

UTILITY PATENT APPLICATION TRANSMITTAL <i>(Only for new nonprovisional applications under 37 CFR 1.53(b))</i>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 2px;">Attorney Docket No.</td> <td style="padding: 2px;">103-1284</td> </tr> <tr> <td style="padding: 2px;">First Inventor</td> <td style="padding: 2px;">Jin Sub KIM</td> </tr> <tr> <td style="padding: 2px;">Title</td> <td style="padding: 2px;">LIQUID CRYSTAL DISPLAY DEVICE</td> </tr> <tr> <td style="padding: 2px;">Express Mail Label No.</td> <td style="padding: 2px;"></td> </tr> </table>	Attorney Docket No.	103-1284	First Inventor	Jin Sub KIM	Title	LIQUID CRYSTAL DISPLAY DEVICE	Express Mail Label No.	
Attorney Docket No.	103-1284								
First Inventor	Jin Sub KIM								
Title	LIQUID CRYSTAL DISPLAY DEVICE								
Express Mail Label No.									

APPLICATION ELEMENTS See MPEP chapter 600 concerning utility patent application contents. 1. ☒ Fee Transmittal Form (e.g., PTO/SB/17) <i>(Submit an original and a duplicate for fee processing)</i> 2. ☐ Applicant claims small entity status. See 37 CFR 1.27. 3. ☒ Specification [Total Pages <u>20</u>] Both the claims and abstract must start on a new page <i>(For information on the preferred arrangement, see MPEP 608.01(a))</i> 4. ☒ Drawing(s) (35 U.S.C. 113) [Total Sheets <u>10</u>] 5. Oath or Declaration [Total Sheets <u>2</u>] a. ☒ Newly executed (original or copy) b. ☐ A copy from a prior application (37 CFR 1.63(d)) <i>(for continuation/divisional with Box 18 completed)</i> i. ☐ DELETION OF INVENTOR(S) Signed statement attached deleting inventor(s) name in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b). 6. ☐ Application Data Sheet. See 37 CFR 1.76 7. ☐ CD-ROM or CD-R in duplicate, large table or Computer Program (Appendix) ☐ Landscape Table on CD 8. Nucleotide and/or Amino Acid Sequence Submission <i>(if applicable, items a. – c. are required)</i> a. ☐ Computer Readable Form (CRF) b. ☐ Specification Sequence Listing on: i. ☐ CD-ROM or CD-R (2 copies); or ii. ☐ Paper c. ☐ Statements verifying identity of above copies	ACCOMPANYING APPLICATION PARTS 9. ☒ Assignment Papers (cover sheet & document(s)) Name of Assignee <u>Samsung Electronics Co., Ltd</u> <u>Suwon-si, Republic of Korea</u> 10. ☐ 37 CFR 3.73(b) Statement <i>(when there is an assignee)</i> ☒ Power of Attorney 11. ☐ English Translation Document <i>(if applicable)</i> 12. ☒ Information Disclosure Statement (PTO/SB/08 or PTO-1449) ☒ Copies of citations attached 13. ☐ Preliminary Amendment 14. ☐ Return Receipt Postcard (MPEP 503) <i>(Should be specifically itemized)</i> 15. ☒ Certified Copy of Priority Document(s) <i>(if foreign priority is claimed)</i> 16. ☐ Nonpublication Request under 35 U.S.C. 122(b)(2)(B)(i). Applicant must attach form PTO/SB/35 or equivalent. 17. ☐ Other: _____
18. If a CONTINUING APPLICATION, check appropriate box, and supply the requisite information below and in the first sentence of the specification following the title, or in an Application Data Sheet under 37 CFR 1.76: ☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No.: _____ Prior application information: _____ Examiner: _____ Art Unit: _____	

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ABSTRACT OF THE DISCLOSURE

A liquid crystal display device includes a liquid crystal panel, a protection panel arranged a predetermined distant from the liquid crystal panel, and a flow control device to impart turbulence to an air flow in a channel, which is defined between the liquid crystal panel and the protection panel.

CLAIMS

What is claimed is:

1. A liquid crystal display device, comprising:
a liquid crystal panel;
a protection panel arranged a predetermined distance from the liquid crystal panel; and
a flow control device to impart turbulence to an air flow in a channel, which is defined between the liquid crystal panel and the protection panel.
2. The liquid crystal display device according to claim 1, wherein:
the flow control device comprises a cooling fan to blow air to the channel;
the channel comprises an air inlet to receive air and an air outlet to discharge the air received from the channel; and
the cooling fan is located near the air inlet.
3. The liquid crystal display device according to claim 2, wherein the flow control device further comprises:
a temperature sensor to measure a temperature of air having passed through the channel; and
a flow rate controller to regulate a flow rate of air blown from the cooling fan according to a signal transmitted from the temperature sensor.
4. The liquid crystal display device according to claim 3, wherein:
the flow rate controller regulates the flow rate of air in the cooling fan such that the air in the channel has a controlled flow velocity in a range of 4 to 14m/s.
5. The liquid crystal display device according to claim 2, wherein:
each of the air inlet and the air outlet is provided with a dust filter to remove foreign materials from the air.
6. The liquid crystal display device according to claim 1, wherein:
the channel defined between the liquid crystal panel and the protection panel has a spacing distance in a range of 5 to 25mm.

7. The liquid crystal display device according to claim 1, further comprising:
a housing enclosing the liquid crystal panel,
wherein the protection panel is made of a transparent material and is entirely located at
a front side of the housing.

8. The liquid crystal display device according to claim 1, further comprising:
a backlight unit and a circuit board, both provided at a rear side of the liquid crystal
panel; and a rear panel spaced apart from the backlight unit and the circuit board, wherein:
the air emerging from the channel, which is defined between the protection panel and
the liquid crystal panel, flows via another channel formed by the backlight unit and the circuit
board so as to remove heat generated from the backlight unit and the circuit board.

9. A liquid crystal display device, comprising:
a liquid crystal panel;
a protection panel arranged a predetermined distance from the liquid crystal panel; and
a flow control device to detect temperature variation caused by heat incident on a front
side of the liquid crystal panel, and to control a flow rate of air blowing toward a channel, which
is defined between the liquid crystal panel and the protection panel.

10. The liquid crystal display device according to claim 9, wherein:
the flow control device has a flow rate controller to regulate the flow rate of the air such
that air in the channel has a flow velocity of not less than 4m/s when the channel defined
between the liquid crystal panel and the protection panel has a spacing distance in a range of 5
to 25mm.

11. The liquid crystal display device according to claim 10, wherein:
the flow control device further includes a temperature sensor to detect a temperature
variation of the air having passed through the channel, and the flow rate controller is operated
according to a signal transmitted from the temperature sensor.

12. A liquid crystal display device, comprising:
a housing partitioned into upper and lower spaces;
a liquid crystal panel assembly arranged in the upper space; and

an air conditioner arranged in the lower space to blow air to the liquid crystal assembly, and to cool the liquid crystal assembly.

13. The liquid crystal display device according to claim 12, further comprising:
a flow control device to impart turbulence to the air being blown toward the liquid crystal panel assembly, to cool the liquid crystal panel assembly.

14. The liquid crystal display device according to claim 13, wherein:
the housing includes a protection panel provided at a front side of the housing, and the air conditioner includes a cooling fan to blow the air to a channel defined between the protection panel and the liquid crystal panel assembly.

15. The liquid crystal display device according to claim 14, wherein the flow control device further comprises:

a flow rate controller to regulate a flow rate of the air in the cooling fan such that the air in the channel has a controlled flow velocity.

16. The liquid crystal display device according to claim 15, wherein:
the channel defined between the liquid crystal panel assembly and the protection panel has a spacing distance in a range of 0.005 to 0.025m, and the flow rate controller regulates the flow rate of the air in the cooling fan such that the flow velocity of air in the channel is maintained at 4m/s or more.

17. The liquid crystal display device according to claim 15, wherein:
the flow control device further includes a temperature sensor to measure a temperature of the air having passed through the channel, and to send a resulting signal to the flow rate controller.

18. The liquid crystal display device according to claim 17, wherein:
the flow rate controller controls the cooling fan such that the flow velocity of the air in the channel is maintained at 14m/s or less.

19. The liquid crystal display device according to claim 12, wherein the liquid crystal panel assembly comprises:

- a liquid crystal panel;
- a backlight unit irradiate light to the liquid crystal panel; and
- a circuit board to control the backlight unit and the liquid crystal panel.

20. A display device, comprising:
a liquid crystal panel to display an image;
a protection panel to protect the liquid crystal panel; and
a channel formed between the liquid crystal panel and the protection panel to pass air therebetween to remove heat from a front side of the liquid crystal panel,
wherein a distance between the liquid crystal panel and the protection panel is in a range of 5mm to 25mm.

21. A display device, comprising:
a liquid crystal panel to display an image;
a protection panel to protect the liquid crystal panel;
a channel formed between the liquid crystal panel and the protection panel; and
a flow control device to provide turbulent air in the channel to remove heat from a front side of the liquid crystal panel.

22. The display device according to claim 21, wherein the flow control device comprises:
a cooling fan to blow the air to the first channel;
a flow rate controller to regulate a flow rate of air in the cooling fan to control a flow velocity of the air in the channel; and
a temperature sensor to measure temperature of the air having passed through the first channel, and to send a resulting signal to the flow rate controller.

23. The display device according to claim 22, wherein a distance between the liquid crystal panel and the protection panel is determined by a static pressure-flow rate curve of the cooling fan.

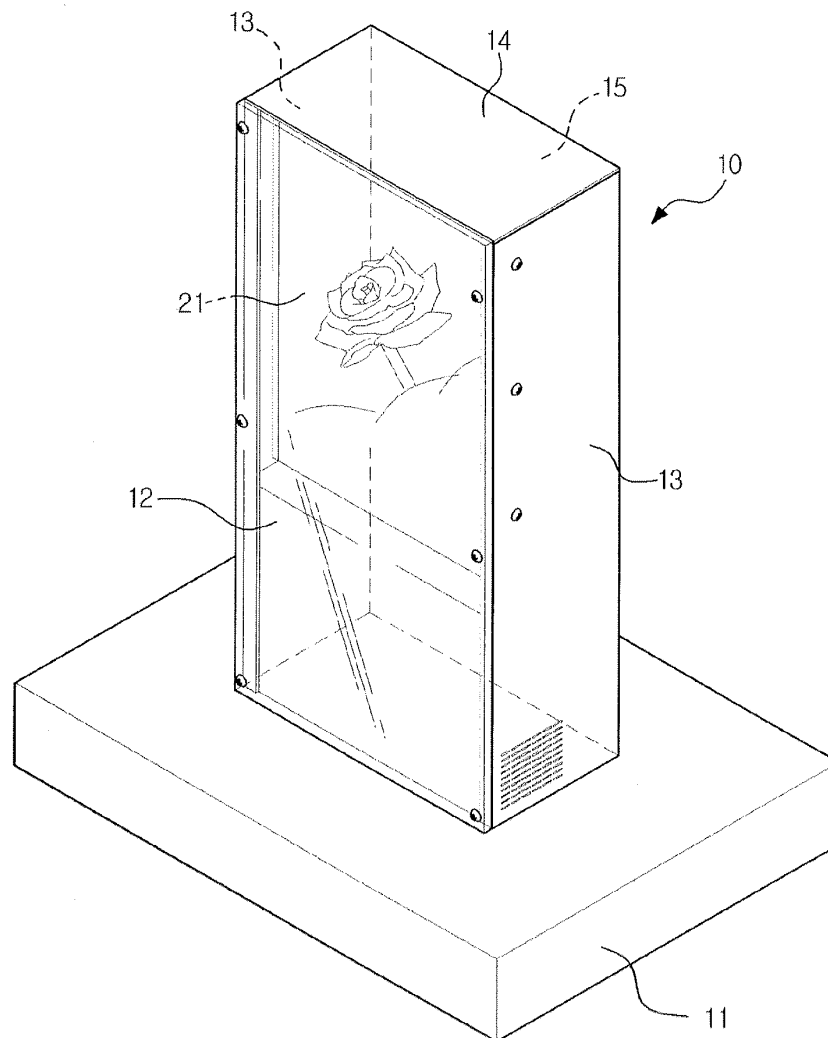
24. A display device, comprising:
a housing;
a display assembly disposed inside the housing and spaced apart from the housing to

form front, top, and rear air flow channels in order; and

a flow control device to generate an air flow to flow air through the front, top and rear air channels in order.

25. The display device according to claim 21, further comprising:
an air conditioner to generate a cooling air as the air flows.

FIG. 1



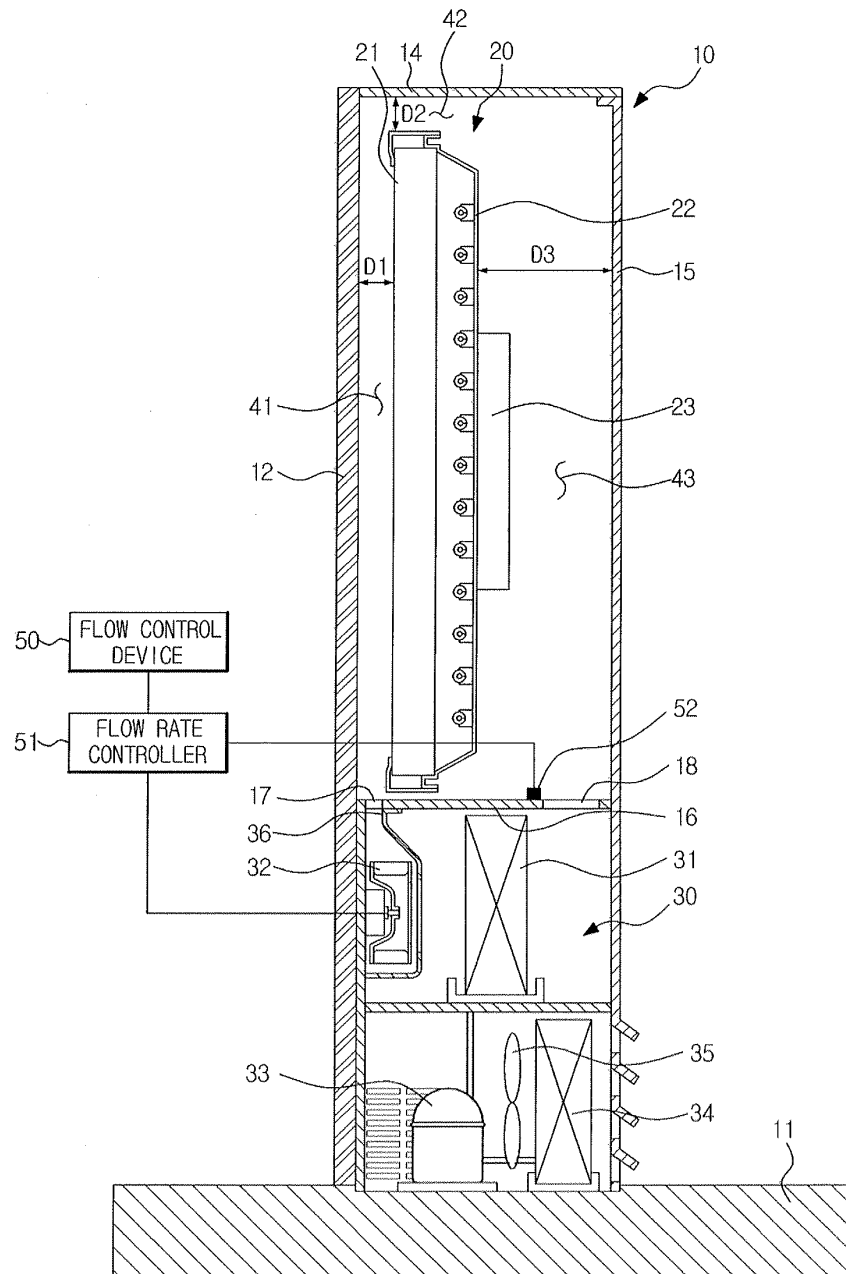


FIG. 3

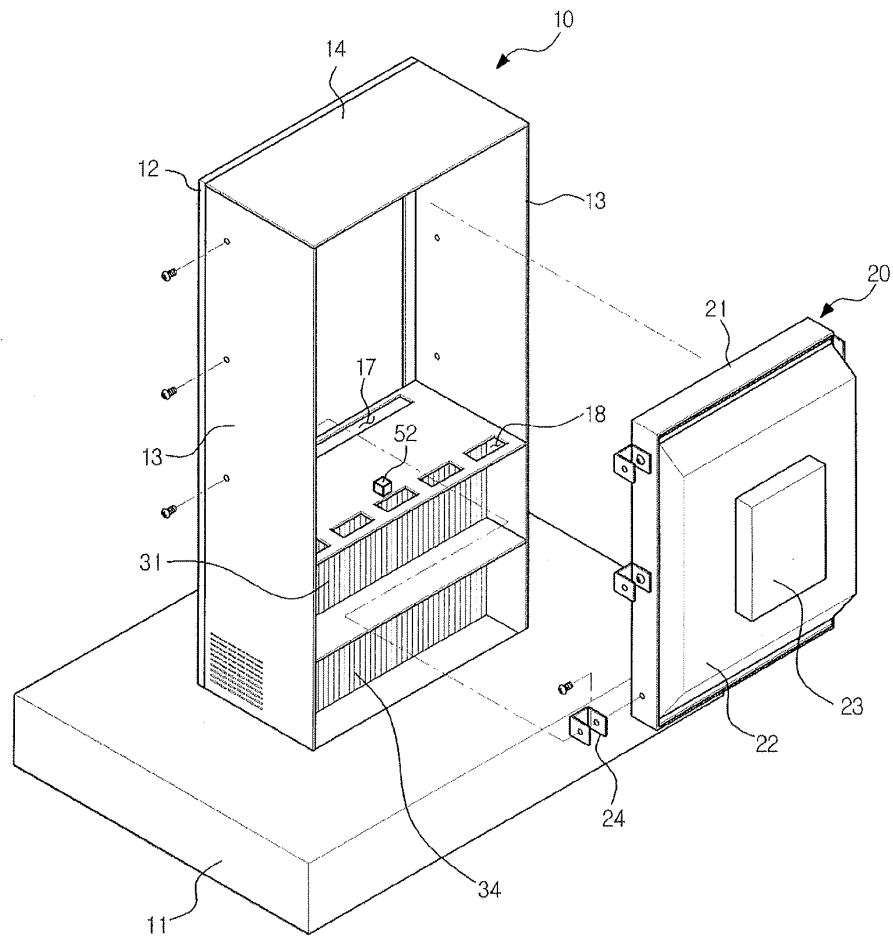


FIG. 4

$d = 0.004 \text{ m}$

SOLAR RADIATION [W/m ²]	FLOW VELOCITY IN CHANNEL [m/s]					
	5	8	10	12	14	16
600	84.5	70.6	65.8	62.6	60.3	58.5
850	101	81.2	74.5	69.9	66.6	64.1
1100	117.5	91.9	83.1	77.2	73	69.7

FIG. 5

$d = 0.005 \text{ m}$

SOLAR RADIATION [W/m ²]	FLOW VELOCITY IN CHANNEL [m/s]					
	4	6	8	10	12	14
600	88	74.7	67.8	63.6	60.8	58.7
850	105.9	87	77.3	71.4	67.3	64.4
1100	123.9	99.4	86.8	79.1	73.9	70

FIG. 6

$d = 0.025 \text{ m}$

SOLAR RADIATION [W/m ²]	FLOW VELOCITY IN CHANNEL [m/s]				
	3	4	6	8	10
600	82	74.1	65.7	61.3	58.6
850	97.4	86.2	74.4	68.1	64.2
1100	112.8	98.3	83	74.9	69.9

FIG. 7

d = 0.03 m

SOLAR RADIATION [W/m ²]	FLOW VELOCITY IN CHANNEL [m/s]				
	3	4	6	8	10
600	82	74.1	65.8	61.4	58.7
850	97.4	86.3	74.5	68.3	64.3
1100	112.8	98.4	83.2	75.1	70

FIG. 8

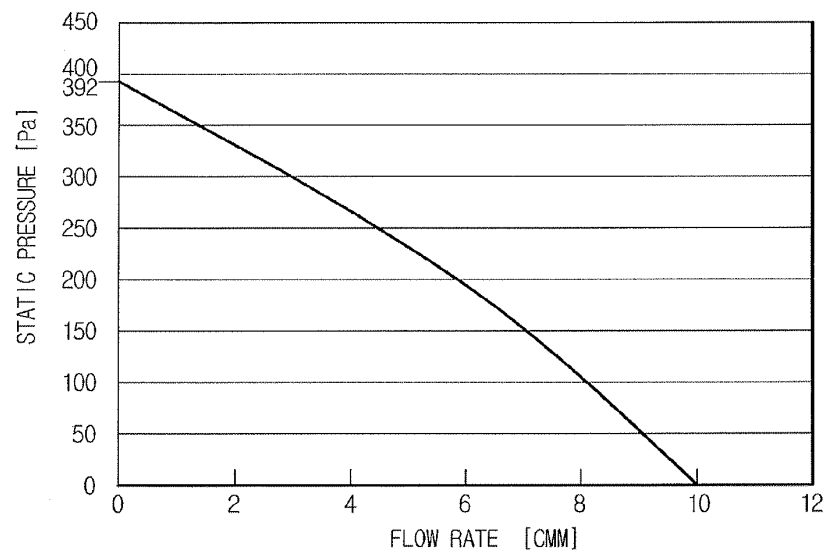
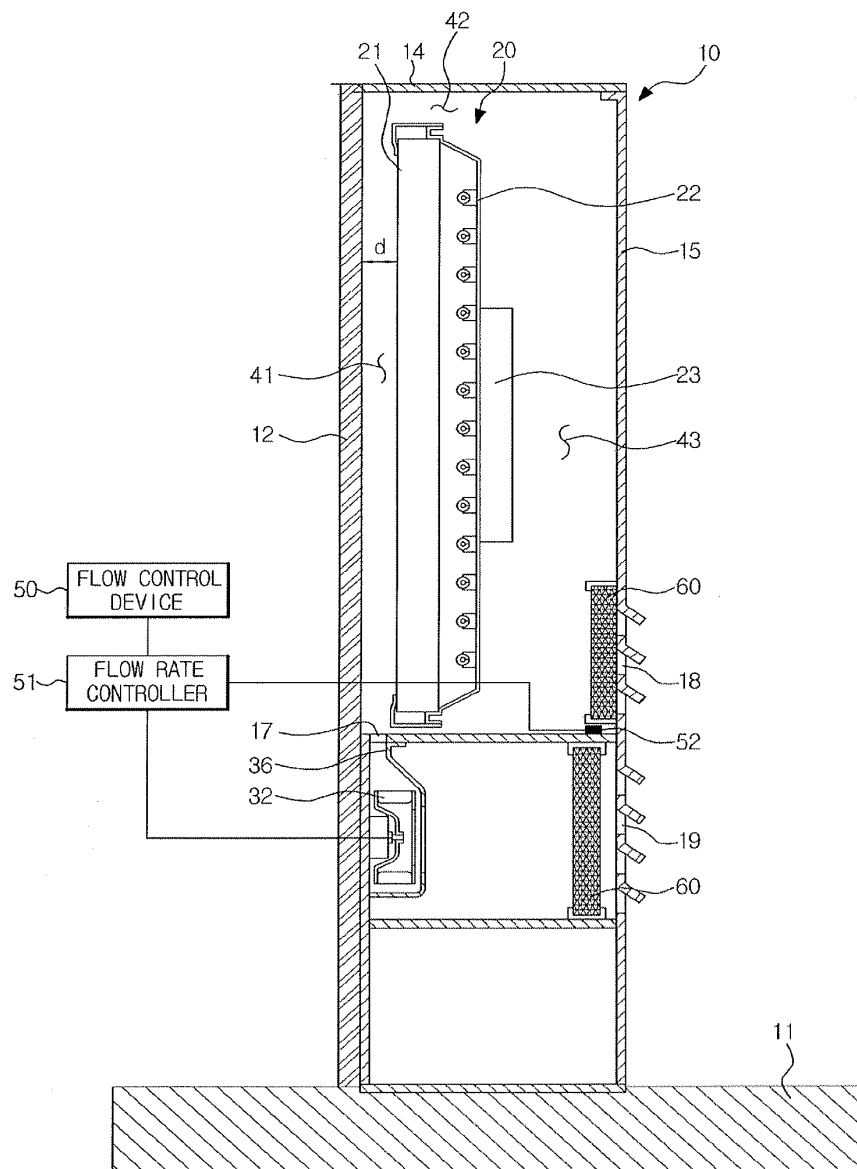


FIG. 9

FLOW VELOCITY, V [m/s]	SPACING DISTANCE, d [m]				
	0.005	0.01	0.015	0.02	0.025
1	629	1259	1888	2517	3147
2	1259	2517	3776	5035	6293
3	1888	3776	5664	7552	9440
4	2517	5035	7552	10069	12587
5	3147	6293	9440	12587	15733
6	3776	7552	11328	15104	18880

FIG. 10



PATENT ABSTRACTS OF JAPAN

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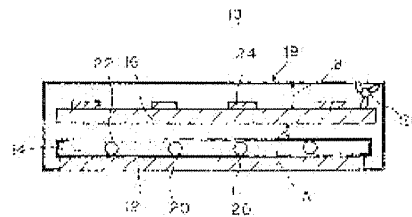
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(54) LIQUID CRYSTAL DISPLAY DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a liquid crystal display device allowing improved heat dissipation efficiency.

SOLUTION: The liquid crystal display device 10 comprises a liquid crystal panel 12, a backlight 14 and a printed circuit (PC) board 16 housed in a frame 18, wherein the backlight 14 and the PC board 16 are disposed leaving a predetermined gap so as to dispose a cooling fan 26 on the side of a transformer 24 mounted on the PC board 16.



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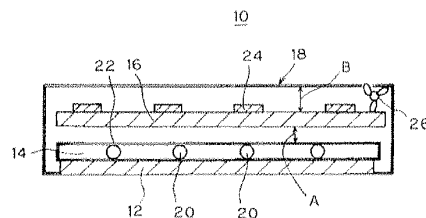
(54) 【発明の名称】 液晶表示装置

(57) 【要約】

【課題】 放熱効率を向上させることができる液晶表示装置を提供する。

【解決手段】 液晶パネル12とバックライト14とPC基板16とをフレーム18に収納した液晶表示装置10において、バックライト14とPC基板16とを所定間隔を開けて配し、PC基板16に取り付けられたトランス24側に冷却ファン26を設けたものである。

【選択図】 図1



【特許請求の範囲】

【請求項1】

液晶パネルと、
前記液晶パネルの裏面に配されたバックライトと、
前記バックライトの裏面に配され、かつ、前記バックライトを点灯させるための発熱電子部品を備えるインバータ回路を有する配線基板と、
前記液晶パネル、前記バックライト、前記配線基板を収納するフレームと、
を具備する液晶表示装置において、
前記バックライトと前記配線基板とを所定間隔を開けて配し、
前記発熱電子部品が存在する空隙部分に送風する冷却ファンを配した
ことを特徴とする液晶表示装置。

【請求項2】

液晶パネルと、
前記液晶パネルの裏面に配されたバックライトと、
前記バックライトの裏面に配され、かつ、前記バックライトを点灯させるための発熱電子部品を備えるインバータ回路を有する配線基板と、
前記液晶パネル、前記バックライト、前記配線基板を収納するフレームと、
を具備する液晶表示装置において、
前記バックライトと前記配線基板とを所定間隔を開けて配し、
前記発熱電子部品に非導電性の伝熱シートを接触させ、
前記伝熱シートを前記フレームに接触させた
ことを特徴とする液晶表示装置。

【請求項3】

液晶パネルと、
前記液晶パネルの裏面に配されたバックライトと、
前記バックライトの裏面に配され、かつ、前記バックライトを点灯させるための発熱電子部品を備えるインバータ回路を有する配線基板と、
前記液晶パネル、前記バックライト、前記配線基板を収納するフレームと、
を具備する液晶表示装置において、
前記バックライトと前記配線基板とを所定間隔を開けて配し、
前記発熱電子部品が存在する空隙部分に送風する冷却ファンを配し、
前記配線基板に取り付けられた発熱電子部品に伝熱シートを接触させ、
前記伝熱シートを前記フレームに接触させた
ことを特徴とする液晶表示装置。

【請求項4】

前記バックライトと前記配線基板との間に熱反射板を配した
ことを特徴とする請求項3記載の液晶表示装置。

【請求項5】

液晶パネルと、
前記液晶パネルの裏面に配されたバックライトと、
前記バックライトの裏面に配され、かつ、前記バックライトを点灯させるためのインバータ回路を有する配線基板と、
前記液晶パネル、前記バックライト、前記配線基板を収納するフレームと、
を具備する液晶表示装置において、
前記バックライトと前記配線基板とを所定間隔を開けて配し、
前記バックライトと前記配線基板との間に放熱板を配し、
前記配線基板からの熱を前記放熱板に伝える伝熱部材を設けた
ことを特徴とする液晶表示装置。

【請求項6】

前記バックライトが、前記液晶パネルの裏面直下にランプを配する直下型バックライトである

【発明の詳細な説明】 求項1～5の少なくとも一項に記載の液晶表示装置。

【技術分野】

【0001】

本発明は、液晶パネルの裏面にバックライトが配された液晶表示装置に関するものである。

【背景技術】

【0002】

液晶表示装置は、液晶パネルを照明するためにその裏面にバックライトを配し、この液晶パネルとバックライトとプリント配線基板が、フレームに収納されている。

【0003】

従来より、この液晶表示装置のフレーム内部を冷却するために、フレームの空気取入口近傍に冷却ファンを設けたり（例えば、特許文献1参照）、プリント配線基板（以下、PC基板という）とフレームとの間に熱遮蔽手段を設けたものが提案されている（例えば、特許文献2参照）。

【特許文献1】特開2004-109306公報

【特許文献2】特開2002-350807公報

【発明の開示】

【発明が解決しようとする課題】

【0004】

最近の大型液晶表示装置においては、液晶パネルをバックライトと一体化したものが提案されている。この場合に、バックライトのインバータ回路のトランスの熱により、バックライトの温度が上昇し、バックライトに接する液晶パネルや偏光板が不均一な変化をして表示ムラが発生するという問題点が出てきた。この問題点は、上記の特許文献1や特許文献2の方法を用いても解決できなかった。

【0005】

図7は、従来のOCB (Optically Compensated Bend) モードの液晶表示装置100の縦断面図である。なお、OCBモードとは、液晶分子が曲がって配列されたベンド配向状態を維持して映像を表示するものであり、応答速度が速くしかも視野角が広がるモードである。

【0006】

この液晶表示装置100は、液晶パネル102の裏面にバックライト104が配され、このバックライト104の裏面側にPC基板106が配されている。バックライト104は、液晶パネル102の裏面直下を照明するためにランプ108を複数有する直下型バックライトである。PC基板106には、液晶パネル102の駆動回路及びバックライト104を点灯させるためのインバータ回路が設けられている。インバータ回路には、インバータ制御を行うために複数のトランス110が設けられている。

【0007】

OCBモードの液晶は複屈折モードであり、例えば、 $\delta n = 0.16$ の比較的大きな液晶材料を用いている。このような複屈折の大きな液晶材料では温度依存が大きくムラが発生し易い。本発明者の実験では、 δn が0.15以上の複屈折の液晶材料を使用した場合に表示ムラが発生し易いことが確認されている。特に白表示の際に、表示領域における輝度ムラの分布が発生する。

【0008】

また、テレビ等に用いられる大型の液晶表示装置においては、バックライト104の輝度を高くして明るさをかせぐため、多数のランプ108を使用し、このため発熱電子部品であるインバータ制御用のトランス110も多数配置されている。それに伴いランプ108やトランス110からの発熱量が増加し、より放熱が問題となる。

【0009】

さらに、サイド型のバックライトよりも、上記のような直下型のバックライト104では、液晶パネル102の裏面全面に亘ってバックライト104やPC基板106が配されるために、その放熱の問題がより大きくなるばかりでなく、液晶パネル102に加わる温度分布の不均一性が問題となっている。

【0010】

そこで、本発明は上記問題点を鑑み、放熱効率を向上させると共に、液晶パネルに加わる温度分布をより均一化することができる液晶表示装置を提供する。

【課題を解決するための手段】

【0011】

請求項1に係る発明は、液晶パネルと、前記液晶パネルの裏面に配されたバックライトと、前記バックライトの裏面に配され、かつ、前記バックライトを点灯させるための発熱電子部品を備えるインバータ回路を有する配線基板と、前記液晶パネル、前記バックライト、前記配線基板を収納するフレームと、を具備する液晶表示装置において、前記バックライトと前記配線基板とを所定間隔を開けて配し、前記発熱電子部品が存在する空隙部分に送風する冷却ファンを配したことを特徴とする液晶表示装置である。

【0012】

請求項2に係る発明は、液晶パネルと、前記液晶パネルの裏面に配されたバックライトと、前記バックライトの裏面に配され、かつ、前記バックライトを点灯させるための発熱電子部品を備えるインバータ回路を有する配線基板と、前記液晶パネル、前記バックライト、前記配線基板を収納するフレームと、を具備する液晶表示装置において、前記バックライトと前記配線基板とを所定間隔を開けて配し、前記発熱電子部品に非導電性の伝熱シートを接触させ、前記伝熱シートを前記フレームに接触させたことを特徴とする液晶表示装置である。

【0013】

請求項3に係る発明は、液晶パネルと、前記液晶パネルの裏面に配されたバックライトと、前記バックライトの裏面に配され、かつ、前記バックライトを点灯させるための発熱電子部品を備えるインバータ回路を有する配線基板と、前記液晶パネル、前記バックライト、前記配線基板を収納するフレームと、を具備する液晶表示装置において、前記バックライトと前記配線基板とを所定間隔を開けて配し、前記配線基板に取り付けられた発熱電子部品が存在する空隙部分に送風する冷却ファンを配し、前記発熱電子部品に伝熱シートを接触させ、前記伝熱シートを前記フレームに接触させたことを特徴とする液晶表示装置である。

【0014】

請求項5に係る発明は、液晶パネルと、前記液晶パネルの裏面に配されたバックライトと、前記バックライトの裏面に配され、かつ、前記バックライトを点灯させるためのインバータ回路を有する配線基板と、前記液晶パネル、前記バックライト、前記配線基板を収納するフレームと、を具備する液晶表示装置において、前記バックライトと前記配線基板とを所定間隔を開けて配し、前記バックライトと前記配線基板との間に放熱板を配し、前記配線基板からの熱を前記放熱板に伝える伝熱部材を設けたことを特徴とする液晶表示装置である。

【発明の効果】

【0015】

本発明であると、放熱効率を上げ、かつ、液晶パネルに加わる熱分布状態をより均一化することにより、熱分布変動による表示ムラが発生することがない。

【発明を実施するための最良の形態】

【0016】

以下、本発明の各実施形態の液晶表示装置10について説明する。

【0017】

(第1の実施形態)

本発明の第1の実施形態の液晶表示装置10について図1、図8に基づいて説明する。

【0018】

(1) 液晶表示装置10の構成

液晶表示装置10の構成について図1に基づいて説明する。

【0019】

O C B型の液晶パネル12の裏面にバックライト14が配されている。バックライト14の裏面側にはP C基板16が配されている。これら液晶パネル12とバックライト14とP C基板16とが金属製のフレーム18に収納されている。

【0020】

バックライト14は、直下型のバックライトであり、液晶パネル12の裏面直下に複数のランプ20が配され、バックライトフレーム22に収納されている。

【0021】

P C基板16は、バックライト14と所定間隔Aを開けて配されており、液晶パネル12の駆動回路及びバックライト14を点灯させるインバータ回路24が配線されている。このP C基板16の裏面側、即ち、図1においてはP C基板16の上面にインバータ回路を駆動させるための複数のトランス24が配置されている。

【0022】

P C基板16とフレーム18との間には、少なくとも1個の冷却ファン26が設けられ、また、P C基板16とフレーム18との間は間隔Bが設けられている。

【0023】

(2) 液晶表示装置10の放熱効果

液晶表示装置10においては、P C基板16のトランス24側の位置に冷却ファン26を設けると共に、バックライト14とP C基板16との間を間隔A、P C基板16とフレーム18との間を間隔Bにすることによって、トランス24からの熱による表示ムラが発生することがない。

【0024】

この理由は、最も発熱が多いトランス24側に冷却ファン26を配して強制冷却し、P C基板16からの熱がバックライト14に伝わらないようにするために間隔Aと間隔Bを開けることにより熱が分散する。換言すれば、発熱電子部品であるトランス24にて発生した熱分は、冷却ファン26によってトランス24が存在する間隔Bの空隙部分に対し送風されるため、液晶表示装置10のフレーム18内において分散され、熱分が集中的に不均一に液晶パネル12に印加されることがない。そのため、バックライト14に接している液晶パネル12や偏光板が不均一にトランス24の発熱によって加熱されることがなく、熱分の不均一性に起因する表示ムラが発生しない。

【0025】

更に、液晶表示装置10自体で自己完結型形態として表示ムラ対策を実施しているために、効率的且つ効果的に表示ムラの改善を図ることができ、本液晶表示装置10を組込む最終製品となるテレビ等の製品ユーザーサイドでの特別な対策も不要にすることが可能となり、製品ユーザーサイドの仕様に影響されることが少ないので、より汎用性のある液晶表示装置10とすることができる。

【0026】

(3) 実験結果

本発明者が、間隔Aと間隔B及び冷却ファン26の個数aとを替えて実験したところ、図8に示すような結果となった。

【0027】

冷却ファン26を1個設けた場合には、間隔Aと間隔Bを5mm開けると、液晶パネル12に表示ムラが発生しない。特に、テレビ等に用いられるバックライトの輝度が10000カンデラ/c m²以上でも表示ムラが発生しなかった。これは、液晶表示装置10のフレーム18内に配置されている発熱源であるトランス24を直接冷却ファン26を用いて空冷冷却していることと、トランス24が存在している空隙内に送風して気流を発生させ、空気を循環させることで熱分布を均一化している効果が大きく寄与しているものと考え

えられる。また、放熱させた熱分がフレーム18内にこもらないように、フレーム18に放熱用の透孔(図示せず)を設けることによって、更に放熱効果を高めることも可能である。

【0028】

また、フレーム18の大きさを考慮すると、間隔Aと間隔Bが30mm、冷却ファン26の個数を5個設けると有効であることが分かった。

【0029】

なお、図8における「効果的な範囲」とは、肉眼で液晶パネル12を監視して、表示ムラが発生しない範囲をいう。

【0030】

(第1の実施形態の変更例)

第2の実施形態の液晶表示装置10について図2、図9に基づいて説明する。

【0031】

第1の実施形態では、PC基板16のトランス24がフレーム18側に配されていたため、冷却ファン26をフレーム18とPC基板16との間に設けた。

【0032】

しかしながら、トランス24がバックライト14側に設けられている場合には、図2に示すように冷却ファン26をバックライト14とPC基板16との間に設けることで、同様の効果を達成し得る。

【0033】

本発明者が、間隔Aと間隔B及び冷却ファン26の個数aとを替えて実験したところ、図9に示すような結果となった。

【0034】

この変更例であっても、間隔A及び間隔Bについては第1の実施形態と同様に5～30mm開け、冷却ファン26も1個～5個にすることにより放熱効果があり、表示ムラが発生しない。また、この場合には、冷却ファン26によってトランス24とバックライト14のバックライトフレーム22とを同時に冷却させることが可能となるため、2つの発熱源を効率良く冷却することができ、液晶表示装置10全体としての放熱効果の向上が期待できる。

【0035】

(第2の実施形態)

第2の実施形態の液晶表示装置10について図3、図10に基づいて説明する。

【0036】

本実施形態と第1の実施形態の異なる点は、図3に示すように、冷却ファン26に代えて、放熱を促進させるために非導電性の伝熱シートを設けた点にある。非導電性の伝熱シートであるシリコンゴムシート28の一方の面をトランス24に面接触させると共に、シリコンゴムシート28の他方の面をフレーム18に密着させている。このシリコンゴムシート28の大きさは、トランス24より大きくすればよく、例えば、PC基板16と同じ大きさに形成すれば、トランス24から発生した熱を広い面積を有するシリコンゴムシート28面を介してフレーム18に伝導させることが可能となり放熱効果を向上させられるが、トランス24個々に個別に設けるような構成でもよい。また、バックライト14とPC基板16との間には間隔Aが設けられている。

【0037】

これにより、トランス24から放熱された熱がシリコンゴムシート28を伝ってフレーム18に伝わり、広い面積を有する金属製のフレーム18から放熱される。

【0038】

本発明者が、間隔A及びシリコンゴムシート28の枚数cとを替えて実験したところ、図10に示すような結果となった。

【0039】

本実施形態であっても、間隔Aについては第1の実施形態と同様に5mm～30mm開

け、また、シリコンゴムシート28も1枚～5枚にすることにより放熱効果があり、表示ムラが発生しない。

【0040】

(第2の実施形態の変更例)

第2の実施形態の変更例の液晶表示装置10について図4、図11に基づいて説明する。

【0041】

図4は、第2の実施形態の変更例であって、第2の実施形態と異なる点は、トランス24がバックライト14側に設けられている点にある。そのため、シリコンゴムシート28をPC基板16の裏面側に密着させ、かつ、フレーム18にも密着させる。これによって、トランス24からの熱がPC基板16を伝って間接的にシリコンゴムシート28及びフレーム18に伝えられ放熱効果が促進される。この際、PC基板16に熱伝導率の高い材質を採用すれば、放熱効果も高めることが可能となる。

【0042】

また、トランス24とバックライト14とは、間隔Aだけ開けられているため、トランス24からの熱がバックライト14に直接的には伝わらない。

【0043】

本発明者が、間隔A及びシリコンゴムシート28の枚数cとを替えて実験したところ、図11に示すような結果となった。

【0044】

本実施形態であっても、間隔Aについては第2の実施形態と同様に5mm～30mm開け、また、シリコンゴムシート28も1枚～5枚にすることにより放熱効果があり、表示ムラが発生しない。

【0045】

(第3の実施形態)

第3の実施形態の液晶表示装置10について図5、図12に基づいて説明する。

【0046】

第3の実施形態は、第1の実施形態の変更例と第2の実施形態の変更例を組み合わせ、さらに赤外線を反射する反射板(断熱板)30をバックライト14とPC基板16との間に配したものである。

【0047】

本実施形態の液晶表示装置10であると、冷却ファン26及びシリコンゴムシート28の作用によりトランス24からの熱が放熱され、さらに、トランス24からの熱が反射板30によって反射されるため、バックライト14に熱が伝わり難い。したがって、熱による表示ムラが発生しない。

【0048】

本発明者が、間隔A-1と間隔A-2、冷却ファン26の個数a、反射板30の枚数b、シリコンゴムシート28の枚数cとを替えて実験したところ、図12に示すような結果となった。なお、間隔A-1は反射板30とバックライト14の距離であり、間隔A-2は反射板30とPC基板16の距離である。

【0049】

本実施形態であっても、間隔A-1、A-2について5mm～30mm開け、また、冷却ファン26の個数が1～5個、反射板30の枚数が1～5枚、シリコンゴムシート28も1枚～5枚にすることにより放熱効果があり、表示ムラが発生しない。

【0050】

(第4の実施形態)

第4の実施形態の液晶表示装置10について図6、図13に基づいて説明する。

【0051】

第1の実施形態から第3の実施形態においては、液晶パネル12の温度上昇を防ぎ、あるいはまた、液晶パネル12に加わる熱温度分布が均一となるようにすることを目的とし

た。しかし、表示ムラが発生するという問題は液晶パネル12の温度上昇が直接的な原因ではなく、むしろ液晶パネル12が不均一な温度状態になることにある。

【0052】

したがって、本実施形態の液晶表示装置10では、図6に示すように、PC基板16の表面側に設けられたトランス24にシリコンゴムシート28を全面に接触させ、このシリコンゴムシート28からの熱がバックライト14に均一に伝わるようにバックライト14の裏面側に放熱板34を設け、トランス24とバックライト14とでシリコンゴムシート28と放熱板34とを挟む構成としている。

【0053】

なお、放熱板34としては金属板が好ましく、また、バックライト14のバックライトフレーム22を金属製として、放熱板34を兼ねてもよい。

【0054】

本実施形態の液晶表示装置10であっても、PC基板16からの熱がバックライト14及び液晶パネル12に均等に伝わるため、温度ムラによる不均一な表示ムラを防止することができる。

【0055】

本発明者が、間隔B、シリコンゴムシート28の枚数c、放熱板34の枚数dとを替えて実験したところ、図13に示すような結果となった。なお、間隔BとはPC基板16とフレーム18との間の距離である。

【0056】

本実施形態であっても、間隔BについてPC基板16とフレーム18とを密接させた状態0mm～30mm開け、また、シリコンゴムシート28も1枚～5枚、放熱板34の個数dを1枚にすることにより放熱効果及び熱の分散均一化に効果があり、表示ムラが発生しない。

【図面の簡単な説明】

【0057】

【図1】本発明の第1の実施形態の液晶表示装置の縦断面図である。

【図2】第1の実施形態の変更例の液晶表示装置の縦断面図である。

【図3】第2の実施形態の液晶表示装置の縦断面図である。

【図4】第2の実施形態の変更例の液晶表示装置の縦断面図である。

【図5】第3の実施形態の液晶表示装置の縦断面図である。

【図6】第4の実施形態の液晶表示装置の縦断面図である。

【図7】従来の液晶表示装置の縦断面図である。

【図8】第1の実施形態における実験結果を示す表の図である。

【図9】第1の実施形態の変更例における実験結果を示す表の図である。

【図10】第2の実施形態における実験結果を示す表の図である。

【図11】第2の実施形態の変更例における実験結果を示す表の図である。

【図12】第3の実施形態における実験結果を示す表の図である。

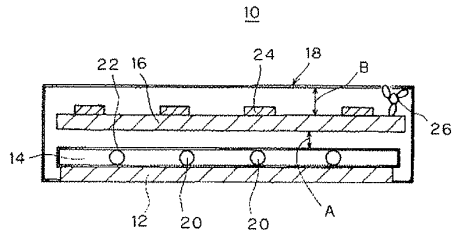
【図13】第4の実施形態の変更例における実験結果を示す表の図である。

【符号の説明】

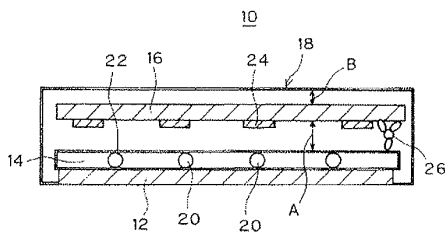
【0058】

- 10 液晶表示装置
- 12 液晶パネル
- 14 バックライト
- 16 PC基板
- 18 フレーム
- 20 ランプ
- 22 バックライトフレーム
- 24 トランス
- 26 冷却ファン

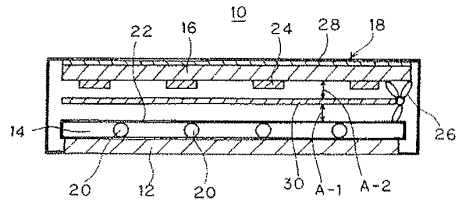
【図1】



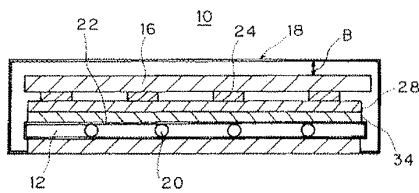
【図2】



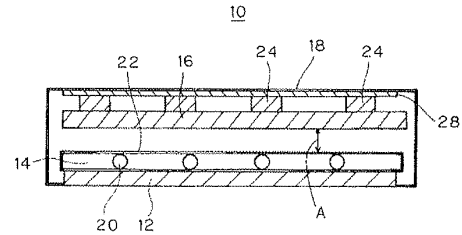
【図5】



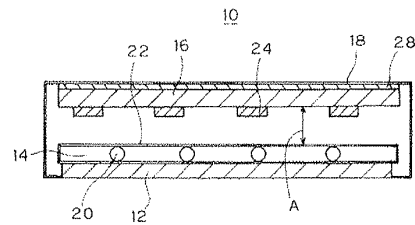
【図6】



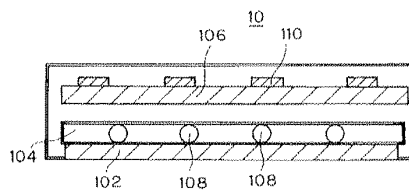
【例3】



【图4】



【図7】



【図8】

(単位: mm)		
効果的な範囲	最小	最大
A 距離	5	30
B 距離	5	30
a 個数	1	5

【例9】

(単位: mm)		
効果的な範囲	最小	最大
A 距離	5	30
B 距離	5	30
a 個数	1	5

【図10】

(単位：mm)

効果的な範囲	最小	最大
A 距離	5	30
c 個数	1	5

【図11】

(単位：mm)

効果的な範囲	最小	最大
A 距離	5	30
c 個数	1	5

【図12】

(単位：mm)

効果的な範囲	最小	最大
A-1 距離	5	30
A-2 距離	5	30
a 個数	1	5
b 個数	1	5
c 個数	1	5

【図13】

(単位：mm)

効果的な範囲	最小	最大
B 距離	0	30
c 個数	1	5
d 個数	1	

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	Filing Date		2009-06-05
	First Named Inventor	Jin Sub KIM	
	Art Unit		
	Examiner Name		
	Attorney Docket Number		103-1284

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EFS ID:	5455732
Application Number:	12478832
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Confirmation Number:	1220
Title of Invention:	LIQUID CRYSTAL DISPLAY DEVICE
First Named Inventor/Applicant Name:	Jin Sub KIM
Customer Number:	38209
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1	Transmittal of New Application	UtilityTransmittal.pdf	198073	no	1
			d8e72355c59e3453a2ecfb6f32f7f67cb747b639		
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COMBINED DECLARATION/POWER OF ATTORNEY FOR UTILITY/DESIGN PATENT APPLICATION

As a below named Inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe that I am the original, first and sole Inventor (if only one name is listed below) or an original, first and joint Inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

LIQUID CRYSTAL DISPLAY DEVICE

The specification of which is attached hereto, unless the following box is checked:

☐ was filed on _____ as United States Application Number or PCT Application Number _____ and was amended on (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 C.F.R. § 1.56.

I hereby claim foreign priority benefit(s) under 35 U.S.C. § 119(a)-(c) of any foreign application(s) for patent or inventor certificate listed below and have also identified below any foreign application(s) for patent or inventor certificate having a filing date before the application on which priority is claimed.

Prior Foreign Application(s)

Priority NOT

Claimed ☐

2008-55687
(Number)

Republic of Korea
(Country)

13/June/2008
Day/Month/Year Filed

I hereby claim the benefit under 35 U.S.C. § 120 or § 110(c) of any United States application(s), or § 365(c) of any PCT International application designating the United States listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application(s) in the manner provided by the first paragraph of 35 U.S.C. § 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 C.F.R. § 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application.

(Application Serial No.)

(Filing Date)

(Status-patented, pending, abandoned)

I hereby appoint the attorneys and agents of Stanzone & Kim, LLP under USPTO Customer No. 38,209 to prosecute the application and to transact all business in the Patent and Trademark Office connected therewith.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issues thereon.

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☒ Additional Inventors are being named on separately numbered sheets attached hereto.

COMBINED DECLARATION/POWER OF ATTORNEY FOR UTILITY/DESIGN PATENT APPLICATION

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TITLE OF THE INVENTION

LIQUID CRYSTAL DISPLAY DEVICE

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority under 35 U.S.C. §119(a) from Korean Patent Application No. 2008-0055687, filed on June 13, 2008 in the Korean Intellectual Property Office, the disclosure of which is incorporated herein in its entirety by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0002] The present general inventive concept relates to a liquid crystal display device, and, more particularly, to a liquid crystal display device with a heat dissipation structure to cool a liquid panel of the device.

2. Description of the Related Art

[0003] Liquid crystal display (LCD) devices are widely used in display applications such as displays of meters for automobiles and/or construction equipment, laptop computers, mobile phones, TVs, etc.

[0004] An LCD device generally includes a liquid crystal panel and a backlight unit (BLU) to apply light to a rear side of the liquid crystal panel. The liquid crystal panel consists of a pair of substrates which face each other with a liquid crystal layer interposed therebetween. The backlight unit includes a light source to emit the light to the liquid crystal panel. Such light source may include a cold cathode fluorescent tube, a light emitting diode (LED), and the like.

[0005] The light source in the backlight unit not only emits light but also generates heat to cause degradation of liquid crystals. Therefore, the LCD device must include a heat dissipation element to discharge or release the heat generated by the light source. The heat dissipation element is typically located at a rear side relative to the liquid crystal panel, such that this releases the heat generated from the BLU mounted on the rear side of the liquid crystal panel.

[0006] Thus, when the LCD device is used outdoors, a front side of the liquid crystal panel is exposed to sunlight, leading to an increase in temperature and degradation of the panel. Accordingly, the LCD device must only be used in a limited place, such as a room. That is,

conventional LCD devices are not applicable to outdoor billboards to which sunlight energy is incident for long periods of time.

[0007] In order to solve the problems described above due to limitations and disadvantages of the related art, the present general inventive concept is directed an LCD device with a heat dissipation structure to remove or release heat incident on a front side of a liquid crystal panel.

SUMMARY OF THE INVENTION

[0008] Additional aspects and utilities of the present general inventive concept will be set forth in part in the description which follows and, in part, will be obvious from the description, or may be learned by practice of the general inventive concept.

[0009] The foregoing and/or other aspects and utilities of the general inventive concept may be achieved by providing a liquid crystal display (LCD) device including a liquid crystal panel, a protection panel arranged a predetermined distance from the liquid crystal panel, and a flow control device to impart turbulence to an air flow in a channel, which is defined between the liquid crystal panel and the protection panel.

[0010] The flow control device may be a cooling fan to blow air to the channel.

[0011] The flow control device may also include a temperature sensor to detect a temperature of air having passed through the channel, and a flow rate controller to regulate a flow rate of the air blown from the cooling fan.

[0012] The flow control device may regulate a flow rate of air in the cooling fan, which in turn, controls a flow velocity of air in the channel in a range of 4m/s to 14m/s.

[0013] The channel may be defined between the liquid crystal panel and the protection panel and has a spacing distance in a range of 5 to 25mm.

[0014] The channel may be an air inlet to receive air and an air outlet to discharge the received air from the channel. The cooling fan may be located near the air inlet.

[0015] Each of the air inlet and the air outlet may be provided with a dust filter to remove foreign matter from the air.

[0016] The LCD device may include a backlight unit and a circuit board, both provided at the rear side of the liquid crystal panel, and a rear panel spaced apart from the backlight unit and the circuit board. The air passing through the channel, which is defined between the protection panel and the liquid crystal panel, may flow via another channel formed by the backlight unit and

the circuit board so as to remove heat generated from the backlight unit and the circuit board.

[0017] The foregoing and/or other aspects and utilities of the general inventive concept may also be achieved by providing a liquid crystal display (LCD) including a liquid crystal panel, a protection panel arranged a predetermined distance from the liquid crystal panel, and a flow control device to detect a variation in temperature caused by heat incident on the front side of the liquid crystal panel, and to control a flow rate of the air blowing toward a channel, which is defined between the liquid crystal panel and the protection panel.

[0018] The flow control device may have a flow rate controller to regulate the flow rate of the air such that air in the channel has a flow velocity of not less than 4m/s when the channel defined between the liquid crystal panel and the protection panel has a spacing distance in the range of 5 to 25mm.

[0019] The flow control device may also have a temperature sensor to detect a temperature variation of the air having passed through the channel. The flow rate controller is operated by a signal transmitted from the temperature sensor.

[0020] The foregoing and/or other aspects and utilities of the general inventive concept may also be achieved by providing a liquid crystal display (LCD) device including a housing partitioned into upper and lower spaces, a liquid crystal panel assembly arranged in the upper space, and an air conditioner arranged in the lower space to blow air to the liquid crystal assembly to cool the liquid crystal assembly.

[0021] The LCD device may also include a flow control device to impart turbulence to air blowing toward the liquid crystal panel assembly and, thus, to cool the liquid crystal panel assembly.

[0022] The housing may include a protection panel formed at the front side thereof, and the air conditioner has a cooling fan to blow the air to a channel formed by the protection panel and the liquid crystal panel assembly.

[0023] The flow control device may also have a flow rate controller to regulate a flow rate of the air blown from the cooling fan such that the air in the channel has a controlled flow velocity.

[0024] The channel may be formed in a space between the liquid crystal panel assembly and the protection panel by a spacing distance in the range of 0.005 to 0.025m (that is, 5 to 25mm). The flow rate controller regulates the flow rate of the air in the cooling fan such that the flow velocity of air in the channel may be maintained at 4m/s or more.

[0025] The flow control device may also include a temperature sensor to measure a temperature of the air having passed through the channel, and to send a resulting signal to the flow rate controller.

[0026] The flow rate controller may control the cooling fan such that the flow velocity of the air in the channel may be maintained at 14m/s or less.

[0027] The liquid crystal panel assembly includes a liquid crystal panel, a backlight unit to irradiate light to the liquid crystal panel, and a circuit board to control the liquid crystal panel and the backlight unit.

[0028] The foregoing and/or other aspects and utilities of the general inventive concept may also be achieved by providing a display device including a liquid crystal panel to display an image, a protection panel to protect the liquid crystal panel, and a channel formed between the liquid crystal panel and the protection panel to pass air therebetween to remove heat from a front side of the liquid crystal panel, wherein a distance between the liquid crystal panel and the protection panel is in a range of 5mm to 25mm.

[0029] The foregoing and/or other aspects and utilities of the general inventive concept may also be achieved by providing a display device including a liquid crystal panel to display an image, a protection panel to protect the liquid crystal panel, a channel formed between the liquid crystal panel and the protection panel, and a flow control device to provide turbulent air in the channel to remove heat from a front side of the liquid crystal panel.

[0030] The flow control device may include a cooling fan to blow the air to the first channel, a flow rate controller to regulate a flow rate of air in the cooling fan to control a flow velocity of the air in the channel, and a temperature sensor to measure temperature of the air having passed through the first channel, and to send a resulting signal to the flow rate controller.

[0031] A distance between the liquid crystal panel and the protection panel may be determined by a static pressure-flow rate curve of the cooling fan.

[0032] The foregoing and/or other aspects and utilities of the general inventive concept may also be achieved by providing a display device including a housing a display assembly disposed inside the housing and spaced apart from the housing to form front, top, and rear air flow channels in order.

[0033] The display device may further include a flow control device to generate an air flow to flow air through the front, top and rear air channels in order.

[0034] The flow control device may include an air conditioner to generate a cooling air as the air flows.

[0035] Each of the LCD devices with the constructions described above according to the present general inventive concept has an advantage of not being degraded even when used outdoors and, therefore, is effectively applicable regardless of location.

[0036] Furthermore, the cooling fan in the LCD device of the present general inventive concept can be controlled depending on the outdoor environments, thereby possibly reducing electric power consumption.

BRIEF DESCRIPTION OF THE DRAWINGS

[0037] These and/or other aspects and utilities of the present general inventive concept will become apparent and more readily appreciated from the following description of the embodiments, taken in conjunction with the accompanying drawings of which:

[0038] FIG. 1 is a perspective view illustrating a liquid crystal display device according to an embodiment of the present general inventive concept;

[0039] FIG. 2 is a side cross-sectional view illustrating the liquid crystal display device of FIG. 1;

[0040] FIG. 3 is a rear side view illustrating the liquid crystal display device of FIG. 1;

[0041] FIG. 4 illustrates a table for maximum temperatures of a liquid crystal with respect to solar radiation at an outdoor temperature of 45°C and flow velocity of air in a first channel, when the first channel is formed at a spacing distance of 0.004m;

[0042] FIG. 5 illustrates a table for maximum temperatures of a liquid crystal with respect to solar radiation at an outdoor temperature of 45°C and flow velocity of air in a first channel, when the first channel is formed at a spacing distance of 0.005m;

[0043] FIG. 6 illustrates a table for maximum temperatures of a liquid crystal with respect to solar radiation at an outdoor temperature of 45°C and flow velocity of air in a first channel, when the first channel is formed at a spacing distance of 0.025m;

[0044] FIG. 7 illustrates a table for maximum temperatures of a liquid crystal with respect to solar radiation at an outdoor temperature of 45°C and flow velocity of air in a first channel, when the first channel is formed at a spacing distance of 0.03m;

[0045] FIG. 8 is a graph illustrating a static pressure-flow rate curve of a typical cooling fan;

[0046] FIG. 9 illustrates a table for Reynolds numbers with respect to different flow velocities of air in a first channel depending on a spacing distance of the same; and

[0047] FIG. 10 is a cross sectional view illustrating a liquid crystal display device according to another embodiment of the present general inventive concept.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0048] Reference will now be made in detail to embodiments of the present general inventive concept, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to the like elements throughout. The embodiments are described below to explain the present general inventive concept by referring to the figures.

[0049] A description will be given of an exemplary embodiment of the present general inventive concept with reference to FIGS. 1 to 3.

[0050] FIG. 1 is a perspective view illustrating a liquid crystal display device according to the exemplary embodiment of the present general inventive concept. A display device, such as a flat display panel or a PDP apparatus, can be used as the liquid crystal display device.

[0051] As illustrated in FIG. 1, the liquid crystal display device includes a housing 10 and a bottom plate 11 arranged beneath the housing 10 to support the same. The housing 10 includes two opposite side panels 13, a top panel 14 to join the side panels 13, a protection panel 12 provided at a front side of the housing 10, and a rear panel 15 provided at a rear side of the housing 10. The housing 10 is equipped with an LCD assembly 20 having a liquid crystal panel 21 therein. The protection panel 12 may be prepared using a transparent material such as glass such that an image displayed by the liquid crystal panel 21 (as illustrated in FIG. 2) can be viewed outside the housing 10.

[0052] FIG. 2 is a side cross-sectional view and FIG. 3 is a rear perspective view illustrating the liquid crystal display device illustrated in FIG. 1.

[0053] As illustrated in FIGS. 2 and 3, the housing 10 is partitioned into upper and lower spaces by a partition 16 built in the housing. There is a liquid crystal panel assembly 20 in the upper space while an air conditioner 30 is arranged in the lower space. A display panel assembly, such as a flat display assembly or a PDP assembly, can be used as the LCD assembly 20. The liquid crystal panel 21 which displays an image is included in the liquid crystal

panel assembly 20. The liquid crystal panel assembly 20 also includes a backlight unit 22 located at a rear side of the liquid crystal panel 21 to irradiate light thereto, and a circuit board 23 located at a rear side of the backlight unit 22 to control operation of the liquid crystal panel 21 and the backlight light 22. The air conditioner 30 includes an evaporator 31 and a cooling fan at an upper portion thereof, as well as a compressor 33, a condenser 34 and an air blowing fan 35 at a lower portion thereof.

[0054] The liquid crystal panel assembly 20 is disposed such that the liquid crystal panel assembly 20 is spaced apart from the protection panel 12 at the front side of the housing 10. The liquid crystal panel assembly 20 is also spaced apart from the rear panel 15 at the rear side of the housing 10. The liquid crystal panel assembly 20 is also spaced from the top panel 14 of the housing 10. Accordingly, air in the housing 10 can pass through a first channel 41 defined between the liquid crystal panel assembly 20 and the protection panel 12, a second channel 42 defined between the liquid crystal panel assembly 20 and the top panel 14 of the housing 10, and a third channel 43 defined between the liquid crystal panel 20 and the rear panel 15. The first channel 41 has a first distance D1, the second channel 42 has a second distance D2, and the third channel 43 has a third distance D3. The third distance D3 may be different from the first distance D1 and the second distance D2.

[0055] The partition 16 has an air outlet 18 at a rear portion thereof such that the upper space and lower spaces of the housing 10 can communicate with each other. Therefore, the air in the third channel 43 can move toward the evaporator 31. The partition 16 also has an air inlet 17 at a front portion thereof such that the upper and lower spaces of the housing 10 communicate with each other. As a result, air blown from the cooling fan 32 can move to the first channel 41.

[0056] The cooling fan 32 has an exit 36 arranged at the air inlet 17 where air emerging from the exit 36 passes through the first channel 41. Therefore, the air blown toward the first channel 41 by the cooling fan 32 is maintained at a relatively low temperature because it has already passed through the evaporator 31. Accordingly, the air blown toward the first channel 41 by the cooling fan 32 removes heat incident on the front side of the liquid crystal panel 21 and cools the liquid crystal panel 21 while passing through the first channel 41. The heat incident on the front side of the liquid crystal panel 21 may include solar radiation, heat transfer caused by a variation in ambient temperature, and the like. After passing through the first channel 41, the air passes through the second and third channels 42 and 43 in this order. In particular, the air passing through the third channel 43 removes heat generated from the backlight unit 22 and the

circuit board 23. After emerging from the third channel 43, the air is cooled again while passing through the evaporator 31.

[0057] An air flow process in the housing 10 will be described in detail below: the cooled air having passed through the evaporator 31 passes through the air inlet 17 by the cooling fan 32. Next, the air sequentially passes through the first, second and third channels 41, 42 and 43. Herein, the air removes the heat incident on the front side of the liquid crystal panel 21 while passing through the first channel 41 as well as the heat generated from the backlight unit 22 and the circuit board 23 during passage through the third channel 43. Following this, the air returns to the evaporator 31 through the air outlet 18.

[0058] As is apparent from the description disclosed above, in the liquid crystal display device of the present general inventive concept, the liquid crystal panel assembly 20 is disposed in the upper space and the air conditioner 30 is disposed in the lower space of the housing 10, so that the air conditioner 30 can cool the liquid crystal panel assembly 20. However, when the liquid crystal display device is located outside and is continuously exposed to solar radiation and, when the external temperature increases in the summer, the front side of the liquid crystal panel 21 is heated and leads to a rapid increase in temperature of liquid crystals in the panel, which in turn, results in degradation of liquid crystals. Therefore, a method may be devised that improves performance of the air conditioner 30 to decrease the temperature of air blowing toward the first channel 41 to prevent degradation of liquid crystals. However, in order to improve the performance of the air conditioner 30, the air conditioner 30 must be enlarged, which may result in increased manufacturing costs. Consequently, in consideration of various requirements and manufacturing costs that inhibit the liquid crystal display device from being infinitely enlarged, another approach to prevent degradation of liquid crystals is still required.

[0059] The LCD device of the present general inventive concept is configured such that the air passing through the first channel 41 can sufficiently absorb the heat incident on the front side of the liquid crystal panel 21, taking into consideration the fact that the degradation of liquid crystals occurs due to the heat incident on the front side of the liquid crystal panel 21. Thus, if the air passing through the first channel 41 is turbulent, the turbulent air flow can considerably remove the heat incident on the front side of the liquid crystal panel 21, compared to a laminar flow. One reason for this is presumed to be because the turbulent air flow has greater inertia than the laminar flow to induce a variation of velocity over time, therefore, this abnormal flow accelerates mixing in a boundary layer, resulting in improved momentum and heat transfer performance.

[0060] Hereinafter, a description will be given of a spacing distance “d” of the first channel 41 to generate a turbulent air flow in the first channel 41 and the flow velocity of air blown toward the first channel 41 by the cooling fan 32.

[0061] FIG. 3 illustrates that the liquid crystal panel assembly 20 is fixed to the opposite side panels 13 of the housing 10 by U-shaped coupling pieces 24. When fixing the liquid crystal panel assembly 20 to the housing 10, the liquid crystal panel 21 may be located a spacing distance “d” from the protection panel 12 and the spacing distance D1 is regulated in a range of 5 to 25mm. If D1 is less than 5mm, the liquid crystal panel 21 has a high risk of damage where the protection panel 12 fails due to an external impact. Alternatively, if D1 exceeds 25mm, the protection panel 12 has a relatively high index of refraction, which may cause a problem that an image displayed by the liquid crystal panel 21 cannot be clearly viewed.

[0062] FIGS. 4 to 7 illustrate tables of maximum temperatures of the LC with respect to solar radiation at an outdoor temperature of 45°C and flow velocity of the first channel. In particular, FIG. 4 illustrates the table when the spacing distance D1 of the first channel 41 is 0.004m and, likewise, FIG. 5 illustrating a case that the spacing distance D1 of the first channel 41 is 0.005m, FIG. 6 illustrating a case that the spacing distance D1 of the first channel 41 is 0.025m and FIG. 7 illustrating a case that the spacing distance D1 of the first channel 41 is 0.03m.

[0063] To consider that ambient temperature can reach a maximum of about 45°C under typical outdoor environments and solar radiation generally ranges from 600 to 850 W/m² with a maximum of about 1100 W/m², determining the flow velocity of air in the first channel 41 is possible, which is required to prevent degradation of liquid crystals. It is generally known that the liquid crystals are degraded at temperatures above 70°C. As such, the flow velocity of air in the first channel 41 may be determined based on the above conditions.

[0064] Referring to FIGS. 4 and 5, if the first channel 41 has a spacing distance D1 of 0.004m, the air has a maximum flow velocity of 16m/s to prevent the degradation of liquid crystals. Likewise, if the first channel 41 has a spacing distance D1 of 0.005m, the maximum flow velocity of air to prevent the degradation of liquid crystals is 14m/s. Also, as illustrated in FIGS. 6 and 7, the maximum flow velocity of air required to prevent the degradation of liquid crystals is 10 m/s, which is substantially the same in cases that the first channel 41 has the spacing distance D1 of 0.025m and 0.03m, respectively.

[0065] However, if the spacing distance D1 of the first channel 41 is too narrow, an excessive pressure drop may occur while achieving a desired flow velocity of air. On the contrary, when

the spacing distance D1 of the first channel 41 is too wide, an excessively high air flow rate may be required to achieve the desired flow velocity of air. For a common LCD device where the LCD device 21 has a size of 46 inches and the cooling fan 32 is a typical one, the spacing distance D1 of the first channel 41 may be determined by a static pressure-flow rate curve of the cooling fan 32.

[0066] FIG. 8 is a graph illustrating the static pressure-flow rate curve of a typical cooling fan.

[0067] With reference to FIG. 8, the spacing distance D1 of the first channel 41 where the pressure drop is acceptable will hereinafter be described in more detail.

[0068] When the spacing distance D1 of the first channel 41 is 0.004m, the maximum flow velocity of air required to prevent the degradation of liquid crystals is 16m/s. Herein, the pressure drop may be calculated by the following equation 1:

[Equation 1]

$$\Delta P = f\rho(LV^2)/2D_h$$

$$= 622 \text{ Pa}$$

wherein f is a coefficient of friction; ρ is density; L is the length of a liquid crystal panel; V is a flow velocity; and Dh is a hydraulic diameter.

[0069] When the spacing distance D1 of the first channel 41 is 0.005m, the maximum flow velocity of air required to prevent the degradation of liquid crystals is 14m/s. Herein, the pressure drop may be calculated by the above equation 1, as follows.

$$\Delta P = f\rho(LV^2)/2D_h = 371 \text{ Pa}$$

[0070] Referring to FIG. 8, which illustrates the static pressure-flow rate curve of the cooling fan, in conjunction with the pressure drop obtained from equation 1, when the spacing distance D1 of the first channel 1 is 0.004m, the pressure drop is 622 Pa which is considerably higher than the critical static pressure of the cooling fan 32, that is, 392 Pa. Alternatively, if the spacing distance d of the first channel is 0.005m, the pressure drop is 371 Pa, which is within an effective operational range of the cooling fan 32. Accordingly, a minimum spacing distance “d1” of the channel 41 may be determined to be 0.005m.

[0071] Next, referring to FIG. 8, a description will be given of a limitation for the flow rate of air depending on the spacing distance D1 of the first channel 41 below.

[0072] When the spacing distance D1 of the first channel 41 is 0.025m, the maximum flow velocity required to prevent the degradation of liquid crystals is 10m/s. Herein, a desired flow rate of air may be calculated by the following equation 2:

[Equation 2]

$$\begin{aligned} Q &= VA \\ &= 10 * 0.6 * 0.025 \\ &= 0.15 \text{ m}^3/\text{s} \\ &= 9 \text{ CMM} \end{aligned}$$

wherein V is a flow velocity, and A is a cross-sectional area.

[0073] If the spacing distance D1 of the first channel 41 is 0.03m, the maximum flow velocity of air required to prevent the degradation of liquid crystals is 10m/s. Herein, the desired flow rate of air may be calculated by the above equation 2, as follows.

$$Q = VA = 10 * 0.6 * 0.03 = 0.18 \text{ m}^3/\text{s} = 10.8 \text{ CMM}$$

[0074] Referring to FIG. 8, which illustrates the static pressure-flow rate curve of the cooling fan, in conjunction with the flow rate of air obtained from equation 2, when the spacing distance D1 of the first channel 1 is 0.025m, the desired flow rate is 9CMM which is within a critical flow rate of air in the cooling fan 32, that is, 10CMM. Alternatively, if the spacing distance D1 of the first channel is 0.03m, the desired flow rate is 10.8CMM over the critical flow rate described above. Accordingly, in consideration of the flow rate condition, the spacing distance D1 of the first channel 41 must be less than 0.025m. Moreover, the critical flow rate of air in the cooling fan 32, 10CMM, is a value only possible under free flow conditions without pressure drop. However, since the pressure drop must be considered for a real flow, for example, the first channel 41 has the maximum spacing distance “d2” of 0.025m.

[0075] Consequently, to consider functions of the protection panel 12 as well as the static pressure-flow rate curve of the cooling fan 32, the spacing distance D1 of the first channel 41 may be defined in the range of 0.005 to 0.025m.

[0076] The above description was given of the maximum flow velocity required to prevent the degradation of liquid crystals depending on the spacing distance D1 of the first channel 41. However, even when the LCD device is located outside, maintaining the flow velocity of air which flows through the first channel 31 at a maximum level is unnecessary. This is because

outdoor air temperature is typically below 45 °C and the solar radiation is also generally less than 1100W/m².

[0077] Referring to FIG. 2, the LCD device of the present general inventive concept includes the flow control device 50 to regulate the flow rate of air in the cooling fan 32 based on the temperature around the liquid crystal panel assembly 20, which in turn, controls the flow velocity of air flowing through the first channel 41. That is, when the outdoor air temperature is below 45 °C and the solar radiation is less than 1100W/m² such that the maximum flow velocity is not needed, the flow control device 50 controls the cooling fan 32 to regulate the flow velocity of air in the first channel 41 to be maintained at a lower level.

[0078] The flow control device 50 includes the cooling fan 32 to blow air to the first channel 41, the temperature sensor 52 that measures the temperature of air emerging from the first channel 41, and the flow rate controller 51 that controls the cooling fan 32 according to a signal transmitted from the temperature sensor 52. The temperature sensor 52 determines the temperature when the air absorbed heat as much as possible while passing through the first to third channels 41, 42 and 43, in order. For this reason, the temperature sensor 52 may be arranged near the outlet 18 provided at the partition 16.

[0079] When the flow control device 50 imparts turbulence to air in the first channel 41, the turbulent air flow may effectively remove heat incident on the front side of the liquid crystal panel 21. Accordingly, the flow control device 50 must control the cooling fan 32 such that the air in the first channel 41 has a flow velocity required to impart turbulence to the air flow.

[0080] Thus, the following description will be given of flow velocity conditions for the first channel 2 to generate a turbulent air flow where the spacing distance D1 of the first channel 41 ranges from 0.005 to 0.025m. It is well known that the Reynolds number is an indication index to distinguish a laminar flow from a turbulent flow in a channel and may be defined by the following equation:

$$Re = VD/\nu$$

wherein V is a flow velocity; D is a hydraulic diameter; and ν is kinematic viscosity.

[0081] Flows with a Reynolds number of not more than 2300 are defined as laminar and, if the Reynolds number exceeds 2300, the flow may be considered turbulent.

[0082] FIG. 9 illustrates a table of Reynolds numbers with respect to different flow velocities of air in the first channel depending on the spacing distance of the first channel.

[0083] With reference to FIG. 9, achieving a minimum flow velocity of air sufficient to generate a turbulent flow is possible. Also, the flow velocity of air must be at least 4m/s in order to generate a turbulent flow, where the channel has the spacing distance of 0.005m. As a result, the minimum flow velocity may be assumed to be 4m/s, which is required to reduce the solar radiation incident on the front side of the liquid crystal panel 21 using the turbulent flow. Therefore, the flow rate controller 51 in the flow control device 50 must regulate the flow rate of air in the cooling fan 32 such that the air in the first channel 41 has a controlled flow velocity of at least 4m/s.

[0084] Consequently, the flow control device 50 may control the cooling fan 32 to maintain the flow velocity of at least 4m/s such that a turbulent flow is generated in the channel 41, while regulating the flow velocity up to a maximum value of 14m/s required to prevent degradation of liquid crystals. In this case, the temperature sensor 52 measures the temperature of the air having passed through all of the first to third channels 41, 42 and 43, and the flow rate controller 51 regulates the flow rate of air in the cooling fan 32 according to a signal transmitted from the temperature sensor 52 such that the air in the first channel 41 has a flow velocity ranging from 4m/s to 14m/s.

[0085] FIG. 10 is a cross sectional view illustrating a liquid crystal display device according to another embodiment of the present general inventive concept.

[0086] The LCD device illustrated in FIG. 10 is substantially identical to that illustrated in FIG. 2, except that the air conditioner 30 is omitted. Since the incident heat on the front side of the liquid crystal panel 21 is mostly removed by the turbulent flow flowing through the first channel 41, the LCD device illustrated in FIG. 10 does not include any additional air conditioner 30 (see FIG. 2).

[0087] With regard to an air flowing structure in the housing 10, air flows through an opening 19 formed through the rear panel 15 into the cooling fan 32. After dust filters 60 filter foreign materials from the air, the cooling fan 32 passes the filtered air through the air inlet 17. Following this, the air sequentially flows through the first, second and third channels 41, 42 and 43. The air removes heat incident on the front side of the liquid crystal panel 21 while passing through the first channel 41. Alternatively, the air also removes heat generated from the BLU 22 and the circuit board 23 during passage through the third channel 43. Thereafter, the air is discharged through the air outlet 18 out of the housing 10.

[0088] Similarly to the LCD device illustrated in FIG. 2, the LCD device illustrated in FIG. 10

also has the flow control device 50 to impart turbulence to the air in the first channel 41. The flow control device 50 includes the cooling fan 32 to blow air to the first channel 41, the flow rate controller 51 that regulates the flow rate of air in the cooling fan 32 to control the flow velocity of air in the first channel 41, and the temperature sensor 52 that measures temperature of the air having passed through the first channel 41 and sends the resulting signal to the flow rate controller 51.

[0089] In this regard, the first channel is located a spacing distance D1 in the range of 0.005 to 0.025m, and the flow rate controller 51 controls the cooling fan 32 to maintain the flow velocity of air in the first channel 41 in the range of 4 to 14m/s.

[0090] Such conditions, that is, the spacing distance D1 of the first channel 41 and the flow velocity of the air in the first channel 41 have been described with reference to FIGS. 4 to 9, therefore, no further detailed description of the same conditions will be given.

[0091] Although various embodiments of the present general inventive concept have been illustrated and described, it would be appreciated by those skilled in the art that changes may be made in these embodiments without departing from the principles and spirit of the general inventive concept, the scope of which is defined in the claims and their equivalents.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		
	Filing Date		2009-06-05
	First Named Inventor	Jin Sub KIM	
	Art Unit		
	Examiner Name		
	Attorney Docket Number		103-1284

CERTIFICATION STATEMENT

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

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☐ Fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ None

SIGNATURE

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

Signature	/Seungman Kim/	Date (YYYY-MM-DD)	2009-06-05
Name/Print	Seungman Kim	Registration Number	50,012

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. **DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
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7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
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9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

UTILITY PATENT APPLICATION TRANSMITTAL (Only for new nonprovisional applications under 37 CFR 1.53(b))	Attorney Docket No.	103-1284
	First Inventor	Jin Sub KIM
	Title	LIQUID CRYSTAL DISPLAY DEVICE
	Express Mail Label No.	

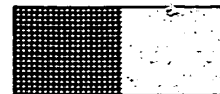
APPLICATION ELEMENTS See MPEP chapter 600 concerning utility patent application contents.	ADDRESS TO: Commissioner for Patents P.O. Box 1450 Alexandria VA 22313-1450
1. ☒ Fee Transmittal Form (e.g., PTO/SB/17) (Submit an original and a duplicate for fee processing) 2. ☐ Applicant claims small entity status. See 37 CFR 1.27. 3. ☒ Specification [Total Pages <u>20</u>] Both the claims and abstract must start on a new page (For information on the preferred arrangement, see MPEP 608.01(a)) 4. ☒ Drawing(s) (35 U.S.C. 113) [Total Sheets <u>10</u>] 5. Oath or Declaration [Total Sheets <u>2</u>] a. ☒ Newly executed (original or copy) b. ☐ A copy from a prior application (37 CFR 1.63(d)) (for continuation/divisional with Box 18 completed) i. ☐ DELETION OF INVENTOR(S) Signed statement attached deleting inventor(s) name in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b). 6. ☐ Application Data Sheet. See 37 CFR 1.76 7. ☐ CD-ROM or CD-R in duplicate, large table or Computer Program (Appendix) ☐ Landscape Table on CD 8. Nucleotide and/or Amino Acid Sequence Submission (if applicable, items a. – c. are required) a. ☐ Computer Readable Form (CRF) b. Specification Sequence Listing on: i. ☐ CD-ROM or CD-R (2 copies); or ii. ☐ Paper c. ☐ Statements verifying identity of above copies	ACCOMPANYING APPLICATION PARTS 9. ☒ Assignment Papers (cover sheet & document(s)) Name of Assignee <u>Samsung Electronics Co., Ltd</u> <u>Suwon-si, Republic of Korea</u> 10. ☐ 37 CFR 3.73(b) Statement (when there is an assignee) ☒ Power of Attorney 11. ☐ English Translation Document (if applicable) 12. ☒ Information Disclosure Statement (PTO/SB/08 or PTO-1449) ☒ Copies of citations attached 13. ☐ Preliminary Amendment 14. ☐ Return Receipt Postcard (MPEP 503) (Should be specifically itemized) 15. ☒ Certified Copy of Priority Document(s) (if foreign priority is claimed) 16. ☐ Nonpublication Request under 35 U.S.C. 122(b)(2)(B)(i). Applicant must attach form PTO/SB/35 or equivalent. 17. ☐ Other: _____
18. If a CONTINUING APPLICATION, check appropriate box, and supply the requisite information below and in the first sentence of the specification following the title, or in an Application Data Sheet under 37 CFR 1.76: ☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No.: _____ Prior application information: _____ Examiner: _____ Art Unit: _____	

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If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Electronic Patent Application Fee Transmittal				
Application Number:				
Filing Date:				
Title of Invention:		LIQUID CRYSTAL DISPLAY DEVICE		
First Named Inventor/Applicant Name:		Jin Sub KIM		
Filer:		Seungman Kim/Aisha Goins		
Attorney Docket Number:		103-1284		
Filed as Large Entity				
Utility under 35 USC 111(a) Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Utility application filing	1011	1	330	330
Utility Search Fee	1111	1	540	540
Utility Examination Fee	1311	1	220	220
Pages:				
Claims:				
Claims in excess of 20	1202	5	52	260
Independent claims in excess of 3	1201	3	220	660
Miscellaneous-Filing:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
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Total in USD (\$)				2010



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출원 번호 : 10-2008-0055687

Application Number

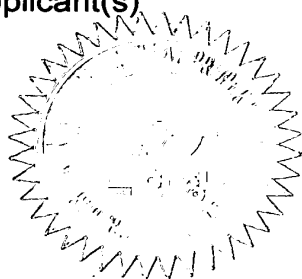
출원 년 월 일 : 2008년 06월 13일

Filing Date JUN 13, 2008

출원인 : 삼성전자주식회사

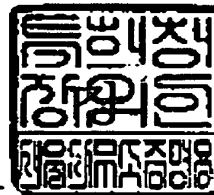
Applicant(s) SAMSUNG ELECTRONICS CO., LTD.

2008년 07월 31일



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【서지사항】

【서류명】 특허출원서

【참조번호】 0003

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【포괄위임등록번호】 2005-053352-1

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【대리인코드】 9-1998-000289-6

【포괄위임등록번호】 2003-068131-1

【발명의 국문명칭】 액정표시장치

【발명의 영문명칭】 Liquid Crystal Display Device

【발명자】

【성명】 김진섭

【성명의 영문표기】 KIM Jin Sub

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【우편번호】 463-935

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【수수료】

【출원료】 0 면 38,000 원

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【가산출원료】	33	면	0	원
【우선권 주장료】	0	건	0	원
【심사청구료】	0	항	0	원
【합계】	38,000	원		

【요약서】

【요약】

본 발명은 액정표시장치에 관한 것으로, 본 발명의 목적은 액정패널의 전면으로 입사되는 열을 냉각시킬 수 있는 방열구조를 가지는 액정표시장치를 제공하는 것이다.

본 발명에 따른 액정표시장치는 액정패널과, 상기 액정패널에서 이격되어 배치되는 보호패널과, 상기 액정패널과 상기 보호패널이 형성하는 채널에서의 공기흐름을 난류로 천이시키는 유동제어장치를 구비하여 구성되는 것이다.

【대표도】

도 2

【명세서】

【발명의 명칭】

액정표시장치{Liquid Crystal Display Device}

【발명의 상세한 설명】

【기술분야】

- <1> 본 발명은 액정표시장치에 관한 것으로, 보다 상세하게는 액정패널을 냉각시키는 방열구조를 가지는 액정표시장치에 관한 것이다.

【배경기술】

- <2> 액정표시장치(Liquid Crystal Display Device)는 자동차나 건설기계 등의 계기류의 표시, 노트북 컴퓨터, 핸드폰, 텔레비전 등의 디스플레이 분야에 다양하게 이용되고 있다.
- <3> 액정표시장치는 액정패널과, 액정패널의 배면으로 광을 입사시키는 백라이트 유닛을 구비한다. 액정패널은 액정층을 사이에 두고 서로 마주보는 한 쌍의 기판으로 형성된다. 백라이트 유닛에는 액정패널로 광을 입사시키는 광원이 마련되고, 이러한 광원으로는 냉음극 형광관, 발광 다이오드 등이 사용되고 있다.
- <4> 백라이트 유닛의 광원은 광을 발생시킬 뿐만 아니라 열도 함께 방출하여 액정을 열화시키게 된다. 이에 액정표시장치는 백라이트 유닛의 광원에서 발생하는 열을 방출시키기 위한 방열장치를 필수적으로 구비하고 있다. 다만 이때의 방열장치는 액정패널의 배면에 설치된 백라이트 유닛에서 발생하는 열을 방출시키는 것으로

로써 액정패널을 기준으로 그 배면에 설치되는 것이 일반적이다.

【발명의 내용】

【해결하고자 하는 과제】

<5> 이로 인해 액정표시장치가 실외에 설치되는 경우 액정패널의 전면으로 태양 에너지가 입사되어 액정패널의 온도를 상승시키고 액정을 열화시키게 된다. 이에 액정표시장치는 실내 등의 한정된 장소에서만 사용이 가능하여 액정표시장치를 다양한 분야에 적용할 수 없는 한계점이 존재한다. 즉 태양에너지가 장시간 입사되는 실외의 광고판 등에는 액정표시장치를 사용할 수 없는 실정이다.

<6> 본 발명은 상기 문제점을 해결하기 위하여 안출된 것으로, 본 발명의 목적은 액정패널의 전면으로 입사되는 열을 냉각시킬 수 있는 방열구조를 가지는 액정표시장치를 제공하기 위한 것이다.

【과제 해결 수단】

<7> 상기 목적을 달성하기 위하여, 본 발명에 따른 액정표시장치는 액정패널과, 상기 액정패널에서 이격되어 배치되는 보호패널과, 상기 액정패널과 상기 보호패널이 형성하는 채널에서의 공기 흐름을 난류로 천이시키는 유동제어장치를 구비한다.

<8> 또한, 상기 유동제어장치는 상기 채널로 공기를 송풍하는 냉각팬을 구비한다.

<9> 또한, 상기 유동제어장치는 상기 채널을 통과한 공기의 온도를 측정하는 온도감지부와, 상기 온도감지부의 신호에 따라서 상기 냉각팬이 송풍하는 유량을 제

어하는 유량제어부를 더 구비한다.

<10> 또한, 상기 유량제어부는 상기 냉각팬의 유량을 제어하여 상기 채널의 유속을 4 m/s ~ 14 m/s 범위 내로 제어한다.

<11> 또한, 상기 액정패널과 상기 보호패널이 형성하는 상기 채널의 간격은 5 ~ 25mm 범위에서 형성된다.

<12> 또한, 상기 채널은 공기가 유입되는 흡입구와, 공기가 토출되는 토출구를 구비하고, 상기 냉각팬은 상기 흡입구 측에 설치된다.

<13> 또한, 상기 흡입구 및 토출구에는 흡입되는 공기 중에 포함된 이물질을 제거하는 먼지필터가 설치된다.

<14> 또한, 상기 액정패널의 배면에 마련되는 백라이트 유닛 및 회로기판과, 상기 백라이트 유닛 및 회로기판과 이격되어 배치되는 후면패널을 구비하고, 상기 보호패널과 상기 액정패널이 형성하는 채널을 통과한 공기는 상기 백라이트 유닛 및 회로기판과 상기 후면패널이 형성하는 채널을 통과하면서 상기 백라이트 유닛 및 회로기판에서 발생하는 열을 냉각시킨다.

<15> 본 발명에 따른 액정표시장치는 액정패널과, 상기 액정패널과 이격되어 배치되는 보호패널과, 상기 액정패널의 전면으로 입사되는 열에 의한 온도 변화를 감지하여 상기 액정패널과 상기 보호패널이 형성하는 채널로 송풍되는 공기 유량을 제어하는 유동제어장치를 구비한다.

<16> 또한, 상기 유동제어장치는 상기 채널의 간격이 5 ~ 25mm 범위에 해당할 때

상기 채널에서 유속이 4 m/s 이상되도록 공기 유량을 제어하는 유량제어부를 구비한다.

<17> 또한, 상기 유동제어장치는 상기 채널을 통과한 공기의 온도 변화를 감지하는 온도감지부를 더 구비하고, 상기 유량제어부는 상기 온도감지부에서 전달되는 신호에 따라서 동작한다.

<18> 본 발명에 따른 액정표시장치는 상하로 구획되는 하우징과, 상기 하우징의 상측에 마련되는 액정패널 조립체와, 상기 하우징의 하측에 마련되는 공기조화장치를 구비하고, 상기 공기조화장치는 상기 액정패널 조립체 측으로 공기를 송풍하여 상기 액정패널 조립체를 냉각시킨다.

<19> 또한, 상기 액정패널 조립체 측으로 송풍되는 공기를 난류로 천이시켜 상기 액정패널 조립체를 냉각시키는 유동제어장치를 더 구비한다.

<20> 또한, 상기 하우징은 그 전면에 설치되는 보호패널을 구비하고, 상기 공기조화장치는 상기 보호패널과 상기 액정패널 조립체가 형성하는 채널로 공기를 송풍하는 냉각팬을 구비한다.

<21> 또한, 상기 유동제어장치는 상기 냉각팬의 유량을 제어하여 상기 채널의 유속을 제어하는 유량제어부를 구비한다.

<22> 또한, 상기 채널의 간격은 0.005 ~ 0.025 m 범위 내로 형성하고, 상기 유량제어부는 상기 냉각팬의 유량을 제어하여 상기 채널의 유속을 4 m/s 이상으로 유지시킨다.

<23> 또한, 상기 유동제어장치는 상기 채널을 통과한 공기의 온도를 측정하여 상기 유량제어부에 신호를 전달하는 온도감지부를 구비한다.

<24> 또한, 상기 유량제어부는 상기 냉각팬을 제어하여 상기 채널의 유속을 14 m/s 이하로 유지시킨다.

<25> 또한, 상기 액정패널 조립체는 영상을 표시하는 액정패널과, 상기 액정패널로 광을 조사하는 백라이트 유닛과, 상기 액정패널과 상기 백라이트 유닛을 제어하는 회로기판을 구비한다.

【효과】

<26> 상기와 같은 구성을 통하여, 본 발명에 따른 액정표시장치는 옥외 환경에서도 액정이 열화되지 않기 때문에 장소에 관계없이 활용될 수 있는 효과가 있다.

<27> 또한 옥외 환경이 변화함에 따라 냉각팬을 제어함으로써 소비 전력을 저감시킬 수 있는 효과가 있다.

【발명의 실시를 위한 구체적인 내용】

<28> 이하, 본 발명의 다른 액정표시장치의 바람직한 실시예를 첨부도면을 참조하여 상세히 설명한다.

<29> 도 1은 본 발명에 따른 액정표시장치를 나타낸 사시도이다.

<30> 도 1에 도시된 바와 같이, 본 발명에 따른 액정표시장치는 하우징(10)과, 하우징(10)을 하부에서 지지하는 받침대(11)를 구비한다. 하우징(10)은 그 측면에서 서로 대향하게 마련되는 측면패널(13)과, 양 측면패널(13)을 연결하는 상부패널

(14)과, 하우징(10)의 전면에 마련되는 보호패널(12)과, 하우징(10)의 후면에 마련되는 후면패널(15)을 구비한다. 하우징(10) 내부에는 액정패널(21)이 설치되는데, 하우징(10) 외부에서 액정패널(21)(도 2참조)이 나타내는 영상을 볼 수 있도록 보호패널(12)은 투명한 재질이 유리 등으로 형성된다.

<31> 도 2는 본 발명에 따른 액정표시장치를 나타낸 측 단면도이고, 도 3은 본 발명에 따른 액정표시장치를 나타낸 배면 사시도이다.

<32> 도 2 및 도 3에 도시된 바와 같이, 하우징(10) 내부에는 하우징(10)의 내부 공간을 상하로 구획하는 격벽(16)이 설치된다. 격벽(16)을 기준으로 하우징(10)의 내부 상측 공간에는 액정패널 조립체(20)가 마련되고, 격벽(16)을 기준으로 하우징(10)의 내부 하측 공간에는 공기조화장치(30)가 마련된다. 액정패널 조립체(20)는 영상을 나타내는 액정패널(21)과, 액정패널(21)의 배면에 마련되어 액정패널(21)에 광을 조사하는 백라이트 유닛(22)과, 백라이트 유닛(22)의 배면에 마련되어 액정패널(21)과 백라이트 유닛(22)의 동작을 제어하는 회로기판(23)을 구비한다. 공기조화장치(30)는 상측에 증발기(31) 및 냉각팬(32)을 구비하고, 하측에 압축기(33)와 응축기(34)와 송풍팬(35)을 구비한다.

<33> 액정패널 조립체(20)는 하우징(10)의 전면에 마련되는 보호패널(12)에서 이격되어 설치되고, 하우징(10)의 후면에 마련되는 후면패널(15)에서 이격되어 설치되고, 하우징(10)의 상부패널(14)과도 이격되어 설치된다. 이로써 하우징(10) 내부에서 유동하는 공기는 액정패널 조립체(20)와 보호패널(12) 사이 공간이 형성하는 제1채널(41)과, 액정패널 조립체(20)와 하우징(10)의 상부패널(14) 사이 공간이 형

성하는 제2채널(42)과, 액정패널 조립체(20)와 후면패널(15) 사이 공간이 형성하는 제3채널(43)을 통과하는 것이 가능하다.

<34> 격벽(16)에는 그 후방에 토출구(18)가 형성되어 하우징(10)의 상측 공간과 하측 공간을 서로 연통시킨다. 이로써 제3채널(43)의 공기가 증발기(31) 측으로 이동할 수 있다. 이와 더불어 격벽(16)에는 그 전방에 흡입구(17)가 형성되어 하우징(10)의 상측 공간과 하측 공간을 서로 연통시킨다. 이로써 냉각팬(32)에서 송풍되는 공기는 제1채널(41) 측으로 이동할 수 있다.

<35> 냉각팬(32)의 출구부(36)는 흡입구(17)에 설치되고, 냉각팬(32)의 출구부(36)에서 송풍되는 공기는 제1채널(41)을 통과한다. 냉각팬(32)에 의해서 제1채널(41)로 송풍되는 공기는 증발기(31)를 통과한 상태이기 때문에 상대적으로 차가운 온도를 유지한다. 따라서 냉각팬(32)에 의해서 제1채널(41)로 송풍되는 공기는 제1채널(41)을 통과하면서 액정패널(21)의 전면으로 입사되는 열을 냉각시키게 된다. 여기서 액정패널(21)의 전면으로 입사되는 열이란 태양복사열 및 외기 온도에 의한 열전달을 예로 들 수 있다. 이후 제1채널(41)을 통과한 공기는 제2채널(42) 및 제3채널(43)을 순차적으로 통과한다. 특히 제3채널(43)을 통과하는 공기는 백라이트 유닛(22)과 회로기판(23)에서 발생하는 열도 함께 냉각시킨다. 마지막으로 제3채널(43)을 통과한 공기는 증발기(31)를 통과하면서 다시 차가워진다.

<36> 하우징(10) 내부에서 유동하는 공기의 유동 순서를 설명하면, 증발기(31)를 통과하여 차가워진 공기는 냉각팬(32)에 의해서 흡입구(17)를 통과한다. 이후 제1채널(41), 제2채널(42), 제3채널(43)을 순차적으로 통과한다. 이때 제1채널(41)을

통과하면서 액정패널(21)의 전면으로 입사되는 열을 냉각시키고 제3채널(43)을 통과하면서 백라이트 유닛(22) 및 회로기관(23)에서 발생하는 열을 냉각시킨다. 이후 토출구(18)를 통과하여 다시 증발기(31)를 통과하게 된다.

<37>

이처럼 본 발명에 따른 액정표시장치는 하우징(10)의 상측 공간에 액정패널 조립체(20)를 설치하고 하우징(10)의 하측 공간에 공기조화장치(30)를 설치함으로써, 공기조화장치(30)를 이용하여 액정패널 조립체(20)를 냉각할 수 있다. 그러나 액정표시장치가 실외에 설치되어 지속적으로 태양복사열이 입사되고 여름철에 외기 온도가 상승하는 경우 액정패널(21)의 전면의 온도가 상승하게 됨에 따라 액정의 온도도 급격히 상승하여 액정 무너짐이 발생하게 된다. 이에 액정 열화를 방지하기 위해 공기조화장치(30)의 성능을 개선하여 제1채널(41)로 송풍되는 공기의 온도를 낮추는 방안을 고려해볼 수 있다. 그러나 공기조화장치(30)의 성능을 높이기 위해서는 공기조화장치(30)가 커져야 하는 문제점이 있고 제조 비용이 많이 드는 문제점도 내포하고 있다. 결국 액정표시장치의 크기를 무한정 크게할 수 없는 제반사항 및 제조비용을 고려할 때 액정 열화를 방지하기 위한 다른 방안이 요구된다.

<38>

본 발명에 따른 액정표시장치에서 액정의 열화는 액정패널(21) 전면으로 입사되는 열에 의해서 발생하는 점을 고려하여 제1채널(41)을 통과하는 공기가 액정패널(21) 전면으로 입사되는 열을 충분히 흡수할 수 있도록 한다. 즉 제1채널(41)을 통과하는 공기가 난류 유동을 하는 경우 층류 유동에 비해서 액정패널(21) 전면으로 입사되는 열을 충분히 냉각시킬 수 있다. 왜냐하면 난류 유동은 층류 유동에 비해 관성력이 증대됨으로 해서 속도의 시간 변동성을 가지게 되는데, 이와 같은

비정상유동은 경계층 내의 혼합을 촉진시켜 운동량 및 열전달 성능을 향상시키기 때문이다.

<39> 이하에서는 제1채널(41)에 난류를 발생시키기 위한 제1채널(41)의 간격(d) 및 냉각팬(32)에 의해서 제1채널(41)로 송풍되는 공기의 유속 조건에 대해서 살펴본다.

<40> 도 3은 액정패널 조립체(20)가 "ㄷ"자형 체결편(24)에 의해서 하우징(10)의 측면패널(13)에 결합되는 것을 나타내고 있다. 액정패널 조립체(20)를 하우징(10)에 결합할 때 액정패널(21)과 보호패널(12)의 간격(d)을 조절할 수 있는데, 액정패널(21)과 보호패널(12)의 간격(d)은 5 ~ 25mm 범위 내로 한다. 만약 액정패널(21)과 보호패널(12)의 간격(d)이 5mm 미만으로 형성 되는 경우 보호패널(12)이 외부 충격에 의해서 손상될 때 액정패널(21)도 함께 손상될 위험성이 매우 크기 때문이다. 이와 더불어 액정패널(21)과 보호패널(12)의 간격(d)이 25mm 보다 크게 형성되는 경우 보호패널(12)을 통과하는 빛의 굴절률이 커져서 액정패널(21)이 나타내는 영상을 정확하게 볼 수 없는 문제점이 생길 수 있기 때문이다.

<41> 도 4 내지 도 7은 외기 온도가 45℃ 일때 태양광 강도 및 채널 유속에 따른 액정의 최고 온도를 나타낸 표이다. 특히 도 4는 제1채널(41)의 간격(d)이 0.004 m 인 경우이고 도 5는 제1채널(41)의 간격(d)이 0.005 m 인 경우를 나타낸 것이고, 도 6은 제1채널(41)의 간격(d)이 0.025 m 인 경우를 나타낸 경우이고 도 7은 제1채널(41)의 간격(d)이 0.03 m 인 경우를 나타낸 것이다.

<42> 일반적으로 옥외 환경에서 외기 온도가 상승할 수 있는 최고 온도는 약 45℃

정도이고 태양복사열의 강도가 일반적으로 $600 \sim 850 \text{ W/m}^2$ 정도에 해당하고 태양복사열의 강도가 최대로 높을 때 1100 W/m^2 정도인 점을 감안할 때 액정이 열화되지 않기 위해 필요한 제1채널(41)에서의 공기 유속을 측정할 수 있다. 통상 액정은 70°C 가 넘어서게 되면 열화되기 때문에 이를 참고하여 제1채널(41)에서 필요한 공기의 유속을 측정한다.

<43> 도 4 내지 도 5를 참조하면, 제1채널(41)의 간격(d)이 0.004 m 인 경우 액정이 열화되지 않기 위해서 필요한 최대 유속은 16 m/s 이고, 제1채널(41)의 간격(d)이 0.005 m 인 경우 액정이 열화되지 않기 위해서 필요한 최대 유속은 14 m/s 라는 것을 알 수 있다. 또한 도 6 내지 도 7을 참조하면, 제1채널(41)의 간격(d)이 0.025 m 인 경우 액정이 열화되지 않기 위해서 필요한 최대 유속은 10 m/s 이고, 제1채널(41)의 간격(d)이 0.03 m 인 경우 액정이 열화되지 않기 위해서 필요한 최대 유속은 10 m/s 라는 것을 알 수 있다.

<44> 다만 여기서 유의해야 할 점은 제1채널(41) 간격이 지나치게 좁아지게 되면 필요 유속을 달성하는데 과도한 압력 강하가 발생하게 되고, 반대로 제1채널(41) 간격이 넓어지게 되면 필요 유속을 달성하기 위해 과도한 유량이 요구된다. 통상 액정표시장치에서 사용되는 대략 46인치 액정패널(21)과 이에 사용되는 전형적인 냉각팬(32)을 고려할 때 적절한 제1채널(41)의 간격(d)은 냉각팬(32)의 정압-유량 곡선에 의해서 정해질 수 있다.

<45> 도 8은 전형적인 냉각팬의 정압-유량 곡선을 나타낸 그래프이다.

<46> 먼저 도 8을 참고하여, 압력 강하가 허용되는 제1채널(41)의 간격(d)을 살펴본다.

<47> 제1채널(41) 간격(d)가 0.004m 인 경우 액정 열화를 방지하기 위해서 필요한 최대 유속은 16 m/s 이다. 이때의 압력강하는 다음과 같은 계산식에 의해서 계산된다.

$$\Delta P = f \rho (LV^2)/2D_h \quad \text{--- 계산식(1)}$$

$$= 622 \text{ Pa}$$

<50> 여기서, f: 마찰계수, ρ : 밀도, L: 액정패널 길이, V: 유속, D_h : 수력직경

<51> 제1채널(41) 간격(d)가 0.005 m 인 경우 액정 열화를 방지하기 위해서 필요한 최대 유속은 14 m/s 이다. 이때의 압력강하는 계산식(1)과 같이 계산된다.

$$\Delta P = f \rho (LV^2)/2D_h = 371 \text{ Pa}$$

<53> 계산식(1)에 의해서 산출된 압력강하 값과 도 8의 냉각팬의 정압-유량 곡선을 참조하면, 제1채널(41) 간격(d)가 0.004 m 가 되면 압력 강하가 622 Pa 로써 압력 강하 정도가 과도하여 냉각팬(32)의 정압한계(~ 392 Pa)를 벗어남을 확인할 수 있다. 반면 제1채널(41) 간격(d)가 0.005 m 가 되면 압력 강하가 371 Pa 로써 냉각팬(32)의 작동 범위 내에 있음을 확인할 수 있다. 따라서 제1채널(41)의 최소 간격

(d1)은 0.005 m 로 정할 수 있다.

<54> 다음으로 도 8을 참조하여, 제1채널(41)의 간격(d)에 따른 유량 한계를 살펴 본다.

<55> 제1채널(41)의 간격(d)이 0.025 m 인 경우 액정 열화를 방지하기 위해 필요한 최대 유속은 10 m/s 이다. 이때 필요한 유량은 다음과 같은 계산식에 의해서 계산할 수 있다.

<56> $Q = VA$ ---계산식(2)

<57> $= 10 * 0.6 * 0.025$

<58> $= 0.15 \text{ m}^3/\text{s}$

<59> $= 9 \text{ CMM}$

<60> 여기서, V: 유속 , A: 제1채널의 단면적

<61> 제1채널(41)의 간격(d)이 0.03 m 인 경우 액정 열화를 방지하기 위해 필요한 최대 유속은 10 m/s 이다. 이때 필요한 유량은 계산식(2)와 같이 계산된다.

<62> $Q = VA = 10 * 0.6 * 0.03 = 0.18 \text{ m}^3/\text{s} = 10.8 \text{ CMM}$

<63> 계산식(2)에 의해서 산출된 유량 값과 도 8의 냉각팬의 정압-유량 곡선을 참

조하면, 제1채널(41)의 간격(d)이 0.025 m 인 경우 필요 유량은 9 CMM 으로서 냉각팬(32)의 유량 한계(10 CMM) 내에 존재한다. 반면 제1채널(41)의 간격(d)이 0.03 m 인 경우 필요 유량은 10.8 CMM 으로서 냉각팬(32)의 유량 한계(10 CMM)를 넘어서게 된다. 따라서 유량 조건을 고려할 때 제1채널(41)의 간격(d)은 0.025 m 이하가 되어야 한다. 더군다나 냉각팬(32)의 유량 한계인 10 CMM 은 압력 강하가 없는 자유 유동 조건에서 가능한 유량이며 실제 유동에서는 압력 강하를 고려해야 하기 때문에 제1채널(41)이 최대 간격(d₂)을 0.025 m 로 결정하는 것이 타당하다.

<64> 결론적으로 제1채널(41)의 간격(d)은 보호패널(12)의 기능 및 냉각팬(32)의 정압-유량 곡선을 고려할 때 0.005 ~ 0.025 m 범위 내로 정할 수 있다.

<65> 지금까지는 제1채널(41)의 간격(d)에 따라서 액정의 열화를 방지하기 위해 필요한 최대 유속을 살펴보았다. 그러나 액정표시장치가 옥외 환경에 설치된다고 하더라도 항상 제1채널(41)을 흐르는 공기의 유속이 최대 유속을 유지할 필요는 없다. 실제 옥외 환경에서는 외기 온도가 45℃보다 낮은 경우가 대부분이고 태양복사열의 강도도 1100 W/m² 이하인 경우가 대부분이기 때문이다.

<66> 이에 도 2를 참고하면, 본 발명에 따른 액정표시장치는 액정패널 조립체(20) 주변의 온도에 따라 냉각팬(32)의 유량을 제어하여 제1채널(41)을 통과하는 공기의 유속을 제어하는 유동제어장치(50)를 구비한다. 즉 유동제어장치(50)는 외기 온도가 45℃보다 낮고 태양복사열의 강도가 1100 W/m² 보다 낮아서 최대 유속이 필요하지 않은 경우 냉각팬(32)을 조절하여 제1채널(41)을 흐르는 공기 유속을 더 낮게

제어하는 것이다.

<67> 유동제어장치(50)는 제1채널(41)로 공기를 송풍하는 냉각팬(32)과, 제1채널(41)을 통과한 공기의 온도를 측정하는 온도감지부(52)와, 온도감지부(52)에 의해서 전달되는 신호에 따라 냉각팬(32)을 제어하는 유량제어부(51)를 구비한다. 여기서 온도감지부(52)는 공기가 제1채널(41)과 제2채널(42)과 제3채널(43)을 통과하면서 최대한 열을 많이 흡수한 때의 온도를 측정하는 것이 바람직하므로 격벽(16)에 마련된 토출구(18) 주변에 설치된다.

<68> 유동제어장치(50)는 제1채널(41)을 흐르는 공기의 흐름을 난류로 천이시키는 경우 액정패널(21) 전면으로 입사되는 열을 효율적으로 냉각시킬 수 있다. 따라서 유동제어장치(50)는 제1채널(41)을 흐르는 공기의 유동이 난류로 천이되기 위해 필요한 유속을 갖도록 냉각팬(32)을 조절하여야 한다.

<69> 이에 제1채널(41)의 간격(d)이 0.005 ~ 0.025 m 인 경우 난류가 되기 위한 제1채널(41)의 유속 조건을 살펴본다. 일반적으로 채널 유동에서 층류와 난류를 구분하는 지표로 레이놀즈(Reynolds) 수를 사용하며 다음과 같이 정의된다.

<70> $Re = VD/$

<71> 여기서, V: 유속, D: 수력직경, : 동점성 계수

<72> 이와 같은 레이놀즈 수가 2300 이하일 경우 층류 유동으로 판단하며 2300 이상일 때는 난류로의 천이가 일어난다고 구분할 수 있다.

<73> 도 9는 제1채널의 간격에 있어서 유속에 따른 레이놀즈 수를 나타낸 표이다.

<74> 도 9를 참조하면, 난류 유동을 일으키기 위한 최소 유속을 도출할 수 있으며 채널 간격이 0.005 m 인 경우 유속이 4 m/s 이상 되어야 난류 유동이 발생하는 것을 알 수 있다. 이로부터 액정패널(21) 전면으로 입사되는 태양 복사열을 난류 유동으로 냉각하기 위한 최소 유속을 4 m/s로 상정할 수 있다. 따라서 유동제어장치(50)의 유량제어부(51)는 냉각팬(32)의 유량을 제어하여 제1채널(41)의 유속이 4 m/s 이상으로 유지되도록 하여야 한다.

<75> 결과적으로 유동제어장치(50)는 제1채널(41)에 난류를 발생시키기 위하여 냉각팬(32)을 조절하여 유속이 4 m/s 이상으로 유지되도록 함과 동시에 액정 열화를 방지하기 위해서 필요한 최대 유속인 14 m/s 까지 조절할 수 있다. 이때 온도감지부(52)는 제1채널(41) 내지 제3채널(43)을 통과한 공기의 온도를 측정하고, 유량제어부(51)는 온도감지부(52)가 전달하는 신호에 따라 냉각팬(32)의 유량을 조절하여 제1채널(41)의 유속이 4 m/s ~ 14 m/s 범위 내에 해당하도록 한다.

<76> 도 10은 본 발명에 따른 액정표시장치의 다른 실시예를 나타낸 단면도이다.

<77> 도 10에 나타낸 액정표시장치는 도 2에 도시된 액정표시장치에서 공기조화장치(30)를 제거한 것과 거의 동일하다. 액정패널(21) 전면으로 입사되는 열을 냉각시키는 것은 제1채널(41)을 흐르는 난류에 의한 것이 대부분이기 때문에 별도의 공기조화장치(30)(도 2참조) 설치하지 않은 것이다.

<78> 하우징(10) 내부에서 공기가 유동하는 구조를 살펴보면, 냉각팬(32)으로 유입되는 공기는 후면패널(15)에 형성되는 개구부(19)를 통하여 유입된다. 이후 공기

중에 포함된 이물질이 먼지필터(60)를 통하여 걸러진 후 냉각팬(32)에 의해서 흡입구(17)를 통과한다. 이후 제1채널(41) 및 제2채널(42) 및 제3채널(43)을 통과한다. 이때 제1채널(41)을 통과하면서 액정패널(21) 전면으로 입사되는 열을 냉각시키고 제3채널(43)을 통과하면서 백라이트 유닛(22) 및 회로기판(23)에서 발생하는 열을 냉각시킨다. 이후 후면패널(15)에 형성된 토출구(18)를 통하여 하우징(10) 외부로 배출된다.

<79> 도 2에 나타낸 액정표시장치와 동일하게 도 10에 나타난 액정표시장치도 제1채널(41)을 흐르는 공기를 난류로 천이시키기 위한 유동제어장치(50)를 구비한다. 유동제어장치(50)는 제1채널(41)로 공기를 송풍시키는 냉각팬(32)과, 냉각팬(32)의 유량을 제어하여 제1채널(41)의 유속을 제어하는 유량제어부(51)와, 제1채널(41)을 통과한 공기의 온도를 측정하여 유량제어부(51)에 신호를 전달하는 온도감지부(52)를 구비한다.

<80> 이때 제1채널(41)의 간격(d)이 0.005 ~ 0.025 m 범위 내로 설치되고, 유량제어부(51)는 냉각팬(32)을 제어하여 제1채널(41)의 유속이 4 ~ 14 m/s 범위 내로 유지되도록 한다.

<81> 이와 같은 제1채널(41)의 간격(d)과 제1채널(41)의 유속 조건은 도 4 내지 도 9를 참조하여 이미 설명하였으므로 이하에서는 자세한 설명을 생략한다.

【특허청구범위】

【청구항 1】

액정패널과,

상기 액정패널에서 이격되어 배치되는 보호패널과,

상기 액정패널과 상기 보호패널이 형성하는 채널에서의 공기 흐름을 난류로
천이시키는 유동제어장치를 구비하는 액정표시장치.

【청구항 2】

제1항에 있어서,

상기 유동제어장치는 상기 채널로 공기를 송풍하는 냉각팬을 구비하는 액정
표시장치.

【청구항 3】

제2항에 있어서,

상기 유동제어장치는 상기 채널을 통과한 공기의 온도를 측정하는 온도감지
부와, 상기 온도감지부의 신호에 따라서 상기 냉각팬이 송풍하는 유량을 제어하는
유량제어부를 더 구비하는 액정표시장치.

【청구항 4】

제3항에 있어서,

상기 유량제어부는 상기 냉각팬의 유량을 제어하여 상기 채널의 유속을 4
m/s ~ 14 m/s 범위 내로 제어하는 액정표시장치.

【청구항 5】

제1항에 있어서,
상기 액정패널과 상기 보호패널이 형성하는 상기 채널의 간격은 5 ~ 25mm 범
위에서 형성되는 액정표시장치.

【청구항 6】

제2항에 있어서,
상기 채널은 공기가 유입되는 흡입구와, 공기가 토출되는 토출구를
구비하고,
상기 냉각팬은 상기 흡입구 측에 설치되는 액정표시장치.

【청구항 7】

제6항에 있어서,
상기 흡입구 및 토출구에는 흡입되는 공기 중에 포함된 이물질을 제거하는
먼지필터가 설치되는 액정표시장치.

【청구항 8】

제1항에 있어서,
상기 액정패널의 배면에 마련되는 백라이트 유닛 및 회로기판과, 상기 백라
이트 유닛 및 회로기판과 이격되어 배치되는 후면패널을 구비하고,
상기 보호패널과 상기 액정패널이 형성하는 채널을 통과한 공기는 상기 백라
이트 유닛 및 회로기판과 상기 후면패널이 형성하는 채널을 통과하면서 상기 백라

이트 유닛 및 회로기판에서 발생하는 열을 냉각시키는 액정표시장치.

【청구항 9】

액정패널과,

상기 액정패널과 이격되어 배치되는 보호패널과,

상기 액정패널의 전면으로 입사되는 열에 의한 온도 변화를 감지하여 상기 액정패널과 상기 보호패널이 형성하는 채널로 송풍되는 공기 유량을 제어하는 유동 제어장치를 구비하는 액정표시장치.

【청구항 10】

제9항에 있어서,

상기 유동제어장치는 상기 채널의 간격이 5 ~ 25mm 범위에 해당할 때 상기 채널에서 유속이 4 m/s 이상되도록 공기 유량을 제어하는 유량제어부를 구비하는 액정표시장치.

【청구항 11】

제10항에 있어서,

상기 유동제어장치는 상기 채널을 통과한 공기의 온도 변화를 감지하는 온도 감지부를 더 구비하고, 상기 유량제어부는 상기 온도감지부에서 전달되는 신호에 따라서 동작하는 액정표시장치.

【청구항 12】

상하로 구획되는 하우징과,

상기 하우징의 상측에 마련되는 액정패널 조립체와,
상기 하우징의 하측에 마련되는 공기조화장치를 구비하고,
상기 공기조화장치는 상기 액정패널 조립체 측으로 공기를 송풍하여 상기 액
정패널 조립체를 냉각시키는 액정표시장치.

【청구항 13】

제12항에 있어서,
상기 액정패널 조립체 측으로 송풍되는 공기를 난류로 천이시켜 상기 액정패
널 조립체를 냉각시키는 유동제어장치를 더 구비하는 액정표시장치.

【청구항 14】

제13항에 있어서,
상기 하우징은 그 전면에 설치되는 보호패널을 구비하고,
상기 공기조화장치는 상기 보호패널과 상기 액정패널 조립체가 형성하는 채
널로 공기를 송풍하는 냉각팬을 구비하는 액정표시장치.

【청구항 15】

제14항에 있어서,
상기 유동제어장치는 상기 냉각팬의 유량을 제어하여 상기 채널의 유속을 제
어하는 유량제어부를 구비하는 액정표시장치.

【청구항 16】

제15항에 있어서,

상기 채널의 간격은 0.005 ~ 0.025 m 범위 내로 형성하고, 상기 유량제어부는 상기 냉각팬의 유량을 제어하여 상기 채널의 유속을 4 m/s 이상으로 유지시키는 액정표시장치.

【청구항 17】

제16항에 있어서,

상기 유동제어장치는 상기 채널을 통과한 공기의 온도를 측정하여 상기 유량제어부에 신호를 전달하는 온도감지부를 구비하는 액정표시장치.

【청구항 18】

제17항에 있어서,

상기 유량제어부는 상기 냉각팬을 제어하여 상기 채널의 유속을 14 m/s 이하로 유지시키는 액정표시장치.

【청구항 19】

제12항에 있어서,

상기 액정패널 조립체는 영상을 표시하는 액정패널과, 상기 액정패널로 광을 조사하는 백라이트 유닛과, 상기 액정패널과 상기 백라이트 유닛을 제어하는 회로기판을 구비하는 액정표시장치.

【도면의 간단한 설명】

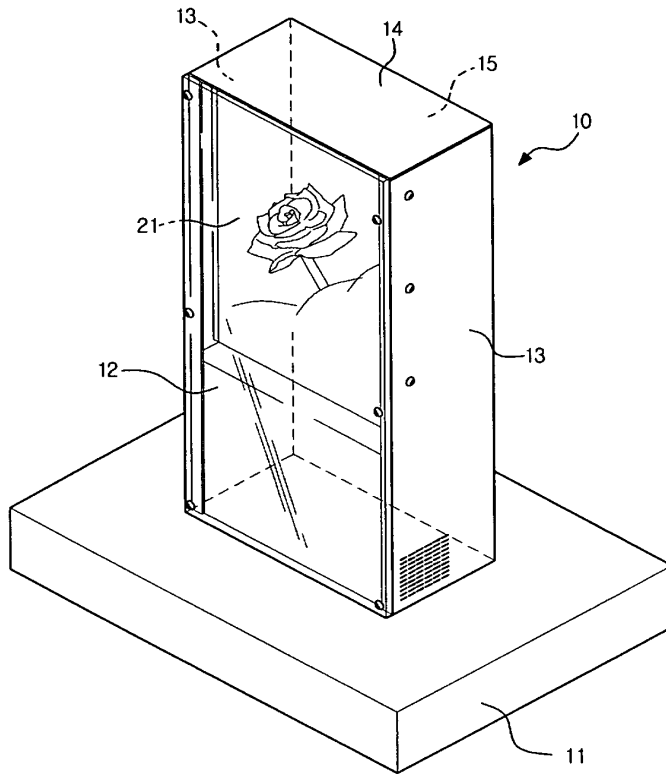
<82> 도 1은 본 발명에 따른 액정표시장치를 나타낸 사시도.

<83> 도 2는 본 발명에 따른 액정표시장치를 나타낸 측 단면도.

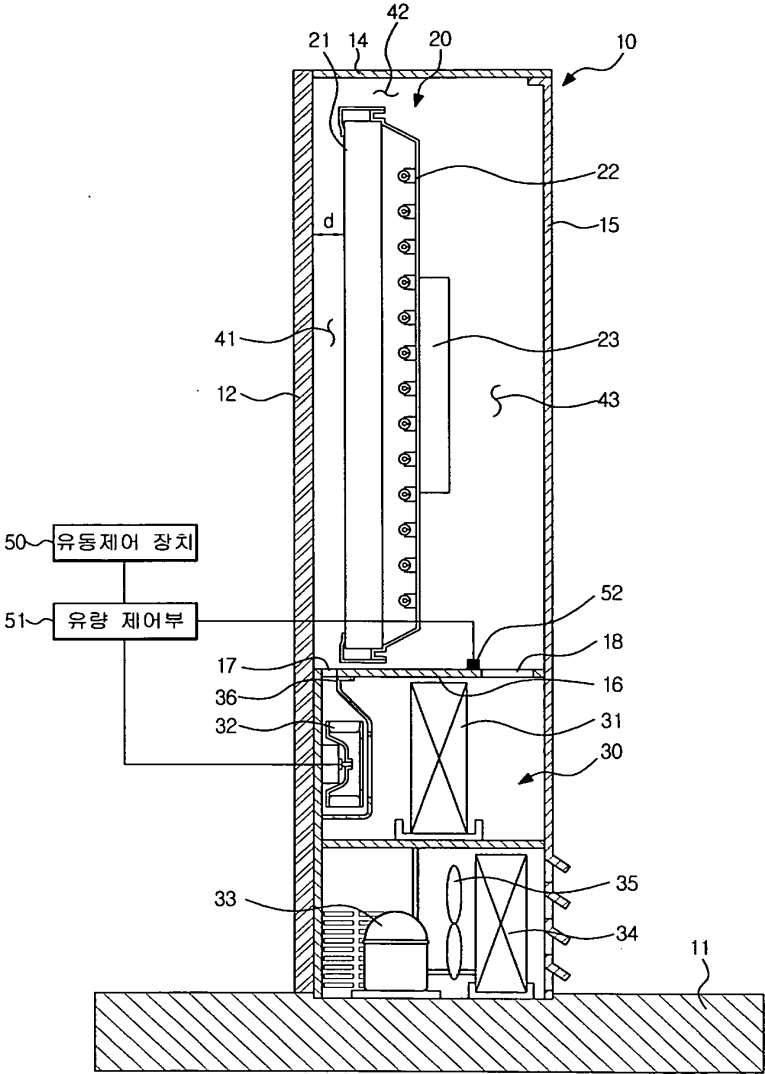
- <84> 도 3은 본 발명에 따른 액정표시장치를 나타낸 배면 사시도.
- <85> 도 4는 제1채널의 간격이 0.004 m 인 경우 외기 온도가 45? 일때 태양광 강도 및 채널 유속에 따른 액정의 최고 온도를 나타낸 표.
- <86> 도 5는 제1채널의 간격이 0.005 m 인 경우 외기 온도가 45? 일때 태양광 강도 및 채널 유속에 따른 액정의 최고 온도를 나타낸 표.
- <87> 도 6은 제1채널의 간격이 0.025 m 인 경우 외기 온도가 45? 일때 태양광 강도 및 채널 유속에 따른 액정의 최고 온도를 나타낸 표.
- <88> 도 7은 제1채널의 간격이 0.03 m 인 경우 외기 온도가 45℃ 일때 태양광 강도 및 채널 유속에 따른 액정의 최고 온도를 나타낸 표.
- <89> 도 8은 전형적인 냉각팬의 정압-유량 곡선을 나타낸 그래프.
- <90> 도 9는 제1채널의 간격에 있어서 유속에 따른 레이놀즈 수를 나타낸 표.
- <91> 도 10은 본 발명에 따른 액정표시장치의 다른 실시예를 나타낸 단면도.
- <92> *도면의 주요부분에 대한 부호 설명*
- | | |
|-------------------|-----------|
| <93> 10: 하우징 | 12: 보호패널 |
| <94> 20: 액정패널 조립체 | 21: 액정패널 |
| <95> 32: 냉각팬 | 41: 제1채널 |
| <96> 50: 유동제어장치 | 51: 유량제어부 |

【도면】

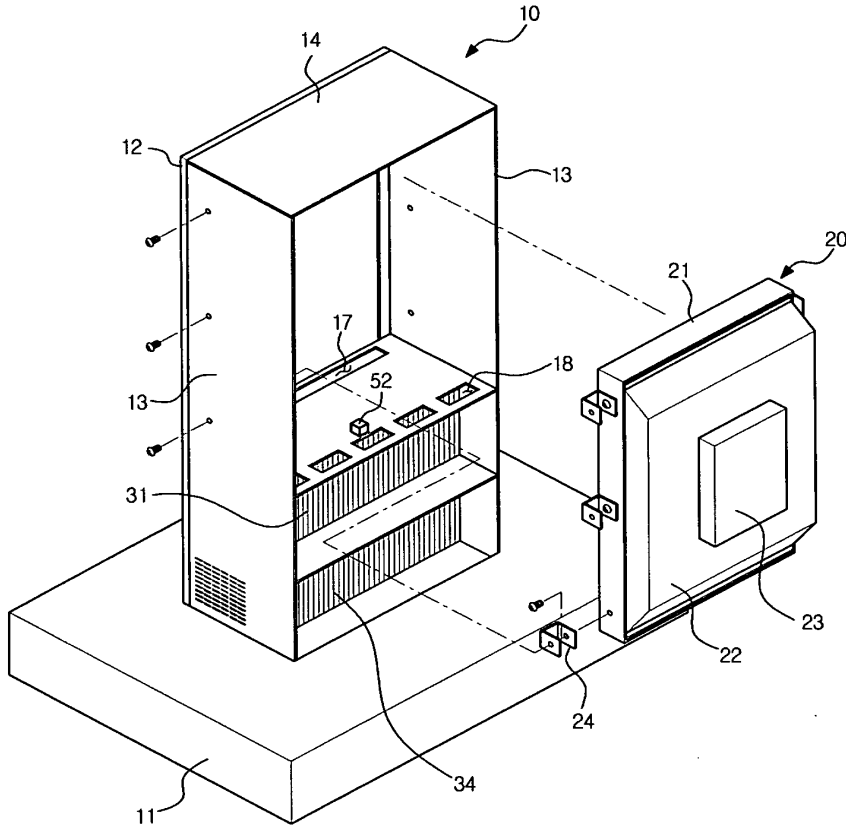
【도 1】



【도 2】



【도 3】



【도 4】

$d = 0.004 \text{ m}$

태양광 강도 [W/m ²]	채널 유속[m/s]					
	5	8	10	12	14	16
600	84.5	70.6	65.8	62.6	60.3	58.5
850	101	81.2	74.5	69.9	66.6	64.1
1100	117.5	91.9	83.1	77.2	73	69.7

【도 5】

d = 0.005 m

태양광 강도 [W/m ²]	채널 유속[m/s]					
	4	6	8	10	12	14
600	88	74.7	67.8	63.6	60.8	58.7
850	105.9	87	77.3	71.4	67.3	64.4
1100	123.9	99.4	86.8	79.1	73.9	70

【도 6】

d = 0.025 m

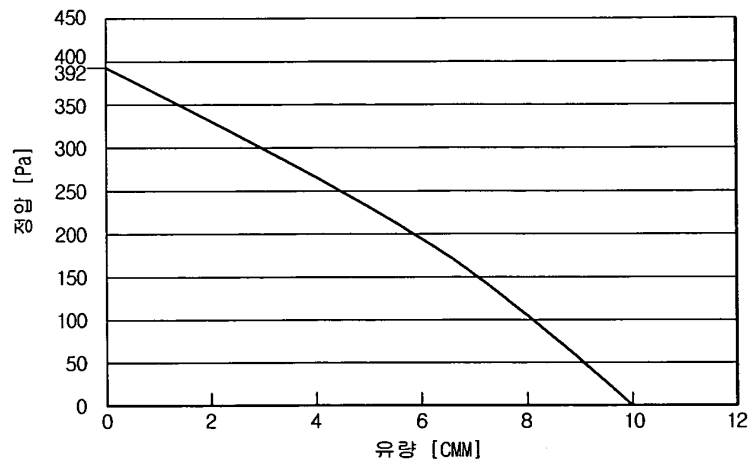
태양광 강도 [W/m ²]	채널 유속[m/s]				
	3	4	6	8	10
600	82	74.1	65.7	61.3	58.6
850	97.4	86.2	74.4	68.1	64.2
1100	112.8	98.3	83	74.9	69.9

【도 7】

d = 0.03 m

태양광 강도 [W/m ²]	채널 유속[m/s]				
	3	4	6	8	10
600	82	74.1	65.8	61.4	58.7
850	97.4	86.3	74.5	68.3	64.3
1100	112.8	98.4	83.2	75.1	70

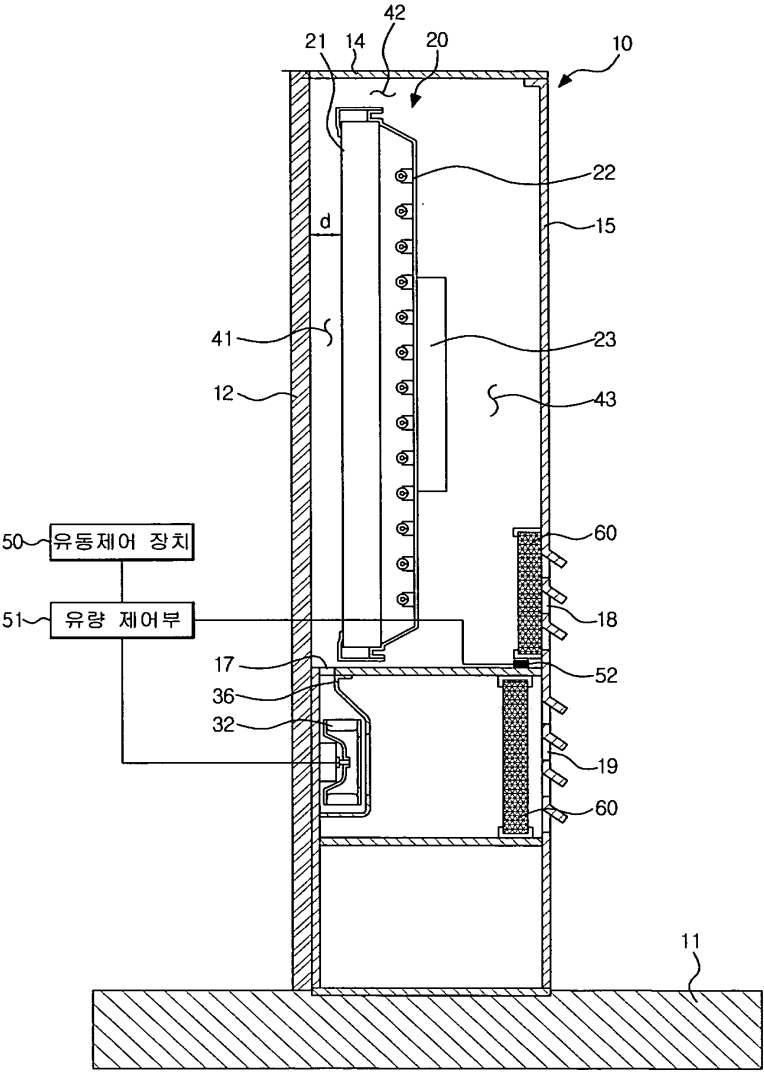
【도 8】



【도 9】

유속, V [m/s]	채널 간격, d [m]				
	0.005	0.01	0.015	0.02	0.025
1	629	1259	1888	2517	3147
2	1259	2517	3776	5035	6293
3	1888	3776	5664	7552	9440
4	2517	5035	7552	10069	12587
5	3147	6293	9440	12587	15733
6	3776	7552	11328	15104	18880

【도 10】





TFW

Docket No. 103-1284

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:

Jin Sub KIM

Application No.: 12/478,832

Group Art Unit No.: Unassigned

Filed: June 5, 2009

Examiner Unassigned

Customer No.: 38209

Confirmation No. 1220

For: LIQUID CRYSTAL DISPLAY DEVICE

SUBMISSION OF CERTIFIED COPY OF PRIOR FOREIGN APPLICATION
IN ACCORDANCE WITH
THE REQUIREMENTS OF 37 C.F. R. § 1.55

Assistant Commissioner for Patents
Alexandria, VA 20231

Sir:

In accordance with the provisions of 37 C.F.R. § 1.55, the applicant(s) submit(s) herewith a certified copy of the following foreign application:

Korean Patent Application No.: 2008-55687

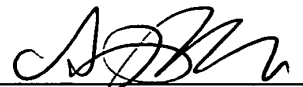
Filed: June 13, 2008

It is respectfully requested that the applicant(s) be given the benefit of the foreign filing date(s) as evidenced by the certified papers attached hereto, in accordance with the requirements of 35 U.S.C. §119.

Respectfully submitted,

STANZIONE & KIM, LLP

Dated: June 9, 2009
919 18th St., NW, Suite 440
Washington, D.C. 20006
Telephone: (202) 775-1900
Facsimile: (202) 775-1901

By: 
Seungman Kim
Registration No. 50,012



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United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	TOT CLAIMS	IND CLAIMS
12/478,832	06/05/2009	2871	2010	103-1284	25	6

CONFIRMATION NO. 1220

FILING RECEIPT



0C000000036476800

38209
STANZIONE & KIM, LLP
919 18TH STREET, N.W.
SUITE 440
WASHINGTON, DC 20006

Date Mailed: 06/22/2009

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Applicant(s)

Jin Sub KIM, Seongnamn-si, KOREA, REPUBLIC OF;
Jin Hyun Cho, Seoul, KOREA, REPUBLIC OF;
Sung Ki Kim, Seoul, KOREA, REPUBLIC OF;
Joon Kang, Seoul, KOREA, REPUBLIC OF;

Assignment For Published Patent Application

Samsung Electronics Co., Ltd, Suwon-si, KOREA, REPUBLIC OF

Power of Attorney: The patent practitioners associated with Customer Number 38209

Domestic Priority data as claimed by applicant

Foreign Applications

REPUBLIC OF KOREA 2008-55687 06/13/2008

Request to Retrieve - This application either claims priority to one or more applications filed in an intellectual property Office that participates in the Priority Document Exchange (PDX) program or contains a proper **Request to Retrieve Electronic Priority Application(s)** (PTO/SB/38 or its equivalent). Consequently, the USPTO will attempt to electronically retrieve these priority documents.

If Required, Foreign Filing License Granted: 06/12/2009

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 12/478,832**

Projected Publication Date: To Be Determined - pending completion of Corrected Papers

Non-Publication Request: No

Early Publication Request: No

Title

LIQUID CRYSTAL DISPLAY DEVICE

Preliminary Class

349

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

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For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4158).

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This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/478,832	06/05/2009	Jin Sub KIM	103-1284

CONFIRMATION NO. 1220

FORMALITIES LETTER



38209
STANZIONE & KIM, LLP
919 18TH STREET, N.W.
SUITE 440
WASHINGTON, DC 20006

Date Mailed: 06/22/2009

NOTICE TO FILE CORRECTED APPLICATION PAPERS

Filing Date Granted

An application number and filing date have been accorded to this application. The application is informal since it does not comply with the regulations for the reason(s) indicated below. Applicant is given TWO MONTHS from the date of this Notice within which to correct the informalities indicated below. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

The required item(s) identified below must be timely submitted to avoid abandonment:

- Replacement drawings in compliance with 37 CFR 1.84 and 37 CFR 1.121(d) are required. The drawings submitted are not acceptable because:
 - More than one figure is present and each figure is not labeled "Fig." with a consecutive Arabic numeral (1, 2, etc.) or an Arabic numeral and capital letter in the English alphabet (A, B, etc.)(see 37 CFR 1.84(u)(1)). See Figure(s) 2. A brief description of the several views of the drawings (see 37 CFR 1.74) should be added or amended to correspond to the corrected numbering of the figures. See also 37 CFR 1.77(b)(7).

Applicant is cautioned that correction of the above items may cause the specification and drawings page count to exceed 100 pages. If the specification and drawings exceed 100 pages, applicant will need to submit the required application size fee.

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/tlc/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

FIG. 1

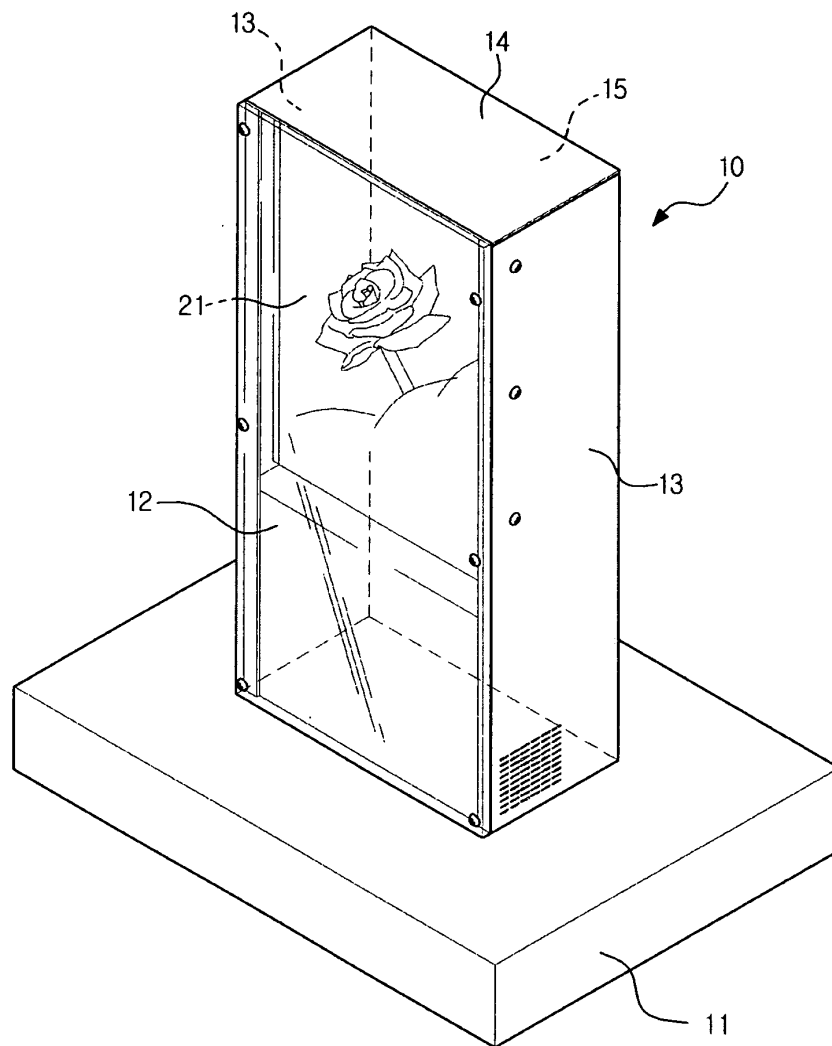


FIG. 2

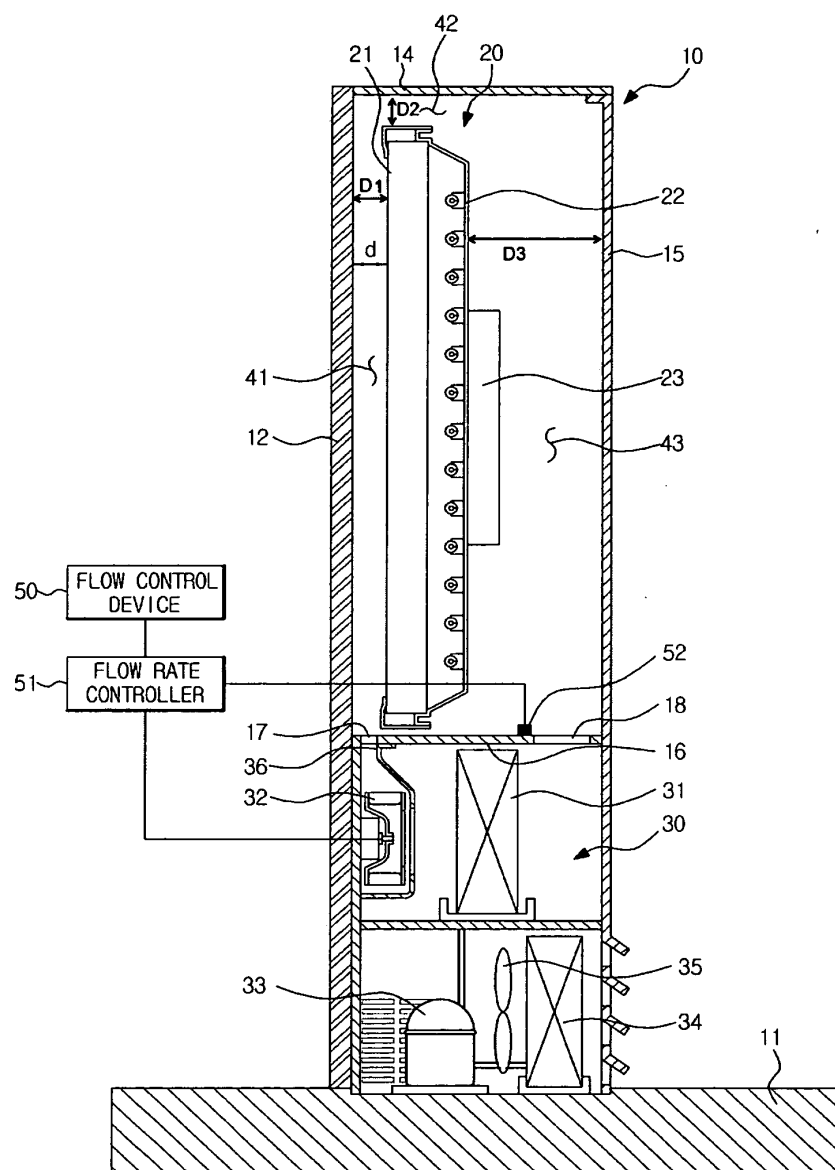
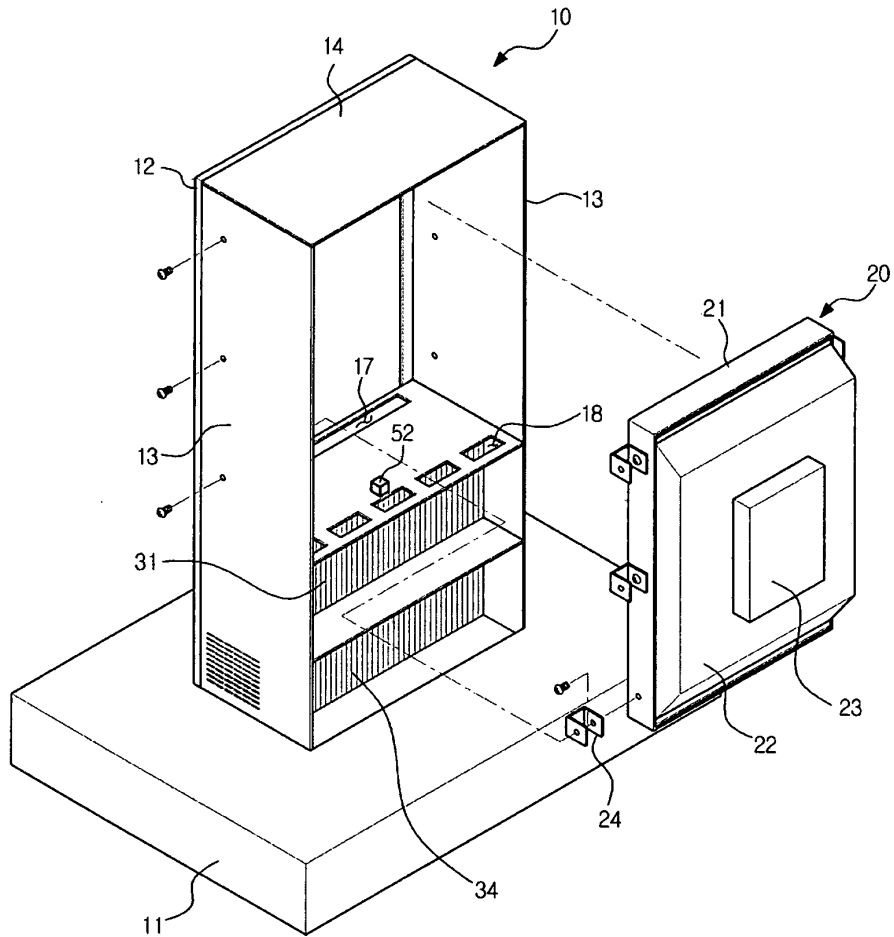


FIG. 3



REPLACEMENT SHEET

FIG. 4

$d = 0.004 \text{ m}$

SOLAR RADIATION [W/m ²]	FLOW VELOCITY IN CHANNEL [m/s]					
	5	8	10	12	14	16
600	84.5	70.6	65.8	62.6	60.3	58.5
850	101	81.2	74.5	69.9	66.6	64.1
1100	117.5	91.9	83.1	77.2	73	69.7

REPLACEMENT SHEET

FIG. 5

$d = 0.005 \text{ m}$

SOLAR RADIATION [W/m ²]	FLOW VELOCITY IN CHANNEL [m/s]					
	4	6	8	10	12	14
600	88	74.7	67.8	63.6	60.8	58.7
850	105.9	87	77.3	71.4	67.3	64.4
1100	123.9	99.4	86.8	79.1	73.9	70

REPLACEMENT SHEET

FIG. 6

$d = 0.025 \text{ m}$

SOLAR RADIATION [W/m ²]	FLOW VELOCITY IN CHANNEL [m/s]				
	3	4	6	8	10
600	82	74.1	65.7	61.3	58.6
850	97.4	86.2	74.4	68.1	64.2
1100	112.8	98.3	83	74.9	69.9

REPLACEMENT SHEET

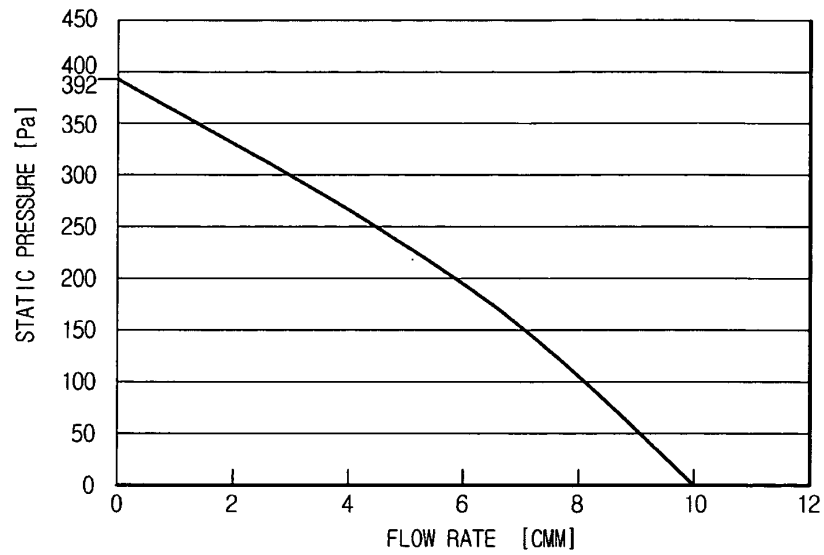
FIG. 7

d = 0.03 m

SOLAR RADIATION [W/m ²]	FLOW VELOCITY IN CHANNEL [m/s]				
	3	4	6	8	10
600	82	74.1	65.8	61.4	58.7
850	97.4	86.3	74.5	68.3	64.3
1100	112.8	98.4	83.2	75.1	70

REPLACEMENT SHEET

FIG. 8

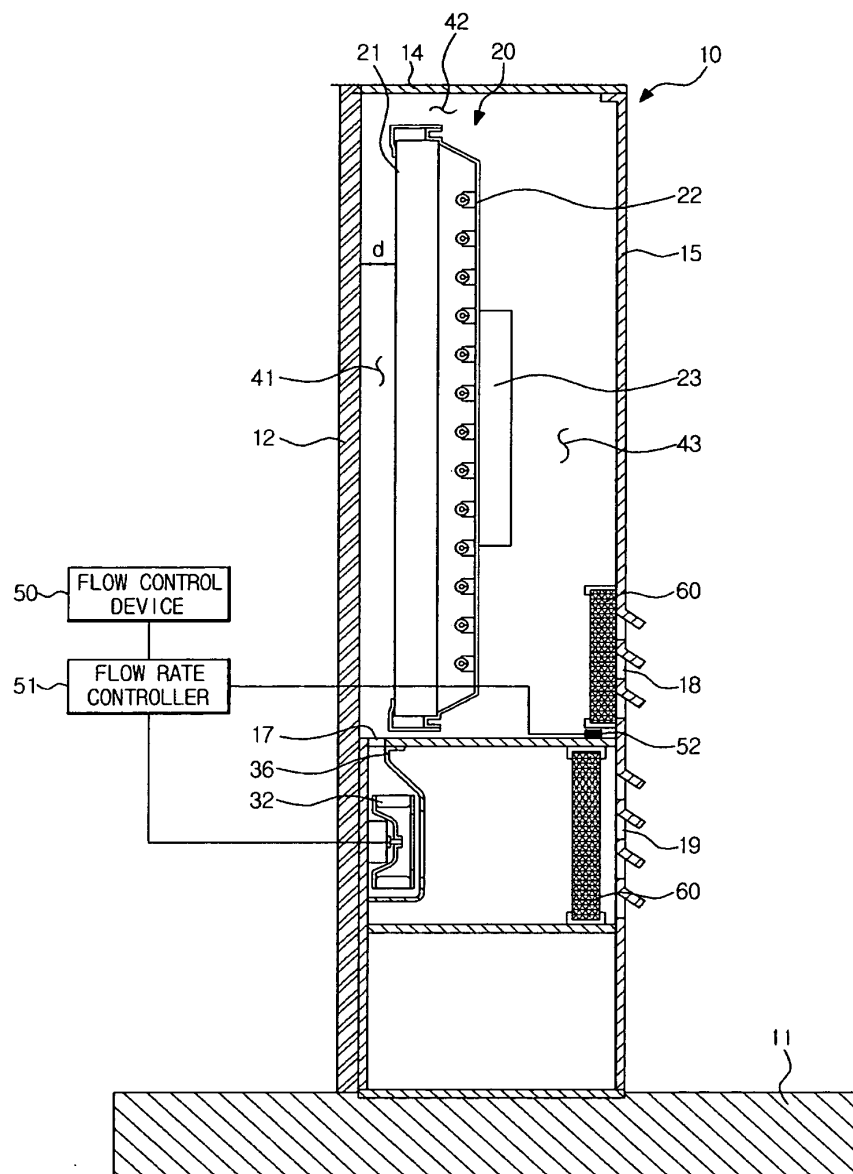


REPLACEMENT SHEET

FIG. 9

FLOW VELOCITY, V [m/s]	SPACING DISTANCE, d [m]				
	0.005	0.01	0.015	0.02	0.025
1	629	1259	1888	2517	3147
2	1259	2517	3776	5035	6293
3	1888	3776	5664	7552	9440
4	2517	5035	7552	10069	12587
5	3147	6293	9440	12587	15733
6	3776	7552	11328	15104	18880

FIG. 10





Docket No. 103-1284

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:

Jin Sub KIM

Application No.: 12/478,832

Group Art Unit No.: 2871

Filed: June 5, 2009

Examiner Unassigned

Customer No.: 38209

Confirmation No. 1220

For: LIQUID CRYSTAL DISPLAY DEVICE

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Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

RESPONSE TO NOTICE TO FILE CORRECTED APPLICATION PAPERS

Sir:

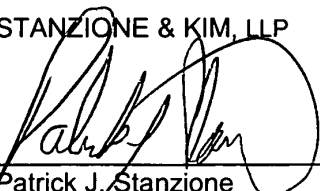
Responsive to the Notice to File Corrected Application Papers dated June 22, 2009, the below-identified documents are submitted in the above-captioned application or proceeding:

- ☒ Copy of Notice to File Corrected Application Papers
- ☒ Replacement Sheets (Figs. 1-10)

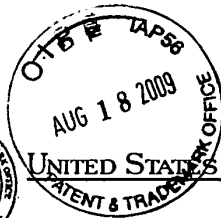
The commissioner is hereby authorized to charge any additional fees which may be required by this paper, or credit any overpayment to Deposit Account No. 502827.

Respectfully submitted,

STANZIONE & KIM, LLP

By: 
Patrick J. Stanzone
Registration No. 40,434

Dated: August 18, 2009
919 18th St., NW, Suite 440
Washington, D.C. 20006
Telephone: (202) 775-1900
Facsimile: (202) 775-1901



SLK

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United States Patent and Trademark Office
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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/478,832	06/05/2009	Jin Sub KIM	103-1284

CONFIRMATION NO. 1220

FORMALITIES LETTER

38209

STANZIONE & KIM, LLP

919 18TH STREET, N.W.

SUITE 440

WASHINGTON, DC 20006

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0000000036476802

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Date Mailed: 06/22/2009

On:

By:

Due Date:

[Handwritten signature]
[Handwritten date: 8/22/09] (Resp)

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An application number and filing date have been accorded to this application. The application is informal since it does not comply with the regulations for the reason(s) indicated below. Applicant is given TWO MONTHS from the date of this Notice within which to correct the informalities indicated below. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

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- Replacement drawings in compliance with 37 CFR 1.84 and 37 CFR 1.121(d) are required. The drawings submitted are not acceptable because:
 - More than one figure is present and each figure is not labeled "Fig." with a consecutive Arabic numeral (1, 2, etc.) or an Arabic numeral and capital letter in the English alphabet (A, B, etc.)(see 37 CFR 1.84(u)(1)). See Figure(s) 2. A brief description of the several views of the drawings (see 37 CFR 1.74) should be added or amended to correspond to the corrected numbering of the figures. See also 37 CFR 1.77(b)(7).

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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO.	TOT CLAIMS	IND CLAIMS
12/478,832	06/05/2009	2871	2010	103-1284	25	6

CONFIRMATION NO. 1220

UPDATED FILING RECEIPT



OC000000037560240

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STANZIONE & KIM, LLP
919 18TH STREET, N.W.
SUITE 440
WASHINGTON, DC 20006

Date Mailed: 09/02/2009

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Applicant(s)

Jin Sub KIM, Seongnam-si, KOREA, REPUBLIC OF;
Jin Hyun Cho, Seoul, KOREA, REPUBLIC OF;
Sung Ki Kim, Seoul, KOREA, REPUBLIC OF;
Joon Kang, Seoul, KOREA, REPUBLIC OF;

Assignment For Published Patent Application

Samsung Electronics Co., Ltd, Suwon-si, KOREA, REPUBLIC OF

Power of Attorney: The patent practitioners associated with Customer Number 38209

Domestic Priority data as claimed by applicant

Foreign Applications

REPUBLIC OF KOREA 2008-55687 06/13/2008

Request to Retrieve - This application either claims priority to one or more applications filed in an intellectual property Office that participates in the Priority Document Exchange (PDX) program or contains a proper **Request to Retrieve Electronic Priority Application(s)** (PTO/SB/38 or its equivalent). Consequently, the USPTO will attempt to electronically retrieve these priority documents.

If Required, Foreign Filing License Granted: 06/12/2009

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 12/478,832**

Projected Publication Date: 12/17/2009

Non-Publication Request: No

Early Publication Request: No

Title

LIQUID CRYSTAL DISPLAY DEVICE

Preliminary Class

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The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign Assets Control, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).



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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/478,832	06/05/2009	Jin Sub KIM	103-1284

CONFIRMATION NO. 1220

38209

STANZIONE & KIM, LLP
919 18TH STREET, N.W.
SUITE 440
WASHINGTON, DC 20006

PUBLICATION NOTICE



OC000000039283062

Title: LIQUID CRYSTAL DISPLAY DEVICE

Publication No. US-2009-0310059-A1

Publication Date: 12/17/2009

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently <http://www.uspto.gov/patft/>.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Office of Public Records. The Office of Public Records can be reached by telephone at (703) 308-9726 or (800) 972-6382, by facsimile at (703) 305-8759, by mail addressed to the United States Patent and Trademark Office, Office of Public Records, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently <http://pair.uspto.gov/>. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/478,832	06/05/2009	Jin Sub KIM	103-1284	1220
38209	7590	09/22/2011		
STANZIONE & KIM, LLP 919 18TH STREET, N.W. SUITE 440 WASHINGTON, DC 20006			EXAMINER QI, ZHI QIANG	
			ART UNIT 2871	PAPER NUMBER
			MAIL DATE 09/22/2011	DELIVERY MODE PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	12/478,832	KIM ET AL.	
	Examiner	Art Unit	
	MIKE QI	2871	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 1 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☐ Responsive to communication(s) filed on ____.

2a) ☐ This action is **FINAL**. 2b) ☐ This action is non-final.

3) ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on ____; the restriction requirement and election have been incorporated into this action.

4) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

5) ☒ Claim(s) 1-25 is/are pending in the application.

5a) Of the above claim(s) ____ is/are withdrawn from consideration.

6) ☐ Claim(s) ____ is/are allowed.

7) ☐ Claim(s) ____ is/are rejected.

8) ☐ Claim(s) ____ is/are objected to.

9) ☒ Claim(s) 1-25 are subject to restriction and/or election requirement.

Application Papers

10) ☐ The specification is objected to by the Examiner.

11) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

12) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a) ☒ All b) ☐ Some c) ☐ None of:

1. ☒ Certified copies of the priority documents have been received.

2. ☐ Certified copies of the priority documents have been received in Application No. ____.

3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)	4) ☐ Interview Summary (PTO-413)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)	Paper No(s)/Mail Date. ____.
3) ☐ Information Disclosure Statement(s) (PTO/SB/08)	5) ☐ Notice of Informal Patent Application
Paper No(s)/Mail Date ____.	6) ☐ Other: ____.

DETAILED ACTION

Election/Restrictions

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:
 - I. Claims 1-11, 20-23 and 25, drawn to an air flow control, classified in class 349, subclass 161.
 - II. Claims 12-19 and 24, drawn to a housing to arrange the liquid crystal assembly and air conditioner, classified in class 349, subclass 58.
2. Inventions I and II are related as combination and subcombination. Inventions in this relationship are distinct if it can be shown that (1) the combination as claimed does not require the particulars of the subcombination as claimed for patentability, and (2) that the subcombination has utility by itself or in other combinations (MPEP § 806.05(c)). In the instant case, the combination as claimed does not require the particulars of the subcombination as claimed because each can be made without the particular features of the other. The subcombination has separate utility such as a housing partitioned into upper and lower spaces.

The examiner has required restriction between combination and subcombination inventions. Where applicant elects a subcombination, and claims thereto are subsequently found allowable, any claim(s) depending from or otherwise requiring all the limitations of the allowable subcombination will be examined for patentability in accordance with 37 CFR 1.104. See MPEP § 821.04(a). Applicant is advised that if any claim presented in a continuation or divisional application is anticipated by, or includes all the limitations of, a claim that is allowable in the present application, such

claim may be subject to provisional statutory and/or nonstatutory double patenting rejections over the claims of the instant application.

3. Restriction for examination purposes as indicated is proper because all these inventions listed in this action are independent or distinct for the reasons given above and there would be a serious search and/or examination burden if restriction were not required because at least the following reason(s) apply:

Such as the distinct features need to do different searches.

Applicant is advised that the reply to this requirement to be complete must include (i) an election of a invention to be examined even though the requirement may be traversed (37 CFR 1.143) and (ii) identification of the claims encompassing the elected invention.

The election of an invention may be made with or without traverse. To reserve a right to petition, the election must be made with traverse. If the reply does not distinctly and specifically point out supposed errors in the restriction requirement, the election shall be treated as an election without traverse. Traversal must be presented at the time of election in order to be considered timely. Failure to timely traverse the requirement will result in the loss of right to petition under 37 CFR 1.144. If claims are added after the election, applicant must indicate which of these claims are readable upon the elected invention.

Should applicant traverse on the ground that the inventions are not patentably distinct, applicant should submit evidence or identify such evidence now of record showing the inventions to be obvious variants or clearly admit on the record that this is

the case. In either instance, if the examiner finds one of the inventions unpatentable over the prior art, the evidence or admission may be used in a rejection under 35 U.S.C. 103(a) of the other invention.

4. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MIKE QI whose telephone number is (571)272-2299. The examiner can normally be reached on M-T 7:30 am-6:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Nelms can be reached on (571) 272-1787. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Mike Qi/
Primary Examiner, Art Unit 2871

<i>Index of Claims</i> 	Application/Control No. 12478832	Applicant(s)/Patent Under Reexamination KIM ET AL.
	Examiner MIKE QI	Art Unit 2871

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47										
CLAIM		DATE								
Final	Original	09/20/2011								
	1	÷								
	2	÷								
	3	÷								
	4	÷								
	5	÷								
	6	÷								
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	25	÷								

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:

Jin Sub KIM et al.

Application No.:	12/478,832	Group Art Unit:	2871
Filed:	June 5, 2009	Examiner	Zhi Qiang Qi
Customer No.:	38209	Confirmation No.	1220
For:	LIQUID CRYSTAL DISPLAY DEVICE		

Commissioner of Patents and Trademarks
P.O. Box 1450
Alexandria, VA 22313-1450

RESPONSE TO RESTRICTION REQUIREMENT

Sir:

In response to the Office Action mailed on September 22, 2011, Applicants provisionally elect Invention I, directed to claims 1-11, 20-23 and 25, without traverse.

Respectfully submitted,

STANZIONE & KIM, LLP

Dated: October 17, 2011
919 18th St., NW, Suite 440
Washington, DC 20006
Telephone: (202) 775-1900
Facsimile: (202) 775-1901

By: /Seungman Kim/
Seungman Kim
Registration No. 50,012

Electronic Acknowledgement Receipt	
EFS ID:	11200243
Application Number:	12478832
International Application Number:	
Confirmation Number:	1220
Title of Invention:	LIQUID CRYSTAL DISPLAY DEVICE
First Named Inventor/Applicant Name:	Jin Sub KIM
Customer Number:	38209
Filer:	Seungman Kim/Barbera Dooley
Filer Authorized By:	Seungman Kim
Attorney Docket Number:	103-1284
Receipt Date:	17-OCT-2011
Filing Date:	05-JUN-2009
Time Stamp:	15:26:33
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Response to Election / Restriction Filed	RespRR_10-17-11.pdf	22162 aefe36325da1da224f42f07524484e9beb591ffb	no	1

Warnings:

Information:

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11) **EP 1 253 459 A2**

(12) **EUROPEAN PATENT APPLICATION**

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(30) Priority: **23.04.2001 US 840338**

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(54) **Thermal management for a thin environmentally-sealed LCD display enclosure**

(57) The present invention relates to a thermal management system for a thin depth LCD display enclosure. The LCD display enclosure may be used in environmentally sensitive conditions and may be environmentally-sealed to protect the components of the LCD display from environmental conditions. The LCD display components may include a lens and a LCD module, and other heating producing components, such as backlights and electronic circuitry. The heat producing components and any external heat placed on the enclosure causes the ambient air temperature inside the enclosure to rise thereby possibly causing the LCD display to not operate properly. The ambient air temperature inside the enclosure is lowered by transferring heat in the ambient air through the enclosure to a heat sink that is attached on the outside rear portion of the enclosure, and to the atmosphere using forced convection, natural convection, or both.

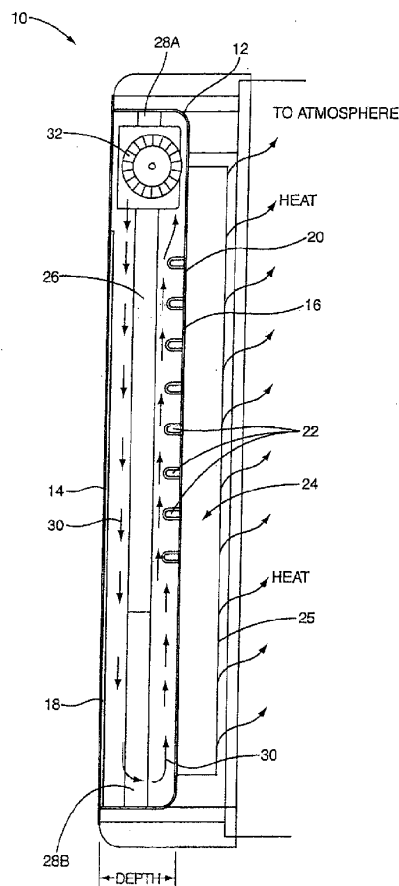


FIG. 1

EP 1 253 459 A2

Description

Field of the Invention

[0001] The present invention relates to a thermal management system for a LCD display in a thin depth, environmentally-sealed enclosure.

Background of the Invention

[0002] LCD displays are commonly used today in devices that require information to be displayed in human-perceptible form. LCD displays are typically comprised of an enclosure, a LCD module, backlights and supporting electronics. Since LCD displays use thin depth LCD modules to display information as opposed to larger in depth cathode ray tube (CRT) displays for similar sized screens, LCD displays are often used in devices that have packaging and/or space constraints. Unlike LCD displays, the tube in a CRT display increases substantially in depth as the screen size increases.

[0003] Electronic devices, such as fuel dispensers and automatic teller machines (ATM) for example, use displays to display information to users of these devices. Such information may be instructions on how to use the machine or a customer's account status. Such information may also include other useful information and/or services that generate additional revenue beyond the particular function of the device, such as advertising or newsworthy information. Through increasingly easier and cheaper access to the Internet, it has become even more desirable for electronic devices to use displays that are larger in screen size and employ higher resolution color graphics without substantially increasing the depth of the display due to packaging limitations. Therefore, LCD displays are advantageous to use in displays in electronic devices because of the thin nature of LCD modules.

[0004] LCD displays used in outdoor devices typically use an environmentally-sealed enclosure since LCD displays include internal components, such as electronics, backlights and display modules, whose operations are sensitive to outdoor conditions, such as water and dust. However, the backlights and the electronic circuitry generate extreme heat during their operation thereby raising the ambient air temperature inside the enclosure. The ambient temperature in the enclosure rises even more in outdoor devices due to sunlight heat. If the ambient temperature in the enclosure is not managed, components of the LCD display may fail. For example, the LCD module may start to white or black out if the ambient temperature inside the enclosure rises above a certain temperature.

[0005] One method keeping the ambient air temperature lower inside the enclosure is to provide a larger enclosure so that it takes more heat generated by the internal components of the LCD display and external sources, such as the sunlight, to raise the ambient air

temperature inside the enclosure. However, increasing the size of the enclosure is counter to the goal of using a thin depth enclosure for a LCD display.

[0006] Therefore, a need exists to provide a thin LCD display enclosure that is sealed from the environment and is capable of efficiently dissipating heat generated by the internal components of the LCD display and external heat, such as sunlight.

Summary of the Invention

[0007] The present invention relates to a thermal management system for a liquid crystal display (LCD) that is placed inside a thin depth enclosure and may be incorporated into an outdoor device. The thermal management system efficiently transfers and dissipates heat in the ambient air of the LCD display enclosure generated by components of the LCD display and external heat, such as sunlight.

[0008] In one embodiment of the present invention, the LCD display comprises an environmentally-sealed, heat conducting enclosure with a backlight assembly having at least one backlight. The backlight assembly is connected to the inside rear portion of the enclosure. A heat sink is attached on the outside rear portion of the enclosure. Heat generated by the backlights is transferred using natural convection from the enclosure to the heat sink, and the heat sink dissipates such heat to the atmosphere.

[0009] In another embodiment of the present invention, the LCD display contains the backlight assembly as discussed in the preceding paragraph. The LCD display also contains a lens on the front portion of the enclosure and a LCD module between the lens and the backlight assembly. The LCD module is placed in between the top and bottom of the enclosure to provide air gaps inside and at the top and the bottom of the LCD module to form a circular airflow path around the LCD module. A fan is placed in the airflow path to forcibly move heated air inside the enclosure from the front of the LCD module to the rear portion of the enclosure for heat dissipation through the heat sink and to the atmosphere.

[0010] The LCD display may be placed in any type of electronic device, including but not limited to a kiosk, a fuel dispenser, a personal computer, an elevator display, and an automated teller machine (ATM). The LCD display may display information and other instructions to a user of an electronic device incorporating the LCD display. If the LCD display has a touch screen, the LCD display may also act as an input device.

Brief Description of the Drawings

[0011] Figure 1 is a schematic diagram of one embodiment of a thin depth LCD display enclosure having a thermal management system according to the present invention;

[0012] Figure 2 is a schematic diagram of a kiosk having a LCD display according to the present invention;

[0013] Figure 3 is a schematic diagram of one embodiment of the LCD display electronics architecture; and

[0014] Figure 4 is a schematic diagram of a fuel dispenser having a LCD display according to the present invention.

Detailed Description of the Invention

[0015] The present invention relates to a thermal management system for a LCD display having a thin depth enclosure, and that may be placed in and outdoor environment and/or device. A thermal management system aids the LCD display 10 in overcoming the effects of internal heat generated by components of the LCD display 10 and heat from sunlight heat, if the LCD display 10 is placed in sunlight. The thermal management system also allows a thinner depth enclosure to be used for the LCD display. Use of a thin depth LCD display may be useful for addressing space and packaging issues for devices requiring a display.

[0016] A LCD display 10 according to one embodiment of the present invention is illustrated in Figure 1. The LCD display 10 comprises an environmentally-sealed enclosure 12 that has a front portion 14 and a rear portion 16. The environmentally-sealed enclosure 12 protects the internal components of the LCD display 10 from external elements that may affect the proper operation, such as water, dust, etc. The enclosure 12 is constructed out of a heat conducting material, such as sheet metal, aluminum, or copper for example, so that heat generated by components of the LCD display 10 can be dissipated outside of the enclosure 12 to the atmosphere using convective heat transfer. In one embodiment, the depth of the enclosure 12 is approximately 40 millimeters.

[0017] The enclosure 12 includes a transparent lens 18 at the front portion 14 of the enclosure 12 for external viewing of the LCD display 10. The lens protects the internal components of the LCD display 10 and also allows the LCD module 26 to be viewed from outside of the enclosure 12. The lens 18 may be constructed out of clear plastic, glass, Plexiglas, or other transparent material so long as the LCD module 26 can be viewed from outside the enclosure 12. The LCD module 26 may be an active or passive matrix display, may include color, and may pass or block light to provide information for external viewing.

[0018] A backlight assembly 20 is provided in the rear portion 16 of the enclosure 12. The backlight assembly 20 holds one or more backlights 22. The backlights 22 project light towards the rear of the LCD module 26 so that the LCD module 26 can be properly viewed through the lens 18. In this particular embodiment, the backlights 22 are fluorescent light bulbs. When power is provided to the backlights 22, light is projected from the backlights 22 towards the LCD module 26. The LCD module 26,

depending on its design, either blocks the light or allows the light to pass through to display information for external viewing in human-perceptible form through the lens 18.

[0019] The LCD display 10 also includes a thermal management system for convectively moving and dissipating heat generated by internal components of the LCD display 10, such as the backlights 22 and electronic circuitry (not shown) in the enclosure 12, as well as external heat on the enclosure 12, such as sunlight. Heat generated by these sources raises the ambient air temperature inside the enclosure 12 thereby possibly causing the LCD display 10 to not function properly. Although the backlights 22 are designed to operate at higher temperatures, the heat generated by the backlights may affect the performance of the LCD module 26. For example, if the LCD module 26 is a color module, the color will start to fade as the ambient temperature inside the enclosure 12 increases beyond designed operating temperatures of the LCD module 26.

[0020] It may be desirable for a LCD display 10 in an outdoor device to be brighter than would otherwise be required in an indoor device due to light and glare created by sunlight. Increasing the brightness of the backlights 22 causes the backlights 22 to generate more heat and/or the power to the electronic circuitry to be greater. Because the enclosure 12 is environmentally-sealed, heat generated by the backlights 22, the electronic circuitry, and external sources needs to be dissipated outside of the enclosure 12 in order for the LCD module 26 to operate at a lower temperature. For example, some LCD modules 12 may need to be kept at temperatures at or lower than 70 degrees Celsius to operate properly. One solution is to reduce the power to the backlights 22 that in turn lowers the heat generated by the backlights 22, but this also reduces the brightness of the LCD display 10.

[0021] The present invention may be used to avoid having to reduce the brightness of the backlights 22. Heat generated by the LCD display 10 may be convectively dissipated in two manners. The LCD display 10 dissipates heat inside the enclosure 12 using one or more heat sinks 24 attached to the rear portion 16 of the enclosure 12. The heat sink 24 may contain one or more fins 25 to create greater surface area on the heat sink 24 for dissipation of heat. This heat sink 24 ensures that the internal surface temperature of the enclosure 12 is kept as close to the atmospheric temperature as possible to ensure that the heated air inside the enclosure 12 is absorbed by the enclosure 12. Figure 1 illustrates the heat dissipated by the heat sink 24 to the atmosphere using arrows pointing upward on the outside of the rear portion 16 of the enclosure 12.

[0022] Heat generated by the backlights 22 is dissipated through the heat sink 24. The backlight assembly 20 is located against the surface of the rear portion 16 of the enclosure 12. In one embodiment, the center of the backlights is approximately 3.25 millimeters from the

rear portion 16 of the enclosure 12. In this manner, heat generated by the backlights 22 is convectively transferred to the atmosphere, using natural convection. The heat generated by the backlights 22 is transferred to the rear portion 16 of the enclosure 12 and to the heat sink 24. The closer the heat sink 24 is to the backlights 22, the faster heat generated by the backlights 22 can be transferred outside of the enclosure 12 thereby reducing the chance of such heat to increase the ambient air inside the enclosure 12.

[0023] Heat generated by the backlights 22 that is not immediately dissipated through the rear portion 16 of the enclosure 12 and the heat sink 24 causes the ambient air temperature inside the enclosure 12 to rise. Heat generated by electronic circuitry inside the enclosure 12 and any external heat on the enclosure 12, such as sunlight, also causes the ambient air temperature inside the enclosure 12 to rise. To dissipate the heat in the ambient air, thereby cooling the LCD module 26, an airflow path 30 is created around the LCD module 26 by placement of the LCD module 26 between the lens 18 and the backlight assembly 20. In one embodiment of the present invention, the back of the LCD module 26 is placed approximately 12.9 millimeters from the backlights 22 to properly diffuse and evenly backlight the LCD module 26. The front of the LCD module 26 is placed approximately 9.4 millimeters from the lens 18 so that any protrusion on the lens 18 does not damage the LCD module 26. Spacing between the lens 18 and the LCD module 26 also allows air to be routed across the LCD module 26 for thermal management, as discussed below. The LCD module 26 is also placed between the top and bottom of the enclosure 12 in the vertical plane so that air gaps 28A and 28B are formed on the top and bottom of the LCD module 26. In this manner, air is free to flow around the LCD module 26 in a circular fashion, as illustrated by the counter-clockwise airflow arrows moving around the LCD module 26 in Figure 1.

[0024] In order to dissipate heat in the ambient air in the enclosure 12, a fan 32 is placed in the airflow path 30. The fan 32 provides forced convection of the ambient air inside the enclosure 12 to the rear portion 16 of the enclosure 12 for dissipation. In one embodiment, the fan 32 is placed at the top of the enclosure 12 above the LCD module 26. During operation, that fan 32 rotates counter-clockwise to create the counter-clockwise circular airflow path 30. The ambient air is routed to the rear of the LCD module 26 and to the rear portion 16 of the enclosure 12 for dissipation through the enclosure 12 to the heat sink 24 and to the atmosphere.

[0025] The fan 32 may be any type of air movement device that can create the airflow path 30; however, one embodiment of present invention employs a laminar flow fan 32 manufactured by Delta Corporation. An example of such a laminar flow fan 32 is disclosed in U.S. Patent No. 5,961,289 entitled "Cooling axial flow fan with reduced noise levels caused by swept laminar and/or asymmetrically staggered blades," incorporated

herein by reference in its entirety. A laminar flow fan 32 creates a sheet of air, rather than turbulent air, across the LCD module 26. The laminar airflow is more efficient than turbulent airflow for moving air and transferring heat from the front of the LCD module 26 to the rear portion 16 of the enclosure 12. A more efficient fan 32 allows selection of a fan 32 that is smaller in size since it may require less rotations of the fan 32 to move an amount of air desired and/or move the same amount of air in a smaller airflow path 30. Each of these factors contributes to a smaller fan 32 size that in turn contributes to a thinner depth enclosure 12. In one embodiment, the fan 32 operates at approximately 3400 revolutions per minutes (RPM). However, the present invention may use any type of fan 32, including those that generate turbulent air. The fan 32 speed may also be adjusted to move air in the desired manner and efficiency.

[0026] Figure 2 illustrates one embodiment of a device that incorporates the LCD display 10 known as a "kiosk" 34. A kiosk 34 is any type of interactive electronic device that provides an input device, an output device, or both. Kiosks 34 are typically used in retail environments to sell products and/or services to customers. Some common types of kiosk 34 include vending machines, fuel dispensers, automatic teller machines (ATM), and the like. Figure 2 illustrates one example of a kiosk 34 that includes the LCD display 10 illustrated in Figure 1 as an output device for displaying information. Soft keys 36 are located on each side of the LCD display 10 as an input device for customer selections; however, an input device may also take others forms, such as a keypad 38, touch screen keys on the LCD display 10 (not shown), card entry device, magnetic or optically encoded cards for example, voice recognition, etc. The LCD display 10 of the present invention is particularly suited for kiosks 34 that are located in outdoor environments where the enclosure 12 of the LCD display 10 is environmentally-sealed. However, the LCD display 10 may be placed in any type of kiosk 34 regardless of whether the kiosk 34 is placed in an outdoor environment.

[0027] Figure 3 illustrates one embodiment of a communication architecture used for the LCD display 10. The LCD display 10 comprises a display CPU board 40 that contains electronics and software. In this particular embodiment, the display CPU board 40 contains a single display microprocessor 42 and display software 44. The display software 44 contains both volatile memory 46, such as RAM and/or flash memory, and non-volatile memory 48, such as EPROM and/or EEPROM. The display software 44 contains program instructions for the display microprocessor 42 and may also contain information to be displayed on the LCD module 26. The display microprocessor 42 may also manages information received from external sources and controls the operation of the LCD module 26.

[0028] In this embodiment, information is communi-

cated from one or more external devices to the display microprocessor 42 to then be displayed on the LCD module 26. A main controller 50 is provided as the interface to the display microprocessor 42. The main controller 50 may be any type of control system, including a point-of-sale system for example. The main controller 50 may be coupled to more than one display microprocessor 42 for managing multiple LCD modules 26. The main controller 50 may also be connected to a local server 56, located in close proximity to the LCD display 10, that sends information to be displayed on the LCD module 26. A remote server 52, located remotely from the LCD display 10, may also be provided to send information to the LCD module 26. The remote server 52 may send information over a network 54 directly to the display microprocessor 42, through the main controller 50, and/or through the local server 56 to be eventually displayed on the LCD module 26. The remote server 52, the local server 56, the main controller 50, and the display microprocessor 42 may be coupled each other through either a wired or wireless connection or network 54 using any type of communication technology, including but not limited to the Internet, serial or parallel bus communication, radio-frequency communication, optical communication, etc.

[0029] Examples of Internet information management that may be used with the present invention to send information to a LCD display 10 and/or communicate information entered into a LCD display 10 having a touch screen or other electronic device incorporating an LCD display 10 are disclosed in U.S. Patent Nos. 6,052,629 and 6,176,421 entitled "Internet capable browser dispenser architecture" and "Fuel dispenser architecture having server" respectively, both of which are incorporated herein by reference in their entirety.

[0030] Figure 4 illustrates another exemplary outdoor device that may incorporate the LCD display 10 of the present invention known as a "fuel dispenser" 60. A fuel dispenser 60 may also be considered a type of kiosk 34 depending on its configuration and features. The illustrated fuel dispenser 60 contains a LCD display 10 for providing instructions and/or information to a customer at the fuel dispenser 60. The fuel dispenser 60 is comprised of a housing 62 and at least one energy-dispensing outlet, such as a hose 64 and nozzle 66 combination, to deliver fuel to a vehicle (not shown). As illustrated in Figure 2, the fuel dispenser 60 may have other input and/or output devices for interaction with a customer, such as price-per-unit of fuel displays 72, soft-keys 36, a receipt printer 68, a radio-frequency identification (RFID) antenna 74, and a cash acceptor 70.

Also note that the LCD display 10 may also be placed external to the fuel dispenser 60 and attached to the fuel dispenser 60 as disclosed in co-pending patent application entitled "Multiple browser interface," filed on April 23, 2001.

[0031] Certain modifications and improvements will occur to those skilled in the art upon a reading of the

foregoing description. It should be understood that the present invention is not limited to any particular type of component in the LCD display 10 including, but not limited to the enclosure 12, the lens 18, the backlight 22 and backlight assembly 20, the heat sink 24, the LCD module 26, and the fan 32. Additionally, the LCD display 10 may be used in any type of device having or using a display, including but not limited to a personal computer, a kiosk 34, an elevator, an ATM, and a fuel dispenser 60. Also for the purposes of this application, couple, coupled, or coupling is defined as either a direct connection or a reactive coupling. Reactive coupling is defined as either capacitive or inductive coupling.

[0032] One of ordinary skill in the art will recognize that there are different manners in which these elements can accomplish the present invention. The present invention is intended to cover what is claimed and any equivalents. The specific embodiments used herein are to aid in the understanding of the present invention and should not be used to limit the scope of the invention in a manner narrower than the claims and their equivalents.

Claims

1. A LCD display, comprising:

an environmentally-sealed enclosure having a front portion and a rear portion;
a lens placed on said front portion for viewing of the LCD display;
a backlight assembly attached to said rear portion and having at least one backlight;
a heat sink connected to the outside of said rear portion to convectively transfer heat through said enclosure to the atmosphere;
a LCD module located in between said lens and said backlight assembly and in between the top and bottom of said enclosure to form air gaps at the top and bottom of the inside of said enclosure to form a circular airflow path for the ambient air inside said enclosure; and
a fan placed in said airflow path to circulate the ambient air inside said enclosure to said rear portion to transfer heat in the ambient air through said enclosure to said heat sink and to the atmosphere using forced convection.

2. The LCD display of claim 1, wherein said heat sink transfers heat generated by said at least one backlight through said enclosure to said heat sink and to the atmosphere using natural convection.

3. The LCD display of claim 1, wherein said fan is an axial fan.

4. The LCD display of claim 1, wherein said fan pro-

- duces a laminar airflow across said LCD module.
5. The LCD display of claim 1, wherein said fan rotates at a speed of around about 3400 rpm. 5
 6. The LCD display of claim 1, wherein said fan is placed in said airflow path at an end of said enclosure. 10
 7. The LCD display of claim 1, wherein said fan is placed in said airflow path in between the ends of said enclosure. 15
 8. The LCD display of claim 1, wherein said enclosure is less than or equal to a depth of around about 40 millimeters. 20
 9. The LCD display of claim 1, wherein said LCD module is spaced at a distance of around about 9.4 millimeters from said lens. 25
 10. The LCD display of claim 1, wherein said enclosure is constructed out of materials comprised from the group consisting of sheet metal, aluminum, and copper. 30
 11. The LCD display of claim 1, wherein said backlight assembly is physically connected to said rear portion of said enclosure. 35
 12. The LCD display of claim 1, wherein said backlight assembly comprises a backlight reflector that is attached to said rear portion to place said at least one backlight bulb in close proximity to said rear portion. 40
 13. The LCD display of claim 1, further comprising a control system that controls information displayed on said LCD module. 45
 14. The LCD display of claim 13, wherein said control system is comprised of electronics having a micro-processor and software. 50
 15. The LCD display of claim 1, wherein said LCD module is adapted to display an Internet browser. 55
 16. The LCD display of claim 1, wherein said enclosure is less than or equal to a depth of around about 40 millimeters.
 17. An energy dispenser that dispenses energy into a customer's vehicle, comprising:
 - a housing;
 - an energy-dispensing outlet;
 - a control system in said housing that controls the dispensing of the energy through said energy dispensing outlet; and
- a LCD display under control of said control system that displays information to the customer, said LCD display comprising:
 an environmentally-sealed enclosure having a front portion and a rear portion;
 a lens placed on said front portion for external viewing of the LCD display;
 a backlight assembly attached to said rear portion and having at least one backlight;
 a heat sink connected to the outside of said rear portion to convectively transfer heat through said enclosure to the atmosphere;
 a LCD module located in between said lens and said backlight assembly and in between the top and bottom of said enclosure to form air gaps at the top and bottom of the inside of said enclosure to form a circular airflow path for the ambient air inside said enclosure; and
 a fan placed in said airflow path to circulate the ambient air inside said enclosure to said rear portion to transfer heat in the ambient air through said enclosure to said heat sink and to the atmosphere using forced convection.
18. The energy dispenser of claim 1, wherein said heat sink transfers heat generated by said at least one backlight through said enclosure to said heat sink and to the atmosphere using natural convection.
 19. The energy dispenser of claim 17, wherein said information is comprised from the group consisting of text and graphical information.
 20. The energy dispenser of claim 17, wherein said information is comprised from the group consisting of weather, stock quotes, discounts, advertising, coupons, purchasing information, and special purchases.
 21. The LCD display of claim 17, wherein said fan is an axial fan.
 22. The LCD display of claim 17, wherein said fan produces a laminar airflow across said LCD module.
 23. The LCD display of claim 17, wherein said fan rotates at a speed of around about 3400 rpm.
 24. The LCD display of claim 17, wherein said fan is placed in said airflow path at an end of said enclosure.
 25. The LCD display of claim 17, wherein said fan is placed in said airflow path in between the ends of said enclosure.
 26. The LCD display of claim 17, wherein said enclosure is less than or equal to a depth of around about

40 millimeters.

27. The LCD display of claim 17, wherein said LCD module is spaced at a distance of around about 9.4 millimeters from said lens.

28. The LCD display of claim 17, wherein said enclosure is constructed out of materials comprised from the group consisting of sheet metal, aluminum, and copper.

29. The LCD display of claim 17, wherein said backlight assembly is physically connected to said rear portion of said enclosure.

30. The LCD display of claim 17, wherein said backlight assembly comprises a backlight reflector that is attached to said rear portion to place said at least one backlight bulb in close proximity to said rear portion.

31. The LCD display of claim 17, further comprising a control system that controls information displayed on said LCD module.

32. The LCD display of claim 31, wherein said control system is comprised of electronics having a micro-processor and software.

33. The LCD display of claim 17, wherein said LCD module is adapted to display an Internet browser.

34. The LCD display of claim 17, wherein said energy dispenser is a fuel dispenser.

35. A method of manufacturing a cooled LCD display in an environmentally-sealed enclosure, comprising the steps of:

placing a lens on a front portion of the enclosure;

attaching a backlight assembly to a rear portion of the enclosure;

placing at least one backlight in said backlight assembly;

attaching a heat sink to the outside of said rear portion to convectively transfer heat through said enclosure to the atmosphere ;

placing a LCD module in the enclosure in between said lens and said backlight assembly and leaving gaps at the top and bottom of the inside of the enclosure to form a circular air flow path around said LCD module; and

placing a fan in said airflow path to circulate the ambient air inside said enclosure to said rear portion to transfer heat in the ambient air through said enclosure to said heat sink and to the atmosphere using forced convection.

36. The method of claim 35, further comprising transferring heat generated by said at least one backlight through said enclosure to said heat sink and to the atmosphere using natural convection.

37. The method of claim 35, further comprising mounting said enclosure in an energy dispenser.

38. The method of claim 37, further comprising attaching a control system to said LCD module for controlling information displayed on said LCD module.

39. A method of lowering the temperature of ambient air inside an environmentally-sealed enclosure for a LCD display, comprising the steps of:

heating the ambient air inside the enclosure by operation of the LCD display;
moving the ambient air inside in the enclosure to a rear portion of the enclosure; and
convectively transferring the heat in the ambient air to the atmosphere by transferring the heat through a heat sink attached to said rear portion of the enclosure using forced convection.

40. The method of claim 39, further comprising transferring heat generated by at least one backlight to the enclosure through said heat sink and to the atmosphere using natural convection.

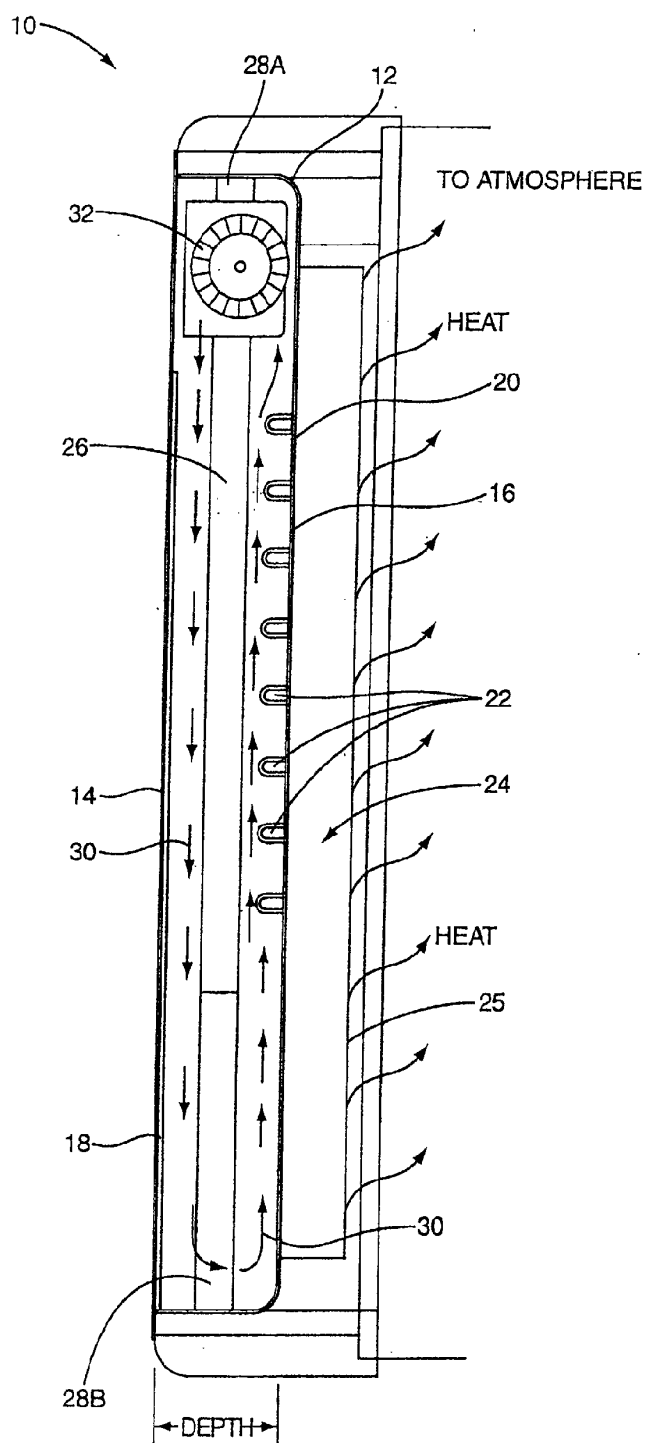


FIG. 1

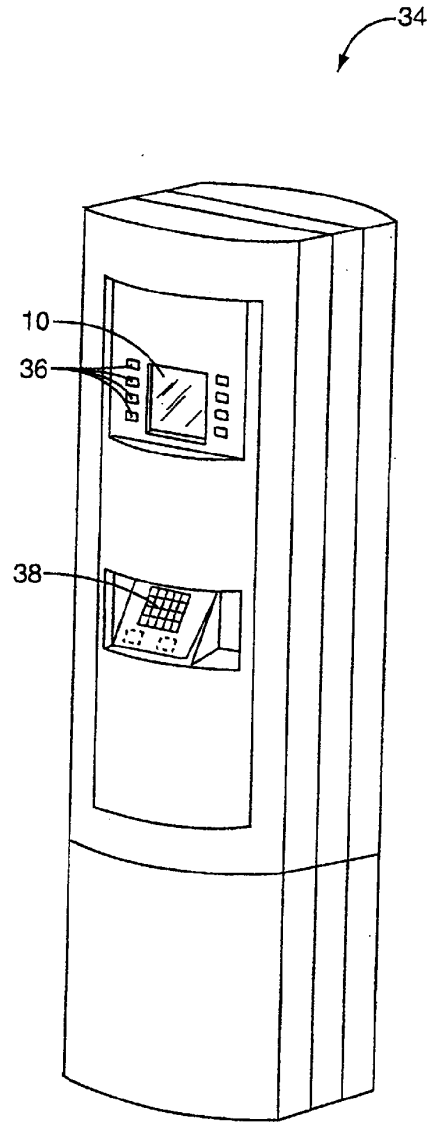


FIG. 2

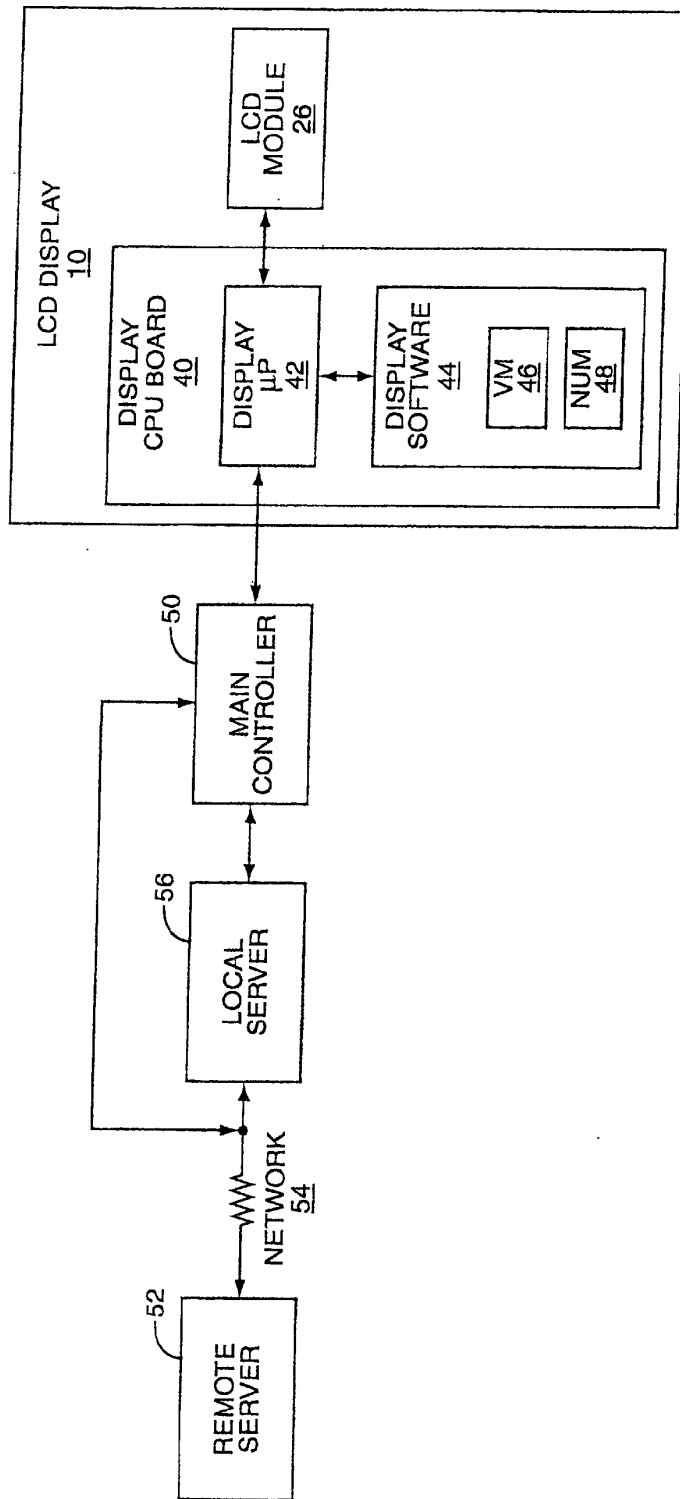


FIG. 3

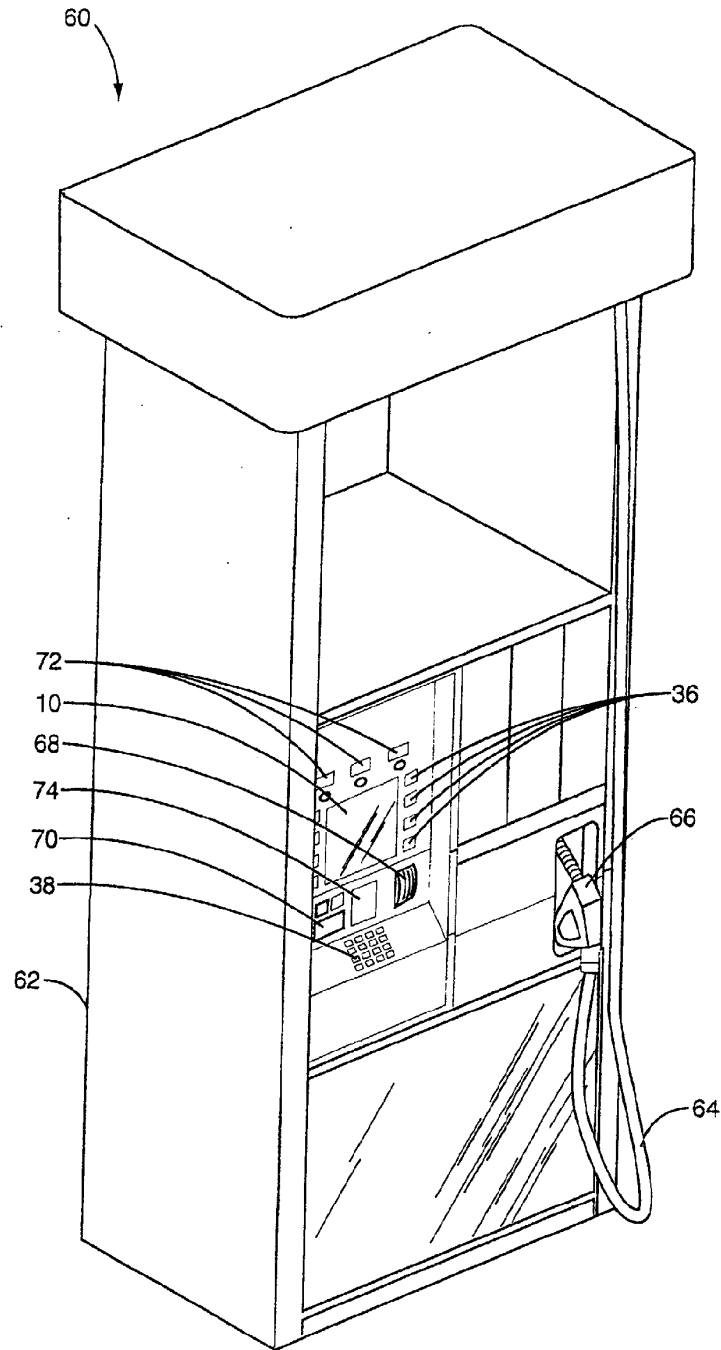


FIG. 4

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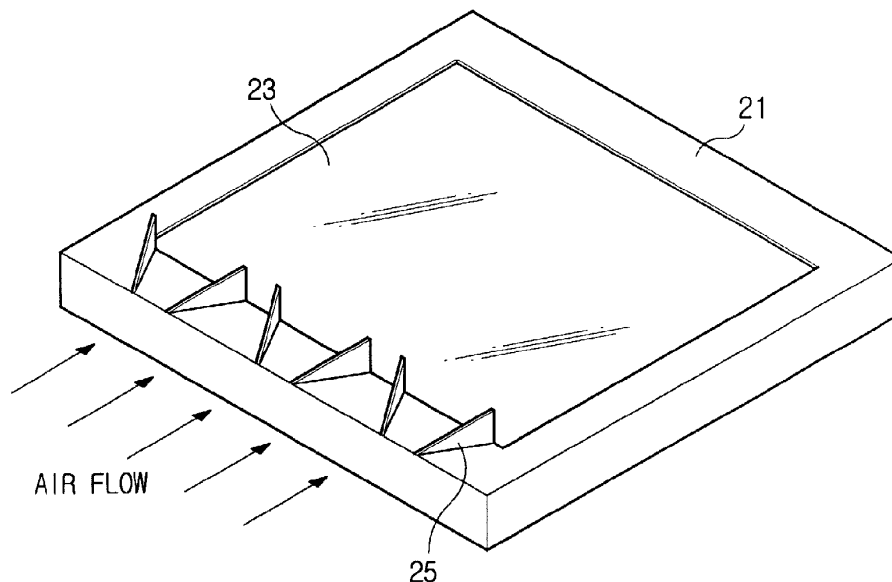
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(54) Title: LIQUID CRYSTAL DISPLAY FOR PROJECTOR



(57) Abstract: Disclosed is an LCD for a projector comprising inclined plates mounted on a frame of an LCD panel for a projector, and optionally, on a polarizer frame for the projector which are cooled in a form of forced convection by inflow air. The inclined plates serve to change inflow air into vortices in order to increase heat transfer coefficient at surfaces of optical components such as the LCD panel and the polarizer as well as improve heat radiation efficiencies thereof thereby restricting the temperature growth of the LCD panel and the polarizer while prolonging lifetimes thereof.



For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

LIQUID CRYSTAL DISPLAY FOR PROJECTOR

TECHNICAL FIELD

The present invention relates to a Liquid Crystal Display (LCD) for a projector. In particular, the LCD comprises inclined plates mounted on a frame of an LCD panel or a polarizer, which serve to change inflow air into vortices in order to increase heat transfer coefficient at a surface of the LCD panel or the polarizer.

10

BACKGROUND ART

Generally, as shown in FIG. 1, an LCD projector emits rays from a lamp or a light source 2. Then, blue light B is reflected from a blue reflective dichroic mirror 3, and then introduced via a total reflection mirror 6 into an LCD panel 8.

Red light R and Green light G penetrate through the blue reflective dichroic mirror 3. Green light G is reflected from a green reflective dichroic mirror 4 and then introduced into an LCD panel 9. Red light R penetrates through the green reflective dichroic mirror 4 and then via total reflection mirrors 5 and 7 introduced into the LCD panel 10. Polarizers 14 may be disposed respectively in front and rear of the LCD panels 8, 9 and 10.

The LCD panels 8, 9 and 10 respectively reproduce red, green and blue images according to the above procedures. The red, green and blue images are respectively introduced into a cross dichroic mirror, a blue reflective dichroic mirror 12 and a red reflective

dichroic mirror 11. The blue and red images join with each other after being reflected from the mirrors 12 and 11 and the green image penetrates the cross mirror to join the blue and red images. Then, the joined entire images are expanded and projected via a
5 lens 13 toward a screen (not shown).

The lamp 2 of the LCD projector generally utilizes a metal halide lamp, which consumes about 150W or more to emit light of about 5,000lm. Since light from the metal halide lamp is largely absorbed or disappears while propagating along optical paths,
10 only about 3 to 5% of light reaches the screen. The most of absorbed light is radiated in the form of heat.

Lifetime and operating characteristics of the LCD panel are particularly in close relation with the temperature of the panel. So, a suction fan or a discharge fan is installed to cool the panel
15 within the projector. Because such a cooling method blows ambient air at a room temperature to cool the LCD panel and/or the polarizer, it is necessary to increase the size or the rotation speed of the fan in order to ensure sufficient wind quantity and speed for cooling the LCD panel and the polarizer.

20

DISCLOSURE OF THE INVENTION

The present invention has been made to solve the foregoing problems and it is therefore an object of the present invention to provide an LCD for a projector comprising inclined plates
25 mounted on a frame of an LCD panel or a polarizer, which serves to change inflow air into vortices in order to increase heat

transfer coefficient at a surface of the LCD panel or the polarizer as well as to improve cooling efficiency thereby lowering temperatures of the LCD panel and the polarizer while prolonging lifetimes thereof.

5 It is another object of the invention to provide an LCD for a projector capable of improving cooling efficiency to decrease the size or the rotation speed of a fan necessary for cooling the LCD panel and the polarizer thereby ensuring a quiet projector.

 According to an aspect of the invention to obtain the above
10 objects, it is provided an LCD for a projector comprising: an LCD panel; an LCD panel frame for supporting the LCD panel; and at least one LCD panel inclined plate mounted on a surface of the LCD panel frame, the LCD panel inclined plate being inclined in respect to an advancing direction of inflow air introduced to the
15 LCD panel frame.

 It is preferable that adjacent inclined plates are inclined in a symmetric direction from each other, the inclined plates are alternatively mounted on upper and lower surfaces of the LCD panel frame or the polarizer frame, and the inclined plates are
20 quadrangular or triangular.

 It is also preferable that a lateral portion of the frame for receiving inflow air is rounded to obtain efficient air inflow.

 According to another aspect of the invention to obtain the
25 above objects, it is provided an LCD panel comprising: an LCD; an LCD panel frame for supporting the LCD panel; and at least one

LCD panel inclined plated mounted on a surface of the LCD panel frame, the LCD panel inclined plate having a configuration of a delta wing and an angle in respect to an advancing direction of inflow air introduced to the LCD panel frame.

5

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features and other advantages of the present invention will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

10

FIG. 1 is a conceptual view of a conventional projector;

FIG. 2 is a perspective view of an LCD for a projector according to a preferred embodiment of the invention;

FIG. 3A is a sectional view of the LCD for a projector according to the preferred embodiment of the invention;

15

FIG. 3B shows an alteration of FIG. 3B;

FIG. 4 is a plan view of the LCD for a projector according to the preferred embodiment of the invention;

FIG. 5 is a front elevation view of the LCD for a projector according to the preferred embodiment of the invention; and

20

FIG. 6 is a perspective view of an LCD for a projector according to an alternative embodiment of the invention.

BEST MODE FOR CARRYING OUT THE INVENTION

25

The following detailed description will present a preferred embodiment of the invention in reference to the accompanying

drawings.

FIG. 2 is a perspective view of an LCD for a projector according to a preferred embodiment of the invention, FIG. 3A is a sectional view of the LCD for a projector according to the preferred embodiment of the invention, FIG. 3B shows an alteration of FIG. 3B, and FIG. 4 is a plan view of the LCD for a projector according to the preferred embodiment of the invention.

As shown in FIG. 2, the LCD for a projector according to the preferred embodiment of the invention has at least one or plural inclined plates 25, 25' on a frame 21 for supporting an LCD panel 23. The incline plates 25, 25' is mounted on a surface of a portion of the frame 21 to which air inflow is primarily introduced, and inclined to a designated angle in respect to a direction of air flow toward the frame 21.

Likewise, at least one inclined plate can be mounted on each of frames for surrounding each of the polarizers 14 in front and rear of the LCD panels shown in FIG. 1, as inclined to a proper angle in respect to a direction of air flow which is introduced to the frames.

Air flow introduced to the frame 21 is changed into vortices 27 at a rear end of the inclined plates 25, 25' while flowing through the inclined plates 25, 25' as shown in FIGS. 3A to 4. Such vortices 27 perform active turbulent motion to increase a heat transfer coefficient of the LCD panel 23 in the rear of the inclined plates 25, 25' thereby promoting heat radiation of the LCD panel 23.

This action is identically applied to the inclined plate mounted on the each frame surrounding the each polarizer 14 to restrict temperature growth of the polarizer 14.

Preferably, adjacent inclined plates 25 are inclined
5 symmetrical to each other. Where the adjacent inclined plates 25 are so arranged to have symmetrical inclination to each other, the vortices 27 obtained from air through the inclined plates 25 have rotational directions symmetric to those of adjacent ones but an identical advancing direction. As a result, this can
10 promote mixture of air at interfaces of the vortices 27.

The inclined plates can be mounted on upper and lower surfaces of the frame as shown in FIG. 5. Then, introduced air forms vortices 27 while flowing through the inclined plates 25, 25' in upper and lower portions of the frame 21 thereby further
15 promoting heat radiation of the LCD panel 23.

The inclined plates 25 can be shaped as a quadrangle or triangle. According to experiments, a quadrangular plate forms a vortex earlier than a triangular plate. However, the quadrangular and triangular plates have a similar value of heat
20 transfer coefficient.

Referring to FIG. 3B, the frame for surrounding the LCD panel and the polarizer may alternatively be rounded at a lateral portion to which air is introduced so as to promote inflow of air toward the inclined plate.

25 FIG. 6 is a perspective view of an LCD for a projector according to an alternative embodiment of the invention.

As shown in FIG. 6, inclined plates 25 are in the shape of a triangular or delta wing and have an angle θ in respect to air flow. The inclined plates 25 are arrayed in parallel to incline in respect to an advancing direction of inflow air. The inclined
5 plates 25 of this embodiment can obtain an effect identical with that of the above embodiment of the invention.

Although the invention has been shown and described with reference to certain preferred embodiments thereof, it will be understood by those skilled in the art that various changes in
10 form and details may be made therein without departing from the spirit and scope of the invention as defined by the appended claims. Therefore, any future alterations of the embodiments of the invention may not reach beyond the technical principle of the invention.

15

INDUSTRIAL APPLICABILITY

As set forth above, the LCD for a projector of the invention changes inflow air into vortices to increase the heat transfer coefficient of the LCD panel or the polarizer as well as heat
20 radiation efficiency so that heat radiation can be promoted without any additional cost.

Furthermore, the inclined plates for changing inflow air into the vortices are mounted on the frame for supporting the LCD panel to effectively remove air generated from the LCD panel
25 thereby improving characteristics of the LCD panel as well as prolonging the lifetime thereof.

CLAIMS

1. A liquid crystal display(LCD) for a projector comprising:

5 an LCD panel;

an LCD panel frame for supporting the LCD panel; and

at least one LCD panel inclined plate mounted on a surface of the LCD panel frame, the LCD panel inclined plate being inclined in respect to an advancing direction of inflow air introduced to

10 the LCD panel frame.

2. The liquid crystal display of claim 1, further comprising:

a polarizer in the rear of the LCD panel;

15 a polarizer frame for supporting the polarizer; and

at least one polarizer inclined plate mounted on a surface of the polarizer frame, the polarizer inclined plate being inclined in respect to an advancing direction of inflow air introduced to the polarizer frame.

20 3. The Liquid crystal display of claim 1 or 2, wherein adjacent inclined plates are inclined in a symmetric direction from each other.

25 4. The Liquid crystal display of claim 1 or 2, wherein the inclined plates are mounted on upper and lower surfaces of the

LCD panel frame or the polarizer frame.

5. The Liquid crystal display of claim 1 or 2, wherein the inclined plates are quadrangular or triangular.

5

6. The Liquid crystal display of claim 1 or 2, wherein a lateral portion of the frame for receiving inflow air is rounded.

7. An LCD panel comprising:

10

an LCD;

an LCD panel frame for supporting the LCD panel; and

at least one LCD panel inclined plated mounted on a surface of the LCD panel frame, the LCD panel inclined plate having a configuration of a delta wing and an angle in respect to an advancing direction of inflow air introduced to the LCD panel frame.

15

8. The LCD panel of claim 7, further comprising:

a polarizer in the rear of the LCD panel;

20

a polarizer frame for supporting the polarizer; and

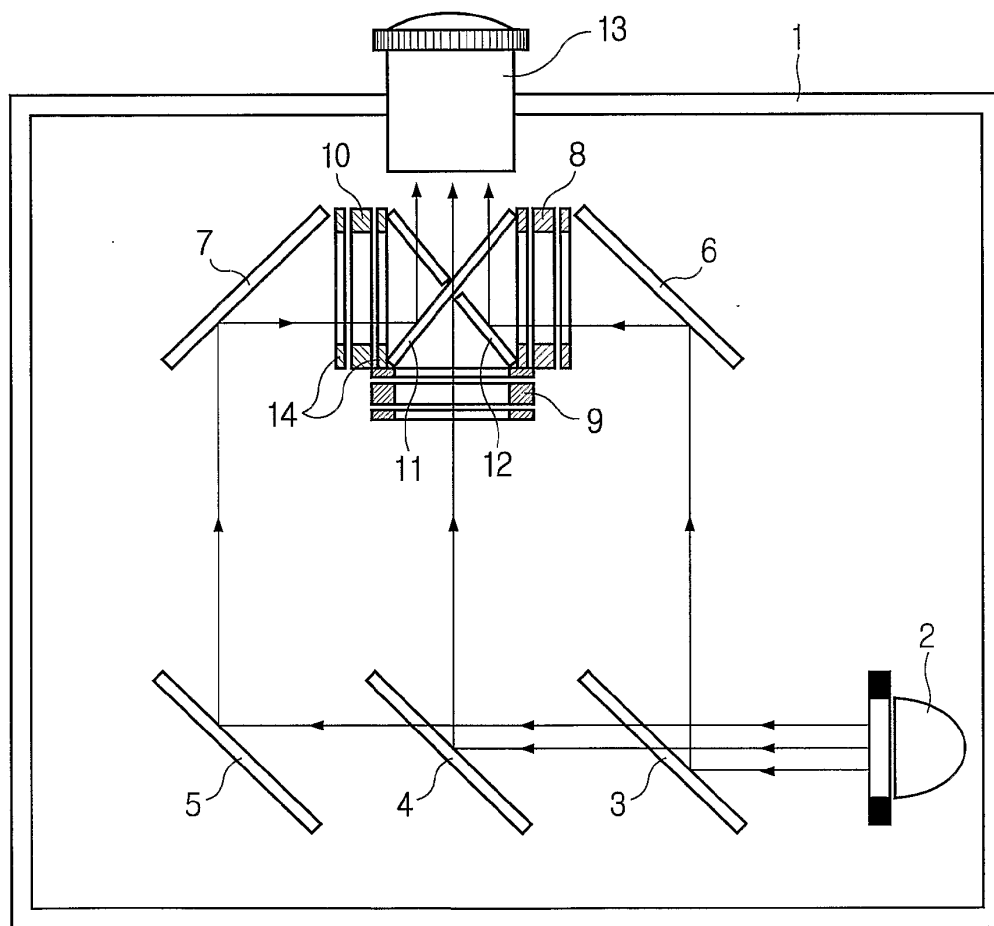
at least one polarizer inclined plate mounted on a surface of the polarizer frame, the polarizer inclined plate having a configuration of a delta wing and an angle in respect to an advancing direction of inflow air introduced to the LCD panel frame.

25

9. The LCD panel of claim 7 or 8, wherein a lateral portion of the frame for receiving inflow air is rounded.

1/5

FIG. 1



2/5

FIG. 2

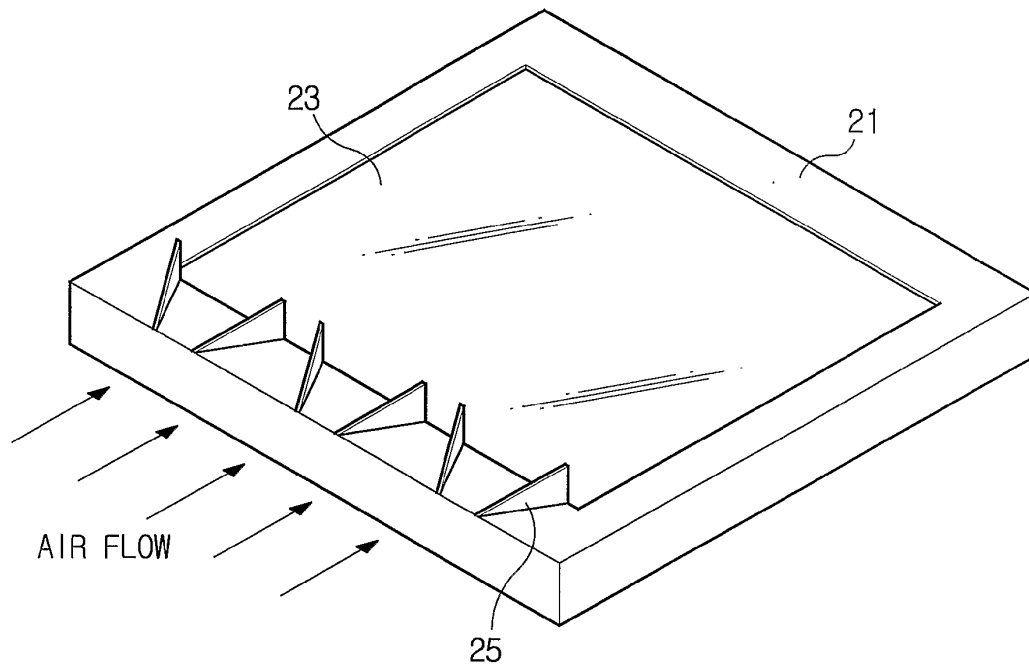


FIG. 3A

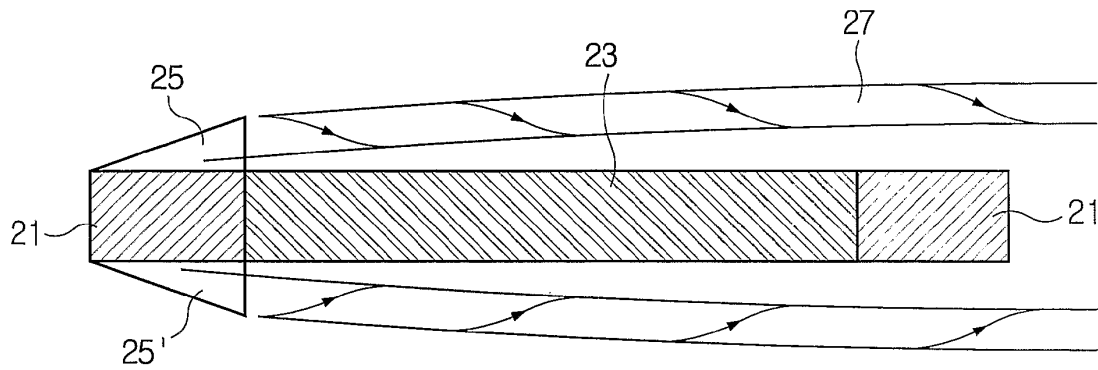


FIG. 3B

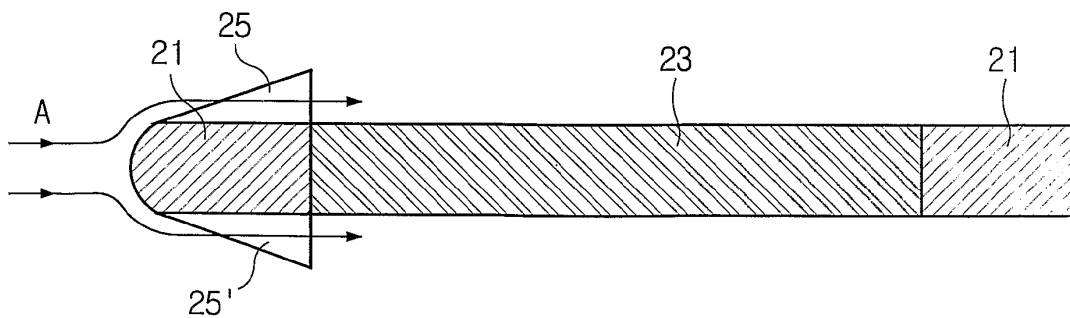


FIG. 4

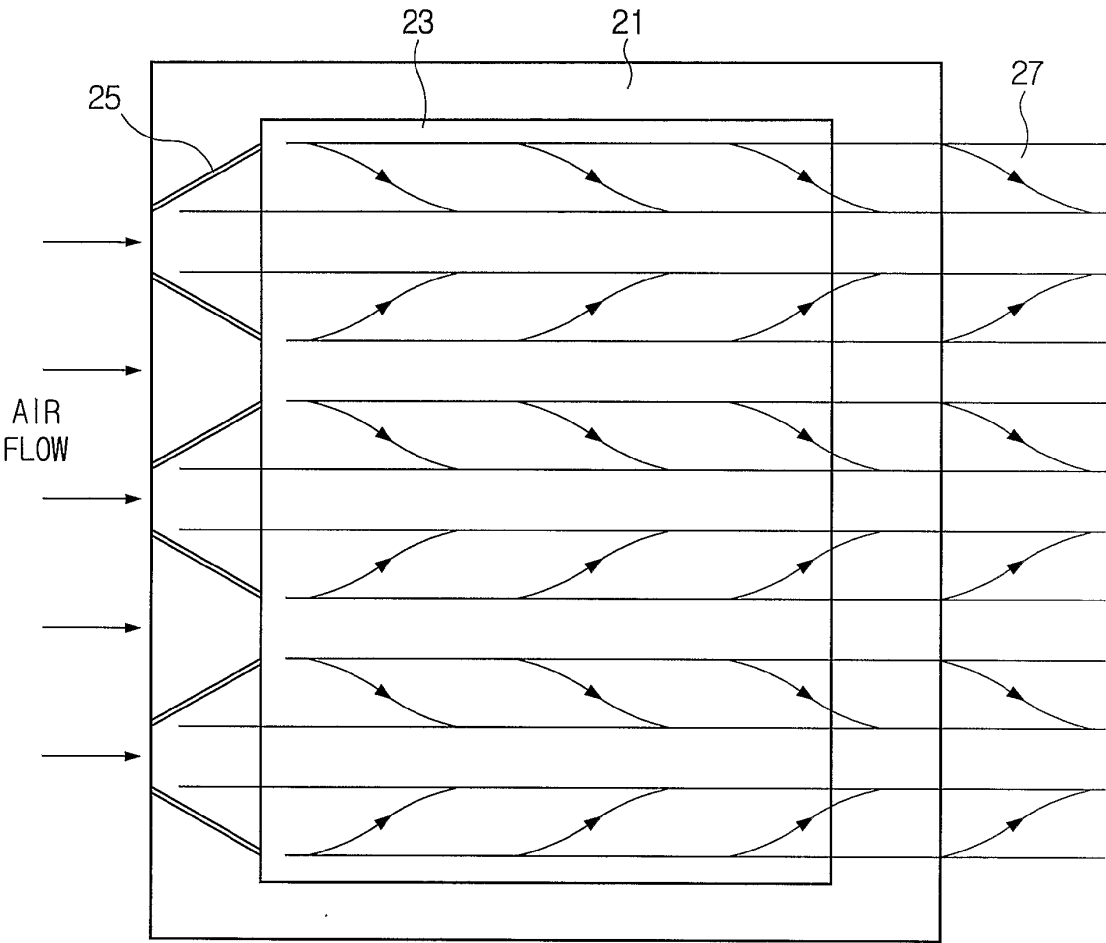


FIG. 5

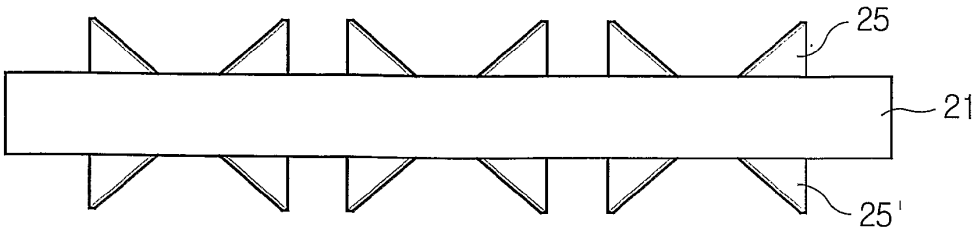
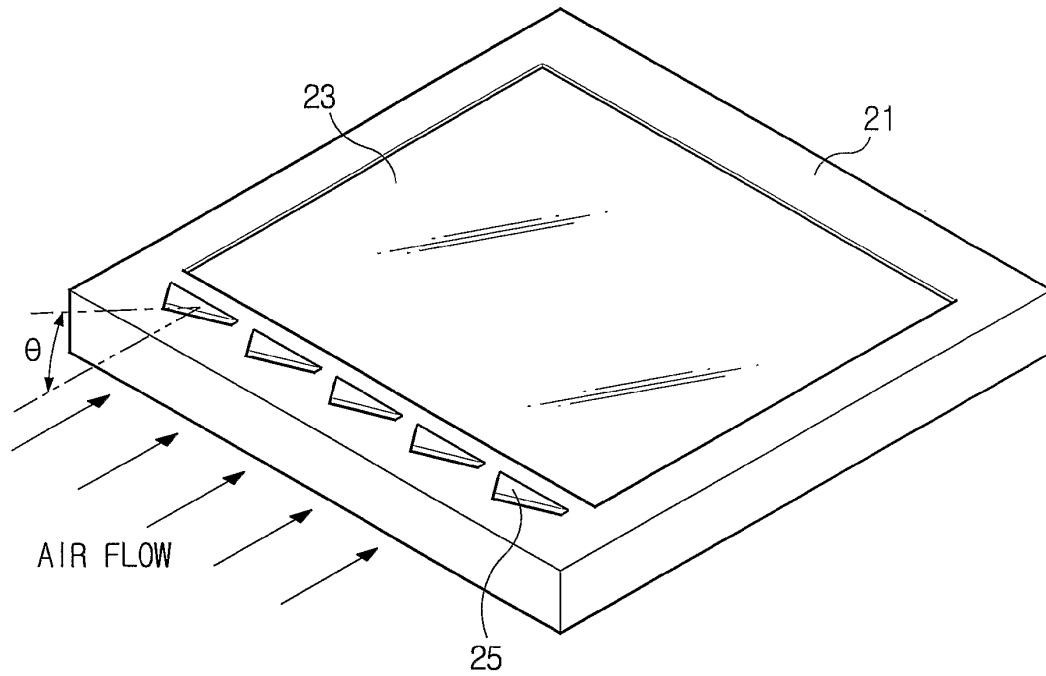


FIG. 6



INTERNATIONAL SEARCH REPORT

International application No.
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A. CLASSIFICATION OF SUBJECT MATTER**IPC7 G02F 1/13**

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

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

Korean Patents and applications since 1975

Korean Utility models and applications Utility since 1975

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

KIPONET

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	KR 1999-008986U(LG ELECTRONICS CO., LTD.) 05 MARCH 1999 SEE THE WHOLE DOCUMENT	1
A	KR 2001-0104271A(HUJISASHIN FILM KABUSHIKIKAISHA) 24 NOVEMBER 2001 SEE THE WHOLE DOCUMENT	1-9
A	KR 2000-0056980A(HITACHI, LTD.) 15 SEPTEMBER 2000 SEE THE WHOLE DOCUMENT	1-9
A	US 6334686B1(HITACHI, LTD.) 1 JANUARY 2002 SEE THE WHOLE DOCUMENT	1-9

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

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"&" document member of the same patent family

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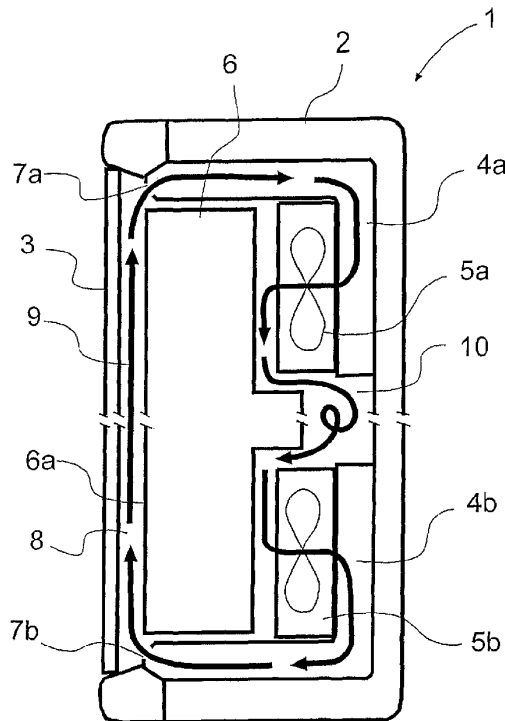
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[Continued on next page]

(54) Title: PROCEDURE AND APPARATUS FOR CONTROLLING THE TEMPERATURE OF A DISPLAY SURFACE



(57) Abstract: The invention relates to a procedure and an apparatus for controlling the temperature of the display surface (6a) of an encapsulated display device (6). The display device is placed in a casing (1) provided with a transparent protecting element (3), in which casing a medium, such as air, is circulated. According to the invention, the flow of the circulated air stream (9) is equalized and after the equalization the air stream is caused to flow along the display surface (6a) of the display device (6) over the display surface (6a).

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SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

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PROCEDURE AND APPARATUS FOR CONTROLLING THE TEMPERATURE OF A
DISPLAY SURFACE

The present invention relates to a procedure as defined in
5 the preamble of claim 1 and an apparatus as defined in the
preamble of claim 5 for controlling the temperature of a
display surface.

The procedure and apparatus of the invention, which are
10 hereinafter also referred to by the common designation "so-
lution of the invention", is particularly well applicable
for use for controlling the display surface of electric dis-
plays, such as TFT, LCD, plasma or similar display devices,
either by cooling, heating or in some cases even drying the
15 display surface. This type of electric displays are also
referred to as digital displays.

Aforesaid displays provided with a digital display surface
have been mainly used in indoor spaces, which is why they
20 have generally been non-encapsulated. The display surface of
the display has therefore been in direct contact with ambi-
ent air, and consequently it has been impossible to control
the temperature of the display surface accurately enough.
Still, this type of displays generally work without major
25 problems in indoor spaces because the air circulation rate
is sufficiently high to prevent the display surface from
becoming overheated. However, as displays used for different
purposes have been gaining ground, there has arisen the
problem that a bare display surface can not be left exposed
30 to touch by people. Such exposure may lead to damage of the
display surface in consequence of vandalism or otherwise due
to the surface being accidentally touched with excessive
force. For this reason, a display surface that is exposed to
touch by people has to be protected with a pane of glass,
35 plastic or equivalent placed in front of the display sur-
face. Often it is also necessary to encapsulate the entire
display. However, such encapsulation and protective plate in
front of the display surface easily cause overheating of the
display surface, which is due to the display's own heat pro-

duction, the sun or other external heat sources or the combined effect of these. Overheating may reduce the service life of the display if it e.g. causes local damage to the display, or overheating may damage the whole display beyond
5 repair.

Due to the difficult control of temperature of the display surface, it has been difficult to use aforesaid electric displays outdoors where the display surface is more readily
10 exposed e.g. to direct sunshine, which might cause excessive heating of the display surface. Besides, bright sunshine affects the visibility of the display surface. In bright illumination and in sunshine, the display's own brightness has to be increased, and consequently the additional power
15 needed to form the image and increase the contrast produces a higher surface temperature of the display, thus heating the display surface further. Likewise, when used outdoors the display surface may be exposed to other extreme conditions, e.g. rain or low temperatures, in which aforesaid
20 electric displays do not necessarily work without a heating arrangement.

In prior art, international patent application no. WO 01/99482, among others, discloses a solution for cooling an
25 encapsulated electric display. However, the solution according to this WO specification concentrates on cooling the components located in the rear part of the display casing and on cooling the rear part of the plasma display, as is stated on lines 1-10 on page 2 of the WO specification. In
30 addition, from Fig. 2A and 2C of the WO specification we can clearly see that the display surface 21a is outside the casing and the cooling air gap E is on the opposite side of the casing, behind the display 21. Although the display is encapsulated, the display surface in this solution, too, is in
35 direct contact with ambient air, so it is not possible to reliably implement control of the temperature of the display surface, and the display surface is exposed to vandalism and damage from being touched.

Previously known is also a solution as disclosed in British patent application no. GB2357178 for controlling the temperature of a plasma display in a case where the plasma display is enclosed in a hermetic casing provided with a transparent front plate to prevent disturbances caused by dust and other particles present in the air. In the solution according to this GB application, the cooling air is taken through filters directly from the external air surrounding the casing and returned after the cooling function from the casing directly back into the space outside the casing. Therefore, controlling the temperature of the air taken from outside the casing may prove difficult because the temperature of the air may change even very quickly e.g. when the sun emerges from behind a cloud and heats the air. Likewise, displays used outdoors are exposed to large temperature differences in different seasons, and therefore correct control of temperature is difficult. Moreover, in the solution according to the GB application, the air stream is blown into a gap 26 behind the display panel, between the display panel 13 and an auxiliary panel 12 behind the display panel, and not into the gap between the transparent front plate 14 and the actual display surface. Consequently, control of the temperature of the display surface itself is not as fast and efficient as it could be. Besides, in the solution according to the GB application, the air stream is not equalized in any way, so the air stream may be different in respect of cooling/heating power in different parts of the display. In difficult conditions this may result in damage e.g. to a part of the display surface.

Thus, both non-encapsulated displays and partially or completely encapsulated displays still have the common drawback that no reliable arrangement for controlling the temperature of the display surface has been achieved, and consequently the use of electric displays is restricted.

The object of the present invention is to overcome the above-mentioned drawbacks and to achieve a simple and reliable procedure and apparatus for controlling the temperature of the display surface of an electric display, in which solution the display surface of a display placed in a casing can be provided with a protective glass pane or equivalent. A further object is to achieve a procedure and apparatus that will enable the use of an electric display for many different purposes and in many different places of application. The procedure of the invention is characterized by what is disclosed in the characterization part of claim 1. Correspondingly, the apparatus of the invention is characterized by what is disclosed in the characterization part of claim 5. Other embodiments of the invention are characterized by what is disclosed in the other claims.

The solution of the invention has the advantage that, being completely encapsulated, the display device, in more simple terms the display withstands all kinds of external conditions, including exceptional situations, whether caused by weather or man. An additional advantage is that the encapsulated construction with the display surface placed inside a casing enables the control of the temperature of the display surface to be reliably implemented so that the limit temperature values specified by the manufacturer will not be exceeded under any circumstances at any point of the display surface. The advantages resulting from this include a longer service life of the display and more versatile possibilities of use of the display than at present. The display can be used both indoors and outdoors and also at a close distance from spectators as the display surface is protected against touch. A further advantage is that the casing of the display can be easily provided with a cooling system, allowing a display provided with the solution of the invention to be safely used even in reasonably hot outdoor conditions. An additional advantage is good sound insulation of the fans used, because the fans producing the air streams are placed as far away from the front edges of the air ducts opening in

the spectator's direction, so that the fan noise carried by the air stream travels through as long a distance in the air duct as possible. Yet another advantage is that the closed box-type structure also protects the display from dust, sand, water and other harmful materials. A further advantage is that, as a constant dynamic pressure is maintained over the entire width of the display surface, the velocity of the flow of circulated air can be equalized over the entire width of the display surface, so a sufficiently even flow velocity is achieved even in the display surface edge areas having the greatest flow resistance.

In the following, the invention will be described in detail with reference to an embodiment example and the attached drawing, wherein

- Fig. 1 presents a technical solution according to the invention in simplified and diagrammatic form in side view,
- 20 Fig. 2 presents a technical solution according to the invention in simplified and diagrammatic form in top view, and
- Fig. 3 presents a technical solution according to the invention in simplified and diagrammatic form in front view.
- 25

To provide an understanding of the solution of the invention, first a technical solution implementing the procedure of the invention for controlling the temperature of the display surface of an electric display will be described. Fig. 1 presents a simplified and diagrammatic cross-sectional side view of a casing 1 according to the invention. An arrow pattern 9 represents the circulating air stream used to control the temperature of the display surface 6a. The casing structure comprises e.g. a thermally insulated envelope 2, which has an open front provided with a transparent protecting element 3, such as a glass or plastic plate or a corresponding transparent structure. The envelope 2 and the pro-

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protecting element 3 together form a substantially closed and substantially watertight and airtight casing structure, inside which a display device 6, i.e. a display provided with a display surface 6a can be mounted.

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Provided in the upper part of the envelope 2 is an air duct 4a of a width covering substantially the entire interior width of the envelope 2, which air duct forms a hollow structure with an L-shaped cross-sectional profile such that
10 a first branch of the L-profile is substantially parallel to the interior upper surface, i.e. ceiling of the envelope and adjoins the ceiling of the envelope 2 while a second branch of the L-profile is substantially parallel to the interior rear surface, i.e. back wall of the envelope 2 and adjoins
15 the inner surface of the back wall of the envelope. In the lower part of the envelope 2 is an air duct 4b corresponding to air duct 4a and placed in an upside-down position with respect to air duct 4a and adjoining in a corresponding manner both the back wall of the envelope 2 and the interior
20 bottom surface of the envelope 2. The front edges of the first branches of the air ducts 4a and 4b, i.e. the branches at the ceiling and bottom surfaces of the envelope 2 extend to the front part of the envelope 2, close to the rear surface of the protecting element 3.

25

The air duct 4a in the upper part of the is provided with at least one fan 5a, which sucks air used for controlling the temperature of the display surface 6a from the air duct 4a and blows the air further into a space 10 in the rear part
30 of the envelope 2, which may contain e.g. display components producing turbulence in the circulated air stream. The fan 5a is secured to the second branch of air duct 4a, i.e. to the branch adjoining the rear wall, close to the space 10 in the rear part. Similarly, air duct 4b is provided with a fan
35 5b secured to the second branch of the air duct, i.e. to the branch adjoining the rear wall. The fan 5b sucks air from the space 10 in the rear part of the envelope 2 into air

duct 4b and blows it further through the air duct 4b towards the front part of the envelope 2.

The front part of the air duct 4b in the lower part of the envelope 2 is provided with a throttle element 7b, such as an air gap or equivalent, throttling the circulated air stream and having a width substantially covering at least the entire display surface 6a, the effective cross-sectional area of the throttle element being smaller than the effective cross-sectional area of air duct 4b after fan 5b. Correspondingly, the front part of the air duct 4a in the upper part of the envelope 2 is provided with an exhaust element 7a, such as an air gap or equivalent, for the exhaust of the circulated air stream, said exhaust element having a width at least substantially equal to the entire width of the display surface 6a and an effective cross-sectional area at least equal to the effective cross-sectional area of the throttle element 7b.

The display device 6 is so placed inside the envelope 2 that between the display surface 6a and the protecting element 3 there remains an air gap 8 having a substantially uniform width and oriented in a direction parallel to the plane of the display surface 6a, in which air gap the circulated air stream 9 produced by the fans 5a and 5b has been fitted to rise along the surface of the display surface 6a from the lower part of the envelope 2 to its upper part to control the temperature of the display surface 6a.

Fig. 2 correspondingly presents a simplified and diagrammatic cross-sectional top view of the casing structure 1 of the invention. The arrow pattern 13 indicates the path of the cooling replacement air in the casing structure 1 of the invention. Placed on each interior side surface, i.e. side wall of the envelope 2 has a hollow air duct 11a and 11b of L-shaped cross-sectional profile substantially corresponding to air ducts 4a, 4b. The first branch of the air ducts 11a, 11b adjoins the side wall of the envelope 2 and the second

branch adjoins the rear wall of the envelope 2. Air ducts 11a and 11b are mitred with air ducts 4a and 4b and fastened at the mitre to air ducts 4a and 4b, so that the four air ducts together form a structure resembling a picture frame.

5 The hollow interiors of air ducts 4a and 4b are mechanically insulated from the corresponding interiors of air ducts 11a and 11b either at or near the mitre to separate the air streams circulating in the air ducts from each other.

10 The vertical front side of the envelope 2 is provided with one or more air intake openings 14a communicating with the opening at the front edge of air duct 11a. Air duct 11a is provided with at least one fan 12a, which sucks replacement air into the air duct from outside the of the envelope 2

15 through the intake opening 14a and blows the air further into the space 10 in the rear part of the envelope 2, where the replacement air stream 13 is mixed with the circulated air stream 9, cooling, heating or drying the circulated air as necessary. In the labyrinthine structure of the space 10

20 in the rear part, the replacement air is well mixed with the circulated air, so that the temperature of the circulated air is rendered as even as possible. The fan 12a is fastened to the second branch of air duct 11a, i.e. to the branch adjoining the rear wall, close to the space 10 in the rear

25 part. Similarly, air duct 11b is provided with a fan 12b attached to the second branch of the air duct, i.e. to the branch adjoining the rear wall, which sucks air from the space 10 in the rear part of the envelope 2 into air duct 11b and blows it further through the air duct 11b out of the

30 envelope via one or more exhaust openings 14b provided in the vertical front side of the envelope. As the air intake and exhaust openings 14a, 14b are located in the front side of the envelope, the display casing can even be embedded in a wall or a corresponding mounting surface.

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Fig. 3 presents a simplified and diagrammatic cross-sectional front view of the casing structure 1 of the invention. For the sake of clarity, the figure only shows the

circulation air 9 flowing upwards along the front side of the display surface 6a of the display device 6. Correspondingly, behind the display device 6 the circulation air 9 flows downwards, as can be seen from Fig. 1. The replacement
5 air stream 13 mainly separated from the circulated air stream 9 is sucked via fan 12a into the space 10 in the rear part, circulated in a substantially horizontal direction and blown out of the casing 1 via fan 12b. Thus, the display surface 6a is never directly exposed to raw air from outside
10 the casing but only to air mixed in the circulated air stream 9. This results in easier and better filtering of the air used to control the temperature of the display surface 6a.

15 In the casing structure 1 of the invention, the circulating air stream 9 produced by one or more fans 5b creates an overpressure in the lower part of the of air duct 4b, because the cross-section of the throttle element 7b in the fore part of the air duct 4b is smaller than the cross-
20 section of the air duct 4b. The result of this is that the pressure is equalized in the throttle element 7b and the circulating air stream is evenly distributed over the entire width of the throttle element 7b, and therefore a substantially smooth circulated air stream 9 of uniform temperature
25 is flowing at the same velocity through the throttle element 7b, rising upwards in the gap 8 along the display surface 6a of the display device 6.

By means of the circulating air stream 9, the temperature of
30 all pixels on the display surface 6a is controlled by supplying circulation air at a temperature as required in each situation to the display surface 6a at least over the entire width of the display surface and at a sufficiently high flow rate. Placed in the upper part of the air gap 8 and the display
35 surface 6a are one or more temperature sensors, by means of which a correct temperature of the circulating air is maintained. Generally a temperature adjustment of the circulating air stream 9 effected by using the replacement

air stream 13 is sufficient. To prepare the casing 1 for difficult conditions, it can be provided with one or more heating elements to heat the circulating air when necessary on the basis of the information obtained from the temperature sensors. Similarly, the casing 1 can be provided with one or more cooling elements to cool the circulating air when necessary on the basis of the information obtained from the temperature sensors if the cooling effected by using the replacement air stream 13 is insufficient. In addition, the apparatus comprises controlling and adjusting elements for keeping the circulating air stream 9 at a correct temperature or within correct temperature limits. For the sake of clarity, the figures do not show the temperature sensors, heating elements, cooling elements and controlling and adjusting elements.

According to the procedure of the invention, the control of the temperature of the display surface 6a of a display device 6 is implemented e.g. as follows: In the procedure, a circulating air stream 9 is circulated inside a substantially closed casing structure 1 by blowing circulation air by means of a fan 5b into an air duct 4b and throttling the flow of the circulation air 9 away from the air duct 4b by means of a throttle element 7b so as to create in the air duct 4b an overpressure equalizing the circulating air stream 9. The overpressurized circulating air stream 9 is passed further via the throttle element 7b at an even flow rate along the display surface 6a of the display device 6 substantially upwards in an air gap 8 between the display surface 6a and a protecting element 3 placed in front of the display surface 6a, at least over the entire width of the display surface 6a. From the air gap 8, the circulating air stream 9 is passed further via an exhaust element 7a into an air duct 4a from which the circulating air stream 9 is sucked by a fan 5a into a space 10 in the envelope 2 behind the display device 6, in which space the circulation air is mixed at least when necessary with replacement air sucked into the envelope 2 from outside the envelope 2 via an air

duct 11a by means of a fan 12a to keep the circulating air stream at a desired temperature or within desired temperature limits.

5 In addition, the circulation and replacement air is used for cooling display device components placed in the space 10 in the rear part. When necessary, the circulating air stream is cooled or heated by means of a separate cooling and/or heating element. The replacement air stream 13 is partially
10 mixed with the circulating air stream 9 and passed out of the envelope 2 via a fan 12b and an air duct 11b. In addition, the circulating air stream 9 and the replacement air stream 13 are prevented from being mixed with each other except in the space 10 in the rear part of the envelope 2
15 behind the display device 6.

It is obvious to the person skilled in the art that the invention is not limited to the embodiments described above but that it may be varied within the scope of the claims
20 presented below. Thus, for example, the structure of the envelope and the structure and number of the air ducts may differ from those described above. Likewise, the placement and number of fans may vary. Similarly, it is obvious that the intake and exhaust of replacement air as well as the
25 circulation as a whole may be implemented in ways differing from those described above. For example, the replacement air can be taken from the side of or from behind the casing, and it can also be exhausted to the side of and behind the casing. The replacement air can also be taken into the casing
30 or exhausted from the casing at a point near an area containing components that require e.g. special cooling. If necessary, the replacement air can also be taken in and exhausted from the same side of the casing.

35 It is also obvious to the person skilled in the art that the elongated opening presented above as a throttle element may also consist of a series of smaller apertures or holes, which may be disposed in more than one row. The essential

point is that the throttle element or equivalent is used to equalize the pressure of the circulating air stream in the air duct and thus to distribute the entire circulating air stream over the entire width of the display surface. It is
5 also obvious that, instead of consisting of aforesaid apertures or holes, the throttle element may also be formed e.g. directly on the basis of the mutual positions and shape of the display device, protecting element and fore part of the air duct. It is likewise obvious to the person skilled in
10 the art that, instead of throttle elements of fixed shape and size, the opening of the throttle element may be adjustable.

It is further obvious to the person skilled in the art that
15 the pressure, velocity or equivalent of the air stream before it flows onto the display surface 6a can also be equalized without an actual throttle part reducing the cross-sectional area of air duct 5b. In this case, using a high power with fan 4b, in the air duct 5b after the fan 4b a
20 pressure is created that has a magnitude such that the whole air duct forms a kind of throttle functioning as an equalizing element and the pressure as well as the rate of flow are equalized before the air stream reaches the lower edge of the display surface 6a. in this case, air duct 5b may have a
25 substantially constant cross-sectional area throughout its length.

It is additionally obvious to the person skilled in the art that the air intake opening 14a at least for the replacement
30 air stream 13 may be provided with a filter to prevent dust and other small particles present in the air from getting into the replacement air stream 13.

It is further obvious that, instead of being formed from
35 plate-like structural elements, the air ducts may also be formed by the components and other structural parts of the apparatus.

CLAIMS

1. A procedure for controlling the temperature of the display surface (6a) of an encapsulated display device (6), in which procedure the display device is placed inside a casing (1) provided with a transparent protecting element (3), and in which procedure a medium, such as air, is circulated in the casing (1), **characterized** in that the flow of the circulated air stream (9) is equalized and after the equalization the air stream (9) is caused to flow along the display surface (6a) of the display device (6) over the display surface (6a).

2. A procedure according to claim 1, **characterized** in that circulated air stream (9) is throttled to equalize the air stream by means of a throttle element (7b) placed below the display surface (6a), whereupon the air stream (9) is passed over the display surface (6a) through an air gap (8) between the display surface (6a) and the transparent protecting element (3) in front of the display surface (6a).

3. A procedure according to claim 1 or 2, **characterized** in that the circulated air stream (9) is passed after the display surface (6a) via an air duct (4a) provided inside the casing (1) into a space (10) in the rear part of the casing (1), in which space the circulated air stream (9) is mixed if necessary with replacement air taken from outside the casing (1), after which space (10) the circulated air stream (9) is passed again through an air duct (4b) provided inside the casing (1) via the throttle element (7b) into the air gap (8) and over the display surface (6a).

4. A procedure according to claim 1, 2 or 3, **characterized** in that the temperature of the circulated air stream (9) is monitored by means of temperature sensors and, when necessary, the circulated air stream (9) is either heated or cooled by means of a separate heating or cooling element.

5. An apparatus for controlling the temperature of the display surface (6a) of an encapsulated display device (6), in which apparatus the display device (6) is placed inside a casing (1) provided with a transparent protecting element (3), and which apparatus is provided with at least one fan (5b) for circulating a medium, such as air, in the casing (1), **characterized** in that the apparatus is provided with at least one element for equalizing the circulated air stream (9), which equalizing element, as seen in the direction of the circulated air stream (9), is placed between the fan (5b) and the display surface (6a).

6. An apparatus according to claim 5, **characterized** in that the apparatus is provided with at least one throttle element (7b) functioning as an equalizing element, which, as seen in the direction of the circulated air stream (9), is placed between the fan (5b) and the display surface (6a).

7. An apparatus according to claim 6, **characterized** in that the throttle element (7b) is placed in the casing and that the throttle element (7b) is an elongated opening of a length at least corresponding to the width of the display surface (6a), the cross-sectional area of said opening being smaller than the cross-sectional area of the air duct (4b) between the fan (5b) and the opening.

8. An apparatus according to claim 5, 6 or 7, **characterized** in that the front wall of the casing (1) consists of a transparent protecting element (3) placed at a horizontal distance from the display surface (6a) of the display device (6) so that the protecting element (3) and the display surface (6a) have an air gap (8) between them through which the circulated air stream (9) is passed over the display surface (6a).

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9. An apparatus according to any one of the preceding claims 5-8, **characterized** in that, in addition to the aforesaid components, the casing (1) is provided with at least an ap-

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erture-like exhaust element (7a) for exhausting the circulated air stream, an air duct (4a) and a fan (5a) for passing the circulated air stream (9) over the display surface (6a) as a smooth flow inside the casing (1).

5

10. An apparatus according to any one of the preceding claims 5-9, **characterized** in that the apparatus is provided with air ducts (11a, 11b) and fans (12a, 12b) connected to the air ducts (11a, 11b) for taking in replacement air from
10 outside the casing (1) and mixing it with the circulated air stream (9) in the space (10) in the rear part of the casing and for exhausting it from the casing (1) after the mixing, and that the air ducts (4a, 4b) guiding the circulated air stream (9) are mechanically separated from the air ducts
15 (11a, 11b) guiding the replacement air stream (13).

20

1/3

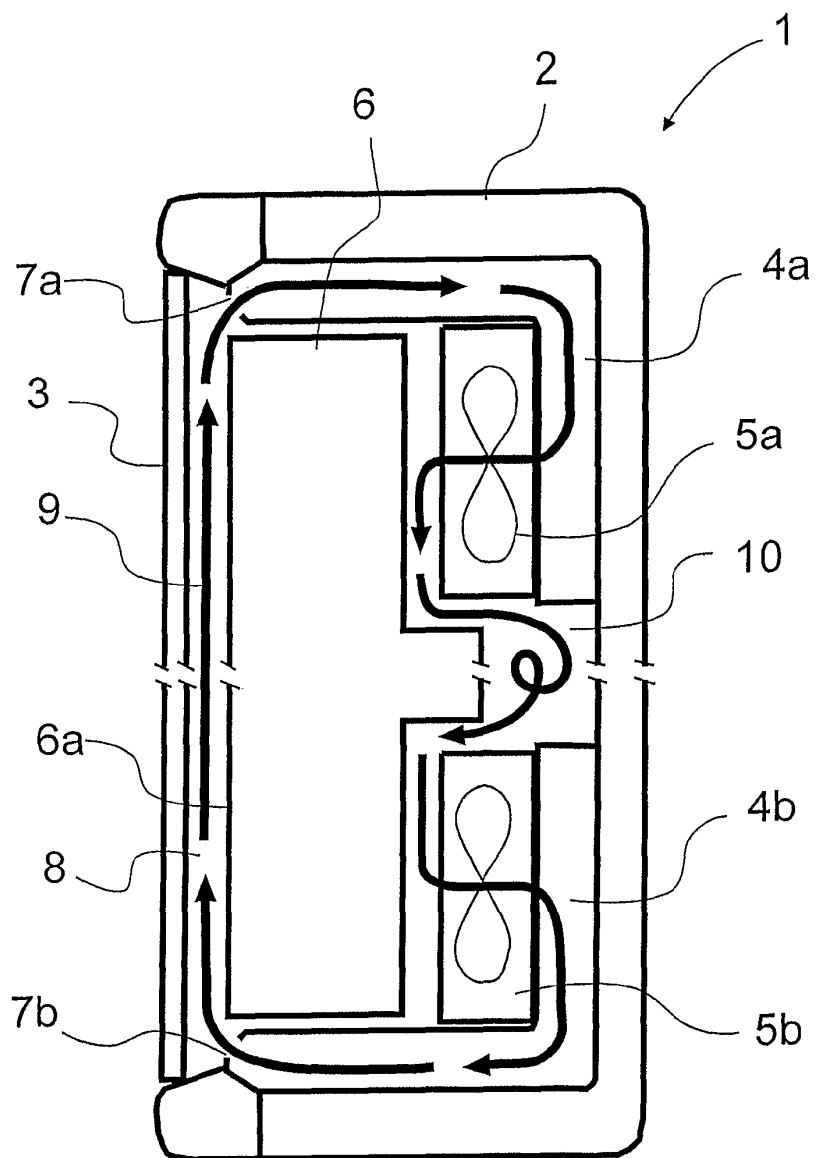


Fig. 1

2/3

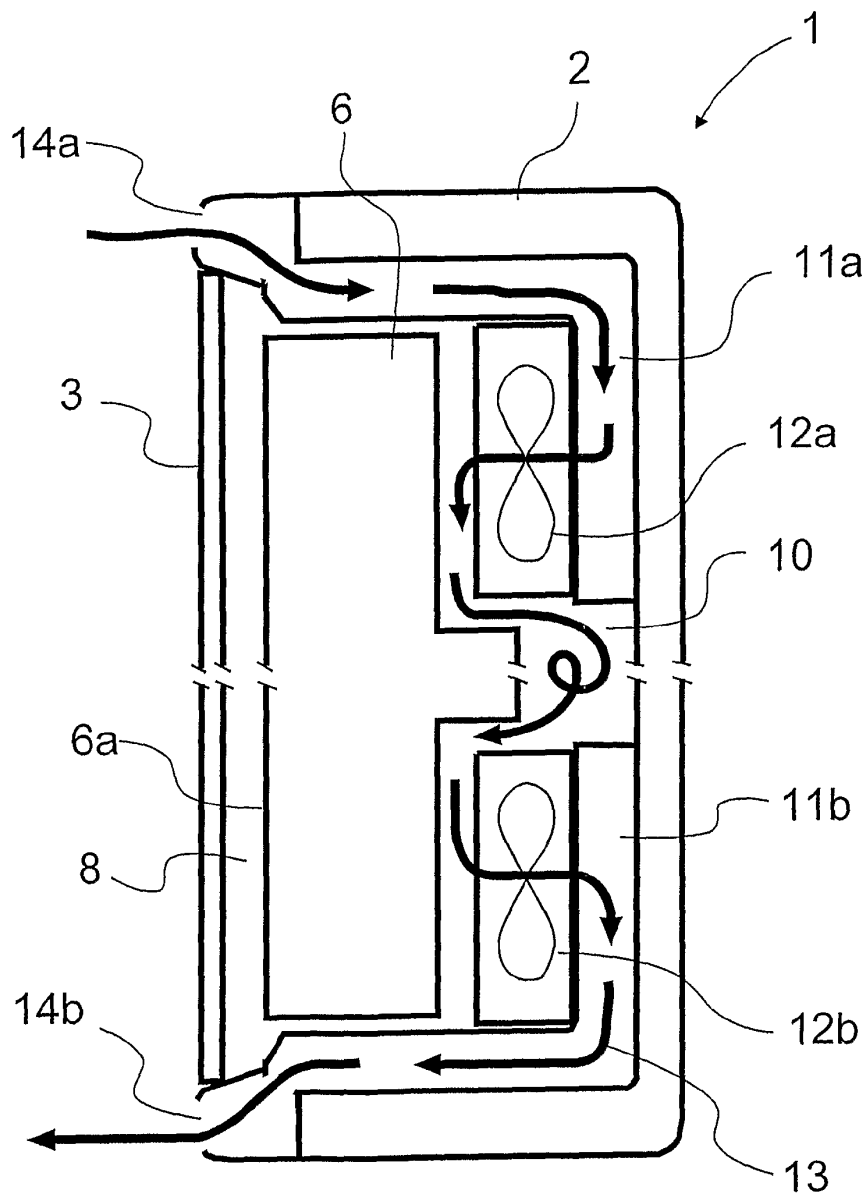


Fig. 2

3/3

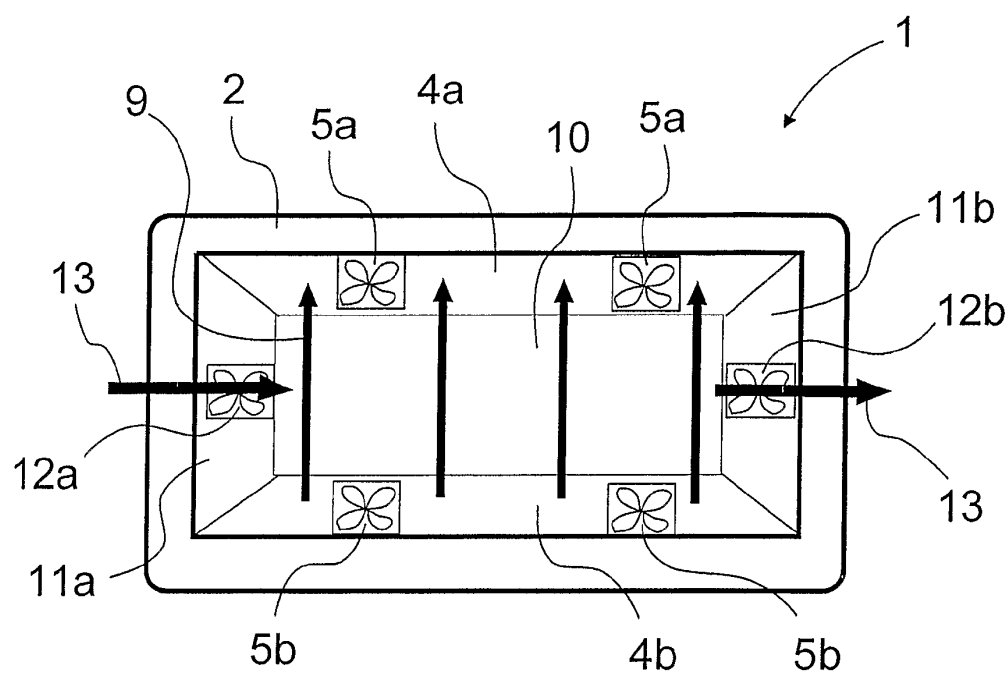


Fig. 3

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 2005/000098

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H05K 7/20, G03B 21/16

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: G09F, H05K, G03B

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

SE,DK,FI,NO classes as above

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

EPO-INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5991153 A (GREGORY S. HEADY ET AL), 23 November 1999 (23.11.1999), column 8, line 9 - line 21, figure 2, abstract --	1,2,5-9
A	US 6226180 B1 (AKIRA UEDA ET AL), 1 May 2001 (01.05.2001), figure 18 --	1-10
A	DE 20018447 U1 (OPTOMA CORP), 22 February 2001 (22.02.2001), figure 1 -- -----	1-10



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

14 July 2005

Date of mailing of the international search report

18 -07- 2005

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INTERNATIONAL SEARCH REPORT

Information on patent family members

28/05/2005

International application No.

PCT/FI 2005/000098

US	5991153	A	23/11/1999	NONE		
US	6226180	B1	01/05/2001	JP	3251180 B	28/01/2002
				JP	10116137 A	06/05/1998
				US	6385043 B	07/05/2002
				US	6469892 B	22/10/2002
				US	6507493 B	14/01/2003
				US	6717808 B	06/04/2004
				US	20010010623 A	02/08/2001
				US	20010017762 A	30/08/2001
				US	20010050840 A	13/12/2001
DE	20018447	U1	22/02/2001	JP	2002043780 A	08/02/2002
				TW	427511 Y	00/00/0000

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		12478832	
	Filing Date		2009-06-05	
	First Named Inventor	Jin Sub KIM et al.		
	Art Unit	2871		
	Examiner Name	Zhi Qiang Qi		
	Attorney Docket Number	103-1284		

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Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear		
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	1	20070058339		2007-03-15	Hoffman et al.			
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	1	1 253 459	EP		2002-10-30	GILBARCO INC.		☐
	2	03/075081	WO		2003-09-12	ILJIN DIAMOND CO., LTD.		☐
	3	2005/079129	WO		2005-08-25	INSSIMAINOS OY		☐

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	Art Unit	2871	
	Examiner Name	Zhi Qiang Qi	
	Attorney Docket Number	103-1284	

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Name/Print	Kevin Roddy	Registration Number	50,577

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International Application Number:	
Confirmation Number:	1220
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First Named Inventor/Applicant Name:	Jin Sub KIM
Customer Number:	38209
Filer:	Seungman Kim/Barbera Dooley
Filer Authorized By:	Seungman Kim
Attorney Docket Number:	103-1284
Receipt Date:	19-OCT-2011
Filing Date:	05-JUN-2009
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Application Type:	Utility under 35 USC 111(a)

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	Filing Date		2009-06-05	
	First Named Inventor	Jin Sub KIM et al.		
	Art Unit	2871		
	Examiner Name	Zhi Qiang Qi		
	Attorney Docket Number	103-1284		

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	2	03/075081	WO		2003-09-12	ILJIN DIAMOND CO., LTD.		☐
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Name/Print	Kevin Roddy	Registration Number	50,577

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Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.
		T ⁵

Receipt date: 06/05/2009 INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		12478832 - GAU: 2871	
	Filing Date		2009-06-05	
	First Named Inventor	Jin Sub KIM		
	Art Unit			
	Examiner Name			
	Attorney Docket Number		103-1284	

	1		☐
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If you wish to add additional non-patent literature document citation information please click the Add button

EXAMINER SIGNATURE

Examiner Signature	/Zhi Qi/	Date Considered	10/26/2011
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*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

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

Notice of References Cited	Application/Control No. 12/478,832	Applicant(s)/Patent Under Reexamination KIM ET AL.	
	Examiner MIKE QI	Art Unit 2871	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-7,157,838 B2	01-2007	Thielemans et al.	313/35
*	B	US-2007/0081344 A1	04-2007	Cappaert et al.	362/373
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
*	N	WO 2005/079129 A1	08-2005	PCT	INSSIMAINOS OY	H05K 7/20
	O	(see IDS of 10/19/2011)				
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/478,832	06/05/2009	Jin Sub KIM	103-1284	1220
38209	7590	10/31/2011	EXAMINER	
Stanzione & Kim, LLP 919 18th Street, NW Suite 440 Washington, DC 20006			QI, ZHI QIANG	
			ART UNIT	PAPER NUMBER
			2871	
			MAIL DATE	DELIVERY MODE
			10/31/2011	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.		Applicant(s)	
	12/478,832		KIM ET AL.	
	Examiner		Art Unit	
	MIKE QI		2871	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☐ Responsive to communication(s) filed on ____.

2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.

3) ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on ____; the restriction requirement and election have been incorporated into this action.

4) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

5) ☒ Claim(s) 1-25 is/are pending in the application.

5a) Of the above claim(s) 12-19 and 24 is/are withdrawn from consideration.

6) ☒ Claim(s) 9-11 and 20 is/are allowed.

7) ☒ Claim(s) 1,2,5,7,8,21 and 25 is/are rejected.

8) ☒ Claim(s) 3,4,6,22 and 23 is/are objected to.

9) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

10) ☐ The specification is objected to by the Examiner.

11) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

12) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a) ☒ All b) ☐ Some * c) ☐ None of:

1. ☒ Certified copies of the priority documents have been received.

2. ☐ Certified copies of the priority documents have been received in Application No. ____.

3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)	4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. ____.
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)	5) ☐ Notice of Informal Patent Application
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date <u>6/5/09;10/19/11</u> .	6) ☐ Other: ____.

DETAILED ACTION

Election/Restrictions

1. Applicant's election without traverse of the claims 1-11, 20-23 and 25 in the reply filed on October 17, 2011 is acknowledged.

Specification

2. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claim 2 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 2, recitation "... the cooling fan is located near the air inlet." That is not defined and clear as near the air inlet cannot tell how near is the near, So that any position can be a position near to the air inlet.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

Art Unit: 2871

25 (a) A patent may not be obtained though the invention is not identically disclosed or described as set
 26 forth in section 102 of this title, if the differences between the subject matter sought to be patented and
 27 the prior art are such that the subject matter as a whole would have been obvious at the time the
 28 invention was made to a person having ordinary skill in the art to which said subject matter pertains.
 29 Patentability shall not be negated by the manner in which the invention was made.
 30

31 5. Claims 1, 2, 5, 7-8, 21 and 25 are rejected under 35 U.S.C. 103(a) as being
 32 unpatentable over WO 2005/079129 A1 (INSSIMAINOE OY).

33 Regarding claims 1 and 21, INSSIMAINOE OY teaches (see page 5, line 27 –
 34 page 8, line 34; Fig.1) that a liquid crystal display device comprises:

- 35 - a liquid crystal panel (display device 6);
- 36 - a protection panel (protecting element 3 and envelope 2 together form a
 37 substantially closed and substantially watertight and airtight casing structure
 38 (see page 5, line39-page 6, line 1) so that the protecting element 3 functions
 39 as a protection panel to protect the liquid crystal panel (6) arranged a
 40 predetermined distance from the liquid crystal panel (6) as shown in Fig.1;
- 41 - (concerning claim 21) a channel (such as air gap 8) formed between the liquid
 42 crystal panel (6) and the protection panel (2, 3);
- 43 - a flow control device such as the fans (5a, 5b) functions as a flow control
 44 device to impart turbulence to an air flow (or to provide turbulence air) in the
 45 channel which is defined between the liquid crystal panel (6) and the
 46 protection panel (3) so as to remove heat from a front side of the liquid crystal
 47 panel (6) as shown in Fig.1.

48 INSSIMAINOE OY further teaches (see page 5, lines 9-10) that such
 49 display device achieves a sufficient even flow velocity.

50 Therefore, it would have been at least obvious to those skilled in the art at
51 the time the invention was made to modify the liquid crystal display device of
52 INSSIMAINOE OY with the teachings of using a flow control device to impart
53 turbulence of an air flow in a channel as taught by INSSIMAINOE OY, since the
54 skilled in the art would be motivated for achieving a sufficient even flow velocity.
55 Regarding claim 2, INSSIMAINOE OY teaches the invention set forth above.
56 INSSIMAINOE OY further teaches (see Fig.1 and Fig.2) that the flow control
57 device comprises a cooling fan (5a, 5b) to blow air to the channel such as air gap
58 (8); the channel having an air inlet to receive air and an air outlet to discharge the
59 air receive from the channel; and the cooling fan is located near the air inlet as
60 shown in Fig.1, Fig.2.
61 Regarding claim 5, INSSIMAINOE OY teaches the invention set forth above.
62 Concerning each of the air inlet and air outlet is provided with a dust filter to
63 remove foreign material from the air that is common and known in the art to use
64 air filter in order to prevent the foreign material such as dust air particles to enter
65 the housing, and that is conventional and obvious.
66 Regarding claim 7, INSSIMAINOE OY teaches the invention set forth above.
67 INSSIMAINOE OY further teaches (see Fig.1 and Fig.2) that a housing
68 (protecting element 3 and envelope 2 together form a housing) enclosing the
69 liquid crystal panel (6), wherein the protection panel is made of a transparent
70 material and entirely located at a front side of the housing such as the protecting
71 element (3) made of a transparent material in order to pass light and that is

72 conventional and obvious, and such protection element (3) is entirely located at a
73 front side of the housing as shown in Fig.1 and Fig.2.

74 Regarding claim 8, INSSIMAINOE OY teaches the invention set forth above.

75 Concerning a backlight unit and a circuit board both provided at a rear side of the
76 liquid crystal panel and a rear panel spaced apart from the backlight unit and the
77 circuit board that is conventional and obvious as the display panel need to use
78 the backlight at rear side to display image in which the backlight unit and circuit
79 board must be located in the rear side of the display panel. INSSIMAINOE OY
80 further teaches (see Fig.1 and Fig.2) that the air emerging from the channel (air
81 gap 8) which is defined between the protection panel (3) and the liquid crystal
82 panel (6), and the air flows via another channel such as side channel and rear
83 channel, and the rear channel must be formed by such backlight unit and the
84 circuit board so as to remove heat generated from the backlight unit and the
85 circuit board, and that is conventional and obvious to those skilled in the art.

86 Regarding claim 25, INSSIMAINOE OY teaches the invention set forth above.

87 Concerning using an air conditioner to generate a cooling air as the air flow that
88 is common and known in the art as the air conditioner having the property of
89 generating a cooling air and that is conventional and obvious.

90

91 ***Allowable Subject Matter***

92 6. Claims 9-11 and 20 are allowed.

93 7. Claims 3-4, 6 and 22-23 objected to as being dependent upon a rejected base
94 claim, but would be allowable if rewritten in independent form including all of the
95 limitations of the base claim and any intervening claims.

96 8. The following is a statement of reasons for the indication of allowable subject
97 matter:

98 Claims 9-11 and 20 are allowable because the prior art of record neither
99 anticipated nor rendered obvious that a liquid crystal display device comprises various
100 related elements as claimed with specific features recited in the claims 9 and 20 as
101 follows:

102 In claim 9, a flow control device to detect temperature variation caused by heat
103 incident on a front side of the liquid crystal panel and to control a flow rate of air
104 blowing toward a channel between the liquid crystal panel and the protection
105 panel such as shown in Fig.2.

106 In claim 20, a distance between the liquid crystal panel and the protection panel
107 is in a range of 5mm to 25mm such as shown in Fig.2.

108

109 Claims 3-4, 6 and 22-23 contain allowable subject matter because the prior art
110 of record neither anticipated nor rendered obvious that a liquid crystal display
111 device comprises various related elements as claimed with specific features
112 recited in the claim s 3, 6 and 22 as follows:

113 In claim 3, a flow rate controller to regulate a flow rate of air blow from the cooling
114 fan according to a signal transmitted from the temperature sensor such as shown
115 in Fig.2.

116 In claim 6, the channel defined between the liquid crystal panel and the
117 protection panel has a spacing distance in a range of 5 to 25 mm such as shown
118 in Fig.2

119 In claim 22, a flow rate controller to regulate a flow rate of air in the cooling fan to
120 control a flow velocity of the air in the channel; and a temperature sensor to
121 measure temperature of the air having passed through the first channel and to
122 send a resulting signal to the flow rate controller such as shown in Fig.2.

124 **Conclusion**

125 9. The prior art made of record and not relied upon is considered pertinent to
126 applicant's disclosure.

127 10. Any inquiry concerning this communication or earlier communications from the
128 examiner should be directed to MIKE QI whose telephone number is (571)272-2299.

129 The examiner can normally be reached on M-T 7:30 am-6:00 pm.

130 If attempts to reach the examiner by telephone are unsuccessful, the examiner's
131 supervisor, David Nelms can be reached on (571) 272-1787. The fax phone number for
132 the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Mike Qi/
Primary Examiner, Art Unit 2871

<i>Index of Claims</i> 	Application/Control No. 12478832	Applicant(s)/Patent Under Reexamination KIM ET AL.
	Examiner MIKE QI	Art Unit 2871

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant			☐ CPA			☐ T.D.			☐ R.1.47		
CLAIM		DATE									
Final	Original	10/26/2011									
	1	✓									
	2	✓									
	3	O									
	4	O									
	5	✓									
	6	O									
	7	✓									
	8	✓									
	9	=									
	10	=									
	11	=									
	12	÷									
	13	÷									
	14	÷									
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	17	÷									
	18	÷									
	19	÷									
	20	=									
	21	✓									
	22	O									
	23	O									
	24	÷									
	25	✓									

<i>Search Notes</i> 	Application/Control No. 12478832	Applicant(s)/Patent Under Reexamination KIM ET AL.
	Examiner MIKE QI	Art Unit 2871

SEARCHED			
Class	Subclass	Date	Examiner
349	161,72,58	10/26/11	MQ

SEARCH NOTES		
Search Notes	Date	Examiner
Searched in USPG_PUB,USPAT,USOCR,FPRS,EPO,JPO,DERWENT,IBM_TDB.	10/26/11	MQ

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner

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EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	256	air and flow and (channel duct) and (heat adj dissipat\$4) and temperature and distance and fan and cool\$4 and (liquid adj crystal) and (@ad<"20090605" @ad="20090605")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/10/26 10:20
L2	7	air and flow and (channel duct) and (heat adj dissipat\$4) and temperature and distance and fan and cool\$4 and (liquid adj crystal) and (@ad<"20090605" @ad="20090605") and 349/161.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/10/26 10:21
L3	1	air and flow and (channel duct) and (heat adj dissipat\$4) and temperature and distance and fan and cool\$4 and (liquid adj crystal) and (@ad<"20090605" @ad="20090605") and 349/72.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/10/26 10:21
L4	3	air and flow and (channel duct) and (heat adj dissipat\$4) and temperature and distance and fan and cool\$4 and (liquid adj crystal) and (@ad<"20090605" @ad="20090605") and 349/58.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/10/26 10:21
L5	27	air and flow and (channel duct) and (heat adj dissipat\$4) and temperature and distance and fan and cool\$4 and (liquid adj crystal) and (@ad<"20090605" @ad="20090605") and "349"/\$.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/10/26 10:21
L7	2	(air near10 flow) and channel and cool\$4 and 349/72.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/10/26 10:22
L8	91	air and flow and (channel duct) and (heat adj dissipat\$4) and (temperature near10 sensor) and distance and fan and cool\$4 and (liquid adj crystal) and (@ad<"20090605" @ad="20090605")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/10/26 10:24
S1	353	349/161.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/09/20 09:20
S2	3243	349/58.ccls.	US-PGPUB; USPAT;	OR	ON	2011/09/20 09:21

			USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
S3	184	349/72.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/09/20 09:21
S4	203	(air near10 flow) and channel and (flow near10 control) and turbulence and heat and cool\$4 and (liquid adj crystal)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/09/20 09:23
S5	3	(air near10 flow) and channel and (flow near10 control) and turbulence and heat and cool\$4 and "349"/\$.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/09/20 09:23
S6	192	(air near10 flow) and channel and (flow near10 control) and turbulence and heat and cool\$4 and (liquid adj crystal) and (@ad<"20090605" @ad="20090605")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/09/20 09:27
S7	1	"2007183436".pn.	JPO	OR	ON	2011/09/20 09:29
S8	1	(air near10 flow) and channel and (flow near10 control) and turbulence and cool\$4 and 349/161.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/09/20 09:48
S9	1	(air near10 flow) and channel and (flow near10 control) and turbulence and cool\$4 and 349/58.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/09/20 09:48
S10	1	(air near10 flow) and channel and (flow near10 control) and turbulence and cool\$4 and 349/72.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/09/20 09:48
S11	3	(air near10 flow) and channel and (flow near10 control) and cool\$4 and 349/161.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/09/20 09:49
S12	20	(air near10 flow) and channel and cool\$4 and 349/161.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/09/20 09:49

S13	24	(air near10 flow) and channel and cool\$4 and 349/58.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/09/20 09:49
S15	101	(air near10 flow) and channel and cool\$4 and "349"/\$.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/09/20 09:49
S16	3443	(air near10 flow) and channel and cool\$4 and (liquid adj crystal)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/09/20 09:50
S17	788	(air near10 flow near10 channel) and cool\$4 and (liquid adj crystal)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/09/20 09:51
S18	572	(air near10 flow near10 channel) and distance and cool\$4 and (liquid adj crystal)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/09/20 09:51
S19	305	(air near10 flow near10 channel) and distance and fan and cool\$4 and (liquid adj crystal)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/09/20 09:52
S20	284	(air near10 flow near10 channel) and distance and fan and cool\$4 and (liquid adj crystal) and (@ad<"20090605" @ad="20090605")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/09/20 09:53
S21	2	"5682216".pn. "20070058339".pn.	US-PGPUB; USPAT	OR	OFF	2011/10/25 15:25

10/ 26/ 2011 11:28:11 AM

C:\Users\mqi\Documents\EAST\Workspaces\12478832(cooling_air_channels).wsp

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:

Jin Sub KIM, et al.

Application No.: 12/478,832

Group Art Unit: 2871

Filed: June 5, 2009

Examiner: Zhi Qiang Qi

Customer No.: 38209

Confirmation No.: 1220

For: LIQUID CRYSTAL DISPLAY DEVICE INCLUDING AIRFLOW CHANNEL
(As Amended)

Commissioner of Patents and Trademarks
P.O. Box 1450
Alexandria, VA 22313-1450

AMENDMENT

Sir:

In response to the Office Action mailed October 31, 2011, please amend the above-identified application as follows:

Amendments to the Specification begin on page 2 of this paper.

Amendments to the Claims are reflected in the listing of claims which begins on page 3 of this paper.

Remarks begin on page 9 of this paper.

Serial No.: 12/478,832
Docket No.: 103-1284
Amendment dated February 29, 2012
Reply to the Office Action of October 31, 2011

Amendments to the Claims

The listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended) A liquid crystal display device, comprising:
a liquid crystal panel;
a protection panel separated ~~arranged a predetermined distance from~~ the liquid crystal panel by a channel; and
a flow control device to impart turbulence to an air flow in the a-channel, the flow control device comprising: which is defined between the liquid crystal panel and the protection panel
a temperature sensor to measure the temperature of air discharged from the channel; and
a flow rate controller to control air flow through the channel according to the measured temperature.
2. (Currently Amended) The liquid crystal display device according to claim 1, wherein: the channel comprises:
~~the flow control device comprises a cooling fan to blow air to the channel;~~
~~the channel comprises an air inlet to guide air into the channel; receive air and~~
an air outlet to discharge the air received from the channel; and
~~the cooling fan is located near the air inlet.~~
3. (Currently Amended) The liquid crystal display device according to claim 2, wherein the flow control device further comprises: a fan to force air through the channel,
wherein the flow rate controller controls the fan according to the detected temperature.
~~a temperature sensor to measure a temperature of air having passed through the channel; and~~
a flow rate controller to regulate a flow rate of air blown from the cooling fan according to a signal transmitted from the temperature sensor.

Serial No.: 12/478,832
Docket No.: 103-1284
Amendment dated February 29, 2012
Reply to the Office Action of October 31, 2011

4. (Currently Amended) The liquid crystal display device according to claim 3, wherein:

the flow rate controller controls ~~regulates the flow rate of air in the cooling fan~~ such that the air in the channel has a ~~controlled flow~~ velocity in a range of 4 to 14m/s.

5. (Currently Amended) The liquid crystal display device according to claim 2, ~~further comprising dust filters disposed in wherein each of the air inlet and the air outlet is provided with a dust filter to remove foreign materials from the air.~~

6. (Currently Amended) The liquid crystal display device according to claim 1, wherein:

the width of the channel ~~is defined between the liquid crystal panel and the protection panel~~ has a ~~spacing distance~~ in a range of 5 to 25mm.

7. (Original) The liquid crystal display device according to claim 1, further comprising:

a housing enclosing the liquid crystal panel,
wherein the protection panel is made of a transparent material and is entirely located at a front side of the housing.

8. (Currently Amended) The liquid crystal display device according to claim 1, further comprising:

a backlight unit and a circuit board, both provided at a rear side of the liquid crystal panel; and

a rear panel spaced apart from the backlight unit and the circuit board,
wherein:

the air discharged ~~emerging from the channel, which is defined between the protection panel and the liquid crystal panel, flows through~~ via another channel formed by the backlight unit and the circuit board so as to remove heat generated from the backlight unit and the circuit board.

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Docket No.: 103-1284
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9. (Original) A liquid crystal display device, comprising:
a liquid crystal panel;
a protection panel arranged a predetermined distance from the liquid crystal panel; and
a flow control device to detect temperature variation caused by heat incident on a front side of the liquid crystal panel, and to control a flow rate of air blowing toward a channel, which is defined between the liquid crystal panel and the protection panel.

10. (Original) The liquid crystal display device according to claim 9, wherein:
the flow control device has a flow rate controller to regulate the flow rate of the air such that air in the channel has a flow velocity of not less than 4m/s when the channel defined between the liquid crystal panel and the protection panel has a spacing distance in a range of 5 to 25mm.

11. (Original) The liquid crystal display device according to claim 10, wherein:
the flow control device further includes a temperature sensor to detect a temperature variation of the air having passed through the channel, and the flow rate controller is operated according to a signal transmitted from the temperature sensor.

12. (Withdrawn) A liquid crystal display device, comprising:
a housing partitioned into upper and lower spaces;
a liquid crystal panel assembly arranged in the upper space; and
an air conditioner arranged in the lower space to blow air to the liquid crystal assembly, and to cool the liquid crystal assembly.

13. (Withdrawn) The liquid crystal display device according to claim 12, further comprising:
a flow control device to impart turbulence to the air being blown toward the liquid crystal panel assembly, to cool the liquid crystal panel assembly.

14. (Withdrawn) The liquid crystal display device according to claim 13, wherein:
the housing includes a protection panel provided at a front side of the housing, and the

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Amendment dated February 29, 2012
Reply to the Office Action of October 31, 2011

air conditioner includes a cooling fan to blow the air to a channel defined between the protection panel and the liquid crystal panel assembly.

15. (Withdrawn) The liquid crystal display device according to claim 14, wherein the flow control device further comprises:

a flow rate controller to regulate a flow rate of the air in the cooling fan such that the air in the channel has a controlled flow velocity.

16. (Withdrawn) The liquid crystal display device according to claim 15, wherein: the channel defined between the liquid crystal panel assembly and the protection panel has a spacing distance in a range of 0.005 to 0.025m, and the flow rate controller regulates the flow rate of the air in the cooling fan such that the flow velocity of air in the channel is maintained at 4m/s or more.

17. (Withdrawn) The liquid crystal display device according to claim 15, wherein: the flow control device further includes a temperature sensor to measure a temperature of the air having passed through the channel, and to send a resulting signal to the flow rate controller.

18. (Withdrawn) The liquid crystal display device according to claim 17, wherein: the flow rate controller controls the cooling fan such that the flow velocity of the air in the channel is maintained at 14m/s or less.

19. (Withdrawn) The liquid crystal display device according to claim 12, wherein the liquid crystal panel assembly comprises:

a liquid crystal panel;
a backlight unit irradiate light to the liquid crystal panel; and
a circuit board to control the backlight unit and the liquid crystal panel.

20. (Original) A display device, comprising:
a liquid crystal panel to display an image;

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a protection panel to protect the liquid crystal panel; and
a channel formed between the liquid crystal panel and the protection panel to pass air therebetween to remove heat from a front side of the liquid crystal panel,
wherein a distance between the liquid crystal panel and the protection panel is in a range of 5mm to 25mm.

21. (Currently Amended) A display device, comprising:
a liquid crystal panel to display an image;
a protection panel to protect the liquid crystal panel;
a channel formed between the liquid crystal panel and the protection panel; and
a flow control device to control the flow rate of ~~provide turbulent~~ air in the channel to remove heat from a front side of the liquid crystal panel, the flow control device comprising:
a fan to force air through the channel;
a temperature sensor to measure the temperature of air discharged from the channel; and
a flow rate controller control the fan according to the measured temperature to regulate the flow rate of the air in the channel.

22. (Canceled)

23. (Currently Amended) The display device according to claim 21-22, wherein the width of the channel ~~a distance between the liquid crystal panel and the protection panel~~ is determined by a static pressure-flow rate curve of the ~~cooling fan~~.

24. (Withdrawn) A display device, comprising:
a housing;
a display assembly disposed inside the housing and spaced apart from the housing to form front, top, and rear air flow channels in order; and
a flow control device to generate an air flow to flow air through the front, top and rear air channels in order.

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25. (Currently Amended) The display device according to claim 21, further comprising:

an air conditioner to supply cooled air to the fan ~~generate a cooling air as the air flows.~~

Electronic Acknowledgement Receipt	
EFS ID:	12188146
Application Number:	12478832
International Application Number:	
Confirmation Number:	1220
Title of Invention:	LIQUID CRYSTAL DISPLAY DEVICE
First Named Inventor/Applicant Name:	Jin Sub KIM
Customer Number:	38209
Filer:	Seungman Kim/Teresa Perry
Filer Authorized By:	Seungman Kim
Attorney Docket Number:	103-1284
Receipt Date:	29-FEB-2012
Filing Date:	05-JUN-2009
Time Stamp:	16:43:35
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	\$150
RAM confirmation Number	4438
Deposit Account	
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
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1		AmendExt1_02-29-12.pdf	293562 c46f44d10d5a3479de84cd68358f29b59046cb13	yes	11
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Amendment/Req. Reconsideration-After Non-Final Reject		1	1	
	Specification		2	2	
	Claims		3	8	
	Applicant Arguments/Remarks Made in an Amendment		9	11	
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30257 f357731d504312e70224458a14093a1b0ed273	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			323819		
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					

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Docket No.: 103-1284
Amendment dated February 29, 2012
Reply to the Office Action of October 31, 2011

REMARKS

Introduction

Applicant notes with appreciation the Examiner's indication that claims 9-11 and 20 are allowed, and claims 3, 4, 6, 22, and 23 would be allowable if rewritten in independent form. Applicant also notes with appreciation the Examiner's indication that each of the references cited in the Information Disclosure Statement of June 5, 2009 and October 19, 2011 have been considered.

Claims 1-6, 8, 21, 23, and 25 have been amended. Claim 22 has been canceled without prejudice or disclaimer. Claims 12-19 and 24 have been withdrawn from consideration. Accordingly, claims 1-11, 20, 21, 23, and 25 are currently pending and under consideration. No new matter is being presented. In view of the following remarks, reconsideration and allowance of all the pending claims are requested.

Objections

The Examiner has objected to the Title for lacking sufficient descriptiveness. The Title has been amended in order to provide additional descriptiveness. Reconsideration and withdrawal of this objection are respectfully requested.

Rejection under 35 USC §112

Claim 2 has been rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 2 has been amended to delete the objected to subject matter. Accordingly, reconsideration and withdrawal of this rejection are respectfully requested.

Rejection under 35 USC §103

Claims 1, 2, 5, 7-8, 21, and 25 have been rejected under 35 U.S.C. §103(a) as being unpatentable over WO 2005/07129 A1 (Oy).

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In order to even more particularly clarify differences between the present invention and the cited art, claim 1 has been amended to recite a temperature sensor and flow rate controller, as previously recited in allowable claim 3. In addition, claim 21 has been amended to include the aspects of allowable claim 22, which has been canceled without prejudice or disclaimer.

As stated on page 7 of the Office Action, the subject matter recited in claims 3 and 6 is not disclosed in the cited art. Accordingly, amended claims 1 and 21 recite patentable subject matter. In addition, claims 2, 5, 7-8, and 25 are also patentable for at least their dependency from claims 1 and 21. Accordingly, reconsideration and withdrawal of this rejection and prompt allowance of the amended claims are respectfully requested.

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Conclusion

It is respectfully submitted that a full and complete response has been made to the outstanding Office Action and, as such, there being no other objections or rejections, this application is in condition for allowance, and a notice to this effect is earnestly solicited.

If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at the number provided below.

If any further fees are required in connection with the filing of this amendment, please charge the same to our Deposit Account No. 502827.

Respectfully submitted,

STANZIONE & KIM, LLP

Dated: February 29, 2012
919 18th St., NW, Suite 440
Washington, DC 20006
Telephone: (202) 775-1900
Facsimile: (202) 775-1901

By: /Matthew T. Gill/
Matthew T. Gill
Registration No. 48,490

Serial No.: 12/478,832
Docket No.: 103-1284
Amendment dated February 29, 2012
Reply to the Office Action of October 31, 2011

Amendments to the Specification

Please replace the Title with the following amended Title, where changes are shown with “track changes.”

LIQUID CRYSTAL DISPLAY DEVICE INCLUDING AIRFLOW CHANNEL

Electronic Patent Application Fee Transmittal				
Application Number:	12478832			
Filing Date:	05-Jun-2009			
Title of Invention:	LIQUID CRYSTAL DISPLAY DEVICE			
First Named Inventor/Applicant Name:	Jin Sub KIM			
Filer:	Seungman Kim/Teresa Perry			
Attorney Docket Number:	103-1284			
Filed as Large Entity				
Utility under 35 USC 111(a) Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Extension - 1 month with \$0 paid	1251	1	150	150

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Miscellaneous:				
Total in USD (\$)				150

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875					Application or Docket Number 12/478,832		Filing Date 06/05/2009		☐ To be Mailed	
APPLICATION AS FILED – PART I										
(Column 1)			(Column 2)			SMALL ENTITY ☐ OR		OTHER THAN SMALL ENTITY		
FOR	NUMBER FILED	NUMBER EXTRA	RATE (\$)	FEE (\$)	OR	RATE (\$)	FEE (\$)			
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A				
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A				
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A				
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X \$ =		OR	X \$ =				
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X \$ =			X \$ =				
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$250 (\$125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).									
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))										
* If the difference in column 1 is less than zero, enter "0" in column 2.										
APPLICATION AS AMENDED – PART II										
(Column 1)			(Column 2)			SMALL ENTITY OR		OTHER THAN SMALL ENTITY		
AMENDMENT	02/29/2012	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)	OR	RATE (\$)	ADDITIONAL FEE (\$)	
	Total (37 CFR 1.16(i))	* 24	Minus	** 25	=	0	OR	X \$60=	0	
	Independent (37 CFR 1.16(h))	* 6	Minus	*** 6	=	0	OR	X \$250=	0	
☐ Application Size Fee (37 CFR 1.16(s))										
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))										
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	0	
(Column 1)			(Column 2)			SMALL ENTITY OR		OTHER THAN SMALL ENTITY		
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)	OR	RATE (\$)	ADDITIONAL FEE (\$)	
	Total (37 CFR 1.16(i))	*	Minus	**	=		OR	X \$ =		
	Independent (37 CFR 1.16(h))	*	Minus	***	=		OR	X \$ =		
☐ Application Size Fee (37 CFR 1.16(s))										
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))										
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE		
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3. ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3". The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.										

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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BIB DATA SHEET

CONFIRMATION NO. 1220

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.		
12/478,832	06/05/2009	349	2871	103-1284		
APPLICANTS Jin Sub KIM, Seongnamn-si, KOREA, REPUBLIC OF; Jin Hyun Cho, Seoul, KOREA, REPUBLIC OF; Sung Ki Kim, Seoul, KOREA, REPUBLIC OF; Joon Kang, Seoul, KOREA, REPUBLIC OF; ** CONTINUING DATA ***** ** FOREIGN APPLICATIONS ***** REPUBLIC OF KOREA 2008-55687 06/13/2008 ** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** 06/12/2009						
Foreign Priority claimed ☒ Yes ☐ No 35 USC 119(a-d) conditions met ☒ Yes ☐ No Verified and Acknowledged <u>/MIKE QI/</u> Examiner's Signature		☐ Met after Allowance Initials _____	STATE OR COUNTRY KOREA, REPUBLIC OF	SHEETS DRAWINGS 10	TOTAL CLAIMS 25	INDEPENDENT CLAIMS 6
ADDRESS Stanzione & Kim, LLP 919 18th Street, NW Suite 440 Washington, DC 20006 UNITED STATES						
TITLE LIQUID CRYSTAL DISPLAY DEVICE INCLUDING AIRFLOW CHANNEL						
FILING FEE RECEIVED 2010	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:			☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit		

<i>Index of Claims</i> 	Application/Control No. 12478832	Applicant(s)/Patent Under Reexamination KIM ET AL.
	Examiner MIKE QI	Art Unit 2871

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant			☐ CPA			☐ T.D.			☐ R.1.47		
CLAIM			DATE								
Final	Original	10/26/2011									
1	1	=									
2	2	=									
3	3	=									
4	4	=									
5	5	=									
6	6	=									
7	7	=									
8	8	=									
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	16	-									
	17	-									
	18	-									
	19	-									
12	20	=									
13	21	=									
	22	-									
14	23	=									
	24	-									
15	25	=									

Issue Classification 	Application/Control No. 12478832	Applicant(s)/Patent Under Reexamination KIM ET AL.
	Examiner MIKE QI	Art Unit 2871

ORIGINAL						INTERNATIONAL CLASSIFICATION												
CLASS		SUBCLASS				CLAIMED					NON-CLAIMED							
349		161				G	0	2	F	1 / 1333 (2006.01.01)								
CROSS REFERENCE(S)						G	0	2	F	1 / 133 (2006.01.01)								
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)																	
349	58	72																

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47															
Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1		17												
2	2		18												
3	3		19												
4	4	12	20												
5	5	13	21												
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9	9	15	25												
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11	11														
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	13														
	14														
	15														
	16														

NONE		Total Claims Allowed:	
		15	
(Assistant Examiner)	(Date)		
/MIKE QI/ Primary Examiner. Art Unit 2871	3/12/12	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	2



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NOTICE OF ALLOWANCE AND FEE(S) DUE

38209 7590 03/16/2012
Stanzione & Kim, LLP
919 18th Street, NW
Suite 440
Washington, DC 20006

EXAMINER

QI, ZHI QIANG

ART UNIT

PAPER NUMBER

2871

DATE MAILED: 03/16/2012

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/478,832	06/05/2009	Jin Sub KIM	103-1284	1220

TITLE OF INVENTION: LIQUID CRYSTAL DISPLAY DEVICE INCLUDING AIRFLOW CHANNEL

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	\$1740	\$300	\$0	\$2040	06/18/2012

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

- A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.
- B. If the status above is to be removed, check box 5b on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above, or

If the SMALL ENTITY is shown as NO:

- A. Pay TOTAL FEE(S) DUE shown above, or
- B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and 1/2 the ISSUE FEE shown above.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PART B - FEE(S) TRANSMITTAL

**Complete and send this form, together with applicable fee(s), to: Mail Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885**

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

38209 7590 03/16/2012
Stanzione & Kim, LLP
919 18th Street, NW
Suite 440
Washington, DC 20006

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/478,832	06/05/2009	Jin Sub KIM	103-1284	1220

TITLE OF INVENTION: LIQUID CRYSTAL DISPLAY DEVICE INCLUDING AIRFLOW CHANNEL

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	\$1740	\$300	\$0	\$2040	06/18/2012

EXAMINER	ART UNIT	CLASS-SUBCLASS
QI, ZHI QIANG	2871	349-058000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

- (1) the names of up to 3 registered patent attorneys or agents OR, alternatively, 1 _____
(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed. 2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.111. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

- ☐ Issue Fee
☐ Publication Fee (No small entity discount permitted)
☐ Advance Order - # of Copies _____

4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above)

- ☐ A check is enclosed.
☐ Payment by credit card. Form PTO-2038 is attached.
☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. Change in Entity Status (from status indicated above)

- ☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27. ☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature _____

Date _____

Typed or printed name _____

Registration No. _____

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/478,832	06/05/2009	Jin Sub KIM	103-1284	1220

38209	7590	03/16/2012
Stanzione & Kim, LLP 919 18th Street, NW Suite 440 Washington, DC 20006		

EXAMINER	
QI, ZHI QIANG	

ART UNIT	PAPER NUMBER
2871	

DATE MAILED: 03/16/2012

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 382 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 382 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

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

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No.	Applicant(s)	
	12/478,832	KIM ET AL.	
	Examiner	Art Unit	
	MIKE QI	2871	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to the amendment filed on 2/29/2012.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on ____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are 1-11,20,21,23 and 25.
4. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) ☒ All b) ☐ Some* c) ☐ None of the:
 1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: ____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
 6. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date ____.
 - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date ____.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).**
7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

- | | |
|--|--|
| <ol style="list-style-type: none"> 1. ☐ Notice of References Cited (PTO-892) 2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 3. ☐ Information Disclosure Statements (PTO/SB/08),
Paper No./Mail Date ____ 4. ☐ Examiner's Comment Regarding Requirement for Deposit
of Biological Material | <ol style="list-style-type: none"> 5. ☐ Notice of Informal Patent Application 6. ☐ Interview Summary (PTO-413),
Paper No./Mail Date ____ 7. ☐ Examiner's Amendment/Comment 8. ☒ Examiner's Statement of Reasons for Allowance 9. ☐ Other ____ |
|--|--|

DETAILED ACTION

Election/Restrictions

1. This application is in condition for allowance except for the presence of claims 12-19 and 24 directed to the claims non-elected without traverse. Accordingly, claims 12-19 and 24 have been cancelled.

Allowable Subject Matter

2. Claims 1-11, 20-21, 23 and 25 are allowed. The claim 22 has been canceled.
3. The following is an examiner's statement of reasons for allowance:

Claims 1-11, 20-21, 23 and 25 are allowable because the prior art of record neither anticipated nor rendered obvious that a liquid crystal display device comprises various related elements as claimed with specific features recited in the claims 1, 9, 20 and 21 as follow:

In claims 1 and 21, a temperature sensor to measure the temperature of air discharged from the channel; and a flow rate controller to control air flow through the channel according to the measured temperature such as shown in Fig.2.

In claim 9, a flow control device to detect temperature variation caused by heat incident on a front side of the liquid crystal panel, and to control a flow rate of air blowing toward a channel, which is defined between the liquid crystal panel and the protection panel such as shown in Fig.2.

In claim 20, a distance between the liquid crystal panel and the protection panel is in a range of 5mm to 25mm such as shown in Fig.2.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MIKE QI whose telephone number is (571)272-2299. The examiner can normally be reached on M-T 7:30 am-6:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Edward Glick can be reached on (571) 272-2490. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Mike Qi/
Primary Examiner, Art Unit 2871

<i>Search Notes</i> 	Application/Control No. 12478832	Applicant(s)/Patent Under Reexamination KIM ET AL.
	Examiner MIKE QI	Art Unit 2871

SEARCHED			
Class	Subclass	Date	Examiner
349	161,72,58	3/8/12	MQ

SEARCH NOTES		
Search Notes	Date	Examiner
Update searched in USPG-PUB,USPAT,USOCR,FPRS,EPO,JPO,DERWENT,IBM_TDB.	3/8/12	MQ
Interference searched in USPG-PUB,USPAT,UPAD.	3/8/12	MQ

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner
349	161,72,58	3/8/12	MQ

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EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	302	air and flow and (channel duct) and (heat adj dissipat\$4) and (temperature adj sensor) and panel and control and (liquid adj crystal)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/03/08 15:10
L2	265	air and flow and (channel duct) and (heat adj dissipat\$4) and (temperature adj sensor) and panel and control and (liquid adj crystal) and (@ad<"20090605" @ad="20090605")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/03/08 15:11
S1	353	349/161.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/09/20 09:20
S2	3243	349/58.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/09/20 09:21
S3	184	349/72.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/09/20 09:21
S4	203	(air near10 flow) and channel and (flow near10 control) and turbulence and heat and cool\$4 and (liquid adj crystal)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/09/20 09:23
S5	3	(air near10 flow) and channel and (flow near10 control) and turbulence and heat and cool\$4 and "349"/\$.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/09/20 09:23
S6	192	(air near10 flow) and channel and (flow near10 control) and turbulence and heat and cool\$4 and (liquid adj crystal) and (@ad<"20090605" @ad="20090605")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/09/20 09:27
S7	1	"2007183436".pn.	JPO	OR	ON	2011/09/20 09:29

S8	1	(air near10 flow) and channel and (flow near10 control) and turbulence and cool\$4 and 349/161.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/09/20 09:48
S9	1	(air near10 flow) and channel and (flow near10 control) and turbulence and cool\$4 and 349/58.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/09/20 09:48
S10	1	(air near10 flow) and channel and (flow near10 control) and turbulence and cool\$4 and 349/72.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/09/20 09:48
S11	3	(air near10 flow) and channel and (flow near10 control) and cool\$4 and 349/161.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/09/20 09:49
S12	20	(air near10 flow) and channel and cool\$4 and 349/161.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/09/20 09:49
S13	24	(air near10 flow) and channel and cool\$4 and 349/58.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/09/20 09:49
S15	101	(air near10 flow) and channel and cool\$4 and "349"/\$.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/09/20 09:49
S16	3443	(air near10 flow) and channel and cool\$4 and (liquid adj crystal)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/09/20 09:50
S17	788	(air near10 flow near10 channel) and cool\$4 and (liquid adj crystal)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/09/20 09:51
S18	572	(air near10 flow near10 channel) and distance and cool\$4 and (liquid adj crystal)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/09/20 09:51

S19	305	(air near10 flow near10 channel) and distance and fan and cool\$4 and (liquid adj crystal)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/09/20 09:52
S20	284	(air near10 flow near10 channel) and distance and fan and cool\$4 and (liquid adj crystal) and (@ad<"20090605" @ad="20090605")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/09/20 09:53
S21	2	"5682216".pn. "20070058339".pn.	US-PGPUB; USPAT	OR	OFF	2011/10/25 15:25
S22	256	air and flow and (channel duct) and (heat adj dissipat\$4) and temperature and distance and fan and cool\$4 and (liquid adj crystal) and (@ad<"20090605" @ad="20090605")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/10/26 10:20
S23	7	air and flow and (channel duct) and (heat adj dissipat\$4) and temperature and distance and fan and cool\$4 and (liquid adj crystal) and (@ad<"20090605" @ad="20090605") and 349/161.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/10/26 10:21
S24	1	air and flow and (channel duct) and (heat adj dissipat\$4) and temperature and distance and fan and cool\$4 and (liquid adj crystal) and (@ad<"20090605" @ad="20090605") and 349/72.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/10/26 10:21
S25	3	air and flow and (channel duct) and (heat adj dissipat\$4) and temperature and distance and fan and cool\$4 and (liquid adj crystal) and (@ad<"20090605" @ad="20090605") and 349/58.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/10/26 10:21
S26	27	air and flow and (channel duct) and (heat adj dissipat\$4) and temperature and distance and fan and cool\$4 and (liquid adj crystal) and (@ad<"20090605" @ad="20090605") and "349"/\$.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/10/26 10:21
S27	2	(air near10 flow) and channel and cool\$4 and 349/72.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/10/26 10:22
S28	91	air and flow and (channel duct) and (heat adj dissipat\$4) and (temperature near10 sensor) and distance and fan and cool\$4 and (liquid adj crystal) and (@ad<"20090605" @ad="20090605")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/10/26 10:24

EAST Search History (Interference)

Ref	Hits	Search Query	DBs	Default	Plurals	Time
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#				Operator		Stamp
L5	0	(air and flow and (channel duct) and (heat adj dissipat\$4) and (temperature adj sensor) and panel and control and (liquid adj crystal)).clm.	US-PGPUB; USPAT; UPAD	OR	ON	2012/03/08 15:46
L6	3	(air and flow and (channel duct) and (temperature adj sensor) and panel and control and (liquid adj crystal)).clm.	US-PGPUB; USPAT; UPAD	OR	ON	2012/03/08 15:47
L7	71	(air and flow and (channel duct) and (temperature adj sensor) and panel and control).clm.	US-PGPUB; USPAT; UPAD	OR	ON	2012/03/08 15:47
L9	1	(air and flow and (channel duct) and (temperature adj sensor) and panel and control).clm. and 349/161.ccls.	US-PGPUB; USPAT; UPAD	OR	ON	2012/03/08 15:49
L10	1	(air and flow and (channel duct) and (temperature adj sensor) and panel and control).clm. and 349/58.ccls.	US-PGPUB; USPAT; UPAD	OR	ON	2012/03/08 15:49
L11	1	(air and flow and (channel duct) and (temperature adj sensor) and panel and control).clm. and 349/72.ccls.	US-PGPUB; USPAT; UPAD	OR	ON	2012/03/08 15:49
L12	1	(air and flow and (channel duct) and (temperature adj sensor) and panel and control).clm. and "349"/\$.ccls.	US-PGPUB; USPAT; UPAD	OR	ON	2012/03/08 15:50

3/ 8/ 2012 3:53:31 PM

C:\ Users\ mqj\ Documents\ EAST\ Workspaces\ 12478832(cooling_air_channels).wsp

PART B - FEE(S) TRANSMITTAL

**Complete and send this form, together with applicable fee(s), to: Mail Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885**

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

38209 7590 03/16/2012
Stanzione & Kim, LLP
919 18th Street, NW
Suite 440
Washington, DC 20006

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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12/478,832	06/05/2009	Jin Sub KIM	103-1284	1220
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TITLE OF INVENTION: LIQUID CRYSTAL DISPLAY DEVICE INCLUDING AIRFLOW CHANNEL

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	\$1740	\$300	\$0	\$2040	06/18/2012

EXAMINER	ART UNIT	CLASS-SUBCLASS
QI, ZHI QIANG	2871	349-058000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

- (1) the names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 Stanzione & Kim, LLP

2 _____

3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

SAMSUNG Electronics Co., Ltd.

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Suwon-si, Republic of Korea

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

- ☒ Issue Fee
☒ Publication Fee (No small entity discount permitted)
☐ Advance Order - # of Copies _____

4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above)

- ☐ A check is enclosed.
☐ Payment by credit card. Form PTO-2038 is attached.
☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number 502827 (enclose an extra copy of this form).

5. Change in Entity Status (from status indicated above)

- ☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27. ☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature /Seungman Kim/

Date June 15, 2012

Typed or printed name Seungman Kim

Registration No. 50,012

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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Electronic Acknowledgement Receipt	
EFS ID:	13021749
Application Number:	12478832
International Application Number:	
Confirmation Number:	1220
Title of Invention:	LIQUID CRYSTAL DISPLAY DEVICE INCLUDING AIRFLOW CHANNEL
First Named Inventor/Applicant Name:	Jin Sub KIM
Customer Number:	38209
Filer:	Seungman Kim/aisha goins
Filer Authorized By:	Seungman Kim
Attorney Docket Number:	103-1284
Receipt Date:	15-JUN-2012
Filing Date:	05-JUN-2009
Time Stamp:	09:45:57
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	\$2040
RAM confirmation Number	8094
Deposit Account	502827
Authorized User	KIM,SEUNGMAN
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees) Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)	

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	IF_6-15-12.pdf	102766	no	1
			aebec092b776c37f3b54148e1bc93f03b3d ac10e		

Warnings:

Information:

2	Fee Worksheet (SB06)	fee-info.pdf	32138	no	2
			66025bd4c38fe8697f56f6875557725e819 5b4c		

Warnings:

Information:

Total Files Size (in bytes): 134904

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Electronic Patent Application Fee Transmittal				
Application Number:	12478832			
Filing Date:	05-Jun-2009			
Title of Invention:	LIQUID CRYSTAL DISPLAY DEVICE INCLUDING AIRFLOW CHANNEL			
First Named Inventor/Applicant Name:	Jin Sub KIM			
Filer:	Seungman Kim/aisha goins			
Attorney Docket Number:	103-1284			
Filed as Large Entity				
Utility under 35 USC 111(a) Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Utility Appl issue fee	1501	1	1740	1740
Publ. Fee- early, voluntary, or normal	1504	1	300	300

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				2040



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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/478,832	07/17/2012	8223311	103-1284	1220

38209 7590 06/27/2012
Stanzione & Kim, LLP
919 18th Street, NW
Suite 440
Washington, DC 20006

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (application filed on or after May 29, 2000)

The Patent Term Adjustment is 424 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site <http://pair.uspto.gov> for additional applicants):

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