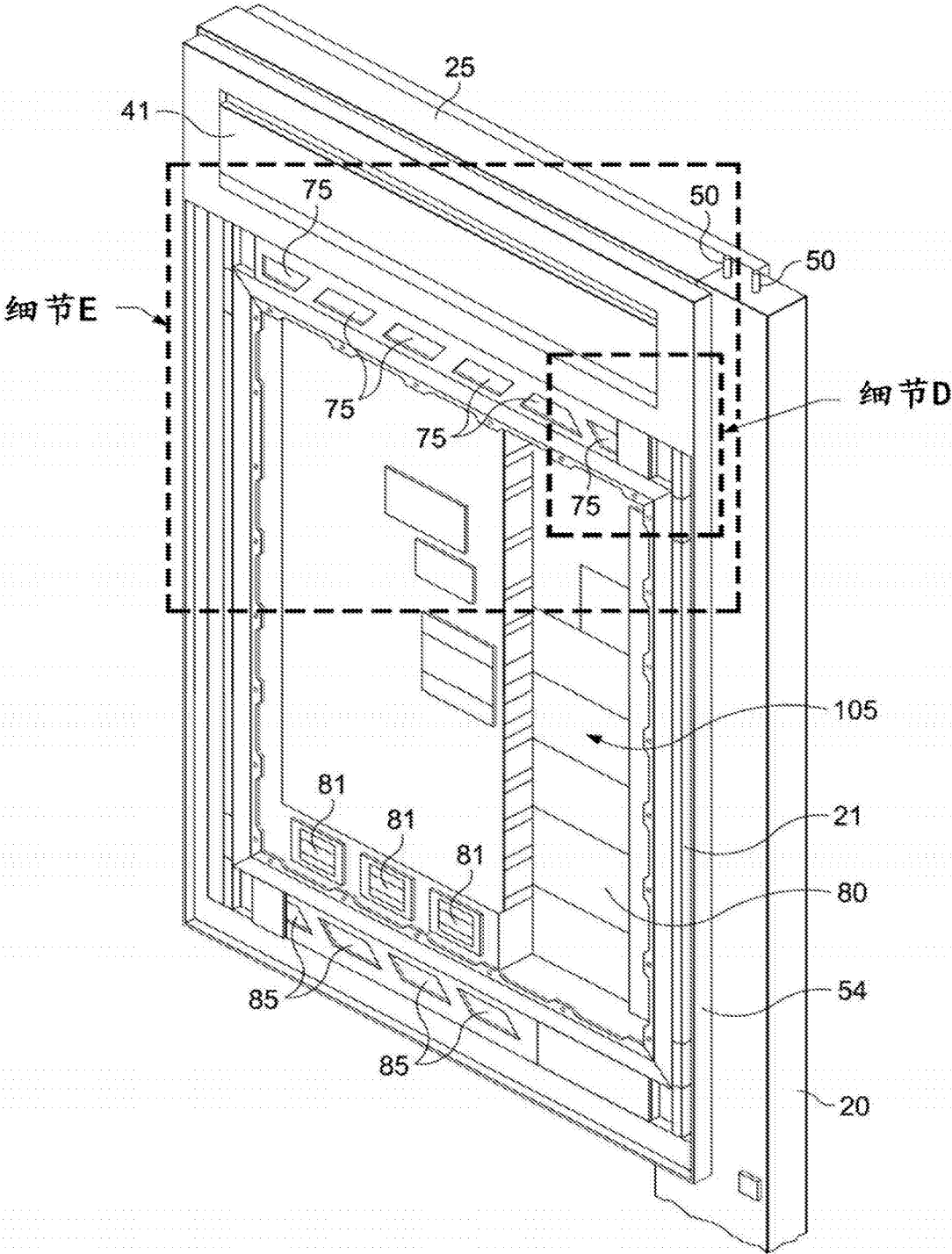


图6

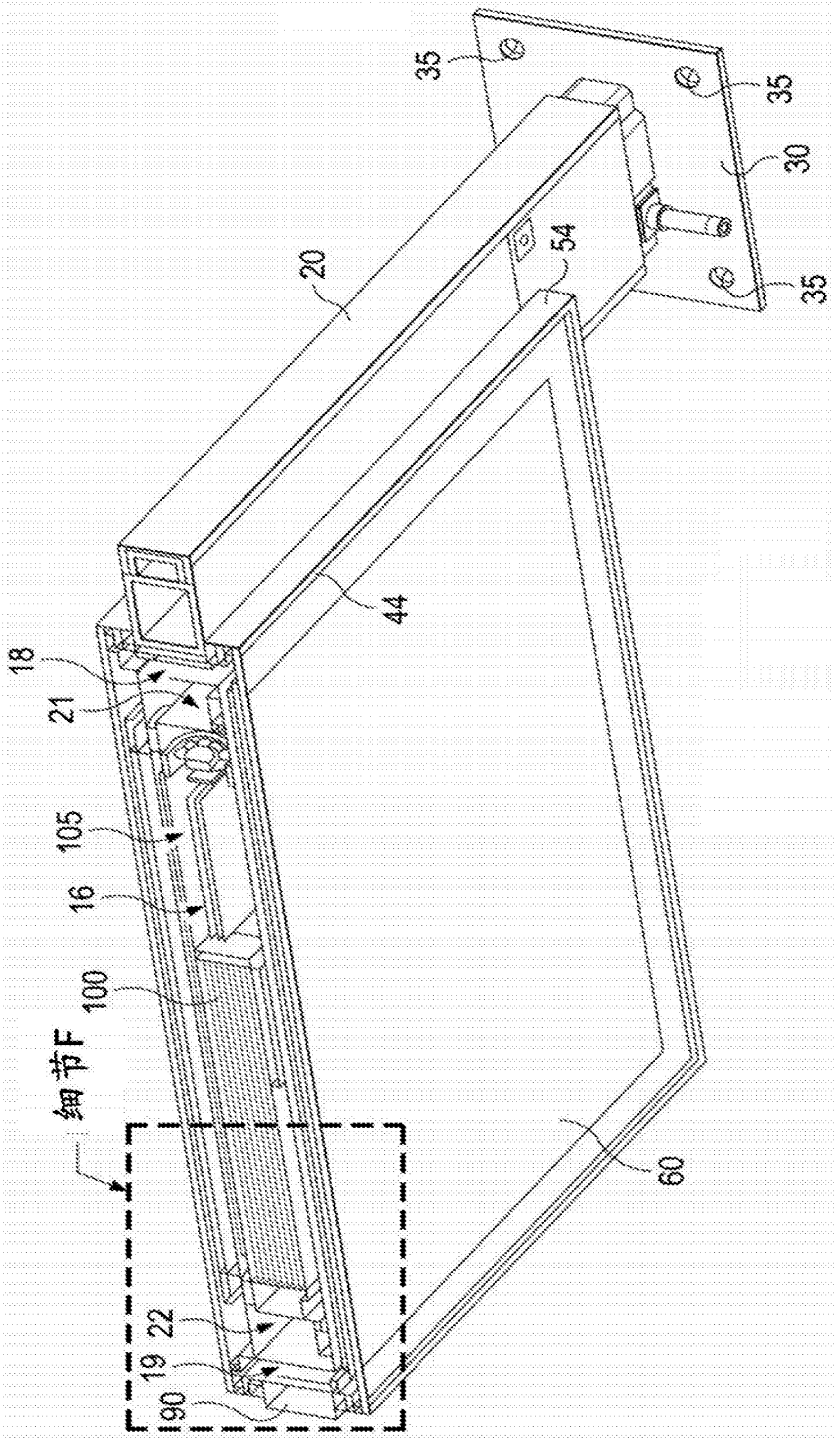


图7

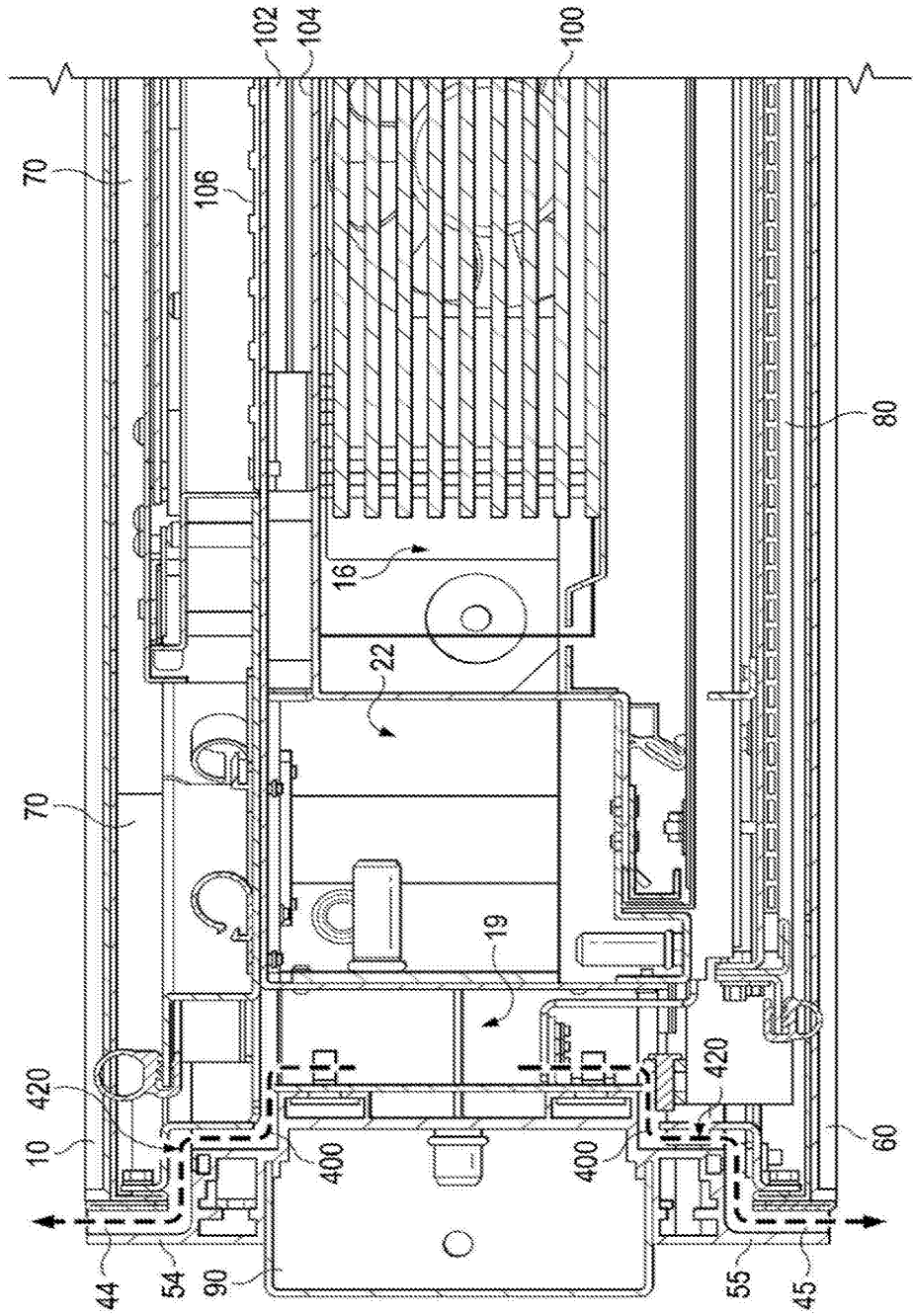


图8

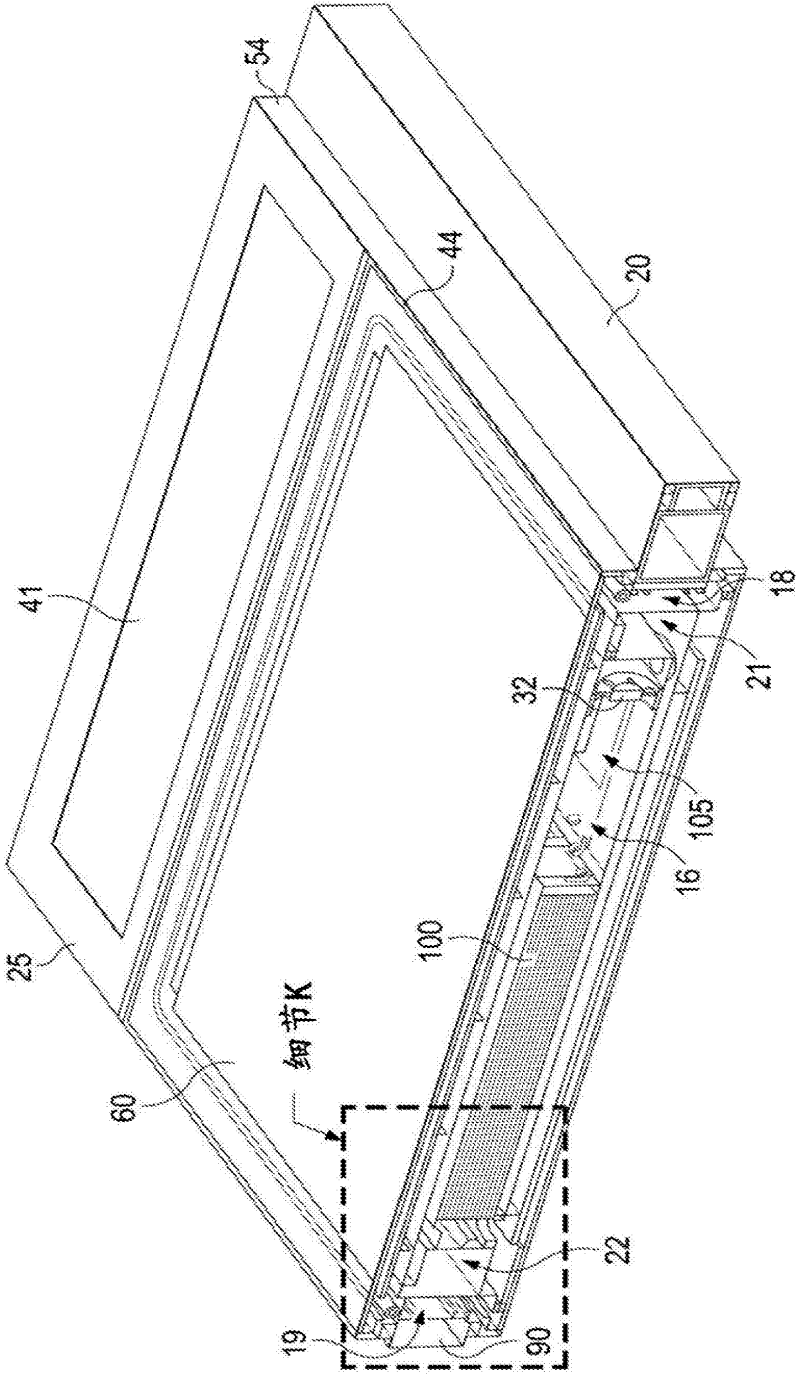


图9

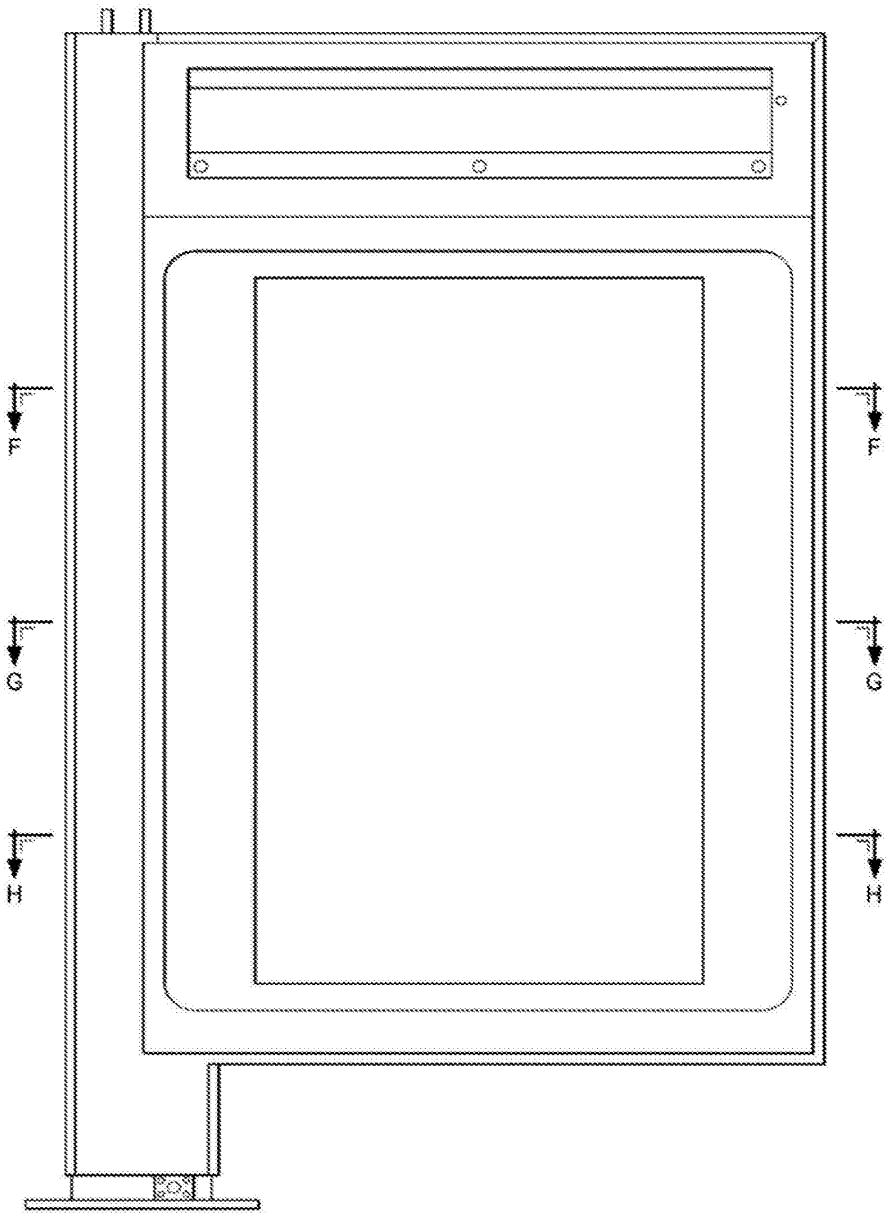


图11

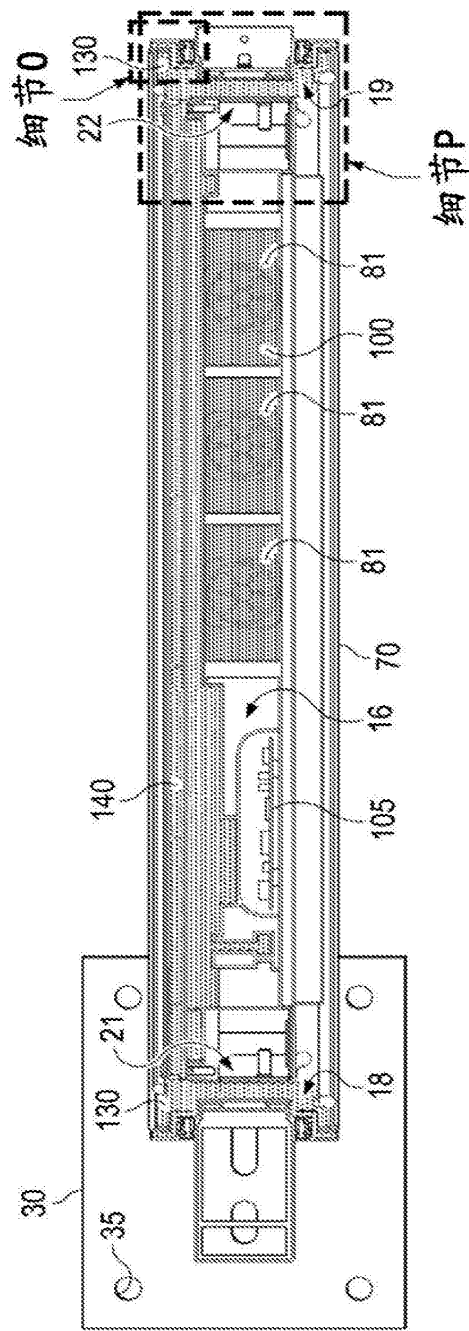


图12A

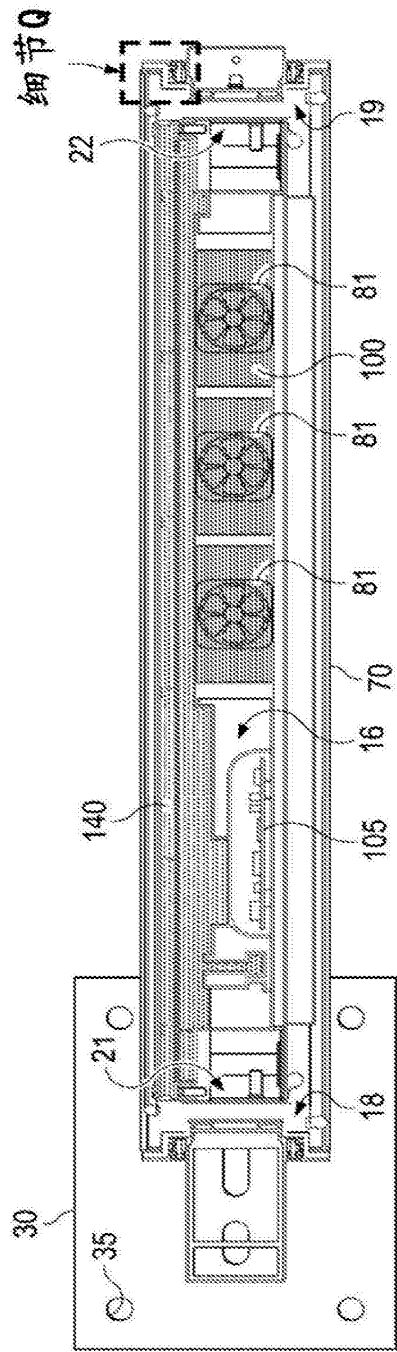


图12B

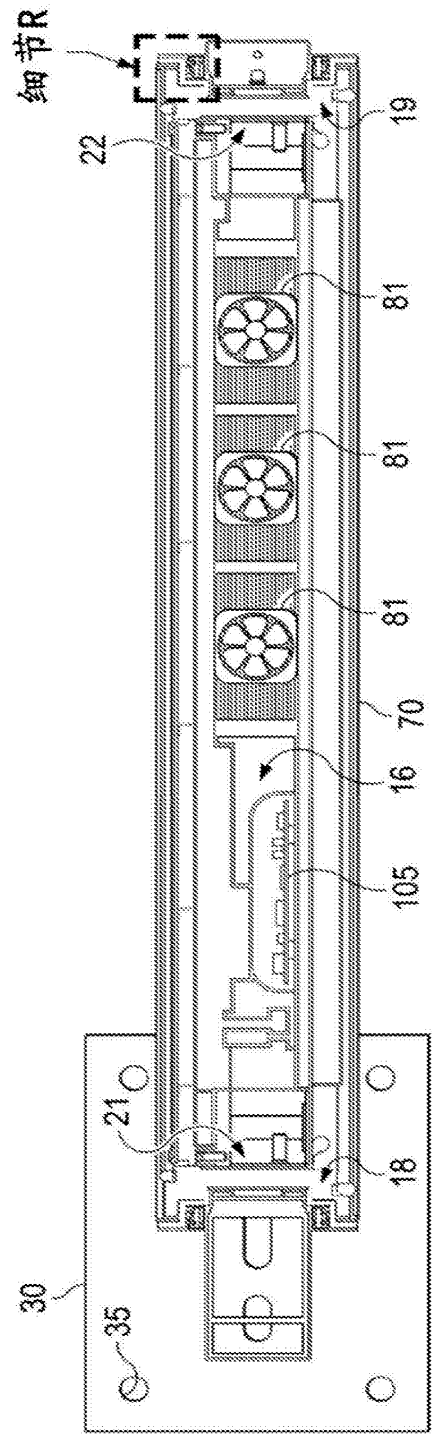


图12C

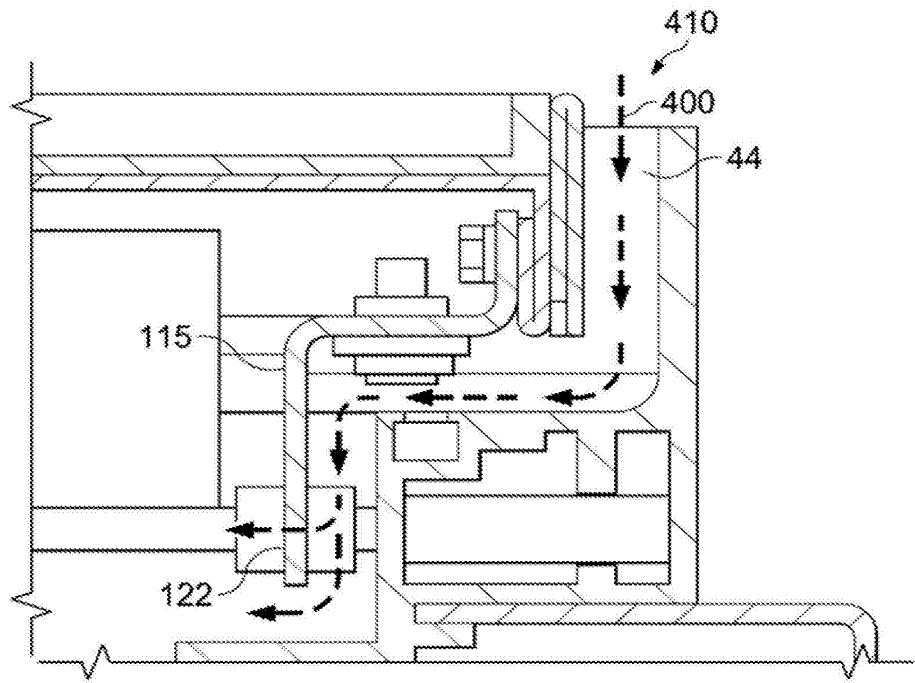


图13A

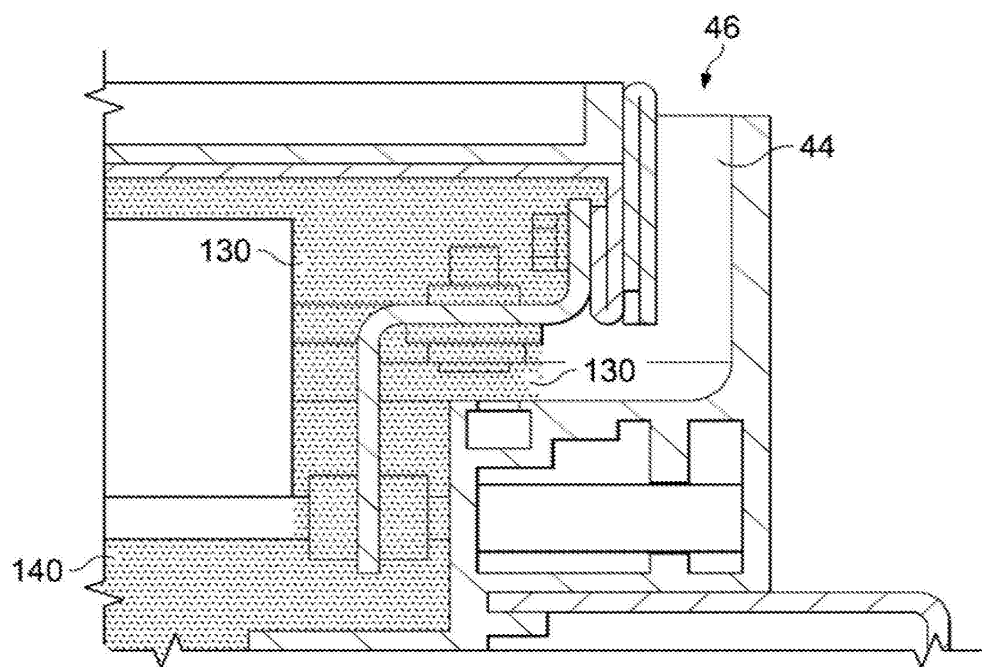


图13B

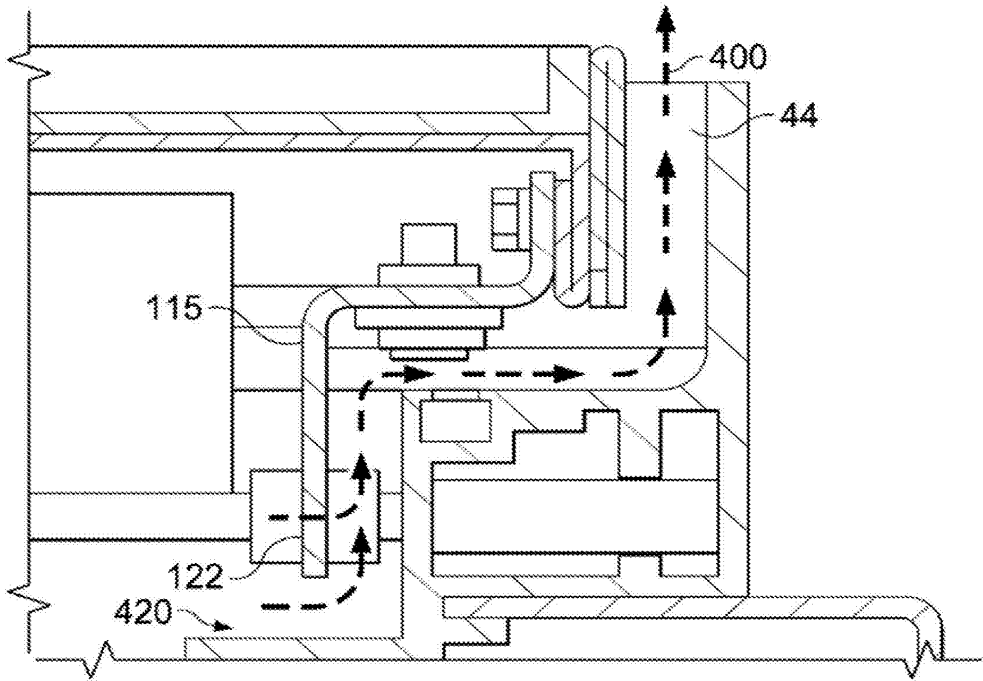


图13C

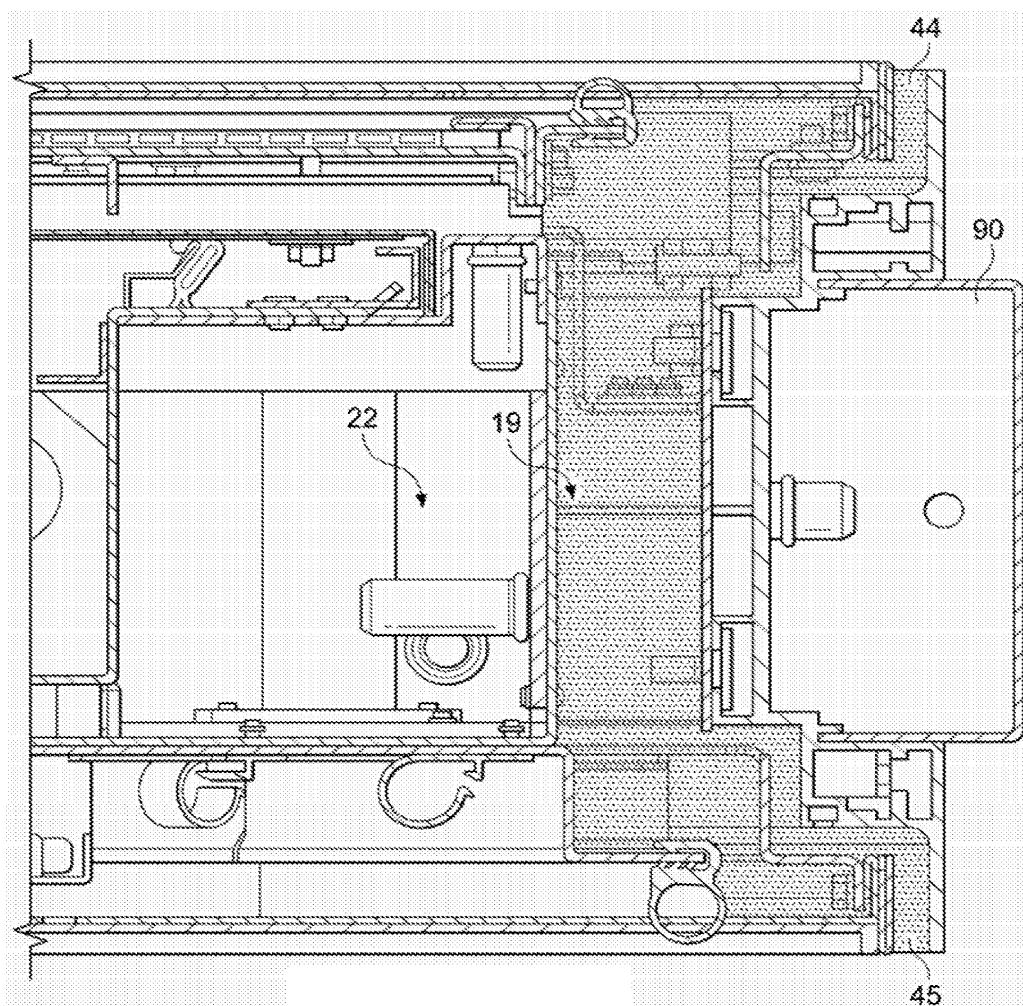


图14

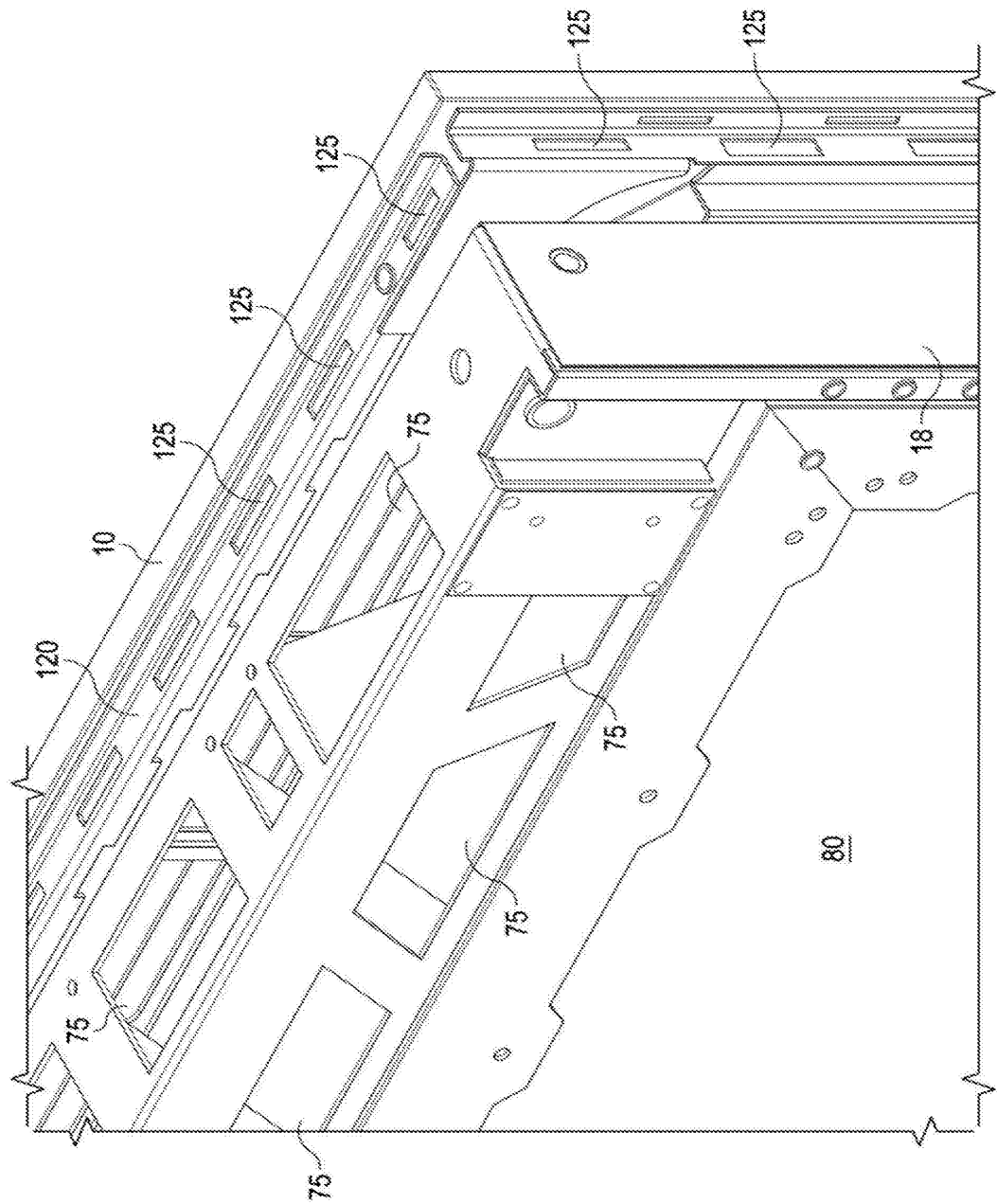


图15

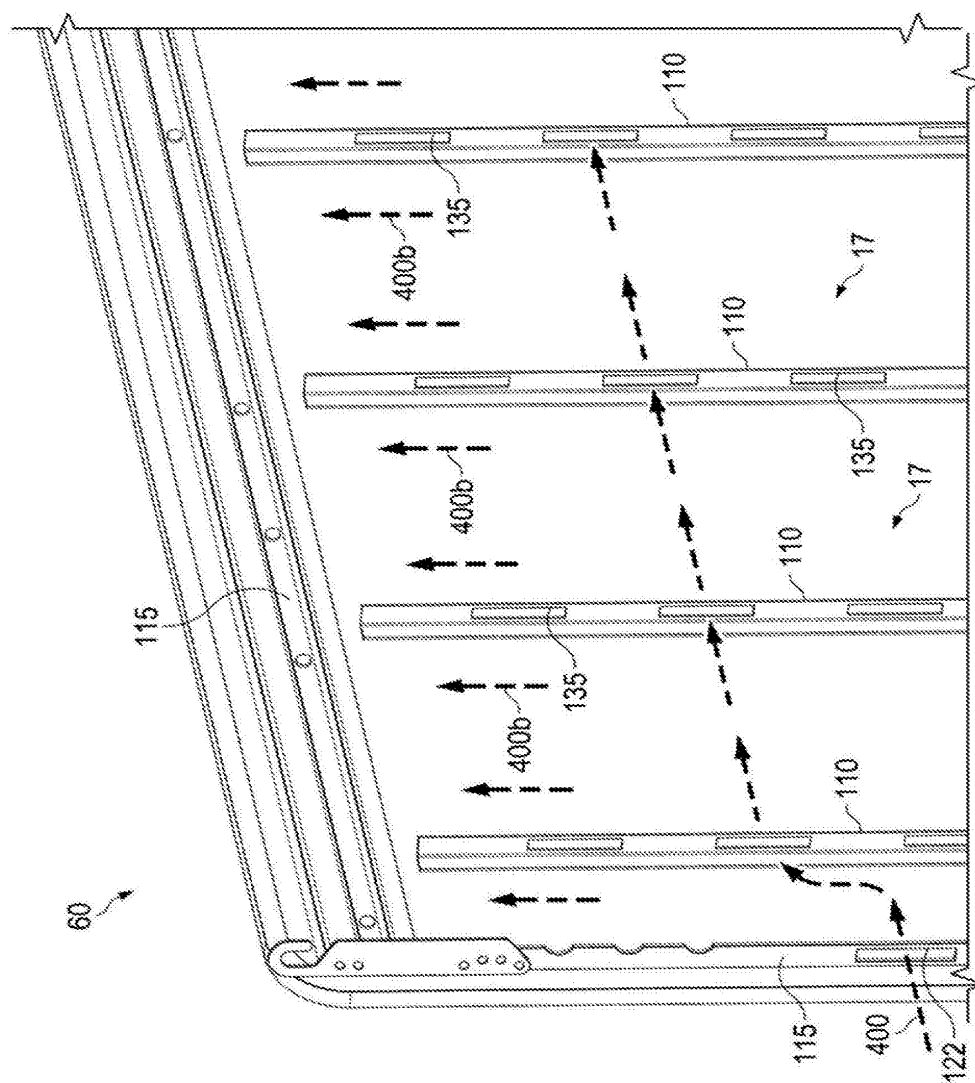


图16

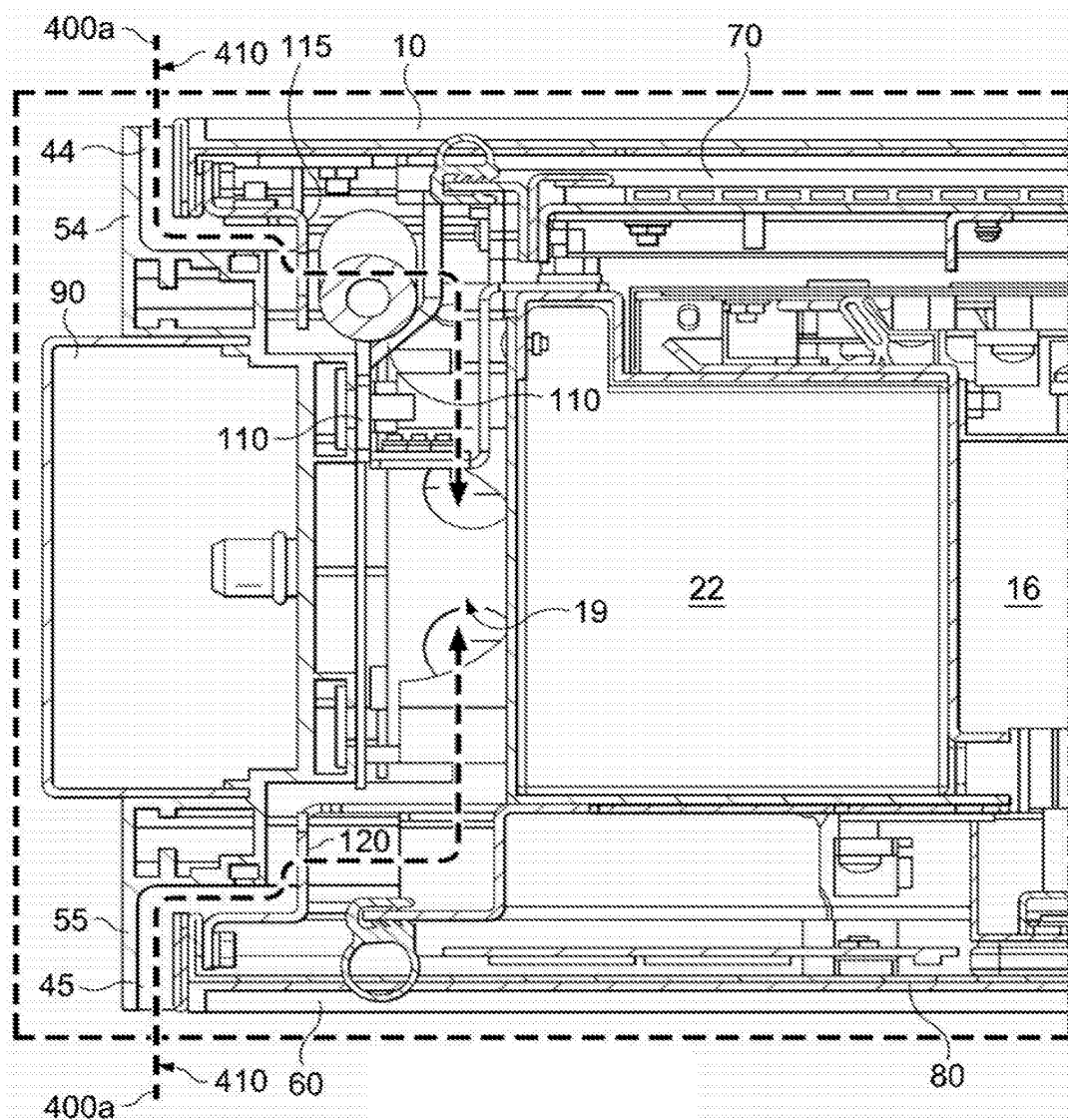


图17

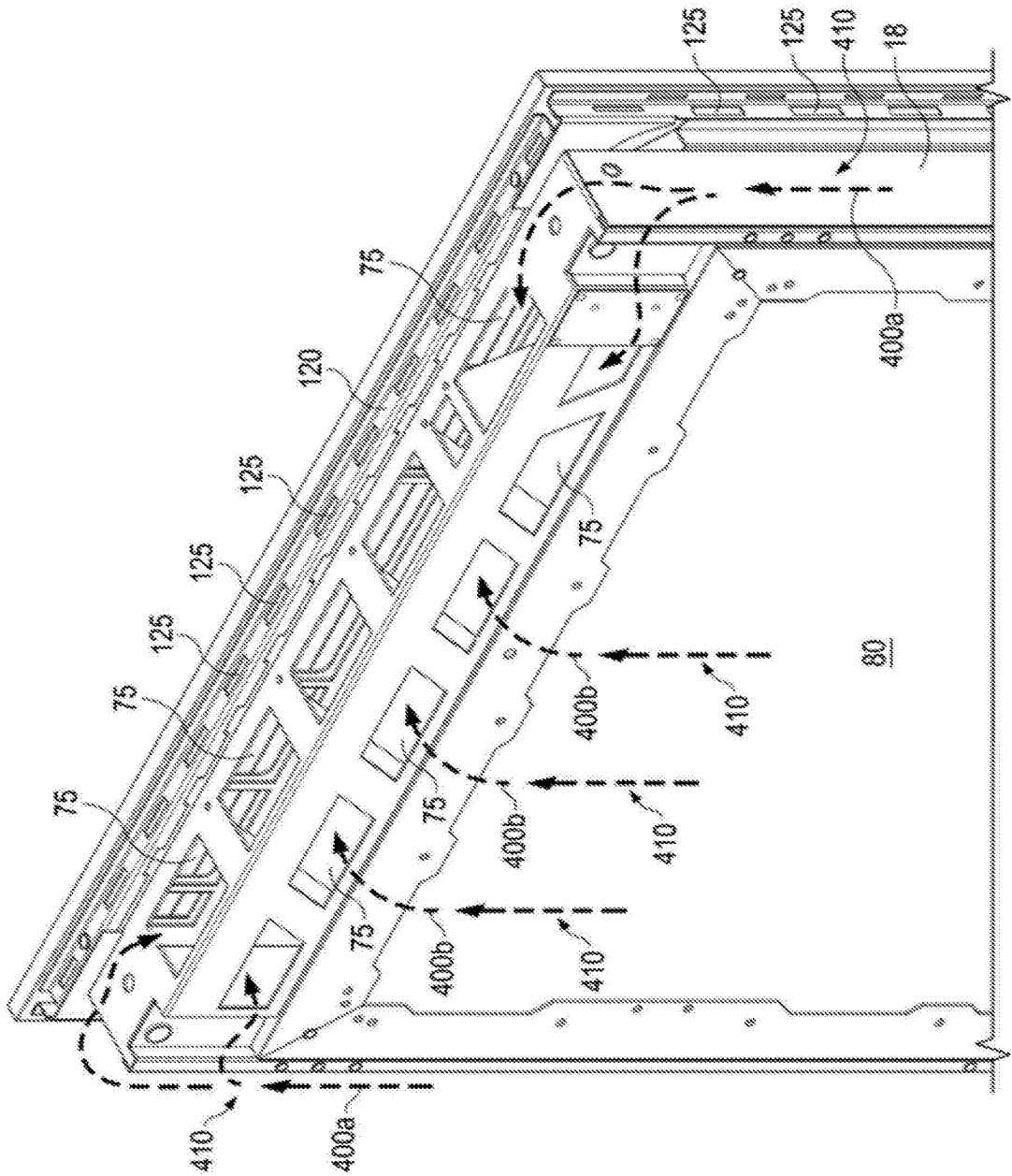


图18

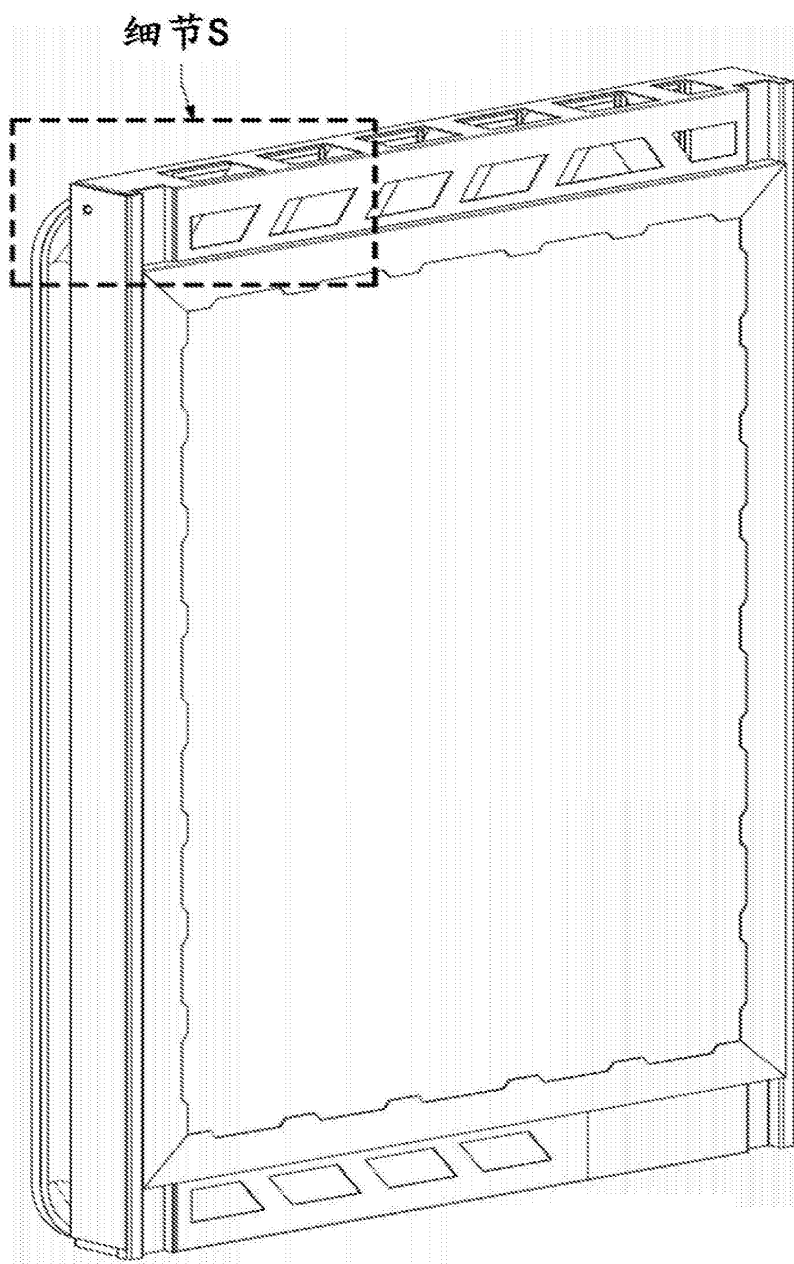


图19A

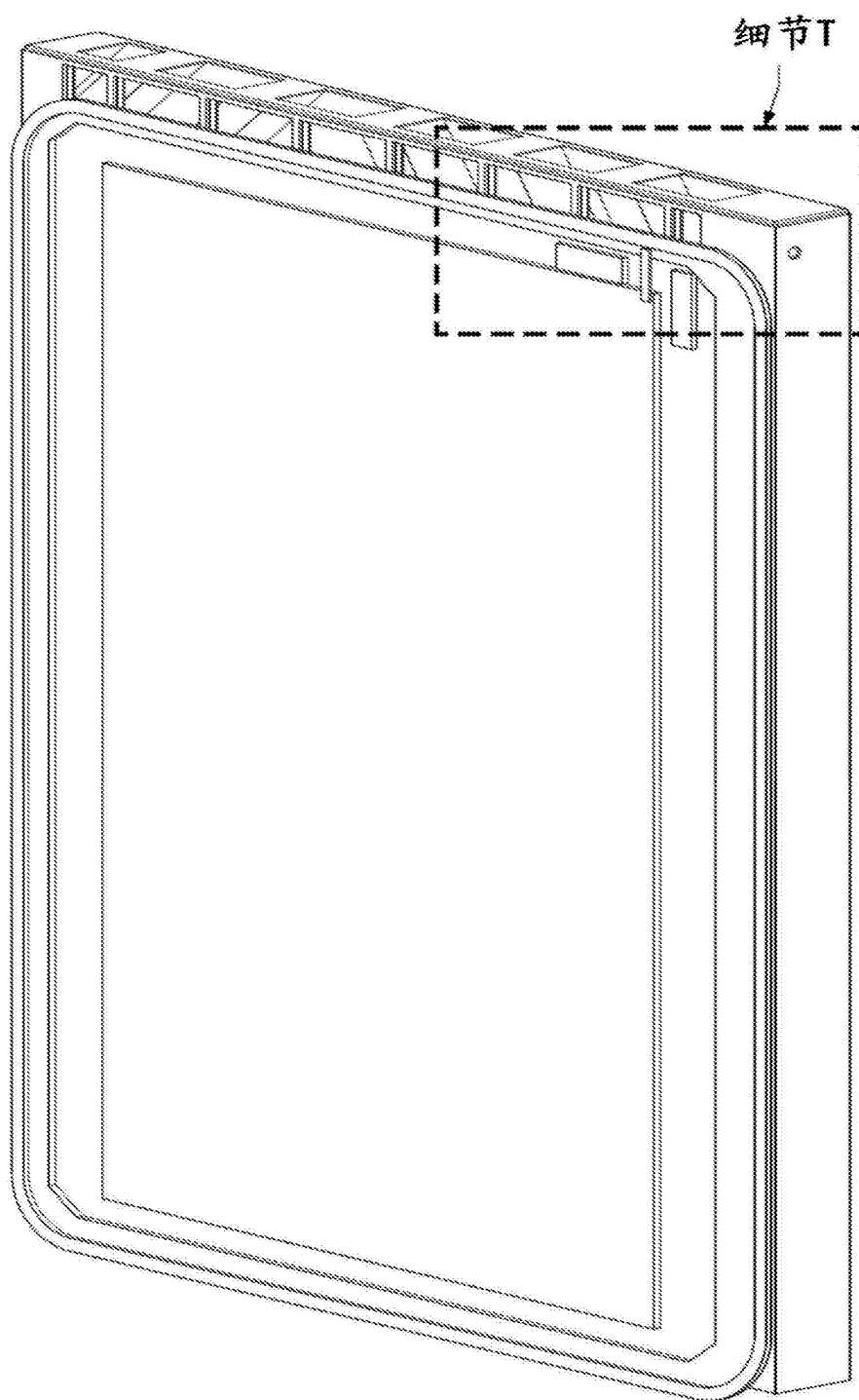


图19B

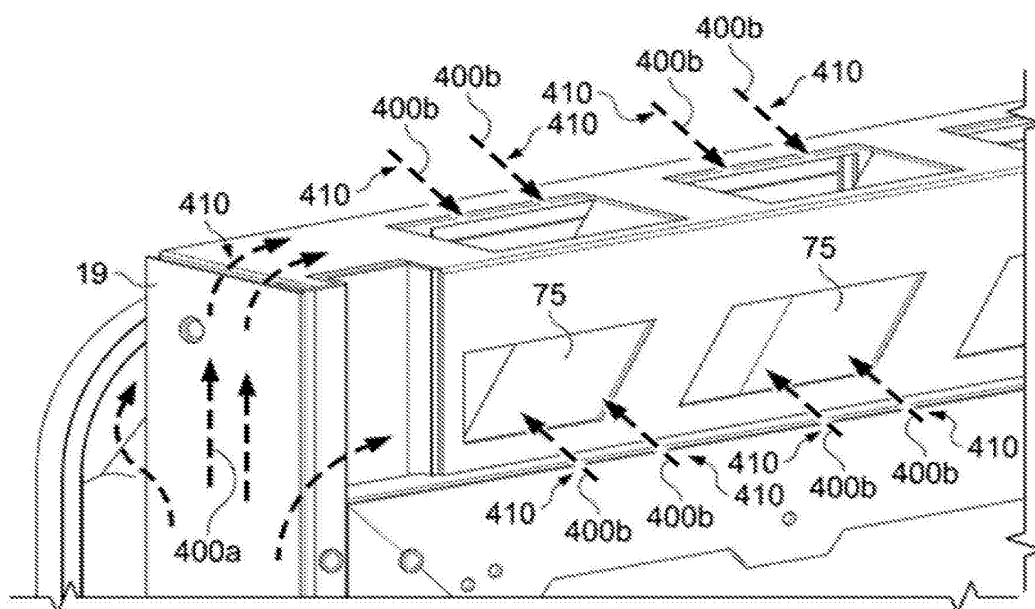


图20

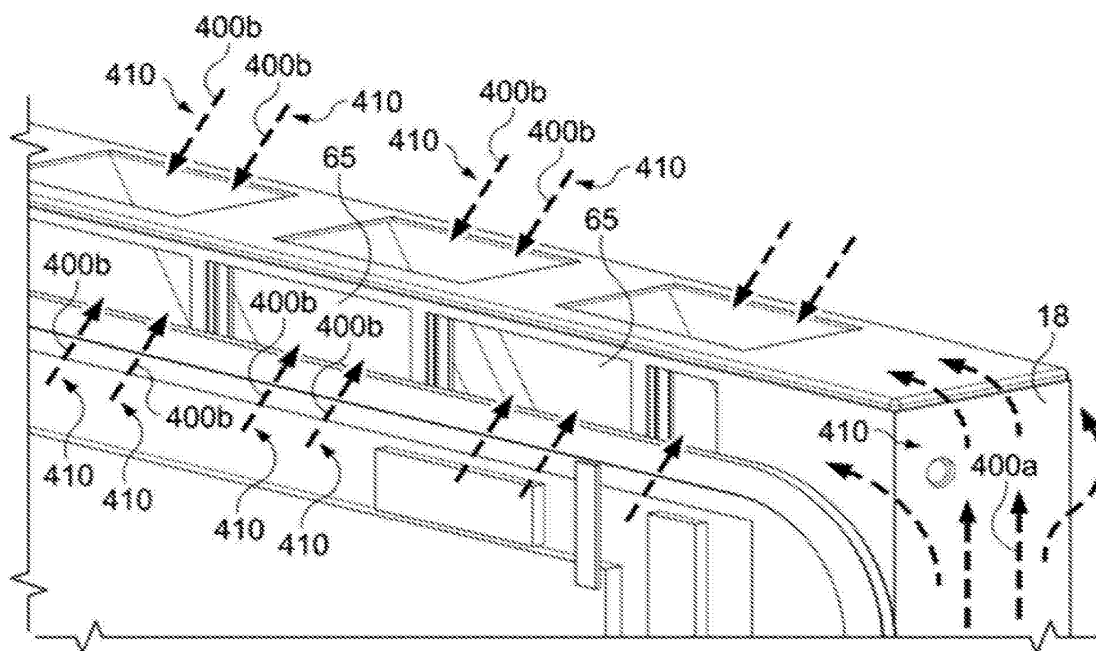


图21

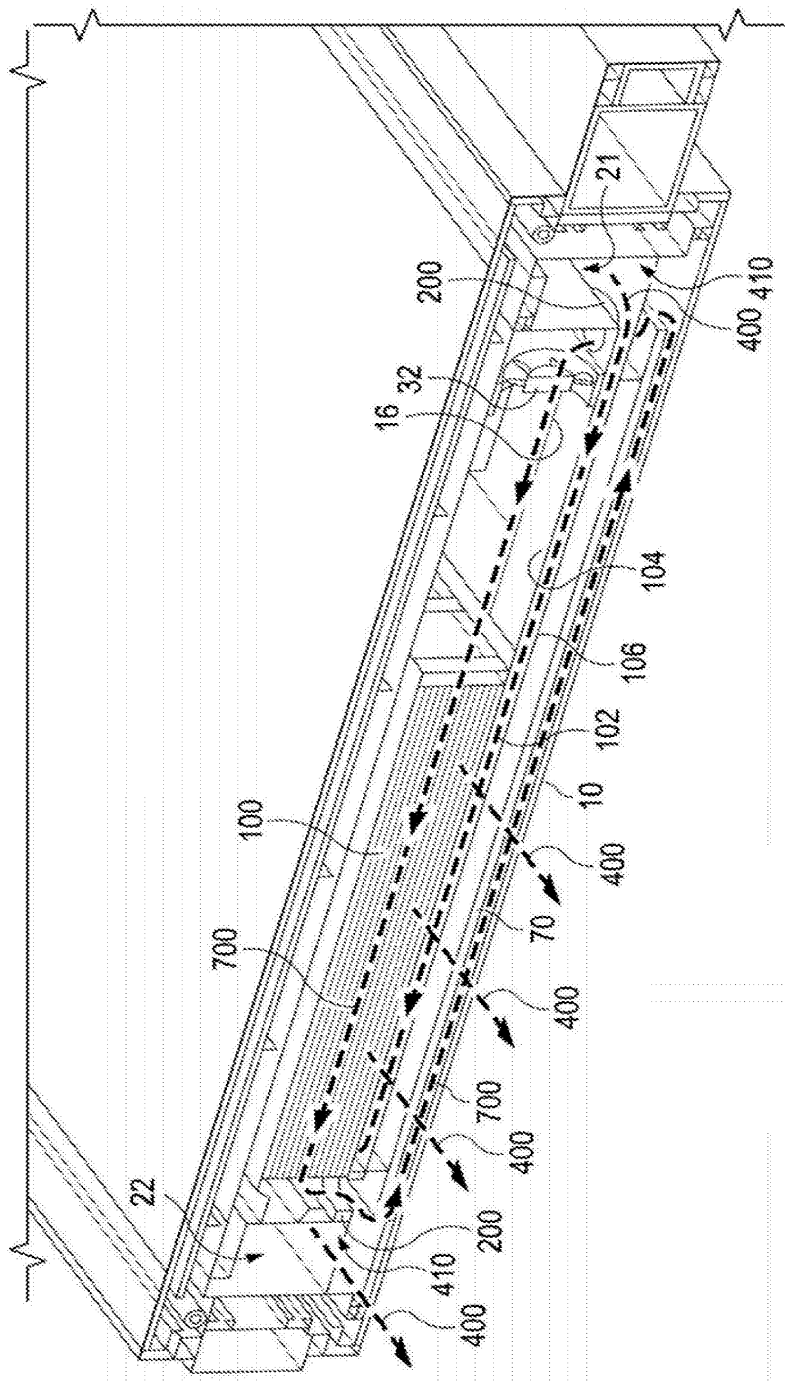


图22

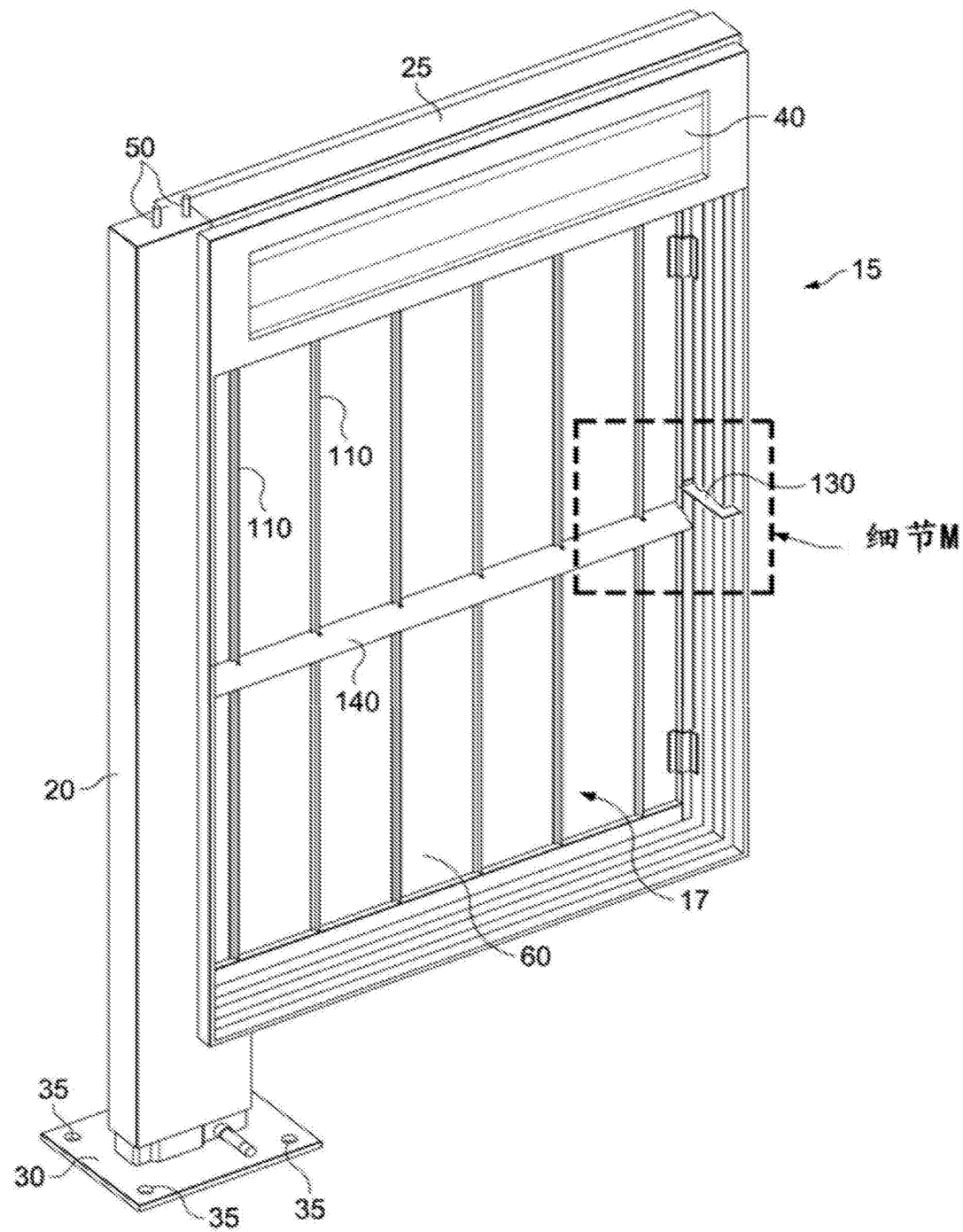


图23

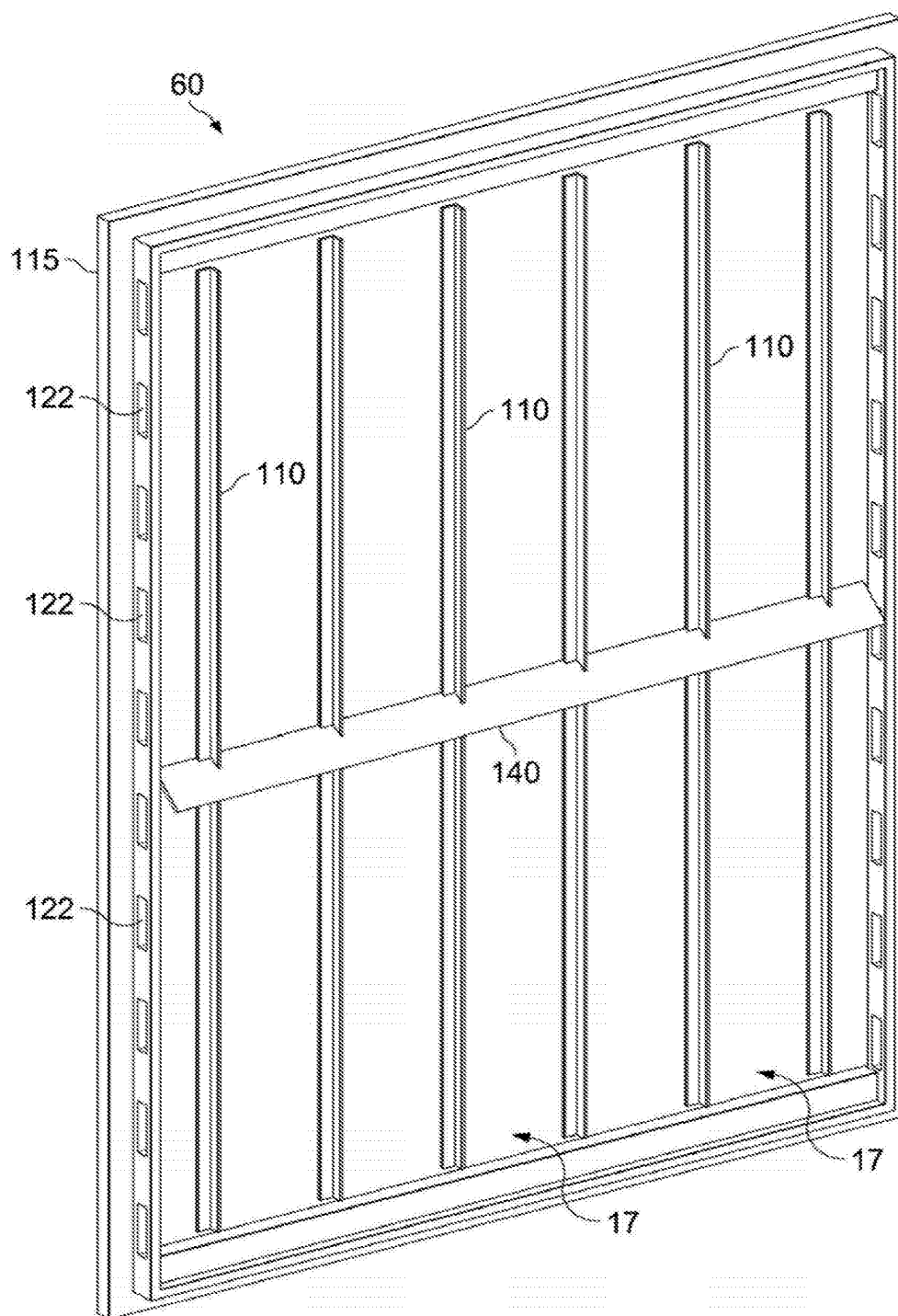


图24

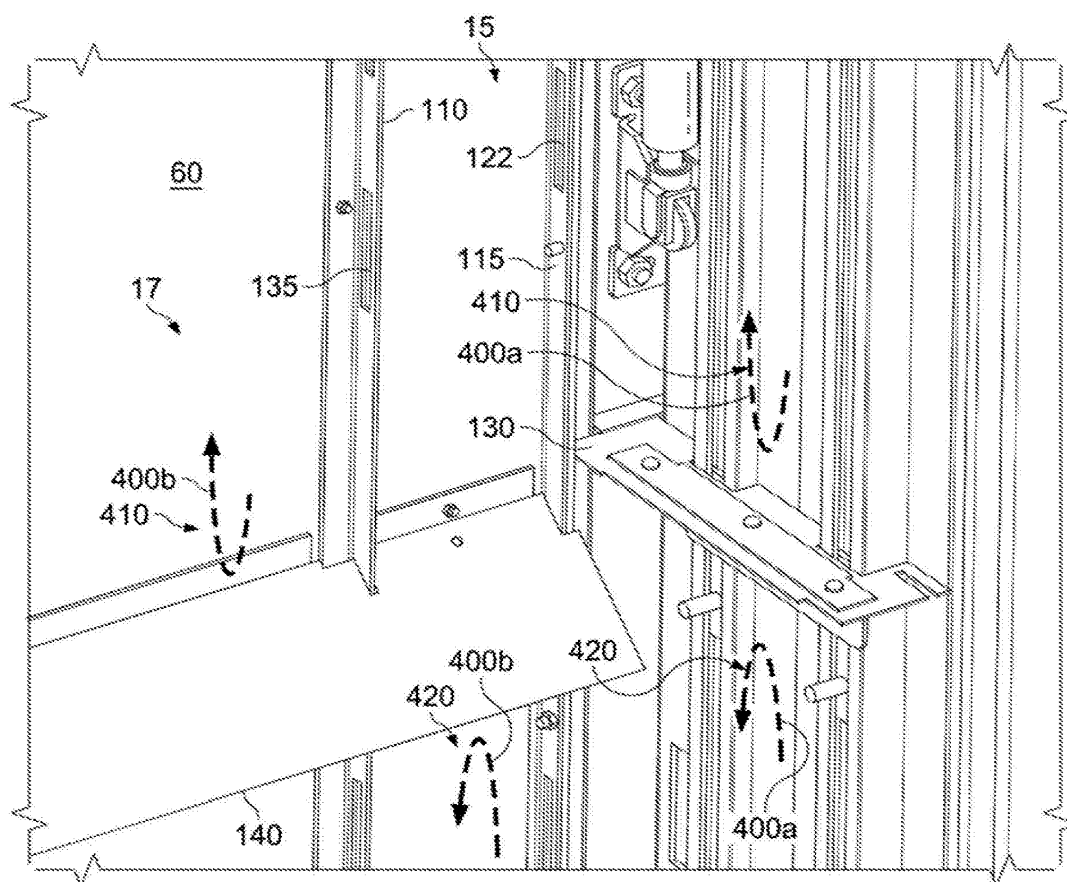


图25

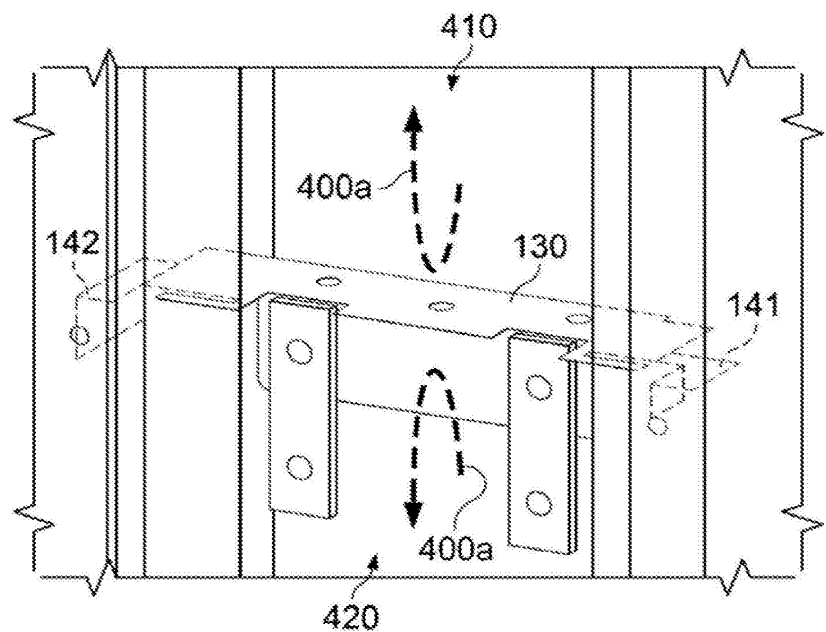


图26A

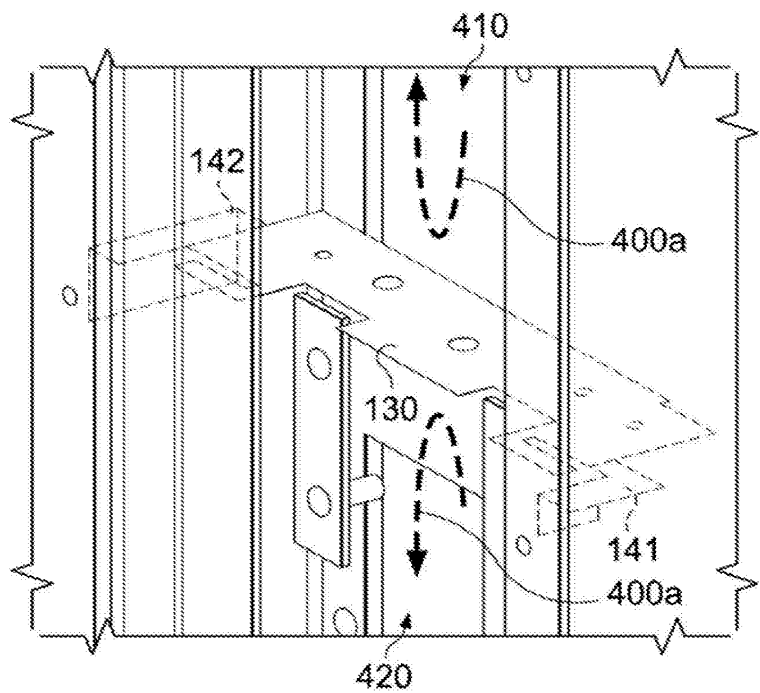


图26B

[translation]

CERTIFICATE OF PATENT

Republic of Korea

PATENT NO.: 10-2010515

APPLICATION NO.: 10-2018-7027437

FILING DATE: September 20, 2018

REGISTRATION DATE: August 7, 2019

TITLE OF THE INVENTION: SYSTEM FOR COOLING AN ELECTRONIC
IMAGE ASSEMBLY

PATENTEE: MANUFACTURING RESOURCES INTERNATIONAL, INC.

INVENTOR(S): HUBBARD, Tim
DUNN, William

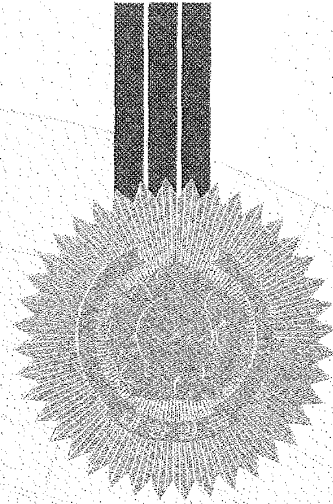
DURATION: May 4, 2031

SPECIAL REMARKS:

- (1) The first three years' annuities were paid as the registration fee.
- (2) To maintain the patent right, you must pay the annuities covering the 4th through 12th year either annually before the expiration of the preceding years' annuity, or in a lump sum before such expiration.
- (3) It is our custom to give timely notice in all cases of the steps to be taken to maintain the patent right but we cannot be responsible for the consequences of omitting to do this.

특허증

CERTIFICATE OF PATENT



특허

Patent Number

제 10-2010515 호

출원번호

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2018년 09월 20일

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2019년 08월 07일

발명의 명칭 Title of the Invention

전자 영상 조립체를 냉각하는 시스템

특허권자 Patentee

매뉴팩처링 리소시스 인터내셔널 인코포레이티드
미국 조지아 30005 알파레타 실로 로드 이스트 6415

발명자 Inventor

등록사항란에 기재

위의 발명은 「특허법」에 따라 특허등록원부에 등록되었음을 증명합니다.

This is to certify that, in accordance with the Patent Act, a patent for the invention has been registered at the Korean Intellectual Property Office.



특허청

Korean Intellectual
Property Office

2019년 08월 07일



QR코드로 현재기준
등록사항을 확인하세요

특허청장

COMMISSIONER,

KOREAN INTELLECTUAL PROPERTY OFFICE

박원주

등 록 사 항

특 허

등록 제 10-2010515 호

Patent Number

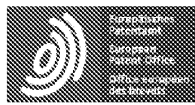
발명자 Inventors

허버드 팀

미국 조지아 30005 알파레타 유니온 힐 로드 1600

던 윌리엄

미국 조지아 30005 알파레타 유니온 힐 로드 1600



Espacenet

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SYSTEM FOR COOLING AN ELECTRONIC IMAGE ASSEMBLY

Inventor(s): HUBBARD TIM; DUNN WILLIAM ± (허버드 팀, ; 던 윌리엄)

Applicant(s): MRI INC [US] ± (매뉴팩처링 리소시스 인터내셔널 인코포레이티드)

Classification: - international: H01L51/52; H05K7/20
 - cooperative: H01L51/529 (EP, KR); H05K7/20972 (EP, KR); G02F2001/133628 (EP)

Application number: KR20187027437 20110504 Global Dossier

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Abstract not available for KR20180108890 (A)
Abstract of corresponding document: WO2011140179 (A2)

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

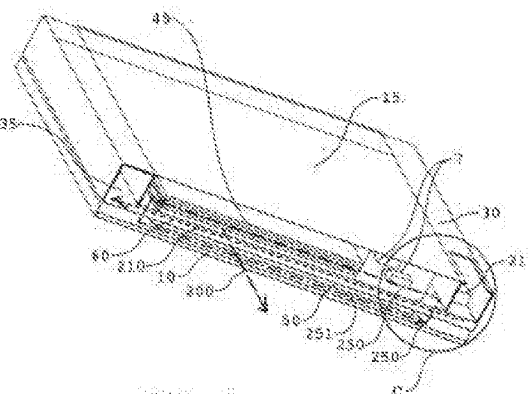


FIG - 4

ps://worldwide.espacenet.com/publicationDetails/biblio?DB=EPODOC&II=0&ND=3&adjacent=...&cc=...

SEC et al. v. MRI
SEC Exhibit 1022.1417
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(73) Patentee: MANUFACTURING RESOURCES
INTERNATIONAL, INC.

(52) CPC Cl.
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(72) Inventor(s): HUBBARD, Tim
DUNN, William

(22) Int'l Appln. Date: May 4, 2011

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(43) Laid-Open Date: Oct. 4, 2018

(62) Parent Patent Appln. No.: 10-2012-7031800

(74) Attorney: Jang Won Park

Int'l Appln. Date: May 4, 2011

Filing Date of Request for Examination: Mar. 22, 2016

(86) Int'l Appln. No.: PCT/US2011/035120

(87) Int'l Laid-Open No.: WO 2011/140179

Int'l Laid-Open Date: Nov. 10, 2011

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61/331,340 May 4, 2010 US

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Examiner: LEE, Woo Ri

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

Abstract, Specification and Claims are not translated.



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(56) 선행기술조사문헌

US20060034051 A1*

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(73) 특허권자

매뉴팩처링 리소시스 인터내셔널 인코포레이티드
미국 조지아 30005 알파레타 실로 로드 이스트
6415

(72) 발명자

허버드 탐
미국 조지아 30005 알파레타 유니온 힐 로드 1600

던 윌리엄
미국 조지아 30005 알파레타 유니온 힐 로드 1600

(74) 대리인

박장원

전체 청구항 수 : 총 49 항

심사관 : 이우리

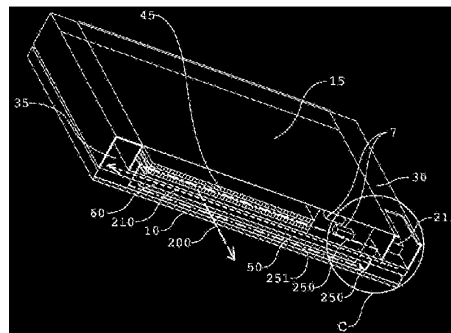
(54) 발명의 명칭 전자 영상 조립체를 냉각하는 시스템

(57) 요약

전자 영상 조립체를 냉각하기 위한 시스템. 실시예의 시스템은 전자 영상 조립체의 뒤에 배치되며 바람직하게는 영상 조립체와 전도성의 열 전달하는 복수의 채널을 포함한다. 주위 가스는 디스플레이 하우징 내로 흡입되고 주위 가스를 복수의 채널로 분배하는 매니폴드로 보내진다. 다른 실시예의 시스템은 내부 팬 조립체와 함께 열교환

(뒷면에 계속)

배표도 - 도4



기를 이용한다. 전자 영상 조립체의 전방 부분 또는 전자 디스플레이 하우징의 다른 내부 캐비티를 냉각시키기 위하여 순환 가스가 또한 사용될 수 있다. 열이 주위 가스로 전달될 수 있도록 순환 가스는 열교환기를 통해서 흡입될 수 있다. 열교환기는 열교환기를 통해서 주위 가스를 흡입하고 디스플레이 하우징 밖으로 주위 가스를 배출하기 위한 내부 팬 조립체를 구비할 수 있다.

명세서

청구범위

청구항 1

전자 디스플레이 조립체로,

하우징;

하우징 내에 수용되며 한 쌍의 대향하는 가장자리를 구비한 전자 영상 조립체;

주위 가스를 받아들이기 위한 하우징의 흡입 구멍;

주위 가스를 배출하기 위한 하우징의 배출 구멍;

전자 영상 조립체 뒤에 배치된 복수의 채널;

흡입 구멍으로부터 주위 가스를 받아들이고 복수의 채널로 주위 가스를 분배하기 위해, 대향하는 가장자리들 중 하나를 따라 배치된 제1 매니폴드;

채널들로부터 주위 가스를 받아들이고 배출 구멍을 향하여 주위 가스를 보내는, 제1 매니폴드와 대향하는 가장자리를 따라 배치된 제2 매니폴드;

채널들을 통해 주위 가스를 보내도록 위치한 팬;

전자 영상 조립체 전방에 배치되는 투명한 전방 플레이트로, 전방 플레이트와 전자 영상 조립체 사이의 공간이 전방 채널을 형성하는, 투명한 전방 플레이트;

전방 채널을 통해 순환 가스를 보내게 위치하는 순환 팬; 및

제1 매니폴드에 인접한 제1 판통 플레이트와 제2 매니폴드에 인접한 제2 판통 플레이트로, 상기 판통 플레이트는 전자 영상 조립체 뒤의 복수의 채널을 통해 이동하는 주위 가스를 위한 제1 가스 경로 및 전방 채널을 통해 이동하는 순환 가스를 위한 제2 가스 경로를 구비하는, 제1 판통 플레이트 및 제2 판통 플레이트;를

포함하는 것을 특징으로 하는 전자 디스플레이 조립체.

청구항 2

제1항에 있어서,

상기 팬이 제1 매니폴드 내에 위치하는 것을 특징으로 하는 전자 디스플레이 조립체.

청구항 3

제1항 또는 제2항에 있어서,

제1 매니폴드와 제2 매니폴드는 수직으로 배향되고,

복수의 채널들은 수평으로 배향되는 것을 특징으로 하는 전자 디스플레이 조립체.

청구항 4

제1항 또는 제2항에 있어서,

제1 가스 경로와 제2 가스 경로는 실질적으로 수직인 것을 특징으로 하는 전자 디스플레이 조립체.

청구항 5

제1항 또는 제2항에 있어서,

제1 가스 경로와 제2 가스 경로는 주위 가스와 순환 가스가 혼합되지 못하게 하는 것을 특징으로 하는 전자 디스플레이 조립체.

청구항 6

제1항 또는 제2항에 있어서,

전자 영상 조립체는 액정 디스플레이인 것을 특징으로 하는 전자 디스플레이 조립체.

청구항 7

전자 디스플레이 조립체로,

상부, 하부, 한 쌍의 수직의 가장자리들 및 순환 가스를 위한 내부 캐비티를 구비하는 하우징;

상기 하우징 내에 수용된 전자 영상 조립체;

주위 가스를 받아들이기 위한 하우징의 흡입 구멍;

주위 가스를 배출하기 위한 하우징의 배출 구멍;

전자 영상 조립체 뒤에 배치되며 전자 영상 조립체와 전도성으로 열 교환하는 금속으로 이루어진 복수의 금속 채널;

흡입 구멍으로부터 주위 가스를 받아들이고 복수의 채널로 주위 가스를 분배하는, 수직의 가장자리들 중의 하나를 따라 배치된 제1 매니폴드;

채널들로부터 주위 가스를 받아들이고 배출 구멍을 향하여 주위 가스를 보내는, 제1 매니폴드와 대향하는 가장자리들 따라 배치된 제2 매니폴드;

흡입 구멍 내로 그리고 채널들을 통해 주위 가스를 흡입하도록 제1 매니폴드 내에 위치하는 적어도 하나의 제1 팬;

흡입 구멍으로부터 주위 가스를 받아들이기에 적합한 제1 부분 및 상기 제1 부분으로부터 주위 가스를 받아들이기에 적합한 제2 부분을 포함하는 열교환기;

상기 제1 부분을 통해 주위 가스를 끌어당기고, 상기 제2 부분을 통해 주위 가스를 밀어내기 위해, 열교환기의 제1 부분과 제2 부분 사이에 위치하는 적어도 하나의 제2 팬; 및

내부 캐비티 및 상기 열교환기의 부분들 중 적어도 하나를 통해 순환 가스를 보내도록 위치하는 적어도 하나의 제3 팬;을 포함하는 것을 특징으로 하는 전자 디스플레이 조립체.

청구항 8

제7항에 있어서,

전자 영상 조립체는 액정 디스플레이인 것을 특징으로 하는 전자 디스플레이 조립체.

청구항 9

제7항 또는 제8항에 있어서,

채널들이 수평으로 배향되는 것을 특징으로 하는 전자 디스플레이 조립체.

청구항 10

제7항 또는 제8항에 있어서,

채널들 내에서 주위 가스와 순환 가스가 혼합되지 못하게 구성되는 것을 특징으로 하는 전자 디스플레이 조립체.

청구항 11

제7항 또는 제8항에 있어서,

열교환기의 제2 부분을 통해 밀려진 주위 가스가 순환 가스와 혼합되지 못하게 구성되는 것을 특징으로 하는 전자 디스플레이 조립체.

청구항 12

전자 영상 조립체를 냉각하기 위한 방법으로,

전자 영상 조립체 주위로 순환 가스를 폐쇄된 루프에서 순환시키는 단계;

제1 매니폴드를 통해 주위 공기 유동을 향하게 하는 단계;

순환 가스와 혼합되지 않으면서 순환 가스와 교차하게 주위 공기를 유동시키는 단계;

전자 영상 조립체 뒤로 주위 공기 유동을 향하게 하는 단계; 및

제2 매니폴드를 통해 주위 공기 유동을 향하게 하는 단계;를 포함하는 것을 특징으로 하는 전자 영상 조립체 냉각 방법.

청구항 13

제12항에 있어서,

순환 가스가 전자 영상 조립체 전방과 전자 영상 조립체 후방을 이동하는 것을 특징으로 하는 전자 영상 조립체 냉각 방법.

청구항 14

제12항 또는 제13항에 있어서,

순환 가스 유동과 교차하게 주위 공기를 유동시키는 단계는 관통 플레이트에 의해 수행되는 것을 특징으로 하는 전자 영상 조립체 냉각 방법.

청구항 15

제12항 또는 제13항에 있어서,

매니폴드들이 전자 영상 조립체의 수직 측면에서 서로 방향 아래로 연장하는 것을 특징으로 하는 전자 영상 조립체 냉각 방법.

청구항 16

제12항 또는 제13항에 있어서,

전자 영상 조립체 뒤로 주위 공기 유동을 향하게 하는 단계는 전자 영상 조립체의 뒤에 배치되어 있으며, 제1 및 제2 매니폴드와 가스 연통하는 복수의 채널들에 의해 수행되는 것을 특징으로 하는 전자 영상 조립체 냉각 방법.

청구항 17

제12항 또는 제13항에 있어서,

열교환기의 제1 통로 세트를 통해 순환 가스를 보내는 단계; 및

상기 열교환기의 제2 통로 세트를 통해 주위 공기를 보내는 단계;를 추가로 포함하는 것을 특징으로 하는 전자 영상 조립체 냉각 방법.

청구항 18

제17항에 있어서,

열교환기를 통해 순환 가스를 보내는 단계는 순환 팬에 의해 수행되고; 및

열교환기를 통해 주위 공기를 보내는 단계는 주위 공기 팬에 의해 수행되는 것을 특징으로 하는 전자 영상 조립체 냉각 방법.

청구항 19

제12항 또는 제13항에 있어서,

순환 가스의 폐쇄 루프는 전자 영상 조립체 전방에서 연장하되 투명한 전방 플레이트와 전자 영상 조립체의 전방 표면 사이에서 연장하는 것을 특징으로 하는 전자 영상 조립체 냉각 방법.

청구항 20

한 쌍의 대향하는 가장자리를 구비하며, 하우징 내에 수용되어 있는 전자 영상 조립체를 냉각하기 위한 방법으로,

전자 영상 조립체 주위로 순환 가스가 폐쇄된 루프로 유동하도록 하우징 내에 순환 팬을 위치시키는 단계;

전자 영상 조립체의 대향하는 가장자리를 중 하나를 따라 제1 매니폴드를 위치시키는 단계;

제1 매니폴드와 대향하는 전자 영상 조립체의 가장자리를 따라 제2 매니폴드를 위치시키는 단계;

전자 영상 조립체 후방에, 제1 및 제2 매니폴드들과 각각이 가스 연통하는 복수의 채널들을 위치시키는 단계; 및

주위 공기가 순환 가스와 혼합하지 않으면서 제1 매니폴드, 채널들 및 제2 매니폴드를 통해 유동하도록 하우징 내에 주위 공기 팬을 위치시키는 단계;를 포함하는 것을 특징으로 하는 전자 영상 조립체 냉각 방법.

청구항 21

제20항에 있어서,

순환 가스가 전자 영상 조립체 전방과 전자 영상 조립체 후방을 이동하는 것을 특징으로 하는 전자 영상 조립체 냉각 방법.

청구항 22

제20항 또는 제21항에 있어서,

제1 매니폴드에 인접하게 제1 관통 플레이트를 위치시키는 단계; 및

제2 매니폴드에 인접하게 제2 관통 플레이트를 위치시키는 단계를 추가로 포함하는 것을 특징으로 하는 전자 영상 조립체 냉각 방법.

청구항 23

제22항에 있어서,

제1 및 제2 관통 플레이트가 주위 공기와 순환 가스를 받아들여되, 주위 공기와 순환 가스가 혼합하지 않는 것을 특징으로 하는 전자 영상 조립체 냉각 방법.

청구항 24

제20항 또는 제21항에 있어서,

열교환기의 제1 통로 셔트를 통해 순환 가스를 보내는 단계; 및

상기 열교환기의 제2 통로 셔트를 통해 주위 공기를 보내는 단계;를 추가로 포함하는 것을 특징으로 하는 전자 영상 조립체 냉각 방법.

청구항 25

제20항 또는 제21항에 있어서,

순환 가스의 폐쇄 루프는 전자 영상 조립체 전방에서 연장하되, 투명한 전방 플레이트와 전자 영상 조립체 전방 표면 사이에서 연장하는 것을 특징으로 하는 전자 영상 조립체 냉각 방법.

청구항 26

제20항 또는 제21항에 있어서,

순환 가스의 폐쇄 루프가 주위 공기 유동 위를 가로지르는 것을 특징으로 하는 전자 영상 조립체 냉각 방법.

청구항 27

대향하는 가장자리들을 따르는 제1 및 제2 매니폴드를 둘러싸는 하우징 내에 수용되어 있는 전자 영상 조립체를 냉각하기 위한 방법으로,

제1 매니폴드에 인접하게 제1 관통 플레이트를 위치시키는 단계;

제2 매니폴드에 인접하게 제2 관통 플레이트를 위치시키는 단계;

전자 영상 조립체 주위와 제1 및 제2 관통 플레이트를 통해 순환 가스를 폐쇄 루프로 순환시키는 단계; 및

제1 매니폴드를 통해, 제1 관통 플레이트를 통해, 전자 영상 조립체 후방에서, 제2 관통 플레이트를 통해 그리고 제2 매니폴드를 통해 주위 공기 유동을 향하게 하는 단계;를 포함하는 것을 특징으로 하는 전자 영상 조립체 냉각 방법.

청구항 28

제27항에 있어서,

열교환기의 제1 통로 세트들 통해 순환 가스를 보내는 단계; 및

상기 열교환기의 제2 통로 세트를 통해 주위 공기를 보내는 단계;를 추가로 포함하는 것을 특징으로 하는 전자 영상 조립체 냉각 방법.

청구항 29

제27항 또는 제28항에 있어서,

순환 가스의 폐쇄 루프는 전자 영상 조립체 전방에서 연장하되, 투명한 전방 플레이트와 전자 영상 조립체 전방 표면 사이에서 연장하는 것을 특징으로 하는 전자 영상 조립체 냉각 방법.

청구항 30

제27항 또는 제28항에 있어서,

전자 영상 조립체와 전도성 열 교환하게 배치되어 있는 복수의 채널들을 통해 주위 공기를 추가로 향하게 하는 단계를 추가로 포함하는 것을 특징으로 하는 전자 영상 조립체 냉각 방법.

청구항 31

제27항 또는 제28항에 있어서,

순환 가스의 폐쇄 루프가 주위 공기 유동 위를 가로지르는 것을 특징으로 하는 전자 영상 조립체 냉각 방법.

청구항 32

전자 영상 조립체 및 상기 전자 영상 조립체를 수용하는 하우징 조립체:

상기 하우징 조립체 내부의 제1 존을 통해 순환 가스를 보내기 위해 상기 하우징 조립체에 고정되어 있는 제1 팬;

주위 가스 유동이 상기 하우징 조립체 외측에서부터 상기 하우징 조립체 내부의 제2 존을 통과하게 하기 위해 상기 하우징 조립체에 고정되어 있는 제2 팬; 및

순환 가스와 주위 가스가 실질적으로 혼합되지 않으면서 순환 가스가 주위 가스 유동과 교차하도록 상기 하우징 조립체 내에 위치하는 구조물;을 포함하는 것을 특징으로 하는 장치.

청구항 33

제32항에 있어서,

주위 가스 유동이 전자 영상 조립체 후방을 이동하기에 적합한 것을 특징으로 하는 장치.

등록특허 10-2010515

청구항 34

제32항 또는 제33항에 있어서,

각각이 흡입구 및 배출구를 구비하며 주위 가스를 받아들여게 위치되어 있으며, 전자 임상 조립체 후방에 배치되어 있는 복수의 채널들을 추가로 포함하는 것을 특징으로 하는 장치.

청구항 35

제34항에 있어서,

각 채널의 흡입구와 가스 연통하는 제1 매니폴드; 및

각 채널의 배출구와 가스 연통하는 제2 매니폴드를 추가로 포함하는 것을 특징으로 하는 장치.

청구항 36

제35항에 있어서,

제1 매니폴드 및 제2 매니폴드가 전자 임상 조립체의 한 쌍의 수직 기둥자리를 따라 배치되어 있는 것을 특징으로 하는 장치.

청구항 37

제32항 또는 제33항에 있어서,

상기 구조물은 순환 가스를 받아들이는 제1 공극 시리즈와 주위 가스를 받아들이는 제2 공극 시리즈를 포함하는 것을 특징으로 하는 장치.

청구항 38

제32항 또는 제33항에 있어서,

상기 구조물은 제1 공극 시리즈와 상기 제1 공극 시리즈와 실질적으로 직교하게 배열되어 있는 제2 공극 시리즈를 포함하는 것을 특징으로 하는 장치.

청구항 39

제32항 또는 제33항에 있어서,

주위 가스 유동이 순환 가스와 폐쇄 무드를 각각으로 기로지르기에 적합한 것을 특징으로 하는 장치.

청구항 40

전자 임상 조립체 및 상기 전자 임상 조립체를 수용하는 하우징 조립체;

상기 하우징 조립체의 제1 끝을 통해 순환 가스를 보내기 위해 상기 하우징 조립체에 고정되어 있는 제1 팬;

하우징 조립체의 제2 끝을 통해 주위 가스가 유동하도록 하기 위해 하우징에 고정되어 있는 제2 팬; 및

순환 가스를 받아들이는 제1 공극 시리즈; 및

주위 가스를 받아들이는 제2 공극 시리즈를 구비하는 구조물;을 포함하는 장치로,

제1 공극 시리즈가 제2 공극 시리즈와 실질적으로 직교하게 배열되어 있는 것을 특징으로 하는 장치.

청구항 41

제40항에 있어서,

전자 임상 조립체 전방에 위치하며, 순환 가스가 통과하기에 적합한 전방 채널을 추가로 포함하는 것을 특징으로 하는 장치.

청구항 42

제40항 또는 제41항에 있어서,

전자 영상 조립체 후방에 위치하며, 각각이 흡입구와 배출구를 구비하고 주위 가스를 받아들여도록 위치하는 복수의 채널을 추가로 포함하는 것을 특징으로 하는 장치.

청구항 43

제42항에 있어서,

전자 영상 조립체 후방에서 각 채널의 흡입구와 가스 연통하는 제1 매니폴드; 및

전자 영상 조립체 후방에서 각 채널의 배출구와 가스 연통하는 제2 매니폴드를 추가로 포함하는 것을 특징으로 하는 장치.

청구항 44

제40항 또는 제41항에 있어서,

구조물이 순환 가스와 주위 가스가 실질적으로 혼합되지 않게 하는 것을 특징으로 하는 장치.

청구항 45

제40항 또는 제41항에 있어서,

제2 주위 가스 유동과 순환 가스를 받아들여게 위치하는 열교환기를 추가로 포함하는 것을 특징으로 하는 장치.

청구항 46

전자 영상 조립체;

전자 영상 조립체 주위를 폐쇄 루프로 순환 가스를 보내도록 위치되어 있는 제1 팬;

주위 가스의 제1 유동을 일으키게 위치되어 있는 제2 팬;

순환 가스와 주위 가스가 실질적으로 혼합되지 않으면서 순환 가스가 주위 가스 유동과 교차하도록, 전자 영상 조립체의 제1 측면 위에 위치하는 제1 구조물;

순환 가스와 주위 가스가 실질적으로 혼합되지 않으면서 순환 가스가 주위 가스 유동과 교차하도록, 전자 영상 조립체의 제2 측면 위에 위치하는 제2 구조물; 및

순환 가스와 주위 가스가 실질적으로 혼합되지 않으면서 순환 가스와 주위 가스 모두를 받아들여게 위치되어 있는 열교환기;를 포함하는 것을 특징으로 하는 장치.

청구항 47

제46항에 있어서,

제1 구조물에 인접하게 위치하는 제1 매니폴드; 및

제2 구조물에 인접하게 위치하는 제2 매니폴드를 추가로 포함하는 것을 특징으로 하는 장치.

청구항 48

제46항 또는 제47항에 있어서,

제1 및 제2 구조물 각각은 순환 가스를 받아들여게 위치되어 있는 제1 공극 시리즈와 주위 가스를 받아들여게 위치되어 있는 제2 공극 시리즈를 포함하는 것을 특징으로 하는 장치.

청구항 49

제46항 또는 제47항에 있어서,

제1 및 제2 구조물 각각은 서로가 실질적으로 직교하게 배향되어 있는 제1 및 제2 공극 시리즈를 포함하는 것을 특징으로 하는 장치.

발명의 설명

기술 분야

[0001] 본 발명은 냉각 시스템에 관한 것이며 특히 전자 디스플레이용 냉각 시스템에 관한 것이다.

배경 기술

[0002] 전자 디스플레이에 대한 발전으로 이제 전자 디스플레이는 정보, 광고, 또는 오락 목적을 위해 실외 환경에서 사용할 수 있다. 과거의 디스플레이는 주로 실온에 가까운 온도에서 작동하도록 설계되었지만, 이제는 디스플레이가 주위 환경의 심한 온도 변화를 견딜 수 있도록 하는 것이 바람직하다. 예를 들어, 일부 디스플레이들은 화씨 -22도 정도의 낮은 온도 및 화씨 113도 이상의 높은 온도에서 작동할 수 있다. 주위 온도가 상승할 때, 내부의 디스플레이 부품들을 냉각하는 것은 더욱 어려워질 수 있다.

[0003] 또한, 최근의 디스플레이들은 매우 밝아졌으며, 일부의 백라이트는 1,000 ~ 2,000 니트(nits) 이상의 휘도를 나타낸다. 때때로, 이러한 조도 수준이 필요한데 왜냐하면 디스플레이가 실외에서 사용되거나 디스플레이가 다른 주위 조명과 경쟁하게 되는 비교적 밝은 구역에서 사용되기 때문이다. 이러한 수준의 휘도를 생성하기 위하여, 조명 장치 및 전자 디스플레이는 비교적 대량의 열을 발생시킬 수 있다.

[0004] 또한, 어떤 상황에서는 태양으로부터 전방 디스플레이 표면을 통한 복사열 전달도 열 공급원이 될 수 있다. 일부 지역에서는 전방 디스플레이 표면을 통한 800 ~ 1400 와트/평방미터(Watts/m²) 이상의 수준이 보편적이다. 또한, 판매 시장에서는 디스플레이용으로 더욱 큰 사이즈를 요구하고 있다. 전자 디스플레이 스크린 사이즈 및 상응하는 전방 디스플레이 표면이 커짐에 따라, 더 많은 열이 발생할 것이며 더 많은 열이 디스플레이 내로 전달될 것이다.

[0005] 최근의 디스플레이들은 패쇄 루프의 가스가 냉각될 수 있도록 디스플레이를 통해 주위 가스를 흡입하고 디스플레이 주위에 패쇄 루프의 가스를 순환시키는 것을 포함한 디스플레이를 냉각하기 위한 효과적인 수단(또한 전자 디스플레이의 일부로서)을 구비하였다. 민감한 전자 부품으로부터 그리고 디스플레이의 밖으로 열을 전달할 수 있는 다양한 열 전달 방식이 밝혀졌다. 패쇄 루프의 가스와 주위 가스 간에 열을 전달하기 위한 양호한 수단을 만들기 위한 열교환기가 제시되었다. 그러나, 디스플레이를 통해 가스를 이동시키기 위한 종래의 설계는 디스플레이로부터 바람직하지 않은 소음 발생뿐만 아니라 디스플레이의 일부는 냉각되지만 나머지 다른 부분들은 냉각되지 않은 상태로 유지되는 열 구배(thermal gradient)를 발생시킨다는 것이 밝혀졌다.

[0006] 액정 디스플레이(LCD)를 사용할 때, 백라이트는 열 공급원이어서 백라이트를 냉각시키기 위하여 백라이트의 후방 표면을 가로질러 가스를 이동시키는 것이 바람직하다는 것을 알아내었다. 이는 바람직하지만, 백라이트 캐비티(backlight cavity)가 먼지, 오염 물질 또는 다른 입자로 오염될 수 있다는 염려 때문에 백라이트의 전방 표면을 냉각시킬 수 없는 것으로 생각되었다.

발명의 내용

해결하려는 과제

[0007] 본 발명은 전자 디스플레이를 적절하게 냉각시키기 위하여 순환 가스 및 주위 가스의 조합을 이용한다. 순환 가스는 전자 영상 조립체의 전방으로부터 열을 제거하기 위하여 사용될 수 있다. 전자 영상 조립체로서 LCD를 사용할 때, 순환 가스는 LCD의 백라이트 캐비티로부터 열을 제거하기 위하여 또한 사용될 수 있다. 가스는 디스플레이 내에서만 순환하기 때문에, 입자 및 오염 물질이 없는 상태로 유지될 수 있고 디스플레이를 손상시키지 않을 것이다.

과제의 해결 수단

[0008] 주위 가스는 순환 가스를 냉각시키기 위하여 디스플레이 내로 흡입될 수 있다. 바람직하게는 순환 가스와 주위 가스가 서로 혼합되지 않도록 하고, 순환 가스로부터 주위 가스로 열을 전달할 수 있는 열교환기를 통해서 주위 가스 및 순환 가스가 흡입될 수 있다. 예시적인 실시예는 직교류 열교환기(cross-flow heat exchanger)를 사용한다. 영상 조립체의 후방 부분으로부터 열을 제거하기 위하여 주위 가스의 추가적인 유동은 영상 조립체의 후방 표면을 가로질러 흡입될 수 있다. 전자 영상 조립체로서 LCD를 사용할 경우, 주위 가스의 추가적인 유동은

LCD를 위한 배리어막의 후방 부분으로부터 전극을 제거하여, 아몰피스 Si를 주입한다.

한국의 고고학은 1908년 조선총독부에서 고고학연구회를 설립한 이래로 고고학이라는 학제적 틀 안에서 연구되어 왔으며, 1945년 광복 이후에는 고고학이 민족문화의 근간을 이루는 학제로 인식되면서 고고학의 연구 범위가 크게 확대되었다. 그러나 고고학의 연구 범위가 확대되면서 고고학의 연구 방법과 연구 결과의 해석에 대한 논쟁이 계속되고 있다. 특히 고고학의 연구 방법과 연구 결과의 해석에 대한 논쟁은 고고학의 연구 방법과 연구 결과의 해석에 대한 논쟁을 계속하고 있다.

다스틀레이의 상부 및 하부 가장자리들은 일반적으로 수직자이에게 보이지 않거나 매우 희미한 것이므로, 다스틀레이의 상부 가장자리는 하부 가장자리로부터 주위 가스를 흡입하는 것이 바람직한 것으로 밝혀졌다. 그러나 새로 방출으로 꽤 많은 다스틀레이의 상부 또는 하부로부터 주위 가스를 흡입할 때, 자기온 주위의 가스는 전자 영역 조밀체의 후방 부분을 가로질러 이동하여 열을 받아들이기 때문에, 온도가 증가하는 것이 확인되었다. 일단 냉각 공기가 대량하는 가장자리(상부 가장자리 또는 하부 가장자리)에 도달하면, 냉각 공기는 순전히 온도가 증가하고 다시 이온 다스틀레이의 대량하는 부분을 위한 냉각을 제공할 수 없다. 따라서, 여기에서 만나고 있는 자이온 주위 공기가 균일한 방식으로 전자 영역 조밀체를 전체적으로 식별하게 내장할 수 있도록 하되 전자 영역 조밀체 내부의 과열점(hot spots)을 감소시킨다.

10. 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 4

$$\frac{\partial}{\partial t} \lambda \in \mathcal{L}(\mathcal{H}_1, \mathcal{H}_2), \quad \frac{\partial}{\partial t} \lambda \in \mathcal{L}(\mathcal{H}_1, \mathcal{H}_2), \quad \frac{\partial}{\partial t} \lambda \in \mathcal{L}(\mathcal{H}_1, \mathcal{H}_2), \quad \frac{\partial}{\partial t} \lambda \in \mathcal{L}(\mathcal{H}_1, \mathcal{H}_2),$$

~~BB~~ ~~BB-2~~ ~~16B3~~

도 18은 전자 디스플레이의 실시예의 변형 사이다.

도 19는 전자 디스플레이의 실시예의 변형 사이다.

도 3은 도 1b에 도시된 A-A선을 따라 취한 단면 σ/σ_0 이다.

표 4는 표 1b에 들어선 B-B선로 따라 국유 산림 사유이다.

주요 연구 주제에 대한 표본 연구 결과를 요약한다.

도 6은 표 3의 관측 자료를 이용하여 β_1 , β_2 , β_3 , β_4 , β_5 를 추정하여 얻은 결과이다.

[illegible][illegible]

2017 12 12 12:12 12:12 12:12

[illegible]

면접할 때를 위하여 준비된 것이 있다.

요소 또는 종의 다른 요소를 포함하는 "위"에 있는 것으로 설명되는 경우, 요소 또는 종은 다른 요소 또는 종의 바로 위에 있거나 종개 요소를 포함하는 종을 바로 위에 있을 수 있다는 것이 이해될 것이다. 마찬가지로, 하나의 요소가 다른 요소 또는 종 "바로 위"에 있는 것으로 설명되는 경우, 종개 요소를 포함하는 종을 종개 요소를 포함하는 종의 바로 위에 사용할 수 있다. 명세서에 사용된 바와 같이, 용어 "위/또는"은 하나 이상의 원가 동일한 도면 부호를 가진 요소를 나타낸다.

- 하는 관련 물품의 어느 것 및 모든 조합을 포함한다.
- [0016] 제1, 제2, 제3 이라는 용어가 다양한 요소들, 부품들, 구역들, 층들 및/또는 섹션들을 설명하기 위하여 명세서에서 사용될 수 있지만, 이 요소들, 부품들, 구역들, 층들 및/또는 섹션은 이러한 용어에 의해서 제한되는 것이 아니라는 것이 이해될 것이다. 이 용어들은 단지 하나의 요소, 부품, 구역, 층 또는 섹션을 다른 구역, 층 또는 섹션과 구별하기 위해서 사용되는 것이다. 따라서, 이하에서 설명하는 제1 요소, 부품, 구역, 층 또는 섹션은 본 발명의 교시로부터 벗어나지 않은 채 제2 요소, 부품, 구역, 층 또는 섹션을 지칭하는 것이 될 수 있다.
- [0017] "하부", "상부" 등과 같은 공간적으로 상대적인 용어들은 도면에 도시된 바와 같은 하나의 요소 또는 특징부와 다른 요소 또는 특징부의 관계를 설명하기 위한 설명의 용이함을 위해 명세서에서 사용될 수 있다. 공간적으로 상대적인 용어들은 도면에 도시된 방향 이외에, 사용 또는 작동 중에 장치의 상이한 방향을 포함하도록 의도한 것이라는 것이 이해될 것이다. 예를 들어, 만약 도면에서의 장치가 거꾸로 되면, 다른 요소들 또는 특징부에 대해서 "하부"로 설명된 요소들은 다른 요소들 또는 특징부들에 대해서 "상부"가 될 것이다. 따라서, 용어 "하부"는 위와 아래의 방향 모두를 포함할 수 있다. 장치는 다르게 배향(90도 또는 다른 각도로 회전된 상태)될 수 있고 명세서에 사용되는 공간적으로 상대적인 설명은 상응하게 해석될 수 있다.
- [0018] 명세서에서 사용된 용어들은 특정 실시예를 설명하기 위한 것일 뿐이며 본 발명을 제한하도록 의도한 것이 아니다. 명세서에 사용된 바와 같이, "하나", 및 "그"와 같은 단수 표현들은 명확하게 달리 나타나지 않는다면 복수 표현들도 포함하도록 의도된 것이다. "포함하는" 및/또는 "포함"과 같은 용어들은 본 명세서에서 사용될 때 언급한 특징, 정수, 단계, 작동, 요소 및/또는 부품이 있음을 명시하지만, 하나 이상의 다른 특징, 정수, 단계, 작동, 요소, 부품 및/또는 이들의 그룹이 있거나 추가되는 것을 배제하지 않는다.
- [0019] 본 발명의 실시예는 본 발명의 이상적인 실시예(및 중간 구조)의 개략적인 도면들인 단면도들을 참조하여 설명된다. 따라서, 예를 들어 제조 기술 및/또는 허용 공차의 결과로서 도면의 형상에서의 변경이 있을 수 있다. 그러므로, 본 발명의 실시예가 명세서에서 설명되는 구역들의 특정 형상으로 제한되는 것으로 해석하면 안되고, 예를 들어 제조로부터 조래되는 형상의 편차를 포함한다.
- [0020] 예를 들어, 직사각형으로 도시된 이식되는 구역은 일반적으로 이식 구역과 이식되지 않는 구역의 이분법적인 변화라기보다는 오히려 그 가장자리에서 등근 또는 곡선의 특징부 및/또는 이식 밀도(implant concentration)에 차이를 갖게 될 것이다. 마찬가지로, 이식에 의해 형성되는 매몰 구역은 이식이 이루어지는 표면과 매몰 구역 사이의 구역에 부분적인 이식이 나타날 수 있다. 따라서, 도면에 도시된 구역들은 본질적으로 개략적인 것이고 그 형상들은 장치의 구역의 실제 형상을 나타내도록 의도한 것이 아니며 본 발명의 범위를 제한하도록 의도한 것이 아니다.
- [0021] 달리 정의되지 않으면, 명세서에 사용된 모든 용어(기술적 및 과학적 용어를 포함)들은 본 발명이 속하는 기술 분야의 통상의 기술자에 의해 보편적으로 이해되는 것과 동일한 의미를 나타내는 것이다. 일반적으로 사용되는 사전들에 정의된 것과 같은 용어는 관련 분야 문헌에서의 의미와 일치하는 의미를 갖는 것으로 해석되어야 하며 명세서에 명시적으로 정의되지 않았다면 이상적이거나 과도하게 형식적인 의미로 해석되지 않아야 한다.
- [0022] 도 1a는 예시적인 실시예의 전자 디스플레이(100)의 전방 사시도를 도시한다. 투명한 전방 플레이트(10)는 내부 부품들을 보호하고 디스플레이(100)에 의해 만들어지는 영상이 보일 수 있도록 디스플레이의 앞 부분에 배치된다. 일부 실시예들은 투명한 전방 플레이트(10)로서 유리를 사용할 수 있다. 예시적인 실시예들은 광학 굴절률 정합 접촉재를 사용하여 적층된 두 장의 유리를 사용할 수 있다. 일부 전방 플레이트(10)는 반사 방지 및 편광 기능과 같은 다른 유용성을 제공할 수 있다. 디스플레이(100)가 디스플레이(100)를 냉각하기 위한 주위 가스를 받아들일 수 있도록 흡입 구멍(24) 및 배출 구멍(25)이 하우징에 제공될 수 있다.
- [0023] 도 1b는 예시적인 실시예의 전자 디스플레이(100)의 후방 사시도를 도시한다. 후방 커버(15)가 디스플레이(100)의 내부 부품들에 대한 접근을 허용하기 위하여 사용될 수 있다.
- [0024] 도 2는 후방 커버(15)가 제거되어 있는 도 1b에 도시된 것과 유사한 후방 사시도를 도시한다. 주위 가스(200)는 흡입 구멍(24)을 통해서 디스플레이 내로 흡입되고 열교환기(45)를 통과하며 배출 구멍(25)을 통하여 디스플레이를 빠져나간다. 주위 가스(200)는 열교환기 팬 조립체(46)를 사용하여 디스플레이 내로 흡입되어 열교환기(45)를 통하여 보내질 수 있다. 열교환기 팬 조립체(46)의 예시적인 배치가 이하에서 설명되지만, 일부 실시예에서 팬 조립체(46)는 흡입 구멍(24) 및/또는 배출 구멍(25) 가까이에 위치될 수 있으며 열교환기(45) 내에 있거나 열교환기 내에 있지 않을 수 있다(도 2에 도시된 경우).
- [0025] 옵션으로, 또한 주위 가스(210)가 흡입 구멍(24)(또는 별개의 흡입 구멍)을 통하여 디스플레이 내로 흡입될 수

[0032] 열이 전자 부품(7)으로부터 순환 가스(250)로 전달될 수 있도록 순환 가스(250)는 다양한 전자 부품(7)들에 걸쳐 또한 분배될 수 있다. 전자 부품(7)들은 전원 모듈, 하트 생크, 축전기, 모터, 마이크로프로세서, 하드 드

[0031] (251)로 다시 보내질 수 있다. 이 방식에서, 열교환기(45)와 전방 채널(251)은 서로 가스 연동하게 배치된다. 스(200)로 전달될 수 있는 열교환기(45)를 빠져나올 때, 순환 가스(250)는 전방 채널 환 가스(250)가 이동할 수 있다. 바람직하게는, 그 후에 순환 가스(250)는 열이 순환 가스(250)로부터 주위 으며, 전자 영상 조립체(50)의 전방 표면(front surface)의 열의 축적을 제거하기 위하여 이 채널을 통해서 순 또한 도시되어 있다. 전방 플레이트(10)와 전자 영상 조립체(50) 사이의 공간이 전방 채널(251)을 형성할 수 있 도 4는 도 1b에 도시된 B-B 선을 따라 도시한 단면 사시도를 도시한다. 이 도면에는, 순환 가스(250)의 경로가 을 한다.

[0030] 며 더욱 바람직하게는 알루미늄이다. 또한, 예시적인 실시예에서 채널(60)들은 전자 영상 조립체(50)와 열 전달 (60)들을 통해서 전달될 수 있고 주위 가스(210)에 의해서 제거될 수 있다. 바람직하게는, 채널(60)들은 금속이 (50)와 열전달을 한다. 그러므로, 바람직한 실시예에서, 전자 영상 조립체(50)의 후방 부분에 축적된 열은 채널 단면을 갖는 채널(60)들을 포함할 수 있다. 바람직하게는, 채널(60)들은 열 전도성이며 또한 전자 영상 조립체 장벽 또는 중실 경방형 단면, I자형 단면, Z자형 단면, 평판 모양 단면, 또는 이들의 임의의 조합이나 혼합된 지만, 이것이 필수적인 것은 아니다. 다른 실시예들은 I-빔 단면, 중공 장방형 단면, 중공 장방형 단면, 중실 채널(60)들은 여러 가지의 형태를 가질 수 있다. 비록 이 실시예에는 경방형의 단면을 갖는 것으로 도시되어 있 록, 전자 영상 조립체(50)의 후방 부분 상에 열 전도성 표면/플레이트를 구비하는 것이 바람직하다.

[0029] 터 열의 축적을 제거하도록 사용될 수 있다. 열이 용이하게 전달되고 주위 가스(210)에 의해서 제거될 수 있도 내릴 수 있다. 전자 영상 조립체(50) 위에서 주위 가스(210)의 유동은 전자 영상 조립체(50)의 후방 부분으로부터 에 배치될 수 있다. 주위 가스(210)는 제1 매니폴드(30)(도시 생략)를 통하여 이동한 후에 채널(60)을 통해 보 전자 영상 조립체(50)가 전방 플레이트(10) 위에 배치될 수 있다. 복수의 채널(60)이 전자 영상 조립체(50) 위 관 수 없도록 하기 위한 차단 수단을 포함할 수 있다.

[0028] 실시예에서 상상은 일어나지 않을 것이다. 또한 배출 구멍(25)은 오염 물질 및/또는 곤충이 다스플레이트로 들어 0)가 미립자 또는 오염 물질로부터의 상상에 민감하지 않게 열교환기(45)를 단순히 통과할 뿐이라면 예시적인 용입 구멍(24)은 필터 또는 다른 차단 수단을 포함할 수 있다. 그러나, 만약 오염 물질을 포함한 주위 가스(2 명백하게, 오염 물질, 곤충, 쓰레기 및/또는 물/유체가 쉽게 다스플레이트 내로 들어갈 수 없도록 하기 위하여, (200)는 열교환기(46)를 사용하여 다스플레이트 내로 용입되어 열교환기(45)를 통하여 보내질 수 있다. 플레이트 내로 용입되고 열교환기(45)를 통과하며 배출 구멍(25)을 통하여 다스플레이트를 빠져나간다. 주위 가스 도 3은 도 1b에 도시된 A-A 선을 따라 단면 사시도를 도시한다. 주위 가스(200)는 용입 구멍(24)을 통해서 다스 수 있다.

[0027] 것이 필수적인 것은 아니다. 따라서, 두 가지 주위 가스의 유동을 위한 개별적인 용입 구멍과 배출 구멍이 있을 두 가지의 주위 가스(200) 및 주위 가스(210)의 유동이 사용된다면, 동일한 용입 구멍 및 배출 구멍을 공유하는 아니다. 일부 실시예들은 주위 가스(200)만을 사용하거나 또는 주위 가스(210)만을 사용할 수 있다. 또한, 만약 예시적인 실시예에서 두 가지 주위 가스의 유동이 사용될 수 있지만, 이들 모두를 사용하는 것이 필수적인 것은 다스플레이트의 수평 방향의 가장자리들을 따라 배치될 수 있다.

[0026] 것이 바람직하다. 다른 실시예들에서 제1 및 제2 매니폴드(30, 35)는 수직으로 진행되는 채널(60)들과 더불어 제1 및 제2 매니폴드(30)는 수평으로 진행되는 채널(60)들과 더불어 다스플레이트의 수평 방향의 가장자리들을 따라 배치될 수 있다. 그러나, 제1 및 제2 제1 및 제2 매니폴드(30, 35)는 다스플레이트의 대향하는 가장자리들을 따라 배치될 수 있다. 그러나, 제1 및 제2 에 배치되거나 또는 제1 매니폴드(30)와 제2 매니폴드(35) 모두에 배치될 수 있다.

[0025] 그러나, 이러한 실시예가 필수적인 것은 아니며 일부 실시예에서 매니폴드 팬 조립체(211)는 제2 매니폴드(35) 가스(210)를 다스플레이트로 용입하여 단면의 유동을 복수의 작은 유동(채널(60))으로 분배하기 위하여 사용된다. 조립체(211)가 사용된다. 이 특별한 실시예에서, 매니폴드 팬 조립체(211)는 제1 매니폴드(30)에 배치되며 주위 위 가스(210)를 용입 구멍(24) 내로 용입하고 주위 가스를 다스플레이트를 가로질러 보내기 위하여 매니폴드 팬 여서 단면의 유동으로 조합하고 배출 구멍(25)(또는 열계의 배출 구멍)의 밖으로 배출한다. 이 실시예에서, 주 스플레이트의 반대면 가장자리를 따라 배치될 수 있다. 제2 매니폴드(35)는 복수의 작은 유동(채널(60))을 받아들 이운다. 제1 매니폴드(30)는 주위 가스(210)를 대량의 단일 용입 유동으로 받아들여서 다스플레이트를 가로질러 있다. 그 다음에 주위 가스(210)는 제1 매니폴드(30)를 통해서 보내질 수 있으며 다스플레이트의 가장자리를 따라

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라이트, AC/DC 컨버터, 변압기, 인체회로기판 중 어느 하나가 될 수 있는데, 이들로만 한정되지는 않는다.

[0033]

상기 단면 사시도에는 전자 영상 조립체(50)의 위에서 채널(60)들 중의 하나 아래로 이동하는 순환 가스(210)의 경로도 도시되어 있다. 이 실시예에서, 주위 가스(210)는 매니폴드(30)와 가스 연통하는 하나의 입구뿐만 아니라 제2 매니폴드(35)와 가스 연통하는 하나의 출구를 갖는다. 이 도면에 도시된 바와 같이, 주위 가스(210) 및 순환 가스(250)의 경로를 교차할 수 있지만, 두 가스가 혼합되는 것을 방지하는 것이 바람직하다(주위 가스(210)는 입자 또는 오염 물질을 포함할 수 있는 반면에 순환 가스는 선택적으로 입자 또는 오염 물질이 없게 유지될 수 있다). 순환 가스는 전자 영상 조립체(50)의 전방을 이동하기 때문에 순환 가스(250)가 입자 또는 오염 물질을 포함하지 않게 유지하는 것이 바람직하다. 따라서, 영상 물질이 손상되지 않도록 하기 위하여, 순환 가스(250)를 깨끗하게 유지하고 주위 가스(210)와 혼합되지 것을 방지하는 것이 바람직할 수 있다.

[0034]

도 5는 도 4에 도시된 표시부 C의 단면 사시도를 도시한다. 전술한 바와 같이, 주위 가스(200) 뿐만 아니라 순환 가스(250)를 사용하는 실시예를 설명한다면, 두 가스의 경로는 서로 교차할 필요가 있고 디스플레이의 민감한 부분들을 오염시키는 것을 방지하기 위하여 두 가스가 혼합되는 것을 방지하는 것이 바람직하다. 여기에서, 교차 관통 플레이트(500)는 두 가스들이 함께 혼합되는 일 없이 두 가스의 경로가 서로 교차하게 한 다. 이 실시예에서 교차 관통 플레이트(500)는 플레이트를 관통하는 일련의 관통구를 포함한다. 일련의 제1 관 통구(550)는 교차 관통 플레이트(500)를 관통하며 주위 가스(210)가 제1 매니폴드(30)로부터 전자 영상 조립체 (50) 위에 떨어 있는 채널(60) 내로 이동하게 한다. 일련의 제2 관통구(525)는 일련의 제1 관통구(550)와 방향 과 선택적으로 수직인 방향으로 교차 관통 플레이트(500)를 관통한다. 일련의 제2 관통구(525)는 순환 가스가 전방 채널(251)을 빠져나가고, 주위 가스(210)와 교차하며, 열교환기(45)를 향하여 진행한다. 이 실시예에 서, 순환 가스 펌 조립체(255)가 전방 채널(251)을 통해서 그리고 열교환기(45)를 통해서 순환 가스(250)를 출 입하기 위하여 사용된다. 여기에서 설명되고 도시된 다른 펌 조립체들과 마찬가지로, 순환 가스 펌 조립체(25 5)는 제한하는 것은 아니지만 열교환기(45)와 입구/출구 또는 전방 채널(251)와 입구/출구를 포함한 디스플레이 와 입와의 위치에 배치될 수 있다.

[0035]

도 6은 교차 관통 플레이트(500)의 하나의 실시예의 단면 사시도를 도시한다. 이 실시예에서, 교차 관통 플레이트(500)는 상부 플레이트(501)와 하부 플레이트(502) 사이에 샌드위치된 복수의 중공 블록(503)으로 이루어져 있는데, 상부 플레이트 및 하부 플레이트(510, 502)와 입부 선택들은 블록(503)의 중공 선택과 상응하도록 정렬 있다. 중공 블록(503), 일련의 제1 관통구(500) 및 일련의 제2 관통구(525)를 상세하게 도시하기 위하여 상부 플레이트(501)와 입부가 제거되었다. 교차 관통 플레이트(500)는 입와의 여러 가지 형태를 가질 수 있으며, 여 러 가지 방식으로 구성될 수 있다. 다른 일부 실시예들은 증설 플레이트를 사용할 수 있는데, 이 경우에 일련의 제1 및 제2 관통부(550, 525)들은 증설 플레이트에 형성된다. 다른 실시예들은 두 세트의 중공 물질을 사용할 수 있는데, 이 경우에 중공 선택들은 서로 수직이며 블록들은 함께 고정된다. 또 다른 실시예들은 이하에 열포 환기(45)에 대해 설명하는 것과 유사한 설계를 사용할 수 있는데, 예를 들어 입와의 형태의 직교류 열교환기 설 계가 사용될 수 있다. 따라서, 예시적인 교차 관통 플레이트(500)는 두 개의 가스 경로를 포함하는데, 두 경로 는 가스가 혼합되지 않도록 한다. 여기에서, 제1 가스 경로는 제2 관통구(525)가 될 수 있고 제2 가스 경로는 제1 관통구(550)가 될 수 있다.

[0036]

도 7은 열교환기(45) 및 펌 조립체(46)의 예시적인 하나의 실시예의 분해 사시도를 도시한다. 이 도면에서, 펌 조립체(46)는 펌 하우징(51) 내의 장착 위치로부터 분리되어 도시되어 있다. 이 실시예에서, 열교환기(45)는 두 부분(47, 48) 간에 가스를 연통을 제공하기 위하여 펌 하우징(51)이 사용된 다. 여기에서, 펌 조립체(46)는 두 부분(47, 48) 사이에 배치된다. 열교환기(45)를 통하여 주위 가스를 통입하 기 위하여 펌 조립체(46)는 입와의 위치에 배치될 수 있지만, 열교환기의 두 부분 사이에 펌 조립체(46)를 배치 하는 것이 여러 가지 장점을 제공할 수 있다는 것이 확인되었다. 첫째, 열교환기를 통한 주위 가스(200)의 체적 유동률이 높고, 결과적으로 열교환기(45)의 양호한 냉각 능력을 나타낸다. 둘째, 열교환기(45)의 주위 부분(47, 48)들이 본질적으로 펌 조립체(46)를 위한 머플러로서 작용하기 때문에 펌 조립체(46)에 의해 야기되는 소음이 감소될 수 있다.

[0037]

이 실시예에서, 부분(48)은 부분(47)보다 더욱 얇고 길다. 이것은 하우징 내에 더 많은 공간을 자유롭게 하므로 하우징 내(부분(48)의 가까이)에 추가적인 전자 부품들을 장착할 수 있다. 도시된 바와 같이, 펌 하우징(51)은 상이한 길이를 갖는 것일 수 있는 열교환기의 두 부분들을 연결하기 위하여 사용될 수 있다. 도시된 바와 같이, 열교환기의 부분(48)이 펌 하우징(51)보다 얇다. 변경 실시예에서, 두 부분(47, 48) 모두가 펌 하우징(51)보다

얇을 수 있으며, 두 부분이 모두 팬 조립체(51)보다 얇더라도 팬 하우징(51)이 두 부분 간에 밀폐된 가스 연통을 제공하도록 사용될 수 있다. 공간이 제한적이라도 최대한(최대 냉각 능력)의 열교환기(45)를 생성하는 것이 요구될 때 이러한 설계가 바람직할 수 있다. 물론 이것이 필수적인 것은 아니며 다른 실시예들은 동일한 폭 및 길이를 갖는 부분들을 구비한 것이 될 수 있다. 또한, 비록 이 실시예는 주위 가스(200)를 유동시키기 위하여 팬 조립체(46)를 사용하지만, 다른 실시예들은 대신에 순환 가스(250)를 유동시키기 위하여 열교환기 내에 배치된 팬 조립체를 사용하고 주위 가스(200)를 다른 팬 조립체(열교환기 내에 배치되거나 열교환기의 입구/출구에 배치된 것)로 유동시킬 수 있다. 일부 실시예들은 주위 가스(200)와 순환 가스(250) 모두를 유동시키기 위하여 열교환기(45) 내에 팬들을 배치할 수 있다.

[0038] 주위 가스(200)는 열교환기(45)의 제1 경로(또는 복수의 경로들)를 통하여 이동하는 반면에, 순환 가스(250)는 열교환기(45)의 제2 경로(또는 복수의 경로들)를 통하여 이동한다. 필수적인 것은 아니지만, 순환 가스(250)와 주위 가스(200)가 혼합되지 않는 것이 바람직하다. 이것은 주위 가스(200) 내에 존재하는 임의의 오염 물질 및/또는 입자가 디스플레이의 내부를 손상시키는 것을 방지한다. 바람직한 실시예에서, 열교환기(45)는 직교류 열교환기이다. 그러나, 많은 종류의 열교환기들이 공지되어 있으며 본 발명의 임의의 실시예에 사용될 수 있다. 열교환기(45)는 직교류 열교환기, 평행류 열교환기 또는 역류 열교환기가 될 수 있다. 예시적인 실시예에서, 열교환기(45)는 얇은 플레이트들이 적층된 복수의 층들로 이루어질 수 있다. 플레이트들은 물결 형태, 벌집 형태 또는 튜브 형태일 수 있으며, 이 경우에 복수의 채널/경로/튜브가 플레이트 길이 방향으로 아래에 뻗어 있다. 각각의 플레이트의 경로들은 인접한 플레이트들의 경로들과 실질적으로 수직이 되게, 경로들의 방향이 각각의 인접한 플레이트에 대해 변경되도록 플레이트들이 적층될 수 있다. 따라서, 주위 가스 또는 순환 가스는 그 채널 또는 경로가 가스의 경로와 평행한 플레이트들을 통해서만 열교환기로 들어갈 수 있다. 플레이트들이 번갈아서 적층되어 있기 때문에, 순환 가스 및 주위 가스는 서로 인접한 플레이트들에서 이동할 수 있고 열은 가스 자체가 혼합하는 일이 없는(바람직하지만 필수적인 것은 아닌 것으로서, 열교환기가 적절하게 밀폐되어 있는 경우) 두 가스 간에 전달될 수 있다.

[0039] 열교환기를 위한 대안적인 설계에서, 쌍으로 이루어진 물결 형태의 플레이트, 벌집형 플레이트, 또는 튜브형 플레이트 사이에 개방 채널이 배치될 수 있다. 개방 채널은 인접한 플레이트의 경로와 수직인 방향으로 진행할 수 있다. 개방 채널은 인접한 플레이트에서의 경로들의 방향과 수직인 방향으로 플레이트의 대향하는 두 개의 가장자리 사이에 뻗어 있는 두 개의 스트립 재료 또는 테이프(특히, 매우 높은 집적력의 테이프)에 의해 생성될 수 있다. 따라서, 제1 방향에서 열교환기로 들어온 가스는 개방 채널(스트립 또는 테이프와 평행한)을 통하여 이동할 수 있다. 제2 방향(제1 방향과 실질적으로 수직)에서 들어온 가스는 인접한 플레이트의 경로들을 통하여 이동할 수 있다.

[0040] 다른 종류의 직교류 열교환기는 제1 가스를 포함하고 있고 제2 가스의 경로와 수직으로 진행되는 복수의 튜브를 포함할 수 있다. 제1 가스를 포함하고 있는 튜브 위로 제2 가스가 이동할 때, 두 가스 간에 열이 교환된다. 명백하게, 많은 종류의 직교류 열교환기가 있으며 임의의 종류의 직교류 열교환기가 본 발명의 실시예와 함께 작동할 수 있다.

[0041] 예시적인 열교환기는 플레이트들을 구비할 수 있으며, 두 가스 간에 쉽게 열이 교환될 수 있도록 측면들은 비교적 낮은 열저항을 갖는다. 열교환기를 생성하기 위하여 다수의 재료들이 사용될 수 있다. 바람직하게는, 사용되는 재료는 내식성을 가지며, 경량이고 저렴해야 한다. 열전도성이 높고 실시예에 적합하기 때문에 일반적으로 열교환기를 위해 금속이 사용된다. 그러나, 플라스틱 및 복합 재료가 또한 전자 디스플레이를 위한 열적 조건들을 충족시킬 수 있다는 것이 밝혀졌다. 예시적인 실시예는 열교환기를 위한 플레이트를 구성하기 위한 재료로서 폴리프로필렌을 사용할 수 있다. 비록 폴리프로필렌은 열악한 열전도체인 것으로 알려져 있지만, 작은 측면 두께에 대해 넓은 표면적은 전체적으로 낮은 열저항을 나타낸다. 따라서, 예시적인 열교환기는 플라스틱으로 만들어질 수 있고 얇고 가벼운 디스플레이 조립체를 생산할 수 있다. 특히, 물결 형태의 플라스틱이 교호하는 모양으로 함께 적층(즉, 각각의 인접한 플레이트는 둘러싸는 플레이트와 수직의 방향으로 진행되는 채널을 갖는다)되는 각각의 플레이트 층을 위해 사용될 수 있다.

[0042] 도 8은 액정 디스플레이(300)의 백라이트 캐비티를 통한 순환 가스(350)의 유동을 이용하는 다른 실시예의 단면 사시도를 도시한다. 이 실시예에서, 액정 디스플레이(300) 및 결합된 백라이트(320)가 전자 영상 조립체로서 사용된다. 백라이트 캐비티를 생성하기 위하여 백라이트 벽(330)이 액정 디스플레이(300) 및 백라이트(320) 사이의 구역을 둘러쌀 수 있다. 일반적으로, 오염 물질/입자가 백라이트 캐비티에 들어가서 백라이트(320)의 광학적/전기적 기능들을 방해하는 것을 방지하기 위하여 백라이트 캐비티는 폐쇄된다. 그러나, 전술한 바와 같이 예시적인 실시예들은 순환 가스로 깨끗한 가스를 사용할 수 있는데, 순환 가스는 이제 백라이트(320) 및 심지어 액

원 디스토피아(300)의 후반 부분을 넘겨쓰기 위하여 맥라이트 케피터를 *벤처(venture)*와도 사용할 수 있다. 순환 가스(350)가 맥라이트 케피터를 통해서 유출할 수 있도록 맥라이트 펌프(330)가 패시브 있다. 펌프(360)는 맥라이트 케피터를 통해 순환 가스(350)를 흡입하기 위하여 사용될 수 있다. 액시온인 원시예외서, 순환 가스(350)가 맥라이트 케피터를 통해 유출하도록 맥라이트 펌프(330)에 도전적 압력과 같이 디스토피아(300)에 개구가 구비될 수 있다. 이 맥시에서, 맥라이트 케피터는 액시온(300)과 가스 압력제외된다.

[0044] 또한 도 9에는 전자 영상 조광체(이 실시예에서는 백라이트(320)) 바로 뒤에 이동할 수 있는 주위 가스(210)의 선택적인 추가 유동이 도시되어 있다. 일단, 제1 매너홀드(30)를 통해 이송하면, 백라이트(320) 및 채널(60)들 자체(채널들이 열전도성인 것이라면)로부터 열을 제거하기 위하여 주위 가스(210)는 채널(60)들을 통과할 수 있다. 주위 가스(210)를 제1 매너홀드(30) 내로 그리고 채널(60)들을 통해서 흡입하기 위하여 매너홀드 밸브 조립체(211)가 사용될 수 있다. 또한, 두 가스가 혼합되는 일 없이 순환 가스(350, 250)들이 주위 가스(210)와 교차할 수 있도록 교차 관통 플레이트(500)가 사용될 수 있다.

[0045] 예시적인 실시예에서, 백라이트(320)는 열전도성 기판(바람직하게는 금속 코어 PCB)에 장착된 복수의 LED를 포함할 수 있다. 채널(60)들과 마주하는 열전도성 기판의 표면 상에, 채널(60)들과 열전달할 수 있는 열전도성 플레이트가 있을 수 있다. 예시적인 실시예에서, 열전도성 플레이트는 금속이고 더욱 바람직하게는 알루미늄이며 채널(60)과 백라이트(320) 간의 열전달은 전도성의 열전달이다.

³⁶ 參見(60) 吳福祥等 編著之 *台灣(大陸)語彙* 卷二 있다.

기에 오임 물결이 출제하는 국내 환경에서 사육될 때 관리하다.

은도가 소정 값에 도달할 때 다수의 내각 행렬이 선택적으로 작동될 수 있다. 소정의 문턱 값이 선택될 수 있고

등록특허 10-2010515

시스템은 허용 온도 범위 내에 디스플레이를 유지하도록 형성될 수 있다. 이러한 자세를 달성하기 위하여 전형적인 온도 조절 장치들이 사용될 수 있다. 온도 감지 장치로서 열전대가 사용될 수 있다.

[0049] 설명된 실시예들의 원리 및 범위는 모든 종류의 전자 디스플레이를 위한 내각을 제공한다는 것이 이해되어야 할

다. 명세서에 사용된 바와 같이, 용어 '전자 영상 조립체'는 영상을 생성하기 위한 임의의 전자 조립체이다. 이

서점에서, 전자 영상 조립체는 LCD(또는 종류), 발광 다이오드(LED), 유기 발광 다이오드(OLED), 전계 방출 디

스플레이(FED), 발광 폴리머(LEP), 유기 전계 발광(OEL), 플라스마 디스플레이, 및 기타 평판/박판 패널 전자

영상 조립체이다. 또한, 실시예들은 아직 출시되지 않은 것을 포함한 다른 종류의 디스플레이와 함께 사용될 수

있다. 특히 본 발명의 시스템은 동 관라 평판 패널 OLED 디스플레이와 함께 사용하기 매우 적합한 것으로 생각

된다. 예시적인 실시예들은 큰(55 인치 이상) LED 백라이트, 높은 해상도의 액정 디스플레이(LCD)를 또한 이용

할 수 있다. 본 명세서에서 설명된 실시예들은 야외 환경에 아주 적합하기는 하지만, 상기 실시예들은 또한 디

스플레이의 열적 안정성이 문제가 될 수 있는 경우의 실내 환경(예를 들어, 공장/산업 환경, 온천, 탄화실)에도

적용될 수 있다.

[0050] 당해 기술 분야에 공지된 바와 같이, 전자 디스플레이는 서로 방향 또는 가로 방향으로 배향되거나, 본 명세서

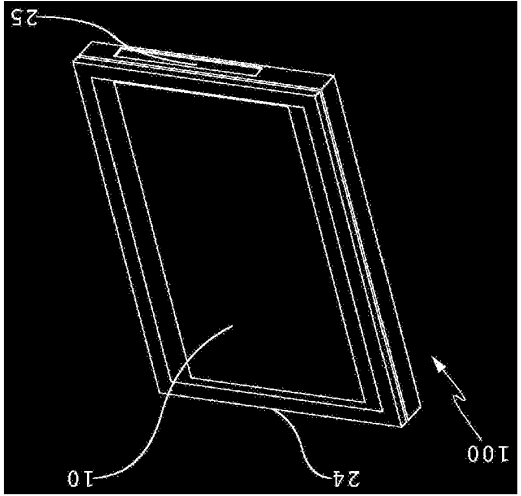
의 실시예에 두 방식 모두가 사용될 수 있다.

[0051] 바람직한 실시예들이 도시되고 설명되었지만, 당업자는 설명된 실시예에 대한 많은 변경과 개량이 이루어질 수

있으며 이러한 것은 여전한 청구범위에 포함되는 것임을 이해할 것이다. 추가로, 앞서 설명한 많은 요소들은 동

일한 결과를 제공하는 다른 요소들로 변경되거나 대체될 수 있고, 청구범위에 따른 발명의 범위 안에 속한다.

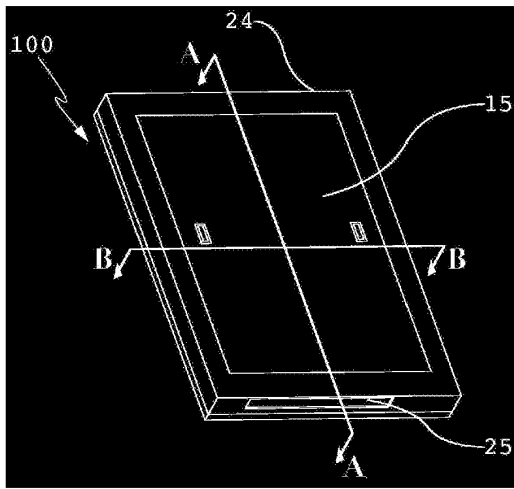
그러므로 본 발명은 청구범위의 청구항들에 의해 명시된 바에 의해서만 제한되는 것이다.



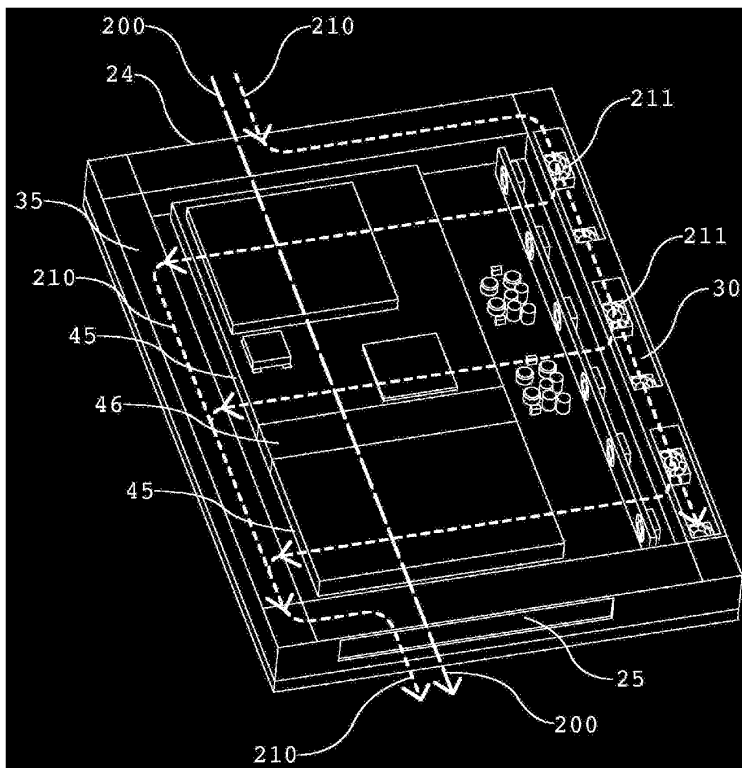
도면 1a

도면

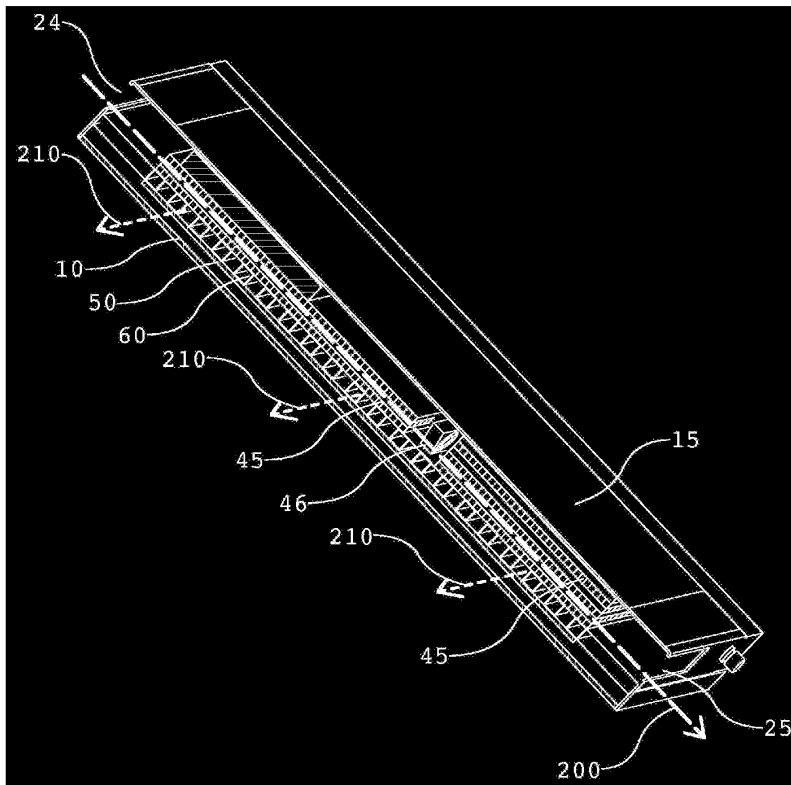
도면1b



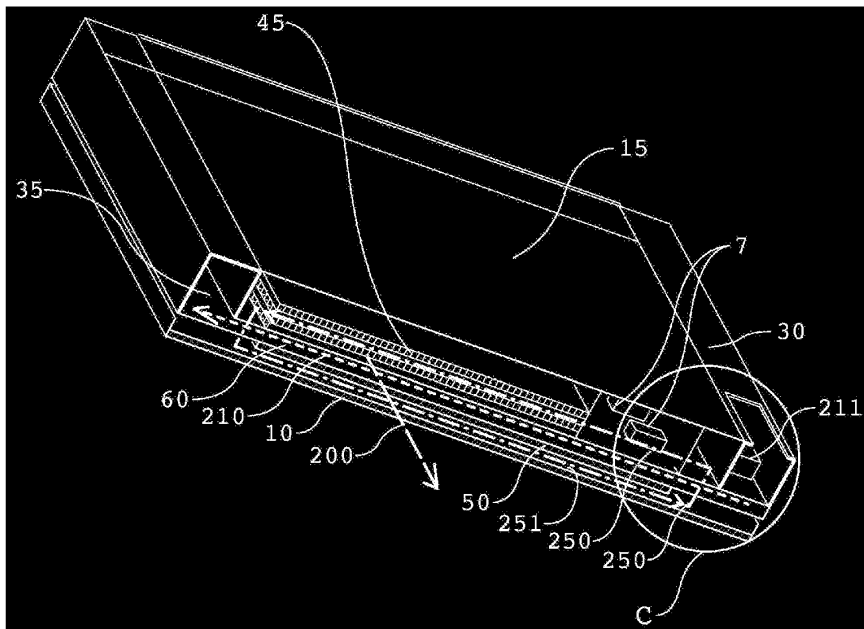
도면2



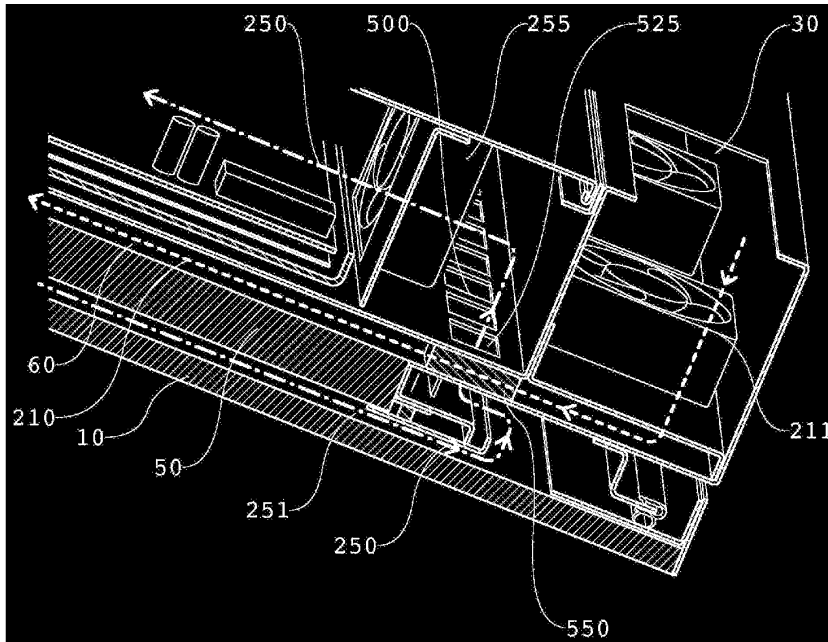
599



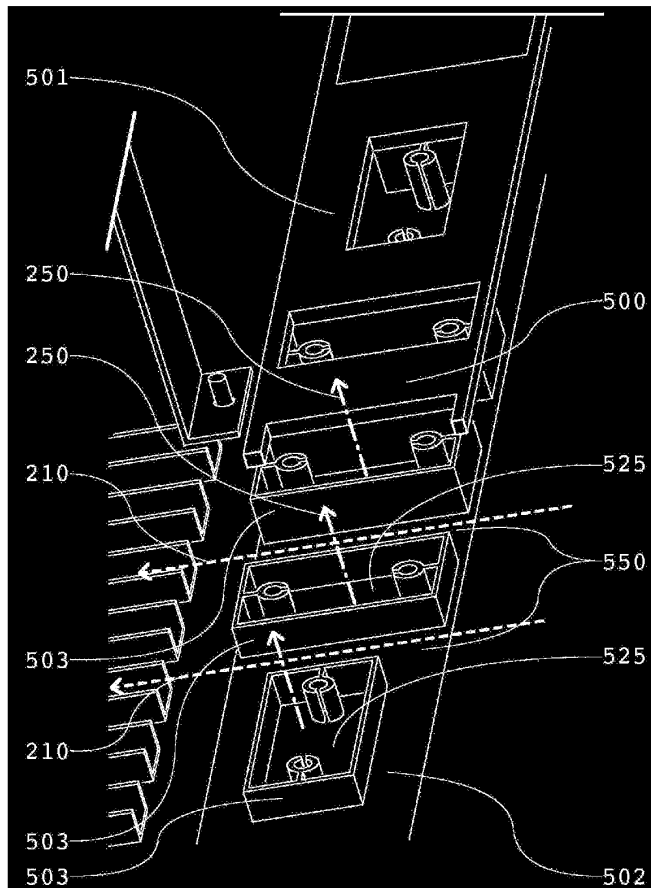
594



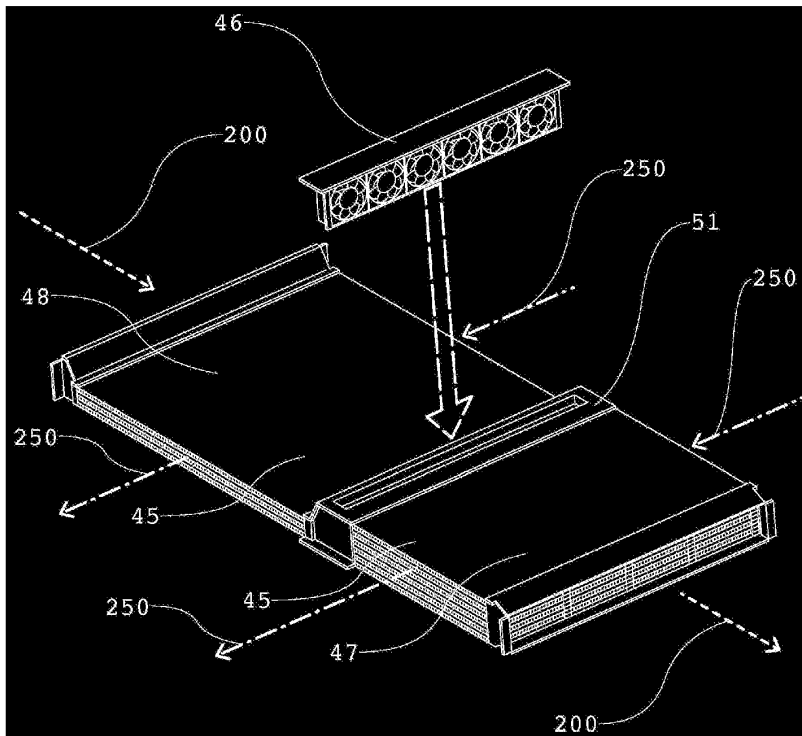
도면5



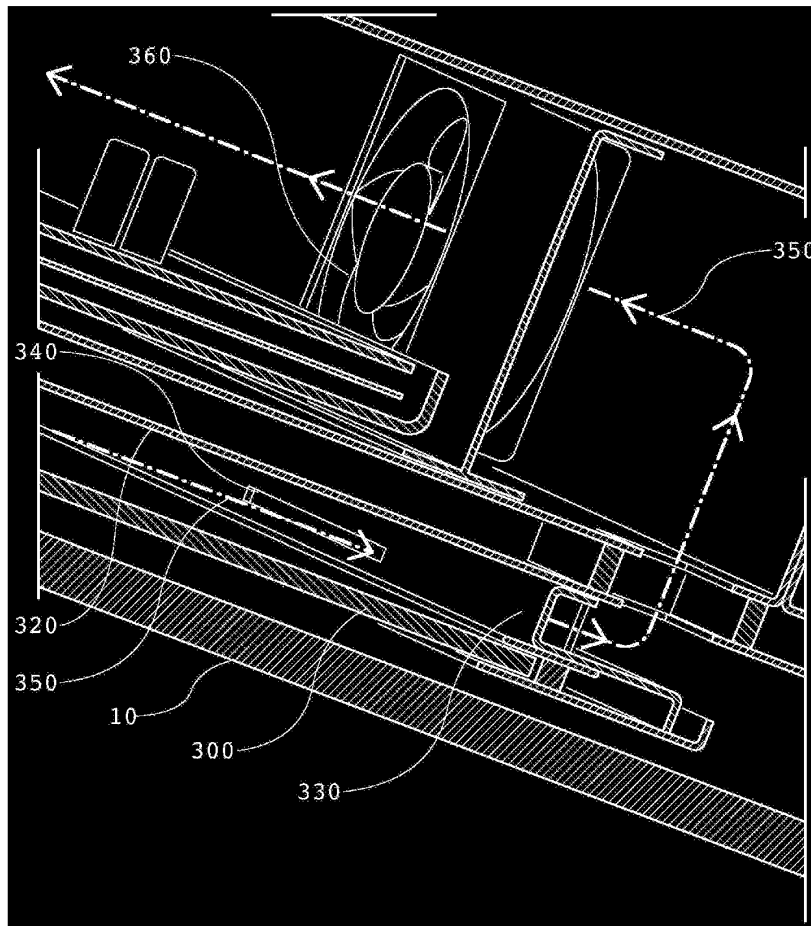
도면6



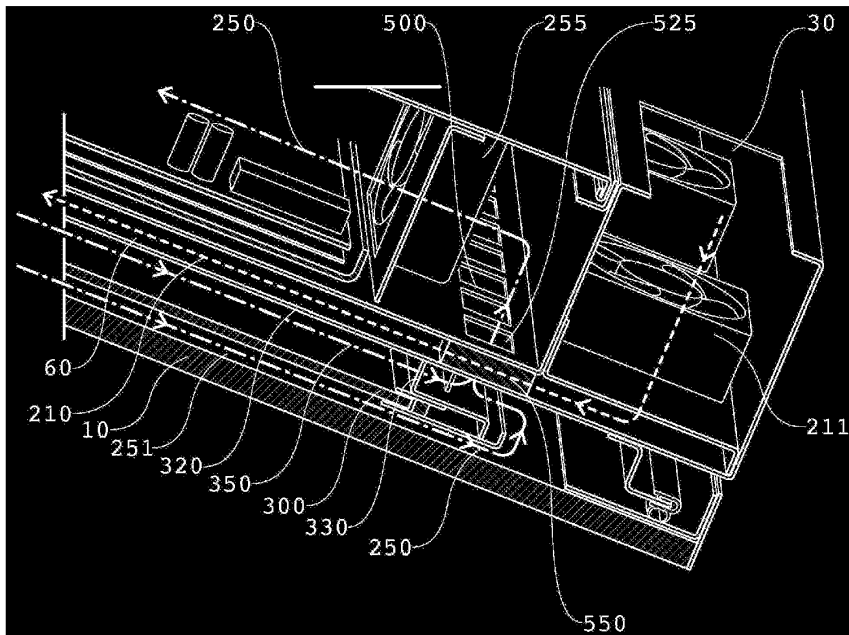
도면7



도면8



도면9



【심사관 직권보정사항】

【직권보정 1】

【보정항목】 청구범위

【보정세부항목】 제46항의 6번째 줄

【변경전】

주위 가스 유동을 가로지를 수 있도록,

【변경후】

주위 가스 유동과 교차하도록,



Espacenet

Bibliographic data: JP6526245 (B2) — 2019-06-05

Perimeter Ventilation System for Electronic Display

Inventor(s): ライアン・デマーズ

Applicant(s): マニファクチャリング・リソース・インターナショナル・インコーポレーテッド

Classification: - international: *F28D9/00; F28F21/06; F28F3/04; G09F9/00; H05K7/20*

- cooperative: H05K7/20972 (EP, US)

Application number: JP20170560902 20160215 Global Dossier

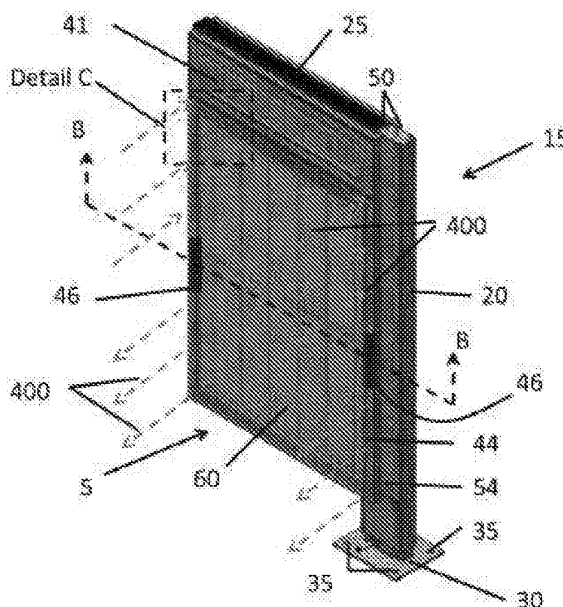
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US10278311 (B2) US2016242329 (A1) US2017332523 (A1)
US2019208674 (A1) US9723765 (B2) WO2016133852 (A1) less

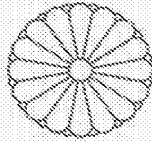
Abstract not available for JP6526245 (B2)

Abstract of corresponding document: US2016242329 (A1)

The exemplary embodiments herein provide an electronic display assembly having an electronic display surrounded by a front panel and a housing. An ingestion gap may be placed near a portion of the perimeter of the front panel while an exhaustion gap may be placed near an opposing portion of the perimeter of the front panel. A buffer zone may be defined between the ingestion gap and the exhaustion gap. A fan may be positioned to draw open loop fluid into the ingestion gap, through a channel behind the electronic display, and out of the exhaustion gap. This fan may also draw open loop fluid through an optional heat exchanger. A circulating fan may force



circulating air through an optional heat exchanger.



特 許 証
(CERTIFICATE OF PATENT)

特許第 6 5 2 6 2 4 5 号
(PATENT NUMBER)

発明の名称
(TITLE OF THE INVENTION)

電子ディスプレイ用の周辺換気システム

特許権者
(PATENTEE)

アメリカ合衆国 30005 ジョージア、ア
ルフレッタ、シロー・ロード・イースト 6
415
国籍・地域 アメリカ合衆国
マニファクチャリング・リソース・
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発明者
(INVENTOR)

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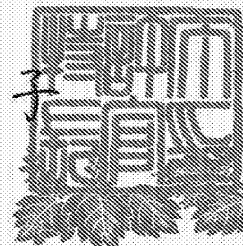
令和 1 年 5 月 17 日 (May 17, 2019)

この発明は、特許するものと確定し、特許原簿に登録されたことを証する。
(THIS IS TO CERTIFY THAT THE PATENT IS REGISTERED ON THE REGISTER OF THE JAPAN PATENT OFFICE.)

令和 1 年 5 月 17 日 (May 17, 2019)

特許庁長官
(COMMISSIONER, JAPAN PATENT OFFICE)

宗 像 直 子



特許証送付先

住所

〒102-0082
東京都千代田区一番町2-7番2 理工図書ビル4階

氏名

下田 容一郎

様

特許権設定登録通知書

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受領日 令和 1年 5月 7日

重要

特許料の納付について

特許料納付期限日

- ・特許権を維持するには、存続期間の満了（特許出願の日から20年）までの各年について所定の特許料の納付が必要です。
なお、**第4年以降の納付に関しては、特許庁から納付についての通知は送付いたしませんので、納付期限の管理はご自身でお願います。**

この通知を保管し、右側の特許料納付期限日の表で納付期限を確認してください。**(自動納付制度)**もありますので、特許庁ホームページを参照してください。)

- ・第4年以降の各年分の特許料は、登録日の翌日を起算日として、納付済年分の満了日（以下「納付期限日」という）までに、次の年分の納付が必要です。
- ・納付期限日までに納付できなかったときは、その期間の経過後6ヶ月以内であれば特許料を追納することができます。
- ・追納する場合は、納付すべき特許料のほか、その特許料と同額の割増特許料が必要です。

- ・追納できる期間内に納付しないときは、その特許権は、納付期限日にさかのぼって消滅したものとみなされます。
- ・特許料納付書の様式及び特許料の額については、以下を参照してください。

特許庁ホームページ

<https://www.jpo.go.jp/index.html>

納付年分	納付期限日
第 4 年分	令和 4 年(2022年) 5月17日
第 5 年分	令和 5 年(2023年) 5月17日
第 6 年分	令和 6 年(2024年) 5月17日
第 7 年分	令和 7 年(2025年) 5月17日
第 8 年分	令和 8 年(2026年) 5月17日
第 9 年分	令和 9 年(2027年) 5月17日
第10年分	令和10年(2028年) 5月17日
第11年分	令和11年(2029年) 5月17日
第12年分	令和12年(2030年) 5月17日
第13年分	令和13年(2031年) 5月17日
第14年分	令和14年(2032年) 5月17日
第15年分	令和15年(2033年) 5月17日
第16年分	令和16年(2034年) 5月17日
第17年分	令和17年(2035年) 5月17日

(注) 納付期限日が行政機関の休日にあたるときは、その日の翌日が期間の末日となります。

問い合わせ先 審査業務課登録室
電話 03(3581)1101 (代表)
特許担当 内線 2708

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H05K 7/20 (2006.01)
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F28F 21/06 (2006.01)
F28D 9/00 (2006.01)

G09F 9/00 304B
G09F 9/00 350Z
H05K 7/20 H
F28F 3/04 A
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(73) 特許権者 510135614
マニファクチャリング・リソース・イン
ターナショナル・インコーポレーテッド
アメリカ合衆国 30005 ジョージア
、アルファレッタ、シロー・ロード・イー
スト 6415
(74) 代理人 100067356
弁理士 下田 容一郎
(74) 代理人 100160004
弁理士 下田 憲雅
(74) 代理人 100120558
弁理士 住吉 勝彦
(74) 代理人 100148909
弁理士 瀧澤 匡則

最終頁に続く

(54) 【発明の名称】 電子ディスプレイ用の周辺換気システム

(57) 【特許請求の範囲】

【請求項 1】

電子ディスプレイと、
前記電子ディスプレイの前に配置される前部パネルと、
前記前部パネル及び前記電子ディスプレイを受け入れるハウジングと、
前記前部パネルの周辺の第1垂直及び第1水平の部分に沿って配置される、開ループ流
体を取り込むための取込ギャップと、
前記前部パネルの前記周辺の第2垂直及び第2水平の部分に沿って配置される、開ルー
プ流体を排出するための排出ギャップと、
前記電子ディスプレイの後ろに配置されるチャンネルと、
開ループ流体が前記取込ギャップから前記チャンネルに移動可能な第1の気体経路と、
前記開ループ流体が前記チャンネルから前記排出ギャップに移動可能な第2の気体経路と
、
前記開ループ流体の流れを形成するように配置されるファンと、
前記取込ギャップと前記排出ギャップとの間に配置されるバッファ・ゾーンと、
前記バッファ・ゾーン内に設けられる中央隔壁と、
垂直的に配置され、且つ前記第1の気体経路の少なくとも一部を形成する第1の側部チ
ャネルと、
垂直的に配置され、且つ前記第2の気体経路の少なくとも一部を形成する第2の側部チ
ャネルと、

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前記第1の側部チャンネル内に設けられるチャンネル隔壁と、
を備える電子ディスプレイ・アセンブリ。

【請求項2】

前記チャンネル隔壁は、前記開ループ流体の垂直方向の流れを実質的に防止する、請求項1に記載の電子ディスプレイ・アセンブリ。

【請求項3】

前記取込ギャップ及び前記排出ギャップは、前記電子ディスプレイの意図された観察者と対向する、請求項1に記載の電子ディスプレイ・アセンブリ。

【請求項4】

電子ディスプレイと、
前記電子ディスプレイ用のハウジングと、
前記電子ディスプレイの意図された観察者と対向するように、前記ハウジングの上に設けられる取込ギャップと、
前記電子ディスプレイの意図された前記観察者と対向するように、前記ハウジングの上に設けられる排出ギャップと、
前記電子ディスプレイの後ろに配置されるチャンネルと、
垂直的に配置され、且つ前記取込ギャップと前記チャンネルとの間の気体の通行を可能にする第1の側部チャンネルと、
垂直的に配置され、且つ前記チャンネルと前記排出ギャップとの間の気体の通行を可能にする第2の側部チャンネルと、
開ループ流体を前記取込ギャップに流入させ、前記第1の側部チャンネルを介して、前記チャンネルを介して、前記第2の側部チャンネルを介して、前記排出ギャップから排出させるように、配置されるファンと、
前記取込ギャップと前記排出ギャップとの間に配置されるバッファ・ゾーンと、
前記バッファ・ゾーンと同じ垂直方向の高さに設けられる中央隔壁と、
前記第1の側部チャンネル内に設けられるチャンネル隔壁と、
を備える電子ディスプレイ・アセンブリ。

【請求項5】

開ループ流体用の第1の経路と循環ガス用の第2の経路とを有する熱交換器と、
前記循環ガスが前記熱交換器を強制的に通過するように、配置される循環ファンと、
を更に備える請求項4に記載の電子ディスプレイ・アセンブリ。

【請求項6】

前記チャンネルは、LEDバックライトとプレートとの間の空間によって規定される、請求項4に記載の電子ディスプレイ・アセンブリ。

【請求項7】

前記取込ギャップは、前記アセンブリの第1の垂直方向の半分に設けられる一方、
前記排出ギャップは、前記アセンブリの反対の垂直方向の半分に設けられる、請求項4に記載の電子ディスプレイ・アセンブリ。

【請求項8】

前記第1の側部チャンネルからの開ループ流体を受け入れて前記電子ディスプレイの後ろのチャンネルに向ける、前記電子ディスプレイの後ろのドア・キャビティを
を更に備える請求項4に記載の電子ディスプレイ・アセンブリ。

【請求項9】

電子ディスプレイと、
前記電子ディスプレイを取り囲むハウジング及び前部パネルと、
前記電子ディスプレイの垂直方向の中央の上に配置され、且つ前記前部パネルと前記ハウジングとの間に位置する取込ギャップと、
前記電子ディスプレイの垂直方向の中央の下に配置され、且つ前記前部パネルと前記ハウジングとの間に位置する排出ギャップと、
開ループ流体用の第1の経路と循環ガス用の第2の経路とを有する熱交換器と、

前記循環ガスが前記熱交換器を強制的に通過するように、配置される循環ファンと、
前記取込ギャップと前記排出ギャップとの間であって前記電子ディスプレイの垂直方向
の中央の近くに配置される中央隔壁と、
開ループ流体の流れを前記取込ギャップに入れて、前記熱交換器を介して、前記排出ギ
ャップから出させるように、配置されるファンと、
垂直的に配置され、且つ前記取込ギャップと前記熱交換器との間の気体の通行を可能に
する第1の側部チャンネルと、
垂直的に配置され、且つ前記熱交換器と前記排出ギャップとの間の気体の通行を可能に
する第2の側部チャンネルと、
前記第1の側部チャンネル内に設けられる第1の側部のチャンネル隔壁と、
前記第2の側部チャンネル内に設けられる第2の側部のチャンネル隔壁と、
を備える電子ディスプレイ・アセンブリ。

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【請求項10】

前記第1の側部のチャンネル隔壁及び前記第2の側部のチャンネル隔壁は、開ループ流体の
垂直方向の流れを実質的に防止する、請求項9に記載の電子ディスプレイ・アセンブリ。

【発明の詳細な説明】

【技術分野】

【0001】

(関連出願の相互参照)

[0001]本出願は、2015年2月17日付けで提出された米国出願第14/624,268号の優先権を主
張し、その参照によってその全体が本明細書に組み込まれたものである。

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【0002】

(技術分野)

[0002]本発明の実施形態は、一般に、電子ディスプレイ用のマウント及び冷却のシステム
に関連する。

【背景技術】

【0003】

(背景)

[0003]電子ディスプレイは、しばしば、アウトドア環境又は他の領域に使用される時に、
環境温度が高くなり得るため、又は太陽等の他の熱源の負荷がかかり得るため、ディスプ
レイ内部の温度が上昇することがある。しかしながら、単に周辺空気を取り入れるだけで
は、敏感な部分に塵が入ることで汚染されて、故障を早めたりするので、ディスプレイは
、特定の部分によっては、冷却することが困難になる。

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【発明の概要】

【課題を解決するための手段】

【0004】

(発明的なコンセプトの概要)

[0004]例示的な実施形態は、ディスプレイ・アセンブリと、自立のディスプレイ・ハウジ
ングと、を備えることができる。そのディスプレイ・アセンブリは、自立のディスプレイ
・ハウジング内に設けられてもよい。ディスプレイ・アセンブリは、前部パネルの周辺に
沿って配置される取込ギャップと、前部パネルの周辺の反対部分に沿って配置される排出
ギャップと、を備えることができる。ファンは、開ループ流体が取込ギャップから入って
電子ディスプレイの背後のチャンネルを通り排出ギャップから出て行くように、配置するこ
とができる。

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【0005】

[0005]同じファン又は追加ファンは、開ループ流体が任意選択である熱交換器も強制的に
通過するように、配置することができる。また、追加の循環ファンを使用して、開ループ
流体を熱交換器に循環させることができる。

【0006】

[0006]バッファ・ゾーンは、取込ギャップと排出ギャップとの間に位置し、また、1つ又

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は複数の隔壁を有することが好ましく、その隔壁は、ハウジング内に吸気された後に開ループ流体の垂直方向の流れを実質的に制限又は禁止することができる。隔壁は、一般に、水平的に位置し、且つディスプレイ・アセンブリの垂直方向の中央付近に位置する（必須ではないが）。

【図面の簡単な説明】

【0007】

（図面の簡単な説明）

[0007] 上述の特徴に加えて、本発明の他の態様は、以下の図面の説明及び例示的な実施形態から容易に理解できるものであり、図中の同様な参照符号は、同一又は等価の特徴を示している。

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【図1】 [0008] 図1は、自立のディスプレイ・ハウジング内に収納された電子ディスプレイ・アセンブリの1実施例の正面斜視図であり、また、線A-A及び細部（Detail）Aを表す。

【図2】 [0009] 図2は、図1の実施例の正面図であり、また、細部（Detail）Nを表す。

【図3】 [0010] 図3は、図2の細部Nの詳細な正面図である。

【図4】 [0011] 図4は、図1の1実施例の背面斜視図であり、また、線B-B及び細部（Detail）Cを表す。

【図5】 [0012] 図5は、図1の細部Aの詳細な正面図であり、図中、前部パネルは取り外されている。

【図6】 [0013] 図6は、図1の1実施例の背面斜視図であり、図中、背部パネルは取り外されており、細部（Detail）D及び細部（Detail）Eを表す。

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【図7】 [0014] 図7は、図1の切断線A-Aによる頂部斜視断面図であり、また、細部（Detail）Fを表す。

【図8】 [0015] 図8は、図7の細部Fの頂部平面切断図である。

【図9】 [0016] 図9は、図4の切断線B-Bによる底部斜視断面図であり、また、細部（Detail）Kを表す。

【図10】 [0017] 図10は、図7の細部Kの底部平面切断図であり、また、細部（Detail）Lを表す。

【図11】 [0018] 図11は、図1の1実施例の正面平面図であり、また、断面線F-F、G-G及びH-Hを表す。

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【図12A】 [0019] 図12Aは、図11の切断線F-Fによる頂部平面断面図であり、また、細部（Detail）O及び細部（Detail）Pを表す。

【図12B】 [0020] 図12Bは、図11の切断線G-Gによる頂部平面断面図であり、また、細部（Detail）Qを表す。

【図12C】 [0021] 図12Cは、図11の切断線H-Hによる頂部平面断面図であり、また、細部（Detail）Rを表す。

【図13A】 [0022] 図13Aは、図12Aの細部Oの頂部平面詳細断面図である。

【図13B】 [0023] 図13Bは、図12Bの細部Qの頂部平面詳細断面図である。

【図13C】 [0024] 図13Cは、図12Cの細部Rの頂部平面詳細断面図である。

【図14】 [0025] 図14は、図12Aの細部Pの頂部平面詳細断面図である。

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【図15】 [0026] 図15は、図6の細部Dの背面斜視図であり、図中、自立のディスプレイ・ハウジングは取り外されている。

【図16】 [0027] 図16は、周囲要素が分離された、背部パネルの図4の細部Cの正面斜視図である。

【図17】 [0028] 図17は、図10の細部Lの底部平面断面図である。

【図18】 [0029] 図18は、図6の細部Eの背面斜視図であり、図中、自立のディスプレイ・ハウジングは取り外されている。

【図19A】 [0030] 図19Aは、図1のアセンブリの背面斜視図であり、図中、自立のディスプレイ・ハウジングは取り外され、また、細部（Detail）Sを表す。

【図19B】 [0031] 図19Bは、図1のアセンブリの前面斜視図であり、図中、自立のデ

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ディスプレイ・ハウジングは取り外され、また、細部 (Detail) Tを表す。

【図 2 0】[0032]図 2 0 は、図 1 9 A の細部 S の背面斜視図の詳細である。

【図 2 1】[0033]図 2 1 は、図 1 9 B の細部 T の前面斜視図の詳細である。

【図 2 2】[0034]図 2 2 は、図 4 の断面線 B-B の底部斜視断面図である。

【図 2 3】[0035]図 2 3 は、他のすべての周囲要素から分離したディスプレイ・アセンブリの、背部パネル、自立のディスプレイ・ハウジング及び選択部分だけを示す、図 1 のアセンブリの前面斜視図である。

【図 2 4】[0036]図 2 4 は、他のすべての周囲要素から分離したディスプレイ・アセンブリの、背部パネル及び選択部分だけを示す、図 1 のアセンブリの上面図であり、また、細部 (Detail) Mを表す。

【図 2 5】[0037]図 2 5 は、図 2 3 の細部 M の前面斜視図である。

【図 2 6 A】[0038]図 2 6 A は、他のすべての周囲要素から分離したディスプレイ・アセンブリの、自立のディスプレイ・ハウジング及び選択部分だけを有する隔壁を示す、図 1 のアセンブリの前面斜視図である。

【図 2 6 B】[0039]図 2 6 B は、他のすべての周囲要素から分離したディスプレイ・アセンブリの、自立のディスプレイ・ハウジング及び選択部分だけを有する隔壁を示す、図 1 のアセンブリのもう 1 つの前面斜視図である。

【発明を実施するための形態】

【0 0 0 8】

(例示的な実施形態の詳細な説明)

[0040]本発明は、以下に、その例示的な実施例が示されている添付図面を参照しながら、より詳細に説明する。なお、本発明は、多くの異なる形式で実施可能であるため、本明細書における例示的な実施例に限定されるべきではない。むしろ、これらの実施例の提供により、本開示は全くの完全なものとなり、当業者は、本発明の範囲を完全に理解することができる。但し、図面においては、層及び領域の大きさ、相対的な大きさは、明確化のために誇張されている場合がある。

【0 0 0 9】

[0041]本明細書での用語は、特定の実施例のみを説明するために使用され、本発明を限定する意図はない。また、明細書において使用されている、単数形は、明らかにその文脈から異なることが明示されていない限り、複数形をも含む意図を持っている。また、用語「備える」及び／又は「備えている」は、本明細書における使用において、記載された特徴、整数、ステップ、動作、構成及び／又は要素の存在を明示していることを理解することができるが、1 又は複数の他の特徴、整数、ステップ、動作、構成、構成要素、及び／又はそれらの群の存在を排除するものではない。

【0 0 1 0】

[0042]本発明の実施例は、本発明の理想的な実施例（及び中間構造）が図示された概要である図面を参酌しながら、以下に説明する。従って、結果として図示された形状における変更、例えば、製造上の技法及び／又は許容誤差などは、予期されている。従って、本発明の実施例は、本出願で図示された領域の特定の形状に限定されることを意図しておらず、例えば製造からの結果物の形状には偏差を含むものである。

【0 0 1 1】

[0043]他に定義しない限り、本明細書で使用される用語（技術用語及び科学用語を含む）は、本発明が属する技術分野の当業者によって通常理解される意味を持つ。例えば一般的に用いられる辞書で定義された用語は、関連技術の文脈における意味と一致する意味を持つように理解されるべきであり、特に本明細書で定義されない限り理想的な意味又は過度に正式な意味で解釈されるものではない。

【0 0 1 2】

[0044]図 1 は、電子ディスプレイ・アセンブリ 5（以下、「アセンブリ」とも言う）の実施例を示す。電子ディスプレイ・アセンブリ 5 は、アセンブリ 5 の前部表面の大部分を覆うことが可能である前部パネル 1 0 を備える。前部パネル 1 0 は、透過であってもよく、

また、電子ディスプレイ70の前に位置してもよい。ここで、電子ディスプレイ70は、好ましくは、前部パネル10の後ろに固定されている。例示的な実施例において、前部パネル10は、タッチ・スクリーンである。周囲壁55は、前部パネル10を取り囲むことができる。

【0013】

[0045]自立のディスプレイ・ハウジング15は、アセンブリ5を取り囲むことができ、また、アセンブリ5を地面に貼り付け可能に構成することができる。例示的な実施例において、自立のディスプレイ・ハウジング15は、旗形に形成可能である。他の実施例において、自立のディスプレイ・ハウジング15は、バス停用のシェルタに一体化されるように、大きさを有し、且つ構成されてもよい。

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【0014】

[0046]自立のディスプレイ・ハウジング15は、柱20、上部ビーム25及び基部30を備えることができる。例示的な実施例において、基部30は、固定具（例えばボルト）が通過できてグラウンドに固定できるような、選択的な開口35（例えば円形孔）を有することができる。開口35の数及び位置は、図示において、単なる実施例に過ぎない。柱20の底部は、自立のディスプレイが地面に固定されるように、埋めることができる。幾つかの実施例において、柱20の底部をコンクリートに埋めることによって実施してもよい。自立のディスプレイ・ハウジング15及び関連する要素は、金属製（例えば、ステンレス鋼又はアルミニウム）であってもよい。

【0015】

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[0047]上部ビーム25は、上部ビーム25の一方の側の大部分を覆う第2のディスプレイ40を更に備えることができる。例示的な実施例において、上部ビーム25は、液晶ディスプレイ(LCD)である。他の実施例において、第2のディスプレイ40は、静的なディスプレイであってもよく、それは、照明デバイス（例えばバックライト）と、静的ディスプレイ（例えばポスター）を収容するキャビティと、を有することができる。

【0016】

[0048]1組の拡張部材50は、柱20の頂部から伸張することができる。拡張部材50は、自立のディスプレイ・ハウジング15、従ってアセンブリ5を適所でより一層固定するように、構成することができる。拡張部材50の数及び形状は、任意である。例示的な実施例において、これらの拡張部材50は、バス停用のシェルタに一体化されるように、大きさを有し、且つ構成されてもよい。

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【0017】

[0049]後続の図面を用いてより詳細に説明されるように、アセンブリ5は、周囲壁55と前部パネル10との間にギャップ45を更に備えることができ、これにより、流体（例えば周辺空気）は、アセンブリ5内及び外に、流れることができる。例示的な実施例において、アセンブリ5は、アセンブリ5の上半分で流体を取り込めるように、また、アセンブリ5の下半分で流体を排出できるように、構成することができる（図中の矢印参照）。これは、単なる実施例に過ぎず、他の実施例では、アセンブリ5の上半分で流体を排出する一方、アセンブリ5の下半分で流体を吸引してもよい。

【0018】

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[0050]図2及び図3は、ギャップ45を示し、更に、アセンブリ5の周辺に沿って伸びるクロスハッチングを表し、詳細を表すために、拡大されている。ギャップ45は、バッファ・ゾーン46を更に有することができる。バッファ・ゾーン46は、領域であってもよく、好ましくは、外部空気の流れを禁止するために、ギャップ45の取入部と排出部との間に設けられる。他の実施例において、バッファ・ゾーン46は、外部空気の流れを実施的に制限してもよい。例示的な実施例において、ギャップ45は、前部パネル10の周辺の周りに位置するが、バッファ・ゾーン46には存在しない。例示的な実施例において、バッファ・ゾーン46は、ディスプレイ・アセンブリ5の垂直方向のセンターラインの近くに配置され、典型的には、第1のバッファ・ゾーンがアセンブリの右手側に存在し、第2のバッファ・ゾーンがアセンブリの左手側に存在する。

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【0019】

[0051]図4において、アセンブリ5は、アセンブリ5の背部表面の大部分を覆う背部パネル60を更に備えることができる。背部周囲壁54は、背部パネル60の側部を取り込むことができる。例示的な実施例において、背部周囲壁54は、周囲壁55と実質的に同じである。上部ビーム25は、第2のディスプレイ40と同様に、バックライト及びグラフィックを含む第3のディスプレイ41を更に備えることができる。例えばバックライトである照明ユニットは、背部パネル60の後ろに配置することができる。キャビティは、背部パネル60背面の背後に配置することができ、また、キャビティは、背部パネル60内に又は背部パネル60の後ろに位置する静的なディスプレイ（例えばポスター）を収容するように、構成することができる。代替的な実施例において、電子ディスプレイ・アセンブリ（例えばLCD）が、背部パネル60の後ろに配置されてもよい。

【0020】

[0052]図1と同様に、後続の図面においてより詳細に説明することができ、アセンブリ5は、背部周囲壁54と背部パネル60との間に背部ギャップ44を更に備えることができ、これにより、流体（例えば周辺空気）は、アセンブリ5内及び外に、流れることができる。例示的な実施例において、図中の矢印で示すように、アセンブリ5は、アセンブリ5の上半分で流体を取り込めるように、また、アセンブリ5の下半分で流体を排出できるように、構成することができる（逆も可能である）。

【0021】

[0053]本発明の例示的な実施例において、開ループ流体400の取込及び排出は、例えば上部及び下部の端のような、背部ギャップ44の選択部分に沿って実施されなくてもよい。他の実施例において、開ループ流体400の取込及び排出は、バッファ・ゾーン46の可能な限りの例外を除いて、背部ギャップ44の全部に沿って実施されてもよい。

【0022】

[0054]図5では、前部パネル10は取り除かれており、また、前部パネル10の後ろであって周囲壁55の内側に固定可能である電子ディスプレイ70が示されている。アセンブリ5は、ディスプレイ70と第2のディスプレイとの間に、電子ディスプレイ70の上に設けられた1連の開口65を更に備えることができる。図示された開口65は、単なる実施例に過ぎず、吸気開口65の数及び形状は、任意である。取込開口65は、流体（例えば、周辺空気）がディスプレイ70の背後を流れる開ループに入り易いように、構成することができる。1組の側部内部チャンネル21及び22は、電子ディスプレイ70の各側部の長さの大部分に及ぶことができる。

【0023】

[0055]図6では、背部パネル60は取り除かれており、また、背部パネル60の後ろに固定された内部背部パネル80が示されている。内部背部パネル80は、アセンブリ5の背面の大部分を覆うことができる。アセンブリは、内部背部パネル80の上であり、場合によって背部周囲壁54内に入っている、1連の背部吸気開口75を有することができる。図示された背部吸気開口75は、単なる実施例に過ぎず、開口75の数及び形状は、任意である。後続の図面においてより詳細に説明するが、開口75は、開ループ流体の取込を容易に実施するように、構成することができる。

【0024】

[0056]同様に、アセンブリ5は、内部背部パネル80の下であり、場合によって背部周囲壁54内に入っている、1連の背部排気開口85を有することができる。図示された背部排気開口85は、単なる実施例に過ぎず、背部排気開口85の数及び形状は、任意である。後続の図面においてより詳細に説明するが、背部排気開口85は、開ループ流体の排出を容易に実施するように、構成することができる。任意選択であるファン81は、内部背部パネル80の背後であって背部排気開口85の上に固定することができる。ファン81は、開ループ流体の流れを制御するように、構成されている。ファン81の数は、任意である。他の実施例において、ファン81は、開ループの流路に沿って任意の場所に配置することができ、即ち、ファン81の位置は、吸気75と排気開口85との間で任意とするこ

とができる。

【0025】

[0057]図7及び図8は、アセンブリ5の下半分を示し、また、自立のディスプレイ・ハウジング15を示す。側部ビーム90は、柱20の反対側に配置され、アセンブリ5の長さの大部分に及ぶことができる。側部ビーム90は、金属製であり、アセンブリ5の構造的
支持及び剛性を提供することができる。電子機器キャビティ16は、アセンブリ5の内部
に配置することができる。任意選択である熱交換器100は、電子機器キャビティ16の
内部又は近くに固定することができる。例示的な実施形態において、熱交換器100は、
交流熱交換器であるが、他の型の熱交換器、特に、逆流熱交換器等が使用されてもよい。
1連の電子要素105は、電子機器キャビティ16でも固定することができる。後続の図
面においてより詳細に説明するが、開ループ流体400（例えば、外部空気）は、熱交換
器100に循環されてもよい。閉ループ流体（例えば、循環ガス700）は、電子機器キ
ャビティに、また、電子要素105及び熱交換器100に、循環されてもよい。

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【0026】

[0058]後続の図面においてより詳細に説明するが、本実施例において、開ループ流体400
は、ギャップ45及び任意選択である背部ギャップ44を介して、アセンブリ5から抜
ける。流れを表す線で図示されるように、開ループ流体は、右側チャンネル19から、ジグ
ザグ経路を流れて、アセンブリ5から出て行く。代替的に、他の経路形状が使用されても
よく、それは明らかに意図されている。

【0027】

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[0059]電子ディスプレイ70等の液晶ディスプレイを使用する場合、バックライト106
は、電子ディスプレイ70の背後に配置することができ、また、好ましくは、直射型LED
バックライトであるが、他の照明源が実施例で用いられてもよい。プレート104又は
他の実質的に平坦な部材は、バックライト106の背後に配置することができ、これによ
り、開ループ流体400を受け入れるチャンネル102を生成することができる。好ましく
は、チャンネル102は、シールされて、開ループ流体400がディスプレイ・アセンブリ
の他の部分に、特に、電子要素16に、進入することを防止することができる。

【0028】

[0060]図9及び図10は、アセンブリ5の上半分及び自立のディスプレイ・ハウジング1
5を示し、任意選択である1組の補強部材110を除き、それぞれ、下半分を示す図7及
び図8と同様である。任意選択である補強部材110は、後続の図面でより詳細に説明す
る。後続の図面においてより詳細に説明するが、この実施例において、開ループ流体400
は、ギャップ45及び任意選択である背部ギャップ44を介して、アセンブリ5に入る
ことができる。流れを表す線で図示されるように、開ループ流体400は、ジグザグ経路
を流れて、右側チャンネル19に向かう。代替的に、他の経路形状が使用されてもよく、そ
れは明らかに意図されている。

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【0029】

[0061]図11は、図1の1実施例の正面平面図であり、また、断面線F-F、G-G及び
H-Hを表す。

【0030】

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[0062]図12A及び図12Bは、1組のチャンネル隔壁130と中央隔壁140とを示し、
後続の図面でより詳細に説明されるように、実質的に水平的に位置し、且つアセンブリ5
の垂直方向のセンターライン付近に位置することが好ましく、実施例では、垂直方向のセ
ンターラインから離れて、それらはアセンブリ5の頂部又は底部の近くに位置することが
できる。

【0031】

[0063]この実施例において、図12Aは、開ループ流体400の吸気として指定されたギ
ャップ45（及び任意選択である背部ギャップ44）の領域を示す。

【0032】

[0064]これらの図及び図12Cで示されるように、ファン81の配置によって、開ループ

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流体４００は、周辺空気（フィルタ後、又はフィルタされていない）の取込として一般的に使用されるギャップ４５（及び任意選択である背部ギャップ４４）の部分に入り込み、左側内部チャンネル２１（取込チャンネル）の下方へ、チャンネル１０２を横切り／又は通過し、右側内部チャンネル２２の下方へ、流体４００の排気として使用されるギャップ４５（及び任意選択である背部ギャップ４４）の部分から出る。なお、左側及び右側の内部チャンネル２１及び２２は、任意選択であり、代替的な実施例では、開ループ流体４００用の以下の経路を含み、その経路は、周辺空気（フィルタ後、又はフィルタされていない）の取込として一般的に使用されるギャップ４５（及び任意選択である背部ギャップ４４）の部分に入り込み、チャンネル１０２を横切り／又は通過し、流体４００の排気として使用されるギャップ４５（及び任意選択である背部ギャップ４４）の部分から出る。

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【００３３】

[0065]図１２Ｃは、図１１の切断線Ｈ－Ｈによる頂部平面断面図であり、また、細部（Detail）Ｒを表す。この実施例において、この図は、開ループ流体４００の出口として指定されたギャップ４５（及び任意選択である背部ギャップ４４）の領域を示す。

【００３４】

[0066]図１３Ａは、背部ギャップ４４を介した開ループ流体４００の取込を示す。開ループ流体４００は、開口１２２を介した任意選択であるドア補強部材１１５を通り抜けることができる。

【００３５】

[0067]図１３Ｂは、バッファ・ゾーン４６の領域のアセンブリの例示的な実施例を示す。この実施例において、バッファ・ゾーン４６は、ギャップ４５（及び任意選択である背部ギャップ４４）での、又は近くの、又は内側の範囲を備えることができ、それは、開ループ流体４００の経路に沿って配置される１又は複数の流体をブロックする栓を含んで、実質的に何も通過させない。例示的な実施例において、バッファ・ゾーン４６は、中央隔壁１４０と一緒にチャンネル隔壁１３０を含むことができるが、幾つかの実施例では、チャンネル隔壁１３０だけを利用することができる（流体４００のドア隔壁の通り抜けを禁止する場合）。他の実施例では、左側及び右側の側部チャンネル１８及び１９内にチャンネル隔壁１３０を設けるよりも、バッファ・ゾーン４６は、ギャップ４４の近くに又は端に設けられた栓を含むことができる。一般的には、バッファ・ゾーンは、水平であり、且つアセンブリ５の垂直方向のセンターライン線の近くに設けられるが、アセンブリ５の頂部又は底部の近くに配置されてもよい。

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【００３６】

[0068]なお、バッファ・ゾーン４６は、アセンブリ５の横の両側に存在すべきであり、（仮に、背部ギャップ４４が使用される場合）アセンブリ５の前部及び背部にも存在すべきであり、バッファ・ゾーン４６は、アセンブリ５の横の両側に存在するアセンブリ５の前部ギャップ４５（及び背部ギャップ４４）の部分ブロックすることができる。

【００３７】

[0069]図１３Ｃは、背部ギャップ４４を介した開ループ流体４００の排出を示す。開ループ流体４００は、開口１２２を介してドア補強部材１１５を通過することができる。

【００３８】

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[0070]図１３Ａ～図１３Ｃは背部ギャップ４４を図示しているが、例示的な１実施例において、前部ギャップ４５は、背部ギャップ４４と同様の方向を有していることに留意すべきである。実質的に同じであるので、省略されている。

【００３９】

[0071]図１４は、ギャップ４５及び背部ギャップ４４の結合された領域を示す、また、クロスのハッチング領域を表す。実施例において、バッファ・ゾーン４６の外側で、クロスのハッチング領域は、開ループ流体４００の流れをギャップ４５（及び任意選択である背部ギャップ４４）の内又は外の何れか一方に許可することができる。

【００４０】

[0072]図１５は、自立のディスプレイ・ハウジング１５が取り外されたアセンブリ５を示

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す。ドア補強部材 120 は、前部パネル 10 のすぐ後ろに取り付けすることができる。幾つかの実施例において、ドア補強部材 120 は、前部パネル 10 の背面に取り付けることができる。ドア補強部材 120 は、実質的に、前部パネル 10 の周辺を及ぶことができる。ドア補強部材 120 は、金属製であるか、又は、アセンブリ 5 の構造的剛性及び強度を提供可能である適切な剛性を有する他の材料で構成することができる。ドア補強部材 120 は、1 連の開口 125 を備えて、開ループ流体 400 の流れを可能にする。図示されるドア補強開口 125 は、単なる実例に過ぎない。開口 125 の数及び形状は、任意であることが意図されている。

【0041】

[0073] 図 16 は、背部パネル 60 を分離して示す。例示的な実施例では、背部補強部材 115 は、背部パネル 60 の周辺端の周りに取り付けことができ、これにより、背部パネル 60 のフレームを形成することができる。ドア・キャビティ 17 は、背部パネル 60、背部ドア補強部材 115 の内部表面、及び内部背部パネル 80 (現図に図示せず) の間の空間によって規定することができる。背部ギャップ 44 を介して取り込まれた開ループ流体 400 は、開口 122 を介して背部ドア補強部材 115 を通ってドア・キャビティ 17 に進むので、開ループ流体 400 b と考えることができる。図示された開口 122 は、単なる実例に過ぎず、開口の数及び形状は、任意であることが意図されている。任意選択である補強部材 110 は、細長い部材の形で、背部パネル 60 の長さを実質的に伸張することができる。任意選択である補強部材 110 は、金属製であるか、ポリマー製であるか、又は、背部パネル 60 の構造的剛性及び強度を提供可能である適切な剛性を有する他の材料で構成することができる。任意選択である補強部材 110 は、1 連の開口 135 を備えて、開ループ流体 400 b が任意選択である補強部材 110 を流れることを容易することができる。図示の、任意選択である補強部材 110 及び開口 135 は、単なる実例に過ぎず、任意選択である補強部材 110 及び開口 135 の数及び形状は、任意であることが意図されている。

【0042】

[0074] ドア・キャビティ 17 内を移動する開ループ流体 400 の一部は、開ループ流体 400 b として呼ばれる。図示されるように、開ループ流体 400 b は、内部パネル 80 の後ろを通過し、吸気開口 75 を経由して取り込まれてチャンネル 102 に向かうことができる。例示的な 1 実施例において、開ループ流体 400 b は、吸気開口 75 を流れて左側チャンネル 18 に向かい、チャンネル 102 を横切って、左側チャンネル 19 から出て行く。

【0043】

[0075] 図 17 は、流れを表す線で、アセンブリ 5 の前部及び背部を通る開ループ流体 400 a の循環を示す。開ループ流体は、ギャップ 45 を経由して取り込み、開口 125 を介してドア・補強部材 120 を進行し、また、右側内部チャンネル 22 及び側部ビーム 90 の一部によって規定される場合もある右側チャンネル 19 を垂直に進行することができる。同様に、開ループ流体 400 a は、背部ギャップ 44 を経由して取り込み、開口 122 を介してドア・補強部材 115 を進行し、開口 135 を介して任意選択である補強部材 110 を進行し、また、右側チャンネル 19 に入る。アセンブリ 5 の反対側で、同様の経路を形成することができる。これにより、開ループ流体は、左側内部チャンネル 21 及び柱 20 の一部によって規定される場合もある左側チャンネル 19 に進入することができる。

【0044】

[0076] 実質的に同一の逆の流体経路を形成して、アセンブリ 5 の反対側の端の上において開ループ流体を排気することができる。再び、実施例において、吸気は、上半分又はアセンブリ 5 で実施され、排気は、アセンブリ 5 の下半分で実施される。他の実施例において、吸気は下半分で実施し、排気はアセンブリ 5 の上半分で実施してもよい。或いは、他の実施例において、吸気は右側で実施し、排気は左側で実施し、バッファ・ゾーン 46 は、アセンブリの頂部及び底部の端に配置されて、2 つの流路の吸気のカrossを防止してもよい。

【0045】

[0077]図18は、ギャップ45及び背部ギャップ44からの取込み後の開ループ流体400の例示的な流路を示す。背部ギャップ44を介して吸気される開ループ流体400は、任意選択であるドア補強部材間のドア・キャビティ17に沿って進み、開ループ流体400bと呼ぶことができる。開ループ流体400bは、その後、背部内部パネル80に沿って垂直に進み、背部吸気開口75を経由して取り込まれる。開ループ流体400の他の部分は、左側の側部チャンネル18及び右側の側部チャンネル19に沿って進み、開ループ流体400aと呼ぶことができる。側部チャンネル18及び19を垂直に進んだ後に、開ループ流体400aは、これらの側部チャンネルの頂部の上を進み、吸気開口75を介して取り込まれる。同様に、開ループ流体は、ギャップ45を介して取り込まれ、前部パネル10の下でドア補強開口125を進み、吸気開口65を介して取り込まれる。

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【0046】

[0078]図19Aは、自立のディスプレイ・ハウジング15が取り外された図1のアセンブリの背面斜視図であり、また、細部(Detail)Sを表す。

【0047】

[0079]図19Bは、自立のディスプレイ・ハウジング15が取り外された図1のアセンブリの前面斜視図であり、また、細部(Detail)Tを表す。

【0048】

[0080]図20は、開ループ流体400aと呼ばれる、右側の側部チャンネル19を進む開ループ流体400の部分を示す。開ループ流体400aは、右側内部チャンネル22の頂部の上で、右側の側部チャンネル19内を移動し、吸気開口75に入っていくことができる。

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【0049】

[0081]図20と同様であるが前面からの視点で、図21は、開ループ流体400aと呼ばれる、左側の側部チャンネル18を進む開ループ流体400の部分を示す。開ループ流体400aは、左側内部チャンネル21の頂部の上で、左側の側部チャンネル18内を移動し、吸気開口65に入っていくことができる。

【0050】

[0082]図22は、図4の断面線B-Bの底部斜視断面図である。開ループ流体400a/400bは、様々な吸気開口75及び65を介して取り入れられると、統合されて、その後、熱交換器100の開ループ気体経路を流れる開ループ流体400の第1の部分と、チャンネル102に向けられる開ループ流体400の第2の部分とに、分けられる。

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【0051】

[0083]1又は複数の循環ファン32を使用して、循環ガス700を電子機器を横切らせて、且つ熱交換器100の開ループ気体経路を通過させるとともに、電子ディスプレイ70と前部パネル10との間で閉ループを形成する。この実施例において、循環ガス700は、ガasket200の通路内の開口部を通過する一方、開ループ流体400は、ガasketの通路の周りを進行し、実質的に開ループ流体400と循環ガス700との混合を防止することができる。しかしながら、この設計は、反転してもよく、この場合、循環ガス700がガasket200の通過経路の周りを通過する一方、外部空気400がガasket200の通過経路を進んでもよい。

【0052】

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[0084]図示されている開ループ流体400の流れは、左側内部チャンネル21の横を通り、ガasket200を通るクロスによって通過し、電子ディスプレイ70の背後(ここでは、バックライト106の背後)を走るチャンネル102に入ることができる。チャンネル102は、好ましくは、電子ディスプレイ70の背面(ここでは、バックライト106の背後)とプレート104との間によって定義することができる。好ましくは波形で好ましくは連続的であるヒートシンクが理想的にはチャンネル内に配置されて、開ループ流体400との対流によって取り除かれる電子ディスプレイ101から連続的なヒートシンクへの熱伝導は、促進される。

【0053】

[0085]熱交換器100は、好ましくは、循環ガス700又は開ループ流体400の何れか

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一方を含むチャンネルを定義する複数の層を含む。好ましくは、循環ガス 700 は、開ループ流体 400 との混合が不可能である。

【0054】

[0086]開ループ流体 400 の流れは、チャンネル 102 を進行し、ガasket 200 の経路の周りを再び通過し、左側内部チャンネル 22 に入ることができ、最終的には、開ループ流体 400 の排出として指定されるギャップ 45（及び任意選択である背部ギャップ 44）の部分から出て行く。この実施例において、図示された循環ガス 700 は、熱交換器 100 を出て、ガasket 200 の経路内の開口部、及びその後の電子ディスプレイ 70 と前部パネル 10 との間を通過する。

【0055】

[0087]好ましい実施例において、熱交換器 100 は、交流熱交換器である。しかしながら、多くの型の熱交換器が既知であるので、それらは、本明細書におけるどの実施例に使用してもよい。熱交換器 100 は、交流熱交換器、又は、平行熱交換器、又は逆流熱交換器であってもよい。実施例において、熱交換器 100 は、薄いプレート群からなる、複数の積層を有する。プレートは、波形、ハニカム、又は管状の設計であってもよく、複数のチャンネル／経路／管は、プレートの長さ方向に下降する。隣接する各プレートで経路の方向が交替するように、プレートは、積み上げられて、これにより、プレートの各経路は、隣接するプレートの経路と実質的に垂直である。従って、外部空気又は循環ガスは、ガスの進路と平行に走るチャンネル又は経路を有するプレートを通じてだけで、例示的な熱交換器に入ることができる。なぜならば、プレートが交互に配置されているので、循環ガス及び開ループ流体は、互いに隣接するプレート内を進むことができ、ガス自身が混合されることがなく、2つのガス間での熱交換が実施される（熱交換器が適切にシールされていることが好ましい）。

【0056】

[0088]熱交換器の代替的な設計において、開チャンネルは、1組の波形、ハニカム、又は管状のプレート間に配置することができる。開チャンネルは、隣接するプレートの経路に垂直な方向に進むことができる。この開チャンネルは、隣接するプレートの経路に垂直な方向にプレートの対向する2つの端間に2つの材料又はテープ（特に、強接着（VHB）テープ）を走らせることによって、生成することができる。従って、第1の方向に熱交換器に入ったガスは、（スリップ又はテープに平行に）開チャンネルを通ることができる。（第1の方向と実質的に垂直である）第2の方向に熱交換器に入ったガスは、隣接するプレートの経路を通ることができる。

【0057】

[0089]他の型の交流熱交換器は、第1のガスを含み、且つ第2のガスの経路に垂直に進む複数の管を備えることができる。第1のガスを含む管の上を第2のガスが流れる時に、2つのガス間で熱交換が実施される。多くの型の交流熱交換器が存在することは明らかであり、どの型も本明細書の実施例で機能するであろう。

【0058】

[0090]例示的な熱交換器は、比較的に低い熱抵抗を有する側壁となるプレートを有し、2つのガス間の熱交換は、容易に実施することができる。多くの材料を使用して熱交換を生成することができる。好ましくは、その材料は、非腐食性であり、耐腐食性であり、軽量であり、また安価である。典型的には、高熱伝導率であるため、熱交換器には金属が用いられ、実施例で実現されている。しかしながら、電子ディスプレイの熱的な条件を満たすプラスチック及び混合物も見つかっている。熱交換器のプレートを構成する材料として、例示的な実施例は、ポリプロピレンを利用することができる。ポリプロピレンは、熱伝導率が低いように思えるが、側壁の厚さが薄くて、表面積が大きいので、全体としては、熱抵抗が低いことが分かっている。従って、例示的な熱交換器は、プラスチック製であってもよく、薄くて軽量であるディスプレイ・アセンブリを製造することができる。特に、各プレート層に、波形のプラスチックを使用することで、交互に積み重ねることができる（即ち、各隣接プレートは、周囲のプレートに垂直な方向に進むチャンネルを有する。）。

【0059】

[0091]例示的な実施例において、電子ディスプレイ70は、直射型LEDバックライトLCDであり、LEDバックライトは、熱的な伝導性を有する基板（好ましくは、金属コアPCB）上にマウントされた複数のLEDを含むことができる。LEDバックライトの裏面は、好ましくは、チャンネル102と熱伝導可能な伝導性を有する熱伝導性プレートを含むことができる。

【0060】

[0092]循環ガス700及び開ループ流体400は、任意の数のガス状物質であってもよい。幾つかの実施例において、すべてのガスとして、空気が使用されてもよい。循環ガス700は、電子ディスプレイ70の前を移動するので、好ましくは、実質的に透明であり、これにより、観察者に画像の見え方に影響を与えないことができる。また、循環ガス700は、好ましくは、汚染物質及び／又は微粒子（例えば、埃、不純物、花粉、水蒸気、煙など）を実質的に含まないものであり、これにより、画質への悪影響及び／又は内部電子部品への損傷を防止することができる。一般的には、例示的な実施例では、開ループ流体400として、周辺空気を利用することができる。

【0061】

[0093]冷却システムは、連続的に運転することができる。しかしながら、必要に応じて、温度検出デバイスが電子ディスプレイ内に組み込まれて、温度が所定の閾値に到達する時に検出してもよい。このような場合、ディスプレイ内の温度が所定値に到達した時に、様々な冷却ファンが選択的に可動してもよい。所定の閾値は、選択的であってもよく、システムは、ディスプレイの温度を許容範囲内に有利に維持するように構成することができる。典型的には、サーモスタット・アセンブリを使用して、この作業を実行することができる。温度検出デバイスとして、熱電対が使用されてもよい。

【0062】

[0094]図23～図25は、中央隔壁140を示し、中央隔壁140は、好ましくは、実質的に水平的に位置し、且つアセンブリ5の垂直方向のセンターライン付近に位置し、実施例では、背部パネル60の表面の中心線に実質的に沿って伸びる垂直方向の上記センターラインから離れて、中央隔壁140はアセンブリ5の頂部又は底部に配置することもできる。右側のチャンネル隔壁130は、自立のディスプレイ・ハウジング15の右側内部端の中心線に実質的に沿って伸びて、中央隔壁140と整列させることができる。同様に、左側のチャンネル隔壁130は、アセンブリ5の左側内部端に固定して、中央隔壁140と整列させることができる。

【0063】

[0095]中央隔壁140、右側のチャンネル隔壁130、及び左側のチャンネル隔壁130（以後、集合的には、「水平パーティション」）は、ドア・キャビティ17を上半分及び下半分に実質的に分割するように、構成することができる。水平パーティションは、ドア・キャビティ17の上半分及び下半分の間に実質的な気密シールを形成するように、構成することができる。任意選択的に、水平パーティションは、上記の上半分及び下半分の間の気密シールを提供するために、水平パーティションと一緒に利用される伸張可能な材料（例えばポリウレタン発泡体）を更に備えることができる。例示的な実施例において、中央隔壁140は、十分に曲げ可能な材料（例えば、ポリマー）から構成されて、ドア・キャビティ17に気密シールを形成することができる。代替的な実施例において、中央隔壁140は、固くて曲がらない材料から構成されてもよい。例示的な実施例において、右側のチャンネル隔壁130及び左側のチャンネル隔壁130は、固くて曲がらなくてもよい。

【0064】

[0096]例示的な実施例において、開ループ流体400は、アセンブリ5の上半分に、ギャップ45（及び任意選択である背部ギャップ44）を介して取り込まれる。上記の開ループ流体400aは、その流体部分が右側のチャンネル隔壁130に到達し、且つそれ以降の移動を禁止されるまで、右側のチャンネル19に沿って移動することができる。同様に、上記の開ループ流体400aは、その流体部分が左側のチャンネル隔壁130に到達するまで

、左側のチャンネル１８に沿って移動することができる。開ループ流体の上記の部分は、反対方向に垂直的に戻るように強制されて、先の図面で説明したように、結果として吸気開口６５及び７５を介して取り込まれるまで、それぞれ、右側のチャンネル１９及び左側のチャンネル１８の上半分で循環する。

【００６５】

[0097]同様の方法で、開ループ流体４００ｂは、その流体４００ｂの部分が中央隔壁１４０に到達し、且つそれ以降の移動を禁止されるまで、ドア・キャビティ１７に沿って移動することができる。このように、取り込まれた（しかしながら、熱交換器１００又はチャンネル１０２を通過していない）開ループ流体４００ｂは、ギャップ４５（及び任意選択である背部ギャップ４４）から排出されることになる熱交換器１００又はチャンネル１０２を通った流体４００ｂと混合されない。

【００６６】

[0098]先の図面で説明したように、開ループ流体４００は、結果として排気開口８５で排出されるまで、任意選択である熱交換器１００を循環することができる。その後、開ループ流体４００は、右側の側部チャンネル１９又は左側の側部チャンネル１８に戻る事ができ、そこで垂直的に移動する。右側チャンネル隔壁１３０及び左側チャンネル隔壁１３０は、それぞれ、開ループ流体４００がアセンブリ５の中心線を超えて移動することを防止し、従って、アセンブリ５の各半分からの開ループ流体が混合することを防止することができる。つまり、吸気開口６５及び７５を経由してまだ取り込まれていない開ループ流体は、吸気開口６５及び７５を経由して既に取り込まれた開ループ流体と混合しない。右側の隔壁１３０及び左側の隔壁１３０に出くわした開ループ流体は、結果として、ギャップ４５（及び任意選択である背部ギャップ４４）を介してアセンブリ５から排気されるまで、それぞれ、反対方向に垂直的に戻ることを強制される。

【００６７】

[0099]図２６Ａ及び図２６Ｂは、チャンネル隔壁１３０の例示的な実施例を示す。このような実施例において、チャンネル隔壁１４１の一部は、（必要に応じて）開ループ流体４００ａの一部がチャンネル隔壁１３０を通過できるように、調整可能であり、これにより、開ループ流体の吸気及び排気間の限定された量の混合が可能となる。このような実施例において、チャンネル隔壁１４２の第２の部分は、静的であってもよく、それらは調整されないで、吸気及び排気の開ループ流体が混合しないような、実質的に気密なシールを形成することができる。他の実施例において、チャンネル隔壁１３０の全体は、調整可能であってもよい。更なる他の実施例において、チャンネル隔壁１３０の全体は、静的であってもよい。

【００６８】

[0100]開示された実施例の精神及び範囲からすれば、多くの型のディスプレイの冷却のために提供可能であることを理解することができるであらう。実例であって限定されない実施例は、以下のどの電子画像アセンブリにも用いることができる：ＬＣＤ（すべての型）、発光ダイオード（ＬＥＤ）、有機発光ダイオード（ＯＬＥＤ）、電解放電ディスプレイ（ＦＥＤ）、発光ポリマー（ＬＥＰ）、有機ＥＬ（ＯＥＬ）、プラズマ・ディスプレイ、及び他の薄型パネル電子画像アセンブリ。加えて、実施例は、他の型のディスプレイに使用してもよく、まだ発見されていなくてもよい。特に、システムは、フルカラーで薄型パネルＯＬＥＤディスプレイによく適しているであろう。例示的な実施例はまた、大型（５５インチ以上）ＬＥＤバックライトで高精細度液晶ディスプレイ（ＬＥＤ）に利用することができる。本明細書の実施例は、アウトドア環境によく適していると同時に、ディスプレイの熱的安定性が危険であり得る屋内用途（工場／産業環境、スパ施設、ロッカールーム）にも適合することができる。

【００６９】

[0101]当該技術分野で既知であるように、電子ディスプレイは、縦置き又は横置きでよく、どちらも本明細書の実施例に使用することができる。

【００７０】

[0102]図面で示された様々な冷却ループは、水平的又は垂直的であるが、特定の実施例に

よっては、逆転してもよく、或いは、変更してもよいことは、明らかである。従って、開ループは、水平又は垂直に、また、時計周り又は反時計周りに走ることができる。加えて、開ループは、水平的又は垂直的であって、左から右に、右から左に、上から下に、或いは、下から上に、走ることにもできる。

【0071】

[0103]本発明の好ましい実施例を示し、説明したが、当業者は、多くの変形及び変更を説明した発明に加えて、それが特許請求の範囲内であることを理解することができるであろう。更に、上述の構成要素の多くは、同様に機能し、請求項の発明の精神に含まれる他の構成要素に、変更又は置換することができる。それゆえに、本発明は、添付の特許請求の範囲によって示されるように、限定されることを意図されているものである。

10

【図1】

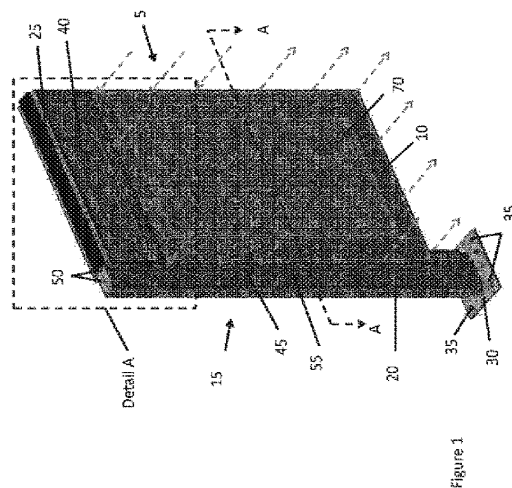


Figure 1

【図2】

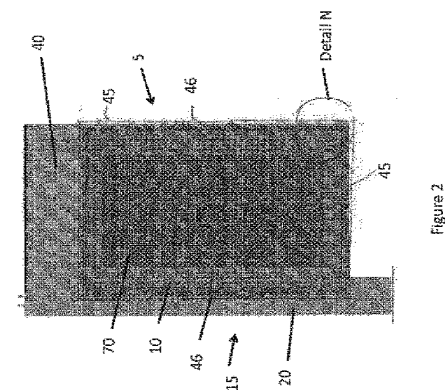


Figure 2

【図 3】

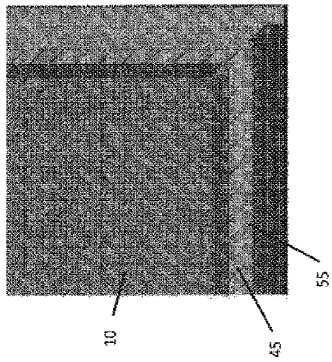


Figure 3

【図 4】

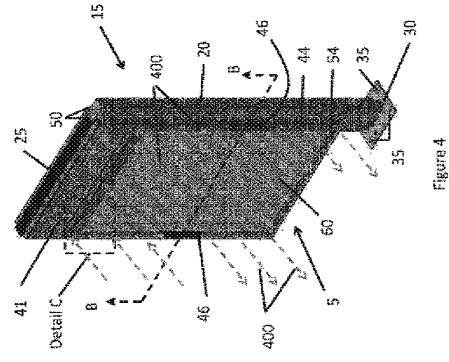


Figure 4

【図 5】

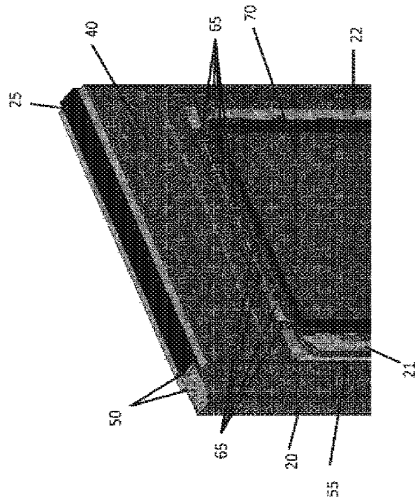


Figure 5

【図 6】

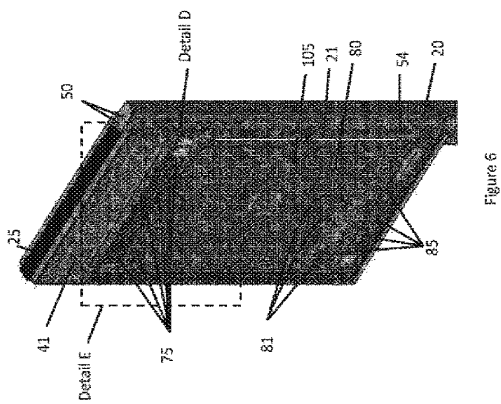


Figure 6

【図 7】

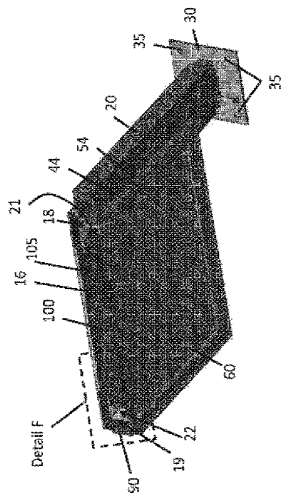


Figure 7

【図 8】

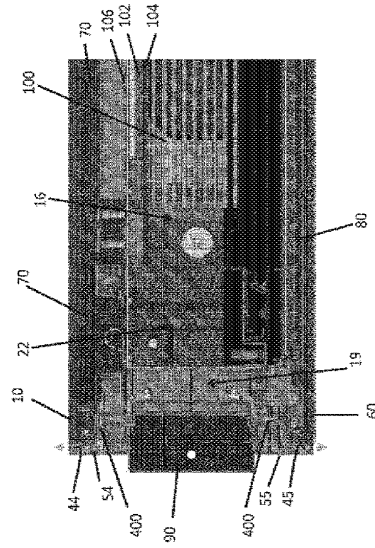


Figure 8

【図 9】

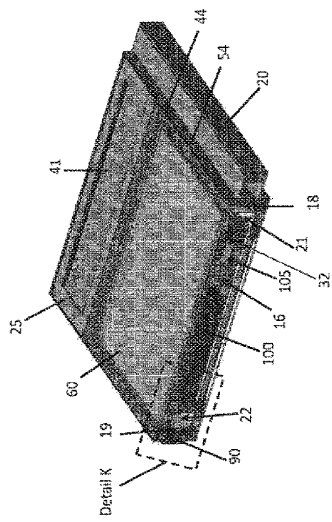


Figure 9

【図 10】

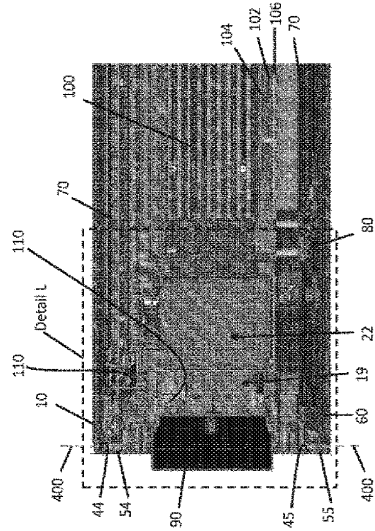


Figure 10

【図 11】

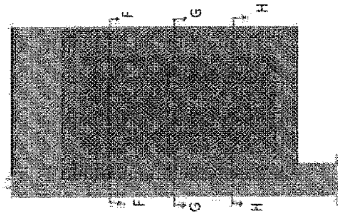


Figure 11

【図 12 A】

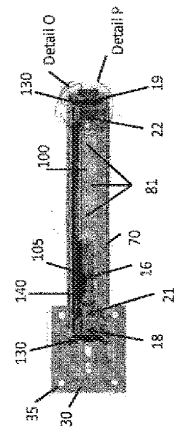


Figure 12A

【図 12 B】

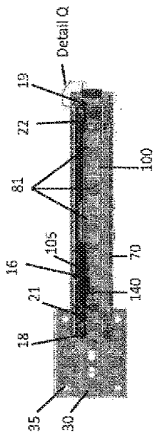


Figure 12B

【図 12 C】

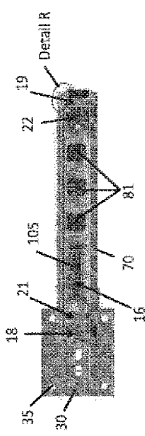
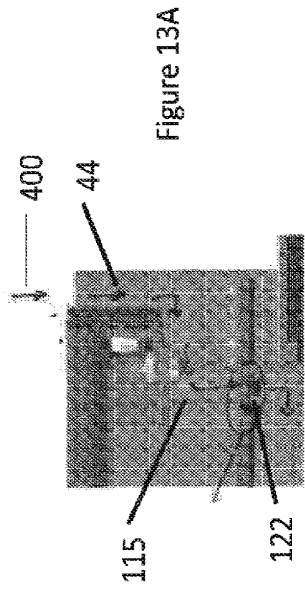
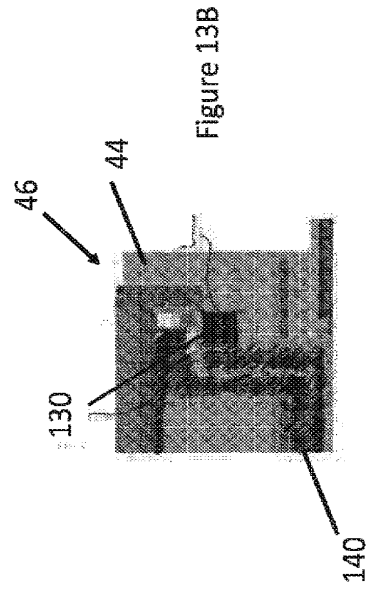


Figure 12C

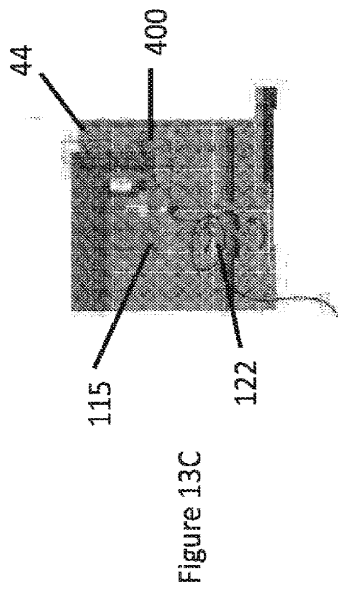
【図13A】



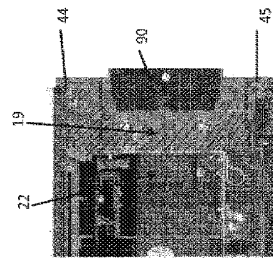
【図13B】



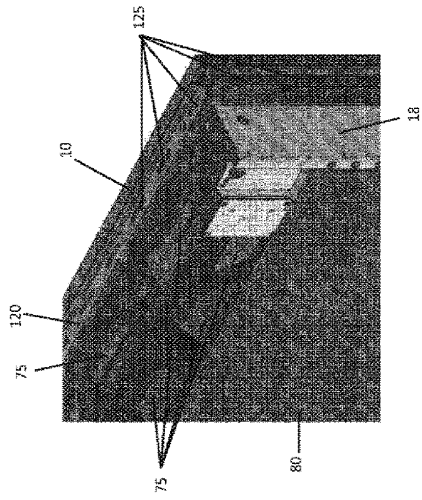
【図13C】



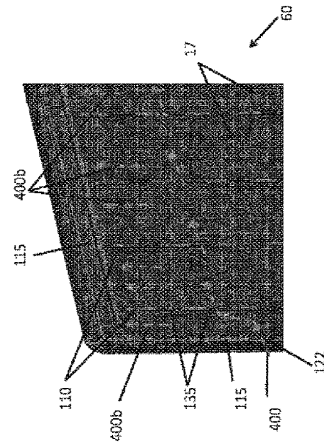
【図14】



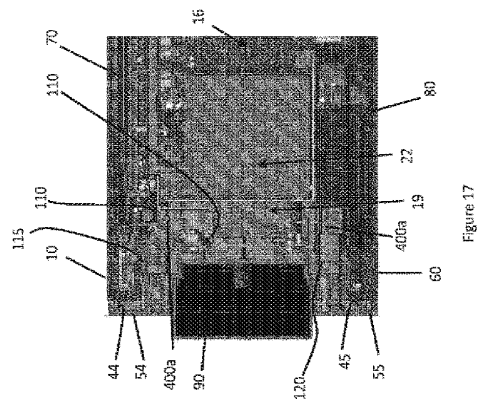
【図 15】



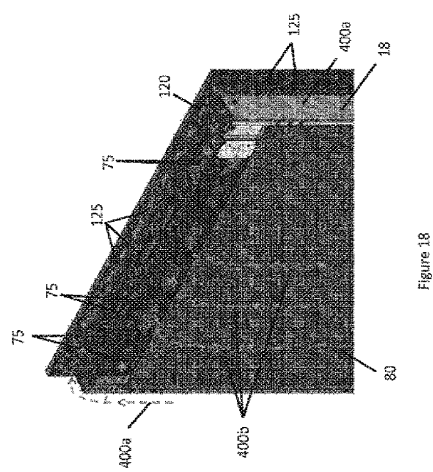
【図 16】



【図 17】



【図 18】



【図 19 A】

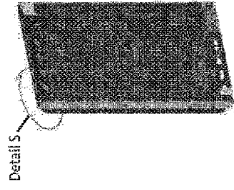


Figure 19A

【図 19 B】

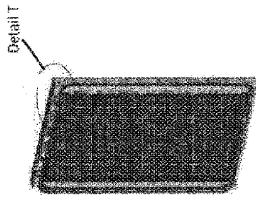


Figure 19B

【図 20】

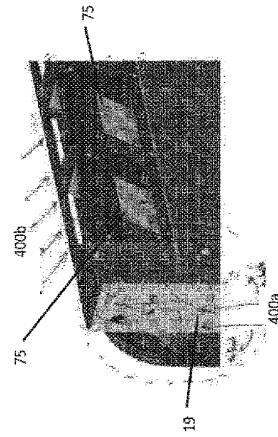


Figure 20

【図 21】

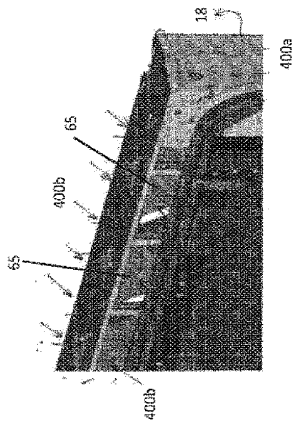


Figure 21

【図 22】

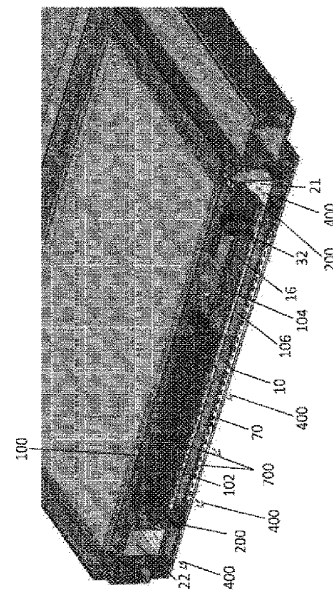


Figure 22

【図 2 3】

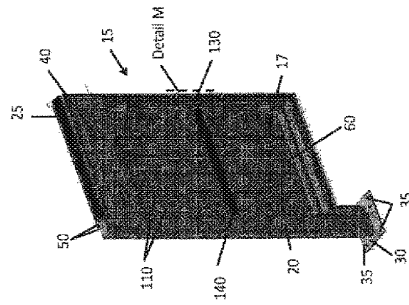


Figure 23

【図 2 4】

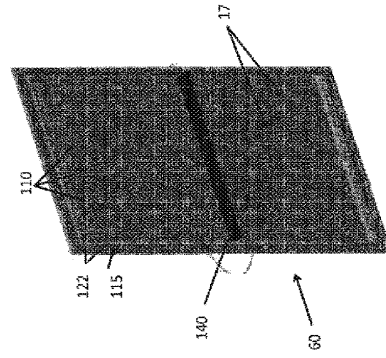


Figure 24

【図 2 5】

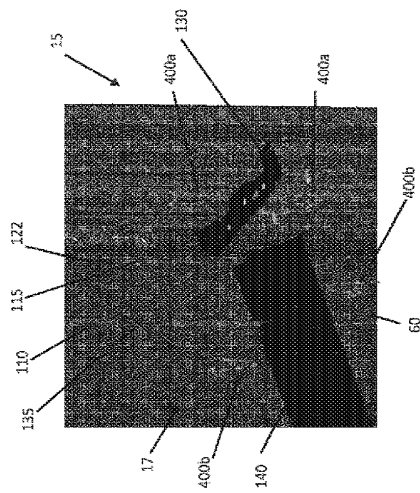


Figure 25

【図 2 6 A】

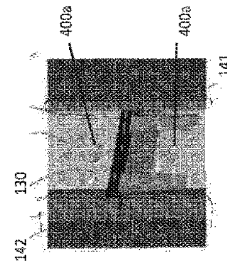


Figure 26A

【図 2 6 B】

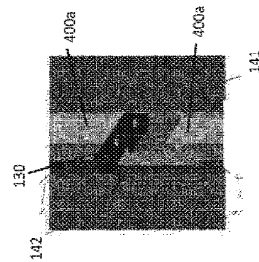


Figure 26B

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(74)代理人 100192533

弁理士 奈良 如紘

(72)発明者 ライアン・デマーズ

アメリカ合衆国 3 0 0 0 5 ジョージア、 アルファレッタ、 シロー・ロード・イースト 6
4 1 5

審査官 小野 博之

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(54) **SYSTEM FOR COOLING AN ELECTRONIC IMAGE ASSEMBLY**

SYSTEM ZUR KÜHLUNG EINER ELEKTRONISCHEN BILDGEBUNGSVORRICHTUNG

SYSTÈME DE REFROIDISSEMENT D'UN ENSEMBLE AFFICHAGE ÉLECTRONIQUE

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**

(30) Priority: **04.05.2010 US 331340 P**

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(73) Proprietor: **Manufacturing Resources
International, Inc.
Alpharetta, GA 30005 (US)**

(72) Inventors:
• **HUBBARD, Tim
Alpharetta
GA 30005 (US)**

• **DUNN, William
Alpharetta
GA 30005 (US)**

(74) Representative: **FRKelly
27 Clyde Road
Dublin D04 F838 (IE)**

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KR-A- 20060 016 469 KR-A- 20060 070 176
KR-B1- 100 666 961 US-A- 5 869 919
US-B1- 6 198 222 US-B2- 7 083 285**

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EP 2 567 283 B1

SEC et al. v. MRI
SEC Exhibit 1022.1470
IPR2023-00221

Description

Technical Field

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

Background of the Art

[0002] Improvements to electronic displays now allow them to be used in outdoor environments for informational, advertising, or entertainment purposes. While displays of the past were primarily designed for operation near room temperature, it is now desirable to have displays which are capable of withstanding large surrounding environmental temperature variations. For example, some displays are capable of operating at temperatures as low as -30°C (-22°F) and as high as 45°C (113°F) or higher. When surrounding temperatures rise, the cooling of the internal display components can become even more difficult.

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

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

[0005] Exemplary modern displays have found some effective means for cooling the displays including circulating a closed loop of gas around the display and drawing ambient gas through the display so that the closed loop of gas may be cooled (as well as portions of the electronic display). Various thermal communications have been discovered which can transfer heat away from the sensitive electronic components and out of the display. Heat exchangers were found to produce an excellent means for transferring heat between the closed loop of gas and the ambient gas. However, previous designs for moving the gas through the display have been found to generate an undesirable amount of noise emission from the display as well as thermal gradients where portions of the display were cooled but others remained warm.

[0006] The US 6 198 222 81 discloses a plasma display device comprising a plasma display panel having a front side and a rear side, the front side of the plasma display

panel being used for displaying images and a rectangular side frame comprising upper, lower, left and right bars over which the plasma display panel is vertically installed at a front end of the four bars of the side frame, and the front side of the plasma display panel is facing in the same direction as the front end of the side frame; a rear plate vertically installed in a rear end of the four bars of the side frame; a supporting rack installed inside the side frame between the plasma display panel and the rear plate comprising a horizontal top beam fixed at the upper bar of the side frame, a horizontal bottom beam fixed at the lower bar of the side frame, and a plurality of vertical columns mounted to the top beam at an upper end of each vertical column and to the bottom beam at a lower end of each vertical column so as to provide strong support, the rear side of the plasma display panel being fixed on a front end of at least one of the vertical columns; wherein vertical spaces between neighbouring vertical columns and between the vertical columns and the left and right sides of the side frame are used as heat dissipation channels for upwardly dissipating heat generated from the rear side of the plasma display panel away from the plasma display device.

[0007] The EP 1 647 766 A2 discloses an LED package having a metal substrate, an insulation sheet formed at an upper surface of the metal substrate, a plurality of electrode lines formed on the insulation sheet, LEDs electrically bonded to an upper surface of the plurality of electrode lines and arrayed in rows and lines and a plurality of striped protruders fixed at one surface thereof to a lower surface of the metal substrate, each spaced a predetermined distance apart and a guide member fixed to the other surface of the protruders a fan case encased therein with a fan for sucking air through a suction inlet and disposed at a lateral surface of the metal substrate and the guide member for circulating the sucked air through spaces of the protruders; a cooling unit for cooling air and for supplying the cooled air to the suction inlet of the fan case and a circulation pipe for supplying the air discharged from spaces among the plurality of protruders to the cooling unit.

[0008] The WO 2009/065125 A2 discloses an isolated gas cooling system. The gas cooling system is a closed loop which includes a first gas chamber comprising a transparent anterior plate and a second gas chamber comprising a cooling plenum. The first gas chamber is anterior to and coextensive with the viewable face of the electronic display. The transparent anterior plate may be set forward of the electronic display surface, defining the depth of the first gas chamber. A cooling chamber fan, or equivalent means, is located within the cooling plenum and is used to propel gas around the isolated gas cooling chamber loop.

[0009] 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

[0010] Exemplary embodiments use a combination of circulating gas and ambient gas in order to adequately cool an electronic display. Circulating gas is used to remove heat from the front of the image assembly. When using a LCD as the electronic image assembly, circulating gas may also be used to remove heat from the backlight cavity of the LCD. Because the gas is only circulating within the display, it can remain free of particulate and contaminates and will not harm the display.

[0011] 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.

[0012] In order to reduce noise emissions, the fans which drive the ambient and/or circulating gas through the heat exchanger may be placed within the heat exchanger, which can then act as a muffler and reduce the noise emitted by the fans. Further, if using the additional ambient gas pathway behind the image assembly, a manifold may be used to collect the ambient gas along an edge of the display and distribute this into a number of smaller flows. The fans for driving this additional ambient gas pathway can be placed within the manifold in order to reduce the noise emitted by the fans and provide an even distribution of ambient gas across the display.

[0013] 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.

[0014] 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

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

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

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

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

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

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

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

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

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

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).

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

Detailed Description

[0016] 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.

[0017] 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.

[0018] 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.

[0019] 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 to 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.

[0020] 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.

[0021] 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.

[0022] 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.

[0023] 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.

[0024] 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 antireflection 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.

[0025] 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.

[0026] 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).

[0027] Optionally, ambient gas 210 may also be ingested into the display through inlet aperture 24 (or a separate inlet aperture). Ambient gas 210 may then be directed through a first manifold 30 which travels along the edge of the display. The first manifold 30 accepts the single larger inlet flow of ambient gas 210 and distributes it into a plurality of smaller flows (channels 60) across the display. A second manifold 35 may be placed along the opposite edge of the display as the first manifold 30. The second manifold 35 accepts the plurality of smaller flows (channels 60) and combines them into a single flow and exhausts it out of the exit aperture 25 (or a separate exit aperture). In this embodiment, a manifold fan assembly

211 is used to draw the ambient gas 210 into the inlet aperture 24 and force the ambient gas 210 across the display. For this particular embodiment, the manifold fan assembly 211 is placed within the first manifold 30 and is used to draw the ambient gas 210 into the display as well as distribute the single flow into a plurality of smaller flows (channels 60). This is not required however, as some embodiments may place the manifold fan assembly 211 in the second manifold 35, or within both the first and second manifolds 30 and 35.

[0028] The first and second manifolds 30 and 35 may be placed along any opposing edges of the display. However, it is preferable that the first and second manifolds 30 and 35 are placed along the vertical edges of the display with the channels 60 travelling horizontally. Other embodiments may place the first and second manifolds 30 and 35 along the horizontal edges of the display with the channels 60 travelling vertically.

[0029] 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.

[0030] FIGURE 3 provides a perspective sectional view along the A-A section line shown in Figure 1B. Again, ambient gas 200 may be ingested into the display through the inlet aperture 24 and pass through a heat exchanger 45 and exit the display through the exit aperture 25. The ambient gas 200 may be drawn into the display and forced through the heat exchanger 45 using heat exchanger fan assembly 46. Obviously, the inlet aperture 24 may contain a filter or other coverings so that contaminants, insects, garbage, and/or water/fluids cannot easily be ingested into the display. However, an exemplary embodiment would not be damaged if the ambient gas 200 contained contaminants as they would only pass through the heat exchanger 45 which may not be susceptible to damage from particulate or contaminants. Exit aperture 25 may also contain some type of covering to ensure that contaminants and/or insects could not enter the display.

[0031] An electronic image assembly 50 may be placed behind the front plate 10. A plurality of channels 60 may be placed behind the electronic image assembly 50. Ambient gas 210 may be forced through the channels 60 after travelling through the first manifold 30 (not shown here). The flow of ambient gas 210 behind the electronic image assembly 50 may be used to remove any buildup of heat from the rear portion of the electronic image assembly 50. It may be preferable to have a thermally conductive surface/plate on the rear portion of the electronic image assembly 50 so that heat can easily transfer to this surface/plate and be removed by the ambient gas 210.

[0032] 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. Preferably, the channels 60 are metallic and even more preferably aluminum. Further, in an exemplary embodiment the channels 60 are in conductive thermal communication with the electronic image assembly 50.

[0033] 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. In this way, the heat exchanger 45 and the front channel 251 are placed in gaseous communication with each other.

[0034] 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.

[0035] Also shown in this sectional view is the path of the ambient gas 210 travelling down one of the channels 60 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. In other words, each channel 60 preferably has an inlet which is in gaseous communication with the first manifold 30 as well as an exit which is in gaseous communication with the second manifold 35. As shown in this Figure, the paths of the ambient gas 210 and the circulating gas 250 may 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 im-

age 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.

[0036] 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.

[0037] 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. Thus, an exemplary cross through plate 500 contains two gaseous pathways where the two pathways do not allow the gaseous matter to mix. Here, the first gas pathway would be 525 while the second gas pathway would be 550.

[0038] FIGURE 7 provides an exploded perspective view of one exemplary embodiment of the heat exchanger

er 45 and fan assembly 46. In this view, the fan assembly 46 is shown removed from its mounted position within the fan housing 51. In this embodiment, the heat exchanger 45 is divided into two portions 47 and 48 where the fan housing 51 is used to provide a gaseous communication between the two portions 47 and 48. Here, 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 reduced because the surrounding portions 47 and 48 of the heat exchanger 45 essentially act as a muffler for the fan assembly 46.

[0039] 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). As shown, the fan housing 51 may be used to connect two portions of a heat exchanger which may be of different lengths. As shown, portion 48 of the heat exchanger is thinner than the fan housing 51. In an alternative embodiment, both portions 48 and 47 may be thinner than the fan assembly 46 such that a fan housing 51 may be used to provide a sealed gaseous communication between the two portions, even though they are both thinner than the fan assembly 51. This design may be preferable when it is desirable to create the largest possible heat exchanger 45 (for maximum cooling abilities) even though space is limited. 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). Some exemplary embodiments may place fans within the heat exchanger 45 to drive both the ambient gas 200 and circulating gas 250.

[0040] 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).

[0041] 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).

[0042] 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.

[0043] 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).

[0044] 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 enclose the area between the LCD 300 and the backlight 320 in order to 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. In this way, the backlight cavity is placed in gaseous communication with the heat exchanger 45.

[0045] 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 through the front channel 251 (the area defined between the LCD 300 and front plate 10). Circulating fan assembly 255 may be placed so that it can draw circulating gas 350 through the backlight cavity as well as circulating gas 250 through the front channel 251. 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). In this way, both the front channel 251 and the backlight cavity are placed in gaseous communication with the heat exchanger 45.

[0046] Also shown in Figure 9 is the optional additional flow of ambient gas 210 which may travel immediately behind the electronic image assembly (in this embodiment 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.

[0047] 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 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 and the thermal communication between the channels 60 and the backlight 320 would be conductive thermal communication.

[0048] 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.

[0049] The circulating gases 250 and 350, ambient gas 200, and optional ambient gas 210 can be any number of gaseous matters. In some embodiments, air may be used as the gas for all. As well known by those of ordinary skill in the art, air typically contains some amount of water vapor. It should be noted that the use of the term 'gas' herein does not designate pure gas and that it is specifically contemplated that any of the gaseous matters described herein may contain some amount of impurities including but not limited to water vapor. Preferably, because the circulating gases 250 and 350 may travel in front of the image assembly and backlight respectively, they should be substantially clear, so that they will not affect the appearance of the image to a viewer. The circulating gases 250 and 350 should also preferably be substantially free of contaminants and/or particulate 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 200 and 210 from having contaminants as well. Filters may be used to help reduce the particulate within ambient gases 200 and 210. Filters could be placed near the inlet aperture 24 so that ambient gases 200 and/or 210 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 200 and 210 but this will not harm the display. In these embodiments, the heat exchanger 45, manifolds 30 and 35, channels 60, 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, ambient air may be ingested for the ambient gases 200 and 210, even if the ambient air contains contaminants or particulate. This can be particularly beneficial

when the display is used in outdoor environments or indoor environments where contaminants are present in the ambient air.

[0050] 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.

[0051] It is to be understood that the spirit and scope of the disclosed embodiments provides for the cooling of many types of electronic image assemblies. As used herein, the term 'electronic image assembly' is any electronic assembly for creating an image. At this time this, these are LCD (all types), light emitting diode (LED), organic light emitting diode (OLED), field emitting display (FED), light emitting polymer (LEP), organic electroluminescence (OEL), plasma displays, and any thin/flat 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 a concern.

[0052] 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.

[0053] 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 cooling an electronic image assembly with ambient gas, the system comprising:

a plurality of channels (60) placed behind the electronic image assembly (50), each channel

- having an inlet and exit;
 a first manifold (30) in gaseous communication with the inlet of each channel (60);
 a second manifold (35) in gaseous communication with the exit of each channel (60); and
 a manifold fan (211) positioned to force ambient gas through the channels (60);
 a circulating fan (255) positioned to force circulating gas in a closed loop;
 a transparent front plate (10) positioned in front of the electronic image assembly (50), the space between the transparent front plate (10) and the electronic image assembly (50) defining a front channel (251) for accepting the closed loop of circulating gases; and
 a cross through plate (500) having a first pathway (550) for circulating gas (250) travelling through the front channel (251) and a second pathway (550) for ambient gas (210) travelling through the plurality of channels (60) behind the electronic image assembly (50).
2. The cooling system of claim 1 wherein: the first (30) and second (35) manifolds are placed along a pair of vertical edges of the electronic image assembly (50).
 3. The cooling system of claim 1 wherein: the manifold fan (211) is placed within either the first or second manifold.
 4. The cooling system of any one of claims 1-3 wherein: the channels (60) are arranged in horizontal rows.
 5. The cooling system of any one of claims 1-3 wherein: the cooling channels (60) are metallic.
 6. The cooling system of any one of claims 1-3 wherein: the first (525) and second (550) gas pathways are substantially perpendicular.
 7. The cooling system of any one of claims 1-3 wherein: the first (525) and second (550) gas pathways do not allow the ambient gas and circulating gas to mix.
 8. The cooling system of claim 1 further comprising:
 - a heat exchanger (45) having first and second gas pathways;
 - a heat exchanger fan (46) placed to draw ambient gas (200) through the first gas pathway of the heat exchanger (45); and
 - wherein the circulating fan (255) is placed to draw circulating gas (250) through the front channel (251) and a second gas pathway of the heat exchanger (45).
 9. A system for cooling an electronic image assembly with ambient gas, the system comprising:
 - a plurality of channels (60) placed behind and in thermal communication with the electronic image assembly (50), each channel having an inlet and exit;
 - a first manifold (30) in gaseous communication with the inlet of each channel (60);
 - a second manifold (35) in gaseous communication with the exit of each channel (60);
 - a manifold fan (211) positioned to force ambient gas through the channels (60);
 - a transparent front plate (10) positioned in front of the electronic image assembly (50), the space between the transparent front plate (10) and the electronic image assembly (50) defining a front channel (251);
 - a heat exchanger (45) in gaseous communication with the front channel (251), the heat exchanger comprising two portions (48 and 47), each portion having first and second gas pathways, where the first gas pathways are in gaseous communication with inlet (24) and exit (25) apertures for ambient gas (200) and the second gas pathways are in gaseous communication with the front channel (251);
 - a heat exchanger fan assembly (46) placed between the two portions (48 and 47) of the heat exchanger (45) to force ambient gas (200) through the first gas pathways; and
 - a circulating gas fan assembly (255) positioned to force circulating gas (250) through a closed loop including the front channel (251) and the second gas pathways.
 10. The cooling system of claim 9 wherein: the heat exchanger (45) is comprised of corrugated layers.
 11. The cooling system of claim 9 wherein: the heat exchanger (45) is a cross-flow heat exchanger.
 12. The cooling system of any of claims 10-11 wherein: the ambient air is substantially prohibited from mixing with the circulating air.
 13. The cooling system of any of claims 10-11 further comprising:
 - a cross through plate (500) which accepts both the ambient gas and circulating gas without allowing the ambient gas to substantially mix with the circulating gas.
 14. The cooling system of any of claims 1-3 and 10-11 wherein: the electronic image assembly (50) is an LED backlit liquid crystal display where the channels (60) are in

thermal communication with the LED backlight.

Patentansprüche

1. System zum Kühlen einer elektronischen Bildanordnung mit Umgebungsgas, wobei das System Folgendes umfasst:

eine Vielzahl von Kanälen (60), die hinter der elektronischen Bildanordnung (50) platziert sind, wobei jeder Kanal einen Einlass und einen Austritt aufweist;
einen ersten Verteiler (30) in Gasverbindung mit dem Einlass jedes Kanals (60);
einen zweiten Verteiler (35) in Gasverbindung mit dem Austritt jedes Kanals (60); und
ein Verteilergebläse (211), das positioniert ist, um Umgebungsgas durch die Kanäle (60) zu blasen;
ein Umwälzgebläse (255), das positioniert ist, um Umwälzgas in einer geschlossenen Schleife zu blasen;
eine durchsichtige Frontplatte (10), die vor der elektronischen Bildanordnung (50) positioniert ist, wobei der Zwischenraum zwischen der durchsichtigen Frontplatte (10) und der elektronischen Bildanordnung (50) einen vorderen Kanal (251) zum Aufnehmen der geschlossenen Schleife von Umwälzgasen definiert; und
eine quer verlaufende Durchgangsplatte (500) mit einem ersten Durchgang (550) für sich durch den vorderen Kanal (251) bewegendes Umwälzgas (250) und einem zweiten Durchgang (550) für sich durch die Vielzahl von Kanälen (60) hinter der elektronischen Bildanordnung (50) bewegendes Umgebungsgas (210).

2. Kühltssystem nach Anspruch 1, wobei: der erste (30) und der zweite (35) Verteiler entlang eines Paares vertikaler Ränder der elektronischen Bildanordnung (50) platziert sind.
3. Kühltssystem nach Anspruch 1, wobei: das Verteilergebläse (211) innerhalb entweder des ersten oder des zweiten Verteilers platziert ist.
4. Kühltssystem nach einem der Ansprüche 1-3, wobei: die Kanäle (60) in horizontalen Reihen angeordnet sind.
5. Kühltssystem nach einem der Ansprüche 1-3, wobei: die Kühlkanäle (60) aus Metall sind.
6. Kühltssystem nach einem der Ansprüche 1-3, wobei: der erste (525) und der zweite (550) Gasdurchgang im Wesentlichen senkrecht zueinander sind.

7. Kühltssystem nach einem der Ansprüche 1-3, wobei: der erste (525) und der zweite (550) Gasdurchgang nicht zulassen, dass sich das Umgebungsgas und das Umwälzgas vermischen.

8. Kühltssystem nach Anspruch 1, das weiter Folgendes umfasst:

einen Wärmetauscher (45) mit einem ersten und einem zweiten Gasdurchgang;
ein Wärmetauschergebläse (46), das platziert ist, um Umgebungsgas (200) durch den ersten Gasdurchgang des Wärmetauschers (45) zu saugen; und
wobei das Umwälzgebläse (255) platziert ist, um Umwälzgas (250) durch den vorderen Kanal (251) und einen zweiten Gasdurchgang des Wärmetauschers (45) zu saugen.

9. System zum Kühlen einer elektronischen Bildanordnung mit Umgebungsgas, wobei das System Folgendes umfasst:

eine Vielzahl von Kanälen (60), die hinter und in thermischer Verbindung mit der elektronischen Bildanordnung (50) platziert sind, wobei jeder Kanal einen Einlass und einen Austritt aufweist;
einen ersten Verteiler (30) in Gasverbindung mit dem Einlass jedes Kanals (60);
einen zweiten Verteiler (35) in Gasverbindung mit dem Austritt jedes Kanals (60);
ein Verteilergebläse (211), das positioniert ist, um Umgebungsgas durch die Kanäle (60) zu blasen;
eine durchsichtige Frontplatte (10), die vor der elektronischen Bildanordnung (50) positioniert ist, wobei der Zwischenraum zwischen der durchsichtigen Frontplatte (10) und der elektronischen Bildanordnung (50) einen vorderen Kanal (251) definiert; und
einen Wärmetauscher (45) in Gasverbindung mit dem vorderen Kanal (251), wobei der Wärmetauscher zwei Abschnitte (48 und 47) umfasst, wobei jeder Abschnitt erste und zweite Gasdurchgänge aufweist, wobei die ersten Gasdurchgänge in Gasverbindung mit Einlassöffnungen (24) und Austrittsöffnungen (25) für Umgebungsgas (200) stehen und die zweiten Gasdurchgänge in Gasverbindung mit dem vorderen Kanal (251) stehen;
eine Wärmetauscher-Gebläseanordnung (46), die zwischen den zwei Abschnitten (48 und 47) des Wärmetauschers (45) platziert ist, um Umgebungsgas (200) durch die ersten Gasdurchgänge zu blasen; und
eine Umwälzgas-Gebläseanordnung (255), die positioniert ist, um Umwälzgas (250) durch eine

geschlossene Schleife zu blasen, die den vorderen Kanal (251) und die zweiten Gasdurchgänge umfasst.

10. Kühltssystem nach Anspruch 9, wobei:
der Wärmetauscher (45) aus gewellten Schichten besteht. 5
11. Kühltssystem nach Anspruch 9, wobei:
es sich bei dem Wärmetauscher (45) um einen Querstromwärmetauscher handelt. 10
12. Kühltssystem nach einem der Ansprüche 10-11, wobei:
die Umgebungsluft im Wesentlichen daran gehindert wird, sich mit der Umwälzlufte zu vermischen. 15
13. Kühltssystem nach einem der Ansprüche 10-11, das weiter Folgendes umfasst:
eine querlaufende Durchgangsplatte (500), die sowohl das Umgebungsgas als auch das Umwälzgas aufnimmt, ohne zuzulassen, dass sich das Umgebungsgas wesentlich mit dem Umwälzgas vermischt. 20
14. Kühltssystem nach einem der Ansprüche 1-3 und 10-11, wobei:
es sich bei der elektronischen Bildanordnung (50) um eine Flüssigkristall-Anzeigevorrichtung mit LED-Hintergrundbeleuchtung handelt, bei der die Kanäle (60) in thermischer Verbindung mit der LED-Hintergrundbeleuchtung stehen. 25

Revendications 35

1. Système servant à refroidir un ensemble d'image électronique au moyen d'un gaz ambiant, le système comportant :
une pluralité de canaux (60) placés derrière l'ensemble d'image électronique (50), chaque canal ayant une entrée et une sortie ;
un premier collecteur (30) en communication gazeuse avec l'entrée de chaque canal (60) ;
un deuxième collecteur (35) en communication gazeuse avec la sortie de chaque canal (60) ; et
un ventilateur de collecteur (211) positionné pour forcer du gaz ambiant au travers des canaux (60) ;
un ventilateur de circulation (255) positionné pour forcer du gaz circulant dans une boucle fermée ;
une plaque avant transparente (10) positionnée devant l'ensemble d'image électronique (50),
l'espace entre la plaque avant transparente (10) et l'ensemble d'image électronique (50) définissant un canal avant (251) servant à accepter la 40

boucle fermée des gaz circulants ; et
une plaque traversante transversale (500) ayant une première voie de passage (550) pour du gaz circulant (250) avançant au travers du canal avant (251) et une deuxième voie de passage (550) pour du gaz ambiant (210) avançant au travers de la pluralité de canaux (60) derrière l'ensemble d'image électronique (50).

2. Système de refroidissement selon la revendication 1, dans lequel :
les premier (30) et deuxième (35) collecteurs sont placés le long d'une paire de bords verticaux de l'ensemble d'image électronique (50). 15
3. Système de refroidissement selon la revendication 1, dans lequel :
le ventilateur de collecteur (211) est placé à l'intérieur de soit le premier soit le deuxième collecteur. 20
4. Système de refroidissement selon l'une quelconque des revendications 1 à 3, dans lequel :
les canaux (60) sont agencés en rangées horizontales. 25
5. Système de refroidissement selon l'une quelconque des revendications 1 à 3, dans lequel :
les canaux de refroidissement (60) sont métalliques. 30
6. Système de refroidissement selon l'une quelconque des revendications 1 à 3, dans lequel :
les premières (525) et deuxième (550) voies de passage de gaz sont sensiblement perpendiculaires. 35
7. Système de refroidissement selon l'une quelconque des revendications 1 à 3, dans lequel :
les premières (525) et deuxième (550) voies de passage de gaz ne laissent pas le gaz ambiant et le gaz circulant se mélanger. 40
8. Système de refroidissement selon la revendication 1, comportant par ailleurs :
un échangeur de chaleur (45) ayant des première et deuxième voies de passage de gaz ;
un ventilateur d'échangeur de chaleur (46) placé pour aspirer du gaz ambiant (200) au travers de la première voie de passage de gaz de l'échangeur de chaleur (45) ; et
dans lequel le ventilateur circulant (255) est placé pour aspirer le gaz circulant (250) au travers du canal avant (251) et d'une deuxième voie de passage de gaz de l'échangeur de chaleur (45). 45
9. Système servant à refroidir un ensemble d'image électronique au moyen d'un gaz ambiant, le système comportant : 50

une pluralité de canaux (60) placés derrière, et en communication thermique avec, l'ensemble d'image électronique (50), chaque canal ayant une entrée et une sortie ;
 un premier collecteur (30) en communication gazeuse avec l'entrée de chaque canal (60) ;
 un deuxième collecteur (35) en communication gazeuse avec la sortie de chaque canal (60) ;
 un ventilateur de collecteur (211) positionné pour forcer du gaz ambiant au travers des canaux (60) ;
 une plaque avant transparente (10) positionnée devant l'ensemble d'image électronique (50), l'espace entre la plaque avant transparente (10) et l'ensemble d'image électronique (50) définissant un canal avant (251) ;
 un échangeur de chaleur (45) en communication gazeuse avec le canal avant (251), l'échangeur de chaleur comportant deux parties (48 et 47), chaque partie ayant des premières et deuxièmes voies de passage de gaz, dans lequel les premières voies de passage de gaz sont en communication gazeuse avec les ouvertures d'entrée (24) et de sortie (25) pour le gaz ambiant (200) et les deuxièmes voies de passage de gaz sont en communication gazeuse avec le canal avant (251) ;
 un ensemble formant ventilateur d'échangeur de chaleur (46) placé entre les deux parties (48 et 47) de l'échangeur de chaleur (45) pour forcer du gaz ambiant (200) au travers des premières voies de passage de gaz ; et
 un ensemble formant ventilateur de gaz circulant (255) positionné pour forcer du gaz circulant (250) au travers d'une boucle fermée comprenant le canal avant (251) et les deuxièmes voies de passage de gaz.

10. Système de refroidissement selon la revendication 9, dans lequel :
 l'échangeur de chaleur (45) est constitué de couches ondulées.
11. Système de refroidissement selon la revendication 9, dans lequel :
 l'échangeur de chaleur (45) est un échangeur de chaleur à courants croisés.
12. Système de refroidissement selon l'une quelconque des revendications 10 à 11, dans lequel :
 l'air ambiant est sensiblement prohibé contre tout mélange avec l'air circulant.
13. Système de refroidissement selon l'une quelconque des revendications 10 à 11, comportant par ailleurs :
 une plaque traversante transversale (500) qui accepte à la fois le gaz ambiant et le gaz circulant sans permettre au gaz ambiant de se mélanger sensible-

ment avec le gaz circulant.

14. Système de refroidissement selon l'une quelconque des revendications 1 à 3 et des revendications 10 à 11, dans lequel :
 l'ensemble d'image électronique (50) est un affichage à cristaux liquides à rétroéclairage par diodes électroluminescentes dans lequel les canaux (60) sont en communication thermique avec le rétroéclairage par diodes électroluminescentes.

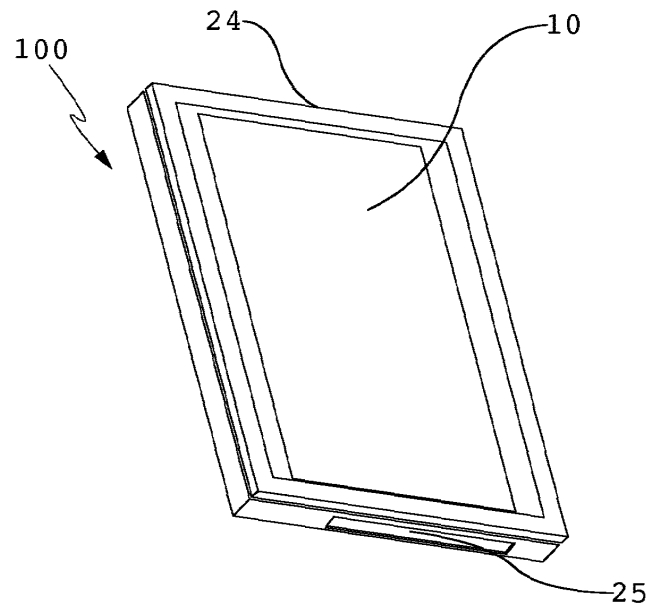


FIG - 1A

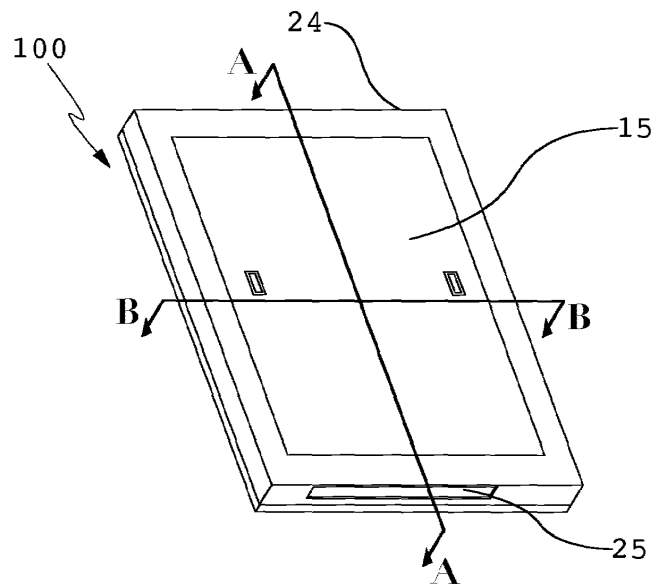


FIG - 1B

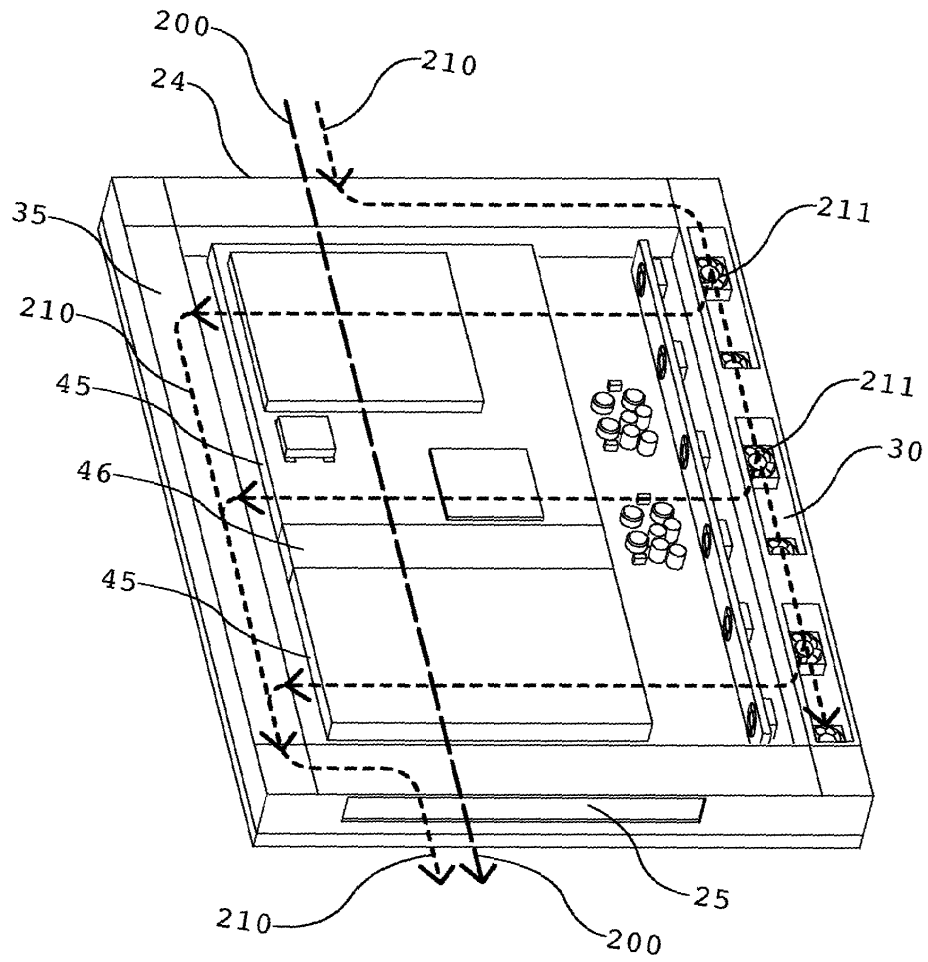


FIG - 2

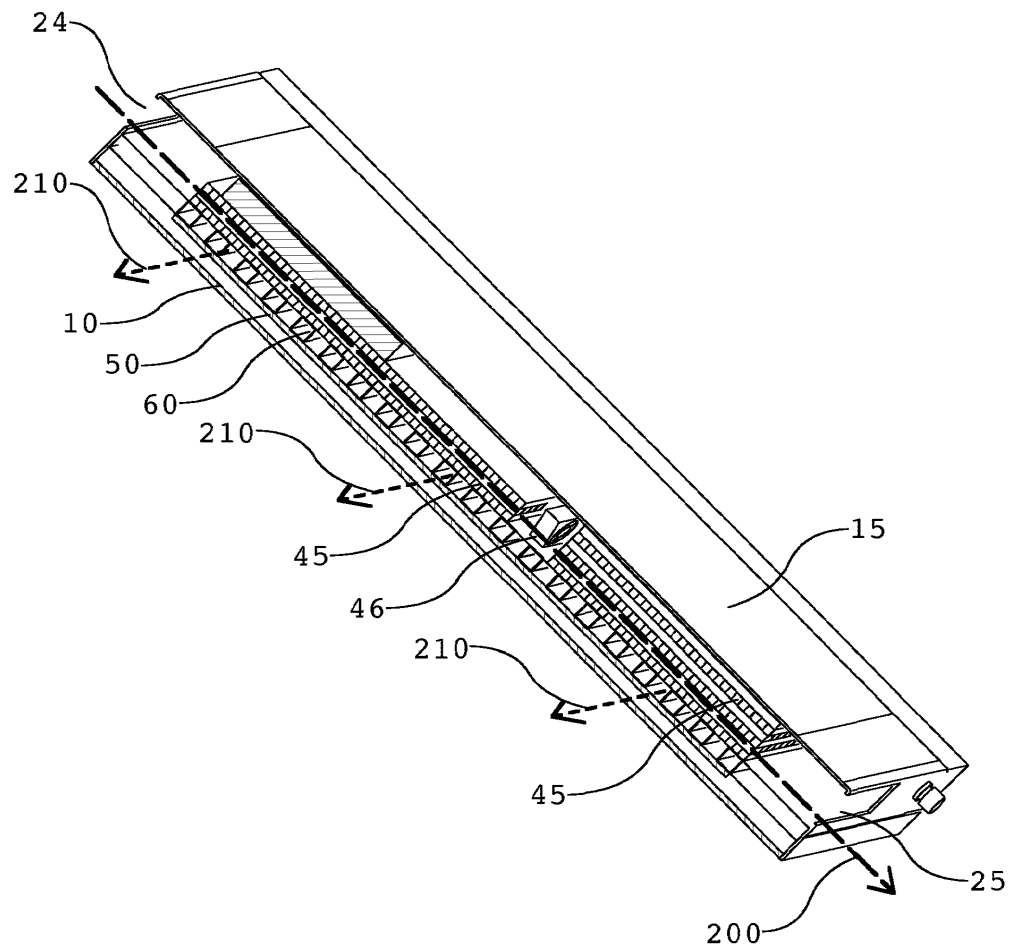


FIG - 3

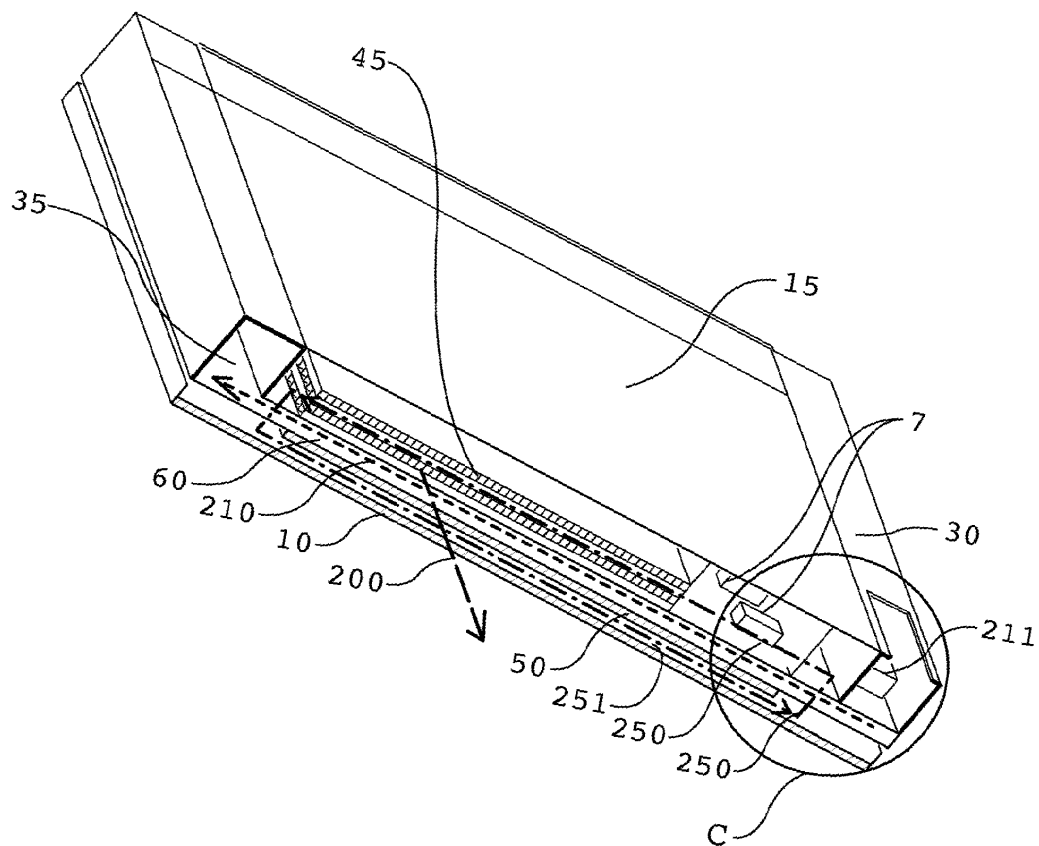


FIG - 4

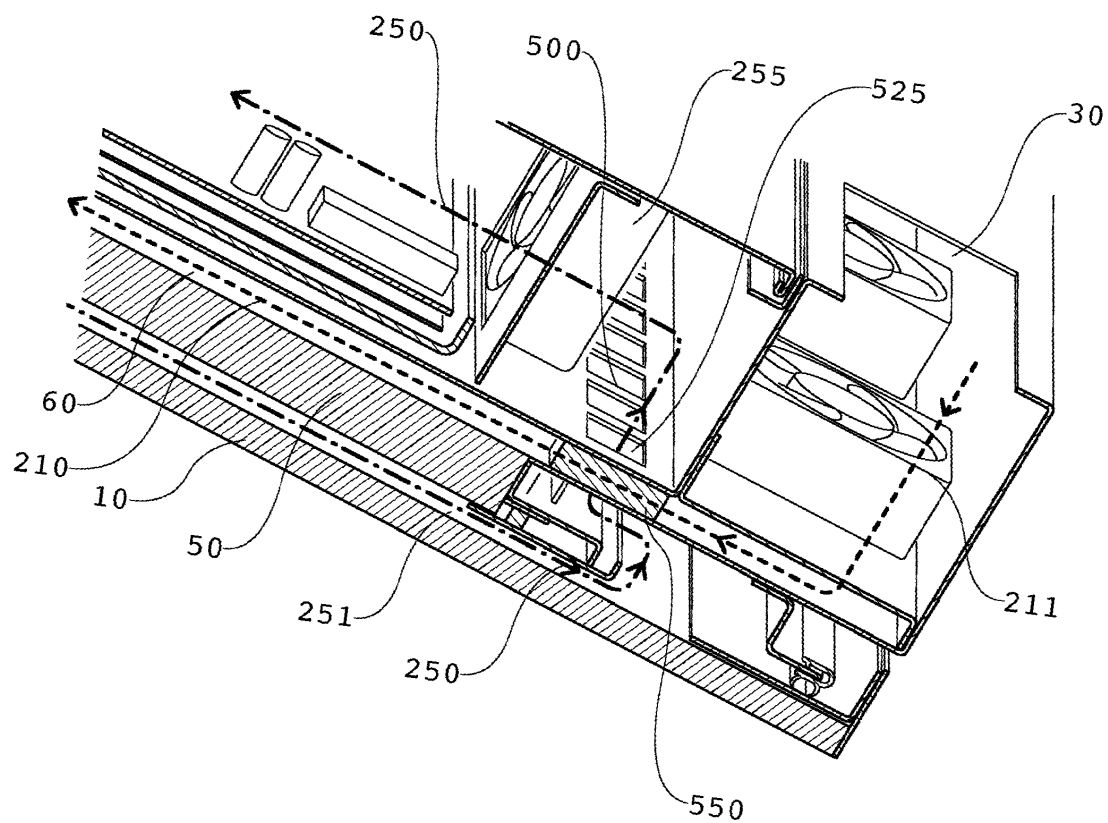


FIG - 5

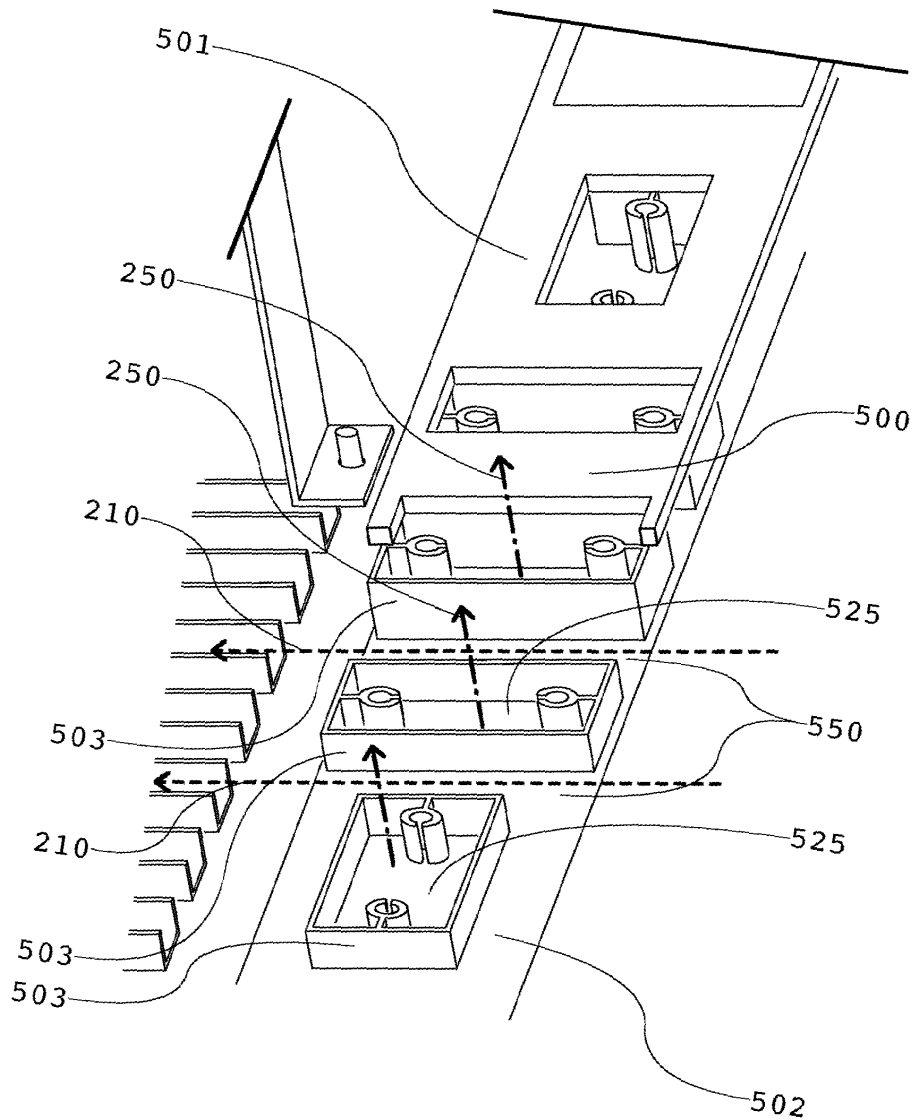


FIG - 6

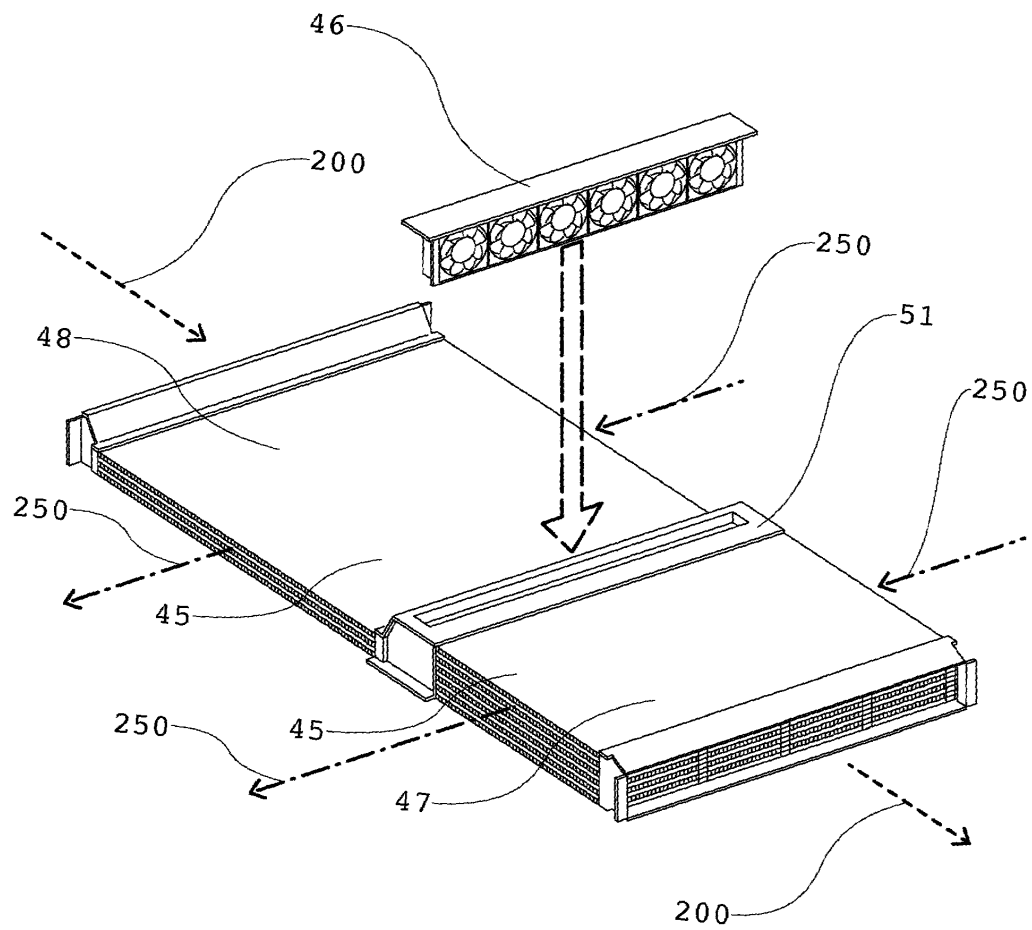


FIG - 7

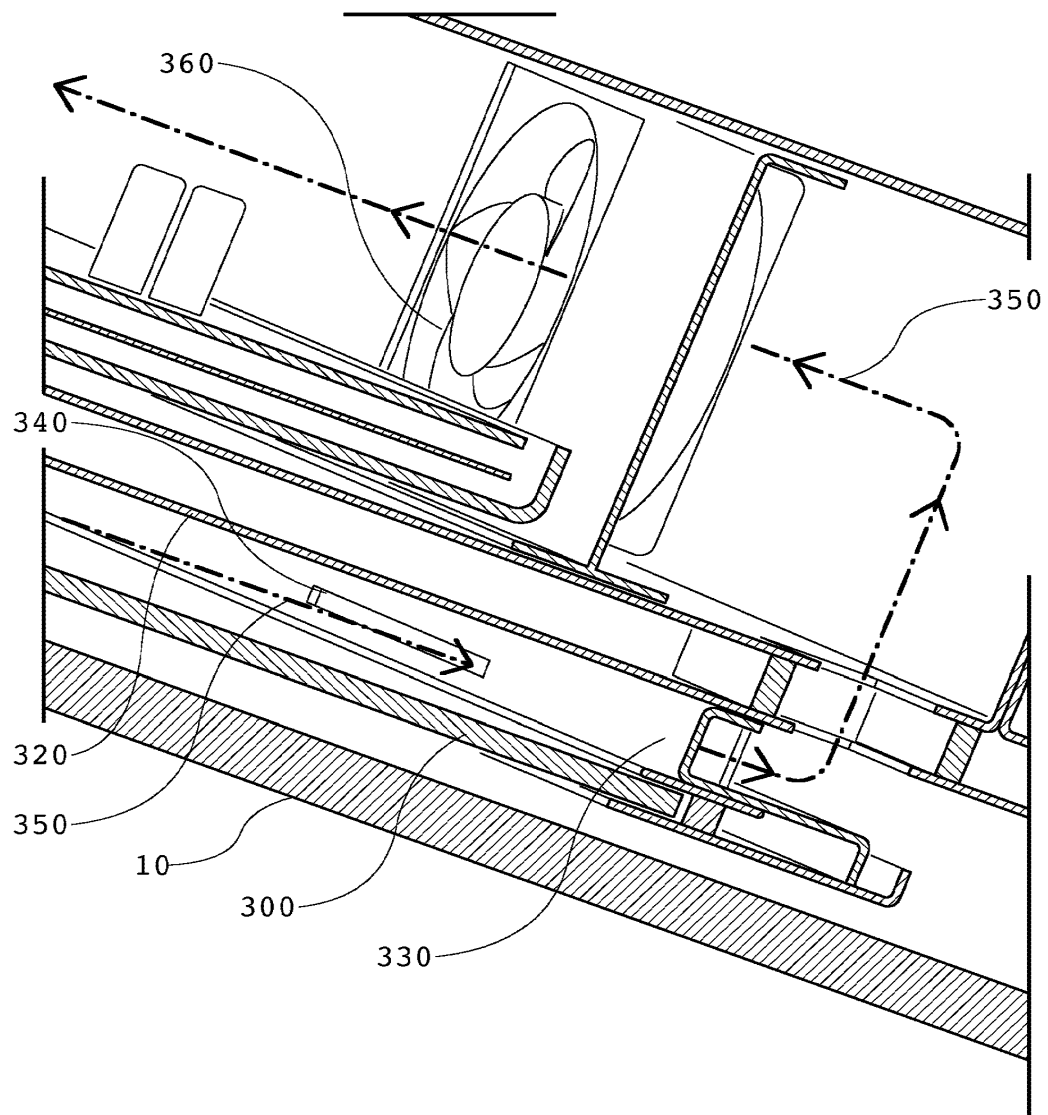


FIG - 8

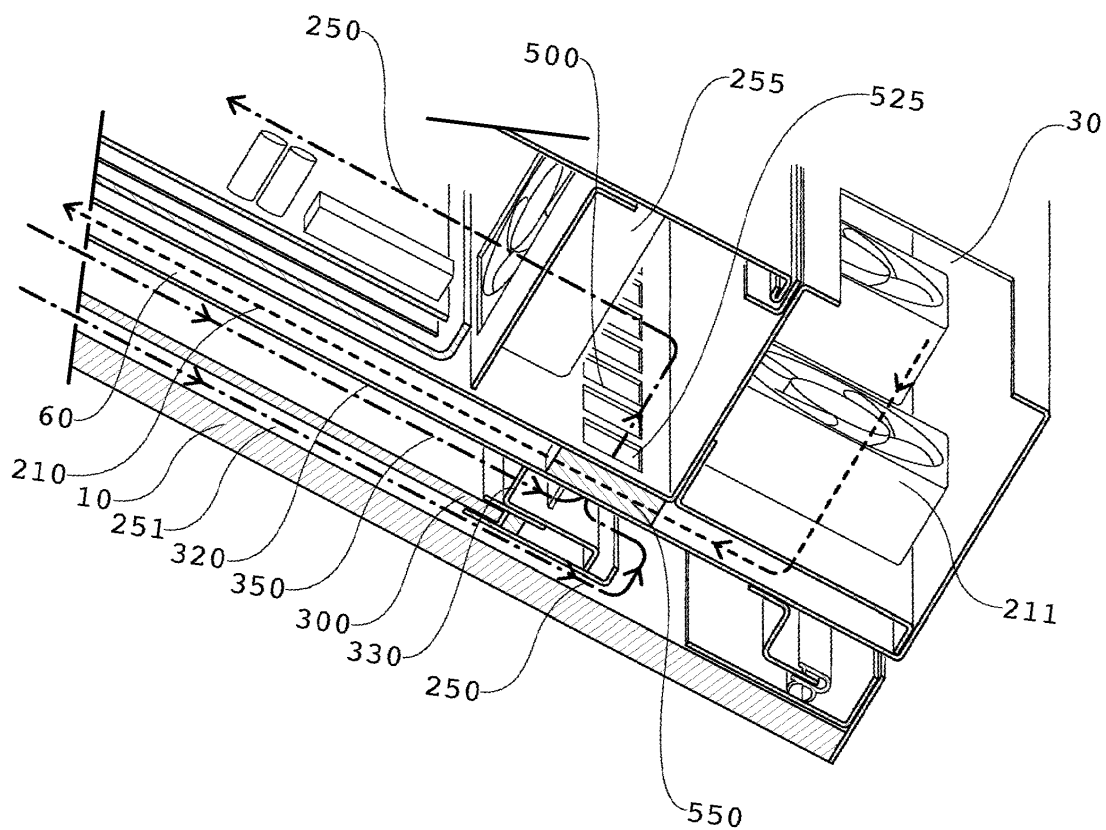


FIG - 9

REFERENCES CITED IN THE DESCRIPTION

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- WO 2009065125 A2 [0008]



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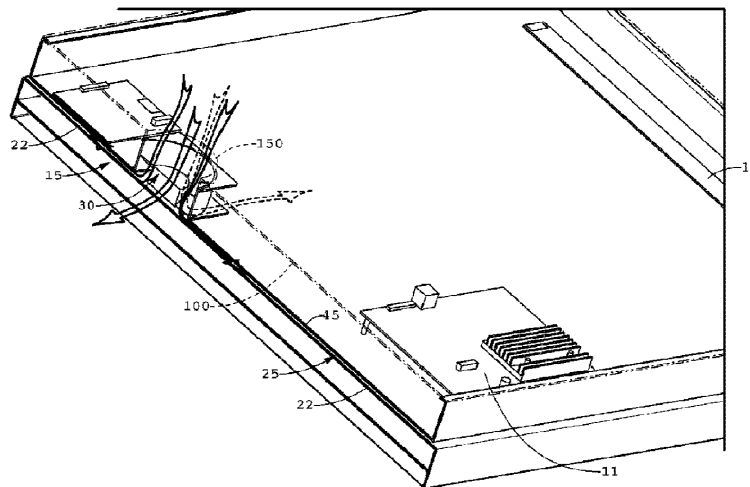
(72) Inventeurs/Inventors:
DUNN, WILLIAM, US;
BROWN, MIKE, US;
HUBBARD, TIM, US

(73) Propriétaire/Owner:
MANUFACTURING RESOURCES INTERNATIONAL,
INC., US

(74) Agent: MLT AIKINS LLP

(54) Titre : ENSEMBLE DE REFROIDISSEMENT DE PANNEAU DE PLAQUE ARRIERE D'UN AFFICHAGE
ELECTRIQUE

(54) Title: BACK PAN COOLING ASSEMBLY FOR ELECTRONIC DISPLAY



(57) Abrégé/Abstract:

Exemplary embodiments disclosed herein provide a back pan cooling assembly for an electronic display having a rear pan. A cooling back pan is preferably positioned behind the rear pan, the space between the cooling back pan and the rear pan defining a gap. A fan is positioned to cause a flow of ambient air through the gap. An electronic component for driving the electronic display may be placed in conductive thermal communication with the cooling back pan. A rear cover can be placed against the cooling back pan to define a sealed compartment which does not permit ambient air to enter. A port can be provided within the rear cover which allows ambient air to travel between the surroundings, the fan, and the gap.

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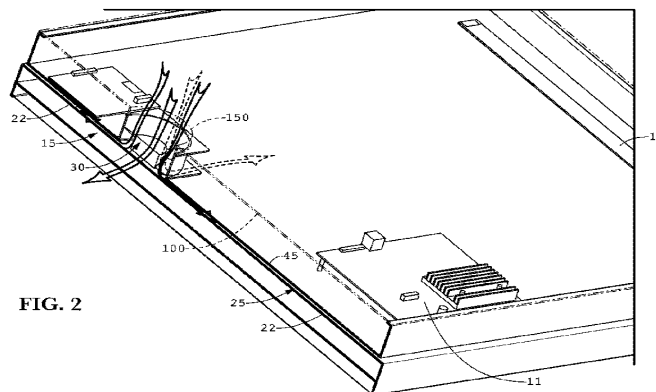
AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

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(54) Title: BACK PAN COOLING ASSEMBLY FOR ELECTRIC DISPLAY



(57) Abstract: Exemplary embodiments disclosed herein provide a back pan cooling assembly for an electronic display having a rear pan. A cooling back pan is preferably positioned behind the rear pan, the space between the cooling back pan and the rear pan defining a gap. A fan is positioned to cause a flow of ambient air through the gap. An electronic component for driving the electronic display may be placed in conductive thermal communication with the cooling back pan. A rear cover can be placed against the cooling back pan to define a sealed compartment which does not permit ambient air to enter. A port can be provided within the rear cover which allows ambient air to travel between the surroundings, the fan, and the gap.

WO 2014/062815 A1

Back Pan Cooling Assembly for Electronic Display

Inventors: William Dunn, Mike Brown, and Tim Hubbard

Cross-Reference to Related Applications

[0001] This application claims priority to US Application No. 61/714,381 filed on October 16, 2012.

Technical Field

[0002] Embodiments generally relate to a cooling assembly for the back pan of an electronic display.

Background of the Art

[0003] Electronic displays are now being used for a variety of applications, in addition to the traditional in-home viewing applications. It is now desirable for electronic displays to be used as restaurant menu boards, advertising, and general informational purposes. Each application may require a different set of electronic assemblies, in order to drive the electronic display and provide any ancillary services related to the electronic display and its purpose. Electronic displays are typically manufactured in standard sizes, shapes, and with standard electronic components.

Summary of the Exemplary Embodiments

[0004] One exemplary embodiment provides a cooling back pan that is positioned behind the rear pan of an electronic display, where the space between the cooling back pan and the rear pan defines a gap. A fan is preferably positioned so as to cause a flow of ambient air through the gap, cooling the rear pan and the cooling back pan. Electronic components for operating the electronic display can be mounted to the cooling back pan and preferably are placed in conductive thermal communication with the cooling back pan.

[0005] In an aspect, there is provided a back pan cooling assembly for an electronic display having a rear pan, the assembly comprising a cooling back pan having a front

surface and a rear surface, wherein the cooling back pan is positioned behind the rear pan. A gap is located between the cooling back pan and the rear pan. A fan is positioned to cause ambient air to flow through the gap. A rear cover is positioned on the cooling back pan to define a rear compartment formed between the cooling back pan and the rear cover which is substantially sealed to prevent ambient air from entering the rear compartment. A power supply or microprocessor for driving the electronic display is placed on the rear surface of the cooling back pan, within the rear compartment, and in conductive thermal communication with the cooling back pan.

[0006] In another aspect, there is provided a back pan cooling assembly for an electronic display having a rear pan. The assembly comprises a cooling back pan having a front surface and a rear surface, wherein said cooling back pan is positioned behind the rear pan. A gap is located between the cooling back pan and the rear pan. A rear cover is positioned behind the rear surface of the cooling back pan to define a rear compartment formed between the cooling back pan and the rear cover, wherein the rear compartment is sealed to prevent ambient air from entering the rear compartment. An electronic component for driving the electronic display is placed at the rear surface of the cooling back pan within the sealed rear compartment and in conductive thermal communication with the cooling back pan. A port is provided to accept ambient air. An open loop gaseous pathway is defined by gaseous communication between the port and the gap. A fan is positioned to cause ambient air to flow through the open loop gaseous pathway.

[0007] In another aspect, there is provided a back pan cooling assembly for an electronic display having a rear pan with a pair of vertical edges and a pair of horizontal edges. The assembly comprises a cooling back pan having a pair of vertical edges substantially aligned with the vertical edges of the rear pan and a pair of horizontal edges which are substantially aligned with the horizontal edges of the rear pan. A gap is defined between the cooling back pan and rear pan which extends to each horizontal edge to define a pair of horizontal edge gaps and to each vertical edge to define a pair of vertical edge gaps. A fan is to be positioned to cause ambient air to flow through the vertical edge gaps and the horizontal edge gaps. A rear cover is positioned behind the cooling back pan to define a rear compartment formed between the cooling back pan

and the rear cover, wherein the rear compartment is sealed to prevent ambient air from entering the rear compartment. A power supply or microprocessor for driving the electronic display is placed at the rear of the cooling back pan within the rear compartment and in conductive thermal communication with the cooling back pan.

[0008] The foregoing and other features and advantages of the present invention will be apparent from the following more detailed description of the particular embodiments, as illustrated in the accompanying drawings.

Brief Description of the Drawings

[0009] 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:

[0010] FIGURE 1 is a rear perspective view of an exemplary back pan cooling assembly.

[0011] FIGURE 2 is a sectional view of the embodiment shown in Figure 1.

Detailed Description

[0012] 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.

[0013] 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.

[0014] Embodiments of the invention are described herein with reference to 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.

[0015] 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.

[0016] **FIGURE 1** is a rear perspective view of an exemplary back pan cooling assembly where the rear cover 100 has been removed. An electronic display 15 is provided on the bottom with an exemplary cooling back pan 45 positioned on the top. The electronic display 15 contains a rear pan 22 on the rear surface of the electronic display 15 (i.e. on the side opposing an intended observer). The rear pan 22 is often a component in mass-manufactured electronic displays and typically provides mounts for electronic subassemblies or housings to go with the electronic display. In some embodiments, the rear pan 22 is metallic. As used herein, the term 'rear pan' does not require that the pan is actually the one that came with the originally mass-manufactured display, as this component may be upgraded from its originally mass-manufactured form by downstream manufacturers.

[0017] Here, electronic components 10 and 11 for driving the electronic display 15 are fastened to the cooling back pan 45. In an exemplary embodiment, the electronic components 10 and 11 may be placed in conductive thermal communication with the

cooling back pan 22. The electronic components 10 and 11 may contain any one of the following: timing and control boards (TCON), power supplies, video cards/drivers/players, input/output interfaces, antennas, wireless receivers, modems, local electronic storage, and CPU/microprocessors.

[0018] The space between the rear pan 22 and the exemplary cooling back pan 45 defines an air gap 25. The fan 30 is positioned so as to cause a flow of ambient cooling air through the gap 25, in order to cool both the rear pan 22 and the cooling back pan 45. The fan 30 preferably draws ambient air from around the display housing, without letting the air enter other portions of the display housing, especially the portions of the cooling back pan 45 which contain the electronic components 10 and 11 (i.e. the portions sealed off between the cooling back pan 45 and the rear cover 100). In other words, the fan 30 is preferably placed in sealed gaseous communication with the surrounding ambient air and the gap 25 such that ambient air can pass through the fan 30 and gap 25 without entering the area sealed by the cooling back pan 45 and rear cover 100.

[0019] In at least one embodiment, a port 150 is provided which provides sealed gaseous communication between the ambient air surrounding the display housing and the fan 30. Once forced through the gap 25, the cooling air can exit any portion of the perimeter of the rear pan 22 and cooling back pan 45 assemblies, and eventually is exhausted out of the edges of the display housing. In other words, the gap 25 preferably extends to all four edges of the display housing and allows ambient air to enter/exit the gap 25 along all four edges of the rear pan 22 and cooling back pan 45.

[0020] FIGURE 2 is a sectional view of the embodiment shown in Figure 1.

[0021] As can be observed, the cooling back pan 45 can be used to mount any number of specialized electrical components 10 and 11 which may be required for the end-use of any electronic display. At the same time, the cooling back pan 45 can help remove heat from the electronic components 10 and 11 as well as the rear pan 22, without exposing the sensitive components to ambient air (which may contain dirt, dust, or contaminants).

[0022] It should be noted that although a single fan 30 is shown, this is not required by any embodiment as there can be multiple fans positioned on the cooling back pan 45

in other embodiments. Also, although an exemplary embodiment uses the fan 30 to push the cooling air into the gap 25, alternative embodiments could also be used to draw air from the edges of the display housing, through the gap 25, and exhaust the air through the port 150. It should also be noted that additional fans may be positioned within the cooling back pan 45 in order to circulate air around the interior of the cooling back pan 45, without mixing with the ambient air.

[0023] It should also be noted that it is preferable to place the fan 30 near the center of the cooling back pan 45, although this is not required. It may be preferable in some instances to place the fan 30 closer to the horizontal top edge of the cooling back pan 45 (as shown in Figure 2), as the heat generated by the display assembly tends to rise where additional flow rates of cooling air would be beneficial in this area. In most cases, if using only one fan 30, it may be preferable to place the fan near the vertically-drawn centerline of the cooling back pan 45.

[0024] As used herein, the term 'electronic display' is any electronic assembly for generating an image to a viewer. The term specifically includes, but is not limited to: liquid crystal displays (all types), OLED, light emitting diode (LED), field emitting display (FED), light emitting polymer (LEP), organic electro luminescence (OEL), plasma displays, and any other type of thin/flat panel display. In an exemplary embodiment, the electronic display 15 comprises an LED edge lit LCD display where the LED backlight is placed in conductive thermal communication with the rear pan 22. In another exemplary embodiment, the electronic display 15 comprises an LED direct backlit LCD display where the rear pan 22 is provided as the rear surface of the direct LED backlight.

[0025] 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. 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

We claim:

1. A back pan cooling assembly for an electronic display having a rear pan, the assembly comprising:
 - a cooling back pan having a front surface and a rear surface, wherein said cooling back pan is positioned behind the rear pan;
 - a gap located between the cooling back pan and the rear pan;
 - a fan positioned to cause ambient air to flow through the gap;
 - a rear cover positioned on the cooling back pan to define a rear compartment formed between the cooling back pan and the rear cover which is substantially sealed to prevent ambient air from entering the rear compartment; and
 - a power supply or microprocessor for driving the electronic display, placed on the rear surface of the cooling back pan, within the rear compartment, and in conductive thermal communication with the cooling back pan.
2. The cooling assembly of claim 1 wherein:
 - the fan is sealed within the cooling back pan such that ambient air is not permitted to contact the power supply or microprocessor.
3. The cooling assembly of claim 1 wherein:
 - the electronic display is in conductive thermal communication with the rear pan.
4. The cooling assembly of claim 1 further comprising:
 - an LED backlight within the electronic display and placed in thermal communication with the rear pan.
5. The cooling assembly of claim 1 wherein:
 - the rear pan and cooling back pan each contain four perimeter edges which are substantially aligned with one another.