

FIG. 4

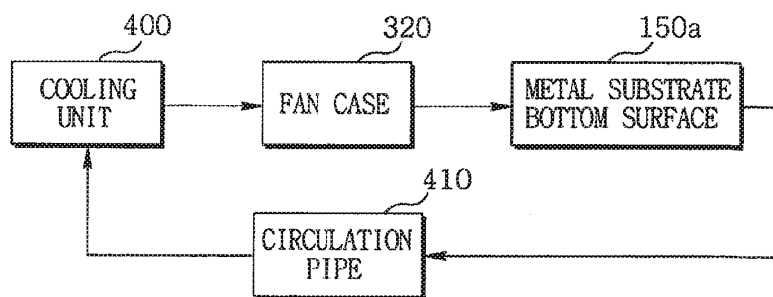


FIG. 5a

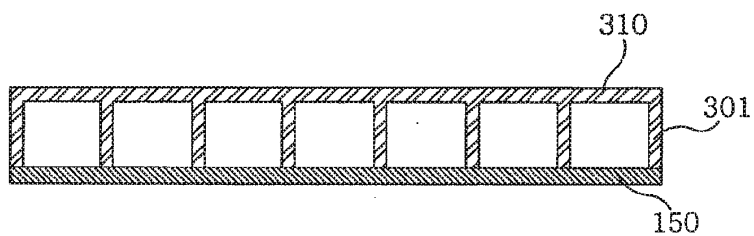


FIG. 5b

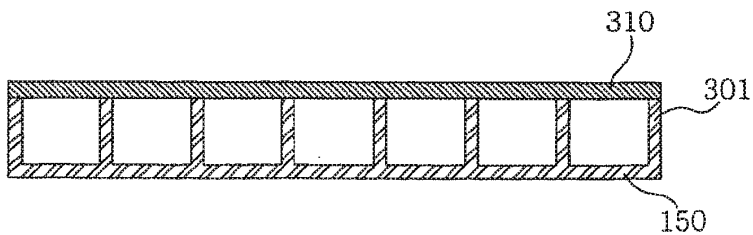


FIG. 6

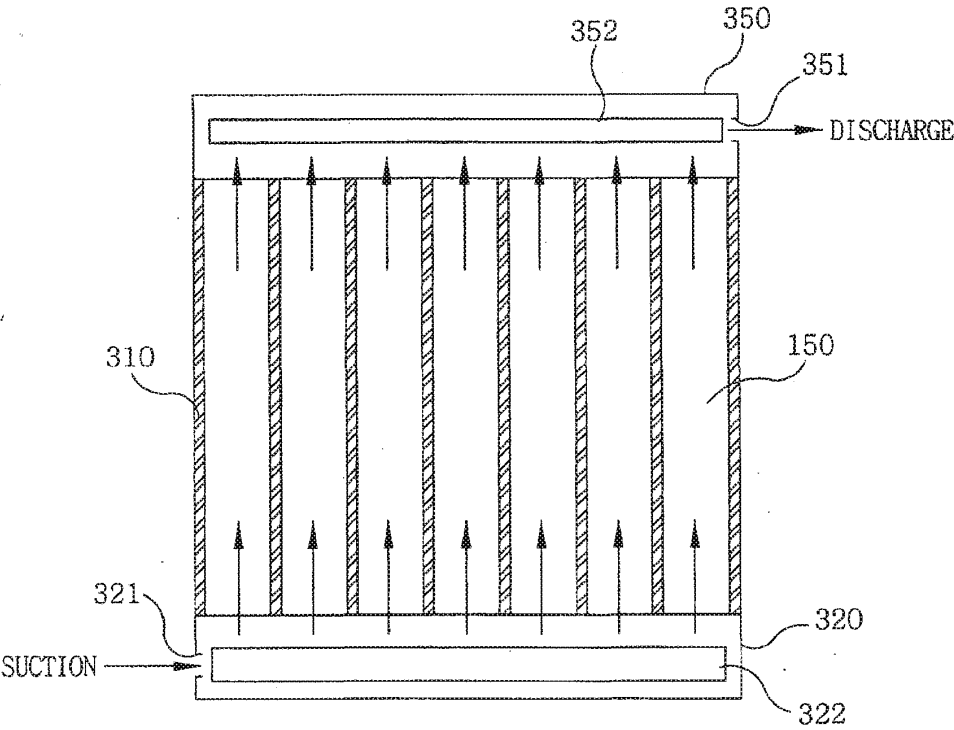


FIG. 7

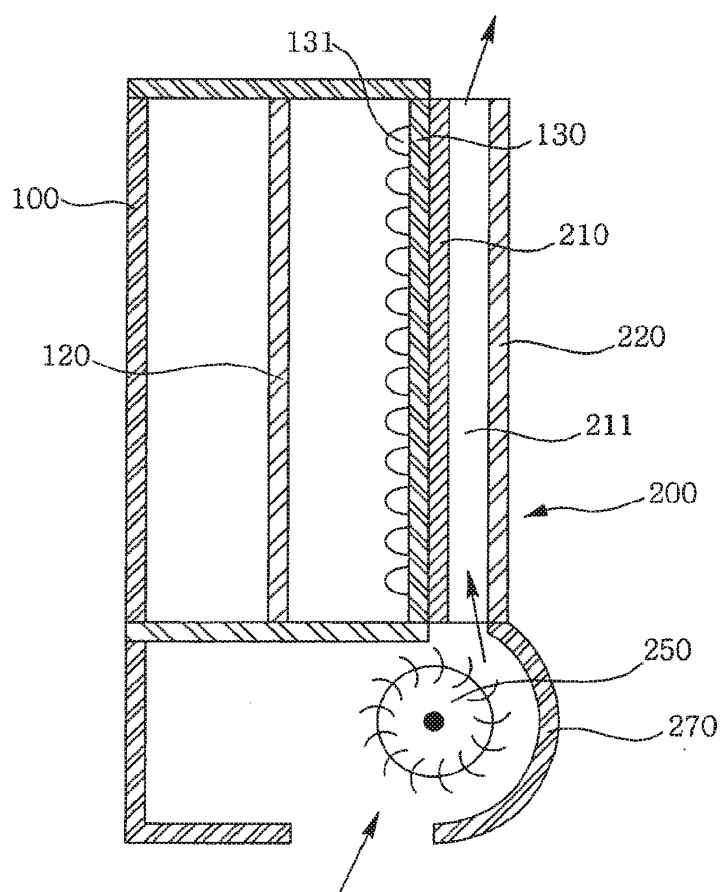


FIG. 8a

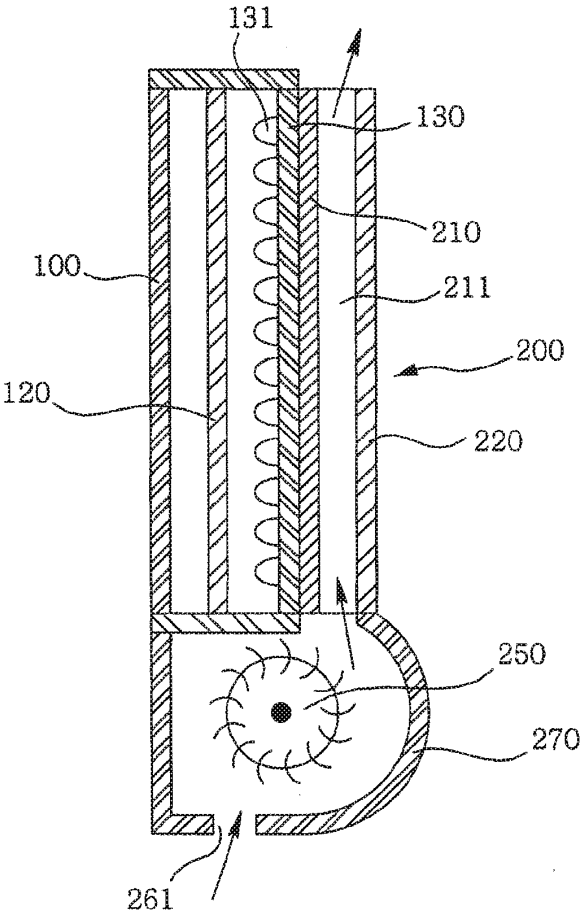


FIG. 8b

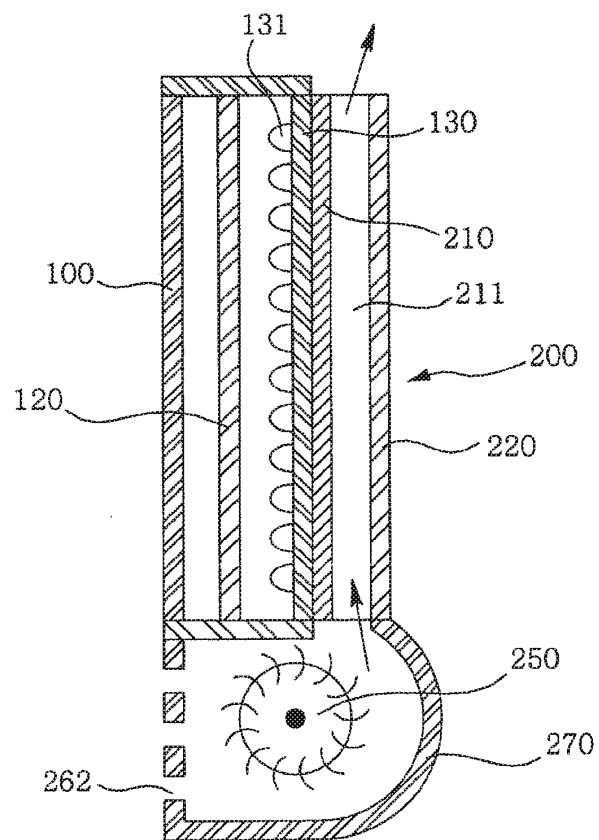


FIG. 9

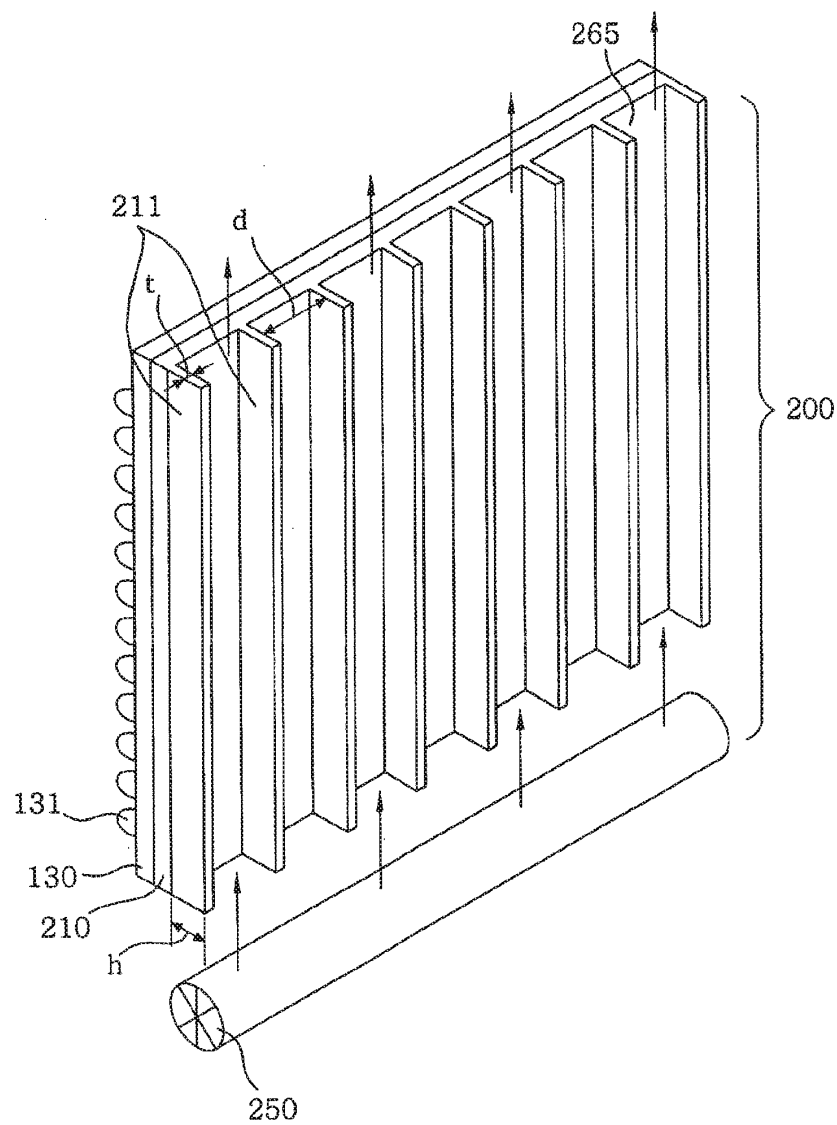


FIG. 10

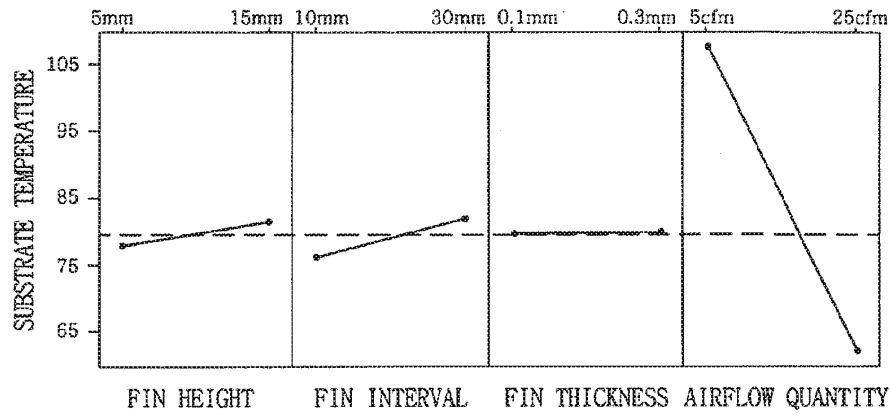
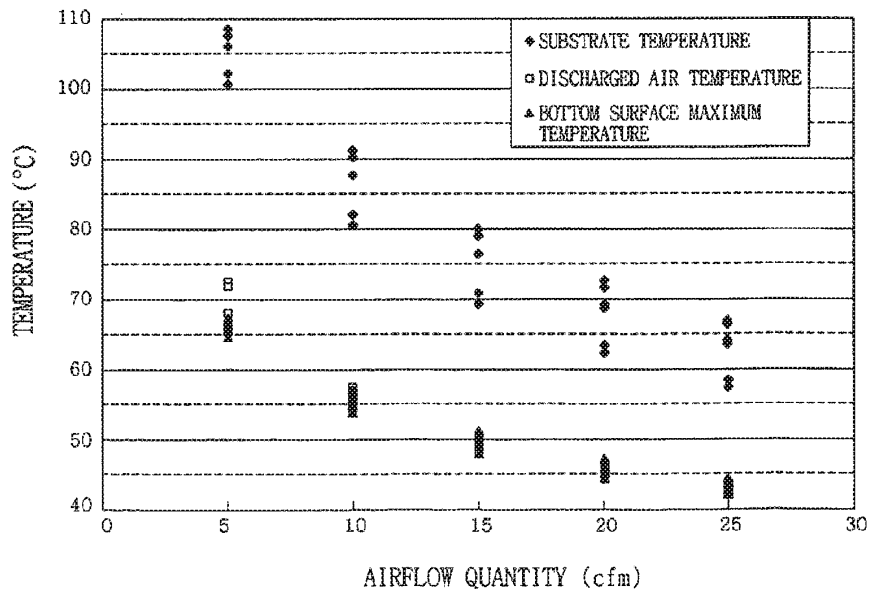


FIG. 11





(11) **EP 1 647 766 A3**

(12) **EUROPEAN PATENT APPLICATION**

(88) Date of publication A3:
25.02.2009 Bulletin 2009/09

(51) Int Cl.:
F21V 29/02 (2006.01) F21Y 101/02 (2006.01)

(43) Date of publication A2:
19.04.2006 Bulletin 2006/16

(21) Application number: 05022343.7

(22) Date of filing: 13.10.2005

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI
SK TR
Designated Extension States:
AL BA HR MK YU

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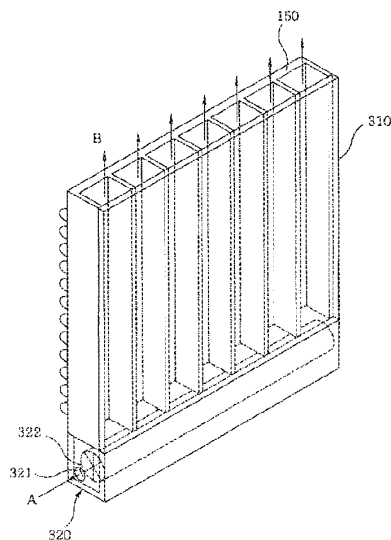
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(54) **Light emitting device package and back light unit for liquid crystal display using the same**

(57) A light emitting device package and a back light unit for liquid crystal display using the same wherein a fan (322) is used to forcibly cool an LED package and a back light unit for LCD to increase the heat radiation efficiency and to prevent the degradation of the device.

FIG. 3



Printed by Jouve, 75001 PARIS (FR)

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EUROPEAN SEARCH REPORT

Application Number
EP 05 02 2343

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	US 5 857 767 A (HOCHSTEIN PETER A [US]) 12 January 1999 (1999-01-12) * column 4, line 11 - column 5, line 6 * * figure 4 *	1,4-6	INV. F21V29/02 ADD. F21V101/02
X	US 2004/120152 A1 (BOLTA CHARLES [US] ET AL) 24 June 2004 (2004-06-24) * paragraphs [0075], [0076] * * figures 5,6 *	7-9,11	
Y	-----	1,4-6	
X	JP 06 202566 A (NIPPON SIGNAL CO LTD) 22 July 1994 (1994-07-22) * abstract; figure 2 *	7	
A	-----	1,9	
X	US 4 729 076 A (MASAMI TSUZAWA [JP] ET AL) 1 March 1988 (1988-03-01) * column 2, line 15 - line 59 * * figures 4,5(C) *	7	
A	-----	1,5,9	TECHNICAL FIELDS SEARCHED (IPC)
A	US 2004/184284 A1 (BUELOW ROGER F [US] ET AL) 23 September 2004 (2004-09-23) * paragraph [0017] * * figure 1 *	2,9,10	F21V F21Y G02F H02K G09F F21K H01L
A	EP 1 408 476 A (BARCO NV [BE]) 14 April 2004 (2004-04-14) * figures 1(a),1(b) *	1	

-The present search report has been drawn up for all claims			
5	Place of search The Hague		
	Date of completion of the search 30 September 2008		
	Examiner Allen, Katie		
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons S : member of the same patent family, corresponding document			



Application Number
EP 05 02 2343

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

- ☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):
- ☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

- ☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.
- ☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.
- ☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:
- ☒ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:
- 1-11
- ☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).



**LACK OF UNITY OF INVENTION
SHEET B**

Application Number
EP 05 02 2343

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-11

An LED package comprising the special technical feature of an insulation sheet formed at an upper surface of the metal substrate and having formed thereon a plurality of electrode lines (claim 1), for solving the problem of how to mount the LEDs to a metal substrate.

2. claims: 12-17

A back light unit for an LCD display comprising the special technical feature of a dissipation sheet disposed at a rear surface of an LCD, where the dissipation sheet is disposed at the front of the substrate having LEDs, for solving the problem of how to light an LCD display with an LED package.

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ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.

EP 05 02 2343

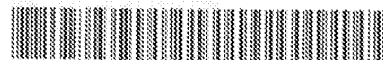
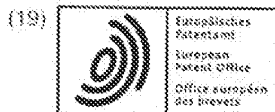
This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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30-09-2008

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5857767 A	12-01-1999	NONE	
US 2004120152 A1	24-06-2004	US 2008037257 A1	14-02-2008
JP 6202566 A	22-07-1994	JP 2986297 82	06-12-1999
US 4729076 A	01-03-1988	DE 3480294 01	30-11-1989
		EP 0202335 A1	26-11-1986
		WO 8602985 A1	22-05-1986
US 2004184284 A1	23-09-2004	NONE	
EP 1408476 A	14-04-2004	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82



(11) EP 1 762 892 A1

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 156(3) EPC

(43) Date of publication:
14.03.2007 Bulletin 2007/11

(51) Int Cl:
G03B 21/16 (2006.01) G02F 1/13 (2006.01)
G03B 21/00 (2006.01)

(21) Application number: 05765354.5

(86) International application number:
PCT/JP2005/011849

(22) Date of filing: 28.06.2005

(87) International publication number:
WO 2006/003698 (12.01.2006 Gazette 2006/02)

(84) Designated Contracting States:
DE FR GB

(30) Priority: 30.06.2004 JP 2004193183
30.06.2004 JP 2004192851

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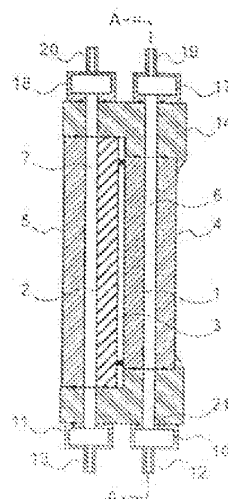
• MINAMITANI, Rintaro,
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Ibaraki 3120034 (JP)
• NAGANAWA, Takashi,
Hitachi, Ltd.
Hitachinaka-shi,
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(54) **LIQUID CRYSTAL PROJECTOR, ITS LIQUID CRYSTAL PANEL, AND ITS LIQUID COOLER**

(57) A liquid crystal projector, a liquid crystal panel, and a liquid cooling apparatus, for obtaining a picture without disturbance due to a liquid coolant passing through a transparent surface of the liquid crystal panel, with achieving cooling effectively with an aid of a liquid cooling cycle, wherein lights from a light source 112 is divided into three (3) parallel light beams.

FIG.1(a)



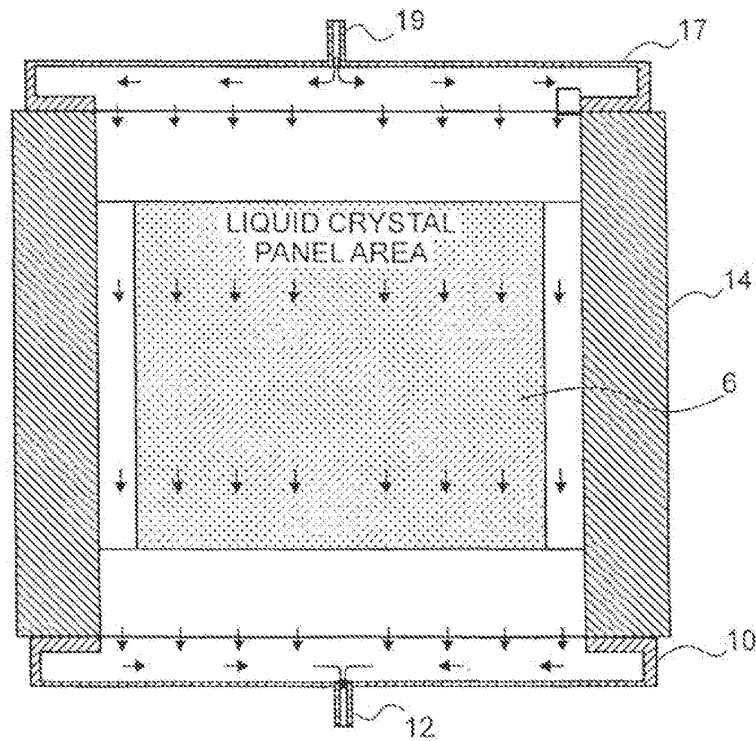
EP 1 762 892 A1

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FIG.1(b)



Description

TECHNICAL FIELD

[0001] The present invention relates to a liquid crystal projector for projecting lights from a light source through liquid crystal panels, being called by a "light bulb", and a liquid crystal panel, as an image on a screen, and it relates to, in particular, the structures of a liquid crystal panel, which is applied within such the liquid crystal projector, and also a liquid cooling apparatus for cooling such the liquid crystal panel through a liquid coolant.

BACKGROUND ARTS

[0002] In recent years, within field of a projection apparatus for displaying a color image screen, etc., on a personal computer, through enlarged projection thereof (hereinafter, being called simply by a "projector"), for example, an apparatus has been widely put into practical use, resolving or dividing the light obtained from a light source, such as, a metal halide lamp, etc., for example, into three (3) directions, and projecting them on a screen through a projection lens or the like, after modulating light intensity thereof through each of the liquid crystal panels for use of the three (3) primary colors, i.e., R, G or B, respectively, and composing them by means of a color composing prism, etc.

[0003] However, within such the projector, in addition to an enlargement in the number of pixels of the liquid crystal panel (i.e., high definition) for increasing the obtainable definition thereof, there is further obtaining high intensity of illumination (i.e., high illuminance) of a light irradiation source (for example, adoption of a metal halide lamp having electric power of 250W or more) accompanying an enlargement of the display screen, etc. For that reason, there is raised up a problem of heat, which is generated from the light irradiation source of such high luminance. In particular, within the projector having such the structures as was mentioned above, the light generated from the light irradiation source is irradiated upon each of the liquid crystal panels for use of three (3) primary colors, R, G or B, to be modulated and/or transmitted on the surface thereof, therefore, if the light intensity (i.e., brightness) of the light irradiation source mentioned above goes up, then the heat generation upon those liquid crystal panels goes up, too, and thereby also affecting ill influences upon the characteristics of the liquid crystal panels.

[0004] By the way, conventionally, within such the projector, in general, for the purpose of preventing each of the portions of the apparatus, including the liquid crystal panel mentioned above therein (in particular, a lamp and a controller portion, etc.), from increasing in the temperature thereof, so as to protect it from the ill influences thereof, there is provided a fan for air cooling, with which a cooling wind is introduced from an outside of the apparatus into an inside of a housing of the apparatus, so

as to be circulated therein. However, as was mentioned in the above, accompanying with an increase of the light intensity from the light irradiation source in the recent years, it comes to be difficult to suppress the heat generation sufficiently, upon the liquid crystal panels, only through the introduction and the circulation of the cooling wind into an inside of the apparatus by means of the cooling fan mentioned above.

[0005] Then, as disclosed in the following Patent Documents 1 to 15 mentioned below, there are already proposed projectors, in which a liquid coolant, such as, a water or the like, is sealed or enclosed within an inside of a space, being defined between a polarizing plate and a glass panel opposing thereto, so that the liquid coolant sealed therein is circulated within the inside of the space with using heat generated from the said liquid crystal panel, and thereby suppressing an increase of temperature due to acceptance of lights upon the liquid crystal panel, i.e., protecting the liquid crystal panel from ill influences due to the increase of temperature thereof. Also, for example, in particular, in the Patent Document 11 mentioned below, there is disclosed a cooling structure, wherein liquid crystal panels for use of three (3) fundamental colors, R, G and B, are formed to surround a photosynthesizing prism, as a whole, so that a coolant is enclosed within an inside thereof, and they are dipped a cooling vessel or container having a stirring or churning means in a part thereof, thereby achieving cooling thereof. In addition thereto, for example, by the Patent Document 15 mentioned below, it is already known a projector, in which the coolant is enclosed within spaces defined between the liquid crystal panel and the polarizing plates, being provided in a front and a rear thereof, while forming connecting flow paths or channels between the spaces in the front and the rear of the liquid crystal panel, and further with using a pump, etc., thereby circulating the coolant filled up within the inside of spaces, actively.

[0006] As was mentioned above, within the projector, enclosing the liquid coolant within a part of the liquid crystal panel, thereby circulating the liquid coolant enclosed within an inside thereof with utilizing a convection caused due to the heat generation of the said liquid crystal panel, or circulating it by the stirring means and/or the pump, etc., actively, due to the circulation of the liquid coolant enclosed within the liquid crystal panel, it is possible to achieve the cooling of the liquid crystal panels, more effectively. However, in case of taking the heat generation upon the liquid crystal panels into the consideration, accompanying a remarkable increase of light intensity (i.e., brightness) of a light source within projectors in recent years, the cooling is not sufficient, yet. Then, further, as are known from the following Patent Documents 16 to 19, there are already known the projectors, in which flow channels for the liquid coolant are formed in the liquid crystal panels for use of three (3) fundamental colors, R, G and B, as well as, a heat exchanger is provided in an outside thereof, and further a cooling cycle is built up for circulating the liquid coolant with using a circulation

pump, so that the liquid coolant, such as, the water or the like, is circulated within that cooling cycle; i.e., achieving the cooling with higher efficiency. Further, in particular, the Patent Document 19 mentioned above discloses a projector, circulation paths are formed on peripheries of the liquid crystal panels mentioned above, so as to achieve the cooling from that periphery, and they are also formed in a periphery of a light irradiation source, thereby achieving the cooling on the entire body of the projector by the cooling cycle.

[0007] Patent Document 1: Japanese Patent Laying-Open No. Hei 3-126011 (1991);
 Patent Document 2: Japanese Patent Laying-Open No. Hei 4-54778 (1992);
 Patent Document 3: Japanese Patent Laying-Open No. Hei 4-73733 (1992);
 Patent Document 4: Japanese Patent Laying-Open No. Hei 4-291230 (1992);
 Patent Document 5: Japanese Patent Laying-Open No. Hei 5-107519 (1993);
 Patent Document 6: Japanese Patent Laying-Open No. Hei 5-232427 (1993);
 Patent Document 7: Japanese Patent Laying-Open No. Hei 6-110040 (1994);
 Patent Document 8: Japanese Patent Laying-Open No. Hei 7-248480 (1995);
 Patent Document 9: Japanese Patent Laying-Open No. Hei 8-211353 (1996);
 Patent Document 10: Japanese Patent Laying-Open No. Hei 11-202411 (1999);
 Patent Document 11: Japanese Patent Laying-Open No. 2002-131737 (2002);
 Patent Document 12: Japanese Patent Laying-Open No. 2002-214696 (2002);
 Patent Document 13: Japanese Patent Laying-Open No. 2003-75918 (2003);
 Patent Document 14: Japanese Patent Laying-Open No. 2003-195135 (2003);
 Patent Document 15: Japanese Patent Laying-Open No. 2004-12934 (2004);
 Patent Document 16: Japanese Patent Laying-Open No. Hei 1-159684 (1999);
 Patent Document 17: Japanese Patent Laying-Open No. Hei 5-216516 (1993);
 Patent Document 18: Japanese Patent Laying-Open No. Hei 5-264947 (1993); and
 Patent Document 19: Japanese Patent Laying-Open No. Hei 11-282381 (1999).

DISCLOSURE OF THE INVENTION

[0008] As was mentioned in details in the above, within the projectors relating to the conventional arts, for obtaining the cooling at higher efficiency, from introduction/circulation of cooling wind by means of an air cooling fan, in particular, accompanying with the remarkable increase of the intensity of light source (i.e., the brightness) in recent years, a method is adopted for achieving the cooling,

by circulating the liquid coolant within an inside thereof while making the liquid coolant in contact with a part of the liquid crystal panel. Further, for achieving the cooling, much more effectively, there is proposed a method for cooling, forming the flow channel for the liquid within the liquid crystal panel, as well as, providing the heat exchanger and/or the circulation pump in an outside thereof, thereby building up the cooling cycle, so that the liquid coolant is circulated within that cooling cycle. However, in that instance, since the ill influences are large due to heat generation on the liquid crystal panels, in particular, in the projector, therefore, strong demands are made for the flow channel structures, being optimal to increase the cooling efficiency with an aid of the liquid coolant in the said liquid crystal panels.

[0009] On the other hand, with the projectors relating to the conventional arts mentioned above, as was mentioned previously, due to the principle thereof, i.e., the lights in three (3) directions obtained from a light source are modulated through the crystal panels for use of three (3) fundamental colors, R, G and B, respectively, and are projected on a screen through a projection lens or the like, after being synthesized by means of a color synthesizing prism or the like, there are generated fluctuations and/or discoloration (or, color shading), etc., on an image projected passing through those liquid crystal panels, for the liquid crystal panels mentioned above, in particular, those achieving cooling with applying the liquid coolant therein as was mentioned above, when bubbles are included within the liquid coolant contacting with or passing through a transparent portion (or a surface) of the liquid crystal panels, of course, and further when difference is generated in the density within the liquid coolant contacting with or passing through due to the difference in the velocity or the difference in temperatures, there is a problem that the projection image is disturbed. Further, also with the conventional arts mentioned above, for example, in the Patent Document 17 mentioned above, there is disclosed the structures for removing the bubbles mixed into the circulating liquid coolant, with provision of a bubble chamber within the circulation cycle of the liquid coolant for cooling the liquid crystal panels.

[0010] However, with the cooling structures of the liquid crystal panels in the various kinds of projectors, which are proposed in the various conventional arts mentioned above, in particular, it is still impossible to say that they can provide the structures being suitable for cooling those liquid crystal panels, with applying the cooling cycle circulating the liquid coolant therein, effectively, including picture quality of the pictures projected, in case when they are applied into a liquid projector of the method, in particular, synthesizing the lights in three (3) directions obtained from the light source by means of the prism, after passing through the crystal panels for use of three (3) fundamental colors, R, G and B, respectively.

[0011] Then, according to the present invention, being accomplished by taking the problems in the conventional arts mentioned above into the consideration thereof, an

object thereof is to provide a liquid crystal projector, and further a liquid crystal panel and a liquid cooling apparatus thereof, for it; i.e., in particular, enabling to cool the liquid crystal panels with utilizing the liquid cooling cycle circulating the liquid coolant therein, effectively, and in particular, the difference in density within the liquid coolant passing through the transparent surface of the liquid crystal panel due to the difference in velocity and the difference in temperature, etc., and for that reason, giving such the ill influences upon the picture, hardly, which passes through the liquid crystal panel; thereby obtaining a preferable projection image.

[0012] For accomplishing the object mentioned above, according to the present invention, first of all, there is provided a liquid crystal projector, comprising: a light source; an optical element for changing the light from said light source into a parallel light, to be divided into three (3) light beams; three (3) kinds of liquid crystal panels for transmitting the three (3) light beams divided by said optical element therethrough, so as to modulate intensity thereof; an optical synthesizing means for synthesizing the three (3) light beams, passing through said three (3) kinds of liquid crystal panels, to be modulate intensity thereof; a projection means for projecting the three (3) light beams, which are synthesized by said optical synthesizing means; and a liquid cooling cycle, including a pump and a radiator therein, for circulating a liquid coolant within said three (3) kinds of liquid crystal panels, so as to conduct cooling thereof, wherein each of said three (3) kinds of liquid crystal panels defines a flow channel for the liquid coolant between a surface of said liquid crystal panel and a transparent member to be disposed opposing thereto, respectively, and further, said flow channel includes a high-resistance flow channel being flat and uniform in thickness thereof, covering a liquid crystal panel area of said liquid crystal panel, and also a buffer portion formed neighboring to a one of upstream side and downstream side of said high-resistance flow channel.

[0013] Also, according to the present invention, there is provided a liquid crystal projector, comprising: a light source; an optical element for changing the light from said light source into a parallel light, to be divided into three (3) light beams; three (3) kinds of liquid crystal panels for transmitting the three (3) light beams divided by said optical element therethrough, so as to modulate intensity thereof; an optical synthesizing means for synthesizing the three (3) light beams, passing through said three (3) kinds of liquid crystal panels, to be modulate intensity thereof; a projection means for projecting the three (3) light beams, which are synthesized by said optical synthesizing means; and a liquid cooling cycle, including a pump and a radiator therein, for circulating a liquid coolant within said three (3) kinds of liquid crystal panels, so as to conduct cooling thereof, wherein each of said three (3) kinds of liquid crystal panels defines a flow channel for the liquid coolant with a surface of said liquid crystal panel and a transparent member to be dis-

posed opposing thereto, respectively, and further, said flow channel includes a high-resistance flow channel being flat and uniform in thickness thereof, covering a liquid crystal panel area of said liquid crystal panel, and also an auxiliary flow channel lower in flow resistance than said high-resistance flow channel, being formed surrounding said high-resistance flow channel.

[0014] Next, according to the present invention, also for accomplishing the object mentioned above, there is provided a liquid crystal panel for use in a liquid crystal projector, comprising: two (2) pieces of transparent substrates, enclosing a liquid crystal between them; and further at least a transparent plate, being disposed opposing to one surface of said two (2) pieces of transparent substrates, so as to form a flow channel for a liquid coolant between them, wherein said flow channel defines a high-resistance flow channel being flat and uniform in thickness thereof, and further comprises a buffer portion neighboring to a one of upstream side and downstream side of said high-resistance flow channel.

[0015] And, according to the present invention, there is further provided a liquid crystal panel for use in a liquid crystal projector, comprising: two (2) pieces of transparent substrates, enclosing a liquid crystal between them; and further at least a transparent plate, being disposed opposing to one surface of said two (2) pieces of transparent substrates, so as to form a flow channel for a liquid coolant between them, wherein said flow channel defines a high-resistance flow channel being flat and uniform in thickness thereof, and further comprises an auxiliary flow channel lower in flow resistance than said high-resistance flow channel, being formed surrounding said high-resistance flow channel.

[0016] Further, according to the present invention, also for accomplishing the object mentioned above, there is provided a liquid cooling apparatus for cooling liquid crystal panels for use in a liquid crystal projector, each panel having two (2) pieces of transparent substrates, enclosing a liquid crystal between them, with a liquid coolant, comprising: at least a transparent plate, being disposed opposing to one surface of said two (2) pieces of transparent substrates, so as to define therebetween a high-resistance flow channel being flat and uniform in thickness thereof, covering a liquid crystal panel area of said liquid crystal panel, and also a buffer portion neighboring to said flow channel; further a driving means for the liquid coolant, connected to said buffer portion of said liquid crystal panel; and a heat radiator means for radiating heat of said liquid crystal panel, which is received in said flow channel into an outside, whereby building a liquid cooling cycle.

[0017] Also, according to the present invention, there is provided a liquid cooling apparatus for cooling liquid crystal panels for use in a liquid crystal projector, each panel having two (2) pieces of transparent substrates, enclosing a liquid crystal between them, with a liquid coolant, comprising: at least a transparent plate, being disposed opposing to one surface of said two (2) pieces of

[0020] Further, also accomplishing the object mentioned above, according to the present invention, there is provided a liquid cooling apparatus for cooling liquid

Figs. 6 (a) to 6 (c) are cross-section views, including A-A and B-B cross sections thereof, for showing the

details of the interior structures of the liquid crystal panel, according to other modification of the present invention;

Fig. 7 is a cross-section view for showing a modification of the liquid crystal panel, according to the other embodiment, which is shown in Figs. 6(a) to 6 (c) mentioned above;

Figs. 8 (a) and 8(b) are cross-section views, including A-A cross section thereof, for showing the details of interior structures of a modification of a liquid crystal panel for use in a liquid crystal projector, according to an embodiment 2 of the present invention;

Fig. 9 is a view for explaining a circulation flow of a liquid coolant within the liquid crystal projector, according to the embodiment 2 of the present invention;

Figs. 10(a) and 10 (b) are cross-section views, including A-A cross section thereof, for showing the details of interior structures of a modification of the liquid crystal panel, which is shown in Figs. 8(a) and 8(b);

Fig. 11 is a cross-section view for showing the details of interior structures of the liquid crystal panel, according to a modification of the present invention motioned above;

Fig. 12 is a cross-section view for showing the details of interior structures of the liquid crystal panel, according to other modification of the present invention motioned above;

Fig. 13 is a cross-section view for showing the details of interior structures of the liquid crystal panel, according to further other modification of the present invention motioned above; and

Fig. 14 is a cross-section view for showing the details of interior structures of the liquid crystal panel, according to further other modification of the present invention motioned above.

BEST MODE FOR CARRYING OUT THE INVENTION

[0023] Hereinafter, embodiments according to the present invention will be fully explained by referring to the attached drawings.

Embodiment 1

[0024] First of all, Fig. 3 shows an example of the entire structures of a liquid crystal projector, comprising a liquid cooling apparatus for liquid crystal panels therein, according to an embodiment of the present invention. In the figure, a reference numeral 100 depicts a housing of

the liquid crystal projector, and also, as is apparent from the figure, within an inside thereof is provided a light irradiation source, such as, a metal halide lamp 112, for example. And, the lights from the light irradiation source 112 are brought into a parallel light by the functions of a first lens array 113, a second lens array 114, a polarization converter element 115 and a condensing lens 116, to be outputted. This parallel light, thereafter, is guided onto a first dichroic mirror 117, and a part thereof, while penetrating through it, is guided onto a liquid crystal panel 101(R) for use of R (red) through a first condenser lens 118, to be modulated therein, and thereafter it reaches to a photosynthesizing prism 119.

[0025] On the other hand, the light reflected upon the first dichroic mirror 117 mentioned above, is reflected upon the surface of a first reflection mirror 120, to be incident upon a second dichroic mirror 121. The light reflected thereon is guided onto a liquid crystal panel 101 (G) for use of G (green) through a second condenser lens 122, and after being modulated therein it reaches to the photosynthesizing prism 119. Further, the light penetrating through the second dichroic mirror 121, passing through a second reflection mirror 123 and a relay lens 124, is reflected upon the surface of a third reflection mirror 125, and is guided onto a liquid crystal panel 101 (B) for use of B (Blue) through a third condenser lens 126, to be modulated therein; thereby reaching to the photosynthesizing prism 119 mentioned above. And, the lights, the light intensity of which are modulated in those liquid crystal panels 101(R), 101(G) and 101(B) for the three (3) fundamental colors, respectively, are synthesized by means of the photosynthesizing prism 119 mentioned above, and are further extended through a projection optic system 127, including a projection lens therein, for example; thereby being projected on a screen not shown in the figure, for example (see a thin arrow in the figure).

[0026] Also, a reference numeral 131 in the figure depicts a cooling fan unit, including a fan and a motor for rotationally driving thereof within an inside thereof, for example, wherein an outside air is taken into the housing through an air suction opening 134, which is formed in a part of the housing 100 of the liquid crystal projector motioned above, as is shown by outlined arrows in the figure, so as to cool down an electric parts unit 128 for electrically controlling/driving various parts, including the liquid crystal panels for R, G and B, therein, for example, as well as, a heat radiating unit 130, which will be mentioned later. Further, the air taken into is discharged, after cooling down the metal halide lamp 112, such as a high luminous light irradiation source, being at issue due to the reason of heat generation, because of a remarkable demand for a high intensity of illumination accompanying with the large-sizing of a display screen in recent years, as was mentioned above, and further the first lens array 113, the second lens array 114, the polarization converter element 115, and the condensing lens 116, which are disposed in the vicinity of that light irradiation source, into

an outside through an air discharge opening 135, which is formed in a part of the housing 100.

[0027] And, within each of the liquid crystal panels 101 (R), 101(G) and 101(B) for the three (3) fundamental colors, R, G and B, there is formed a passage for a liquid coolant, respectively, although the details of which will be mentioned later, and a liquid coolant is circulated by the function of an electromotive pump 129 having a tank in a part thereof, which is provided in an inside of the housing 100 of the liquid crystal projector mentioned above, as is indicated by thick black arrows in the figure, through pipes provided around within the housing, in the order, i.e., the liquid crystal panels 101(R), 101(G) and 101(B) for R, G and B, the electromotive pump 129, and the heat radiating unit 130, thereby building up so-called a liquid cooling cycle.

[0028] Next, in Figs. 1(a) and 1(b) attached herewith are shown the liquid crystal panels 101(R), 101(G) and 101(B) for R, G and B, in particular, the details of interior structures of one of those. First of all, in Fig. 1(a) for showing the cross-section view of the liquid crystal panels 101, a reference numeral 2 depicts a TFT substrate made of a glass, for example, on the surface of which a large number of transistor driver elements are formed, building up a main constituent element of that liquid crystal panel 101, while an opposite substrate 1 also made of glass is disposed opposing to that liquid crystal panel 101, and a liquid crystal 3 is sealed or enclosed between those transparent substrates 2 and 1, thereby building up one (1) of the liquid crystal panels 101 for the three (3) fundamental colors, R, G and B.

[0029] Also, reference numerals 4 and 5 in the figure are so-called the protection glasses, and those protection glasses are provided on a light incident side and a light emission side of the liquid crystal panel 101, and between them are formed flow channels 6 and 7 having high resistance for the liquid coolant. Surrounding the periphery of the opposite substrate 1, the TFT substrate 2 and the protection glass plates 4 and 5, there is attached a case 14 for making up a frame body, and in edge portions at top and bottom thereof are also formed the flow channels 6 and 7 of high resistance for the liquid coolant, neighboring to each other, continuously, in a slit-like manner, and having width same to that of the flow channel mentioned above (i.e., in the horizontal direction in Fig. 1(b)). And, at the upper edge portion and the lower edge portion of this case 14 are attached box-like members 10 and 11 (lower) and 17 and 18 (upper), respectively, for making up buffer flow channels. Thus, as is apparent from Fig. 1(b) showing the A-A cross-section view in Fig. 1(a) mentioned above, on both side surfaces of the panel, including an area or region where the above-mentioned liquid crystal 101 is formed (hereinafter, being called by "a liquid crystal panel area (or region)" therein, the flat flow channels 6 and 7 of high resistance are formed, respectively, i.e., between the opposite substrate 1 and the protection glass plate 4, and between the TFT substrate 2 and the protection glass plate 5, and being equal in thickness "d"

(i.e., the height in direction perpendicular to the paper surface of Fig. 1(b)). Further, though not shown in the figure herein, but on the light incident side surface and the light emission side surface of the protection glass plates 4 and 5 are formed polarizing films, respectively.

[0030] However, in this Fig. 1(b) are shown the flows of the liquid coolant in the flow channels, which are formed within an inside of the liquid crystal panel 101, with an aid of arrows. Also, reference numerals 12, 13, 19 and 20 in those Figs. 1(a) and 1(b) depict induction/delivery tubes for the liquid coolant, each being attached around a central portion of the box-like members 10 and 11 (lower) and 17 and 18 (upper), respectively, which are provided for building up the buffer channels mentioned above. Also, a portion painted with a black color, which is represented by a reference numeral 21 in the figure, for example, depicts so-called "O" rings, which are inserted between the members mentioned above for hermetically sealing up between them when assembling those members.

[0031] Next, explanation will be made in details about the circulating flow of the liquid coolant in the liquid crystal projector, according to the present invention, including the respective liquid crystal panels 101 in apart thereof, the detailed structures of which are shown in the above, by referring to Fig. 2. However, herein the explanation was made that the liquid crystal panels 101(R), 101(G) and 101(B) for R, G and B are connected in series within the liquid cooling cycle shown in the figures, in which the liquid coolant is driven with the function of the pump 129, to be circulated through the radiator 130 for building up the heat radiation portion thereof. But, according to the present invention, it should not be restricted only to that, and those liquid crystal panels 101(R), 101(G) and 101(B) may be connected in parallel with, within the liquid cooling cycle mentioned above. Then, in this figure, the explanation will be made only by taking out one (1) of those three (3) kinds thereof, i.e., to be a single liquid crystal panel 101.

[0032] Namely, receiving heat within the liquid crystal panel 101, heated upon receipt of the lights from the light irradiation source 112, being strong in the intensity thereof, the liquid coolant increased in temperature thereof is discharged from the buffer flow channels 10 and 11, to be driven by the pump 129, and it passes through the radiator 130. In that instance, the heat is discharged into an outside, thereby to be cooled down, and then the liquid coolant flows into the buffer flow channels 17 and 18, again, which are attached on both the top and bottom edge portions of the case 14, being the frame body of the liquid crystal panel 101 mentioned above. Thereafter, the liquid coolant within the buffer flow channels 17 and 18 passes through, within the case 14 mentioned above and also the flat flow channels 6 and 7 of high resistance, having the thickness "d", which are formed between the opposite substrate 1 and the protection glass plate 4 and between the TFT substrate 2 and the protection glass plate 5, and again, it reaches to the buffer flow channels

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[0036] In addition to the above, as the liquid coolant flowing in each of the flow channels mentioned above can be applied, for example, a water mixing an antifreezing solution, such as, ethylene glycol and/or propylene glycol, for example, in a part thereof, or alternatively, an inactive liquid of fluorine (par-chlorocarbon), such as, fluorinate (the trade mark of Sumitomo-3M company) representatively, for example, being superior in light permeability, inactive, and less in bubbling, and having electrical insulating property, as well. In particular, with application of the liquid coolant of the latter, it is possible to protect the projection picture from deterioration or degradation thereof, due to mixing of bubbles into the liquid coolant flowing in the flow channels within the liquid crystal panel area mentioned above, effectively. Also, in particular, upon the surface of the various substrates, bulding up the flat and high-resistance flow channels 6 and 7 having the thickness "d", within the liquid crystal panel area, it is preferable to treat a process for maintaining hydrophilic nature or property thereof, such as, coating of a thin film of titan oxide, for example. With this, due to the function of photocatalytic reaction of the titan oxide with the lights from the lamp mentioned above, the wall surfaces thereof can be kept to be hydrophilic, always; therefore, it is possible to restrain dusts and bubbles from adhering upon the said wall surface.

[9037] Further, it is preferable that the flat flow channels 6 and 7 of high resistance be determined about from 0.2mm to 5mm in the thickness "d" thereof, for example, and that the flow velocity of the liquid coolant within an inside thereof be determined so that it comes up to be equal about 10 times of an averaged flow velocity within the buffer flow channels 17 and 18 (upper) and 10 and 11 (lower), or higher than that.

[0038] Also, in the embodiment mentioned above, explanation was made that the flat high-resistance flow channels 6 and 7, which are formed on both sides (e.g., the light incident side and the light emission side) of the liquid crystal panel 101, are equal to each other in the thickness "d" thereof. However, it is also possible to make the thickness "d" different from each other, thereby to change the flow velocity (e.g., the flow rate) of the liquid coolant within an inside thereof, for example, in a case when the heat generation on the light incident side surface of the liquid crystal panel 101 is larger than that on the light emission side, etc.

[0039] As was mentioned above, with the high and uniform velocity of the coolant flowing through the liquid crystal panel, covering over the entire thereof, it is possible to obtain a good or preferable picture quality, without generating the fluctuations, etc., on the picture obtained therefrom, and also building up the liquid cooling system of discharging the heat generated inside the liquid crystal panel into an outside, actively, enables to cool down the liquid crystal panel at higher cooling efficiency. And, with the liquid crystal projector, applying such the liquid crystal panels 101 into the liquid crystal panels 101(A), 101(B),

other embodiment, and also Figs. 6(b) and 6(c) show the A-A cross-section view and the B-B cross-section view in Fig. 6(a). However, in those figures, the constituent elements similar or same to those, which are illustrated in the above, are also attached with the same reference numerals thereof.

[0044] As is apparent from those figures, within the liquid crystal panel according to this other embodiment, corresponding to the above-mentioned liquid crystal panel area, i.e., an ineffective pixel area of the liquid crystal panel, there are also defined the high-resistance flow channels 6 and 7, each having a small thickness "d", between the opposite substrate 1 and the protection glass plate 4, and between the TFT substrate 2 and the protection glass plate 5, building up the liquid crystal panel, respectively, and in the places of the buffer portions mentioned above, in particular, as is apparent from Fig. 6(a), auxiliary flow channels 70 and 71 of low resistance, having thickness larger than the thickness "d" of the high-resistance flow channel, are formed around the periphery of the high-resistance flow channels 6 and 7 mentioned above. Also, with the liquid crystal panel according to this other embodiment, also apparent from Fig. 6(a), the auxiliary flow channels 70 or 71 is formed to be wide in width below (i.e., the upstream side of the liquid coolant), and thereafter, to be narrow in width, gradually, as it moves upwards in the figure (i.e., the downstream side of the liquid coolant).

[0045] Namely, with the liquid crystal panel according to the other embodiment, the structures of which was explained in the above, it is also possible to achieve the high and uniform velocity of the coolant flowing through the liquid crystal panel, covering over the entire of effective pixel area thereof (i.e., the liquid crystal panel area), within the liquid crystal panel, and with this it is possible to obtain a good or preferable picture quality, without generating the fluctuations, etc., on the picture obtained therefrom. In addition thereto, because of building up the liquid cooling system of discharging the heat generated inside the liquid crystal panel into an outside, actively, it is possible to cooling down the liquid crystal panel at higher cooling efficiency, and at the same time, with forming the auxiliary flow channels of low resistance surrounding the periphery of the high-resistance flow channels, in the places of the buffer portions, it is possible to bring the coolant flowing within the high-resistance flow channels, uniformly, from the periphery thereof, as is shown by arrows in Fig. 5(a). Also, since this structure necessitates no forming of the buffer portions or the like within the inside thereof, nor the case surrounding the periphery of the various substrates building up the liquid crystal panel, it is possible to reduce the number of parts building up the liquid crystal panels, thereby achieving a low cost thereof, and also to reduce the outer size thereof, much more, therefore, being advantageous.

[0046] Further, Fig. 7 attached herewith shows a variation of the liquid crystal panel according to the other embodiment explained in the above, by a plane cross-

[0043] First of all, Fig. 6 (a) shows the plane cross-section view of the liquid crystal panel according to the

section view thereof. However, in this variation, as is apparent from the figure, the auxiliary flow channel 70 or 71 of low resistance shown in Figs. 8(a) to 8(c) is modified into an auxiliary flow channel 70 (or 71), which is rectangular in an outer shape thereof, surrounding the periphery of the rectangular high-resistance flow channel 6 (or 7), which is formed corresponding to the effective pixel region (i.e., the liquid crystal panel area) of the liquid crystal panel, with a uniform width. However, with this variation, it is also possible to bring the coolant flowing within the high-resistance flow channel 6, uniformly, from the periphery thereof, in the similar manner to the above, and also since it needs no such case mentioned above, it is possible to achieve an effect of reducing the number of the constituent parts thereof, and further that of reducing the outer sizes thereof, much more.

Embodiment 2

[0047] Next, explanation will be made on the embodiment 2, according to the present invention, by referring to drawings attached herewith. However, in this embodiment 2, the constituent elements common to those, which are illustrated in the above embodiment 1, are also attached with the same reference numerals thereof.

[0048] Figs. 8(a) and 8(b) show the detailed interior structures of the liquid crystal panel 101, representatively, one of those liquid crystal panels 101(R), 101(G) and 101(B) for R, G and B mentioned above. Firstly, in Fig. 8(a) showing the cross-section of the liquid crystal panel 101, a reference numeral 2 depicts a TFT substrate made of a glass, for example, on the surface of which a large number of transistor driver elements are formed, building up main constituent element of that liquid crystal panel 101, while an opposite substrate 1 also made of glass is disposed opposing to that liquid crystal panel 101, and a liquid crystal 3 is sealed or enclosed between those transparent substrates 2 and 1, thereby building up one (1) of the liquid crystal panels 101 for the three (3) fundamental colors, R, G and B.

[0049] Also, reference numerals 4 and 5 in the figure are so-called the protection glasses, and those protection glasses are provided on a light incident side and a light emission side of the liquid crystal panel 101, and between them are formed flow channels 6 and 7 having high resistance for the liquid coolant. Surrounding the periphery of the opposite substrate 1, the TFT substrate 2 and the protection glass plates 4 and 5, there is attached a case 14 for making up a frame body. Thus, as is apparent from Fig. 8(b) showing the A-A cross-section view in Fig. 8(a) mentioned above, on both side surfaces of the panel, including an area or region where the above-mentioned liquid crystal 101 is formed (hereinafter, being called by "a liquid crystal panel area (or region)" therein, the flat flow channels 6 and 7 of high resistance are formed, respectively, i.e., between the opposite substrate 1 and the protection glass plate 4, and between the TFT substrate

2 and the protection glass plate 5, and being equal in thickness "D" (i.e., the height in direction perpendicular to the paper surface of Fig. 8(b)). Further, though not shown in the figures herein, but on the light incident side surface and the light emission side surface of the protection glass plates 4 and 5 are formed polarizing films, respectively.

[0050] And, in the edge portions at top and bottom of the case 14 building up the frame, which is formed to surround the various substrates mentioned above, as is apparent from Fig. 8(a), there are formed flow channels 8 and 9 (lower) and 15 and 16 (upper) in a slit-like manner, having thickness "d" smaller than the thickness "D" of the flow channels 6 and 7 (i.e., $d < D$), and as is apparent from Fig. 8 (b), are formed with the width (i.e., the horizontal direction in Fig. 8 (b)) being same to that of the flow channels mentioned above, respectively. Further, at end surfaces of the top and bottom edge portions of the case 14 are attached the box-like member 10 and 11 (lower) and 17 and 18 (upper) for forming the buffer flow channels therein, respectively. Further, in this Fig. 8(b), the flows of the liquid coolant are shown by arrows, within the flow channels formed within an inside of the liquid crystal panel 101. Also, reference numerals 12, 13, 19 and 20 in these Figs. 1(a) and 1(b) depict induction/delivery tubes for the liquid coolant, each being attached around a central portion of the box-like members 10 and 11 (lower) and 17 and 18 (upper), respectively, which are provided for building up the buffer channels mentioned above. Also, a portion painted with a black color, which is represented by a reference numeral 21 in the figure, for example, depicts so-called "G" rings, which are inserted between the members mentioned above for hermetically sealing up between them when assembling those members.

[0051] Next, explanation will be made in details about the circulating flow of the liquid coolant in the liquid crystal projector, according to the second embodiment of the present invention, including the respective liquid crystal panels 101 in a part thereof, the detailed structures of which are shown in the above, by referring to Fig. 9. However, herein the explanation was made that the liquid crystal panels 101(R), 101(G) and 101(B) for R, G and B are connected in series within the liquid cooling cycle shown in the figures, in which the liquid coolant is driven with the function of the pump 29, to be circulated through the radiator 130 for building up the heat radiation portion thereof. But, according to the present invention, it should not be restricted only to that, and those liquid crystal panels 101(R), 101(G) and 101(B) may be connected in parallel with; within the liquid cooling cycle mentioned above. Then, in this figure, the explanation will be made only by taking out one (1) of those three (3) kinds thereof, i.e., to be a single liquid crystal panel 101.

[0052] Namely, receiving heat within the liquid crystal panel 101, heated upon receipt of the lights from the light irradiation source 112, being strong in the intensity thereof, the liquid coolant increased in temperature thereof is

the coolant flowing therein. Also, for that reason, there is no chance of generating difference in density of the coolant flowing within an inside thereof, or generating difference in the cooling capacity; i.e., no distribution is created in temperature on the surface of the liquid crystal panel, nor no difference in the refractive index due to that. For the reason, no drawback is generated on the picture obtained, such as the fluctuation, discoloring (or, color shading), etc., and thereby enabling an improvement in the quality of the picture. In addition thereto, with such the flow channel structures as mentioned above, since the so-called liquid cooling cycle can be established, wherein the heat generated is discharged into an outside through the radiator 130 making up the heat radiation portion, while driving the liquid coolant by means of the pump 12, it is needless to say that the liquid crystal panel can be cooled down at higher cooling efficiency.

[0055] Although it is explained that the high-resistance flow channels are provided for achieving the throttle function mentioned above, i.e., the flat flow channels 15 and 16 (upper) and 10 and 11 (lower) having the thickness "d" ($D > d$), and further the buffer flow channels 17 and 18 (upper) and 10 and 11 (lower), respectively, on both sides (e.g., up and down) of the flat flow channels 6 and 7 having the thickness "D" in the explanation made in the above, however the present invention should not be restricted only to such the structures mentioned above, and therefore, only one of those may be provided only on the upstream side or the downstream side thereof.

[0056] In addition to the above, as the liquid coolant flowing in each of the flow channels mentioned above can be applied, for example, a water mixing an antifreezing solution, such as, ethylene glycol and/or propylene glycol, for example, in a part thereof, or alternatively, as inactive liquid of fluorine (per-chlorocarbon), such as, fluorinate (the trade mark of Sumitomo-3M company) representatively, for example, being superior in light permeability, inactive, and less in bubbling, and having electrical insulating property, as well. In particular, with application of the liquid coolant of the latter, it is possible to protect the projection picture from deterioration or degradation thereof, due to mixing of bubbles into the liquid coolant flowing in the flow channels within the liquid crystal panel area mentioned above, effectively. Also, in particular, upon the surface of the various substrates, building up the flat and flat flow channels 6 and 7 having the thickness "D", within the liquid crystal panel area, it is preferable to treat a process for maintaining hydrophilic nature or property thereof, such as, coating of a thin film of titan oxide, for example. With this, due to the function of photocatalytic reaction of the titan oxide with the lights from the lamp mentioned above, the wall surfaces thereof can be kept to be hydrophilic, always; therefore, it is possible to restrain dusts and bubbles from adhering upon the said wall surface.

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nel 16 comes up to be equal about 10 times of an averaged flow velocity within the buffer flow channel 18, or higher than that. Preferably, those relating to the other buffer flow channels and the high-resistance flow channels are also determined in the similar manner. Also, the relationship between the thickness "D" of the flow channel 7 covering the liquid crystal panel area and the thickness "d" of the high-resistance flow channels 16 and 9 should not be limited, in particular, however since the present invention is applicable into the case where "D" is larger than "d"; therefore, it is preferable to determine "D" from 2mm to 5mm while "d" from 0.1mm to 1mm, approximately.

[0058] Also, in the embodiment mentioned above, explanation was made that the flat high-resistance flow channels 6 and 7, which are formed on both sides (e.g., the light incident side and the light emission side) of the liquid crystal panel 101, are equal to each other in the thickness "D" thereof. However, it is also possible to make the thickness differing from each other, thereby to change the flow velocity (e.g., the flow rate) of the liquid coolant within an inside thereof, for example, in a case when the heat generation on the light incident side surface of the liquid crystal panel 101 is larger than that on the light emission side, etc. And, in the similar manner, it is also possible to change, not only the thickness "D" of the flow channels 6 and 7, but also the thickness "d" of the flow channels 15 and 16 (upper) and 10 and 11 (lower), which are provided for forming the throttle, i.e., the high-resistance flow channels for the liquid coolant, and further the areas of the flow pass of the buffer flow channels 17 and 18 (upper) and 10 and 11 (lower), appropriately.

[0059] As was mentioned above, with the equalization and the stabilization of the coolant flowing through the liquid crystal panel, covering over the entire thereof, it is possible to obtain a good and preferable quality of pictures, without generating the fluctuations on the picture obtained, and also building up the liquid cooling system of discharging the heat generated inside the liquid crystal panel into an outside, actively, enables to cool down the liquid crystal panel at higher cooling efficiency. And, applying such the liquid crystal panels 101 into the liquid crystal panels 101(A), 101(G) and 101(B) for use of A, G and B, in the liquid crystal projector, it is possible to maintain a lifetime and reliability for those liquid crystal panels, in spite of an increase in an amount or volume of heat generation on the liquid crystal panels, accompanying with the small-sizing, silent operation, and high luminance or brightness thereof.

[0060] Next, Fig. 10(a) attached herewith shows a modification of the liquid crystal panel 101 shown in Figs. 8(a) and 8(b), by the cross-section view thereof, and also Fig. 10(b) shows the A-A cross section view in Fig. 10(a) mentioned above. With the liquid crystal panel 101 according to this modification, in particular, the flow channels 6 and 9 (lower) and 15 and 16 (upper), which are formed in the top and bottom edge portions of the case

14 for building the frame surrounding the various substrates, are shaped, not into the slit-like as shown in Figs. 1(a) and 1(b) mentioned above, but into a plural number of circular through-holes 32. Further, with the structures of the liquid crystal panel 101 according to such the modification, in addition to the effects similar to those obtainable from the liquid crystal panel according to the above-mentioned embodiment, in particular, since the through-holes 32 are formed in the top and bottom edge portions of the case 14, in the places of the slit-like flow channels mentioned above, there can be obtained an effect that the manufacturing thereof comes to be easy, and also it is advantageous, in particular, when forming the flow channels to be in further high resistance within the flow channels 15 and 16 (upper) and 10 and 11 (lower) for forming the throttles for the liquid coolant.

[0061] Next, Fig. 11 attached here with shows the cross-section view of the liquid crystal panel 101, according to other modification, further. With the liquid crystal panel 101 according to the other variation, as is apparent from the figure, the slit-like flow channels 6 and 9 (lower) and 15 and 16 (upper), which are formed in the top and bottom edge portions of the case 14 for building the frame surrounding the various substrates, are formed to be equal to the thickness "D" of the flow channels 6 and 7 covering the liquid crystal panel area mentioned above, in advance, and thereafter, resistance plates 30 and 31 (upper) and 32 and 33 (lower), each having a predetermined thickness, are attached on one side of the wall surfaces of those slit-like flow channels, thereby making up into the high-resistance flow channels having the thickness "d". However, with such the structures, for example, if determining the flat thickness of the resistance plates 30, 31, 32 or 33 to be fixed within the slit-like flow channels, which are formed in the top and bottom edge portions of the case 14 manufactured in advance, at a desirable value corresponding to the thickness "D" of the flow channels 6 and 7 covering the liquid crystal panel area, it is possible to build up the suitable high-resistance flow channels, easily, while obtaining the functions/effects mentioned above. Also, changing the thicknesses of the resistance plates 30, 31, 32 or 33, depending on the respective one of the flow channels 6 and 7 covering the liquid crystal panel area, it is also possible to change the flow velocity of the coolant within those flow channels 6 and 7.

[0062] Further, Fig. 12 attached herewith shows the liquid crystal panel 101, according to further other embodiment of the present invention, by the cross-section view thereof. As is apparent from the figure, with the liquid crystal panel 101 according to this further other embodiment, the box-like members for forming the buffer flow channels therein, to be attached on the top and bottom edge portions of the case 14 for building the frame surrounding the various substrates, are formed together with, in one body. Thus, in the places of the two (2) pieces of box-like members 10 and 11 (lower) shown in Figs. 8(a) and 8(b), only one (1) piece of the box-like member

10 is attached, while attaching one (1) piece of the box-like member 17 in the places of the two (2) pieces of box-like members 17 and 18 (upper), and thereby forming the buffer flow channels on the top and bottom edge portions of the case 14, respectively. However, with such the structures, since the number of the constituent parts thereof can be reduced, it is possible to manufacture the liquid crystal panel, easily and cheaply, as well as, obtaining the functions/effects mentioned above.

[0063] In addition thereto, Fig. 13 attached herewith shows the liquid crystal panel 101, according to further other embodiment of the present invention, by the cross-section view thereof. Further, as is apparent from the figure, with the liquid crystal panel 101 according to this further other embodiment, differing from the liquid crystal panel shown in Figs. 1(a) and 1(b) mentioned above, the flow channels for the liquid coolant, including the flat flow channel 6 being equal or uniform in the thickness "D" and the flat high-resistance flow channels 30 and 32 provided on both sides thereof, being equal or uniform in the thickness "d", are provided only on the light incident side of the liquid crystal panel 101. Thus, within the liquid crystal panel 101, being constructed with the TFT substrate 2 and the opposite substrate 1, enclosing or sealing the liquid crystal 3 between them, a flat flow channel 6, being equal or uniform in the thickness "D" thereof, is formed between that opposite substrate 1 and the protection glass plate 4 on the light incident side. However, on the other light emission side thereof, the protection glass plate 5 is directly connected on the TFT substrate 2. Also, on the top and bottom edge portions of the case 14 forming the frame surrounding those substrates, there is provided one (1) piece of flow channel 30 (lower) or 32 (upper), respectively, corresponding to the flat flow channel 6 being equal or uniform in the thickness "D" mentioned above, thereby building up the high-resistance flow channels having the thickness "d" mentioned above.

[0064] Further, with such the structures thereof, the liquid crystal panel can be manufactured, easily and cheaply, judging from the structures thereof, relatively, and an amount of heat generation thereof is also relatively small; therefore, it can be applied, preferably, in particular, in case where it is sufficient to remove the heat generation from only the light incident side of the liquid crystal panel.

[0065] Finally, Fig. 14 attached herewith also shows the liquid crystal panel 101, according to further other embodiment of the present invention, by the cross-section view thereof. However, as is apparent from the figure, with the liquid crystal panel 101 according to this further other embodiment, in the top edge portion of the case 14 forming the frame is formed a flow channel having the thickness "D" similar to the flow channel 6, but being wound in the "U" shape, and it is connected to the other flow channel 7, on a while, in the bottom edge portion of the case 14 are formed the high-resistance flow channels 44 and 45 having the thickness "d", to be connected with the box-like members 42 and 43 for forming the buffer

flow channels, respectively. Further, reference numerals 42 and 43 depict the introduction/delivery tubes for the liquid coolant.

[0066] With such the structures, differing from the liquid crystal panel 101 explained in the above, the introduction/delivery tubes for introducing or delivering the liquid coolant into/from the liquid crystal panel can be provided, not on both sides (i.e., up and down) of the panel, only one side thereof, for example, on the bottom side thereof in this example, and therefore, it is advantageous when pipes for the liquid coolant should be connected, in particular, being wound around within the narrow housing of the liquid crystal projector.

Effects of the Invention

[0067] As apparent from the description mentioned above, first of all, with the liquid crystal projector, and further the liquid crystal panel and the liquid cooling apparatus for it, according to the present invention, it is possible to cool down the liquid crystal panels, effectively, with using the liquid cooling cycle circulating the liquid coolant therein, and further since difference in the density hardly generates within the liquid coolant flowing within the high-resistance flow channels covering the light transmitting surface of the liquid crystal panel, due to the differences in the velocity and the temperature thereof, therefore it is possible to obtain a good or preferable projection picture, without disturbing the picture projected. Further, it achieves an extremely superior effect that, in particular, the lifetime and/or the reliability thereof can be maintained high, including the liquid crystal panels thereof.

[0068] Secondary, with the liquid crystal projector, and further the liquid crystal panel and the liquid cooling apparatus for it, according to the present invention, it is possible to cool down the liquid crystal panels, effectively, with using the liquid cooling cycle circulating the liquid coolant therein, and further also since difference in the density hardly generates within the liquid coolant flowing within the high-resistance flow channels covering the light transmitting surface of the liquid crystal panel, due to the differences in the velocity and the temperature thereof, therefore it is possible to obtain a good or preferable projection picture, without disturbing the picture projected. Further, it achieves an extremely superior effect that, in particular, the lifetime and/or the reliability thereof can be maintained high, including the liquid crystal panels thereof.

Claims

1. A liquid crystal projector, comprising

a light source;
an optical element for changing the light from said light source into a parallel light, to be divided

into three (3) light beams;

three (3) kinds of liquid crystal panels for transmitting the three (3) light beams divided by said optical element therethrough, so as to modulate intensity thereof;

an optical synthesizing means for synthesizing the three (3) light beams, passing through said three (3) kinds of liquid crystal panels, to be modulate intensity thereof;

a projection means for projecting the three (3) light beams, which are synthesized by said optical synthesizing means; and

a liquid cooling cycle, including a pump and a radiator therein, for circulating a liquid coolant within said three (3) kinds of liquid crystal panels, so as to conduct cooling thereof, wherein each of said three (3) kinds of liquid crystal panels defines a flow channel for the liquid coolant between a surface of said liquid crystal panel and a transparent member to be disposed opposing thereto, respectively, and further, said flow channel includes a high-resistance flow channel being flat and uniform in thickness thereof, covering a liquid crystal panel area of said liquid crystal panel, and also a buffer portion formed neighboring to a one of upstream side and downstream side of said high-resistance flow channel.

2. A liquid crystal projector, comprising:

a light source;

an optical element for changing the light from said light source into a parallel light, to be divided into three (3) light beams;

three (3) kinds of liquid crystal panels for transmitting the three (3) light beams divided by said optical element therethrough, so as to modulate intensity thereof;

an optical synthesizing means for synthesizing the three (3) light beams, passing through said three (3) kinds of liquid crystal panels, to be modulate intensity thereof;

a projection means for projecting the three (3) light beams, which are synthesized by said optical synthesizing means; and

a liquid cooling cycle, including a pump and a radiator therein, for circulating a liquid coolant within said three (3) kinds of liquid crystal panels, so as to conduct cooling thereof, wherein

each of said three (3) kinds of liquid crystal panels defines a flow channel for the liquid coolant with a surface of said liquid crystal panel and a transparent member to be disposed opposing thereto, respectively, and further, said flow channel includes a high-resistance flow channel being flat and uniform in thickness thereof, covering a liquid crystal panel area of said liquid

crystal panel, and also an auxiliary flow channel lower in flow resistance than said high-resistance flow channel, being formed surrounding said high-resistance flow channel.

3. A liquid crystal panel for use in a liquid crystal projector, comprising:

two (2) pieces of transparent substrates, enclosing a liquid crystal between them; and further at least a transparent plate, being disposed opposing to one surface of said two (2) pieces of transparent substrates, so as to form a flow channel for a liquid coolant between them, wherein

said flow channel defines a high-resistance flow channel being flat and uniform in thickness thereof, and further comprises a buffer portion neighboring to a one of upstream side and downstream side of said high-resistance flow channel.

4. A liquid crystal panel for use in a liquid crystal projector, comprising:

two (2) pieces of transparent substrates, enclosing a liquid crystal between them; and further at least a transparent plate, being disposed opposing to one surface of said two (2) pieces of transparent substrates, so as to form a flow channel for a liquid coolant between them, wherein

said flow channel defines a high-resistance flow channel being flat and uniform in thickness thereof, and further comprises an auxiliary flow channel lower in flow resistance than said high-resistance flow channel, being formed surrounding said high-resistance flow channel.

5. A liquid cooling apparatus for cooling liquid crystal panels for use in a liquid crystal projector, each panel having two (2) pieces of transparent substrates, enclosing a liquid crystal between them, with a liquid coolant, comprising:

at least a transparent plate, being disposed opposing to one surface of said two (2) pieces of transparent substrates, so as to define therebetween a high-resistance flow channel being flat and uniform in thickness thereof, covering a liquid crystal panel area of said liquid crystal panel, and also a buffer portion neighboring to said flow channel; further

a driving means for the liquid coolant, connected to said buffer portion of said liquid crystal panel; and

a heat radiator means for radiating heat of said liquid crystal panel, which is received in said flow

channel into an outside, whereby building a liquid cooling cycle.

6. A liquid cooling apparatus for cooling liquid crystal panels for use in a liquid crystal projector, each panel having two (2) pieces of transparent substrates, enclosing a liquid crystal between them, with a liquid coolant, comprising:

at least a transparent plate, being disposed opposing to one surface of said two (2) pieces of transparent substrates, so as to define therebetween a high-resistance flow channel being flat and uniform in thickness thereof, covering a liquid crystal panel area of said liquid crystal panel, and also an auxiliary flow channel lower in flow resistance than said high-resistance flow channel, being formed surrounding said flow channel; further

a driving means for the liquid coolant, connected to said buffer portion of said liquid crystal panel; and

a heat radiator means for radiating heat of said liquid crystal panel, which is received in said flow channel into an outside, whereby building a liquid cooling cycle.

7. A liquid crystal projector, comprising:

a light source;

an optical element for changing the light from said light source into a parallel light, to be divided into three (3) light beams;

three (3) kinds of liquid crystal panels for transmitting the three (3) light beams divided by said optical element therethrough, so as to modulate intensity thereof;

an optical synthesizing means for synthesizing the three (3) light beams, passing through said three (3) kinds of liquid crystal panels, to be modulate intensity thereof;

a projection means for projecting the three (3) light beams, which are synthesized by said optical synthesizing means; and

a liquid cooling cycle, including a pump and a radiator therein, for circulating a liquid coolant within said three (3) kinds of liquid crystal panels, so as to conduct cooling thereof, wherein

each of said three (3) kinds of liquid crystal panels defines a flow channel for the liquid coolant between a surface of said liquid crystal panel and a transparent member to be disposed opposing thereto, respectively, and further, said flow channel includes a first flow channel being flat and uniform in thickness thereof, covering a liquid crystal panel area of said liquid crystal panel, and also a second flow channel provided on a one of upstream side and downstream side

of said first flow channel, having flow resistance higher than that in said first flow channel.

8. The liquid crystal projector, as described in the claim 7, wherein said liquid crystal panel further comprises a buffer portion neighboring to said second flow channel, in addition to said second flow channel.

9. A liquid crystal panel for use in a liquid crystal projector, comprising:

two (2) pieces of transparent substrates, enclosing a liquid crystal between them; and further at least a transparent plate, being disposed opposing to one surface of said two (2) pieces of transparent substrates, so as to form a flow channel for a liquid coolant between them, wherein

said flow channel defines a first flow channel being flat and uniform in thickness thereof, within an area covering a liquid crystal area of said liquid crystal panel, and further comprises a second flow channel neighboring to a one of upstream side and downstream side of said high-resistance flow channel, having flow resistance higher than that in said first flow channel.

10. The liquid crystal panel for use in a liquid crystal projector, as described in the claim 9, wherein said liquid crystal panel further comprises a buffer portion neighboring to said second flow channel, in addition to said second flow channel.

11. A liquid cooling apparatus for cooling liquid crystal panels for use in a liquid crystal projector, each panel having two (2) pieces of transparent substrates, enclosing a liquid crystal between them, with a liquid coolant, comprising:

at least a transparent plate, being disposed opposing to one surface of said two (2) pieces of transparent substrates, so as to define therebetween a first flow channel being flat and uniform in thickness thereof, covering a liquid crystal panel area of said liquid crystal panel, and also a second flow channel on a one of upstream side and downstream side of said first flow channel, being higher in flow resistance than that in said first flow channel; further

a driving means for the liquid coolant, connected to said first and said second flow channels of said liquid crystal panel; and

a heat radiator means for radiating heat of said liquid crystal panel, which is received in said first and said second flow channels into an outside, whereby building a liquid cooling cycle.

12. The liquid cooling apparatus for cooling liquid crystal

FIG.1(b)

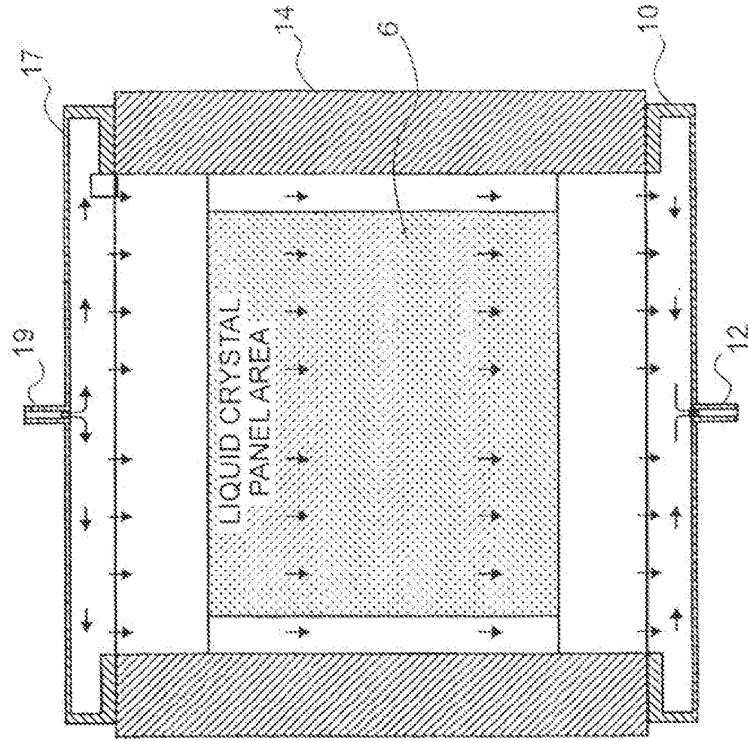


FIG.1(a)

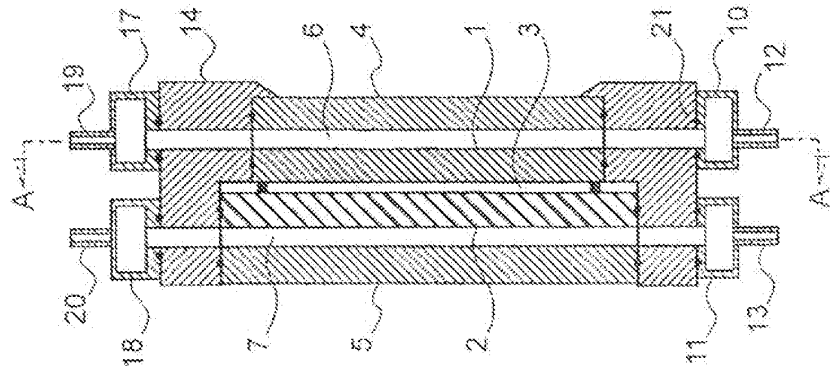


FIG.2

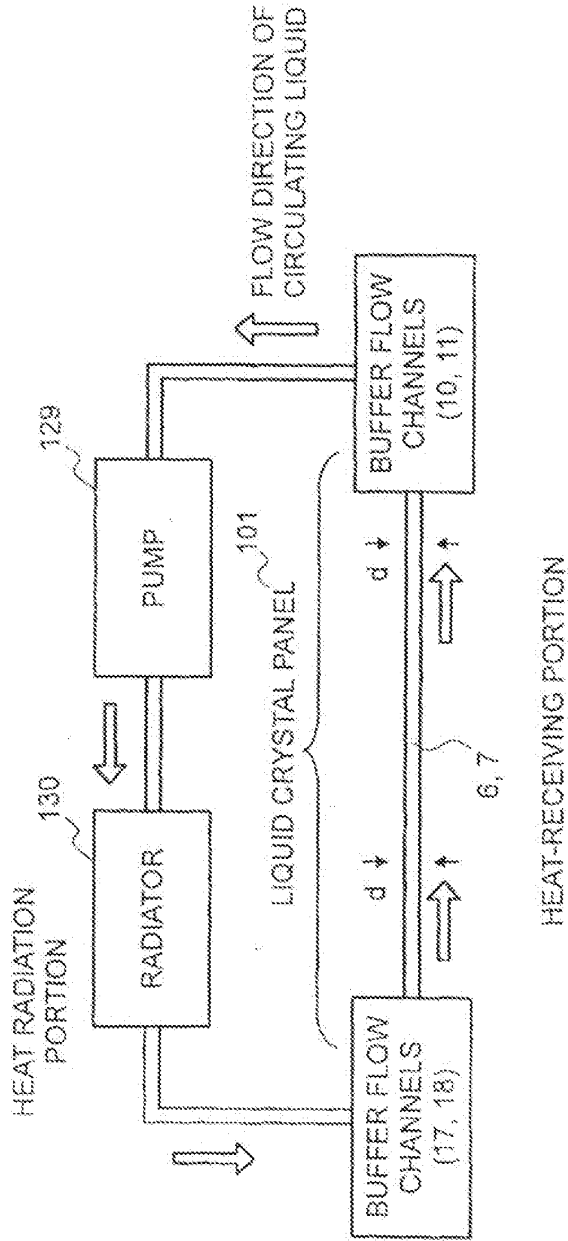


FIG.3

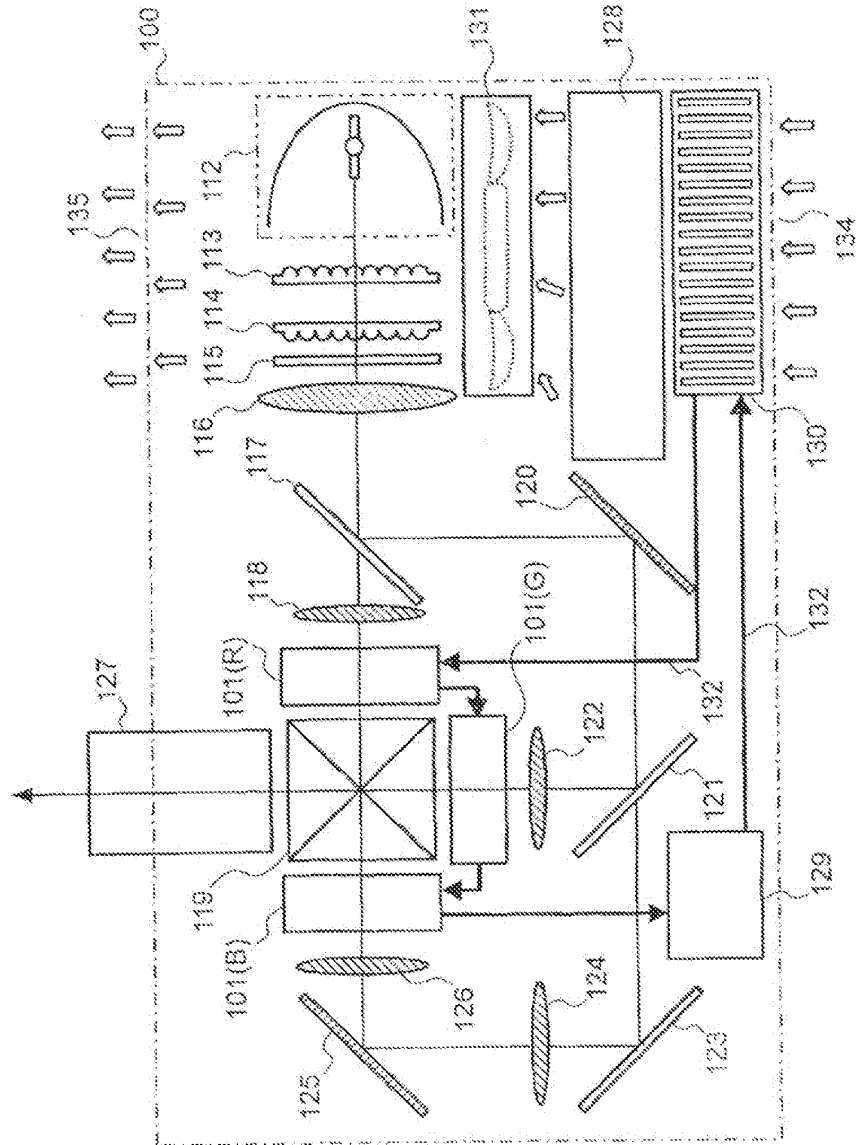


FIG.4(b)

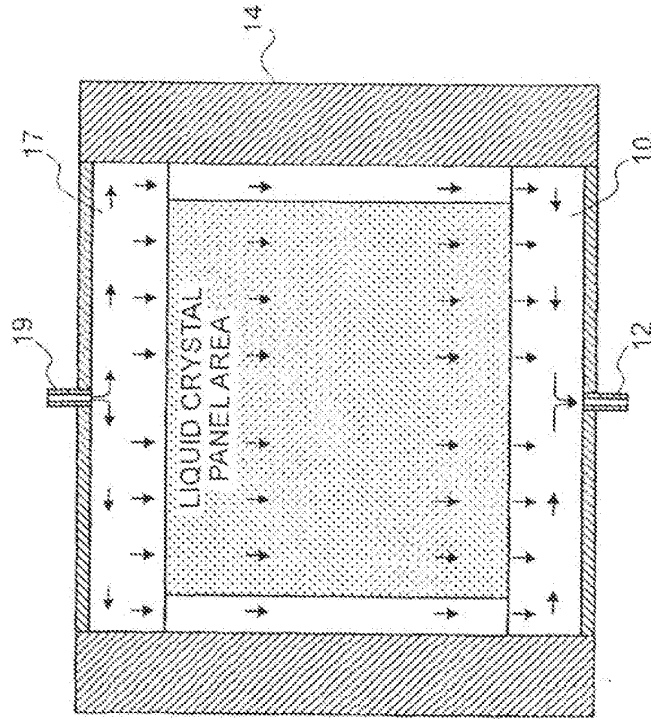


FIG.4(a)

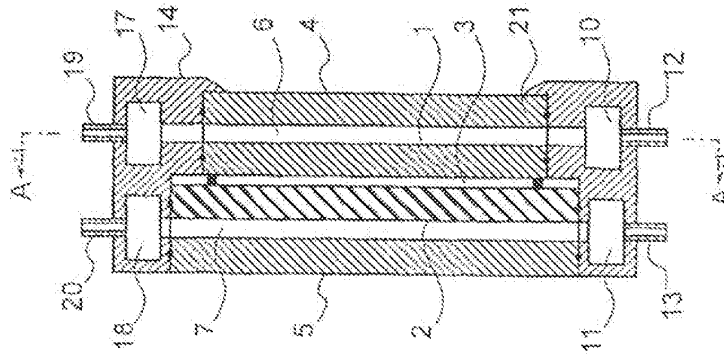


FIG.5(b)

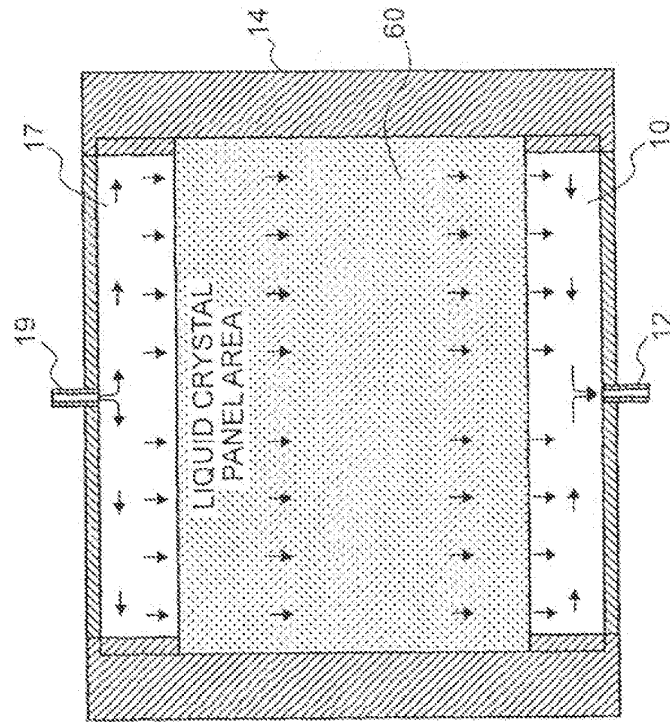
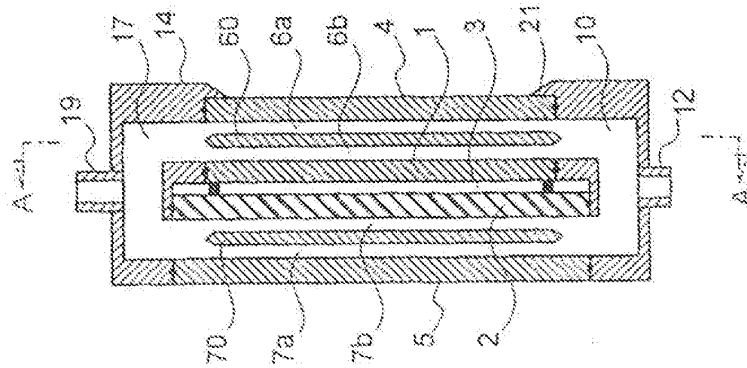


FIG.5(a)



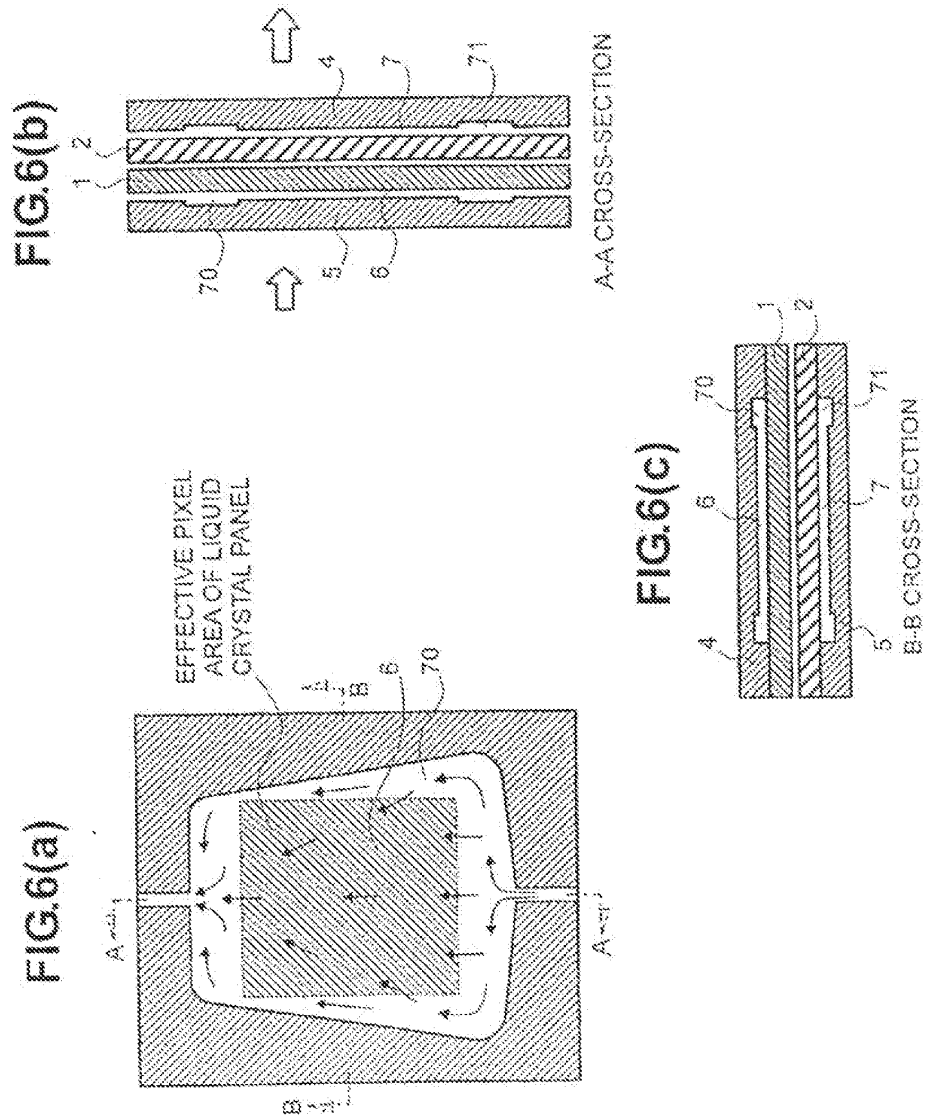


FIG.7

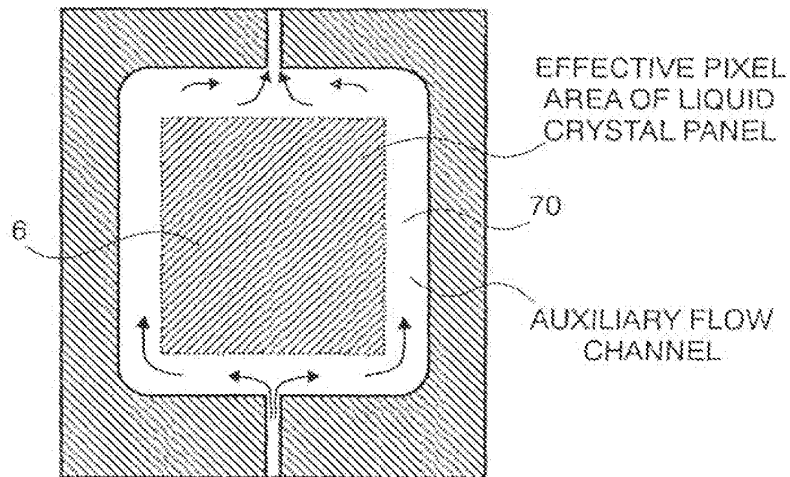


FIG.8(b)

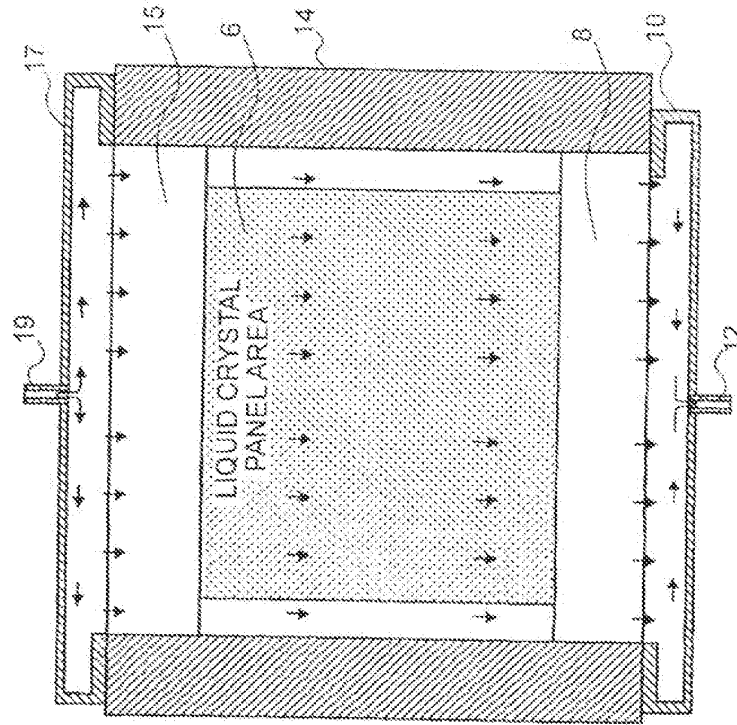


FIG.8(a)

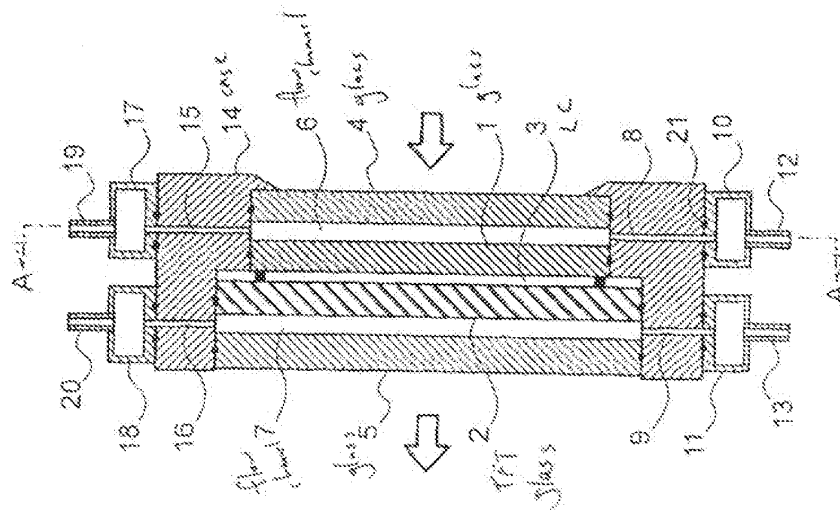


FIG.9

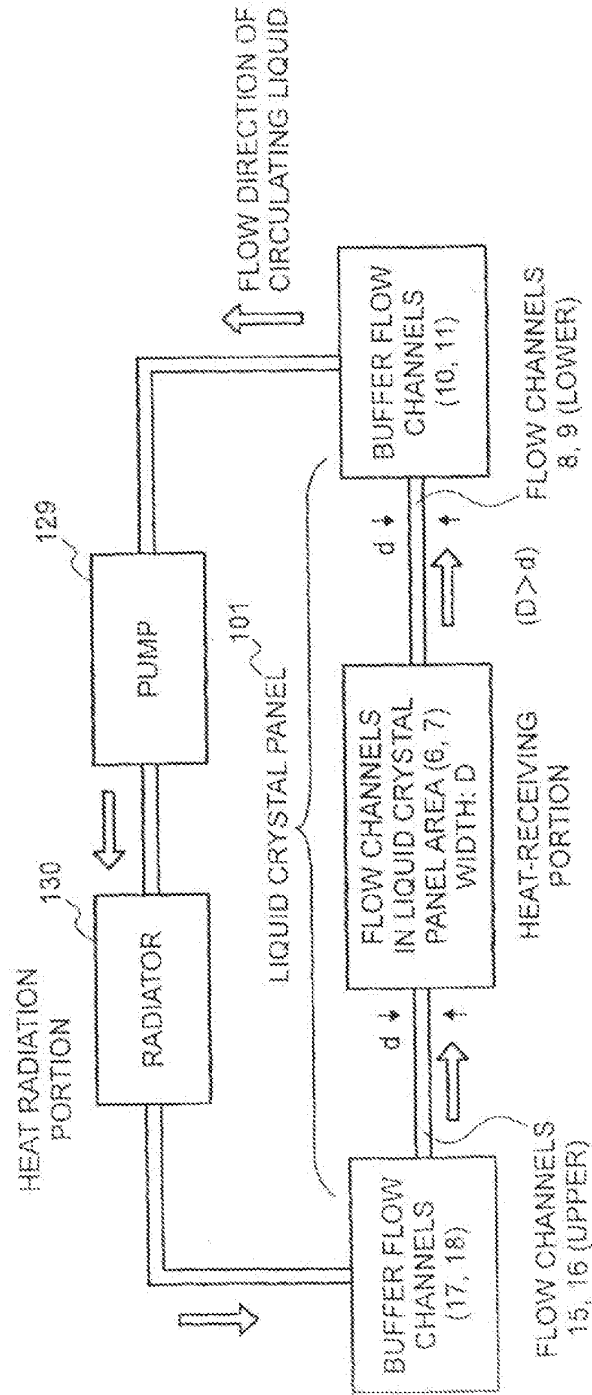


FIG. 10(b)

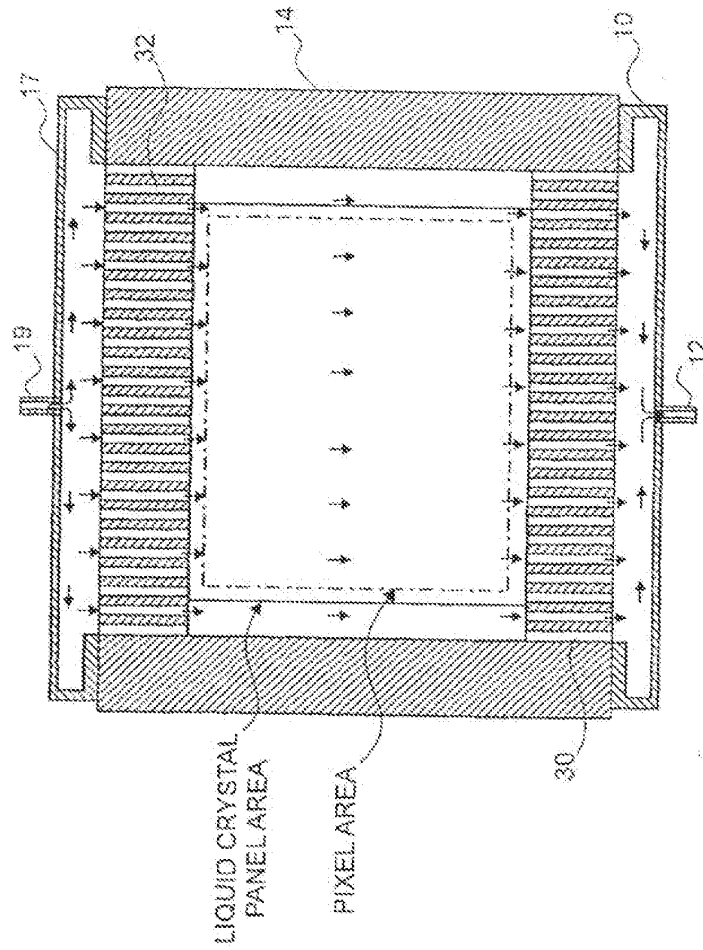


FIG. 10(a)

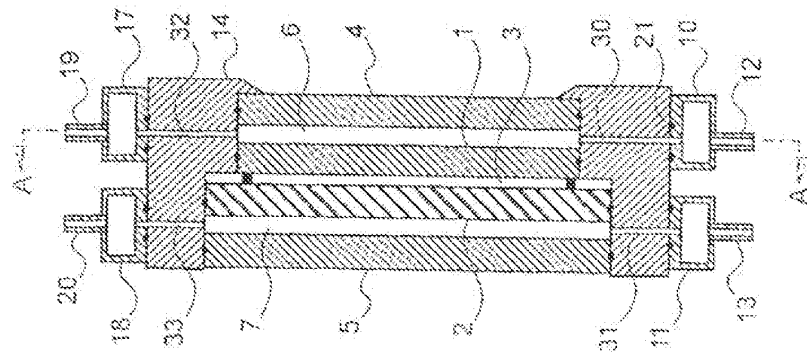


FIG.11

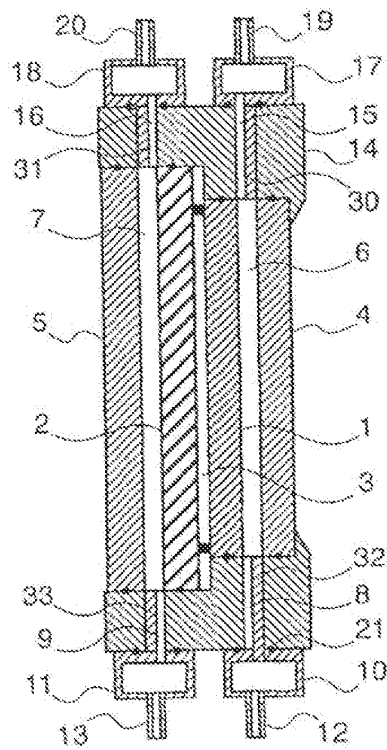


FIG.12

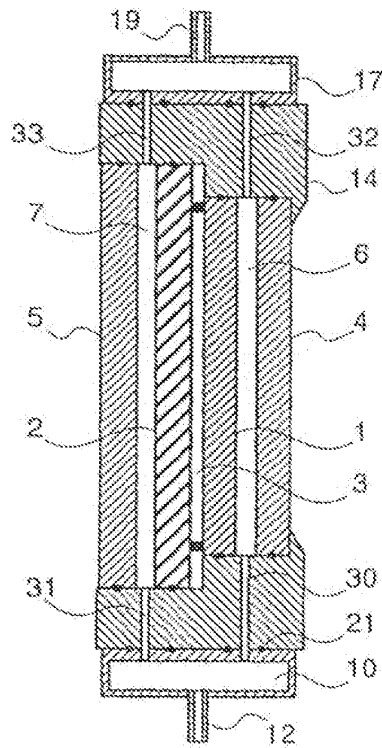


FIG.13

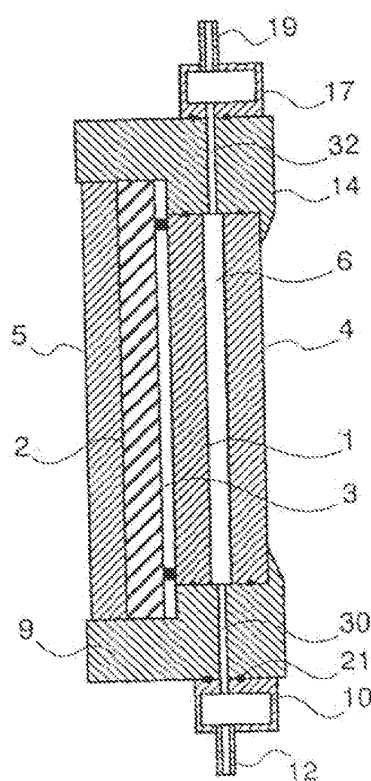
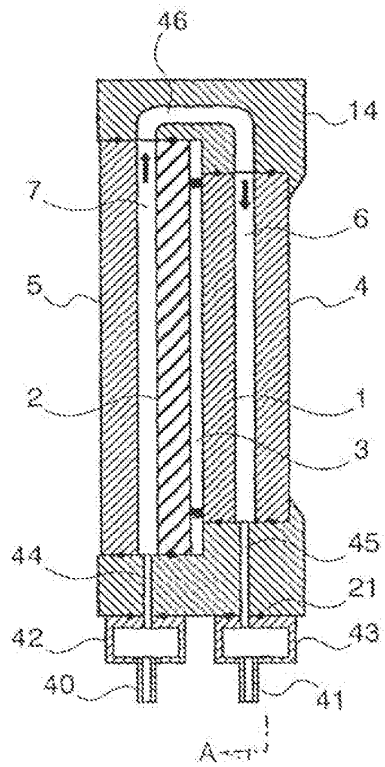


FIG.14



INTERNATIONAL SEARCH REPORT		International application No. PCT/JP2005/011849
A. CLASSIFICATION OF SUBJECT MATTER Int. Cl. ⁷ G01E21/16, G02F1/11		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELD OF SEARCH Minimum documentation searched (classification system followed by classification symbols) Int. Cl. ⁷ G01E21/00-31/33; G02F1/13-1/141, F25D17/00-17/02		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Jitsugo Shinan Koho 1992-1996 Jitsugo Shinan Tokoku Koho 1996-2005 Kokai Jitsugo Shinan Koho 1971-2005 Tokoku Jitsugo Shinan Koho 1994-2005		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Character of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2002-266038 A (Sharp Corp.), 18 September, 2002 (18.09.02), Par. Nos. [0032] to [0038]; Figs. 3 to 7 (Family: none)	1-12
Y	JP 2004-117890 A (Seiko Epson Corp.), 15 April, 2004 (15.04.04), Par. Nos. [0137] to [0150]; Figs. 19 to 23 (Family: none)	1-13
Y	JP 07-181463 A (Canon Inc.), 21 July, 1995 (21.07.95), Par. Nos. [0015] to [0034]; Figs. 1 to 13 (Family: none)	1-12
☒ Further documents are listed in the continuation of Box C ☐ No patent family entries		
* Special categories of cited documents: "A" document defining the general state of the art which is not designated to be of particular relevance "E" earlier publication of patent but published on or after the international filing date "L" document which may have priority claim or which is cited to establish the publication date of another citation or other special feature or significance "T" document relating to an oral disclosure, use, or disclosure in other means "F" document published prior to the international filing date but later than the priority date claimed	"I" document published after the international filing date or priority date and not in conflict with the application but cited to underpin the principle or theory underlying the invention "X" document of particular relevance in the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "W" document not relevant to the present family	
Date of the actual completion of the international search 31 July, 2005 (25.07.05)		Date of mailing of the abstract and search report 09 August, 2005 (09.08.05)
Name and mailing address of the NCI Japanese Patent Office		Authorized officer
Facsimile No.		Telephone No.

Form PCT/ISA 210 (normal sheet) (January 2003)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2005/011849

IPC Class. (Int.): H01H 1/00 (2006.01.01) (Cl. Int.)

Category*	Content of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2004-002814 A (Seiko Epson Corp.), 15 January, 2004 (15.01.04), Full text; all drawings & US 2003/0211271 A1	1-12
A	WO 02/015027 A1 (Matsushita Electric Industrial Co., Ltd.), 07 March, 2002 (07.03.02), Full text; all drawings & US 2002/0163625 A1	1-12
A	JP 2004-084068 A (Hitachi, Ltd.), 18 March, 2004 (18.03.04), Full text; all drawings & US 2004/0061312 A1	1-12
A	JP 2004-095891 A (Toshiba Corp.), 25 March, 2004 (25.03.04), Full text; all drawings & US 2004/0042174 A1	1-12
A	JP 11-282361 A (Mitsubishi Electric Corp.), 15 October, 1999 (15.10.99), Full text; all drawings (Family: none)	1-12
A	JP 04-126682 A (Matsushita Electric Industrial Co., Ltd.), 16 November, 1992 (16.11.92), Full text; all drawings (Family: none)	1-12
A	JP 03-288107 A (Mitsubishi Electric Corp.), 18 December, 1991 (18.12.91), Full text; all drawings (Family: none)	1-12
A	JP 61-059318 A (Seiko Instruments Inc.), 26 March, 1986 (26.03.86), Full text; all drawings (Family: none)	1-12

* For PC files: A/C in continuation of special classes (Annex 2, Table 1)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- | | |
|------------------------|--------------------------|
| • JP 5126011 A [0007] | • JP 2002121737 A [0007] |
| • JP 4454778 A [0007] | • JP 2002214596 A [0007] |
| • JP 4473733 A [0007] | • JP 2003075918 A [0007] |
| • JP 4291230 A [0007] | • JP 2003195135 A [0007] |
| • JP 5107519 A [0007] | • JP 2004012934 A [0007] |
| • JP 5232427 A [0007] | • JP 1159684 A [0007] |
| • JP 6110645 A [0007] | • JP 5216016 A [0007] |
| • JP 7248450 A [0007] | • JP 5264947 A [0007] |
| • JP 6211353 A [0007] | • JP 11262361 A [0007] |
| • JP 11202411 A [0007] | |

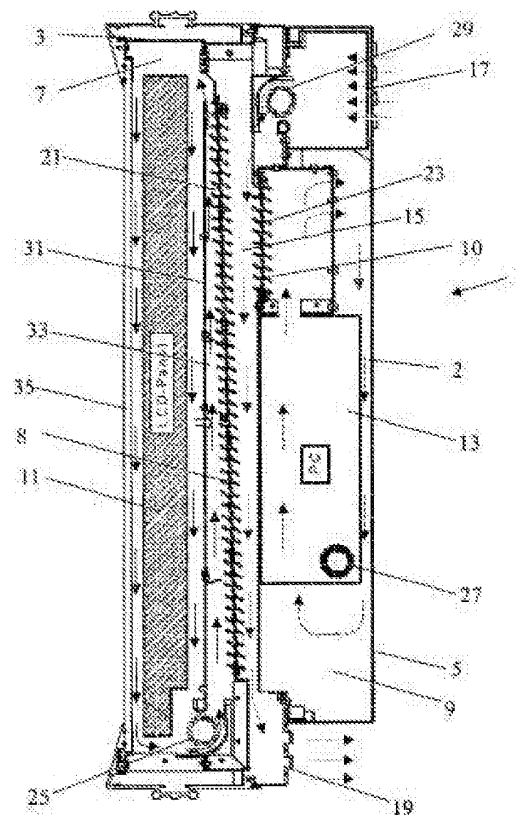


Espacenet

Bibliographic data: EP1951020 (A1) — 2008-07-30

Casing to install electric or electronic instruments**Inventor(s):** WELLHOEFER STEFAN [DE] ± (WELLHOEFER, STEFAN)**Applicant(s):** ISL MEDIA SINGAPORE PTE LTD [SG] ± (ISL MEDIA SINGAPORE PTE LTD)**Classification:** - **international:** H05K7/20
- **cooperative:** H05K7/20972**Application number:** EP20070001753 20070126 Global Dossier**Priority number (s):** EP20070001753 20070126**Abstract of EP1951020 (A1)**

The housing (2) comprises two housing sections (3,5). Each housing section defines a chamber (7,9) that is suitable for retaining electrical or electronic devices (11,13). The housing sections are arranged away from each other, so that between a wall surface of the former housing section and an opposite wall surface of the latter housing section an aeration channel (15) is defined, which is connected with the ambient by an inlet opening for supplying cool air and an outlet opening for discharging heated air. One of the wall surface has a cooling body made of heat conducting material.





(11) **EP 1 951 020 A1**

(12) **EUROPÄISCHE PATENTANMELDUNG**

(43) Veröffentlichungstag:
30.07.2008 Patentblatt 2008/31

(51) Int Cl.:
H05K 7/20 (2006.01)

(21) Anmeldenummer: **07001753.8**

(22) Anmeldetag: **26.01.2007**

(84) Benannte Vertragsstaaten:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI SK TR
Benannte Erstreckungsstaaten:
AL BA HR MK RS

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(54) **Gehäuse zur Aufnahme von elektrischen oder elektronischen Geräten**

(57) Das Gehäuse (2) weist zwei in sich geschlossene Gehäuseabschnitte (3, 5) auf, von denen jeder eine Kammer (7, 9) definiert, die zur Aufnahme von elektrischen oder elektronischen Geräten (11, 13) geeignet ist, wobei die Gehäuseabschnitte (3, 5) beabstandet zueinander angeordnet sind, sodass zwischen einer Wandfläche (8) des ersten Gehäuseabschnittes (3) und einer gegenüberliegenden Wandfläche (10) des zweiten Gehäuseabschnittes (5) ein Lüftungskanal (15) definiert wird, der über mindestens eine Eintrittsöffnung (17) zur Zuführung kühler Luft sowie mindestens eine Austrittsöffnung (19) zur Abgabe erwärmter Luft mit der Umgebung verbunden ist, wobei mindestens eine der den Lüftungskanal (15) definierenden Wandflächen (8, 10) einen Kühlkörper (21, 23) aus Wärme leitendem Material aufweist.

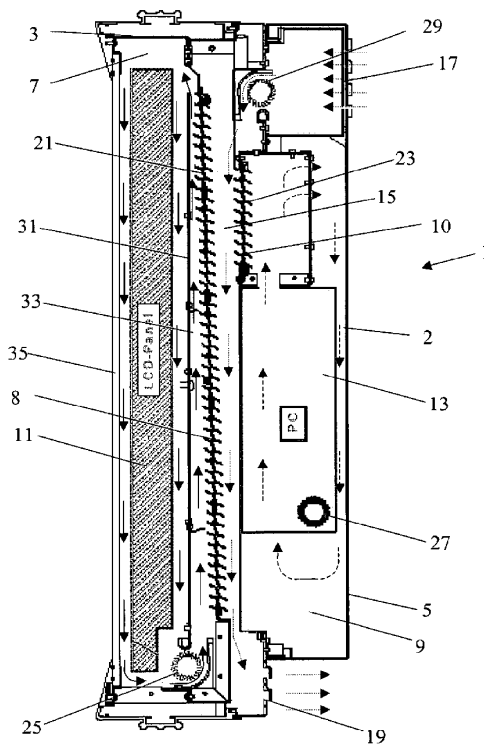


Fig. 1

EP 1 951 020 A1

Beschreibung

[0001] Die Erfindung betrifft ein Gehäuse zur Aufnahme von elektrischen oder elektronischen Geräten im Allgemeinen, und insbesondere ein Gehäusesystem für großflächige elektrische oder elektronische Baugruppen, das im Außenbereich eingesetzt werden kann.

[0002] Durch die technische Entwicklung ist es heute möglich, großflächige Anzeigeeinrichtungen zur Darstellung von bewegten Bildern auf der Basis von Flachbildschirmen, zum Beispiel mittels LCD-Technik, einzusetzen. Möglich ist der Einsatz von großflächigen Monitorsystemen im Außenbereich u.a. als Werbeträger oder als Informationssysteme im öffentlichen Bereich, zum Beispiel auf Flughäfen, Bahnhöfen und dergleichen. Die für einen derartigen Einsatz gewünschte Größe von Flachbildschirminrichtungen beträgt üblicherweise bis zu 80 Zoll (etwa 2 Meter) in der Bildschirmdiagonalen. Mit Hilfe neuer Technologien der Hintergrundbeleuchtung kann die Helligkeit der Anzeigen wesentlich erhöht werden, wodurch derartige Systeme auch tageslichttauglich sind.

[0003] Für den Einsatz im Außenbereich sind die Anforderungen besonders hoch. Zum einen müssen die Monitorsysteme an die klimatischen Bedingungen angepasst sein, d.h. sie müssen in einem Temperaturbereich von - 35°C bis etwa + 40°C einwandfrei arbeiten, ohne dass die elektrischen oder elektronischen Geräte Schaden nehmen. Weiterhin sollten sämtliche elektrischen und elektronischen Bauelemente vor Staub und Feuchtigkeit geschützt sein. Als weitere Anforderung gilt, dass das Monitorsystem durch die Aufstellung oder die Anbringung in öffentlichen Räumen oder Plätzen eine robuste und vandalismussichere Bauweise aufweisen muss. Außerdem soll eine flexible und sichere Befestigung von allen Seiten möglich sein und bei Ausfall einer elektrischen oder elektronischen Baugruppe diese schnell und problemlos ausgetauscht werden können.

[0004] Nach heutigem Stand der Technik werden für derartige Gehäusesysteme im Außenbereich aktive Kühl- oder Heizsysteme, die es in einer Vielzahl von Technologien gibt, verwendet. Diese aktiven Kühl- oder Heizsysteme werden üblicherweise außen am Gehäuse befestigt und kühlen bzw. erwärmen den Teil des Gehäuses, an dem sie befestigt sind. Problematisch an derartigen aktiven Kühl- oder Heizsystemen ist, dass die Kühlflächen für den Wärmeaustausch vor Sonneneinstrahlung geschützt werden müssen. Aus diesem Grund sind sie für eine flexible Verwendung im Außenbereich nicht geeignet.

[0005] Des Weiteren haben sich Standardwärmetauscher, die nach dem Prinzip Luft/Luft funktionieren, aufgrund der unflexiblen konstruktiven Ausführung der Kühlfläche als nicht geeignet erwiesen.

[0006] Es ist daher die Aufgabe der vorliegenden Erfindung, ein Gehäuse zur Aufnahme von elektrischen oder elektronischen Geräten bereitzustellen, das im Außenbereich einsetzbar ist, relativ einfach aufgebaut ist,

eine hervorragende Abfuhr der von den elektrischen Geräten erzeugten Wärme liefert und auch unter extremen Bedingungen eine lange Lebensdauer der aufgenommenen elektrischen Geräte fördert.

[0007] Diese Aufgabe wird durch die Merkmale des Anspruchs 1 gelöst.

[0008] Erfindungsgemäß ist ein Gehäuse mit zwei in sich geschlossenen Gehäuseabschnitten vorgesehen, von denen jeder eine Kammer definiert, die zur Aufnahme von elektrischen oder elektronischen Geräten geeignet ist, wobei die Gehäuseabschnitte beabstandet zueinander angeordnet sind, sodass zwischen einer Wandfläche des ersten Gehäuseabschnitts und einer gegenüberliegenden Wandfläche des zweiten Gehäuseabschnitts ein Lüftungskanal definiert wird, der über mindestens eine Eintrittsöffnung zur Zuführung kühler Luft sowie mindestens eine Austrittsöffnung zur Abgabe erwärmter Luft mit der Umgebung verbunden ist, wobei mindestens eine der den Lüftungskanal definierenden Wandflächen einen Kühlkörper aus Wärme leitendem Material aufweist. Durch die geschlossenen Gehäuseabschnitte ist gewährleistet, dass weder Staub noch Feuchtigkeit zu den elektrischen oder elektronischen Geräten vordringen kann.

[0009] Vorteilhafterweise ist in beiden Wandflächen jeweils mindestens ein Kühlkörper angeordnet. Damit ist je nach Positionierung der elektrischen oder elektronischen Geräte eine Dimensionierung der Kühlkörper möglich, die somit nur einen kleinen Teil der Wandfläche oder auch die gesamte Wandfläche einnehmen können.

[0010] Mit besonderem Vorteil ist in der ersten und/oder zweiten Kammer ein Lüfter angeordnet, der geeignet ist, einen zirkulierenden Luftstrom innerhalb der Kammer zu erzeugen. Ein zirkulierender Luftstrom sorgt für eine gleichmäßige Abfuhr der entstehenden Wärme oder für eine gleichmäßige Zufuhr von Wärme, sodass eine optimierte Kühl- bzw. Heizwirkung erzielt wird.

[0011] Vorteilhafterweise ist in dem Lüftungskanal mindestens ein Lüfter angeordnet, der geeignet ist, einen Luftstrom von der Eintrittsöffnung in Richtung der Austrittsöffnung zu lenken. Durch die Anordnung eines Lüfters im Lüftungskanal ist gewährleistet, dass das Gehäuse in einer beliebigen räumlichen Anordnung positioniert werden kann, d.h. eine Strömungsrichtung von kalter Luft von unten nach oben ist nicht zwingend vorgeschrieben.

[0012] Vorzugsweise ist der oder jeder Lüfter als Walzenlüfter ausgebildet. Der Walzenlüfter sorgt dafür, dass eine große Fläche mit einem einzigen Lüfter gleichmäßig bestrahlt werden kann.

[0013] Mit besonderem Vorteil ist der oder jeder Lüfter temperaturgeregelt. Mit einer an sich bekannten Temperaturregelung des Lüfters ist gewährleistet, dass der Lüfter bei geringer erforderlicher Kühlleistung weniger Leistung verbraucht und damit Strom spart.

[0014] In bevorzugter Weise weist der oder jeder Kühlkörper eine Mehrzahl von Kühlrippen auf, die in Richtung des jeweiligen Luftstroms geneigt sind. Durch die zusätzliche Kühlfläche der Kühlrippen wird die Wärmeaufnahme

meßfläche des Kühlkörpers und damit die Kühlleistung erhöht. Darüber hinaus sorgt die Form der Kühlrippen dafür, dass eine gewisse Verwirbelung der Luftströme, die am Kühlkörper entlang geführt werden, zu einer größeren Kühlwirkung beiträgt, ohne den Luftstrom übermäßig zu bremsen.

[0015] Vorteilhafterweise ist der oder jeder Kühlkörper als Formteil aus einer gepressten Aluminiumlegierung ausgebildet. Aluminium ist aufgrund seiner hohen Wärmeleitfähigkeit als Material für den Kühlkörper ideal geeignet. Selbstverständlich ist es jedoch möglich, auch andere Wärme leitende Materialien anstelle von Aluminium zu verwenden. Darüber hinaus ist es ebenfalls möglich, gegossene oder auf andere Art und Weise geformte Aluminiumteile zu verwenden.

[0016] Mit besonderem Vorteil ist in der ersten Kammer eine Platte schräg zur Wandfläche, die den Kühlkörper aufweist, angeordnet, sodass zwischen der Platte und der Wandfläche ein sich in Richtung des Luftstroms verjüngender Kammerabschnitt definiert wird. Mit dieser Platte können die Strömungsverhältnisse der entstehenden Warmluft in besonderer Weise gesteuert werden. Durch die besondere Anordnung mit dem sich verjüngenden Kammerabschnitt erhöht sich die Strömungsgeschwindigkeit durch den Venturi-Effekt.

[0017] Vorteilhafterweise ist mindestens eine der Außenflächen des Gehäuses als durchsichtige Platte ausgebildet. Damit können in den Gehäuseabschnitten Anzeigevorrichtungen wie zum Beispiel Flachbildschirme (LCD, Plasma, TFT etc.) angeordnet sein. Die durchsichtige Platte selbst kann aus jedem beliebigen durchsichtigen Material sein, wie z.B. Glas, Plexiglas oder dergleichen.

[0018] Erfindungsgemäß wird auch ein Monitorsystem für den Outdoor-Bereich bereitgestellt, wobei das Monitorsystem neben dem oben beschriebenen Gehäuse in der ersten Kammer einen Flachbildschirm sowie in der zweiten Kammer eine Steuereinheit aufweist. Die Steuereinheit kann als handelsüblicher PC ausgebildet sein. Die Technologie des Flachbildschirms kann dabei frei gewählt werden, z.B. LCD, OLED oder Plasma.

[0019] Mit besonderem Vorteil ist der Flachbildschirm in der ersten Kammer derart angeordnet, dass zu beiden Seiten des Flachbildschirms jeweils ein Hohlraum ausgebildet ist. Durch diese Hohlräume strömt der zirkulierende Luftstrom und sorgt somit für eine Wärmeabfuhr des Flachbildschirms.

[0020] Bevorzugter Weise ist in der zweiten Kammer des Monitorsystems für den Outdoor-Bereich ein Computer mit integriertem Lüfter angeordnet, der eine Luftzirkulation in der zweiten Kammer hervorruft. Der Computer kann dabei ein handelsüblicher PC mit Standardgehäuse sein, in dem ein eigener Lüfter für die Zirkulation der Luft sorgt. Das Gehäuse des Computers kann dabei mit geeigneten Lüftungsschlitzen oder -löchern ausgebildet sein, die für eine Zirkulation des Luftstroms in der gesamten Kammer sorgen.

[0021] Weitere Einzelheiten, Merkmale und Vorteile

der vorliegenden Erfindung ergeben sich aus der nachfolgenden Beschreibung unter Bezugnahme auf die Zeichnung.

[0022] Fig. 1 ist eine Querschnittsansicht einer bevorzugten Ausführungsform eines Monitorsystems mit dem erfindungsgemäßen Gehäuse.

[0023] In Fig. 1 ist eine bevorzugte Ausführungsform der vorliegenden Erfindung in Querschnittsansicht dargestellt. Das Monitorsystem 1 umfasst ein Gehäuse 2, das einen ersten in sich geschlossenen Gehäuseabschnitt 3 sowie einen zweiten in sich geschlossenen Gehäuseabschnitt 5 aufweist. Diese beiden staubdicht und im Wesentlichen wasserdicht ausgebildeten Gehäuseabschnitte 3 und 5 definieren jeweils eine Kammer 7 bzw. 9. Die Kammer 7 umfasst in ihrem Inneren ein LCD-Panel 11, das mittels geeigneter Befestigungsmittel ortsfest in der Kammer 7 angeordnet ist. In der zweiten Kammer 9, die durch den zweiten in sich geschlossenen Gehäuseabschnitt 5 definiert ist, ist ein handelsüblicher PC mit eigenem Gehäuse angeordnet, der als Steuereinheit 13 des Monitorsystems 1 dient.

[0024] Die beiden Gehäuseabschnitte 3 und 5 sind derart zueinander beabstandet angeordnet, dass zwischen einer Wandfläche 8 der ersten Kammer 7. und einer gegenüberliegenden Wandfläche 10 der zweiten Kammer 9 ein Lüftungskanal 15 definiert wird. Der Lüftungskanal 15 ist über eine Eintrittsöffnung 17 sowie über eine Austrittsöffnung 19, die jeweils in dem Gehäuse 2 ausgebildet sind, mit dem Außenbereich verbunden. Die Eintritts- bzw. Austrittsöffnungen 17 und 19 können sich seitlich oder an der Ober- und Unterseite des Gehäuses 2 befinden.

[0025] Die den Lüftungskanal 15 definierenden Wandflächen 8, 10 weisen in der dargestellten bevorzugten Ausführungsform der vorliegenden Erfindung jeweils einen Kühlkörper 21, 23 auf. Dabei erstreckt sich der erste Kühlkörper 21 über nahezu die gesamte dem Lüftungskanal 15 zugewandte Wandfläche 8 des ersten Gehäuseabschnitts 3. Der zweite Kühlkörper 23 ist im oberen Bereich der Wandfläche 10 des zweiten Gehäuseabschnitts 5 angeordnet und von der Fläche her wesentlich kleiner als der erste Kühlkörper 21.

[0026] Eine wesentliche Eigenschaft der Kühlkörper 21, 23 ist ihre Wärmeleitfähigkeit. Sie sind deshalb aus einem sehr gut Wärme leitenden Material ausgebildet, beispielsweise einer Aluminiumgusslegierung. Darüber hinaus ist für eine optimale Wärmetauschkfunktion erforderlich, dass die Kühlkörper 21, 23 eine möglichst große Fläche aufweisen. Dies wird in der bevorzugten Ausführungsform der vorliegenden Erfindung durch eine Vielzahl von Kühlrippen erreicht, die so ausgebildet sind, dass sie in Richtung der entsprechenden Luftströme geneigt sind. Dies hat den besonderen Vorteil, dass die durch die Kühlrippen entstehenden Luftverwirbelungen in der hier geschilderten Form relativ groß sind und deshalb für eine Zirkulation der Luftströme im Bereich der Kühlrippen sorgen, ohne den Luftstrom zu stark zu bremsen. Durch die besondere Form und Neigung der Kühl-

rippen wird folglich die Wärmeableitung erhöht. Selbstverständlich sind auch andere Formen von Kühlkörpern und Kühlrippen möglich.

[0027] Wie aus Fig. 1 ersichtlich, ist ebenfalls in dem ersten geschlossenen Gehäuseabschnitt 3 ein Lüfter 25, z.B. ein Walzenlüfter, angeordnet. Der Lüfter 25 erzeugt einen Luftstrom innerhalb der Kammer 7 entlang des ersten Kühlkörpers 21. In ähnlicher Weise erzeugt der Lüfter 27, der in der Kammer 9 angeordnet ist und als Axiallüfter ausgebildet ist, einen Luftstrom, der innerhalb der Kammer 9 am zweiten Kühlkörper 23 vorbei zirkuliert. In der in Fig. 1 gezeigten Ausführungsform ist der Lüfter 27 innerhalb des Gehäuses der Steuereinheit 13 angeordnet. Der zirkulierende Luftstrom innerhalb der zweiten Kammer 9 ist durch gestrichelte Pfeile gekennzeichnet. Er verläuft durch das Gehäuse der Steuereinheit 13 am Kühlkörper 23 entlang, anschließend in den Zwischenraum zwischen der Außenwandfläche des zweiten Gehäuseabschnittes 5 und dem Gehäuse der Steuereinheit 13, um über geeignete Öffnungen wieder in das Gehäuse der Steuereinheit 13 einzutreten.

[0028] In dem Lüftungskanal 15 ist an einer Seite ein Lüfter 29 vorhanden, der z.B. ebenfalls als Walzenlüfter ausgebildet ist. Er ist dazu eingerichtet, die Umgebungsluft außerhalb des Gehäuses 2 über die Eintrittsöffnungen 17 einzusaugen und dem Luftstrom im Lüftungskanal 15 eine solche Richtung und Fließgeschwindigkeit zu geben, dass er bei der Austrittsöffnung 19 wieder aus dem Gehäuse 2 austritt.

[0029] In der Kammer 7 ist neben dem LCD-Panel 11 und dem Lüfter 25 auch eine Platte 31 schräg zum ersten Kühlkörper 21 und damit der Wandfläche 8 der Kammer 7 angeordnet. Dadurch wird ein sich verjüngender Kammerabschnitt 33 definiert, durch den der durch das LCD-Panel 11 erwärmte Luftstrom von dem Lüfter 25 gelenkt strömt. Durch die sich verjüngende Form des Kammerabschnitts 33 wird der Luftstrom durch den Venturi-Effekt in Richtung des enger werdenden Endes beschleunigt, obwohl die gewünschten Verwirbelungen an den Kühlrippen des ersten Kühlkörpers 21 dem zu einem gewissen Maße entgegenwirken.

[0030] Eine durchsichtige Platte 35 bildet die Außenwandfläche des ersten Gehäuseabschnitts 3. Die durchsichtige Platte 35 ist vorzugsweise aus bruchsicherem Glas oder glasähnlichem Kunststoff wie beispielsweise Polymethylmethacrylat oder dergleichen ausgeführt, um die elektrischen oder elektronischen Geräte vor Zerstörung zu schützen. Das LCD-Panel ist innerhalb der Kammer 7 zusammen mit der Platte 31 und dem Lüfter 25 derart angeordnet, dass ein gleichmäßiger Luftstrom an den langen Seitenflächen des LCD-Panels entlang jeweils auf beiden Seiten entsteht. Dadurch wird die Wärme des LCD-Panels abtransportiert und mit Hilfe des Lüfters 25 in den sich verjüngenden Kammerabschnitt 33 gelenkt.

[0031] Im Folgenden wird die Wirkungsweise der Wärmetauschkfunktion des erfindungsgemäßen Gehäuses 2

bzw. des Monitorsystems 1 beschrieben. In den beiden in sich geschlossenen Gehäuseabschnitten 3 und 5, die die Kammern 7 und 9 definieren, zirkulieren zwei unabhängige Warmluftströme. Der erste Warmluftstrom um das LCD-Panel 11 herum nimmt die Verlustleistung des LCD-Panels 11 auf, die je nach Größe des Panels 11 ca. 100-500 W beträgt. Die Verlustleistung des PCs 13 im zweiten Gehäuseabschnitt 5 einschließlich der Stromversorgung des Bildschirms ist dagegen erheblich geringer, in einem Bereich von zwischen 50 und 100 W. Deshalb ist auch die Fläche des zweiten Kühlkörpers 23 im Vergleich zur Fläche des ersten Kühlkörpers 21 wesentlich kleiner. Die beiden in den jeweiligen Kammern 7 und 9 zirkulierenden Luftströme geben ihre Wärme jeweils an die Kühlkörper 21 bzw. 23 ab. Der durch den Lüfter 29 beschleunigte Kühlluftstrom im Lüftungskanal 15, der in Fig. 1 durch gepunktete Pfeile gekennzeichnet ist, nimmt die von den beiden Kühlkörpern 21 und 23 nach innen transportierte Wärme über die innen liegenden Kühlrippen auf, erwärmt sich dabei entsprechend und tritt dort aus dem Gehäuse 2 wieder aus.

[0032] Sämtliche Lüfter 25, 27, 29 sind temperatureregelt und ihre Förderleistung hängt damit von den zu transportierenden Wärmeluftströmen ab, die in den Kanälen bzw. Kammern verlaufen. Die als Walzenlüfter ausgebildeten Lüfter haben einen Durchsatz von bis zu 3.000 m³/h.

[0033] Die Platte 31, die zwischen dem ersten Kühlkörper 21 und der Rückseite des LCD-Panels 11 angeordnet ist, hat auch noch folgenden Effekt: Da die Monitoranordnung auch bei sehr niedrigen Temperaturen, bis zu -35°C, störungsfrei funktionieren soll, muss verhindert werden, dass das großflächige LCD-Panel 11 beschlägt. Durch die Platte 31 wird u.a. dafür gesorgt, dass der Luftstrom um das LCD-Panel 11 herum möglichst gleichmäßig ist. Um bei sehr niedrigen Temperaturen ein Einfrieren zu verhindern, kann die Steuereinrichtung 13 dazu eingerichtet sein, beispielsweise nur die Hintergrundbeleuchtung des Panels 11 anzusteuern.

[0034] Durch die Steuerung der Luftströme über Lüfter bei der bevorzugten Ausführungsform der vorliegenden Erfindung ist es möglich, dass die erfindungsgemäße Monitoranordnung 1 beliebig im Raum angeordnet werden kann und vollständig drehbar gelagert sein kann. Es ist ebenfalls möglich, auf beiden Seiten der Monitoranordnung 1 jeweils ein LCD-Panel 11 anzuordnen, wobei zu beachten ist, dass der zweite Kühlkörper 23 dann in entsprechender Größe gewählt sein muss, um die größere Verlustleistung des zweiten Panels zu kompensieren. Darüber hinaus ist es auch möglich, statt eines handelsüblichen PCs 13 eine Steuereinheit zu verwenden, die von einem kleinen, tragbaren Computer stammt. Damit lässt sich Platz sparen und die abzuführende Wärmeleistung der Steuereinheit 13 auf weniger als 20 W absenken, weshalb man gegebenenfalls auch vollständig auf den zweiten Kühlkörper 23 verzichten kann.

[0035] Es ist anzumerken, dass das Netzteil des LCD-Panels 11 in der bevorzugten Ausführungsform der vor-

liegenden Erfindung in Fig. 1 nicht dargestellt ist. Es befindet sich neben der Steuereinheit 13 innerhalb des zweiten Gehäuseabschnitts 5. Wie bereits erwähnt, wird seine Verlustleistung ebenfalls über den in der zweiten Kammer 9 zirkulierenden Luftstrom zum zweiten Kühlkörper 23 geführt.

[0036] Damit wurde ein Monitorsystem geschaffen, das einfach aufgebaut ist, im Freien einsetzbar ist und bei dem aufgrund der Anordnung der Kühlkörper und des Lüftungskanals im Inneren des Gehäuses keinerlei Beeinträchtigung der Kühlwirkung von außen stattfinden kann.

Gleichzeitig ist es möglich, die gesamte entstehende Wärmeleistung über zwei voneinander getrennte Kreisläufe abzuführen.

Patentansprüche

1. Gehäuse (2) mit zwei in sich geschlossenen Gehäuseabschnitten (3, 5), von denen jeder eine Kammer (7, 9) definiert, die zur Aufnahme von elektrischen oder elektronischen Geräten (11, 13) geeignet ist, wobei die Gehäuseabschnitte (3, 5) beabstandet zueinander angeordnet sind, sodass zwischen einer Wandfläche (8) des ersten Gehäuseabschnittes (3) und einer gegenüberliegenden Wandfläche (10) des zweiten Gehäuseabschnittes (5) ein Lüftungskanal (15) definiert wird, der über mindestens eine Eintrittsöffnung (17) zur Zuführung kühler Luft sowie mindestens eine Austrittsöffnung (19) zur Abgabe erwärmter Luft mit der Umgebung verbunden ist, wobei mindestens eine der den Lüftungskanal (15) definierenden Wandflächen (8, 10) einen Kühlkörper (21, 23) aus Wärme leitendem Material aufweist.
2. Gehäuse (2) nach Anspruch 1, **dadurch gekennzeichnet, dass** in beiden Wandflächen (8, 10) jeweils mindestens ein Kühlkörper (21, 23) angeordnet ist.
3. Gehäuse (2) nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** in der ersten und/oder zweiten Kammer (7, 9) ein Lüfter (25, 27) angeordnet ist, der geeignet ist, einen zirkulierenden Luftstrom innerhalb der Kammer (7, 9) zu erzeugen.
4. Gehäuse (2) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** in dem Lüftungskanal (15) mindestens ein Lüfter (29) angeordnet ist, der geeignet ist, einen Luftstrom von der Eintrittsöffnung (17) in Richtung der Austrittsöffnung (19) zu lenken.
5. Gehäuse (2) nach Anspruch 3 oder 4, **dadurch gekennzeichnet, dass** der oder jeder Lüfter (25, 27, 29) als Walzenlüfter ausgebildet ist.
6. Gehäuse (2) nach einem der Ansprüche 3 bis 5, **dadurch gekennzeichnet, dass** der oder jeder Lüfter (25, 27, 29) temperaturregelt ist.
7. Gehäuse (2) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** der oder jeder Kühlkörper (21, 23) eine Mehrzahl von Kühlrippen aufweist, die in Richtung des jeweiligen Luftstroms geneigt sind.
8. Gehäuse (2) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** der oder jeder Kühlkörper (21, 23) als Formteil aus einer gepressten Aluminiumlegierung ausgebildet ist.
9. Gehäuse (2) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** in der ersten Kammer (7) eine Platte (31) schräg zu der Wandfläche (8), die den Kühlkörper (21) aufweist, angeordnet ist, sodass zwischen der Platte (31) und der Wandfläche (8) ein sich in Richtung des Luftstroms verjüngender Kammerabschnitt (33) definiert wird.
10. Gehäuse (2) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** mindestens eine Außenfläche des Gehäuses (2) als durchsichtige Platte (35) ausgebildet ist.
11. Monitorsystem (1) für den Outdoor-Bereich, mit einem Gehäuse (2) nach einem der Ansprüche 1 bis 10, wobei das Monitorsystem in der ersten Kammer (7) einen Flachbildschirm (11) sowie in der zweiten Kammer (9) eine Steuereinheit (13) aufweist.
12. Monitorsystem (1) für den Outdoor-Bereich nach Anspruch 11, wobei der Flachbildschirm (11) in der ersten Kammer (7) derart angeordnet ist, dass zu beiden Seiten des Flachbildschirms jeweils ein Hohlraum ausgebildet ist.
13. Monitorsystem (1) für den Outdoor-Bereich nach Anspruch 11 oder 12, wobei in der zweiten Kammer (9) ein Computer mit integriertem Lüfter (27) angeordnet ist, der eine Luftzirkulation in der zweiten Kammer (9) hervorruft.

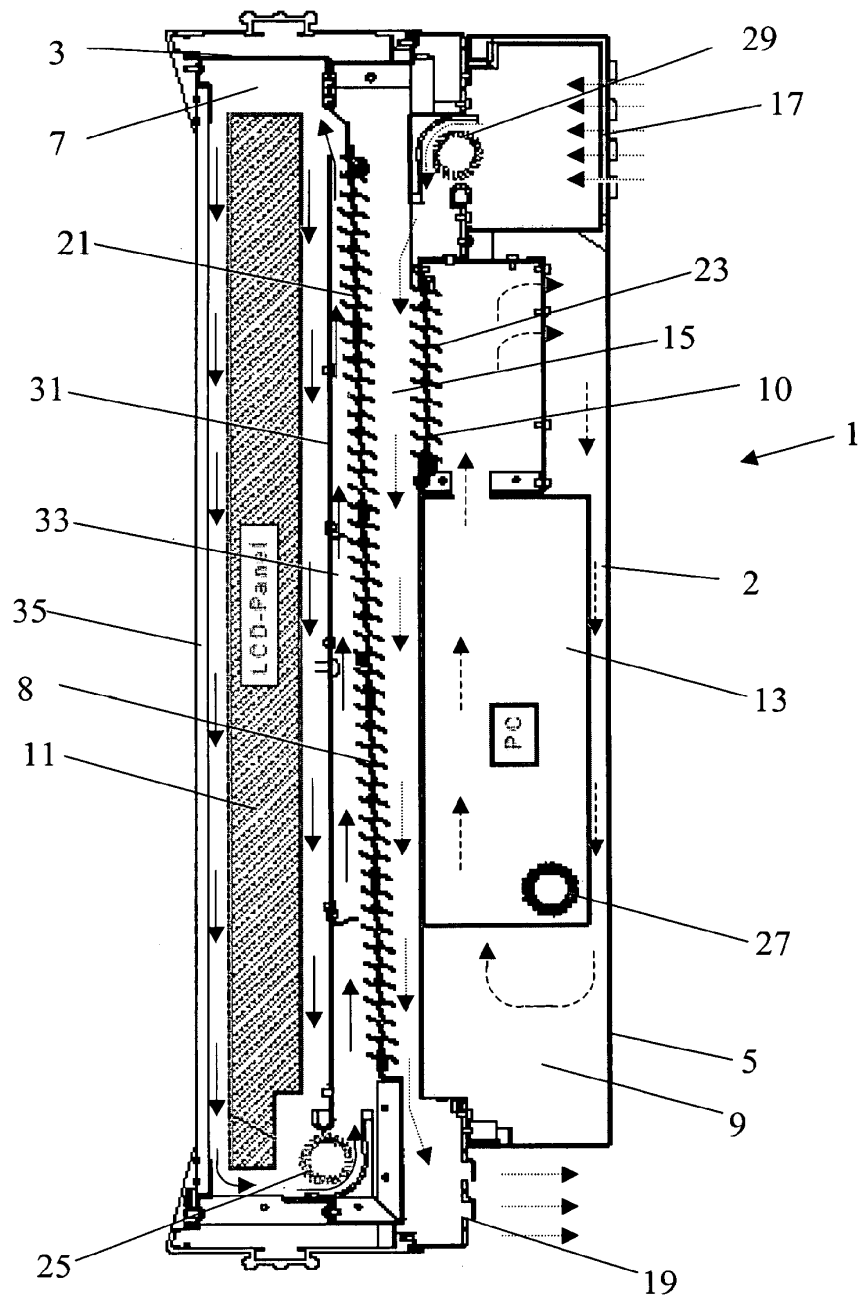


Fig. 1



Europäisches
Patentamt

EUROPÄISCHER RECHERCHENBERICHT

Nummer der Anmeldung
EP 07 00 1753

EINSCHLÄGIGE DOKUMENTE			
Kategorie	Kennzeichnung des Dokuments mit Angabe, soweit erforderlich, der maßgeblichen Teile	Betrifft Anspruch	KLASSIFIKATION DER ANMELDUNG (IPC)
A	GB 2 402 205 A (DENSITRON TECHNOLOGIES PLC [GB]) 1. Dezember 2004 (2004-12-01) * das ganze Dokument *	1	INV. H05K7/20
A	WO 2006/098365 A (MATSUSHITA ELECTRIC IND CO LTD [JP]; YANAGAWA HIROTO; TAKEZAWA HIROAKI) 21. September 2006 (2006-09-21) * das ganze Dokument *	1	
E	FR 2 891 940 A (COTEP SA [FR]) 13. April 2007 (2007-04-13) * das ganze Dokument *	1	
			RECHERCHIERTE SACHGEBIETE (IPC)
			H05K
Der vorliegende Recherchenbericht wurde für alle Patentansprüche erstellt			
Recherherort Den Haag		Abschlußdatum der Recherche 11. Juni 2008	Prüfer Toussaint, François
KATEGORIE DER GENANNTE DOKUMENTE X : von besonderer Bedeutung allein betrachtet Y : von besonderer Bedeutung in Verbindung mit einer anderen Veröffentlichung derselben Kategorie A : technologischer Hintergrund O : mündliche Offenbarung P : Zwischenliteratur T : der Erfindung zugrunde liegende Theorien oder Grundsätze E : älteres Patentedokument, das jedoch erst am oder nach dem Anmeldedatum veröffentlicht worden ist D : in der Anmeldung angeführtes Dokument L : aus anderen Gründen angeführtes Dokument & : Mitglied der gleichen Patentfamilie, übereinstimmendes Dokument			

3
EPO FORM 1503 (03.02.1994) (P4/C03)

**ANHANG ZUM EUROPÄISCHEN RECHERCHENBERICHT
ÜBER DIE EUROPÄISCHE PATENTANMELDUNG NR.**

EP 07 00 1753

In diesem Anhang sind die Mitglieder der Patentfamilien der im obengenannten europäischen Recherchenbericht angeführten Patentdokumente angegeben.
Die Angaben über die Familienmitglieder entsprechen dem Stand der Datei des Europäischen Patentamts am
Diese Angaben dienen nur zur Unterrichtung und erfolgen ohne Gewähr.

11-06-2008

Im Recherchenbericht angeführtes Patentdokument		Datum der Veröffentlichung	Mitglied(er) der Patentfamilie	Datum der Veröffentlichung
GB 2402205	A	01-12-2004	KEINE	
WO 2006098365	A	21-09-2006	KEINE	
FR 2891940	A	13-04-2007	KEINE	

EPO FORM P0481

Für nähere Einzelheiten zu diesem Anhang : siehe Amtsblatt des Europäischen Patentamts, Nr.12/82



(11) **EP 2 225 603 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention
of the grant of the patent:
25.06.2014 Bulletin 2014/26

(51) Int Cl.:
G02F 1/1333 (2006.01) **G02F 1/13357** (2006.01)
H05K 7/20 (2006.01)

(21) Application number: **08848846.5**

(86) International application number:
PCT/US2008/083792

(22) Date of filing: **17.11.2008**

(87) International publication number:
WO 2009/065125 (22.05.2009 Gazette 2009/21)

(54) **SYSTEM AND METHOD FOR THERMALLY CONTROLLING AN ELECTRONIC DISPLAY**
SYSTEM UND VERFAHREN ZUM THERMISCHEN REGELN EINES ELEKTRONISCHEN DISPLAYS
SYSTÈME ET PROCÉDÉ POUR RÉGULER THERMIQUEMENT UN AFFICHAGE ÉLECTRONIQUE

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

(30) Priority: **16.11.2007 US 941728**
03.03.2008 US 33058
03.03.2008 US 33064
26.03.2008 US 39454
16.05.2008 US 53713
30.05.2008 US 57599
26.06.2008 US 76126
14.08.2008 US 191834
19.09.2008 US 234307
19.09.2008 US 234360
22.09.2008 US 235200
24.09.2008 US 237365
17.11.2008 US 115333

(43) Date of publication of application:
08.09.2010 Bulletin 2010/36

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(56) References cited:
EP-A1- 1 762 892 WO-A1-2005/079129
GB-A- 2 402 205 JP-A- 8 194 437
JP-A- 2002 158 475 JP-A- 2005 134 849
KR-A- 20070 070 675 US-A- 5 991 153

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Printed by Jouve, 75001 PARIS (FR)

EP 2 225 603 B1

SEC et al. v. MRI
SEC Exhibit 1031.0509
IPR2023-00254

DescriptionTechnical Field

[0001] Exemplary embodiments generally relate to heating/cooling systems for electronic displays.

Background of the Art

[0002] Electronic displays are typically used in indoor, temperature-controlled environments. Although the temperature surrounding the display might be relatively stable (near room temperature), the components of the display may generate a large amount of heat. If not properly removed, this heat could damage the display or shorten its lifetime. Conductive and convective heat transfer systems have traditionally been used to remove heat from the electronic components in a display through as many sidewalls of the display as possible. While such heat transfer systems have enjoyed a measure of success in the past, today's electronic displays require even greater cooling (and in some case heating) capabilities.

[0003] Modern electronic displays are now being used in outdoor environments as well as other situations where the surrounding temperature may extend above and below room temperature. In addition to heat transfer from the surrounding air, radiative heat transfer from the sun through a display surface may also become a major factor. In some applications and locations, 200 Watts or more of power through such a display surface is common. Furthermore, the market is demanding larger and brighter, sometimes high definition displays. With increased electronic display size more heat will be absorbed from the sun and more heat will be transmitted into the displays. To compete with the ambient light from the sun as well as reflections off surrounding surfaces, displays must produce more light, which also typically results in more heat generated by the display and/or its backlight assembly.

[0004] Further, in some applications the temperature may drop well below room temperature. Some components of an electronic display may malfunction or may be permanently destroyed by exposure to such low temperatures. For example, the performance of the liquid crystal material in a liquid crystal display (LCD) may be effected by low temperatures.

[0005] The US 5,991,153 discloses an electronic display unit comprising a thermal control system for a display stack of the electronic display unit having a display surface and a backlight assembly. The casing of the electronic display unit forms a closed loop gas cooling system consisting of a first gas chamber arranged in front of the display surface and a second gas chamber being in fluid contact with the first gas chamber and being arranged behind the backlight assembly. The second gas chamber is separated from the backlight assembly by a partition wall. In order to enhance the cooling effect of the thermal control system the rear wall of the second gas chamber

is equipped with a cooling element comprising a plurality of cooling fins which are encircled by an air stream generated by an external fan.

[0006] GB 2,402 205 A and WO 2005/079 1299 A1 disclose other thermal control systems of this kind for cooling an electronic display unit.

Summary of the Exemplary Embodiments

[0007] It is an object of the present invention to provide a thermal control system and a method for thermally controlling a display stack of an electronic display with an enhanced cooling/heating efficiency. This object is solved by a system according to the patent claim 1 and by a method according to the patent claim 6. Exemplary embodiments may contain one or more of the thermal control features disclosed herein as far as covered by the claims. A plurality of thermal control features are disclosed and these features may be utilized alone or in any combination. The precise combination of features would depend upon the particular cooling/heating needs of the display at issue, which would depend upon the type of display, size of the display, and its particular environment. The thermal control system may be practiced with any form of electronic display, including but not limited to: LCD, light emitting diode (LED), organic light emitting diode (OLED), field emitting display (FED), cathode ray tube (CRT), plasma, and projection displays. An exemplary embodiment would be practiced with LCD displays.

[0008] The invention relates to 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. As the gas traverses the first gas chamber it contacts the electronic display surface, absorbing heat from the display surface. Because the gas and the relevant surfaces of the first gas chamber are transparent, the image quality remains excellent. After the gas has traversed the transparent first gas chamber, the gas may be directed into the rear cooling plenum where it is cooled.

[0009] Another thermal feature may utilize the isolated gas system as a heating device, either instead of or in addition to its cooling abilities. An isolated gas heating system would also be a closed loop system with a first gas chamber anterior to the display surface and a second chamber comprising a heating plenum or cooling/heating plenum. Heating elements may be placed within the plenum in order to heat the gas within the second chamber. As the gas is forced into the first chamber it may transfer its heat to the display surface. The gas may then return

to the plenum for another heating cycle. The plenum may function as a cooling plenum only, heating plenum only, or a combination heating/cooling plenum; all depending upon the particular display and its particular operating environment.

[0010] Some embodiments may place electronic components used to operate the electronic display within the plenum of the isolated gas chamber. The electronic components may include, but are not limited to: transformers, circuit boards, processors, resistors, capacitors, batteries, motors, power supplies, illumination devices, wiring and wiring harnesses, and switches. If the plenum is being utilized as a cooling plenum, the cool gas within the plenum can further aid in the cooling of the electronic components, which will naturally generate heat during operation. Further, if the plenum is being utilized as a source of heat for the display, the natural heat from the electronic components can also heat the gas in the plenum, reducing the amount of energy which needs to be applied to the heating elements.

[0011] A linear polarizer may be used in some embodiments to further reduce the solar loading on the electronic display. This polarizer can be used in combination with the isolated gas chamber, or may simply be placed anterior to the electronic display with an insulating gap between the polarizer and the display. The insulating gap reduces the amount of heat that is transferred between the polarizer and the display.

[0012] The electronic displays suitable for the invention, such as LCDs for example, require a backlight assembly to produce an image upon the display surface. The backlight assemblies are typically a large source of heat for the display. Thus, some embodiments may utilize a constricted convection system to cool the backlight unit for the display. The constricted convection system may comprise a constricted convection plate which is placed in close proximity to the backlight assembly in order to define a gap. Gas is forced through the gap in order to facilitate more efficient cooling of the backlight assembly. In some embodiments a wall of the plenum may constitute the constricted convection plate.

[0013] Some examples may also utilize an air curtain device which forces air (either warm or cold) over the exterior surface of the display assembly.

[0014] Finally, some examples may use a fluid assembly which contacts a fluid against the display surface in order to cool it. The fluid may be a substantially clear form of coolant fluid which is pumped through an anterior cavity which includes the display surface.

Brief Description of the Drawings

[0015] A better understanding of the exemplary embodiments 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 perspective view of an exemplary arrangement in conjunction with an exemplary electronic display.

FIGURE 2 is an exploded perspective view of an exemplary embodiment showing components of the isolated gas cooling system.

FIGURE 3 is top plan view of an exemplary embodiment of the cooling chamber.

FIGURE 4 is a front perspective view of an embodiment of the isolated cooling chamber, particularly the transparent anterior surface of first gas chamber.

FIGURE 5 is a rear perspective view of an embodiment of the isolated cooling chamber, showing optional electrical components placed in the plenum.

FIGURE 6 is a rear perspective view of an embodiment of the isolated cooling chamber showing surface features that may be included on the plenum.

FIGURE 7 is a top plan view of an exemplary embodiment of the cooling chamber showing surface features that may be included on the plenum.

FIGURE 8 is a front perspective view of an embodiment of the isolated cooling chamber with included thermoelectric modules.

FIGURE 9 is a top plan view of an exemplary embodiment of the cooling chamber with included thermoelectric modules.

FIGURE 10 is an exploded perspective view of an exemplary embodiment showing components of the isolated gas cooling system.

FIGURE 11 is a top plan view of an exemplary embodiment of the heating chamber.

FIGURE 12 is a rear perspective view of an embodiment of the heating chamber, showing optional electrical components and heating elements.

FIGURES 13 and 14 are cross-sectional views of exemplary embodiments for utilizing a linear polarizer with the isolated gas system.

FIGURES 15A and 15B are side views of examples of a constricted convection cooling system with a constricted convection plate.

FIGURE 16 is a top plan view of an exemplary embodiment where the cooling plenum is utilized as the constricted convection plate.

FIGURES 17A-17C are cross-sectional views of embodiments where the cooling plenum is utilized as the constricted convection plate.

Detailed Description

[0016] It is to be understood that the disclosed embodiments include thermally controlling displays including, but not limited to LCDs. For simple explanation purposes, embodiments may be described with respect to the components for LCD displays. By way of example and not by way of limitation, similar arrangements may be used in conjunction with displays selected from among LCD, light emitting diode (LED), organic light emitting diode (OLED), field emitting display (FED), cathode ray tube

(CRT), plasma, and projection displays. Furthermore, similar arrangements may be used with displays other types including those not yet discovered. In particular, it is contemplated that similar arrangements may be well suited for use with full color, flat panel OLED displays. Further, it is particularly contemplated that embodiments may be used with relatively large, high definition LCD displays. While the embodiments described herein are well suited for outdoor environments, they may also be appropriate for indoor applications (e.g., factory environments, coolers/freezers, etc.) where thermal stability of the display may be at risk.

Isolated Gas Cooling System

[0017] As shown in FIGURE 1, when the display 10 is exposed to outdoor elements, the temperatures inside the display 10 may vary greatly without some kind of cooling device. As such, the display 10 may not function properly or may have a greatly reduced life span. Direct sunlight is especially problematic in causing increases in the internal temperature of the display 10.

[0018] In Figure 1, the display area of the electronic display shown includes a narrow gas chamber that is anterior to and coextensive with the electronic display surface. The display shown is also equipped with an optional air curtain device 114. The air curtain device 114 is discussed in detail below. Optionally, the display may have a reflection shield 119, to mitigate reflection of the sunlight on the display surface. Additionally, in outdoor environments, housing 70 is preferably a color which reflects sunlight.

[0019] As shown in FIGURE 2, an exemplary embodiment of the electronic display 10 includes an isolated gas cooling chamber 20 contained within a display housing 70. A transparent first gas chamber is defined by spacers 100 and transparent front plate 90. A second transparent front plate 130 may be laminated to front plate 90 to help prevent breakage of front plate 90 and protect the interior of the display. Cooling chamber 20 surrounds a display stack 80 and associated backlight assembly 140.

[0020] The display 10 includes means for cooling gas contained within the second gas chamber. These means include one or more fans 60 which may be positioned at the base of the display housing 70. The fans 60 ingest cool air and force the cooler ingested air over at least one external surface of a posterior cooling plenum 45. If desired, an air conditioner (not shown) may also be utilized to cool the air which contacts the external surface of plenum 45. Alternatively, the fans 60 may simply ingest ambient air.

[0021] Referring to FIGURE 3, embodiments of the isolated gas cooling chamber 20 comprise closed loop which includes a first gas chamber 30 and a second gas chamber 40. The first gas chamber includes a transparent plate 90. The second gas chamber comprises a cooling plenum 45. The term "isolated gas" refers to the fact

that the gas within the isolated gas cooling chamber 20 is isolated from external air in the housing of the display. Because the first gas chamber 30 is positioned in front of the electronic display surface 85, the gas should be substantially free of dust or other contaminants that might negatively affect the display image. An optional filter (not shown) may be utilized to assist in preventing contaminants and dust from entering the first gas chamber 30.

[0022] The isolated gas may be almost any transparent gas, for example, normal air, nitrogen, helium, or any other transparent gas. The gas is preferably colorless so as not to affect the image quality.

[0023] In the closed loop configuration shown in Fig. 3, the first gas chamber 30 is in gaseous communication with the second gas chamber 40. A cooling chamber fan 50 is provided within the cooling plenum 45 and utilized to propel gas around the isolated gas cooling chamber 20. The first gas chamber 30 includes at least one front glass 90 mounted in front of an electronic display surface 85.

[0024] Referring to FIGURE 4, the front plate 90 may be set forward from the electronic display surface 85 by spacing members 100. The spacing members 100 define the depth of the narrow channel passing in front of the electronic display surface 85. The spacing members 100 may be independent or alternatively may be integral with some other component of the device (e.g., integral with the front plate 90). The electronic display surface 85, the spacing members 100, and the transparent front plate 90 define a first gas chamber 30. The chamber 30 is in gaseous communication with plenum 45 through entrance opening 110 and exit opening 120.

[0025] As shown in Fig. 3, a posterior surface of the first gas chamber 30 preferably comprises the electronic display surface 85 of the display stack 80. As the isolated gas in the first gas chamber 30 traverses the display it contacts the electronic display surface 85. Contacting the cooling gas directly to the electronic display surface 85 enhances the convective heat transfer away from the electronic display surface 85. In exemplary embodiments the electronic display surface 85 comprises the posterior surface of the first gas chamber 30. Accordingly, the term "electronic display surface" refers to the front surface of a typical electronic display (in the absence of the embodiments disclosed herein).

[0026] In an exemplary embodiment, the electronic display surface 85, front plate 90, and optional second front plate 130 may be comprised of a glass substrate. However, neither display surface 85, nor transparent front plate 90, nor optional second transparent front plate 130 need necessarily be glass. Thus, the term "glass" may be used herein interchangeably with the term plate, but a glass material is by no means required. Further, electronic display surface 85 does not have to comprise the posterior surface wall of the front gas compartment 30. An additional plate may be used. However, by utilizing the electronic display surface 85 as the posterior surface wall of the gas compartment 30, there may be fewer sur-

faces to impact the visible light traveling through the display. Furthermore, the device will be lighter and cheaper to manufacture.

[0027] Although the embodiment shown utilizes the electronic display surface 85, certain modifications and/or coatings (e.g., anti-reflective coatings) may be added to the electronic display surface 85, or to other components of the system in order to accommodate the coolant gas or to improve the optical performance of the device. In the embodiment shown, the electronic display surface 85 may be the front glass plate of a liquid crystal display (LCD) stack. However, almost any display surface may be suitable for similar arrangements of the present cooling system. Although not required, it is preferable to allow the cooling gas in the first gas chamber 30 to contact the electronic display surface 85 directly. In this way, the convective transfer of heat from the display components to the circulating gas will be maximized.

[0028] Referring to Fig. 4, the front plate 90 of the first gas chamber 30 is transparent and is positioned anterior to the electronic display surface 85. The arrows shown represent the movement of the isolated gas through the first gas chamber 30. As shown, the isolated gas traverses the first gas chamber 30 in a horizontal direction. Although cooling system 20 may be designed to move the gas in either a horizontal or a vertical direction, it is preferable to propel the gas in a horizontal direction. In this way, if dust or contaminants do enter the first gas chamber 30, they will tend to fall to the bottom of chamber 30 outside of the viewable area of the display. The system may move air left to right, or alternatively, right to left. After the gas traverses the first gas chamber 30 it exits through exit opening 120. Exit opening 120 defines the entrance junction into the rear cooling plenum 45.

[0029] FIGURE 5 shows a schematic of the rear cooling plenum (illustrated as transparent for explanation). One or more fans 50 within the plenum provide the force necessary to move the isolated gas through the isolated gas cooling chamber. Whereas the first gas chamber 30 was designed to collect heat from the surface 85 of the display, the second gas chamber 40 is designed to extract the heat from the gas and remove the heat from the cooling chamber 20. The second chamber 40 may have various contours and features to accommodate the internal structures within a given electronic display application.

[0030] If desired, various electronic components 200 can be placed anywhere throughout the second gas chamber 40. The electronic components 200 may include, but are not limited to: transformers, circuit boards, processors, resistors, capacitors, batteries, motors, power supplies, illumination devices, wiring and wiring harnesses, and switches. These components can be mounted directly on the walls of the chamber or supported on rods or posts. Thus, the cooling plenum can be designed to not only extract heat from the first gas chamber 30 but also to cool these various electronic components 200. (Additionally, as discussed below, if the isolated gas sys-

tem is used to heat the display, the electronic components can assist in heating the isolated gas.)

[0031] Referring now to FIGURES 6 and 7, various surface features 150 may be added to improve heat dissipation from the plenum 45. These surface features 150 provide more surface area to radiate heat away from the gas within the second gas chamber 40. These features 150 may be positioned at numerous locations on the surface of the plenum 45.

[0032] Referring now to FIGURES 8 and 9, one or more thermoelectric modules 160 may be positioned on at least one surface of the plenum 45 to further cool the gas contained in the second gas chamber 40. The thermoelectric modules 160 may be used independently or in conjunction with surface features 150. Alternatively, thermoelectric modules 160 may be used to heat the gas in the plenum if the isolated gas system is utilized to heat a display in a cold environment.

[0033] FIGURE 10 shows an exemplary method for removing heat in the gas contained in the rear plenum 45. Fan 60 is positioned to ingest air and blow that air across the anterior and posterior surfaces of the plenum 45. Again, fan 60 may ingest air conditioned air into the display housing 70 or may simply ingest ambient surrounding air. Furthermore, in this configuration, fan 60 may also force air past the heat generating components of the electronic display (e.g., the display stack 80 and the backlight assembly 140) to further improve the ability to cool the entire display. It should be noted that this embodiment can be combined with the constricted convection cooling method discussed in detail below. The heated exhaust air may exit through one or more apertures 179 located on the display housing 70.

Isolated Gas Heating System

[0034] As mentioned above, the isolated gas system can be utilized to also heat the electronic display. Referring to FIGURES 11 and 12, heating elements 220 may be located within the second gas chamber 40 and operate to warm the gas as it passes through the second gas chamber 40. These heating elements can be any one of the many commonly available heating elements or thermoelectric modules. Many times, these elements are simply a material which contains a high electrical resistance, and thus generates heat when current flows through it. The heating elements can be, but are not limited to, any one of the following: nichrome wire or ribbon, screen printed metal/ceramic tracks deposited on ceramic insulated metal (generally steel) plates, CalRod (typically a fine coil of nichrome wire in a ceramic binder, sealed inside a tough metal shell), heat lamp, and Positive Thermal Coefficient (PTC) of resistance ceramic.

[0035] As discussed above, the plenum 45 may contain electrical components 200 which power and control the electronic display. The electrical components may be any one of the following: transformers, microprocessors, printed circuit boards, power supplies, resistors, capac-

itors, motors, wiring harnesses, and connectors. The electrical connections for the electrical components 200 may pass through a wall of the plenum 45. The electrical components 200 can be located anywhere within the plenum 45. The electrical components 200 may be mounted on the posterior or anterior surface of the plenum and may be mounted directly on the surface of the plenum or may be suspended by mounting posts so that gas may pass all around the component.

[0036] While the display is operational, the isolated gas cooling system may run continuously. However, if desired, a temperature sensor (not shown) and a switch (not shown) may be incorporated within the electronic display. Thus, a thermostat may be used to detect when temperatures have reached a predetermined threshold value and the isolated gas system may be selectively engaged when the temperature in the display reaches a predetermined value. Predetermined temperature thresholds may be selected and the system may be configured to heat, cool, or both heat and cool the display to advantageously keep the display within an acceptable temperature range.

Linear Polarizer with Optional Insulator Gap

[0037] FIGURE 13 is a cross-sectional view of another exemplary embodiment for another thermal control feature. In the arrangement shown, the front plate 90 and a second front plate 130 may be comprised of glass and may be laminated together. The first and second front panels 130 and 90 may be fixed to one another with a layer of index matched optical adhesive 201 to form a front glass unit 206. The display stack 80 may comprise a liquid crystal assembly 212 interposed between a front polarizer 216 and a rear polarizer 214. In other embodiments, the display stack 80 may be any other type of assembly for any other type of electronic display. The space between the display stack 80 and the front glass unit 206 defines an insulator gap 301. The insulator gap 301 serves to thermally separate the front glass unit 206 from the LCD stack 80. This thermal separation localizes the heat on the front glass unit rather than allowing solar loading of the LCD stack. In combination with the isolated gas system, the insulator gap 301 comprises the first gas chamber 30.

[0038] The second front panel may have a first surface 202 and a second surface 208. The first surface 202 may be exposed to the elements; while the second surface 208 may be fixed to the first front plate 90 by the index matched optical adhesive 201. The first front plate 90 may have a third surface 209 and a fourth surface 204. The third surface 209 may be fixed to the second front plate 130 by the index matched optical adhesive 201; while the fourth surface may be directly adjacent to the insulator gap 301. In some embodiments, to decrease the solar loading of the display stack 80 and improve the viewable image quality, an anti-reflective coating may be applied to the first surface 202 and the fourth surface

204. In other embodiments, the anti-reflective coating may only be applied to at least one of the first, second, third, or fourth surface 202, 208, 209, and 204, respectively.

[0039] FIGURE 14 is a cross-sectional view of another exemplary embodiment of the front glass unit 206. In the arrangement shown, the front glass unit 206 comprises a second front plate 130, a layer of index matched optical adhesive 201, a linear polarizer 400, and a first front plate 90. The linear polarizer 400 may be bonded to at least one of the first, second, third or fourth surfaces 202, 208, 209, and 204, respectively. Again, anti-reflective layers may be applied to at least one of the first, second, third or fourth surfaces 202, 208, 209, and 204, respectively. The linear polarizer 400 may be aligned with the front polarizer 209 found in the LCD stack 85. The inclusion of a linear polarizer 400 in the front glass unit 206, further decreases the solar load on the display stack 80. The reduction in solar loading may significantly reduce the internal temperature of the electronic display. The linear polarizer 400 may also cause a reduction in specular reflection of the front glass unit 206 and the display stack 80. As discussed above, in combination with the isolated gas system, the insulator gap 301 comprises the first gas chamber 30. Again, it should be noted that the display stack 80 may be an LCD stack, but it can also be any other type of electronic display.

[0040] It should also be noted that the second front plate 130 is not required. Embodiments may utilize only the first front plate 90 with a linear polarizer attached to either the posterior or anterior surface of the front plate 90. An anti-reflective layer may also be attached to either the anterior or posterior surface of the front plate 90. The front plate 90 may be tempered for additional strength if using only the front plate 90 without the second front plate 130.

Constricted Convection

[0041] The types of electronic displays in accordance with the present invention require a backlight assembly in order to generate an image upon a viewable screen. LCDs are one type of display that requires a backlight assembly. Other types of displays, such as plasma displays and OLEDs, do not require a backlight assembly as they generate light themselves. However, these types of displays still generate a significant amount of heat. Thus, in the following description, a constricted convection system will be described with regard to a backlight assembly, but it should be noted that similar arrangements can be practiced with other types of displays. Therefore, when a backlight or backlight assemblies are discussed, these backlight assemblies could also be the rear surfaces of other heat-generating displays and the constricted convection system would facilitate more efficient cooling of these alternate displays. It should also be noted that Figures 15A-15B and Figures 17A-17C are not necessarily drawn to scale. The relationship between

the elements may be exaggerated for explanatory purposes.

[0042] FIGURE 15A shows a cross-sectional view of the backlight 140 with a constricted convection plate 300, the space between the two features defines a narrow gap 305. The dimensions of the gap may vary depending on several factors including the size of the display, its operating conditions, the type of backlight assembly and its posterior surface material, and the number and power applied to the various constricted convection fans. Some examples may utilize a gap distance of approximately 0.25-3.5 inches. Other examples may utilize a slightly larger gap. It has been found that forcing air through this gap 305 increases the ability to cool the backlight 140. One or more constricted convection fans 310 may be used to pull air through the gap 305. FIGURE 15B shows a cross-sectional view of another example for the constricted convection system where one or more constricted convection fans 310 push air through the gap 305.

[0043] FIGURE 16 shows a top view of the isolated gas system as discussed above. The cross-section line 17-17 is shown passing through the isolated gas system.

[0044] FIGURES 17A-17C show cross-sectional views of the 17-17 section that is shown in Figure 16. Referring first to Figure 17A, towards the front of the display is the first gas chamber 30 which abuts against the electronic display 80. Anterior to the first gas chamber 30 is the front plate 90. Towards the rear of the display, the backlight 140 is placed in close proximity to the second gas chamber 40. In this arrangement, the outer wall of the second gas chamber 40 may function as the constricted convection plate. This arrangement does not utilize a constrictive convection fan, but instead uses the fan 60 which ingest air from outside the display housing and forces it over the surfaces of the second gas chamber 40. As noted above, this air may simply be ambient air or alternatively this air may come from a conditioning unit (not shown). To facilitate the flow of air between the backlight 140 and the cooling chamber 40, a guiding device 320 may be used.

[0045] Referring now to Figure 17B, the cooling chamber 40 contains a guiding feature 41, which is used in combination with the guiding device 320 to facilitate the flow of air between the backlight and the cooling chamber. Figure 17C shows an embodiment, where both the external fan 60 and the constrictive convection fan 310 is used. This embodiment could also utilize a version of the guiding devices shown in Figures 17A and 17B.

[0046] The backlight 140 may comprise a printed circuit board (PCB) with a plurality of lights mounted to the side facing the electronic display 80. The lights in the backlight may be any one of the following: LED's, organic light emitting diodes (OLED), field emitting display (FED), light emitting polymer (LEP), or organic electro-luminescence (OEL) lights. In an exemplary embodiment, the backlight 140 would ideally have a low level of thermal resistance between the side facing the electronic display 80 and the side facing the second gas chamber. To ac-

complish this low level of thermal resistance, the backlight 140 may be built using metal printed circuit board (PCB) technology to further transfer heat away from the lights. The rear surface of the backlight 140 may also be metallic, or some other thermally conductive material, to further enhance the convective heat transferring properties. The surface may even have a plurality of surface features such as fins to further enhance the convective heat transferring properties. The constrictive convection fan 310 may then send the warm air out of an exhaust 179 (shown in Figure 2) so that it may exit the display housing entirely.

[0047] While the display is operational, the external fan 60 and the constrictive convection fan 310 may run continuously. However, if desired, a temperature sensor (not shown) and a switch (not shown) may be incorporated within the electronic display. This effective thermostat may be used to detect when temperatures have reached a predetermined threshold value. In such a case, the various 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 with a thermostat (not shown) to advantageously keep the display within an acceptable temperature range. This would save on both energy costs as well as the useful lifetime of the devices.

[0048] It should be noted, that an air curtain, which is not part of the claimed invention, can be practiced with any type of electronic display and with any combination of the thermal control features described above. Various internal features (not shown) may be placed within a cavity to direct the air towards the baffles 114. The ingested air may continue through the cavity until it reaches the baffles which may direct the air against the exterior display surface. This exterior surface may be the first front plate 90, or alternatively, any of the additional front plates which are described in detail above (ex. second front plate 130).

[0049] Thus, the air curtain can be used as an exhaust for the cooling of internal components of the display. Alternatively, the cool air from the air curtain can be used to further cool the exterior front surface of the display which may be subjected to significant solar loading or heat transfer from ambient hot air.

[0050] Another thermal control feature, which is not part of the claimed invention, may comprise a cooling system which includes various components in fluid communication. Preferably, this may be accomplished by connecting the components with a series of tubes or pipes. The cooling system components include a reservoir tank, a pump, and a cooling chamber in fluid communication. Preferably, the system also includes a filter and a radiator, also in fluid communication. Optionally, the system may also include a fan unit. However, the optional fan unit is preferably not in fluid communication with the other components.

[0051] As one skilled in the art will appreciate, other methods and devices may also be used to regulate the

flow through a cooling chamber. For example, the size and pump speed of the pump may be optimized for a given application. Alternatively, a variable speed pump may also be used. Preferably, the variable speed pump may be in electrical communication with at least one pressure transducer (not shown). Preferably, a pressure transducer may be placed upstream of the cooling chamber and another pressure transducer may be placed downstream of the cooling chamber. The pressure information provided by the at least one pressure transducer may be utilized to set the operating speed of the variable speed pump. In that way, the flow rate through the cooling chamber may be adjusted to maintain appropriate pressures in the device. Maintaining appropriate pressures in the cooling chamber is important for preventing deformation or breakage of the display glass.

[0052] An optional filter may be added to remove contamination in the fluid. Preferably, a radiator and fan unit may also be included to provide even greater thermal stability. Optionally, a spigot (not shown) may be provided to facilitate the process of filling and emptying the coolant fluid from the system.

[0053] If desired, fan units may be located at the base of the housing just behind the cooling chamber of display. Fan units may provide a laminar flow of air through the interior of the housing. Preferably, the airflow will be directed across at least one external surface of reservoir tank. As described above, the air exhaust flow may ultimately be redirected onto the cooling chamber surface by way of an optional air curtain system.

[0054] If desired, a temperature sensor (not shown) and a switch (not shown) may be incorporated within the electronic display. The temperature sensor may be used to detect when temperatures have reached a predetermined threshold value. In such a case, the pump can be selectively engaged when the temperature in the display meets a predetermined value. Predetermined thresholds may be selected and the system may be configured with a thermostat (not shown) to advantageously keep the display at a relatively constant temperature, or at least within a range of acceptable temperatures. Alternatively, to avoid the need for a thermostat, the pump may run continuously when the electronic display is operational.

Claims

1. A thermal control system for a display stack (80) having a display surface (85) and for a backlight assembly (140), the system comprising:

an isolated gas cooling chamber (20) comprising a closed loop having a first gas chamber (30) positioned anterior to the display surface (85), and a second gas chamber (40) in gaseous communication with an entrance (110) and an exit (120) of said first gas chamber (30) and positioned posterior to the backlight assembly (140),

said second gas chamber (40) having interior and exterior surfaces, wherein the gas within the isolated gas cooling chamber (20) is isolated from external air;

one or more chamber fans (50) within said second gas chamber (40) to propel gas around the first and second gas chambers; and **characterized by**

one or more fans (60) adapted to force air over at least one exterior surface of the second gas chamber (40) and between the backlight assembly (140) and an exterior surface of the second gas chamber (40).

2. The system of claim 1, further comprising:

one or more of the electronic components (200) for operating the display stack (80), contained within said second gas chamber (40).

3. The system of claim 1, further comprising:

one or more heating elements (220) within the second gas chamber (40).

4. The system of any one of claims 1 to 3, further comprising:

a linear polarizer (400) placed anterior to said display surface (85).

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

said exterior surface of the second gas chamber (40) is in close proximity to the rear surface of said backlight assembly (140); and comprising one or more additional constricted convection fans (310) adapted to draw air between the exterior surface of the second gas chamber (40) and the rear surface of said backlight assembly (140).

6. The system of claim 1 further comprising:

a plurality of surface features (150) on the exterior surfaces of the second gas chamber (40).

7. The system of claim 4, further comprising:

a first front plate (90) and second front plate (130) surrounding the linear polarizer (400).

8. A method for thermally controlling a display stack (80) having a display surface (85) and a backlight assembly (140), comprising the steps of:

providing an isolated gas system having an isolated gas cooling chamber (20) comprising a

closed loop having a first gas chamber (30) which includes the display surface (85), and a second gas chamber (40) in gaseous communication with said first gas chamber (30); where-
 in the gas within the isolated gas cooling chamber (20) is isolated from external air, the second gas chamber (40) having exterior surfaces and placed adjacent to the rear surface of the back-
 light assembly (140);
 forcing isolated gas into the first gas chamber (30);
 directing the isolated gas into the second gas chamber (40);
characterized by forcing cooling gas over at least one exterior surface of the second gas chamber (40) and between the rear surface of the backlight assembly (140) and an exterior surface of the second gas chamber (40) by one or more fans (60);
 and
 reintroducing the isolated gas into the first gas chamber (30).

9. The method of claim 8, further comprising the step of:

heating the isolated gas within the second chamber (40) if heating is desired.

10. The method of one of claims 8 and 9, further comprising the steps of:

providing said exterior surface of the second gas chamber (40) is in close proximity to the backlight assembly (140), the area between the exterior surface of the second gas chamber (40) and the backlight assembly (140) defining a gap (305); and
 drawing air through said gap (305) in order to cool the posterior portion of the backlight assembly (140) by additional constricted convection fans (310).

Patentansprüche

1. Thermisches Steuersystem für einen Anzeigestapel (80), der eine Anzeigefläche (85) aufweist, und für eine Hintergrundbeleuchtungsanordnung (140), wobei das System umfasst:

eine isolierte Gaskühlkammer (20), die einen geschlossenen Kreislauf aufweist, der eine erste Gaskammer (30), die vor der Anzeigefläche (85) positioniert ist, und eine zweite Gaskammer (40) aufweist, die in gasförmiger Kommunikation mit einem Einlass (110) und einem Auslass (120) der ersten Gaskammer (30) steht und hinter der Hintergrundbeleuchtungsanord-

nung (140) positioniert ist, wobei die zweite Gaskammer (40) innere und äußere Oberflächen aufweist, wobei das Gas innerhalb der isolierten Gaskühlkammer (20) gegenüber externer Luft isoliert ist;

ein oder mehrere Kammergebläse (50) innerhalb der zweiten Gaskammer (40), um Gas um die erste und zweite Gaskammer herum zu bewegen; und **gekennzeichnet durch**

einen oder mehrere Lüfter (60), die dazu ausgelegt sind, Luft über mindestens eine äußere Oberfläche der zweiten Gaskammer (40) und zwischen der Hintergrundbeleuchtungsanordnung (140) und einer äußeren Oberfläche der zweiten Gaskammer (40) zwangsweise zu fördern.

2. System nach Anspruch 1, das weiterhin aufweist:

eine oder mehrere der elektronischen Komponenten (200) für den Betrieb des Anzeigestapels (80), die innerhalb der zweiten Gaskammer (40) enthalten sind.

3. System nach Anspruch 1, das weiterhin aufweist:

ein oder mehrere Heizelemente (23) innerhalb der zweiten Gaskammer (40).

4. System nach einem beliebigen der Ansprüche 1 bis 3, das weiterhin umfasst:

einen linearen Polarisator (400), der vor der Anzeigefläche (85) angeordnet ist.

5. System nach einem beliebigen der Ansprüche 1 bis 4, wobei:

die äußere Oberfläche der zweiten Gaskammer (40) sich in enger Nachbarschaft zu der rückseitigen Oberfläche der Hintergrundbeleuchtungsanordnung (140) befindet; und das aufweist: einen oder mehrere zusätzliche Lüfter (310) mit begrenzter Konvektion, die dazu ausgelegt sind, Luft zwischen der äußeren Oberfläche der zweiten Gaskammer (40) und der rückseitigen Oberfläche der Hintergrundbeleuchtungsanordnung (140) anzusaugen.

6. System nach Anspruch 1, das weiterhin umfasst:

eine Mehrzahl von Oberflächenmerkmalen (150) auf den äußeren Oberflächen der zweiten Gaskammer (40).

7. System nach Anspruch 4, das weiterhin umfasst:

eine erste Frontplatte (90) und eine zweite

Frontplatte (130), die den linearen Polarisator (400) umgeben.

8. Verfahren für die thermische Steuerung eines Anzeigestapels (80), der eine Anzeigefläche (85) und eine Hintergrundbeleuchtungsanordnung (140) aufweist, das die Schritte umfasst:

Bereitstellen eines isolierten Gassystems, das eine isolierte Gaskühlkammer (20), die einen geschlossenen Kreislauf aufweist, der eine erste Gaskammer (30), die die Anzeigefläche (85) aufweist, und eine zweite Gaskammer (40) umfasst, die in gasförmiger Kommunikation mit der ersten Gaskammer (30) steht; wobei das Gas innerhalb der isolierten Gaskühlkammer (20) gegenüber externer Luft isoliert ist, und die zweite Gaskammer (40) äußere Oberflächen aufweist und benachbart zu der rückseitigen Oberfläche der Hintergrundbeleuchtungsanordnung (140) platziert ist; zwangsweises Fördern von isoliertem Gas in die erste Gaskammer (30); Richten des isolierten Gases in die zweite Gaskammer (40); **gekennzeichnet durch** das zwangsweise Fördern von kühlendem Gas über mindestens eine äußere Oberfläche der zweiten Gaskammer (40) und zwischen der hinteren Oberfläche der Hintergrundbeleuchtungsanordnung (140) und einer äußeren Oberfläche der zweiten Gaskammer (40) **durch** ein oder mehrere Gebläse (60); und erneutes Einführen des isolierten Gases in die erste Gaskammer (30).

9. Verfahren nach Anspruch 8, das weiterhin den Schritt umfasst:

Erwärmen des isolierten Gases innerhalb der zweiten Kammer (40), falls eine Erwärmung gewünscht ist.

10. Verfahren nach einem der Ansprüche 8 und 9, das weiterhin die Schritte umfasst:

Bereitstellen der äußeren Oberfläche der zweiten Gaskammer (40) derart, dass sie sich in enger Nachbarschaft zu der Hintergrundbeleuchtungsanordnung (140) befindet, wobei die Fläche zwischen der äußeren Oberfläche der zweiten Gaskammer (40) und der Hintergrundbeleuchtungsanordnung (140) einen Spalt (305) definiert; und Einsaugen von Luft durch den Spalt (305) für eine Kühlung des hinteren Abschnitts der Hintergrundbeleuchtungsanordnung (140) durch zusätzliche Lüfter (310) mit begrenzter Konvek-

tion.

Revendications

1. Système de régulation thermique pour un empilement d'affichages (80) ayant une surface d'affichage (85) et pour un ensemble de rétroéclairage (140), le système comprenant :

une chambre de refroidissement à gaz isolé (20) comprenant une boucle fermée ayant une première chambre à gaz (30) positionnée avant la surface d'affichage (85) et une seconde chambre à gaz (40) en communication gazeuse avec une entrée (110) et une sortie (120) de ladite première chambre à gaz (30) et positionnée derrière l'ensemble de rétroéclairage (140), ladite seconde chambre à gaz (40) ayant des surfaces intérieure et extérieure, dans lequel gaz à l'intérieur de la chambre de refroidissement à gaz isolé (20) est isolé de l'air extérieur ; une ou plusieurs ailettes de chambre (50) à l'intérieur de ladite seconde chambre à gaz (40) pour propulser le gaz autour des première et seconde chambres à gaz ; et **caractérisé par** :

un ou plusieurs ventilateurs (60) adaptés pour forcer l'air sur au moins une surface extérieure de la seconde chambre à gaz (40) et entre l'ensemble de rétroéclairage (140) et une surface extérieure de la seconde chambre à gaz (40).

2. Système selon la revendication 1, comprenant en outre :

un ou plusieurs des composants électroniques (200) pour actionner l'empilement d'affichages (80) contenus à l'intérieur de ladite seconde chambre à gaz (40).

3. Système selon la revendication 1, comprenant en outre :

un ou plusieurs éléments chauffants (220) à l'intérieur de la seconde chambre à gaz (40).

4. Système selon l'une quelconque des revendications 1 à 3, comprenant en outre :

un polariseur linéaire (400) placé devant ladite surface d'affichage (85).

5. Système selon l'une quelconque des revendications 1 à 4, dans lequel :

ladite surface extérieure de la seconde chambre

à gaz (40) est à proximité immédiate de la surface arrière dudit ensemble de rétroéclairage (140) ; et comprenant :

un ou plusieurs ventilateurs de convection étroits supplémentaires (310) adaptés pour aspirer l'air entre la surface extérieure de la seconde chambre à gaz (40) et la surface arrière dudit ensemble de rétroéclairage (140).

6. Système selon la revendication 1, comprenant en outre :

une pluralité de caractéristiques de surface (150) sur les surfaces extérieures de la seconde chambre à gaz (40).

7. Système selon la revendication 4, comprenant en outre :

une première plaque avant (90) et une seconde plaque avant (130) entourant le polariseur linéaire (400).

8. Procédé pour réguler thermiquement un empilement d'affichages (80) ayant une surface d'affichage (85) et un ensemble de rétroéclairage (140), comprenant les étapes consistant à :

prévoir un système à gaz isolé ayant une chambre de refroidissement à gaz isolé (20) comprenant une boucle fermée ayant une première chambre à gaz (30) qui comprend la surface d'affichage (85) et une seconde chambre à gaz (40) en communication gazeuse avec ladite première chambre à gaz (30) ; dans lequel le gaz à l'intérieur de la chambre de refroidissement à gaz isolé (20) est isolé de l'air extérieur, la seconde chambre à gaz (40) ayant des surfaces extérieures et placée de manière adjacente à la surface arrière de l'ensemble de rétroéclairage (140) ;
forcer le gaz isolé dans la première chambre à gaz (30) ;
diriger le gaz isolé dans la seconde chambre à gaz (40) ;
caractérisé par l'étape consistant à forcer le gaz de refroidissement sur au moins une surface extérieure de la seconde chambre à gaz (40) et entre la surface arrière de l'ensemble de rétroéclairage (140) et une surface extérieure de la seconde chambre à gaz (40) par un ou plusieurs ventilateurs (60) ;
et
réintroduire le gaz isolé dans la première chambre à gaz (30).

9. Procédé selon la revendication 8, comprenant en outre l'étape consistant à :

faire chauffer le gaz isolé à l'intérieur de la seconde chambre (40) si le chauffage est souhaité.

10. Procédé selon l'une des revendications 8 et 9, comprenant en outre les étapes consistant à :

prévoir ladite surface extérieure de la seconde chambre à gaz (40) à proximité immédiate de l'ensemble de rétroéclairage (140), la zone entre la surface extérieure de la seconde chambre à gaz (40) et l'ensemble de rétroéclairage (140) définissant un espace (305) ; et aspirer l'air par ledit espace (305) afin de faire refroidir la partie postérieure de l'ensemble de rétroéclairage (140) par des ventilateurs de convection étroits supplémentaires (310).

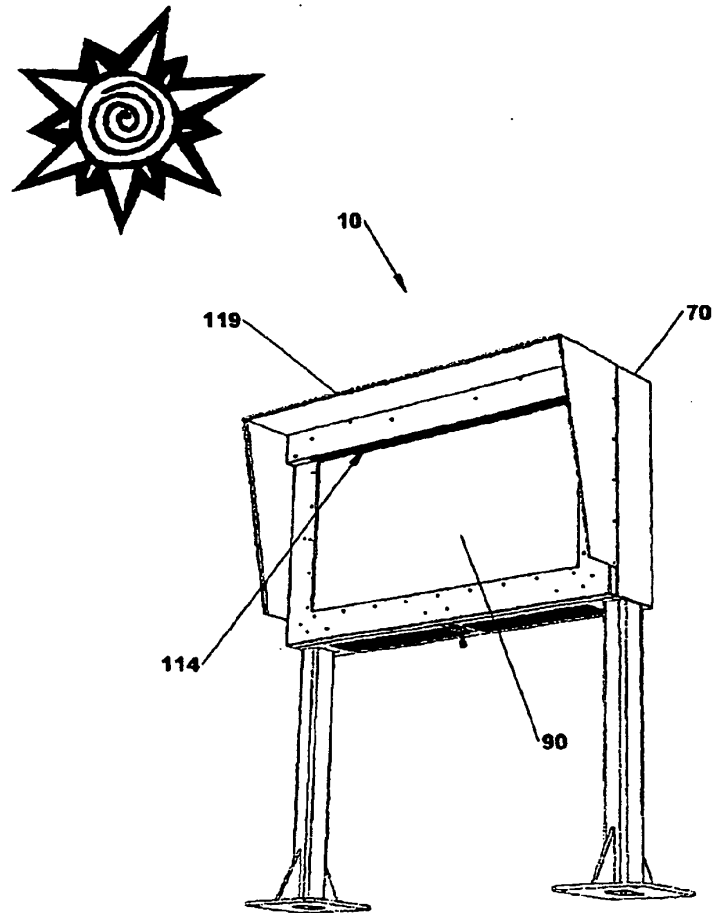


Fig. 1

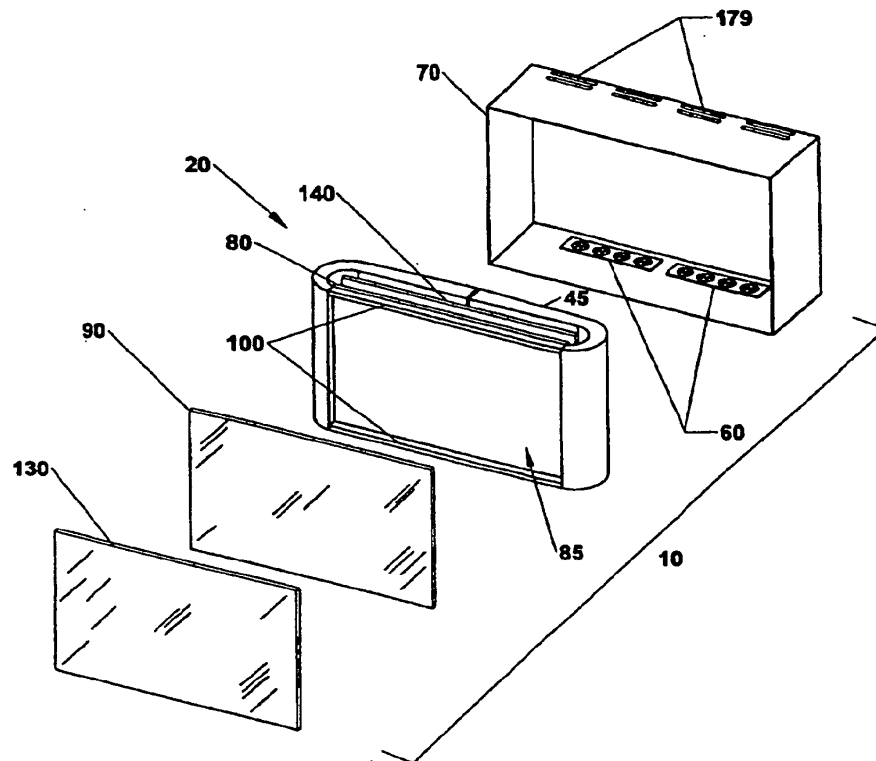


Fig.2

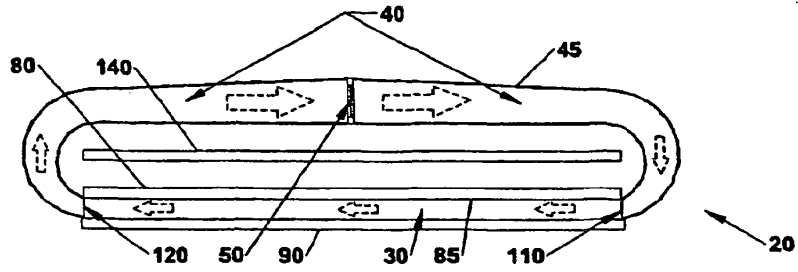


Fig. 3

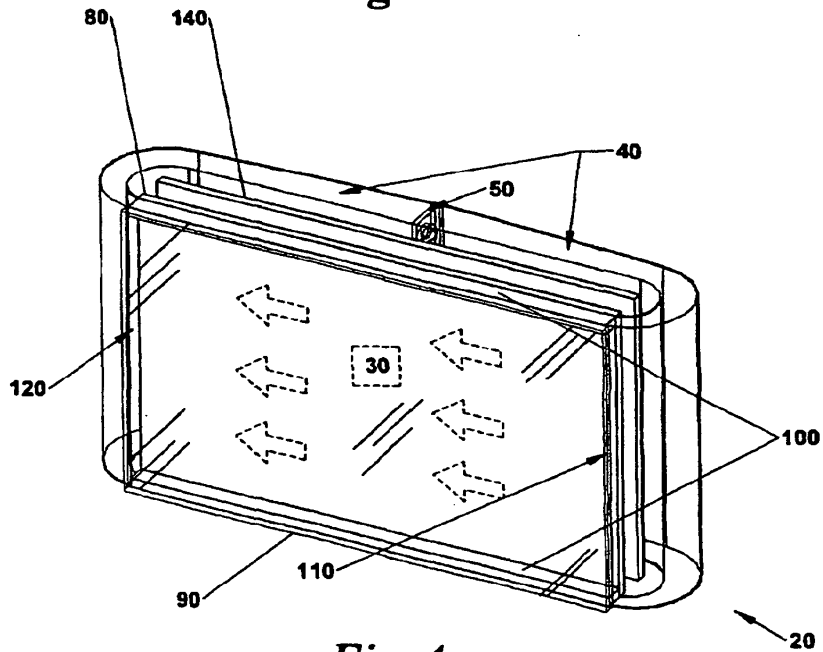


Fig. 4

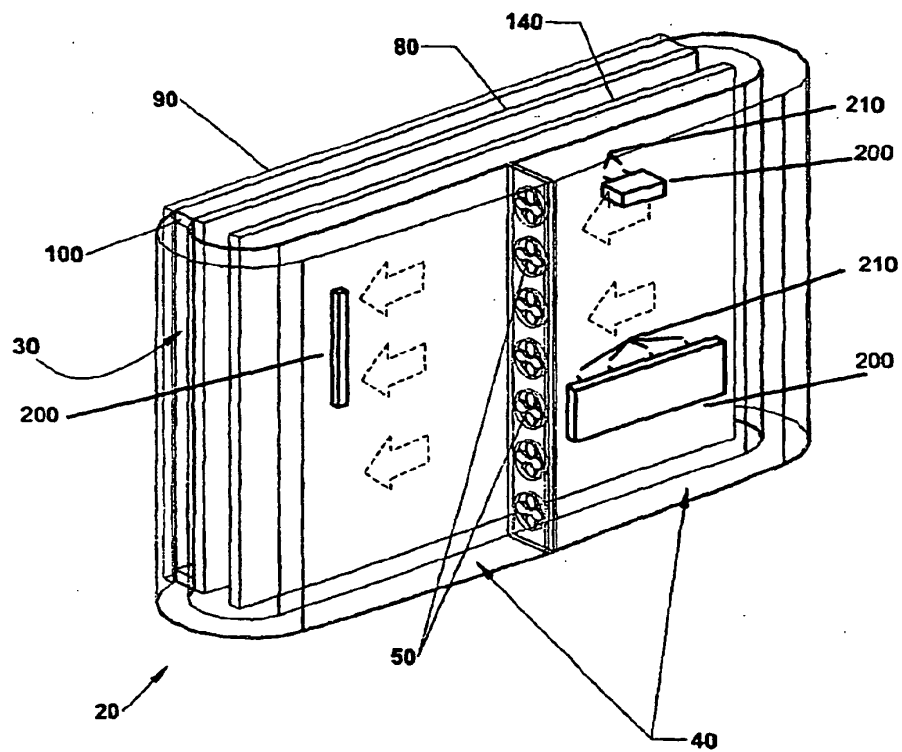


Fig. 5

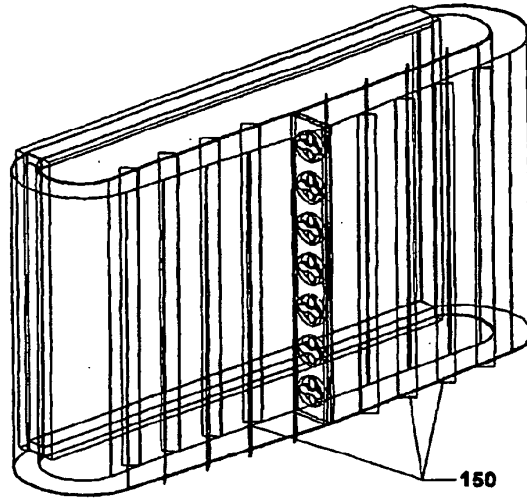


Fig. 6

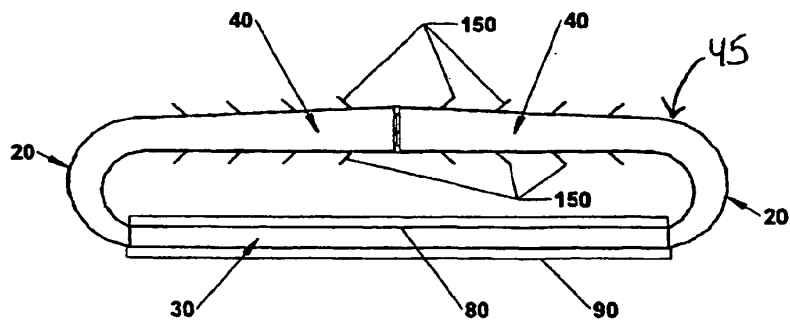


Fig. 7

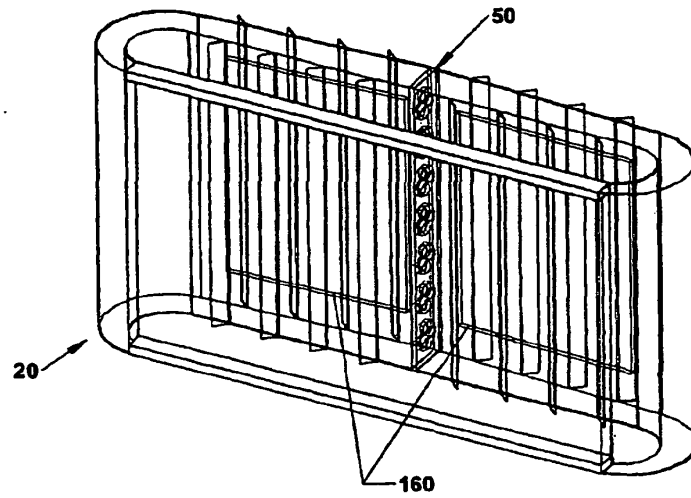


Fig. 8

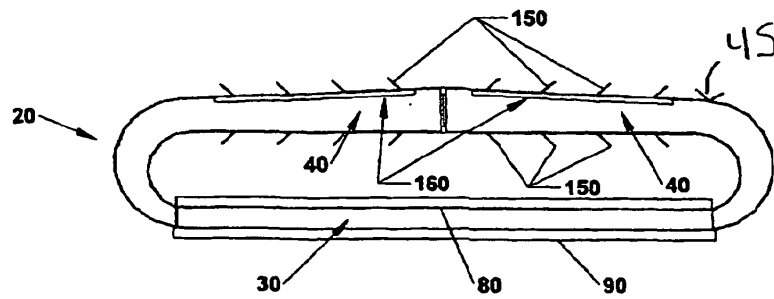


Fig. 9

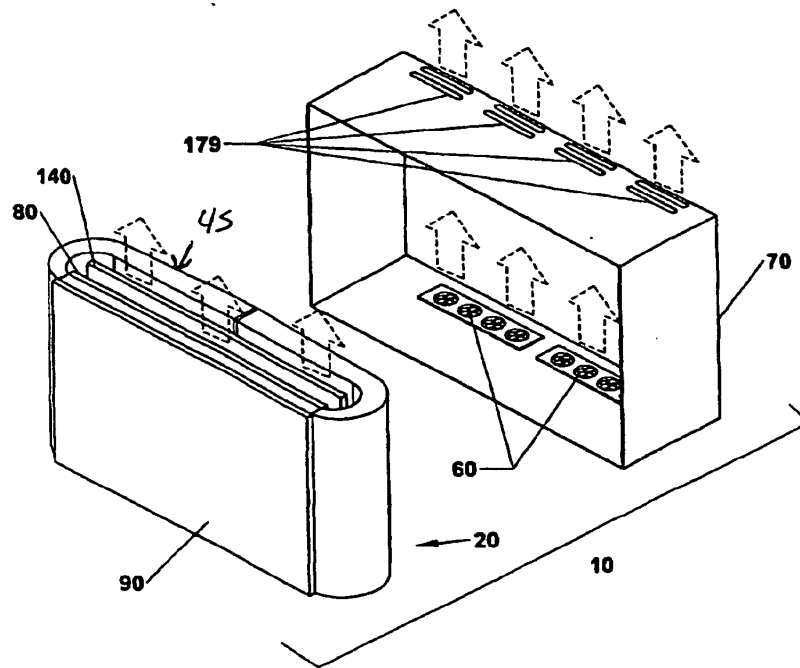
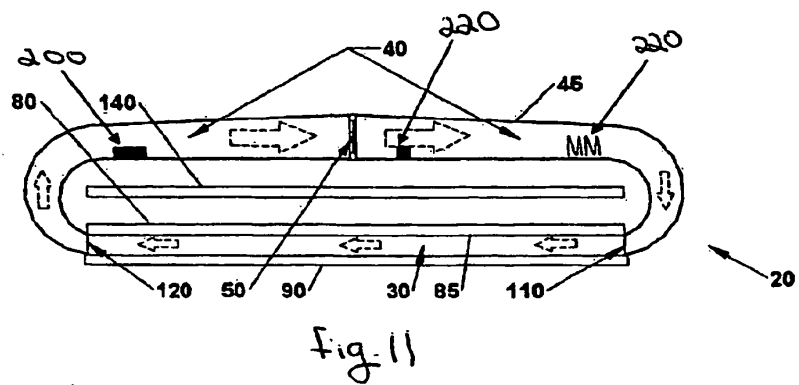


Fig. 10



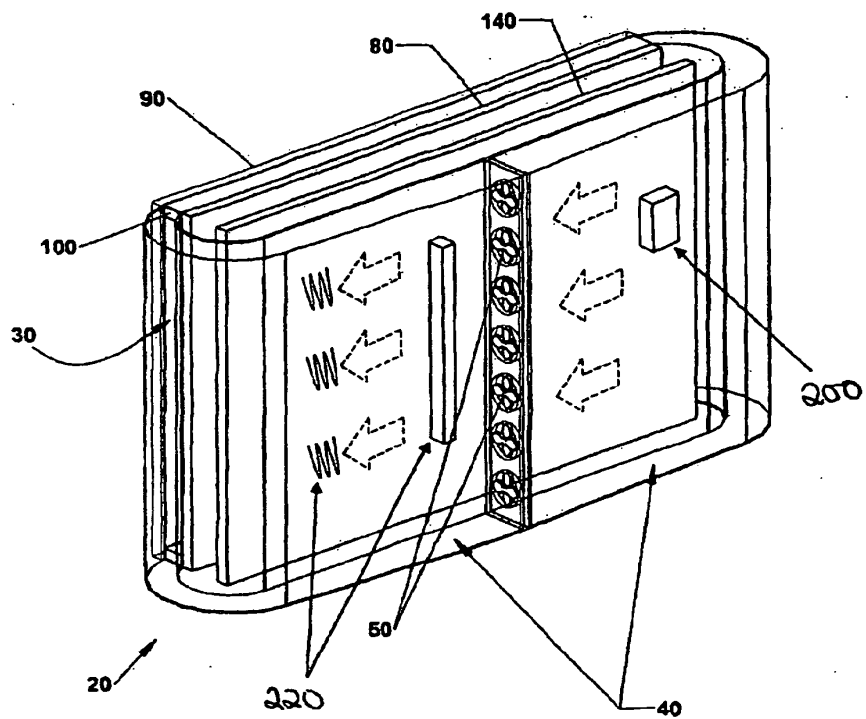
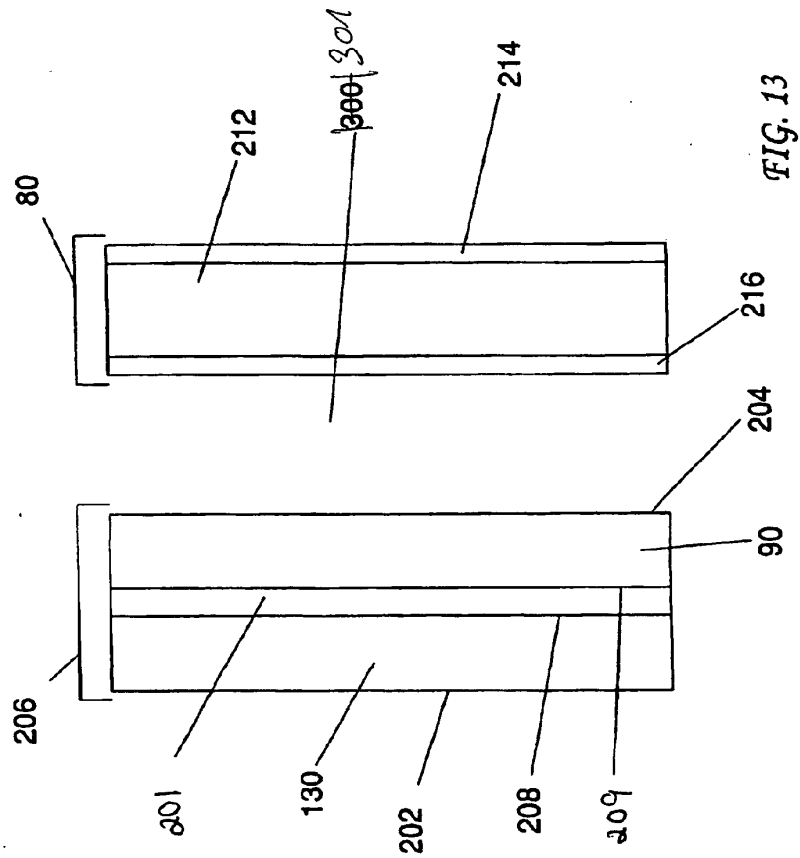
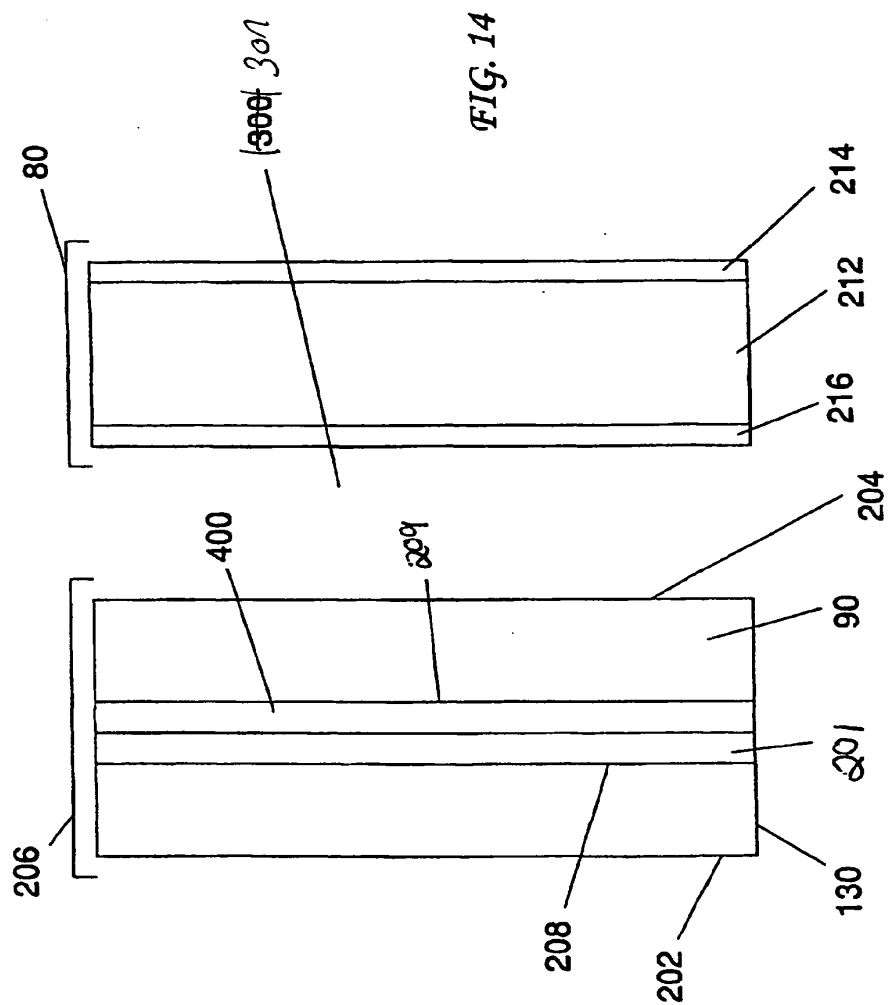


Fig. 12





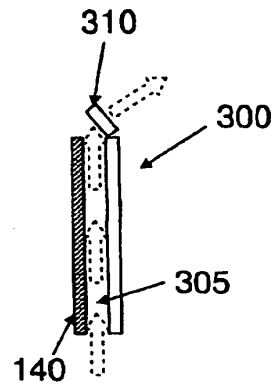


Fig. 15A

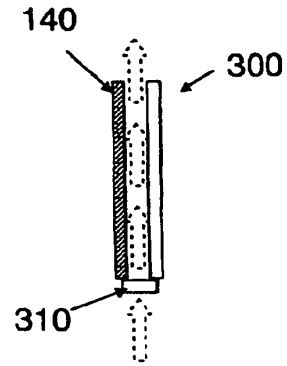


Fig. 15B

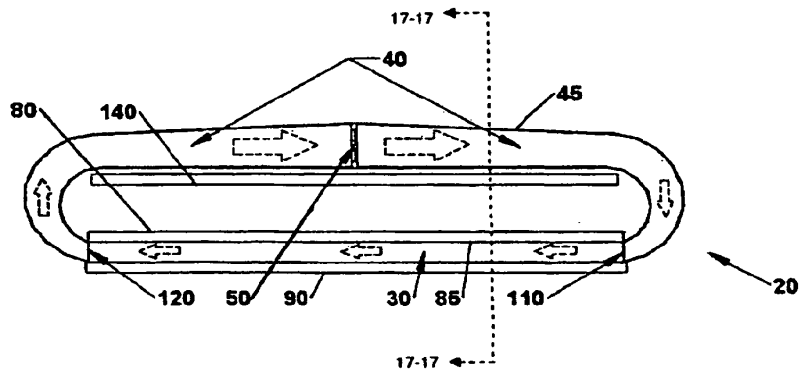


Fig. 16

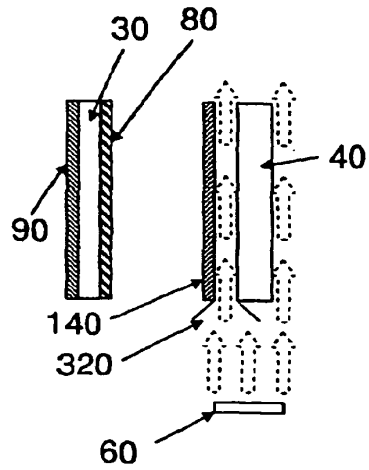


Fig. 17A

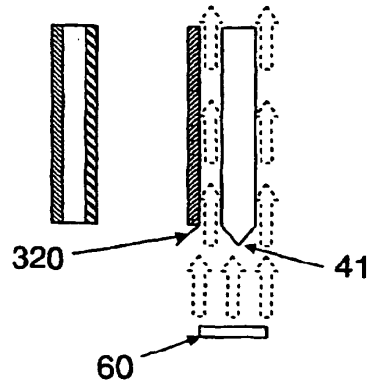


Fig. 17B

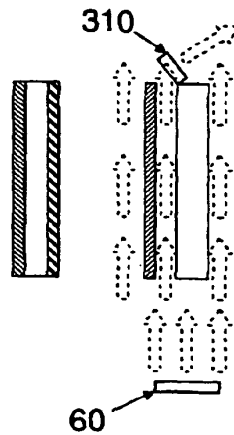


Fig. 17C

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 5991153 A [0005]
- GB 2402205 A [0006]
- WO 20050791299 A1 [0006]

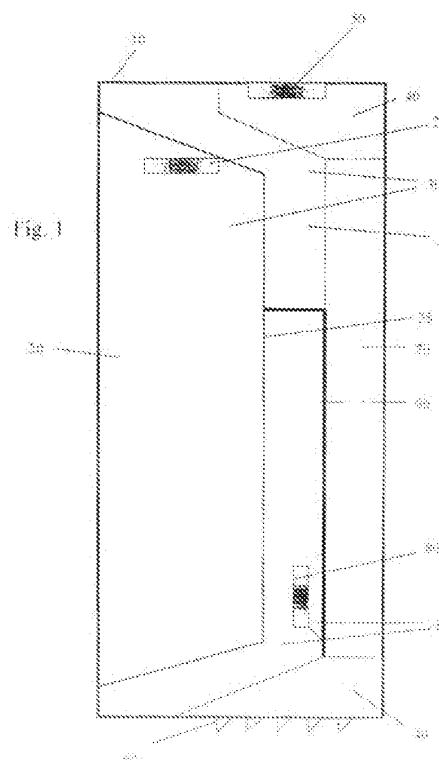
(12) UK Patent Application (19) GB (11) 2 402 205 (13) A

(43) Date of A Publication 01.12.2004

(21) Application No:	0311576.5	(51) INT CL ⁷ :	H04N 5/64 , F25D 23/12 , F28D 3/00 11/02 15/02 , F28F 3/00
(22) Date of Filing:	20.05.2003	(52) UK CL (Edition W) :	F4U U22X U25B F4H H2F H2H H2L F4S S4B U1S S22X3 S22B6
(71) Applicant(s): Densitron Technologies PLC (Incorporated in the United Kingdom) Unit 4 Airport Industrial Estate, BIGGIN HILL, Kent, TN16 3BW, United Kingdom		(56) Documents Cited:	CN 001110453 A JP 100043226 A JP 090307257 A JP 060268388 A US 6474410 A US 6039111 A
(72) Inventor(s): Leslie John Yare		(53) Field of Search:	UK CL (Edition V) : F4H, F4U INT CL ⁷ : A47F, F24F, F25B, F25D, F28B, F28C, F28D, F28F, H04N Other: ON-LINE : WPI, EPODOC, JAPID, EPOQUE English Full TXTE;
(74) Agent and/or Address for Service: Williams Powell Merley House, 25-30 Holborn Viaduct, LONDON, EC1A 2BP, United Kingdom			

(54) Abstract Title: **A display system cabinet and display system including heat removal means**

(57) A display cabinet 10 has a sealed airtight compartment 30 for mounting a display system 20, and includes heat transfer means 70, such as a corrugated heat exchanger, to dissipate heat from the airtight compartment to the surrounding environment via thermal communication with an unsealed atmospheric zone 40. Heat is dissipated by air drawn through vents 60 and the atmospheric air zone 40 by at least one fan 50, which passes across one or more surfaces of the heat exchanger 70. Within the sealed compartment at least one fan 25 circulates air through a rear portion 25, behind a baffle plate 90 and also across the heat exchanger 70. The airtight compartment may include a pressurised zone 85 created by at least one fan 80, and the heat transfer means may alternatively include a heat pipe, a refrigeration unit, a flat plate heat exchanger, or a heat wheel. The display system may include one or more of a plasma display, an LCD display, a TFT display, a CRT display, an LED display, a projection display.



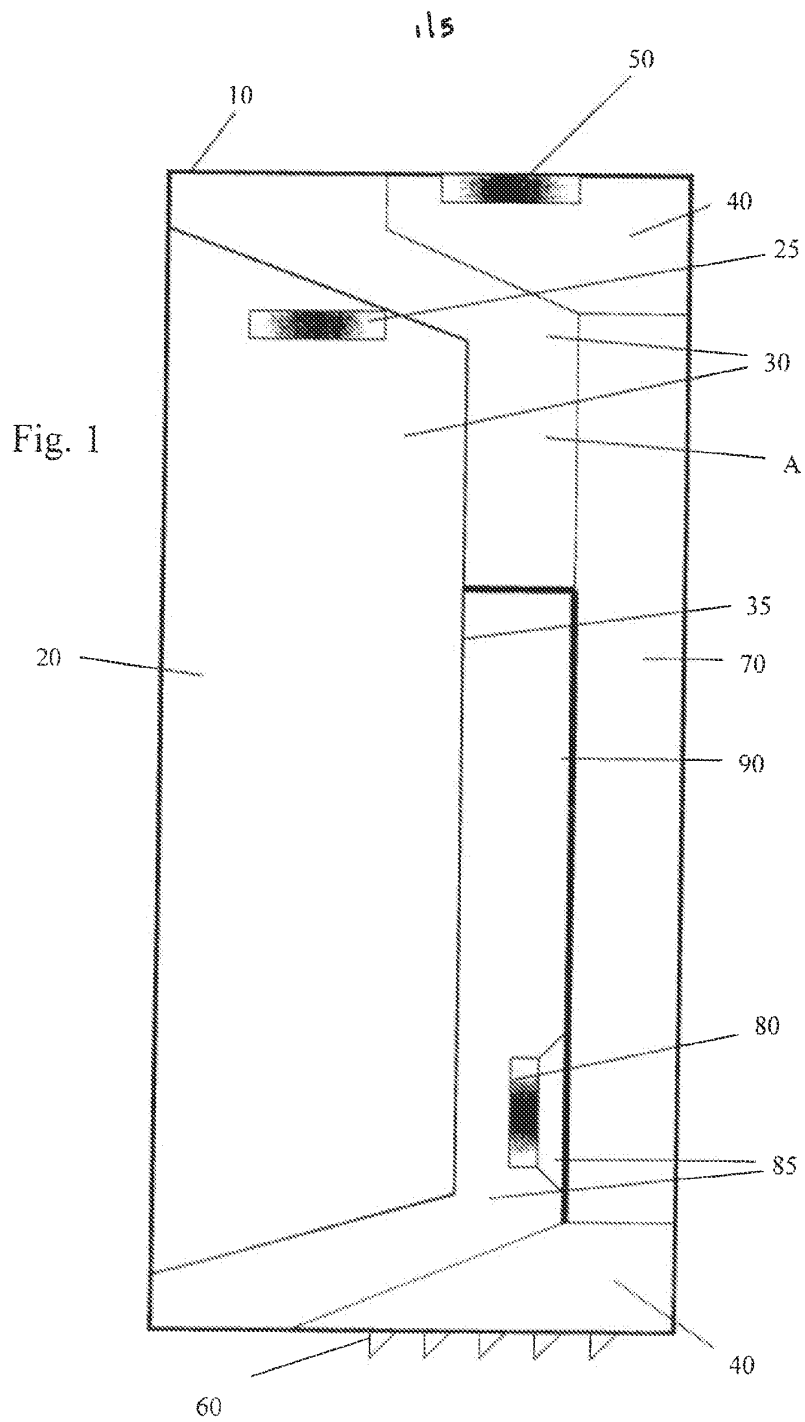
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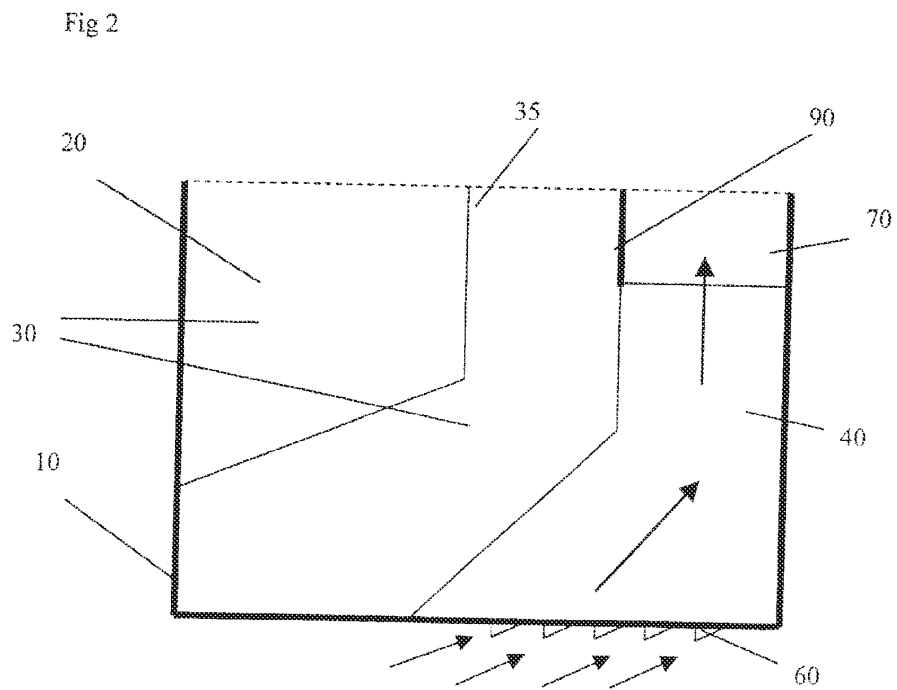
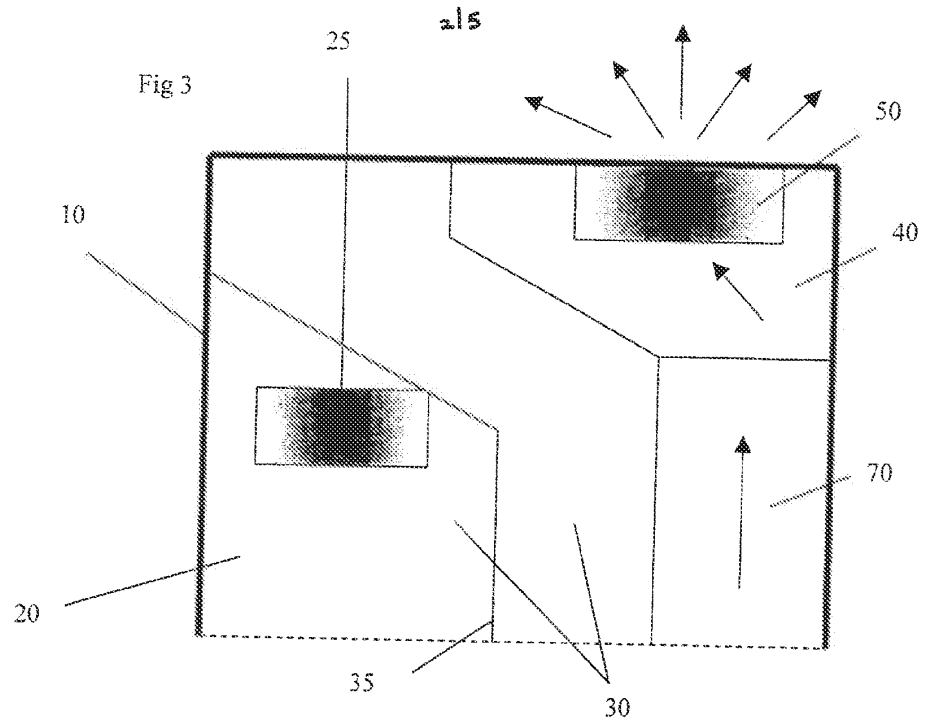
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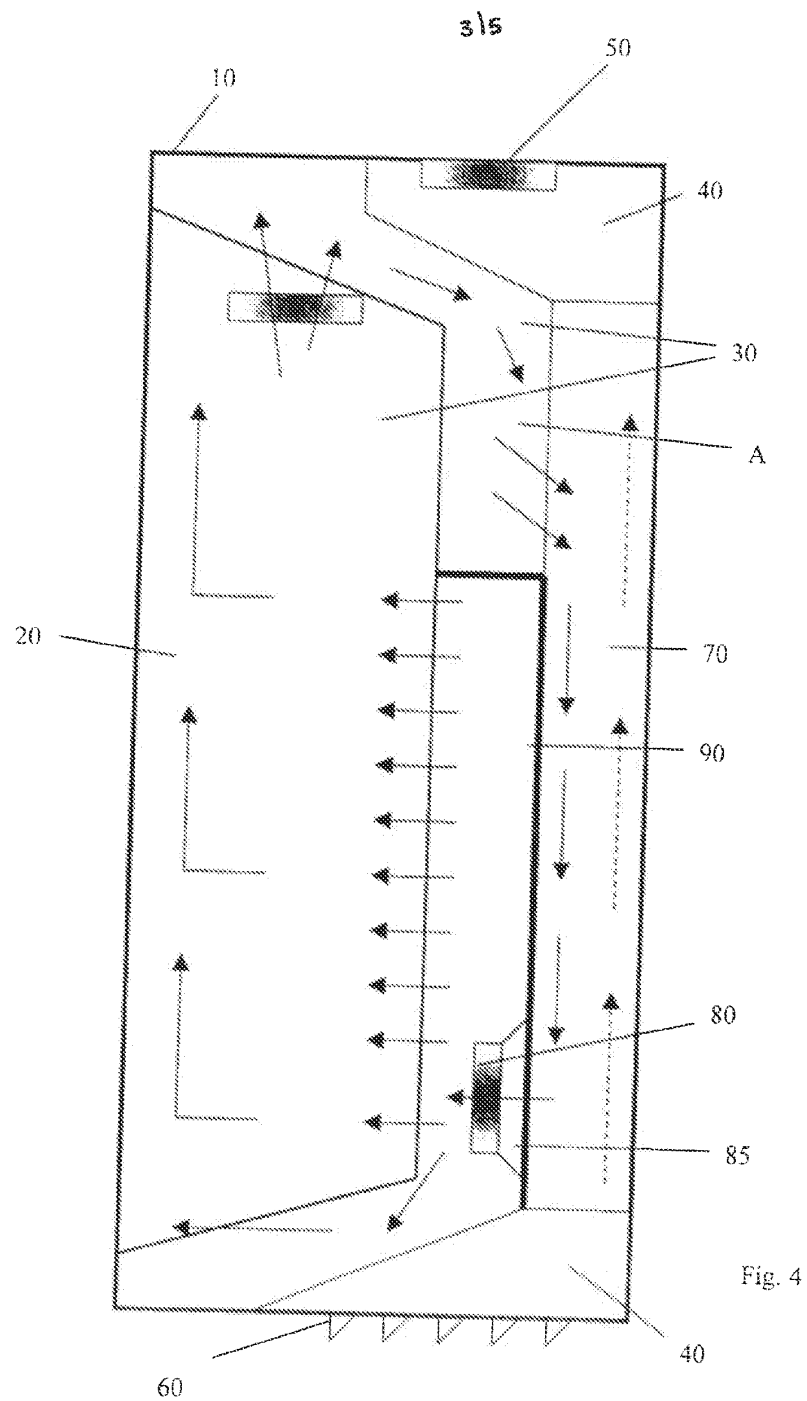
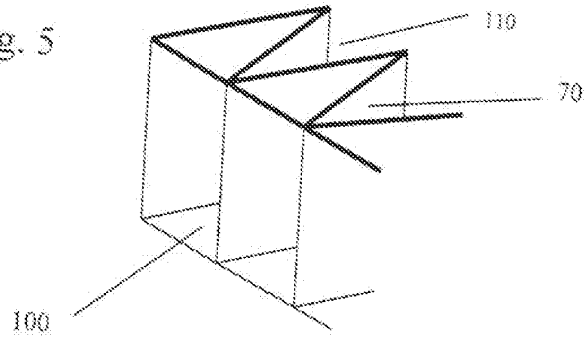
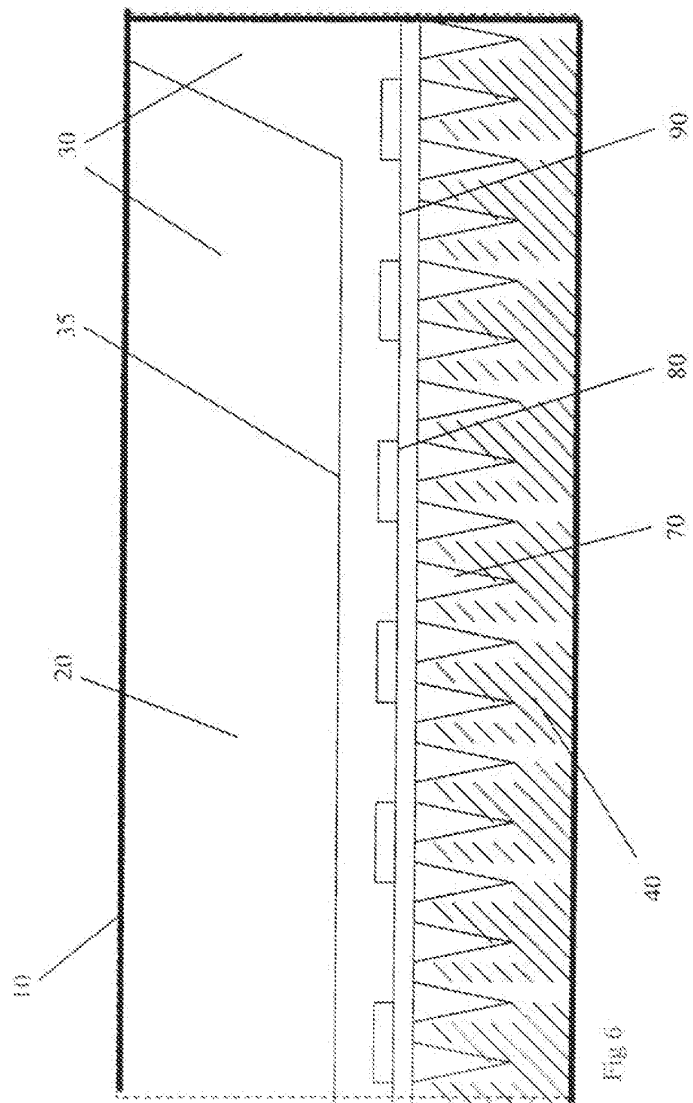


Fig. 5





s/5

The present invention relates to a cabinet for mounting a display system, the cabinet having improved cooling facilities and which is particularly suitable for use in providing large scale displays in public places.

Large scale electronic image and/or video display systems are used in many places, 10 for example, to provide public information or display advertising materials. Such displays must have a size and resolution sufficient for information can be viewed from a distance.

15 In order to provide large display screens, plasma, LCD or rear projection technologies are commonly used. However, such screens can generate a lot of heat and it is therefore essential for them to have an efficient cooling system to remove the heat from the display in order for it to function normally.

Unfortunately, in many public places where there is a large quantity of human or vehicle traffic the cooling system can become clogged with dust, dirt and general pollution. In this situation, the cooling system becomes inefficient and may compromise the functionality of the display by causing it to overheat, resulting in temporary or permanent failure of the display system.

25 In order to address this problem, many display systems use filters at the interface
between the cooling system and the external environment. However, filters
eventually become clogged and inefficient and compromise the system and therefore
require monitoring and/or changing regularly. Where the display system is mounted
in an inaccessible location, as is often the case for such systems, this maintenance is
30 particularly troublesome and is of annoyance to operators.

According to one aspect of the present invention, there is provided a display cabinet comprising a substantially atmospherically scaled zone including means for mounting

a display system in the substantially atmospherically sealed zone and heat transfer means arranged to transfer heat out of the substantially atmospherically sealed zone.

- 5 The present invention seeks to provide a sealed display system having a cooling system that is substantially unaffected by pollution, dust or dirt in the atmosphere.

In a preferred embodiment, a zone of the cabinet containing the display system is sealed to the external environment. The sealed zone includes an internal cooling
10 system that is not open to atmospheric air. Atmospheric air is drawn into a separate zone that allows heat to be exchanged between the two zones. Heat is then removed by expulsion of heated atmospheric air from the casing.

Advantageously, the lifetime of a display is increased due to elimination of ingress of dirt and the like into the display. In addition, the cooling system of the present
15 invention is arranged to co-operate with existing internal cooling systems of the display to improve the effectiveness of the display's cooling system.

The display cabinet may further comprise an atmospheric zone, the heat transfer
20 means being arranged to communicate heat from the substantially atmospherically sealed zone to the atmospheric zone.

The atmospheric zone may include air transfer means arranged to draw air from outside the cabinet and expel air in the atmospheric zone heated by the heat transfer
25 means.

The air transfer means may include one or more fans.

The heat transfer means may comprise a heat exchanger.
30

The heat exchanger may comprise a corrugated heat conducting sheet having a first side in the substantially atmospherically sealed zone and a second side in the atmospheric zone.

The substantially atmospherically sealed zone may include air circulation means arranged to circulate air along the heat transfer means.

5 The air circulation means may include a baffle plate.

The substantially atmospherically sealed zone may include air pressurisation means arranged to project air within the atmospherically sealed zone into circulate air along the mounted display.

10

The air pressurisation means may include one or more fans.

The heat transfer means may include one or more of: a refrigeration unit, heat pipes, flat plates and a heat wheel, although it will be apparent that the heat transfer means
15 may include other systems or methods.

The display cabinet may include a display system such as a plasma display, an LCD, a TFT display, a CRT display, a LED display, a projector or a rear projection display. It will be appreciated that any display could be used and the cabinet could also be
20 adapted to cater for new technologies as and when necessary.

Brief Description of the Drawings

An example of the present invention will now be described in detail, by way of example only, with reference to the accompanying drawings in which:

25 Figure 1 is a cross section of a display system according to an embodiment of the present invention;

Figure 2, 3 and 4 are show parts of the cross section of Figure 1 in more detail;

Figure 5 is a perspective view of part of a heat exchanger suitable for use in the present invention; and,

30 Figure 6 is a cross section of part of the embodiment of Figure 1 along a line substantially perpendicular to the cross-section of Figure 1.

Detailed Description

Figure 1 is a cross section of a display system according to an embodiment of the present invention.

5 A cabinet 10 is arranged to contain a display 20 for displaying information, advertisements or other visual media. The display is sealed within the cabinet in a sealed zone 30. In operation, the components of the display 20 create heat inside the display 20 in the sealed zone 30. Vents and other venting means (not shown) allow air to travel through a rear portion 35 of the display 20, although the air is sealed within the sealed zone 30.

10

The cabinet 10 also includes an atmospheric air zone 40. Air from the outside of the cabinet 10 is drawn through vents 60 into the atmospheric air zone 40 by fans 50. The fans 50 draw the air up through the atmospheric air zone 40. The air is then expelled from the cabinet 10 through the fans 50. Arrows in figures 2 and 3 show the passage of air through the vents 60 into the atmospheric air zone 40 and out through the fans 50, respectively.

15 The cabinet 10 includes a heat exchanger 70 mounted on a baffle plate 90. Also mounted on the baffle plate 90 are fans 80. The sealed zone 30 and atmospheric air zone 40 are sealed from each other to prevent the passage of air, dirt and the like. The heat exchanger 70 is arranged to communicate heat between the sealed zone 30 and the atmospheric zone 40.

20 Arrows in Figure 4 illustrate the movement of air in both the atmospheric air zone 40 and in the sealed zone 30 of the cabinet 10 in more detail. Dotted arrows show movement of air in the atmospheric air zone 40 whilst solid arrows show movement of air in the sealed zone 30.

30 Air is drawn through the atmospheric air zone 40 by fans 50. As the air is drawn through the atmospheric air zone 40 it passes across one or more surfaces of the heat exchanger 70. Similarly, air within the sealed zone 30 is drawn into the heat exchanger 70 behind the baffle plate 90 by the fans 80 at point A and passes across one or more other surfaces of the heat exchanger 70.

Air is circulated within the sealed zone 30 due to operation of the fans 80 within the cabinet and fans 25 within the display 20. Air coming into contact with hot components of the display 20 absorbs some of the heat. Due to operation of the fans 25 and 80 and orientation of the baffle plate 90, air within the sealed zone 30 is directed along one or more surfaces of the heat exchanger 70 around the baffle plate 90. Heat is transferred by the heat exchanger 70 from hot air in the sealed zone 30 to cooler atmospheric air within the atmospheric air zone 40. Heated air in the atmospheric air zone 40 is eventually ejected from the cabinet via exhausts in the fans 50.

The cooled air in the sealed zone is then forced through the fans 80 at the base of the heat exchanger 70 into a pressure zone 85.

As air is forced into the pressure zone 85, existing air in the pressure zone 85 is forced through vents in the rear portion 35 of the display 20. The air circulates around the display 20, aided by a standard internal cooling system of the display 20. In the illustrated embodiment, the internal cooling system includes the fans 25. The air is heated by hot components as it circulates, and is drawn upwards by the fans 25 within the display unit and blown out of the rear portion 35 for the cycle to continue.

The pressure zone 85 is created by forcing air into the zone using a bank of fans 80 at the base of the baffle plate 90. Due to the speed and number of the fans air is forced into the pressure zone more rapidly than it can escape elsewhere. In this manner, air is forced into the display 20 at a greater rate than is normally the case, thereby improving the efficiency of the display's own fans. As a result, more air passes through taking more heat away with it as it goes.

The baffle plate 90 on the side of the sealed zone 30 divides air expelled from the rear portion 35 of the display 20 and ensures air flows properly in the desired direction, along the heat exchanger towards the fans 80, allowing the pressure to be increased on one side of it.

In this manner, the sealed zone 30 is cooled without the ingress of atmospheric air.

Figure 5 is a perspective view of part of a heat exchanger suitable for use in the present invention.

In the illustrated embodiment of the present invention, the heat exchanger 70 is formed from corrugated metal, thereby increasing the surface area in contact with both the atmospheric air zone 40 and the sealed zone 30. The heat exchanger is sealed at the top and the bottom on the inner side to prevent atmospheric air 110 and the re-circulating air 100 within the sealed zone from mixing.

It will be apparent that other heat exchange arrangements or mechanisms could be used depending on the expected environment the product would be placed in. For example, the heat exchanger 70 could be: a refrigeration unit, heat pipes, flat plates, a heat wheel or one of the many other heat exchangers known.

The cooling process need not be in the form of air to air transfer of heat. For example, cooling could be via atmospheric air to another gas sealed within the sealed zone 30, air to a liquid (or air to liquid within heat pipes or the like to air), gas to a liquid, liquid to liquid etc.

The fans 80 are mounted to the baffle plate 90 which is in turn mounted to the heat exchanger 70. This assembly is then mounted within the cabinet 10 whilst allowing appropriate passage of air within the sealed zone 30 behind the baffle plate 90 into contact with the heat exchanger 70.

Figure 6 is a cross section of part of the embodiment of Figure 1 along a line substantially perpendicular to the cross-section of Figure 1.

Various forms of display system may be used, for example plasma, LCD, TFT, CRT, LED, rear projection or any similar technology.

The sealed zone may be created by use of gaskets formed from silicon, rubber, foam or the like.

5 The above-described embodiment significantly reduces the possibility of operational failure by removal of ingress of dirt and the like from the display system 20. In order to maintain full cooling effectiveness, intermittent cleaning of the vents 60 and fans 50 along with infrequent cleaning of the heat exchanger in the atmospheric zone 40 is suggested. Due to the design and configuration of the cabinet and components, it will be appreciated that these areas are much easier to clean than in prior systems
10 facilitating reduced downtime and maintenance costs. Furthermore, separation of the display system 20 from dirt and the like results in a longer life for the display system and a more efficient heat transfer.

15 Thermal fuses may be provided in the atmospheric zone and in the sealed zone to disable the display system (and possibly fans) in the event that a predetermined temperature (for example 40°C) indicative of an air blockage in atmospheric zone, failure of the heat exchanger, fan failure, a fire or the like. Advantageously, since air within the sealed zone is limited, should a fire occur in the sealed zone, any smoke created would be contained and the fire should burn out very quickly due to lack of
20 oxygen. Obviously if it is desired, the air within the sealed zone can be replenished or refreshed by opening and then resealing the sealed zone.

The fans 80 in the sealed zone are preferably temperature controlled and operate independently of the rest of the system.

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Claims

1. A display cabinet comprising a substantially atmospherically sealed zone including means for mounting a display system in the substantially atmospherically sealed zone and heat transfer means arranged to transfer heat out of the substantially atmospherically sealed zone.
2. A display cabinet according to claim 1, further comprising an atmospheric zone, the heat transfer means being arranged to communicate heat from the substantially atmospherically sealed zone to the atmospheric zone.
3. A display cabinet according to claim 2, wherein the atmospheric zone includes air transfer means arranged to draw air from outside the cabinet and expel air in the atmospheric zone heated by the heat transfer means.
4. A display cabinet according to claim 3, wherein the air transfer means includes one or more fans.
5. A display cabinet according to any preceding claim, wherein the heat transfer means comprises a heat exchanger.
6. A display cabinet according to claim 5, wherein the heat exchanger comprises a corrugated heat conducting sheet having a first side in the substantially atmospherically sealed zone and a second side in the atmospheric zone.
7. A display cabinet according to any preceding claim, wherein the substantially atmospherically sealed zone includes air circulation means arranged to circulate air along the heat transfer means.
8. A display cabinet according to claim 7, wherein the air circulation means includes a baffle plate.

9. A display cabinet according to any preceding claim, wherein the substantially atmospherically sealed zone includes air pressurisation means arranged to project air within the atmospherically sealed zone into circulate air along the mounted display.
- 5 10. A display cabinet according to claim 9, wherein the air pressurisation means includes one or more fans.
11. A display cabinet according to any one of claims 1 to 5, wherein the heat transfer means includes one or more of: a refrigeration unit, heat pipes, flat plates and
10 a heat wheel.
12. A display cabinet as claimed in any one of the preceding claims including a display system.
- 15 13. A display cabinet as claimed in claim 12, wherein the display system includes one or more of: a plasma display, an LCD, a TFT display, a CRT display, a LED display, a projector and a rear projection display.
14. A display cabinet as herein described and with reference to the accompanying
20 drawings.
15. A display system as herein described and with reference to the accompanying drawings.



INVESTOR IN PEOPLE

Application No: GB 0311575.5
Claims searched: 1-14

Examiner: Brian A Woods
Date of search: 14 November 2003

Patents Act 1977 : Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance	
X	1-7,9-13	US 6474410	(MINICH) See whole document noting a sealed container for a display device, including a transparent viewing screen 16, a cooling fan 44 and a finned heat exchanger 46 in communication with the environment.
X	1 at least	CN 1110453	(CUI HANPING) See whole document noting sealed TV including heat pipe. Also see WPI abstract accession number 1997-373687 [35]
X	1 at least	JP 100042226	(FUKADA) See whole document noting airtight case having main body 1, liquid crystal screen 2a, heat exchanger 12, etc. Also see WPI abstract accession number 1998-186289 [17].
X	1 at least	JP 090307257	(FUJITSU) See whole document noting a plasma screen 4 within an airtight case 1, and including a heat exchanger 6 and a refrigeration cooling system 8.
A		US 6039111	(DENSO) See whole document noting sealed enclosure and heat transfer means.
A		JP 060268388	(NIPPON) See whole document noting sealed enclosure and heat transfer means.

Categories:

X Document indicating lack of novelty or inventive step	A Document indicating technological background and/or state of the art.
Y Document indicating lack of inventive step if combined with one or more other documents of same category.	P Document published on or after the declared priority date but before the filing date of this invention.
R Member of the same patent family	E Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UICC:

F4H; F4U

Worldwide search of patent documents classified in the following areas of the IPC:



Application No: GB 0311575.5
Claims searched: 1-14

Examiner: Brian A Woods
Date of search: 14 November 2003

A47F; F24F; F25B; F25D; F28B; F28C; F28D; F28F; H04N

The following online and other databases have been used in the preparation of this search report:

WPI; EPODOC; JAPIO; EPOQUE English Full TXTE;



(11) **EP 2 801 888 A2**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
12.11.2014 Bulletin 2014/46

(51) Int Cl.:
G06F 1/16 (2006.01) **G06F 1/20** (2006.01)
G06F 19/00 (2011.01)

(21) Application number: **13198685.3**

(22) Date of filing: **19.12.2013**

(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
Designated Extension States:
BA ME

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(30) Priority: **09.05.2013 KR 20130052372**

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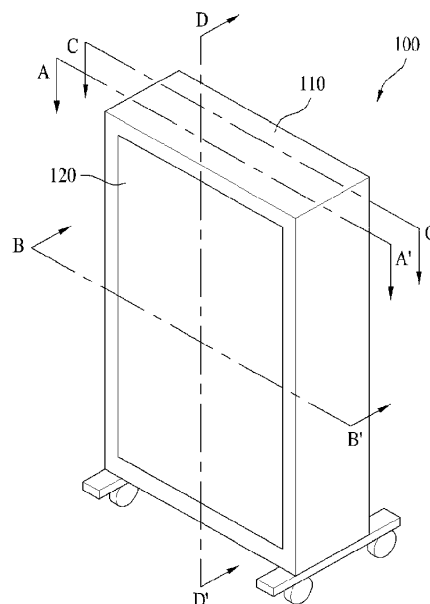
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(54) **Digital signage with heat exhaust**

(57) There are disclosed a digital signage including a display panel, a first support panel coupled to a rear surface of the display panel, the first support panel comprising a plurality of first grooves formed in one direction, a second support panel coupled to a rear surface of the first support panel, the second support panel comprising a plurality of second grooves formed in an orthogonal direction with respect to the first grooves, a driving circuit board (150) provided in a rear surface of the second support panel to control driving of the display panel, and a case comprising the display panel arranged in one surface thereof and an inner space where the first support panel, the second support panel and the driving circuit board are mounted, wherein both ends of the first grooves are open toward the inner space of the case to induce air flow in the case, and both ends of the second grooves are in communication with the outside via a hole formed in the case to flow external air there through, such that the support structure of the display panel may be used in exhausting the heat generated in the display panel and the circuit board effectively.

FIG. 1



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Description

[0001] This application claims the benefit of earlier filing date and right of priority to Korean Application No. 10-2013-0052372, filed on May 9, 2013, the contents of which are hereby incorporated by reference herein in their entirety.

BACKGROUND OF THE DISCLOSURE

Field of the Disclosure

[0002] The present invention relates to a slim-designed digital signage that may emit the heat generated in a display panel and a driving circuit board.

Discussion of the Related Art

[0003] Recently, a digital signage that provides various contents and messages via a display panel has been used as opposed to a hardware media as a signboard and a poster for outdoor advertisement. With rapid development of intelligent digital video devices based on LCDs or LEDs, demands for such digital signage have been increasing recently.

SUMMARY OF THE DISCLOSURE

[0004] To overcome the disadvantages, an object of the present invention is to a digital signage having a slim design that is able to exhaust the heat generated from a display panel and a driving circuit board effectively.

[0005] Additional advantages, objects, and features of the disclosure will be set forth in part in the description which follows and in part will become apparent to those having ordinary skill in the art upon examination of the following or may be learned from practice of the invention. The objectives and other advantages of the invention may be realized and attained by the structure particularly pointed out in the written description and claims hereof as well as the appended drawings.

[0006] To achieve these objects and other advantages and in accordance with the purpose of the invention, as embodied and broadly described herein, a digital signage includes a display panel; a first support panel coupled to a rear surface of the display panel, the first support panel comprising a plurality of first grooves formed in one direction; a second support panel coupled to a rear surface of the first support panel, the second support panel comprising a plurality of second grooves formed in an orthogonal direction with respect to the first grooves; a driving circuit board provided in a rear surface of the second support panel to control driving of the display panel; and a case comprising the display panel arranged in one surface thereof and an inner space where the first support panel, the second support panel and the driving circuit board are mounted, wherein both ends of the first grooves are open toward the inner space of the case to induce

air flow in the inner space of the case, and both ends of the second grooves are in communication with the outside via a hole formed in the case to flow external air there through.

5 **[0007]** The first grooves and the second grooves may be formed of one metallic plate that is folded.

[0008] The first groove and second groove may have a cross section that has at least one of triangular, trapezoidal, rectangular and semicircular shapes.

10 **[0009]** At least one of the first and second support panels may have the grooves toward one surface that are relatively larger than the grooves toward the other surface.

15 **[0010]** At least one of the first support panel and the second support panel has the grooves toward one surface and the grooves toward the other surface that are large symmetrically.

20 **[0011]** The digital signage may further include a separation plate disposed between the first support panel and the second support panel.

[0012] The digital signage may further include a back plate formed between a rear surface of the second support panel and the driving circuit board.

25 **[0013]** The digital signage may further include a first cooling fan provided in the case configured to induce air inside the case along the first grooves.

[0014] The digital signage may further include a second cooling fan to induce external air along the second grooves.

30 **[0015]** The first grooves may be formed in a horizontal direction and the second grooves may be formed in a vertical direction.

35 **[0016]** The case may further include a glass spaced apart a predetermined distance from a front surface of the display panel; and an air curtain formed between the glass and the front surface of the display panel to make air flow in an orthogonal direction with respect to the first grooves, and both ends of the air curtain may be connected to both ends of the second grooves.

40 **[0017]** The digital signage may further include a filter provided in an inlet where external air is drawn into the air curtain.

45 **[0018]** The first grooves may be formed in a vertical direction and the second grooves are formed in a horizontal direction.

50 **[0019]** The case further include a glass spaced apart a predetermined distance from a front surface of the display panel; and an air curtain formed between the glass and the display panel to make air flow in a parallel direction with respect to the first grooves.

[0020] A plurality of first or second support panels may be provided.

55 **[0021]** In another aspect, a digital signage includes a pair of display panels; a pair of first support panels coupled to rear surfaces of the display panels, respectively, the pair of the first support panels comprising a plurality of first grooves formed in one direction, respectively; a pair of second support panels coupled to rear surfaces

of the first support panels, respectively, the pair of the second support panels comprising a plurality of second grooves formed in an orthogonal direction with respect to the first grooves; a case comprising one surface where one of the display panels is arranged and the other surface where the other display panel is arranged and an inner space where the pair of the first support panels and the pair of the second support panels are mounted; and a driving circuit board provided between the pair of the second support panels to control driving of the display panels, wherein both ends of the first grooves are open toward the inner space of the case to induce air flow in the inner space of the case, and both ends of the second grooves are in communication with the outside via a hole formed in the case to flow external air there through.

[0022] The case may further include a pair of glasses spaced apart a predetermined distance from front surfaces of the display panels, respectively; and a pair of air curtains formed between the glasses and the front surfaces of the display panels, respectively, to make air flow in an orthogonal direction with respect to the first grooves, and both ends of the air curtains are connected to both ends of the second grooves.

[0023] The digital signage may further include a filter provided in an inlet formed in each of the air curtains to draw external air therein.

[0024] The first grooves and the second grooves may be formed of one metallic plate that is folded, and the first groove and second groove may have a cross section that has at least one of triangular, trapezoidal, rectangular and semicircular shapes.

[0025] According to at least one of the embodiments described above, the support structure of the display panel may be used in exhausting the heat generated in the display panel and the circuit board effectively.

[0026] Furthermore, no auxiliary passage is formed for heat radiation or no filter member is provided such that the size of the digital signage cannot be increased least. Accordingly, a slim-designed digital signage can be realized and the number of the members can be reduced such that the manufacture cost and the number of manufacture processes can be reduced.

BRIEF DESCRIPTION OF THE DRAWINGS

[0027] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this application, illustrate embodiments of the invention and together with the description serve to explain the principle of the invention. In the drawings:

FIG. 1 is a perspective diagram illustrating an exterior appearance of a digital signage according to one embodiment of the present invention;

FIG. 2 is an exploded perspective diagram illustrating an interior structure of the digital signage according to the embodiment of the present invention;

FIG. 3 is a perspective diagram illustrating a first or second support panel according to one embodiment provided in the digital signage;

FIG. 4 is a sectional diagram of A-A' shown in FIG. 1;

FIG. 5 is a sectional diagram of B-B' shown in FIG. 1;

FIG. 6 is a sectional diagram of C-C' shown in FIG. 1;

FIG. 7 is a sectional diagram of E-E' shown in FIG. 1;

FIG. 8 is a sectional diagram longitudinally illustrating a digital signage according to another embodiment of the present invention;

FIG. 9 is a sectional diagram longitudinally illustrating a digital signage according to a further embodiment of the present invention;

FIG. 10 is a sectional diagram horizontally illustrating a digital signage according to the embodiment of the present invention;

FIG. 11 is a sectional diagram longitudinally illustrating a digital signage according to a still further embodiment of the present invention;

FIG. 12 is a sectional diagram horizontally illustrating a digital signage according to the embodiment of the present invention; and

FIG. 13 is a sectional diagram longitudinally illustrating a digital signage according to a still further embodiment of the present invention;

DESCRIPTION OF SPECIFIC EMBODIMENTS

[0028] Referring to the accompanying drawings, a digital signage according to embodiments will be described in detail as follows. It will be understood that when an element is referred to as being 'on' or 'under' another element, it can be directly on/under the element, and one or more intervening elements may also be present. When an element is referred to as being 'on' or 'under', 'under the element' as well as 'on the element' can be included based on the element.

[0029] FIG. 1 is a perspective diagram illustrating an exterior appearance of a digital signage according to one embodiment of the present invention. As shown in FIG. 1, the digital signage 100 includes a display panel 120 arranged on a front surface thereof and a case 110 having various components arranged therein. In this embodiment, the display panel 120 may be provided only in the front surface of the digital signage. However, in other embodiments which will be described later, the display panel 120 may be provided in each of front and rear surfaces.

[0030] FIG. 2 is an exploded perspective diagram illustrating an interior structure of the digital signage according to the embodiment of the present invention. FIG. 2 shows key components arranged in the case 110 shown in FIG. 1. In the case 110 may be arranged the display panel 120 exposed to a front surface of the case 110 and a first support panel 130, a second support panel 140, a driving circuit board 150 and a cooling fan 160 that are provided behind a rear surface of the display panel 120.

[0031] The display panel 120 may include at least one of a liquid crystal display (LCD), a thin film transistor-liquid crystal display (TFT LCD), an organic light-emitting diode (OLED), a flexible display and a 3D display.

[0032] The display panel 120 may consist of thin films or thin-film type plate members disposed sequentially and it has a disadvantage of warping easily. To prevent such panel warp, a support panel having a predetermined rigidity may be used and a metallic material having a high rigidity such as iron may be used. However, as the size of the display panel is getting larger in the digital signage 100, it is difficult to prevent the warp even in case of using a high rigidity material.

[0033] Accordingly, grooves 131 and 141 may be formed in the support panels 130 and 140 configured to support the rear surface of the display panel 120 so as to enhance a resistance to the warp. Especially, the grooves 131 and 141 orthogonal to each other are formed in the two support panels 130 and 140, respectively. As shown in FIG. 2, the first support panel 130 has a plurality of first grooves 131 formed in a predetermined direction and the second support panel 140 has a plurality of second grooves 141 formed in an orthogonal direction with respect to the direction of the first grooves 131.

[0034] The grooves formed only in one direction may be highly resistant to warp in one direction but insufficiently resistant to warp in the orthogonal direction. Accordingly, the first grooves 131 and the second grooves 141 orthogonal to each other may be provided to enhance a supporting force that acts to resist to the warp in all directions.

[0035] In this embodiment, the first grooves 131 may be longitudinally formed in a horizontal direction and the second grooves 141 may be longitudinally formed in a vertical direction. However, the embodiment is not limited thereto and the first grooves 131 may be longitudinally formed in a vertical direction and the second grooves 141 may be longitudinally formed in a horizontal direction.

[0036] A deck plate formed of one metallic plate that is folded or bent may be used as each of the first support panel 130 and the second support panel 140. A corrugation-shaped deck plate in which grooves having a semicircular cross section are serially formed as shown in FIG. 2 may be used. Alternatively, a deck plate in which grooves having a trapezoidal cross section are serially formed as shown in FIG. 3 (a) or a deck plate in which grooves having a zigzag-shaped cross section are serially formed as shown in FIG. 3 (b).

[0037] As shown in embodiments of FIGS. 2, 3 (a) and 3 (b), grooves formed in one surface and grooves formed in the other surface may be in symmetry. Alternatively, as shown in FIG. 3 (c), grooves formed in one surface may have a larger area than grooves formed in the other surface. In case the grooves formed in one surface are larger, only the grooves formed in one surface may be used as passages. In case the grooves formed in one surface and the other surface are symmetrical to each other, the grooves formed in both surfaces may be used

as passages.

[0038] The thickness of each support panel 130 and 140 may be increased to enhance the rigidity or the gaps between the grooves 131 and 141 may be adjusted to enhance the rigidity. Alternatively, more than one panel as the support panel 130 or 140 may be overlapped to enhance the rigidity.

[0039] The driving circuit board 150 configured to control a screen of the display panel 120 may be disposed behind the two support panels 130 and 140. Various circuit elements 151 are provided on the driving circuit board 150 and they apply a voltage signal for realizing an image and supply the power.

[0040] Such the driving circuit board 150 is electrically connected with the display panel 120 and it transmits a driving signal to the display panel. A cable or a flexible printed circuit may be used in the electrical connection between the driving circuit board and the display panel 120.

[0041] The circuit elements 151 provided in the driving circuit board 150 may include an intelligent power module (IPM) that consumes much power. Once put into operation, such an IPM generates a lot of heat. If the circuit element consuming much power is overheated, it is impossible to stop the operation of the circuit element and it is necessary to radiate the heat generated from the circuit elements 151 effectively.

[0042] The display panel 120 realizes a high brightness to secure the visibility even in bright circumstances and the size of the display panel 120 has been getting larger, such that the display panel 120 may generate relatively much heat, compared with a conventional display device. In case the display panel 120 is overheated, an image quality of the display panel 120 could be affected and it is necessary to radiate the heat exhausted from the display panel 120.

[0043] In case of using the structure configured to make an outside and an inside in communication with each other to exhaust the heat generated in the digital signage, external foreign substances, sands and humidity might come into the digital signage and deteriorate the durability of the digital signage 100. To overcome such a disadvantage of deteriorated durability, a complex passage having a filter to prevent the penetration of foreign substances could be used. In this instance, the size of the digital signage 100 ends up with increasing and an installation space is limited only to deteriorate a design quality.

[0044] The embodiments of the present invention uses the support panels 130 and 140 of the display panel 120 as a heat radiation structure, to overcome the disadvantage of foreign substances penetration caused by the communication with the outside and the disadvantage of the increased size.

[0045] The grooves 131 and 141 formed in the support panels 130 and 140, respectively, may provide passages of air for emitting the heat. The flow of the air along the first grooves 131 of the first support panel 130 is distin-

guished from the air flow along the second grooves 141 of the second support panel 140, such that the passages in communication with the outside may be distinguished from the passages in communication with the inside of the digital signage to prevent foreign substances from being mixed with the air flowing in the case 110.

[0046] The air flowing in the case 110 may not be mixed with the air drawn from the outside. Accordingly, a filter 170, such as that shown in FIG. 8, may be omitted and the passages using the grooves 13 and 141 formed in the support panels 130 and 140 may be simplified.

[0047] Referring to FIGS. 4 to 7, the air passages mentioned above will be described in detail as follows.

[0048] The first grooves 131 formed in the first support panel 130 are open toward an inner space 113 of the case 110 and they induce the air flow in the inner space 113 of the case. The second grooves 141 formed in the second support panel 140 are in communication with the outside via an opening formed in the case 110 to draw or exhaust external air therein or therefrom. Accordingly, such the first and second grooves 131 and 141 may be configured to exhaust the heat generated in the driving circuit board 150 and the display panel 120 arranged in the case 110 outside.

[0049] FIG. 4 is a sectional diagram of A-A' shown in FIG. 1 to show flow of air along the first grooves 131 of the first support panel 130. The air is flowing along a longitudinal direction of the first grooves 131 (a horizontal direction in the drawing) and a cooling fan 160 may be further provided to induce the air flow along the longitudinal direction of the first grooves 131. The first grooves 131 are open toward the inner space 113 of the case and shut off from the outside, such that the air may be continuously circulated in the inner space of the case along the first grooves 131, without being mixed with the external air.

[0050] FIG. 5 is a sectional diagram of B-B' shown in FIG. 1. The air having passed the first grooves 131 is flowing to a rear surface of the second support panel 140 and circulated, with the heat of the driving circuit board 150. In other words, the air having passed the first grooves 131 of the first support panel 130 is configured to uniformly disperse the heat inside the space 113 of the case, while being circulated in the inner space 113.

[0051] As shown in FIG. 5, a separation plate 135 may be further provided between the first support panel 130 and the second support panel 140 to separate the air flow along the first grooves 131 from the air flow along the second grooves 141. A back plate 145 may be further provided between the second support panel 140 and the driving circuit board 150 to separate the air flow along the second grooves 141 from the air flow in the inner space 113 of the case.

[0052] FIG. 6 is a sectional diagram of C-C' shown in FIG. 1 and shows flow of air along the second grooves 141 of the second support panel 140. The air is flowing along a longitudinal direction of the second grooves 141 (a vertical direction in the drawing) and a cooling fan 160

may be further provided to induce the air flow along the longitudinal direction of the second grooves 141. As mentioned above, the second grooves are in communication with the outside of the case 110 via an opening formed in the case 110 and they show flow along one direction.

[0053] Air is drawn via a first hole 111 connected to an end of the second groove 141 and the air is exhausted via a second hole 112 connected to the other end of the second groove 141, such that the heat may be exhausted constantly. As shown in FIG. 5, the air inside the inner space 113 of the case is circulated around the second support panel 140, such that external air passing the second grooves 141 of the second support panel 140 and the air inside the inner space 113 of the case may exhaust the heat in the inner space 113 through heat-exchanging.

[0054] FIG. 7 is a sectional diagram of E-E' shown in FIG. 1 that illustrates that external air is flowing via the second grooves 141. The second grooves 141 are separated from the inner space 113 of the case and the first grooves 131. Accordingly, the air passing the second grooves 141 may not affect the components arranged in the case 110 even if it contains foreign substances. Only if they are washed, the second grooves 141 can be used constantly without the filter 170.

[0055] FIG. 8 is a sectional diagram longitudinally illustrating a digital signage according to another embodiment of the present invention. In this embodiment, the flow of air passing first grooves 131 is the same as in the embodiment mentioned above. However, a predetermined amount of the external air passing the second grooves 141 may pass an air curtain 115 provided in a front surface of the display panel 120 in this embodiment.

[0056] The air curtain 115 is configured to emit the heat generated from a front surface of the display panel 120. In this embodiment, a front glass 116 is additionally provided in a front surface of the display panel 120, spaced apart a predetermined distance from the display panel 120, to form the air curtain 115 between the display panel 120 and the front glass 116. The air passing the air curtain 115 may absorb the heat of the display panel 120.

[0057] As shown in FIG. 8, a predetermined amount of the external air drawn in the second grooves 141 is moved to the air curtain 115, such that the heat may be absorbed even from the front surface of the display panel 120 to improve the heat radiation function. To suck the air drawn to the second grooves 141 to the air curtain partially, the vertical size of the separation plate between the first grooves and the second grooves may be smaller than that of the separation plate according to the embodiment mentioned above.

[0058] In the embodiment shown in FIG. 8, the air curtain 115 is further provided to improve the heat radiation function in case only the heat radiation structure mentioned in the embodiment above is insufficient to exhaust the heat of the digital signage 100, because the heat generated in the display panel 120 is too much.

[0059] In this instance, external air is moving along the front surface of the display panel 120. If foreign substance-

es or humidity is contained in the air moving along the front surface of the display panel 120, there might be a problem of hiding the screen of the display panel 120.

[0060] For a clean screen, the air need to be filtered by a filter 170 to filter foreign substances, before passing the air curtain 115. As shown in FIG. 8, the filter 170 may be further provided in an inlet where the air is drawn into the air curtain 115.

[0061] FIG. 9 and 10 are sectional diagrams longitudinally illustrating a digital signage according to a further embodiment of the present invention. In this embodiment, a first support panel 130 has first grooves 131 formed in a vertical direction and a second support panel 140 has second grooves 141 formed in a horizontal direction. The second support panel 140 is arranged in a horizontal direction and the case 110 is open in a right and left direction. The first support panel 130 is arranged in a vertical direction and the air passing the driving circuit board is flowing in an up and down direction.

[0062] FIG. 11 is a longitudinal sectional diagram illustrating a digital signage according to a still further embodiment that further includes an air curtain 115 provided in a front surface thereof. In this embodiment, the air curtain 115 is connected to the first grooves 131 and the air circulating in the case 110 passes the air curtain 115. The inner space of the case 110 is shut off and air is stopped from coming into the inner space of the case 110, such that dust or foreign substances may not be drawn into the inner space. Accordingly, the heat emitted from the display panel 120 can be diffused while the air is passing the air curtain 115, even without the filter provided in the embodiment shown in FIG. 8.

[0063] In this embodiment, the air absorbing the heat while circulating in the inner space of the case having the driving circuit board 150 mounted therein and the air absorbing the heat while passing the air curtain 115 may pass the first grooves 131 and transfer the heat to the second grooves 141 to diffuse the heat.

[0064] FIG. 12 is a sectional diagram horizontally illustrating a digital signage according to the embodiment of the present invention and FIG. 13 is a sectional diagram longitudinally illustrating a digital signage according to a still further embodiment of the present invention. In this embodiment, display panels 120 are provided in front and rear surfaces of the case, respectively. The two panels 120 are provided and one driving circuit board 150 is used in the drawings. However, the circuit elements 151 that are approximately twice as many as the circuit elements 151 mentioned in the embodiment and the heat generated in the inner space 113 of the case is increased much more.

[0065] In this instance, it is preferable that the air curtain 115 is further provided in the front surface of the display panel to enhance the heat radiation effect, similar to the embodiment shown in FIG. 8. The embodiment shown in FIGS. 12 and 13 is basically similar to the embodiment shown in FIG. 8, except that the display panels 120 are provided in both surfaces of the case to form air

flow in both directions.

[0066] As shown in FIG. 12, the air flowing along first grooves 131 formed in the pair of the first display support panels provided in rear surfaces of the pair of the display panels 120 may be collected in an edge portion to pass the driving circuit board 150. The air having passed the driving circuit board 150 is divided again to both of the first grooves 131. Even in this embodiment, a cooling fan 160 may be provided to make the air flow along the driving circuit board 150 and the first grooves 131 in the inner space 113 of the case performed smoothly.

[0067] As shown in FIG. 13, the flow of external air passing the second grooves 141 is divided in four ways. In the embodiment shown in FIG. 8, one display panel 120 is provided and the air flow is divided in two ways toward the air curtain 115 positioned in the front surface of the display panel 120 and the second grooves 141. However, in this embodiment, two display panels 120 are provided and the air flow is divided in four ways. At this time, the second display panel 120 not having the driving circuit board 150 may be omitted to make the thickness much thinner.

[0068] In case the air curtain 115 is provided, a filter 170 may be further provided in an inlet of the air curtain 115 to prevent foreign substances from being drawn into the air curtain 115. When digital signage 100 is installed in an area having a low atmospheric temperature to radiate the heat of the digital signage 110 easily, the air curtain 115 may be omitted and the flow of the external air may be divided in two ways to make the air pass only the second grooves 141, like in the embodiment of FIG. 4.

[0069] According to at least one of the embodiments described above, the support structure of the display panel 120 may be used in exhausting the heat generated in the display panel and the circuit board effectively.

[0070] Furthermore, no auxiliary passage is formed for heat radiation or no filter member is provided such that the size of the digital signage 100 cannot be increased least. Accordingly, a slim-designed digital signage can be realized and the number of the members can be reduced such that the manufacture cost and the number of manufacture processes can be reduced.

[0071] When a particular feature, structure, or characteristic is described in connection with any embodiment, it is submitted that it is within the purview of one skilled in the art to affect such feature, structure, or characteristic in connection with other ones of the embodiments. Although embodiments have been described with reference to a number of illustrative embodiments thereof, it should be understood that numerous other modifications and embodiments can be devised by those skilled in the art that will fall within the spirit and scope of the principles of this disclosure. More particularly, various variations and modifications are possible in the component parts and/or arrangements of the subject combination arrangement within the scope of the disclosure, the drawings and the appended claims. In addition to variations and modifications in the component parts and/or arrangements,

alternative uses will also be apparent to those skilled in the art.

Claims

1. A digital signage comprising:

a display panel (120) having a front surface and a rear surface;
a first support panel (130) coupled to the rear surface of the display panel (120), the first support panel (130) including a plurality of first grooves (131) formed in a first direction; and
a second support panel (140) coupled to a rear surface of the first support panel (130), the second support panel (140) including a plurality of second grooves (141) formed in a second direction, the second direction being orthogonal to the first direction.

2. The digital signage according to claim 1, further comprising a case (110), the case (110) having the display panel (120) arranged in one surface thereof and an inner space (113) where the first support panel (130) and the second support panel (140) are located.

wherein the case (110) includes a first hole formed in a first end of the case (110) and a second hole formed in a second end of the case (110), wherein both ends of the first grooves (131) are open toward the inner space (113) of the case (110) to induce air flow in the inner space (113) of the case (110), and wherein first ends of the second grooves (141) are in communication with the outside via the first hole and second ends of the second grooves (141) are in communication with the outside via the second hole to allow external air to flow therethrough.

3. The digital signage according to claim 2, further comprising a cooling fan (160) provided in the case (110), the fan (160) being configured to induce air to flow inside the case (110) along the first grooves (131) configured to induce external air to flow along the second grooves (141).

4. The digital signage according to claim 2, wherein the first grooves (131) are formed in a horizontal direction and the second grooves (141) are formed in a vertical direction.

5. The digital signage according to claim 4, wherein the case (110) further comprises a glass (116) spaced apart a predetermined distance from the front surface of the display panel (120) to provide a space (115) to allow an air curtain to be formed between the glass and the front surface of the display panel (120) such that air flows in the second direction be-

tween the glass and the front surface of the display panel (120), wherein a first end of the space (115) is connected to the first ends of the second grooves (141) and a second end of the space (115) is connected to the second ends of the second groove.

6. The digital signage according to claim 5, further comprising a filter provided at the first end of the space (115), the first end being an inlet where external air is drawn into the space (115).

7. The digital signage according to claim 2, wherein the first grooves (131) are formed in a vertical direction and the second grooves (141) are formed in a horizontal direction.

8. The digital signage according to claim 7, wherein the case (110) further comprises a glass (116) spaced apart a predetermined distance from the front surface of the display panel (120) to provide a space (115) to allow an air curtain to be formed between the glass and the front surface of the display such that air flows in the first direction.

9. The digital signage according to one of claims 1 to 8, wherein each of the first support panel (130) and the second support panel (140) is formed of a folded, metallic plate to provide the first grooves (131) and the second grooves (141), respectively.

10. The digital signage according to one of claims 1 to 9, wherein each of the first grooves (131) and second grooves (141) has a cross section having at least one of triangular, trapezoidal, rectangular and semicircular shapes.

11. The digital signage according to one of claims 1 to 10, wherein at least some of the first grooves (131) or some of the second grooves (141) are formed larger than others of the respective first grooves (131) or second grooves (141).

12. The digital signage according to one of claims 1 to 11, wherein at least one of the first grooves (131) and the second grooves (141) are symmetrical.

13. The digital signage according to one of claims 1 to 12, further comprising a separation plate disposed between the first support panel (130) and the second support panel (140).

14. The digital signage according to one of claims 1 to 13, further comprising a driving circuit board (150) provided at a rear surface of the second support panel (140) to control driving of the display panel (120); and a back plate formed between the rear surface of the

second support panel (140) and the driving circuit board (150).

15. The digital signage according to one of claims 1 to 14, wherein a plurality of first or second support panels (140) are provided. 5

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FIG. 1

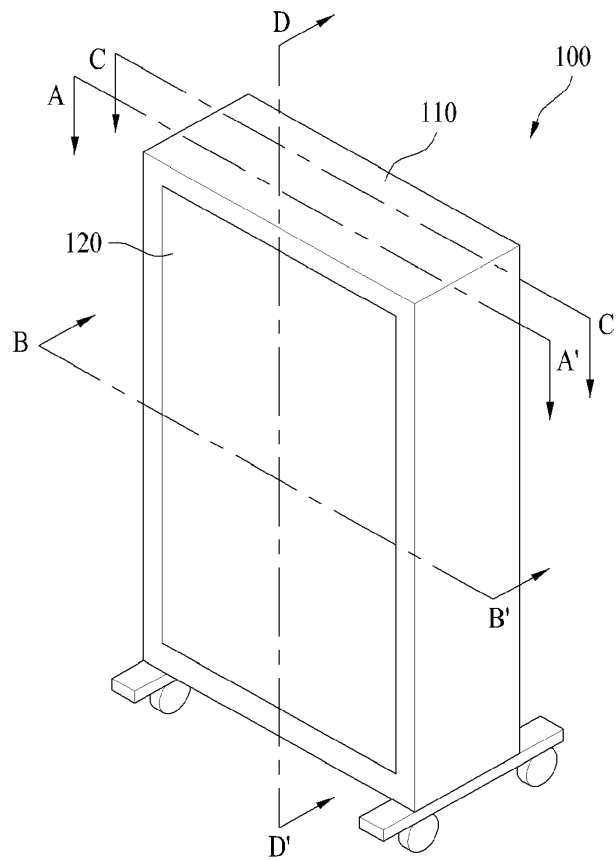


FIG. 2

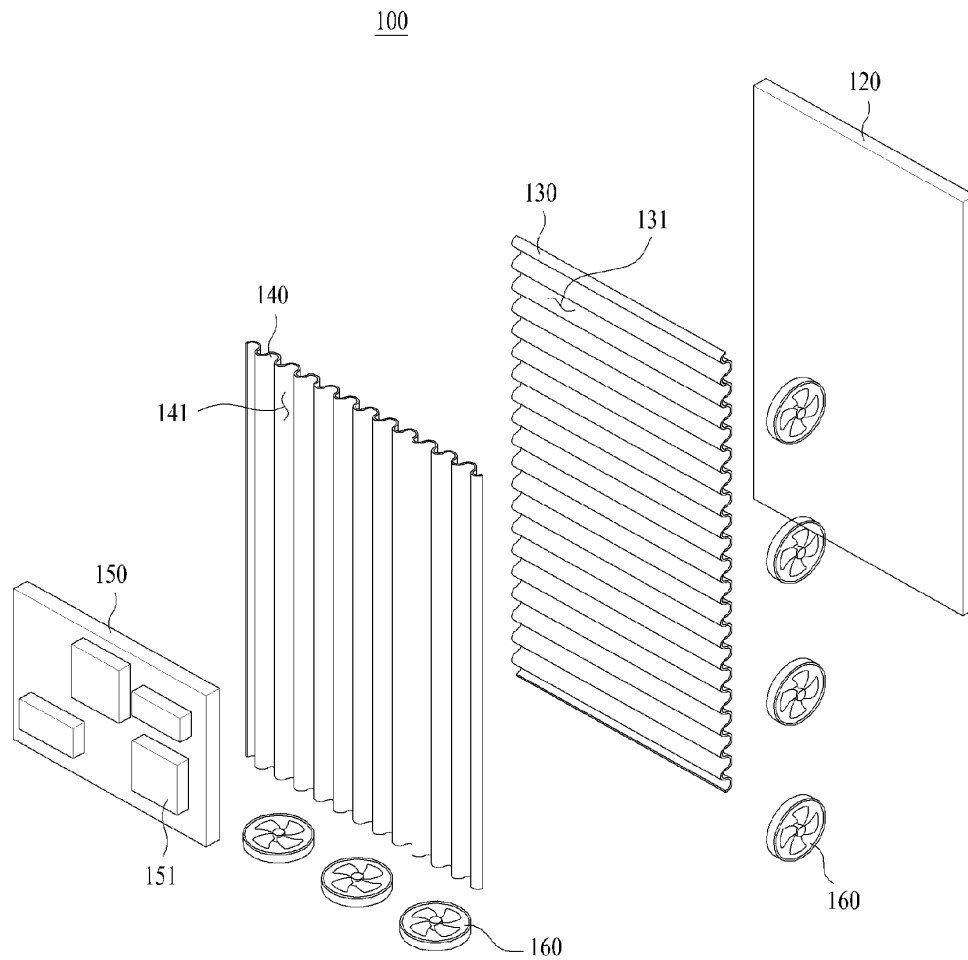
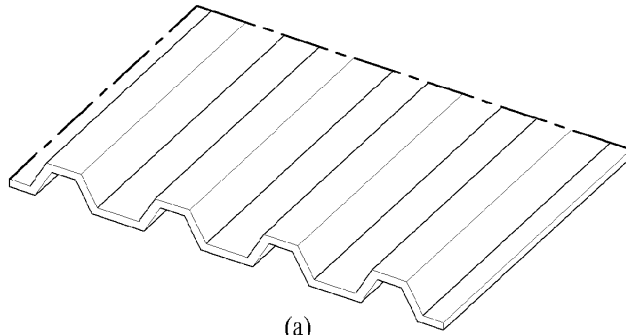


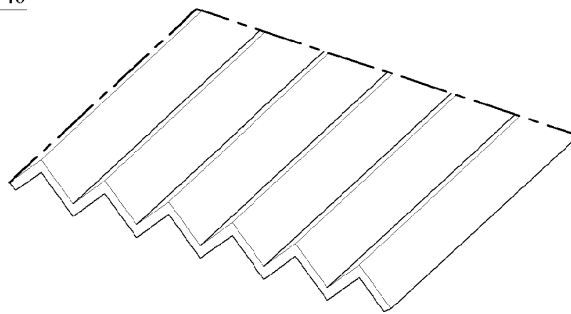
FIG. 3

130,140

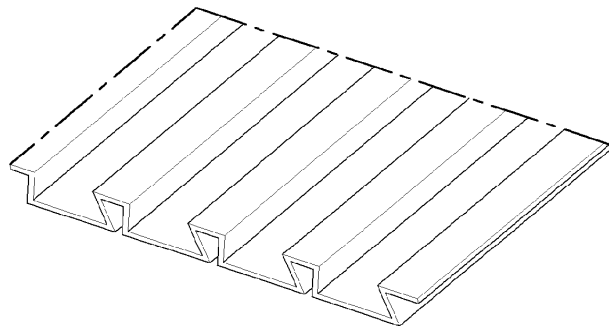


(a)

130,140



(b)



(c)

FIG. 4

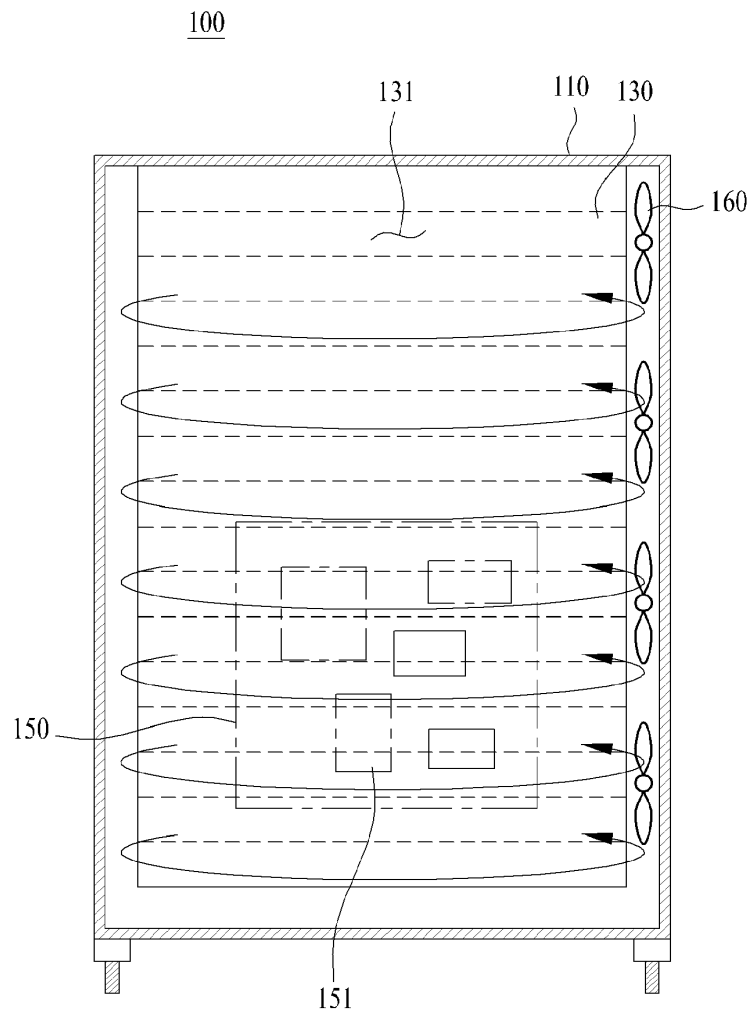


FIG. 5

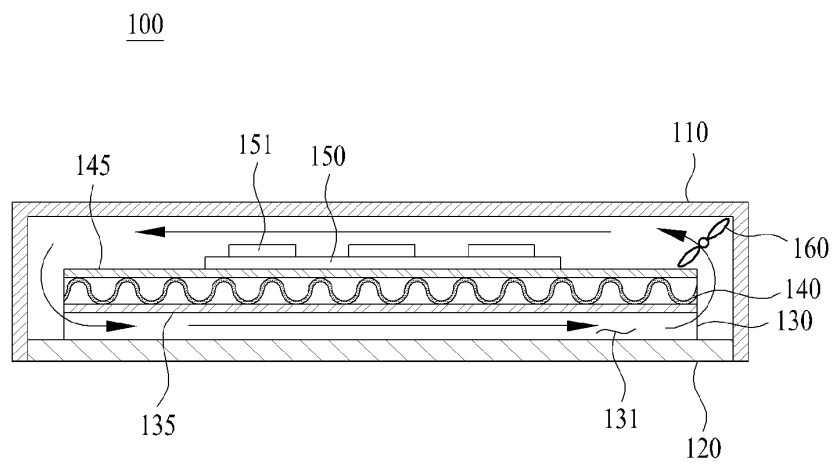


FIG. 6

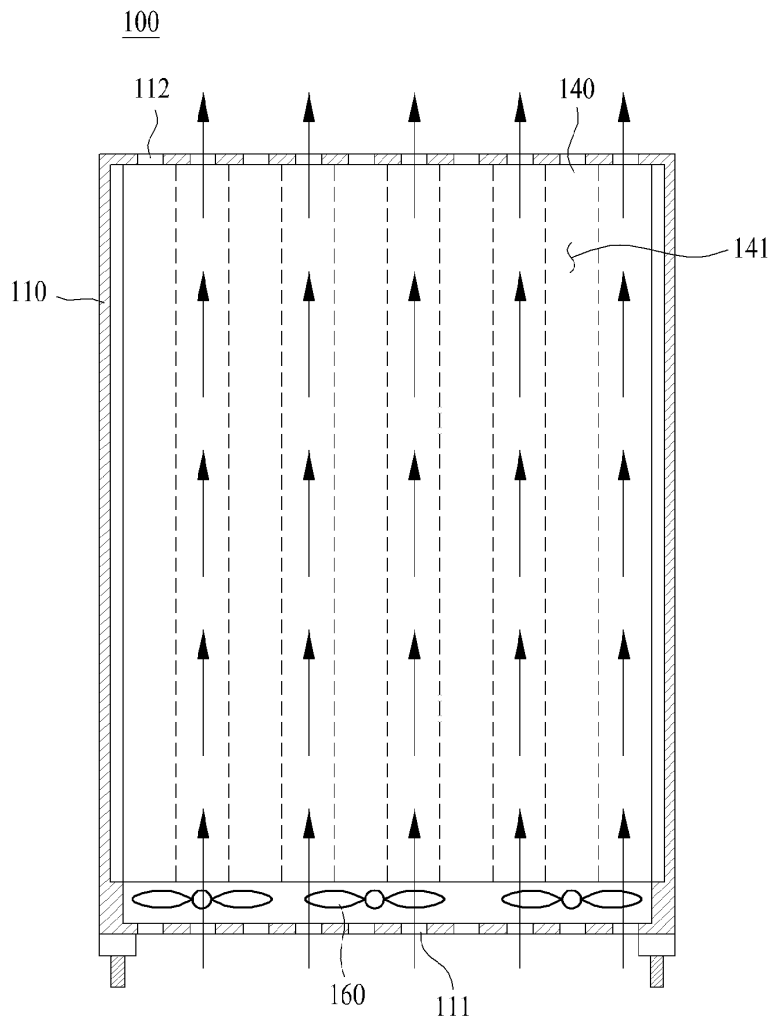


FIG. 7

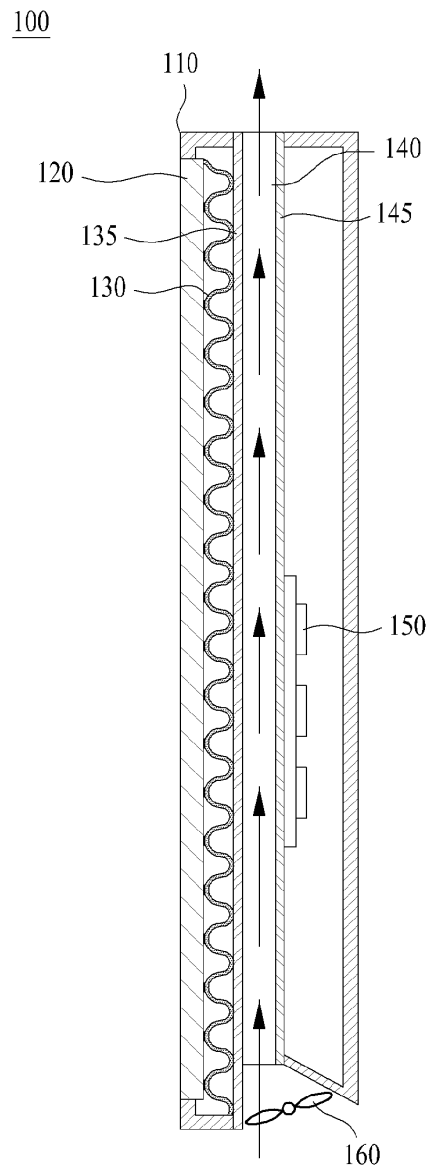


FIG. 8

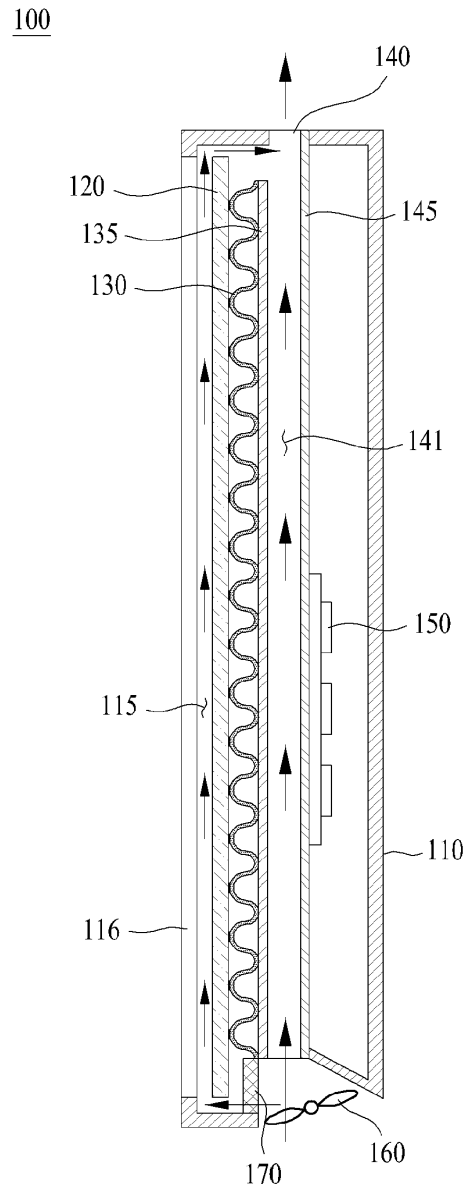


FIG. 9

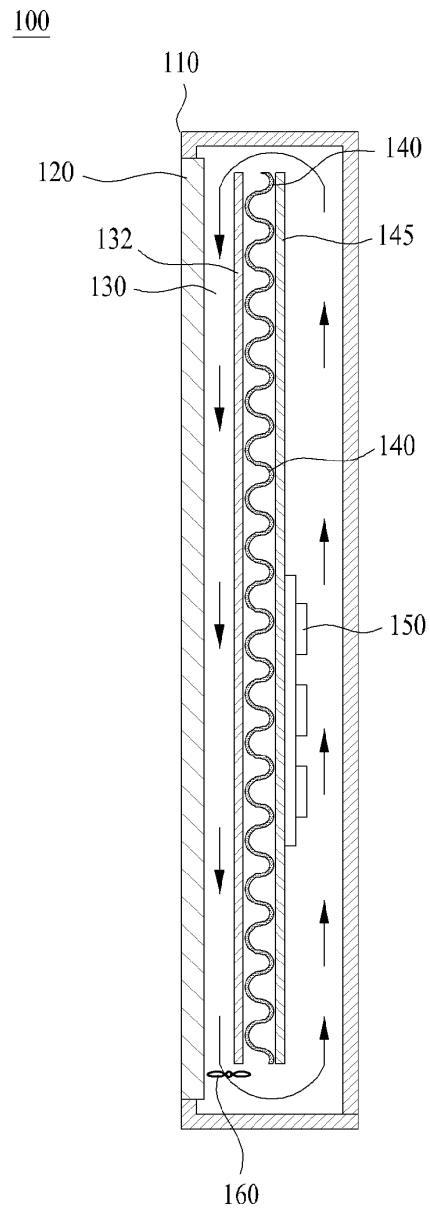


FIG. 10

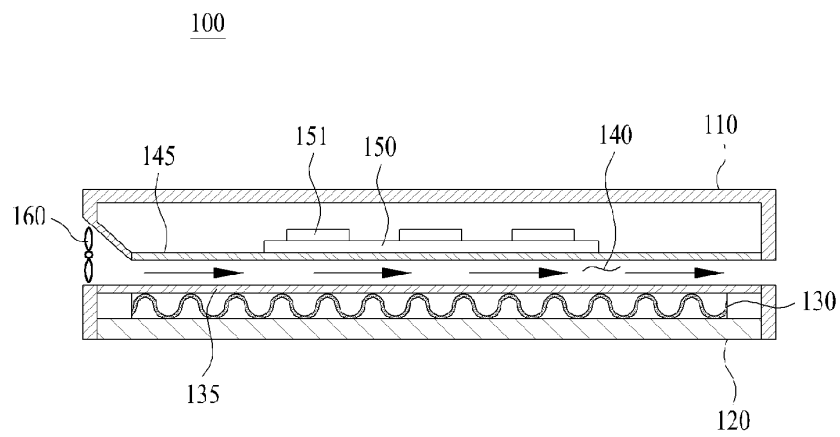


FIG. 11

100

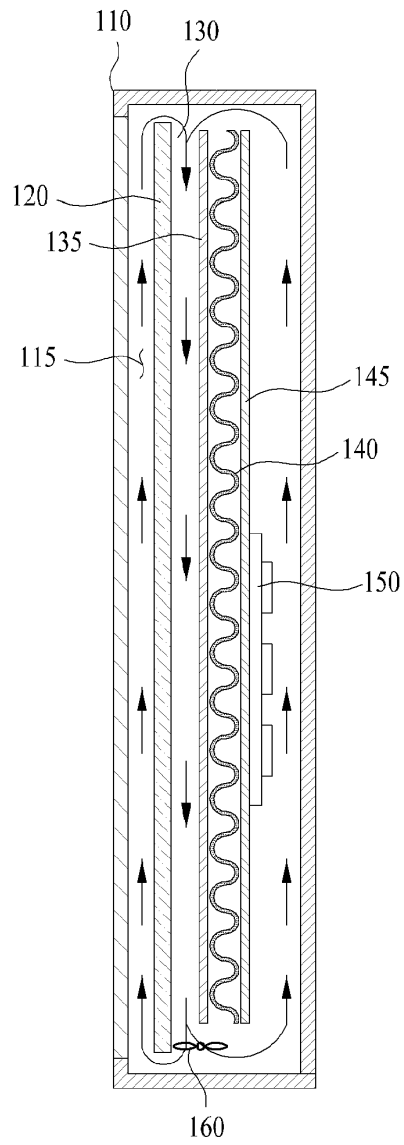


FIG. 12

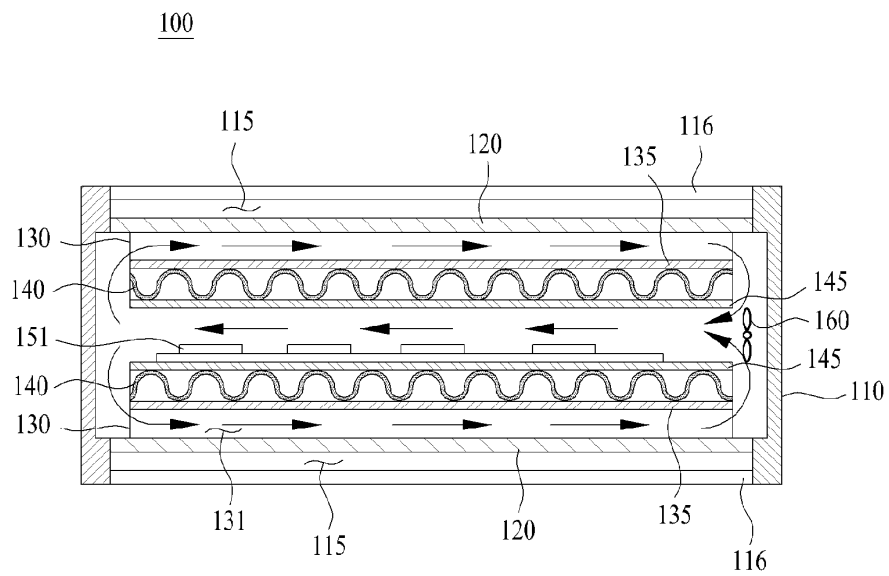
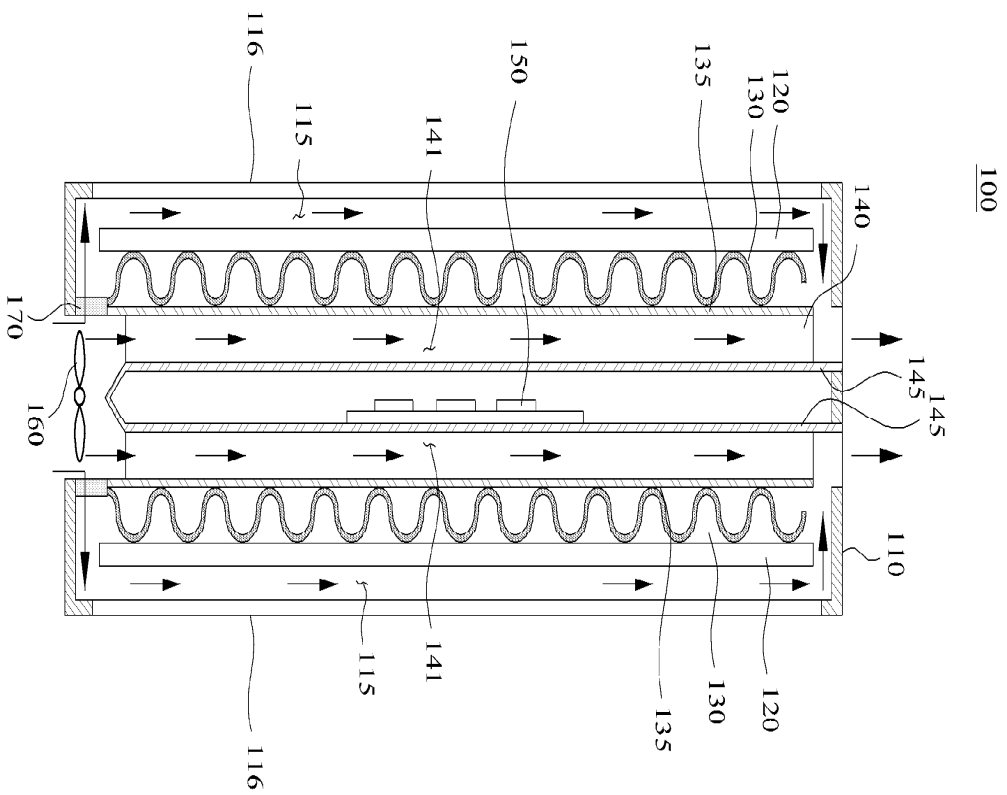


FIG. 13



REFERENCES CITED IN THE DESCRIPTION

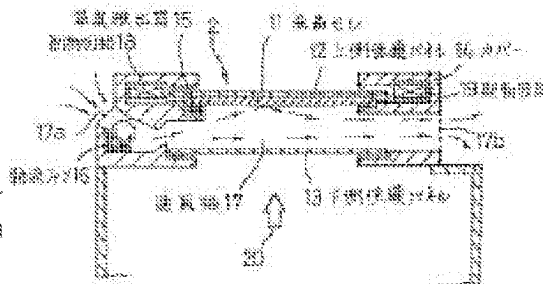
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Patent documents cited in the description

- KR 1020130052372 [0001]



COOLING DEVICE FOR LIQUID CRYSTAL DISPLAY DEVICE FOR OVERHEAD PROJECTOR



Last updated: 14.03.2012 Worldwide Database 5.7.38; 92p

(51)Int.Cl. ⁵	識別記号	庁内整理番号	F I	技術表示箇所
G 0 2 F 1/13	5 0 5	7348－2K		
G 0 3 B 21/132		7316－2K		
21/16		7316－2K		

審査請求 未請求 請求項の数 6 (全 6 頁)

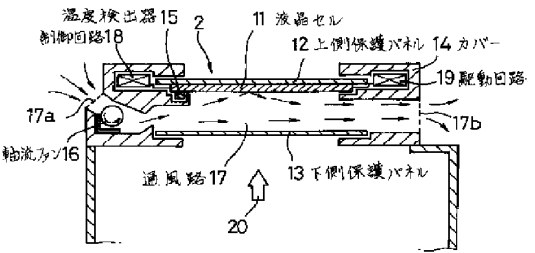
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(54)【発明の名称】 オーバーヘッドプロジェクタ用液晶表示装置の冷却装置

(57)【要約】

【目的】 光源部からスクリーンへ向かう光路内に透過型液晶表示パネルが配置されたオーバーヘッドプロジェクタにおいて、透過型液晶表示パネルの液晶セルが投影ランプからの熱により温度上昇するのを防止する。

【構成】 透過型液晶表示パネルの液晶セル11の上面に透明な上側保護パネル12が、又、液晶セル11の下面とは所要の空間を介して透明な下側保護パネル13がそれぞれ配置され、その空間を通風路17とする。液晶セル11の下面には温度検出器15が配置され、投影光の熱により加熱された液晶セル11の温度を検出する。制御回路18は、温度検出器15の検出結果に応じて冷却風の風量を調節するように軸流ファン16を制御する。



【特許請求の範囲】

【請求項1】 光源部からスクリーンへ向かう光路内に透過型液晶表示パネルが配置されたオーバーヘッドプロジェクタにおいて、前記透過型液晶表示パネルの液晶セルを保護するように前記液晶セルの上面に接するか、若しくは近接して配置された透明な上側保護パネル及び前記液晶セルの下面とは所要の空間を介して配置された透明な下側保護パネルと、前記液晶セルの下面の温度を検出する温度検出器と、前記空間を通風路としその通風路に冷却風を送る送風手段と、前記温度検出器の検出結果に応じて冷却風の風量を調節するように前記送風手段を制御する制御手段とからなることを特徴とするオーバーヘッドプロジェクタ用液晶表示装置の冷却装置。

【請求項2】 液晶セルの温度が予め設定された温度以上になったとき、それを検出した温度検出器の信号に基づいて、オペレータにその旨を報知する手段、若しくは投影ランプの電源を遮断する手段を更に備えていることを特徴とする請求項1記載のオーバーヘッドプロジェクタ用液晶表示装置の冷却装置。

【請求項3】 液晶セルが全面不透過あるいは予め定められた面積以上の不透過の画像面になったとき、冷却風の風量を増加するように送風手段を制御する制御手段を更に備えていることを特徴とする請求項1記載のオーバーヘッドプロジェクタ用液晶表示装置の冷却装置。

【請求項4】 光源部からスクリーンへ向かう光路内に透過型液晶表示パネルが配置されたオーバーヘッドプロジェクタにおいて、前記透過型液晶表示パネルの液晶セルを保護するように前記液晶セルの上面に接するか、若しくは近接して配置された透明な上側保護パネル及び前記液晶セルの下面とは所要の空間を介して配置された透明な下側保護パネルと、前記液晶セルの下面に光源部から照射される赤外線を検出する赤外線検出器と、前記空間を通風路としその通風路に冷却風を送る送風手段と、前記赤外線検出器の検出結果に応じて冷却風の風量を調節するように前記送風手段を制御する制御手段とからなることを特徴とするオーバーヘッドプロジェクタ用液晶表示装置の冷却装置。

【請求項5】 光源部からスクリーンへ向かう光路内に透過型液晶表示パネルが配置されたオーバーヘッドプロジェクタにおいて、前記透過型液晶表示パネルの液晶セルを保護するように前記液晶セルの上面に接するか、若しくは近接して配置された透明な上側保護パネル及び前記液晶セルの下面とは所要の空間を介して配置された透明な下側保護パネルと、前記空間を通風路としその通風路に冷却風を送る送風手段とを備え、前記液晶セルの一方の電極を構成する光源部側電極パネルを赤外線反射型パネルとしたことを特徴とするオーバーヘッドプロジェクタ用液晶表示装置の冷却装置。

【請求項6】 請求項5における、液晶セルの光源部側電極パネルを赤外線反射型パネルとするのに代えて、下

側保護パネルを赤外線反射型パネル又は赤外線吸収パネルとしたことを特徴とするオーバーヘッドプロジェクタ用液晶表示装置の冷却装置。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は、光源部(以下、投影ランプという)からスクリーンへ向かう光路内に透過型液晶表示パネルが配置され、画像が表示された液晶パネルに光を通してその画像をスクリーンへ拡大投影するオーバーヘッドプロジェクタに関し、特に、投影ランプからの熱により透過型液晶表示パネルの液晶セルが温度上昇するのを防止するようにしたオーバーヘッドプロジェクタ用液晶表示装置の冷却装置に関するものである。

【0002】

【従来の技術】液晶表示パネルにおける液晶セルは、投影ランプから発せられる光に含まれる熱によりその温度が上昇する。そして、その温度上昇がある温度以上になると、液晶セルはコントラストの低下や色むらの発生により投影性能が大きく劣化し、さらには、液晶セル自体の寿命を著しく短縮させることになる。

【0003】これに対し、特公平4-21169号公報に見られるように、従来、液晶表示装置を強制空冷して、温度上昇を防止するようにしたものもある。

【0004】

【発明が解決しようとする課題】しかしながら、上記公報に記載されたものは、常に一定の風量を送って冷却するものであるから、実際には冷却能力に限界がある。つまり、オーバーヘッドプロジェクタ用液晶表示装置のように光を通過させるものでは、その光線に含まれる相当な熱量に曝され、その曝される熱量によって温度上昇も大きく異なってくる。その温度上昇に対し、常に一定値以下の温度を保持するためには、冷却風量を常に多くしておく必要があり、従って、送風ノイズが非常に大きくなるという問題が生じる。また、必要以上のパワーで送風するので、電力消費も増加するという問題があった。

【0005】本発明は、上記問題点を解決しようとするもので、液晶表示パネルの温度上昇や液晶表示パネルに照射される光線の強さに応じて冷却風量を制御し、送風ノイズを常に大きくすることなく、一定値以下の温度に保持するようにしたオーバーヘッドプロジェクタ用液晶表示装置の冷却装置を提供することを目的とする。

【0006】

【課題を解決するための手段】この目的を達成するために、本発明は、透過型液晶表示パネルの液晶セルを保護するように液晶セルの上面に接するか、若しくは近接して配置された透明な上側保護パネル及び液晶セルの下面とは所要の空間を介して配置された透明な下側保護パネルと、液晶セルの下面の温度を検出する温度検出器と、空間を通風路としその通風路に冷却風を送る送風手

段と、温度検出器の検出結果に応じて冷却風の風量を調節するように送風手段を制御する制御手段とから構成される。

【0007】 また、上記の構成のうち、液晶セルの下面の温度を検出する温度検出器の代りに、液晶セルの下面に光源部から照射される赤外線線の強さを検出する赤外線検出器を設け、その赤外線検出器の検出結果に応じて冷却風の風量を調節するように送風手段を制御する構成とするものである。

【0008】 さらには、液晶セルの一方の電極を構成する光源部側電極パネルを赤外線反射型パネルとし、あるいは下側保護パネルを赤外線反射型パネル又は赤外線吸収型パネルとした構成とする。

【0009】

【作用】上記の構成によれば、液晶セルの温度に応じて冷却風の風量を制御するので温度の低いときには風量も少なく、従って、送風ノイズを小さく抑えることができる。また、の構成においても、同様に、光源部からの赤外線線の強さに応じて冷却風の風量を制御するので、赤外線線の強さが弱いときは送風ノイズを小さく抑えることができ、常に最適な冷却効果を得ることが可能になる。さらに、の構成によれば、光源部から発せられる光に含まれる赤外線を、光が液晶セルに達する以前に反射、あるいは吸収させて排除するため、液晶セルの温度上昇を効果的に防止することができる。

【0010】

【実施例】以下、図面を参照して実施例を詳細に説明する。図3は、本発明が適用されるオーバーヘッドプロジェクタ(以下OHPと略記する)の外観を示したもので、1はOHP本体であり、図示しない投影ランプやフレネルレンズ、OHP全体を制御する制御部等が内蔵されている。2は透過型の液晶表示パネルであり、拡大投影しようとする画像を表示する表示画面3を有する。4は投影レンズ、5は投影ミラーである。

【0011】このように構成されたOHPでは、画像を表示画面3に表示し、下から投影ランプの光を透過させることにより、その画像が投影レンズ4及び投影ミラー5を介して図示しないスクリーンへ拡大投影される。

【0012】図1は、本発明の第1の実施例を示したもので、11は液晶パネル2の液晶セルであり、周知のように、透明電極をそれぞれ設けた2枚の電極パネルの間に液晶を封入して構成されている。12は、液晶セル11を保護するように液晶セルの上面に接するか、若しくは近接して配置され、他の任意のフィルム原稿を載置するコンタクトガラスを兼ねた透明な上側保護パネルであり、カバー14により水平に保持されている。13は液晶セル11の下面とは所要の空間を介して配置された透明な下側保護パネルで、カバー14により水平に保持されている。15は液晶セル11の下面の温度を検出する温度検出器、16は前記空間を通風路17としその通風路17に冷却風を送る軸流

ファン、18はカバー14の一部に内蔵され、温度検出器15の検出結果に応じて冷却風の風量を調節するように軸流ファン16を制御する制御回路である。なお、19は、制御回路18と同様にカバー14の一部に内蔵され、液晶セル11を駆動する駆動回路である。

【0013】次に、本実施例の動作を説明する。投影する画像を液晶セル11に表示させ、下から投影ランプの光20を照射すると、画像に対応した透過光が投影レンズ4及び投影ミラー5を介してスクリーンへ投影され、画像が拡大表示される。

【0014】液晶セル11が投影ランプの光に含まれる熱に曝されると、次第に温度が上昇し、図2に示したように、温度検出器15が液晶セル11の温度を検出してその検出信号を制御回路18に送る。制御回路18は、軸流ファン16を回転駆動し、通風路17に風の流れを発生させる。通風路17内の空気流は、空気吸入口17aから導入され、液晶セル11の下面に接して熱を奪い、吐出口17bから外部へ吐き出される。

【0015】制御回路18は、温度検出器15が検出する液晶セル11の温度に対応して冷却風の風量を調節するように軸流ファン16を制御する。従って、液晶セル11の温度が予め定められた設定温度以下のときは軸流ファン16を動作させず、設定温度に達した時点で駆動を開始し、それ以降は、温度に応じて風量を変え、冷却作用を高めるようにする。また、投影終了後は、冷却動作を継続するが、液晶セル11の温度が設定温度以下に下がったときは軸流ファン16の駆動を停止させる、といった動作も行なわせることができる。

【0016】OHPの場合、使用する投影ランプの種類によっても発熱量が異なる。そこで、従来のように、投影開始時点から一様の強さの冷却風を送るのではなく、液晶セルの温度に応じて風量を変えるようにすれば、発熱量の小さい投影ランプの場合、あるいは液晶セルの温度が比較的低い時点では、風量を少なくして冷却ノイズを抑制し、さらには省電力化に寄与することができ、発熱量の大きい投影ランプの場合、あるいは液晶セルの温度が比較的高くなると、風量を増加させて冷却を重視した運用が可能になる。

【0017】図4は、本発明の第2の実施例を示したものであり、第1の実施例の構成に、更に、液晶セルの温度が何らかの理由、例えば空気吸入口17aにほこりが溜って送風能力が低下した場合などの理由により、予め定められた温度以上になったとき、それをオペレータに報知する手段と、投影ランプの電源を遮断する手段を設けたものである。具体的には、温度検出器15の信号から、液晶セル11の温度が予め定められた温度以上になったと判断器21が判断したときは、警音器22を鳴らしてオペレータに知らせ、液晶セルの更なる温度上昇を防止するために、継電器23等を介して投影ランプの電源を遮断するようにしたものである。

【0018】このような構成にすることによって、液晶セルを保護し、その寿命を延ばすことができる。なお、投影ランプの電源遮断により液晶セルの温度が下がったとき、直ちに電源を自動復帰させてもよいが、温度上昇の原因を除去した後にリセットさせるようにした方がよい。

【0019】図5は、本発明の第3の実施例を示したもので、ここでは、第1の実施例の構成に、更に、液晶セルの表示状態によっても冷却風量を制御する制御手段を設けたものである。投影中の液晶セル11が全面不透過あるいは予め定められた面積以上の不透過の画像面になったときは、投影光に含まれる大部分の熱も液晶セルに吸収され、液晶セルが急激な温度上昇を招くことになる。そこで、パソコン等24より液晶セル11の駆動回路19に送られる画像データを制御部25で読み取り、液晶セル11が全面不透過あるいは予め定められた面積以上の不透過の画像面になる場合は、制御回路18に信号を送り、軸流ファン16からの風量を増加させ、冷却作用を強めるようにする。これにより、液晶セルの急激な温度上昇を防止し、安全温度を維持することができる。

【0020】第6図は、本発明の第4の実施例を示したものである。本実施例では、第1の実施例(図1)における温度検出器に代えて、液晶セルの下面に投影ランプから照射される赤外線を検出する赤外線検出器31を設けたものであり、その赤外線検出器31の検出結果に応じて、制御回路18が、冷却風の風量を調節するように軸流ファン16を制御するものである。液晶セルの温度上昇は、投影ランプから発せられる光に含まれる熱線、即ち、赤外線に起因するものであるから、赤外線の強さを検出し、それに応じて冷却風の量を制御すれば、液晶セルの温度上昇を抑制し、液晶セルにおけるコントラストの低下や色むら発生等の性能劣化を防ぎ、液晶セルの寿命を延ばすことができる。

【0021】図7は、本発明の第5の実施例を示したもので、ここでは、液晶セルの温度を上昇させる、投影ランプからの光に含まれる赤外線を、光が液晶セルに達する以前に反射、あるいは吸収させて排除する手段を設けたものである。まず、液晶セル11は、図8に示したように、透明電極をそれぞれ設けた2枚の電極パネル33及び34の間に液晶35を封入して構成されているが、その下側の、即ち投影ランプ側の電極パネル34を赤外線反射型パネルとするもので、これにより、赤外線は光が液晶セル11に達する前に反射され、従って、液晶セル11の温度上昇を大幅に低減することができる。

【0022】さらに、液晶セルの投影ランプ側の電極パネル34を赤外線反射型パネルとするのに代えて、下側保護パネル13を赤外線反射型パネル又は赤外線吸収パネルとすることによっても、同様の作用効果を得ることができることは明らかであろう。

【0023】

【発明の効果】以上説明したように、本発明によれば、次のような効果を奏する。

(1) 液晶セルの温度を検出し、その温度に応じて冷却風量を制御するので、温度の低いときは風量も少なく、従って、送風ノイズを小さく抑えることができると共に、不必要な送風を行なうこともなく、省電力化に寄与することができる。そして、液晶セルの温度に応じて適切な冷却を行なうので、投影品質を維持し、かつ液晶セルの劣化を防止することができる。

【0024】(2) さらに、報知手段や光源の電源遮断手段を備えたものでは、液晶セルの温度上昇を直ちにオペレータに知らせて適切な処置をとることができ、また、電源遮断により、液晶セルの更なる温度上昇を防ぐことができる。

【0025】(3) 液晶セルの表示画面が光の全面不透過あるいは予め定められた面積以上の不透過の画像面になる場合、温度検出とは別個に送風手段を制御して風量を増加させ、冷却作用を強めるようにするので、液晶セルの急激な温度上昇を防止し、安全温度を維持することができる。

【0026】(4) 温度検出器に代えて赤外線検出器を設置しても、温度検出器を設置した場合と同様の作用効果を得ることができる。

【0027】(5) さらに、液晶セルの光源側電極パネルを赤外線反射型パネルとしたものや、下側保護パネルを赤外線反射型パネル又は赤外線吸収パネルとしたものでは、光源からの光が液晶セルに達する以前に赤外線を効果的に排除することができ、これにより、液晶セルの温度上昇を防止することができる。

【図面の簡単な説明】

【図1】本発明の第1の実施例の断面図である。

【図2】本発明の第1の実施例の制御系のブロック図である。

【図3】本発明が適用されるOHPの外観図である。

【図4】本発明の第2の実施例の制御系のブロック図である。

【図5】本発明の第3の実施例の制御系のブロック図である。

【図6】本発明の第4の実施例の断面図である。

【図7】本発明の第5の実施例の断面図である。

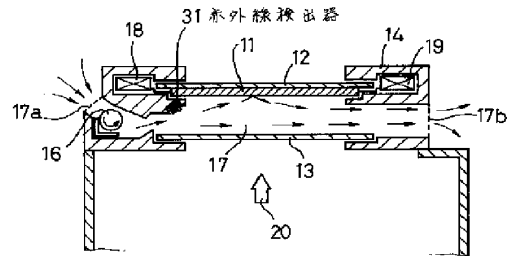
【図8】本発明の第5の実施例の液晶セルの部分断面図である。

【符号の説明】

2 … 液晶表示パネル、11 … 液晶セル、12 … 上側保護パネル、13 … 下側保護パネル、15 … 温度検出器、16 … 軸流ファン、17 … 通風路、18 … 制御回路、19 … 駆動回路、22 … 警音器、23 … 電源遮断用の継電器、25 … 制御部、31 … 赤外線検出器、34 … 投影ランプ側電極パネル。

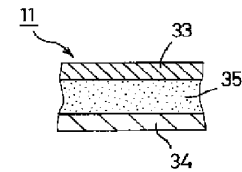
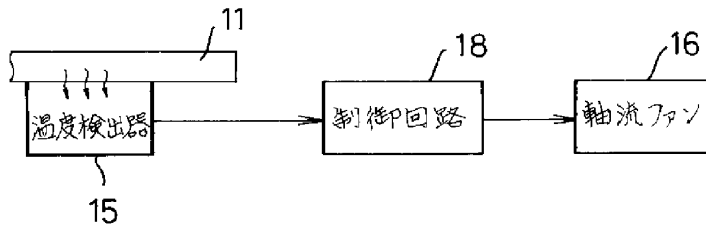
【図1】

【図6】



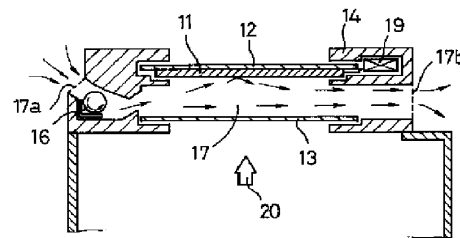
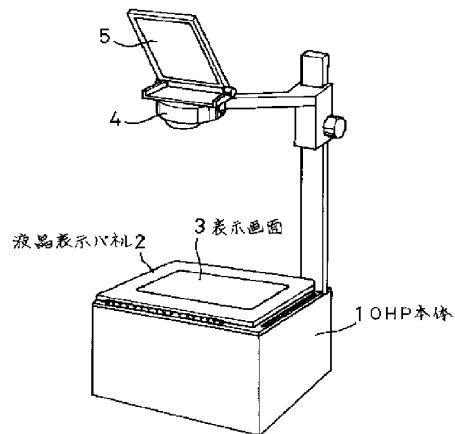
【図2】

【図8】

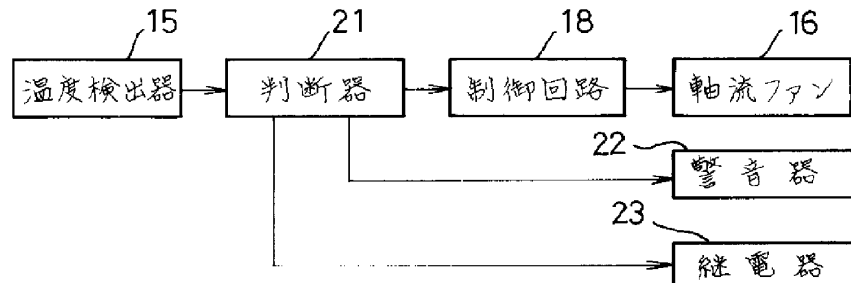


【図3】

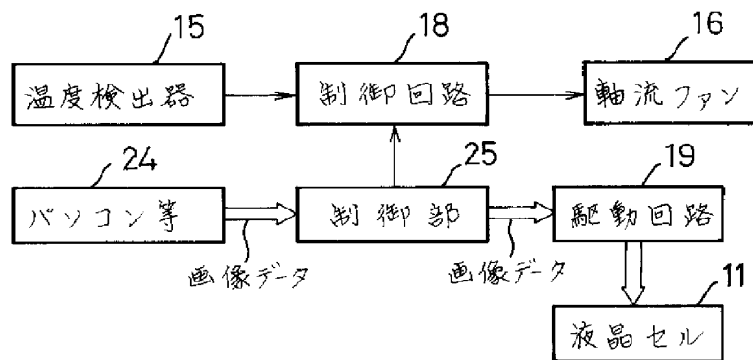
【図7】



【図4】



【図5】



Bibliographic data: JP8115788 (A) — 1996-05-07

LAMP TEMPERATURE CONTROLLING APPARATUS AND COLOR THERMAL PRINTER USING THE APPARATUS

Inventor(s): UEDA SATOSHI ±

Applicant(s): FUJI PHOTO FILM CO LTD ±

Classification: international: **B41J2/315; B41J2/32; B41J2/365; H05B3/00; H05B7/00;** (IPC1-7): B41J2/32; H05B7/00
- european: B41J2/315; B41J2/365

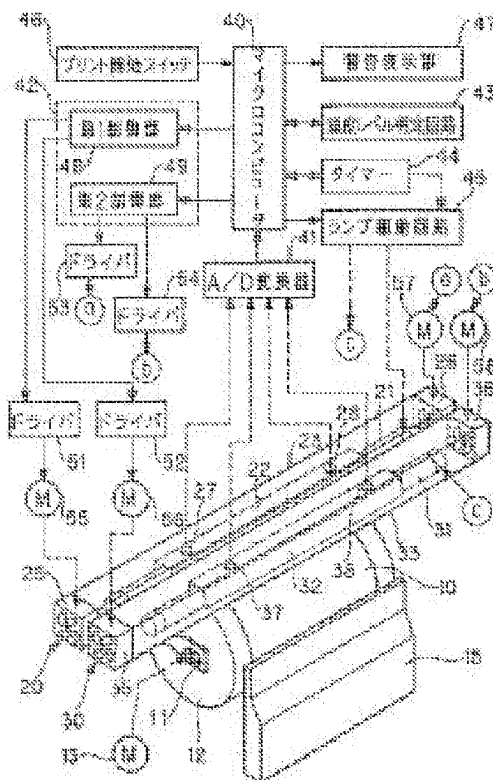
Application number: JP19940251847 19941018

Priority number (s): JP19940251847 19941018

Also published as: JP3393937 (B2) US5565903 (A)

Abstract of JP8115788 (A)

PURPOSE: To keep the temperature of the tubular wall of a rod-like lamp constant and keep the quantity of light constant in the whole range of the lamp. CONSTITUTION: A reflector 22 is set in the back side of an ultraviolet lamp 21 so as to bring a part of the reflector 22 into contact with the back side and they are stored in a tube 23. Cooling fans 25, 26 are installed in both sides of the tube 23 and two temperature sensors 27, 28 are attached to the outer wall of the reflector 22. A cooling fan driving control circuit 42 compares the temperature measured by each temperature sensor 27, 28 with cooling fan driving standard temperature.; In the case the temperature measured by the temperature sensor 27 is higher than the cooling fan driving standard temperature, a first control part 48 drives the cooling fan 25 and in the case the temperature measured by the temperature sensor 28 is higher, a second control part 49 drives the cooling fan 26 to cool an ultraviolet lamp 21. A temperature level determining circuit 43 compares each measured temperature with a printing starting reference temperature and in the case the temperature measured either one of the sensors is lower than the printing starting reference temperature, a lamp driving circuit 45 turns the ultraviolet lamp 21 on to raise the tubular wall temperature. The tubular wall temperature of an ultraviolet lamp 31 is also controlled in the same way.



(19) 日本国特許庁 (J P)

(12) 公開特許公報 (A)

(11) 特許出願公開番号

特開平8-115788

(43) 公開日 平成8年(1996)5月7日

(51) Int.Cl.⁶

H 0 5 B 7/00

B 4 1 J 2/32

識別記号

Z

庁内整理番号

F I

技術表示箇所

B 4 1 J 3/20

1 0 9 J

審査請求 未請求 請求項の数6 O L (全 8 頁)

(21) 出願番号 特願平6-251847

(22) 出願日 平成6年(1994)10月18日

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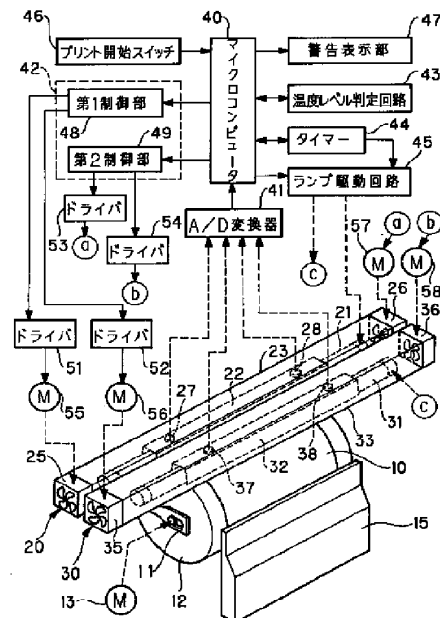
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(54) 【発明の名称】 ランプ温度制御装置及びこれを用いたカラー感熱プリンタ

(57) 【要約】

【目的】 棒状ランプの管壁温度を均一に保ち、その全域にわたって光量を一定にする。

【構成】 紫外線ランプ21の背面に、一部が接触するようにリフレクター22を配置し、これらを筒23に収納する。筒23の両側面部に冷却ファン25、26を設け、リフレクター22の外壁に2つの温度センサ27、28を付設する。冷却ファン駆動制御回路42は、温度センサ27、28の測定温度と冷却ファン駆動基準温度とをそれぞれ比較する。温度センサ27の測定温度が冷却ファン駆動基準温度よりも高い時には、第1制御部48が冷却ファン25を駆動させ、温度センサ28の測定温度が高い時には、第2制御部49が冷却ファン26を駆動させて紫外線ランプ21を冷却する。温度レベル判定回路43は、各測定温度と印画開始基準温度とを比較し、いずれか一方が印画開始基準温度よりも低い時に、ランプ駆動回路45が紫外線ランプ21を点灯させて管壁温度を上昇させる。紫外線ランプ31についても同様にして管壁温度が調節される。



【特許請求の範囲】

【請求項1】 背後にリフレクターを配置した棒状ランプの温度を制御するためのランプ温度制御装置において、

前記棒状ランプの両端を囲むように冷却ファンを配置するとともに、リフレクターの両端側に温度センサを取り付け、これらの温度センサによって棒状ランプの軸方向での管壁の温度勾配を間接的に測定し、管壁の温度が所定の範囲内で、かつ軸方向においてほぼ均一になるように、測定した温度勾配に応じて2個の冷却ファンの駆動を制御することを特徴とするランプ温度制御装置。

【請求項2】 前記リフレクターは、棒状ランプの両端部がはみ出た状態で、かつその一部が棒状ランプに接触するように配置され、またリフレクターの反対面が開口したコ字形の筒内にリフレクターと棒状ランプとが収納され、この筒の両端に冷却ファンを取り付けたことを特徴とする請求項1記載のランプ温度制御装置。

【請求項3】 前記2個の冷却ファンは、温度勾配に応じて回転速度が調節されることを特徴とする請求項2記載のランプ温度制御装置。

【請求項4】 背後にリフレクターを配置した棒状ランプの温度を制御するためのランプ温度制御装置において、

前記棒状ランプとリフレクターとを収納する筒と、この筒の両端に互いに対向するように配置された2つの冷却ファンと、前記リフレクターに取り付けられ、第1の冷却ファンに近い部分と第2の冷却ファンに近い部分の温度を各々測定する第1及び第2の温度センサと、前記第1の温度センサの測定温度が第1の温度よりも高い時には第1の冷却ファンを駆動させ、前記第2の温度センサの測定温度が第1の温度よりも高い時には第2の冷却ファンを駆動させ、また第1及び第2の温度センサの測定温度が第1の温度よりも低い時には、この測定温度が低い温度センサに近接する冷却ファンの駆動を停止させるための制御手段とからなることを特徴とするランプ温度制御装置。

【請求項5】 支持体上に複数の感熱発色層を層設したカラー感熱記録材料を用い、サーマルヘッドとカラー感熱記録材料とを相対移動させながら、サーマルヘッドで各感熱発色層を熱記録するとともに、この熱記録された部分に紫外線ランプからの紫外線を照射して光定着を行うカラー感熱プリンタにおいて、前記紫外線ランプの中央部分を覆うとともに、紫外線ランプと一部接触した状態で背後に配置されたリフレクターと、紫外線ランプとリフレクターとを収納する筒と、この筒の両端に互いに対向するように配置された2つの冷却ファンと、前記リフレクターの外壁に取り付けられ、第1の冷却ファンに近い部分と第2の冷却ファンに近い部分の温度を各々測定する第1及び第2の温度センサと、前記第1の温度センサの測定温度が第1の温度よ

りも高い時には第1の冷却ファンを駆動させ、前記第2の温度センサの測定温度が第1の温度よりも高い時には第2の冷却ファンを駆動させ、また第1及び第2の温度センサの測定温度が第1の温度よりも低い時には、この測定温度が低い温度センサに近接する冷却ファンの駆動を停止させ、さらに測定した2つの温度のいずれか一方が前記第1の温度よりも低い第2の温度に満たない時には紫外線ランプを所定時間点灯させて加熱するための制御手段とを備え、紫外線ランプのカラー感熱記録材料と対向する範囲内の管壁温度を第1の温度と第2の温度との間に保つようにしたことを特徴とするカラー感熱プリンタ。

【請求項6】 前記第1及び第2の冷却ファンは、一方が前記筒内に外気を送り込み、他方が筒内の空気を排出することを特徴とする請求項5記載のカラー感熱プリンタ。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は、光量分布ムラを防ぐために、ランプの全長にわたって管壁の温度をほぼ一定に保つランプ温度制御装置と、これを組み込んだカラー感熱プリンタに関するものである。

【0002】

【従来の技術】蛍光灯や紫外線ランプのような棒状光源は、各種の機器に組み込まれている。例えばカラー感熱プリンタでは、紫外線ランプが定着器として用いられている。このカラー感熱プリンタでは、支持体上にシアン感熱発色層、マゼンタ感熱発色層、イエロー感熱発色層を順次層設したカラー感熱記録材料が用いられる。このカラー感熱記録材料は、表面の感熱発色層から順に熱記録を行うが、次の感熱発色層に熱記録する際に、その上にある熱記録済みの感熱発色層が再度熱記録されないようにするため、熱記録後に個々の感熱発色層に特有な波長域の紫外線を照射して発色能力を失わせている。

【0003】紫外線ランプは、例えば実公昭63-33321号公報に記載されているように、その発光量が管壁温度によって変化し、管壁温度が低いと発光量が少なく、管壁温度が上昇するにつれて発光量も増加するが、より高温になると発光量は逆に低下するという特性を持っている。また、紫外線ランプの発光量は管の軸方向の位置によっても異なり、管の中央部で発光量が最も多く、管の両端部に近づくにつれて減少する。このような特性に影響されことなく安定した光定着を行うためには、紫外線ランプの管壁温度を所定の温度範囲内に維持し、紫外線の光量を一定に保つことが必要である。

【0004】紫外線ランプは点灯によって管壁温度が高くなるため、従来のカラー感熱プリンタでは、管壁温度を測定するためのセンサと、紫外線ランプを冷却するためのファンとを設け、管壁温度を制御している。ランプ冷却用のファンは、一般に紫外線ランプの一方の端に配

置され、紫外線ランプの一方の端部から他方の端部に向けて冷却風を吹き付けている。また紫外線ランプは長めのものを用い、比較的発光量の安定している管の中央部をカラー感熱記録材料と対向させるようにしている。

【0005】

【発明が解決しようとする課題】しかしながら、紫外線ランプの長さが長くなると、一方の端部から吹き付けられる冷却風は他端側にまで行き渡らなくなり、紫外線ランプの管壁温度はファンに近い側と遠い側とで温度差が生じてしまう。この結果、カラー感熱記録材料が対向する紫外線ランプの部位の違いによって紫外線の光量が異なってしまう、定着ムラを生じる恐れがある。

【0006】本発明は、上記の事情を考慮してなされたもので、紫外線ランプの管壁温度を均一に保つランプ温度制御装置と、このランプ温度制御装置を用いて安定した光定着を行うことができるようにしたカラー感熱プリンタを提供することを目的とする。

【0007】

【課題を解決するための手段】上記目的を達成するために、本発明のランプ温度制御装置は、棒状ランプの両端を囲むように冷却ファンを配置するとともに、リフレクターの両端側に温度センサを取り付け、これらの温度センサによって棒状ランプの軸方向での管壁の温度勾配を間接的に測定し、管壁の温度が所定の範囲内で、かつ軸方向においてほぼ均一になるように、測定した温度勾配に応じて2個の冷却ファンの駆動を制御するものである。

【0008】また、請求項2記載のランプ温度制御装置は、棒状ランプの両端部がはみ出た状態で、かつその一部が棒状ランプに接触するようにリフレクターを配置し、リフレクターの反対面が開口したコ字形の筒内にリフレクターと棒状ランプとを収納し、この筒の両端に冷却ファンを取り付けるものである。

【0009】また、請求項3記載のランプ温度制御装置は、温度勾配に応じて2個の冷却ファンの回転速度を調節するものである。

【0010】また、請求項4記載のランプ温度制御装置は、棒状ランプとリフレクターとを収納する筒と、この筒の両端に互に対向するように配置された2つの冷却ファンと、リフレクターに取り付けられ、第1の冷却ファンに近い部分と第2の冷却ファンに近い部分の温度を各々測定する第1及び第2の温度センサと、第1の温度センサの測定温度が第1の温度よりも高い時には第1の冷却ファンを駆動させ、第2の温度センサの測定温度が第1の温度よりも高い時には第2の冷却ファンを駆動させ、また第1及び第2の温度センサの測定温度が第1の温度よりも低い時には、この測定温度が低い温度センサに近接する冷却ファンの駆動を停止させるための制御手段とから構成するものである。

【0011】また、請求項5及び請求項6に記載のカラ

ー感熱プリンタは、紫外線ランプの中央部分を覆うとともに、紫外線ランプと一部接触した状態で背後に配置されたリフレクターと、紫外線ランプとリフレクターとを収納する筒と、この筒の両端に互に対向するように配置された2つの冷却ファンと、リフレクターの外壁に取り付けられ、第1の冷却ファンに近い部分と第2の冷却ファンに近い部分の温度を各々測定する第1及び第2の温度センサと、第1の温度センサの測定温度が第1の温度よりも高い時には第1の冷却ファンを駆動させ、第2の温度センサの測定温度が第1の温度よりも高い時には第2の冷却ファンを駆動させ、また第1及び第2の温度センサの測定温度が第1の温度よりも低い時には、この測定温度が低い温度センサに近接する冷却ファンの駆動を停止させ、さらに測定した2つの温度のいずれか一方が第1の温度よりも低い第2の温度に満たない時には紫外線ランプを所定時間点灯させて加熱するための制御手段とを設け、紫外線ランプのカラー感熱記録材料と対向する範囲内の管壁温度を第1の温度と第2の温度との間に保つようにしたものである。また第1及び第2の冷却ファンは、一方が筒内に外気を送り込み、他方が筒内の空気を排出するように配置するのがよい。

【0012】

【作用】請求項1記載の装置では、2つの冷却ファンが温度勾配に応じて駆動され、適切な冷却空気流を形成するから、棒状ランプの全長にわたって管壁温度を所定の温度範囲に保つことができる。請求項2記載の装置では、リフレクターが棒状ランプに接触しているから、管壁温度が正確に測定され、更に棒状ランプは、コ字形をした筒に囲まれているから、棒状ランプに沿って流れる空気流が形成されるから、効率よく冷却することができる。請求項3記載の装置では、温度勾配に応じて冷却ファンの回転速度が調節されるから、迅速に冷却することができる。

【0013】請求項4記載の装置では、温度センサと冷却ファンとが組み合わされているから、棒状ランプのほぼ半分ずつを冷却し、それにより各部の管壁温度をほぼ一体に保つことができる。請求項5記載のカラー感熱記録装置では、紫外線ランプの各部の光量がほぼ一定に保たれるから、定着ムラの発生をなくすることができる。請求項6記載のカラー感熱記録装置では、送り込み用と排出用の冷却ファンを設けたから、冷却空気の流れがスムーズになる。

【0014】

【実施例】図1は、本発明を実施したカラー感熱プリンタを示すものである。シート状をしたカラー感熱記録材料10は、その先端がクランプ11によってブラテンドラム12に押さえつけられ固定される。熱記録及び光定着時に、ブラテンドラム12は、ブラテン駆動モータ13によって一定速度で回転される。

【0015】ブラテンドラム12の外周には、熱記録位

置にサーマルヘッド15、その下流側にランプユニット20、30が設けられている。サーマルヘッド15は、周知のように多数の発熱素子をライン状に配列したものであり、熱記録すべき色及びその発色濃度に応じた熱エネルギーを発生する。イエロー用ランプユニット20はほぼ420nm、マゼンタ用ランプユニット30はほぼ365nm付近の紫外線を発光する。

【0016】ランプユニット20は、図2に示すように、交流駆動される棒状の紫外線ランプ21と、その背後に配置されたリフレクター22と、筒23と、この筒23の両端に取り付けられた2つの冷却ファン25、26とから構成される。紫外線ランプ21の発光量は、図3に示すように、管壁温度が40℃である時に最大発光量 L_{max} となり、35℃と45℃においては、光定着に必要な規定発光量 L_0 となる。この紫外線ランプ21は、光量が大きく、かつ安定している中央部を利用するために、ブラテンドラム12よりも長くなっている。

【0017】リフレクター22は、例えばアルミニウムなどの熱伝導性が高い素材からなり、紫外線ランプ21の中央部を覆うとともに、紫外線ランプ21の管壁と一部が接触するように配置されている。筒23は、ブラテンドラム12側が開口したコ字形をしており、その内部に紫外線ランプ21とリフレクター22とを収納する。この筒23は、透明又は不透明な材料で作られており、冷却空気の流れを形成する。なお、紫外線透過材料を用いれば、ブラテンドラム12側が閉鎖した角筒でもよい。冷却ファン25は空気を筒23内に送り込み、冷却ファン26は筒23内の空気を外部に排出する。勿論、筒23がコ字形をしているため、2つの冷却ファン25、26は、いずれも空気を筒23内に送り込んでよい。

【0018】またリフレクター22の外壁には、このリフレクター22の温度を測定するための2つの温度センサ27、28が付設されている。温度センサ27、28は、紫外線ランプ21とカラー感熱記録材料10とが対向する範囲の外側に配置され、温度センサ27は冷却ファン25に近い側、温度センサ28は冷却ファン26に近い側にそれぞれ付設されている。温度センサ27、28の測定温度信号は、それぞれA/D変換器41でアナログ信号からデジタル信号に変換され、温度データとされた後にマイクロコンピュータ40に送られる。なお、マゼンタ用ランプユニット30も同じ構成であるので、符号のみを付してある。

【0019】マイクロコンピュータ40には、冷却ファン駆動制御回路42、温度レベル判定回路43、タイマー44、ランプ駆動回路45、プリント開始スイッチ46、及び警告表示部47が接続されている。冷却ファン駆動制御回路42は、温度センサ27と28とから得られた測定温度の勾配に応じて冷却ファン25、26の駆動を制御し、紫外線ランプ21の管壁温度が所定の温度

範囲におさまるようにする。この制御には、冷却ファン25、26の回転速度を一定にし、温度勾配に応じてON・OFF制御する方法と、温度勾配に応じて冷却ファン25、26の回転速度を変える方法とがある。同様に、温度センサ37、38の測定温度に応じて冷却ファン35、36の駆動を制御する。

【0020】この実施例では、冷却ファン駆動制御回路42は、第1制御部48と第2制御部49とから構成され、ON・OFF制御によって各ランプの半分ずつを温度制御する。すなわち、第1制御部48は、温度センサ27、37で測定した温度と、予め決めてあるファン駆動基準温度とを比較する。そして、測定温度が高い場合には、ドライバ51、52に駆動信号を送り、ファン駆動モータ55、56を介して冷却ファン25、35を駆動させる。一方、温度センサ27、37の測定温度がファン駆動基準温度よりも低い時には、ドライバ51、52に停止信号を送出して冷却ファン25、35を停止させる。また第2制御部49は、温度センサ28、38の測定温度とファン駆動基準温度との比較を行う。そして、測定温度がファン駆動基準温度よりも高い時には、ドライバ53、54に駆動信号を送出して冷却ファン26、36を駆動させ、測定温度がファン駆動基準温度よりも低い時には冷却ファン26、36を停止させる。なお、ファン駆動基準温度は紫外線ランプ21、31の発光効率が最もよくなる温度に設定しておくのが好ましく、本実施例では最大発光量 L_{max} を得ることができる「40℃」に設定してある。

【0021】温度レベル判定回路43は、プリント開始スイッチ46が「ON」されて印画指示信号がマイクロコンピュータ40に入力された時に作動する。この温度レベル判定回路43は、温度センサ27、37、及び温度センサ28、38により得られた各測定温度と予め設定されている印画開始基準温度とを比較する。そして、ランプユニット20、30ごとに、2つの測定点での測定温度が両方とも印画開始基準温度よりも高い時に「H」信号を、一方の測定温度が印画開始基準温度よりも低い時には「L」信号をマイクロコンピュータ40に送出する。なお、印画開始基準温度は光定着に必要とする紫外線の光量を確保できる温度であり、本実施例では規定発光量 L_0 を得ることのできる最低温度「35℃」に設定してある。

【0022】ランプ駆動回路45は、イエロー又はマゼンタ画像の記録中に紫外線ランプ21、31を点灯する他に、プリント待機中に、タイマー44で設定された時間中紫外線ランプ21、31を発光させて加熱する。また警告表示部47には、紫外線ランプ21、31のいずれかに異常が発生した時に、マイクロコンピュータ40によって警告表示が行われる。なお、これら一連の機能は、マイクロコンピュータ40の内部でソフトウェア処理される。

【0023】図4は、カラー感熱記録材料10の一例を示すものである。支持体60の上にシアン感熱発色層61、マゼンタ感熱発色層62、イエロー感熱発色層63、保護層64が順次層設されている。これらの各感熱発色層61～63は、熱記録される順番に表面から層設されているが、例えばマゼンタ、イエロー、シアンの順番に熱記録する場合には、イエロー感熱発色層63とマゼンタ感熱発色層62との位置が入れ換えられる。イエロー感熱発色層63は、420nm付近の紫外線が照射されると発色能力が失われる。マゼンタ感熱発色層62は、365nm付近の紫外線で発色能力が失われる。

【0024】次に、本実施例の作用を説明する。カラー感熱プリンタに電源を投入すると、温度センサ27、28、及び37、38が作動を開始し、リフレクター22及び32の温度を測定する。この時、リフレクター22及び32が熱伝導性の高い素材により形成され、それぞれ紫外線ランプ21、31と接触しているので、温度センサ27、28、及び37、38の各測定温度は、それぞれ各温度センサ27、28、37、38がリフレクター22及び32を挟んで対向している部位の管壁温度とほぼ等しくなる。

【0025】温度センサ27、28、37、38の測定温度信号は、それぞれA/D変換器41で温度データとされてから、マイクロコンピュータ40を介して冷却ファン駆動制御回路42に送られる。そして、温度センサ27、37の温度データは第1制御部48に、また温度センサ28、38の温度データは第2制御部49に入力され、それぞれファン駆動基準温度「40℃」と比較される。

【0026】イエロー用ランプユニット20の温度センサ27の測定温度、すなわち、紫外線ランプ21の冷却ファン25に近い部分の管壁温度が40℃よりも高い時には、第1制御部48がドライバ51に駆動信号を送出し、ファン駆動モータ55を介して冷却ファン25を駆動させる。また温度センサ28の測定温度、すなわち、紫外線ランプ21の冷却ファン26側の管壁温度が40℃よりも高い時には、第2制御部49がドライバ53に駆動信号を送出して冷却ファン26を駆動させる。

【0027】ここで、冷却ファン25が外気吸い込み用、冷却ファン26が排気用であるので、これら2つの冷却ファン25、26が同時に駆動した時には、冷却ファン25側から冷却ファン26側に向けて冷却用の空気が流れる。しかも2つの冷却ファン25、26の間に筒23が配置されているので、冷却用の空気は紫外線ランプ21の管壁に沿って流れる。これによって紫外線ランプ21の管壁全体から冷却が行われ、紫外線ランプ21の管壁温度が均一に下降する。

【0028】また2つの冷却ファン25、26のうちいずれか一方だけが駆動した時には、筒23内においては、駆動している冷却ファン25又は26に近い範囲で

のみ空気が発生し、紫外線ランプ21のほぼ半分だけが冷却される。これにより、紫外線ランプ21の管壁温度は、冷却ファン25側と冷却ファン26側との温度差が小さくなり、全体にほぼ均一になる。そして、紫外線ランプ21の管壁温度が40℃よりも低くなると、駆動中の冷却ファン25又は26は停止する。

【0029】他方、温度センサ27、28の測定温度がともに40℃よりも低い時には、第1制御部48及び第2制御部49がドライバ51、53に停止信号を送出するので、2つの冷却ファン25、26はいずれも駆動しない。なお、マゼンタ用ランプユニット30についても、イエロー用ランプユニット20と同様にして、紫外線ランプ31の管壁温度が調節される。

【0030】プリント開始スイッチ46を操作すると、印画準備動作が行われる。まずマイクロコンピュータ40は、温度レベル判定回路43を作動させる。温度レベル判定回路43は、温度センサ27、28及び37、38によって得られた各測定温度と印画開始基準温度「35℃」との比較を行う。そして、ランプユニット20、30ごとに、2つの測定温度の両方が35℃よりも高い時には「H」信号を、いずれか一方が35℃よりも低い時には「L」信号をマイクロコンピュータ40に送出する。マイクロコンピュータ40は、この時点でランプユニット20、30の温度レベル信号が両方とも「H」信号であった時には、紫外線ランプ21、31の管壁温度が既に35℃に達していると判断し、直ちに印画を開始する。

【0031】他方、ランプユニット20、30の温度レベル信号のうちいずれか一方が「L」信号であった時には、マイクロコンピュータ40は、タイマー44を作動させて所定時間のカウントを開始するとともに、ランプ駆動回路45を作動させて紫外線ランプ21、31を発光させる。そして、引き続き温度レベル判定回路43からの出力信号を監視し、所定時間内にランプユニット20、30の温度レベル信号が両方とも「H」信号になった時には、一旦紫外線ランプ21、31を消灯させてから印画動作を開始する。また、所定時間が経過しても温度レベル判定回路43からの出力信号が「L」信号のままである時には、紫外線ランプ21、31の発光能力が光定着に要する紫外線を確保するには不充分であると判断し、警告表示部47に警告表示を行って印画動作への移行を中止する。

【0032】なお、印画準備動作中も冷却ファン駆動制御回路42によって冷却ファン25、26及び35、36の駆動が制御されているので、紫外線ランプ21、31の管壁温度は、35℃から40℃の範囲内に調整される。

【0033】印画準備動作により紫外線ランプ21、31の管壁温度が35℃以上の時に、印画動作が開始される。カセット（図示せず）から供給されたカラー感熱記

録材料10がプラテンドラム12のクランプ位置にセットされると、クランプ11がカラー感熱記録材料10をプラテンドラム12に押しつけて固定する。この後、プラテン駆動モータ13の回転に連動してプラテンドラム12が回転し、カラー感熱記録材料10がプラテンドラム12の外周に巻き付けられる。また、給紙が始まると同時に、イエロー用ランプユニット20の紫外線ランプ21が発光を開始する。

【0034】プラテンドラム12が回転して、カラー感熱記録材料10の記録エリアの先端がサーマルヘッド15に達すると、このサーマルヘッド15によってイエロー画像がイエロー感熱発色層63に1ラインずつ熱記録される。このイエロー画像の熱記録では、サーマルヘッド15の各発熱素子は、画像データに応じた熱エネルギーを発生する。このイエロー画像が熱記録された部分は、イエロー用ランプユニット20に達し、イエロー感熱発色層63の光定着が行われる。紫外線ランプ21はほぼ420nmの紫外線を照射しており、カラー感熱記録材料10の全面において発色能力を消失させる。この紫外線ランプ21は、カラー感熱記録材料10の終端が通過したときに発光を停止する。

【0035】このイエロー感熱発色層63の光定着中も、図5に示すフローに従って冷却ファン駆動制御回路42が紫外線ランプ21の管壁温度を監視しており、温度が40℃よりも高くなると冷却ファン25又は26を駆動させて紫外線ランプ21の管壁温度を40℃付近に保持するので、カラー感熱記録材料10に照射される紫外線の光量は、常に規定光量 L_1 を満たしている。

【0036】プラテンドラム12が回転して、再びカラー感熱記録材料10の記録エリアの先端がサーマルヘッド15の位置に達すると、このサーマルヘッド15によってマゼンタ画像がマゼンタ感熱発色層62に1ラインずつ熱記録される。同時に、マゼンタ用ランプユニット30の紫外線ランプ31が発光を開始し、ほぼ365nmの紫外線を放出する。この紫外線ランプ31も冷却ファン駆動制御回路42によって管壁温度が制御され、紫外線の光量が一定に維持される。マゼンタ画像が熱記録されたカラー感熱記録材料10は、紫外線ランプ31から放出された紫外線で照射され、カラー感熱記録材料10の全面においてマゼンタ感熱発色層62の発色能力が消失される。この紫外線ランプ31は、カラー感熱記録材料10の終端が通過したときに消灯する。

【0037】プラテンドラム12が回転して、再びカラー感熱記録材料10の記録エリアの先端がサーマルヘッド15に対面すると、このサーマルヘッド15によってシアン画像がシアン感熱発色層61に1ラインずつ熱記録される。このシアン感熱発色層61は、感熱発色するのに必要な熱エネルギーがほぼ80mJ/mm²以上であるため、通常の保管状態では発色することはない。このシアン感熱発色層61は、光定着性が与えられてい

ないので、光定着が行われない。

【0038】イエロー画像、マゼンタ画像、シアン画像の熱記録が終了すると、クランプ11による固定が解除され、熱記録済みカラー感熱記録材料10はトレイ（図示せず）に排出される。

【0039】なお上記実施例では、イエロー用ランプユニットとマゼンタ用ランプユニットとを別個に設け、それぞれについて紫外線ランプの管壁温度の調節を行う例について説明したが、イエロー用及びマゼンタ用の2本の紫外線ランプを一体にリフレクターで覆い、これらの紫外線ランプとリフレクターとを1つの筒に収納するようにしてもよい。この場合においても、上記実施例と同様に、筒の両側面部に2つの冷却ファンを配置し、リフレクターの外壁に設けた2つの温度センサの測定温度に基づいて各冷却ファンの駆動を制御すればよい。この実施例によれば、2本の紫外線ランプの管壁温度は、それぞれリフレクターとの熱伝達によってほぼ等しくなるので、同じ条件で同時に管壁温度を制御することが可能となり、制御回路の構成も簡単にすることができる。

【0040】また上記実施例では、冷却ファンを駆動と停止とのいずれかの状態に制御するようにしたが、冷却ファンの回転速度を変化させ、冷却風の風量を調節するようにしてもよい。この場合、温度センサによる測定温度と冷却ファン駆動基準温度との温度差に応じて冷却ファンの回転速度を決定し、温度差が大きい時には高速で回転させ、温度差が小さい時には低速で回転させればよく、測定温度が冷却ファン駆動基準温度よりも低い時には冷却ファンを停止させればよい。こうすると、管壁温度の均一化を迅速にすることができる。また、本発明は他の機器、例えば複写機の照明装置等にも利用できるものである。

【0041】

【発明の効果】以上のように、本発明によれば、棒状をしたランプの両側面部に各々冷却ファンを設けるので、ランプの管壁全体に冷却風が行き渡るようになり、冷却ムラを生じることがなくなる。しかも、棒状ランプの両端側の管壁温度を各々測定し、得られた温度勾配に基づいて2つの冷却ファンを制御するので、その全域に渡ってほぼ均一に調節することができる。また、コ字形をした筒を用いるから、冷却空気の流れが安定し、冷却空気の無駄を少なくすることができる。さらに、温度勾配に応じて冷却ファンの回転速度を調節するから、管壁温度の均一化を迅速に行うことができる。

【0042】また、管壁温度が第1の温度よりも高い時には冷却ファンを作動させ、第2の温度よりも低い時には紫外線ランプを発光させて管壁温度を上昇させるので、紫外線ランプの管壁温度を第1の温度から第2の温度の範囲内に保持することができる。したがって、光定着に必要な光量の紫外線を確実に得ることができ、安定した光定着を行うことができる。

【図面の簡単な説明】

【図1】本発明のカラー感熱プリンタの概略図である。

【図2】図1に表したランプユニットの構成を示す概略図である。

【図3】紫外線ランプの管壁温度と発光量との関係を示すグラフである。

【図4】カラー感熱記録材料の層構造を示す説明図である。

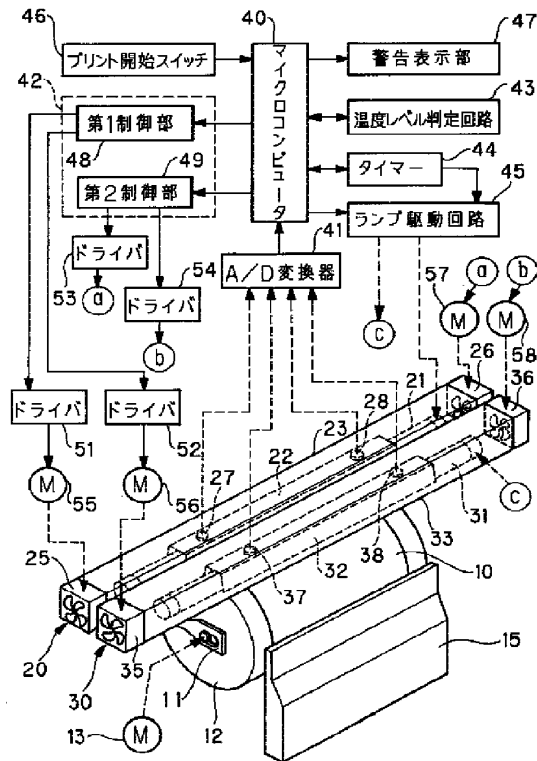
【図5】印画中における管壁温度の調節シーケンスを示すフローチャートである。

【符号の説明】

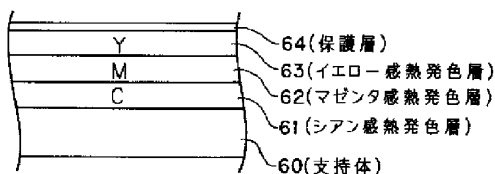
10 カラー感熱記録材料
12 プラテンドラム

15 サーマルヘッド
20, 30 ランプユニット
21, 31 紫外線ランプ
22, 32 リフレクター
23, 33 筒
25, 26, 35, 36 冷却ファン
27, 28, 37, 38 温度センサ
42 冷却ファン駆動制御回路
43 温度レベル判定回路
45 ランプ駆動回路
48 第1制御部
49 第2制御部

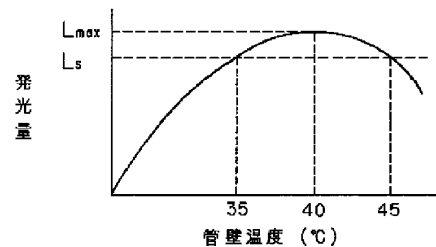
【図1】



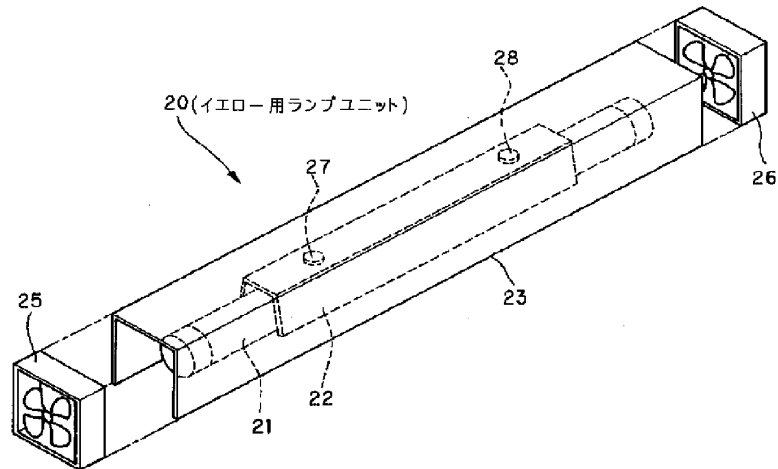
【図4】



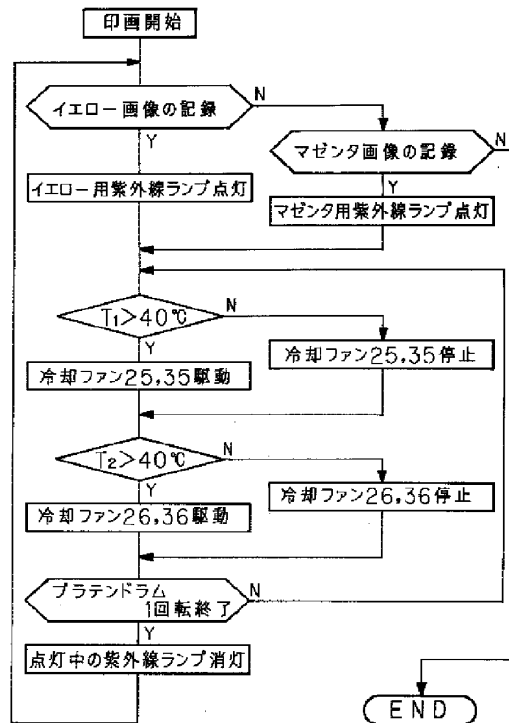
【図3】



【図2】



【図5】

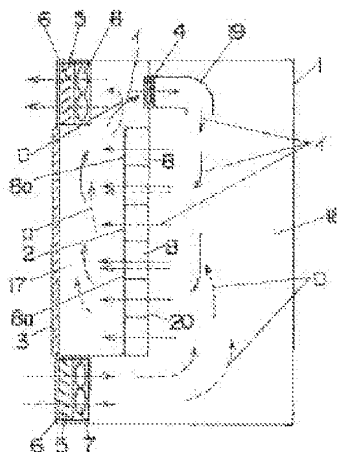


DISPLAY DEVICE**Publication number:** JP8194437 (A)**Publication date:** 1996-07-30**Inventor(s):** KOIDE HAJIME**Applicant(s):** MATSUSHITA ELECTRIC WORKS LTD**Classification:****- International:** G09F9/00; G09F9/30; G09F9/00; G09F9/30; (IPC1-7): G09F9/00; G09F9/00**- European:****Application number:** JP19950004432 19950113**Priority number(s):** JP19950004432 19950113**Also published as:**

JP3179989 (B2)

Abstract of JP 8194437 (A)

PURPOSE: To provide a display device in which a warm-up time can be shortened. **CONSTITUTION:** A display device is provided with a display portion 2 formed by containing and arranging a plurality of fluorescent tube type luminous elements in matrix-like in a display device box body 1. A transparent plate 3 is arranged in front of the display portion 2 so as to cover the front of the display portion 2. Air is introduced from the outside of the display device box body 1 and is exhausted from the front face of the display portion 2 passing through the display portion 2 so that the whole display device is cooled down. A circulation fan 4 is provided so that the warm air between the display portion 2 front face and the transparent plate 3 is introduced to the backside of the display portion 2.



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(19) 日本国特許庁 (J P)

(12) 公開特許公報 (A)

(11) 特許出願公開番号

特開平8-194437

(43) 公開日 平成8年(1996)7月30日

(51) Int.Cl. ⁶	識別記号	庁内整理番号	F I	技術表示箇所
G 0 9 F 9/00	3 6 2	7426-5H		
	3 0 4 B	7426-5H		

審査請求 未請求 請求項の数 2 O L (全 5 頁)

(21) 出願番号 特願平7-4432

(22) 出願日 平成7年(1995)1月13日

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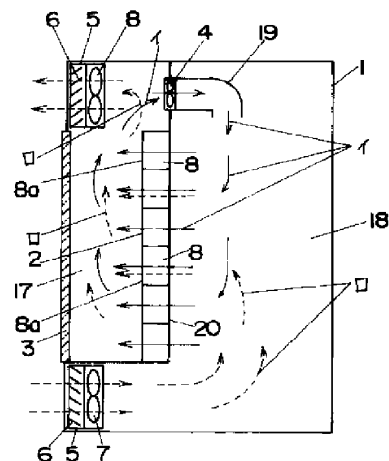
(54) 【発明の名称】 表示装置

(57) 【要約】

【目的】ウォームアップ時間を短縮することができる表示装置を提供する。

【構成】表示装置箱体1内に収納配置される複数の蛍光管方式の発光素子をマトリックス状に配置した表示部2を備える。表示部2の前方を覆うように表示部2の前方に配置された透明板3を備える。表示装置箱体1外部より空気を導入すると共に表示部2を通して表示部2の前面から排気を行うことにより表示装置全体の冷却を行う表示装置である。表示部2前面と透明板3間の暖気を表示部2の後方に導入する循環用ファン4を備える。

1…表示装置箱体
2…表示部
3…透明板
4…循環用ファン
5…開口部分
6…シャッター
7…ファン装置



【特許請求の範囲】

【請求項1】 表示装置箱体内に収納配置される複数の蛍光管方式の発光素子をマトリックス状に配置した表示部を備え、表示部の前方を覆うように表示部の前方に配置された透明板を備え、表示装置箱体外部より空気を導入すると共に表示部を通して表示部の前面から排気を行うことにより表示装置全体の冷却を行う表示装置において、表示部前面と透明板間の暖気を表示部の後方に導入する循環用ファンを備えて成ることを特徴とする表示装置。

【請求項2】 内外に連通するように表示装置箱体に設けられた開口部分に開閉自在なシャッターを設け、シャッターの近傍にファン装置を設け、ウォームアップ時には表示装置箱体と外気とを遮断するためにウォームアップ時のファン装置の停止中はシャッターを閉じ、ウォームアップが完了しファン装置が回転中にはシャッターを開けるように上記ファン装置とシャッターとを連動させて成ることを特徴とする請求項1記載の表示装置。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は、競技場や建物の屋上あるいは壁面等に配置して文字や映像による情報を表示する表示装置に関するものである。

【0002】

【従来の技術】従来、この種の表示装置として特開平356986号公報に示されるようなものがある。このものは図4、図7に示されるように表示面が正方形となっている多色発光型の表示体8をマトリックス状に多数列設して大型表示面を形成し、表示部ユニット20内に収納されている表示素子駆動回路によって各表示体8の発光色及び発光量を制御し、広告映像、コンピュータグラフィック画像などの静止画像の表示、電光ニュースなどのテロップの表示、ビデオテープの録画画像のような動画の表示を行うようになっている。

【0003】ところで、このような表示装置は屋外に設置される場合が多く、周囲が明るくても高コントラストの画像を表示できるように高輝度の表示素子を用いており、表示素子及び表示素子駆動回路の消費電力が大きくなって発熱が問題になる。そこで、通常、図5に示されるように表示装置箱体1の後部に送風ファン30を設け、外気を導入することにより表示装置全体の冷却を行っている。また、表示部ユニット20の冷却には、図4に示されるように表示部ユニット20の後方にユニットファン31を設け、また、マトリックス状に列設された各表示素子間に排気用の微小隙間16を設けることにより、効果的に表示素子及び駆動回路の冷却を行えるようにしている。

【0004】

【発明が解決しようとする課題】ところで、この種の表示装置に用いられている蛍光管方式の表示素子には温度

特性が存在し、素子の発光輝度は素子の最冷点の温度によって決まる。表示体8は図2、図6、図7に示されるように4個の独立した正方形の発光部を有し、表示面8aにR、G、Bフィルタが覆着された多色発光可能な蛍光ランプよりなる素子本体9と、素子本体9のフィラメント部を囲むように設けられた筒状のランプ保持体10とで形成され、ランプ保持体10の後部開口の周縁には表示素子の電極引き出し線11が接続される電極ピン12が突設されて口金部が形成されている。また、ランプ保持体10の後部開口は吸気口13となっており、ランプ保持体10の周囲の前部下面には排気口14が設けられ、ランプ保持体10と素子本体9との間に通風路15が形成されている。したがって、送風ファン30及びユニットファン31による送風を各表示体8の通風路及び表示体8間の微小隙間16を介して流すことにより表示体8の温度をコントロールしている。このような冷却方法であるため、通常、表示体8の最冷点は図2に示されるガラスバルブ部32であり、また、このガラスバルブ部32の温度は表示ユニット20の後方の周囲温度によって左右される。

【0005】図3に表示体8の温度特性のグラフを示す。このグラフから分かるように表示ユニット20の後部温度が40℃前後で表示体8が最大発光輝度を得ることができ、90%の発光効率を得るためにも後部温度が30℃前後必要となる。したがって、冬期等の周囲温度が低い時期には表示装置箱体1内の表示部ユニット20の後方部の温度が30℃までに達し、表示体8の輝度が安定するまである程度の時間ウォームアップが必要となり、運用までに時間がかかるという問題があった。

【0006】本発明は上記問題点の解決を目的とするものであり、ウォームアップ時間を短縮することができる表示装置を提供しようとするものである。

【0007】

【課題を解決するための手段】上記目的を達成するために、請求項1の発明では、表示装置箱体1内に収納配置される複数の蛍光管方式の発光素子をマトリックス状に配置した表示部2を備え、表示部2の前方を覆うように表示部2の前方に配置された透明板3を備え、表示装置箱体1外部より空気を導入すると共に表示部2を通して表示部2の前面から排気を行うことにより表示装置全体の冷却を行う表示装置において、表示部2前面と透明板3間の暖気を表示部2の後方に導入する循環用ファン4を備えたことを特徴とするものである。

【0008】請求項2の発明では、請求項1において内外に連通するように表示装置箱体1に設けられた開口部分5に開閉自在なシャッター6を設け、シャッター6の近傍にファン装置7を設け、ウォームアップ時には表示装置箱体1と外気とを遮断するためにウォームアップ時のファン装置7の停止中はシャッター6を閉じ、ウォームアップが完了しファン装置7が回転中にはシャッター

6を開けるように上記ファン装置7とシャッター6とを連動させたことを特徴とするものである。

【0009】

【作用】請求項1の発明によれば、循環用ファン4によって表示部2前面と透明板3間の暖気を表示部2の後方に導入することで暖気によって表示部2の立ち上げ時のウォームアップ時間を短縮することができる。請求項2の発明によれば、シャッター6の開閉動作によってウォームアップ時には表示装置箱体1外の外気と表示装置箱体1内とを遮断して外の冷気が表示装置箱体1内に侵入するのを防止し、また、表示装置箱体1内の暖気が外部に流出するのを防止することができ、表示部2から発生する熱を効率よく利用することによってウォームアップ時間を短縮することができる。また、ファン装置7によって表示装置箱体1外の冷気を表示装置箱体1内に流入させると共に表示装置箱体1内の暖気を表示装置箱体1外に排出することで表示部2の冷却を行うことができる。

【0010】

【実施例】以下、本発明を図示された実施例に基づいて詳述する。本発明における表示装置は、内部に通気路が形成された表示装置箱体1内に複数の表示体8を隣合うように収納配置して主体が構成されている。表示体8は図2、図6に示されるように4個の独立した正方形の発光部を有しており、表示面8aにR、G、Bフィルタが覆着された多色発光可能な蛍光ランプよりなる素子本体9と、素子本体9のフィラメント部を囲むように設けられた筒状のランプ保持体10とで形成され、ランプ保持体10の後部開口の周縁には表示体8の電極引き出し線11が接続される電極ピン12が突設されて口金部が形成されている。ランプ保持体10の後部開口は吸気口13となっており、ランプ保持体10の周面の前部下面には排気口14が設けられ、ランプ保持体10と素子本体9との間に通風路15が形成されている。この表示体8は図7に示されるように複数隣合うように設置されるものであり、隣合う表示体8間には微小間隙16が設けられている。そして、後述するファン装置7及び循環用ファン4による送風を各表示体8の通風路15及び表示体8間の微小間隙16を介して流すことにより表示体8の温度をコントロールするようになっている。

【0011】表示体8が収納配置される表示装置箱体1は図1に示されるように上下部に開口部分5が設けられており、開口部分5には開閉自在なシャッター6が設置されている。シャッター6の内方にはファン装置7が設置されている。上記表示体8は表示装置箱体1内を前後に仕切るように表示装置箱体1内の略中央部に設置されており、表示体8の前方には強化ガラス等からなる透明板3が設置されており、透明板3と表示体8の前面の表示面8aとの間には第1通気空間17が形成されている。また、表示体8の背方と表示装置箱体1の後部との

間には第2通気空間18が形成されている。表示体8の上方に位置するように表示装置箱体1内の上部には循環用ファン4が設置されており、循環用ファン4を介して第1通気空間17と第2通気空間18とが連通している。循環用ファン4からは第2通気空間18の下部に向けて送風ダクト19が取付けられている。表示装置箱体1内には温度センサーが設置されており、表示装置箱体1内の温度によりファン装置7の回転数をインバータ等で制御して外気の導入量を調整するようになっている。また、シャッター6及び循環用ファン4はファン装置7と連動しており、低温時及びウォームアップ時のファン装置7の停止時にはシャッター6を閉の状態にし、表示装置箱体1と外気とを遮断して外部の冷気の侵入を防止すると共に表示装置箱体1内部の暖気の流出を防止するようになっている。このとき、循環用ファン4は回転しており、複数の表示体8からなる表示体ユニット20と透明板3間の暖気を表示ユニット20の後方に導入している。送風ダクト19は下向きに送風するように取付けられており、表示部ユニット20前面の暖気及び表示部ユニット20後方の上部に溜まった暖気を攪拌する働きを有するようになっている。

【0012】しかし、低温時やウォームアップ時にはシャッター6を閉じた状態にすると共にファン装置7を停止させた状態にし、循環用ファン4のみを動作させることによって図1中実線矢印イにて示されるように表示装置箱体1内において第1通気空間17と第2通気空間18との間で空気が循環することとなり、表示体8の作動によって表示体8と透明板3との間に存在する第1通気空間17内の暖気が循環して表示体8のウォームアップを迅速に行うことができるものであり、表示体8の輝度が安定するまでのウォームアップ時間を短縮することができるようになっている。また、表示体8の温度が必要以上に上昇すると表示体を冷却するものであるが、表示体8を冷却するにあたっては、シャッター6を開いて各シャッター6の内方に設置されているファン装置7を駆動させ、図1中破線矢印ロにて示されるように表示装置箱体1の下部より第2通気空間18内に表示装置箱体1外の空気を導入し、各表示体8内及び各表示体8間の微小間隙16を介して第1通気空間17に向けて空気を流して各表示体8を冷却し、第1通気空間17より上部のファン装置7を介して表示装置箱体1外に空気を排出するようにして表示体8が冷却されるものである。

【0013】

【発明の効果】請求項1の発明は、表示装置箱体内に収納配置される複数の蛍光管方式の発光素子をマトリックス状に配置した表示部を備え、表示部の前方を覆うように表示部の前方に配置された透明板を備え、表示装置箱体外部より空気を導入すると共に表示部を通して表示部

の前面から排気を行うことにより表示装置全体の冷却を行う表示装置において、表示部前面と透明板間の暖気を表示部の後方に導入する循環用ファンを備えているので、循環用ファンによって表示部前面と透明板間の暖気を表示部の後方に導入することで暖気によって表示部の立ち上げ時のウォームアップ時間を短縮することができるものである。

【0014】請求項2の発明は、請求項1において内外に連通するように表示装置箱体に設けられた開口部分に開閉自在なシャッターを設け、シャッターの近傍にファン装置を設け、ウォームアップ時には表示装置箱体と外気とを遮断するためにウォームアップ時のファン装置の停止中はシャッターを閉じ、ウォームアップが完了しファン装置が回転中にはシャッターを開けるように上記ファン装置とシャッターとを連動させてあるので、請求項1の効果に加えてシャッターの開閉動作によってウォームアップ時には表示装置箱体外の外気と表示装置箱体内とを遮断して外の冷気が表示装置箱体内に侵入するのを防止することができ、また、表示装置箱体内の暖気が外部に流出するのを防止することができ、表示部から発生する熱を効率よく利用することによってウォームアップ

時間を短縮することができるものである。また、ファン装置によって表示装置箱体外の冷気を表示装置箱体内に流入させると共に表示装置箱体内の暖気を表示装置箱体外に排出することで表示部の冷却を行うことができるものである。

【図面の簡単な説明】

【図1】本発明の一実施例を示す概略断面図である。

【図2】表示体の内部構成を示す概略断面図である。

【図3】温度変化と発光輝度を示すグラフである。

【図4】従来例を示す概略構成図である。

【図5】同上の内部構成を示す概略断面図である。

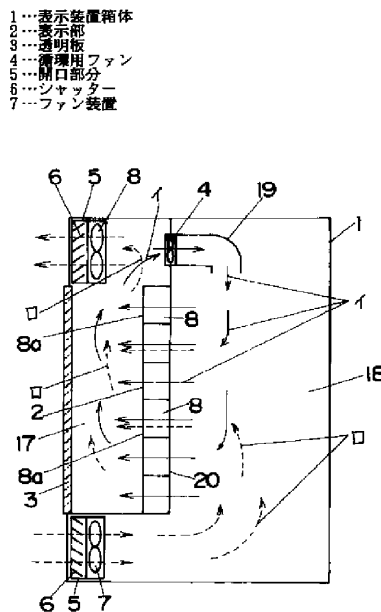
【図6】表示体を示す斜視図である。

【図7】表示部を説明する説明図である。

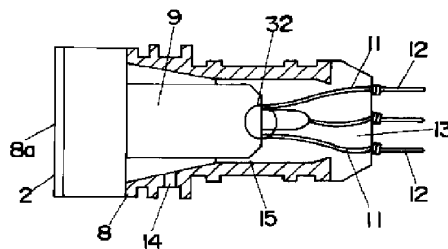
【符号の説明】

- 1 表示装置箱体
- 2 表示部
- 3 透明板
- 4 循環用ファン
- 5 開口部分
- 6 シャッター
- 7 ファン装置

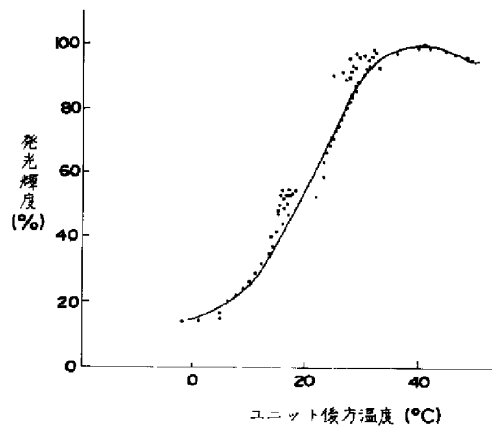
【図1】



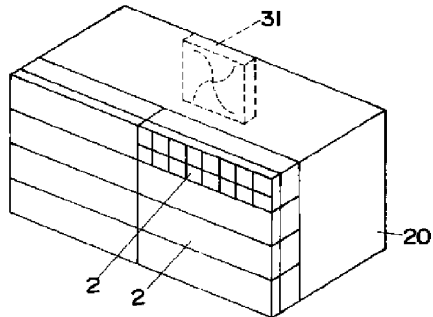
【図2】



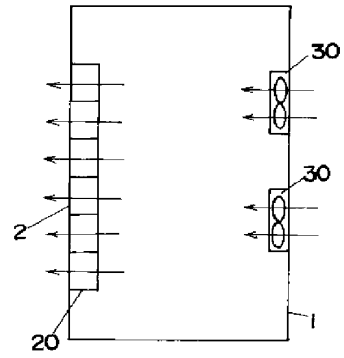
【図3】



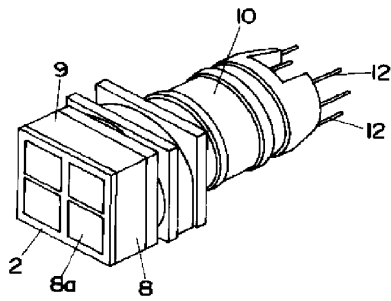
【図4】



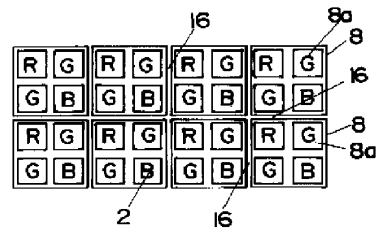
【図5】



【図6】



【図7】





Espacenet

Bibliographic data: JP8339034 (A) — 1996-12-24

LIQUID CRYSTAL DISPLAY DEVICE FOR OVERHEAD PROJECTOR

Inventor(s): KIMOTO TAKAYUKI ±

Applicant(s): MATSUSHITA ELECTRIC IND CO LTD ±

Classification: - **international:** **G02F1/13; G03B21/132; G03B21/16;**
(IPC1-7): G02F1/13; G03B21/132;
G03B21/16

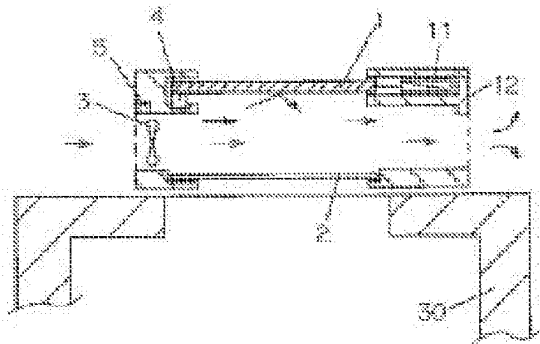
- **European:**

Application number: JP19950146010 19950613

Priority number (s): JP19950146010 19950613

Abstract of JP8339034 (A)

PURPOSE: To provide a liquid crystal display device for an overhead projector in which the amt. of cooling air is controlled according to the temp. increase of a liquid crystal cell in the liquid crystal display device and the noise due to the air blow is rendered as barely audible, and to prevent the temp. increase itself. **CONSTITUTION:** The liquid crystal display device is equipped with a transmission type liquid crystal cell 1, a lower protective panel 2 disposed near the light source part of an overhead projector 30 and apart from the cell 1 at a specified distance, and a cooling means 3 to blow cooling air into the space between the transmission type liquid crystal cell 1 and the lower protective panel 2, a temp. detector 4 to detect temp., and a noise detector 5 to detect noise around the liquid crystal display device 10. In this device, the amt. of the cooling air is controlled according to the detection results of the temp. detector 4 and the noise detector 5.



(19) 日本国特許庁 (J P)

(12) 公 開 特 許 公 報 (A)

(11) 特許出願公開番号

特開平8-339034

(43) 公開日 平成8年(1996)12月24日

(51) Int.Cl. ⁶	識別記号	庁内整理番号	F I	技術表示箇所
G 0 3 B 21/132			G 0 3 B 21/132	
G 0 2 F 1/13	5 0 5		G 0 2 F 1/13	5 0 5
G 0 3 B 21/16			G 0 3 B 21/16	

審査請求 未請求 請求項の数 4 O L (全 5 頁)

(21) 出願番号 特願平7-146010

(22) 出願日 平成7年(1995)6月13日

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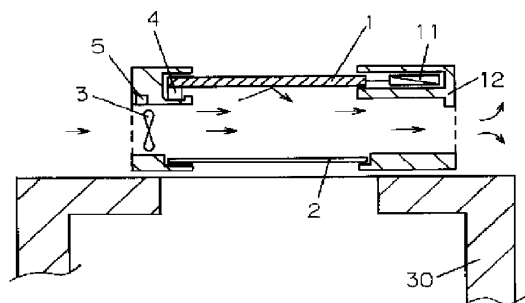
(54) 【発明の名称】 オーバーヘッドプロジェクタ用液晶表示装置

(57) 【要約】

【目的】 液晶表示装置における液晶セルの温度上昇に応じて冷却風量を制御すると共に風量ノイズを目立ちにくくするようにしたオーバーヘッドプロジェクタ用液晶表示装置と温度上昇そのものを防止する。

【構成】 透過型液晶セル1と、オーバーヘッドプロジェクタ30の光源部側の透過型液晶セル1と所望の空間を介して配置する下面保護パネル2と、透過型液晶セル1と下面保護パネル2の間の空間に冷却風を送る冷却手段3と、温度を検出する温度検出器4と、液晶表示装置10の周辺の騒音を検出する騒音検出器5とを有し、温度検出器4、前記騒音検出器5の検出結果に基づき冷却風の量を調整することからなる液晶表示装置である。

- 1 液晶セル
- 2 下面保護パネル
- 3 ファン
- 4 温度検出器
- 5 騒音検出器
- 11 駆動回路
- 12 本体カバー
- 30 オーバーヘッドプロジェクタ



【特許請求の範囲】

【請求項1】 オーバーヘッドプロジェクタの光源部からスクリーンへ向かう光路内に配置する液晶表示装置において、入力された信号により画像として表示する透過型液晶セルと、前記光源部側の前記透過型液晶セルと所望の空間を介して配置する下面保護パネルと、前記透過型液晶セルと前記下面保護パネルの間の空間に冷却風を送る冷却手段と、前記透過型液晶セルの下面の温度を検出する温度検出器と、周辺の騒音を検出する騒音検出器とを有し、前記温度検出器と前記騒音検出器の検出結果に基づき冷却手段を制御し冷却風の量を調整することからなることを特徴とするオーバーヘッドプロジェクタ用液晶表示装置。

【請求項2】 オーバーヘッドプロジェクタの光源部からスクリーンへ向かう光路内に配置する液晶表示装置において、入力された信号により画像として表示する透過型液晶セルと、前記光源部側の前記透過型液晶セルと所望の空間を介して配置する下面保護パネルと、前記透過型液晶セルと前記下面保護パネルの間の空間に冷却風を送る冷却手段と、前記透過型液晶セルの下面の温度を検出する温度検出器と、前記温度検出器の検出結果を入力するマイコンと前記マイコンの制御で警告を表示する警告手段からなることを特徴とするオーバーヘッドプロジェクタ用液晶表示装置。

【請求項3】 オーバーヘッドプロジェクタの光源部からスクリーンへ向かう光路内に配置する液晶表示装置において、入力信号により画像として表示する透過型液晶セルと前記透過型液晶セルの上面に配置する上面保護パネルと、前記オーバーヘッドプロジェクタの光源部側の前記透過型液晶セルに近接して配置させた下面第1保護パネルと、前記下面第1保護パネルと所望の空間を介して配置する下面第2保護パネルを有し、前記下面第1保護パネルと前記下面第2保護パネルの空間に冷却風を送る冷却手段とからなることを特徴とするオーバーヘッドプロジェクタ用液晶表示装置。

【請求項4】 下面第1保護パネルは赤外線および紫外線を反射するフィルムまたは反射板からなることを特徴とする請求項3記載のオーバーヘッドプロジェクタ用液晶表示装置。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は主としてオーバーヘッドプロジェクタの光源部からの光を利用し、透過型液晶セルで駆動した映像情報をスクリーンに拡大投影するオーバーヘッドプロジェクタ用の液晶表示装置に関するものである。

【0002】

【従来の技術】近年パソコンなどの映像を透過型液晶セルに表示させ、オーバーヘッドプロジェクタの光源を利用して拡大投影プレゼンテーションをするための液晶

表示装置が各社から商品化されている。しかしこの透過型液晶セルの透過率は非常に低く、オーバーヘッドプロジェクタ本来の輝度を実現できず、大画面でのプレゼンテーションは困難であった。そこで最近ではこの輝度を向上させるため透過型液晶セルの透過率を上げる一方、液晶表示装置に対応した高輝度オーバーヘッドプロジェクタも相次いで商品化されている。

【0003】しかしながら高輝度オーバーヘッドプロジェクタを使用しようとする、その光源から発せられる光に含まれる熱により透過型液晶セルの温度が上昇する。そしてその温度が上昇すると透過型液晶セルはコントラストが劣化したり色ムラが発生し、投影性能が劣化する。

【0004】

【発明が解決しようとする課題】これらの課題に対し、特開昭63-46416号公報では液晶表示セルと保護パネルとの空隙に空気を流通させて液晶表示セルを冷却することが開示されているが、常に一定値以下の温度を保持するために冷却風量を多くする必要があり風量ノイズが非常に大きくなるという問題があった。

【0005】また特開平6-82745号公報では温度検出器を設け、検出結果に応じて風量を調整することが開示されているが、オーバーヘッドプロジェクタの騒音に関係なく風量を調整するため、オーバーヘッドプロジェクタの機種によっては、やはり風量ノイズが気になるという課題があった。

【0006】本発明は上記問題点を鑑み、液晶表示装置の温度上昇に応じて冷却風量を制御すると共に風量ノイズを目立ちにくくするようにしたオーバーヘッドプロジェクタ用液晶表示装置と温度上昇そのものを防ぐことを特徴とした液晶表示装置を提供するものである。

【0007】

【課題を解決するための手段】上記問題点を解決するための本発明のオーバーヘッドプロジェクタ用液晶表示装置は、入力された信号により画像として表示する透過型液晶セルと、前記光源部側の前記透過型液晶セルと所望の空間を介して配置する下面保護パネルと、前記透過型液晶セルと前記下面保護パネルの間の空間に冷却風を送る冷却手段と、前記透過型液晶セルの下面の温度を検出する温度検出器と、周辺の騒音を検出する騒音検出器とを有し、前記温度検出器、前記騒音検出器の検出結果に基づき冷却手段を制御し冷却風の量を調整することからなるものである。

【0008】さらに温度検出器の検出結果をマイコンに入力し前記マイコンの制御で警告を表示する警告手段からなることを特徴とするオーバーヘッドプロジェクタ用液晶表示装置である。

【0009】また別の本発明では、オーバーヘッドプロジェクタの光源部からスクリーンへ向かう光路内に配置する液晶表示装置において、入力された信号により画像