US008648985B2

(12) **United States Patent**
Kim et al.

(10) **Patent No.: US 8,648,985 B2**
(45) **Date of Patent: Feb. 11, 2014**

(54) **LIQUID CRYSTAL DISPLAY DEVICE**

(75) Inventors: **Yong-Hwan Kim**, Seoul (KR); **Jang-Soo Kim**, Yongin-si (KR); **Hong-Suk Yoo**, Anyang-si (KR); **Seung-Soo Baek**, Seoul (KR); **Hwa-Yeul Oh**, Seoul (KR); **Jae-Ho Choi**, Seoul (KR); **Jong-In Kim**, Suwon-si (KR); **Sang-Hee Jang**, Bucheon-si (KR)

(73) Assignee: **Samsung Display Co., Ltd.** (KR)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 986 days.

(21) Appl. No.: **12/612,620**

(22) Filed: **Nov. 4, 2009**

(65) **Prior Publication Data**

US 2010/0245698 A1 Sep. 30, 2010

(30) **Foreign Application Priority Data**

Mar. 31, 2009 (KR) 10-2009-0027562

(51) **Int. Cl.**
G02F 1/1343 (2006.01)
G02F 1/1368 (2006.01)

(52) **U.S. Cl.**
USPC **349/110**; 349/43; 349/48; 349/106; 349/111; 349/143

(58) **Field of Classification Search**
USPC 349/38, 43, 44, 48, 110, 111, 139, 143, 349/39, 106; 345/92; 257/59, 72
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2004/0032554	A1 *	2/2004	Yoon et al.	349/113
2005/0078240	A1 *	4/2005	Murade	349/110
2006/0290829	A1 *	12/2006	Kim	349/44
2008/0012808	A1	1/2008	Kurahashi et al.	
2009/0073368	A1 *	3/2009	Wang et al.	349/143

FOREIGN PATENT DOCUMENTS

JP	2005536768		12/2005
JP	2007-264233		10/2007
JP	2008-241974		10/2008
KR	1019940015578		7/1994
KR	1020030089952	A	11/2003
KR	1020040016663	A	2/2004
KR	1020040057715	A	7/2004
KR	1020040061594	A	7/2004
KR	1020040110884	A	12/2004

* cited by examiner

Primary Examiner — Dung Nguyen
Assistant Examiner — Tai Duong
(74) *Attorney, Agent, or Firm* — Innovation Counsel LLP

(57) **ABSTRACT**

The present invention relates to a liquid crystal display. The liquid crystal display has a lower panel including a first pixel area having a first pixel electrode and a first light leakage preventing member, a final pixel area having a second pixel electrode and a second light leakage preventing member, and middle pixel areas disposed between the first pixel area and the final pixel area, each of the middle pixel areas including a first middle pixel electrode and a second middle pixel electrode. Accordingly, light leakage may be effectively prevented at the first pixel area and the final pixel area that are disposed on the edge.

20 Claims, 11 Drawing Sheets

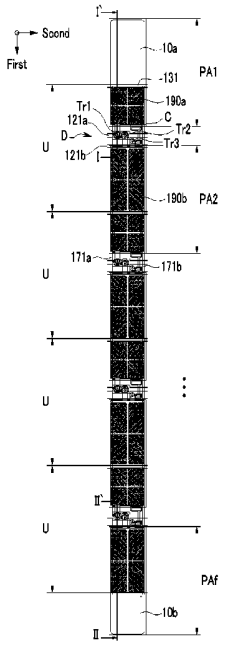


FIG.1

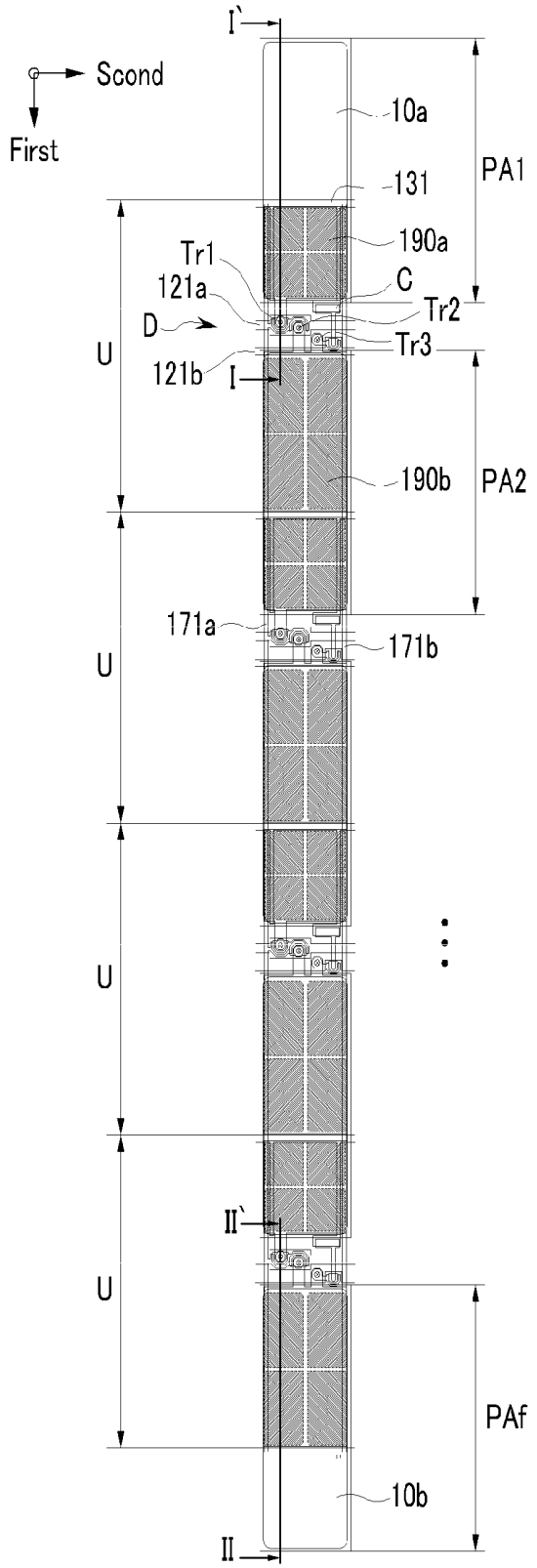

Scond
First
I`
10a
PA1
131
190a
Tr1
121a
C
Tr2
D
Tr3
U
121b
I
190b
PA2
171a
171b
U
U
II`
U
PAf
10b
II

FIG.2

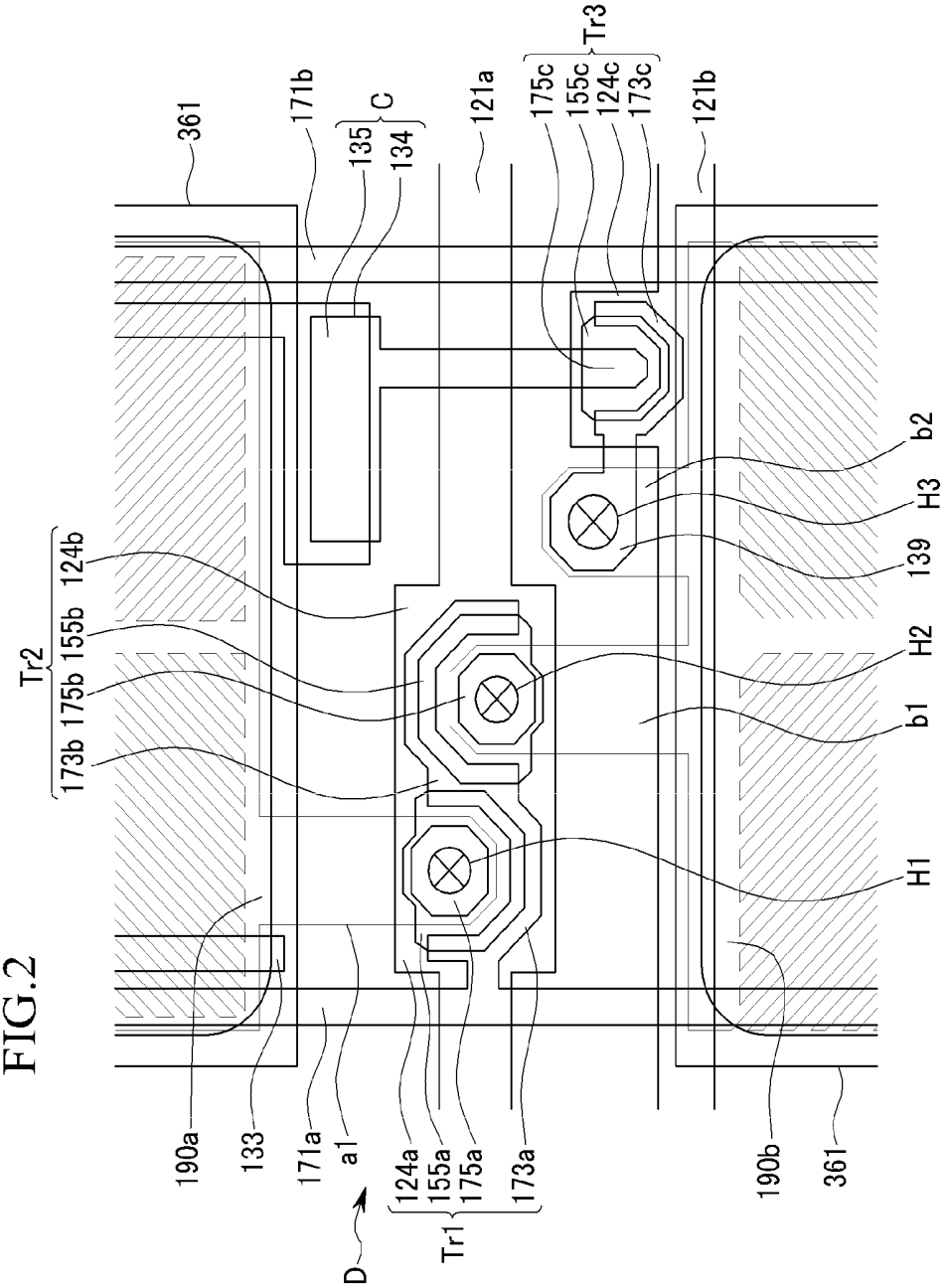

361
171b
135
134
C
121a
175c
155c
124c
173c
Tr3
121b
b2
H3
139
124b
155b
175b
173b
Tr2
H2
b1
H1
190a
133
171a
a1
D
124a
155a
175a
Tr1
173a
190b
361

FIG.3

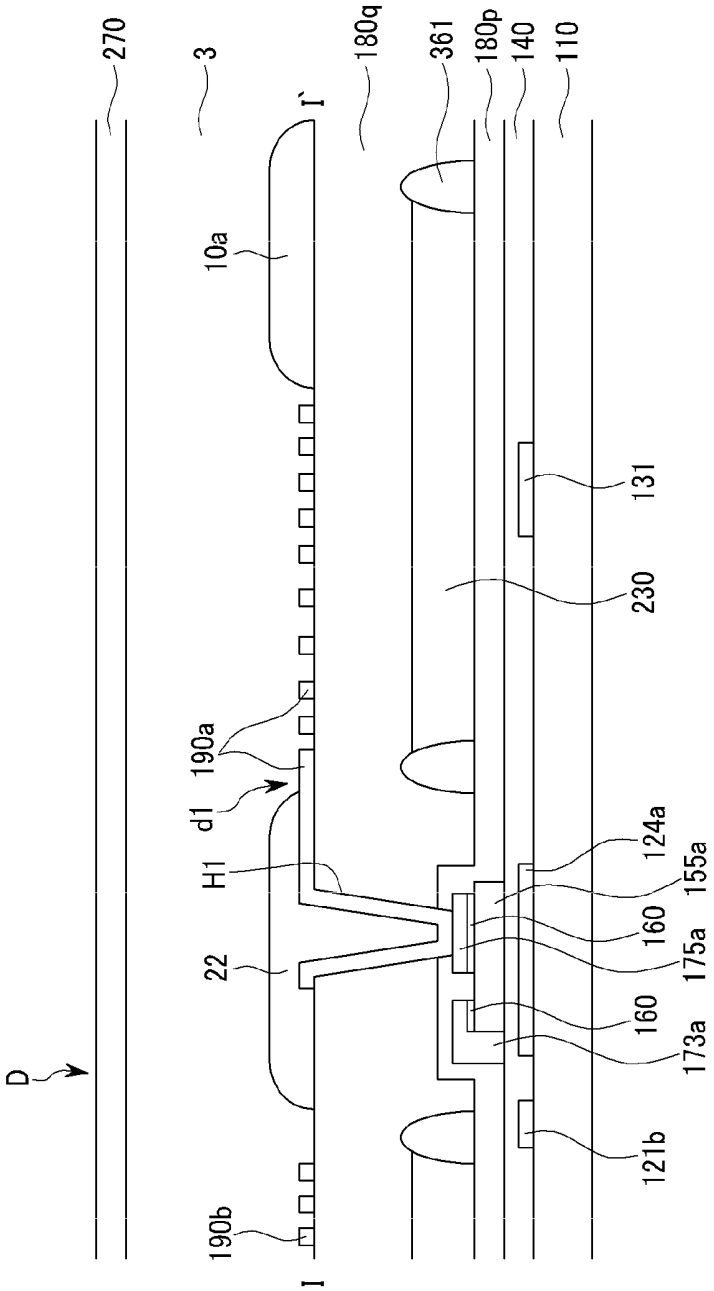

270
3
I`
180q
361
180p
140
110
10a
131
230
190a
d1
H1
124a
155a
160
175a
22
160
173a
D
121b
190b
I

FIG.4

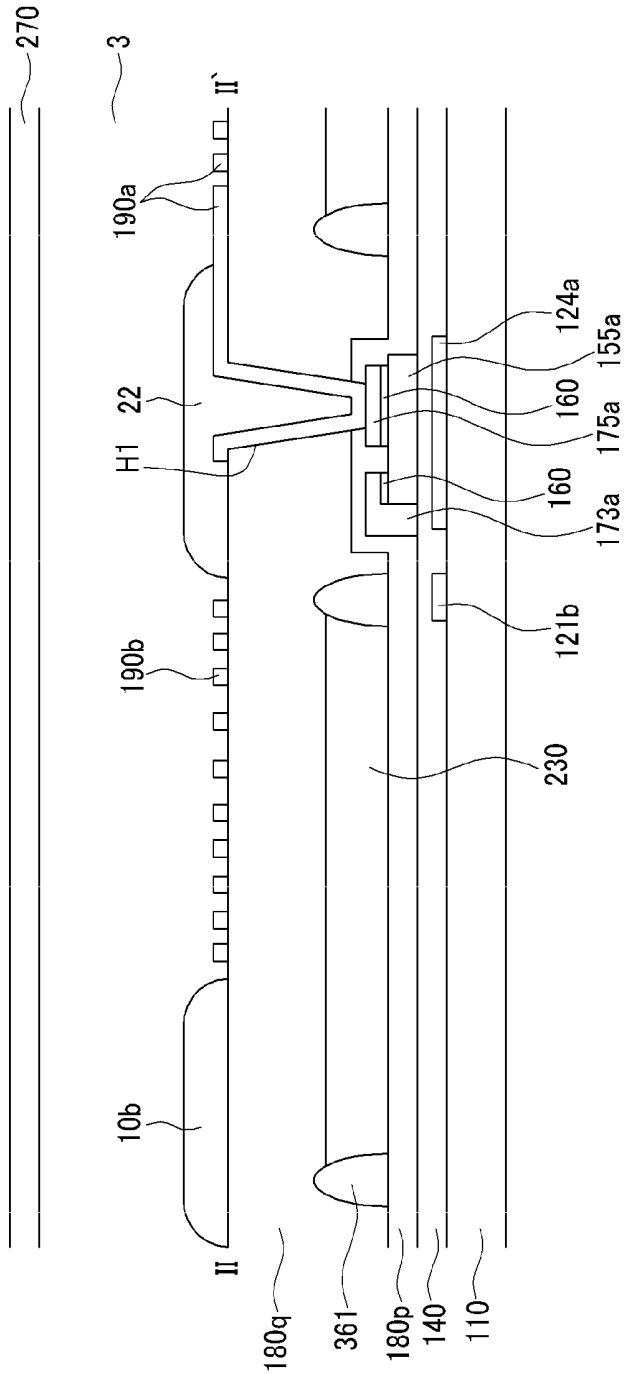

270
3
II`
190a
22
H1
190b
10b
II
180q
361
180p
140
110
124a
155a
160
175a
160
173a
121b
230

FIG.5

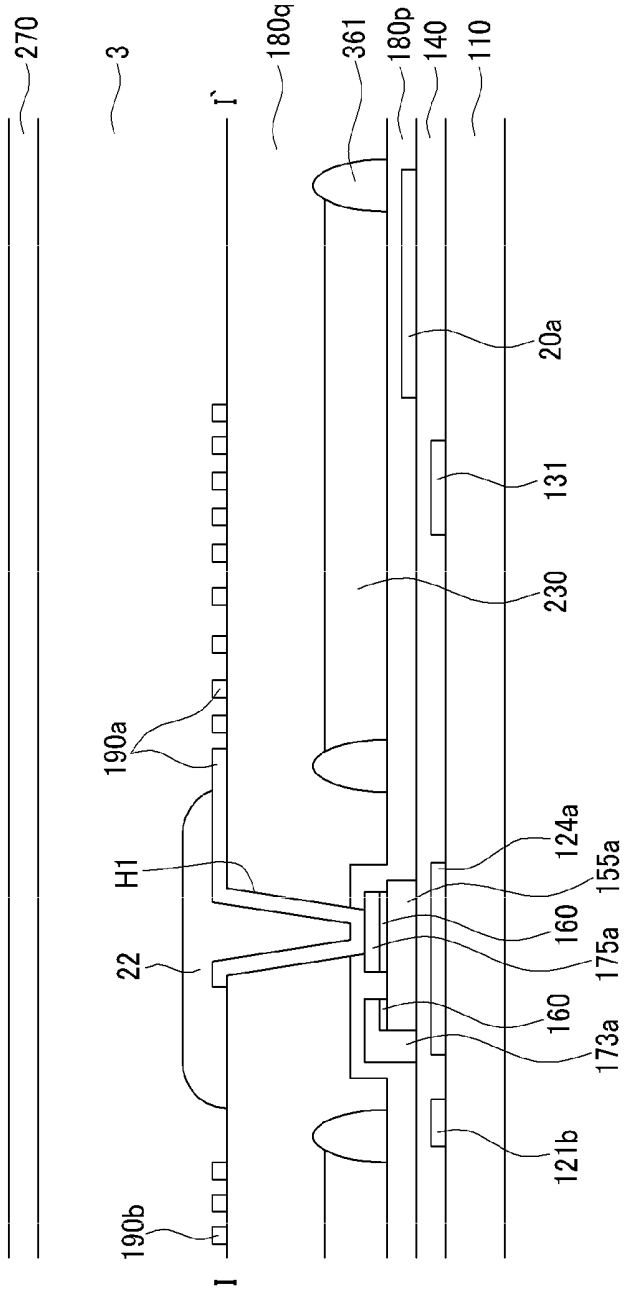

270
3
1`
180q
361
180p
140
110
20a
131
230
190a
H1
22
124a
155a
160
175a
160
173a
121b
190b
1

FIG.6

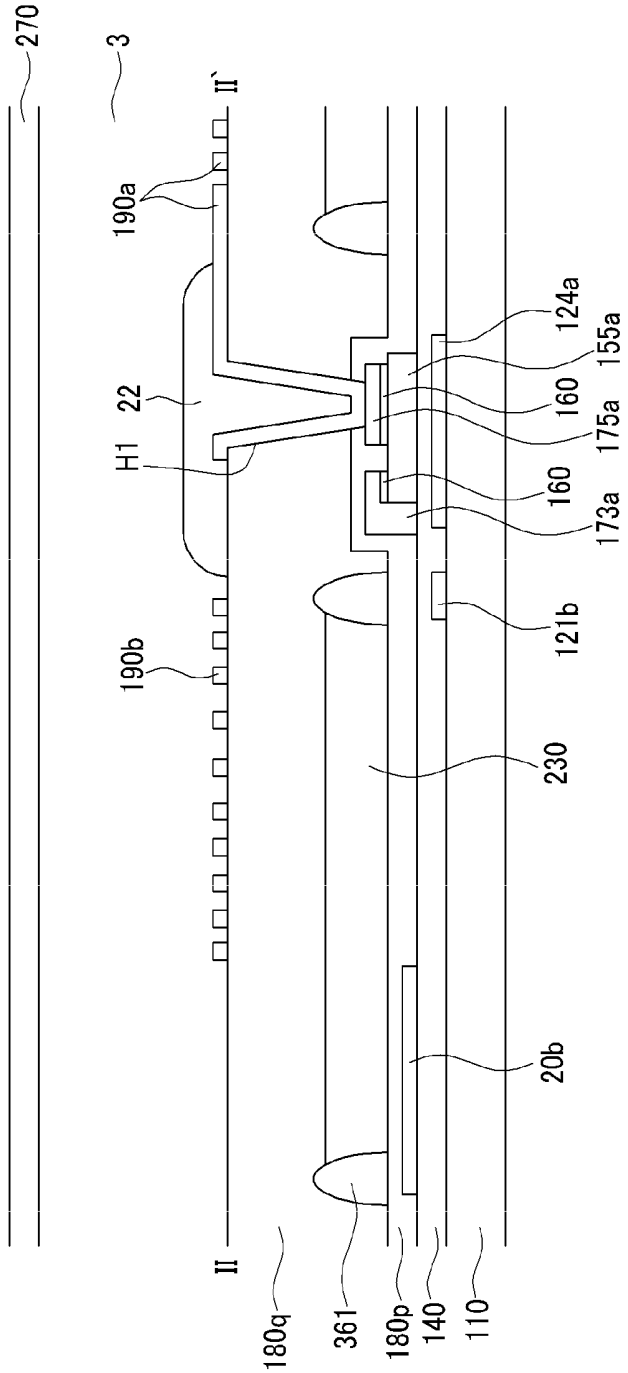

270
3
II`
190a
22
H1
190b
II
180q
361
180p
140
110
20b
230
121b
173a
160
175a
160
155a
124a

FIG.7

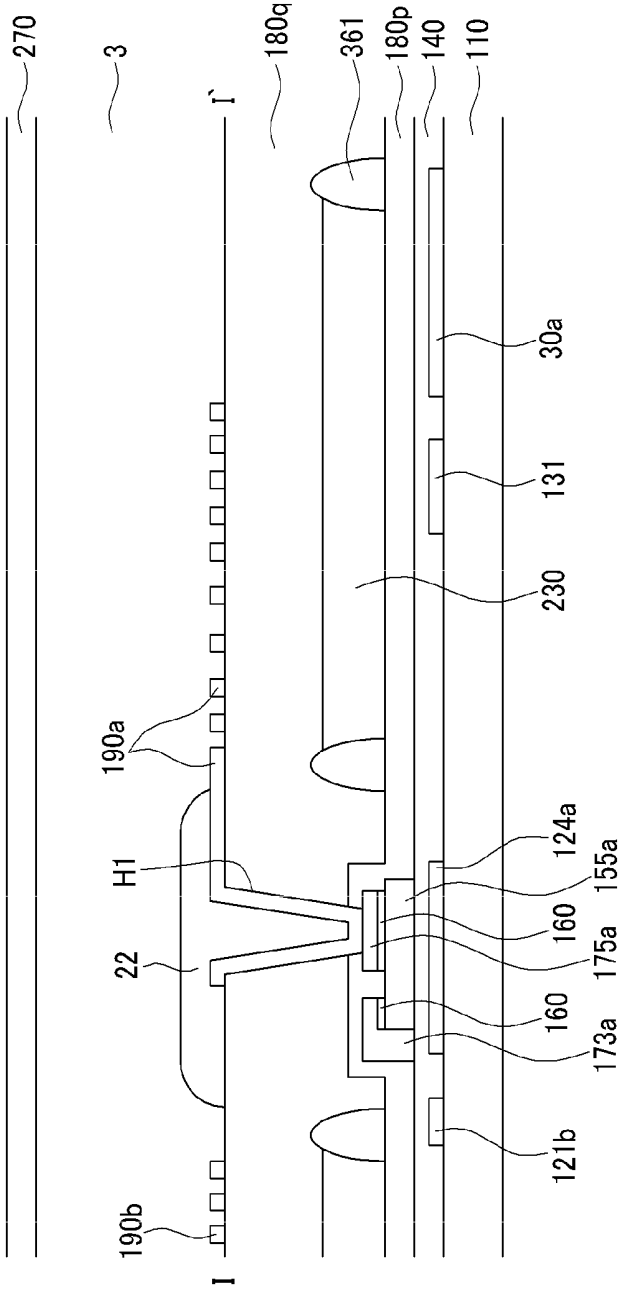

270
3
I`
180q
361
180p
140
110
30a
131
230
190a
H1
22
124a
155a
160
175a
160
173a
121b
190b
I

FIG.8

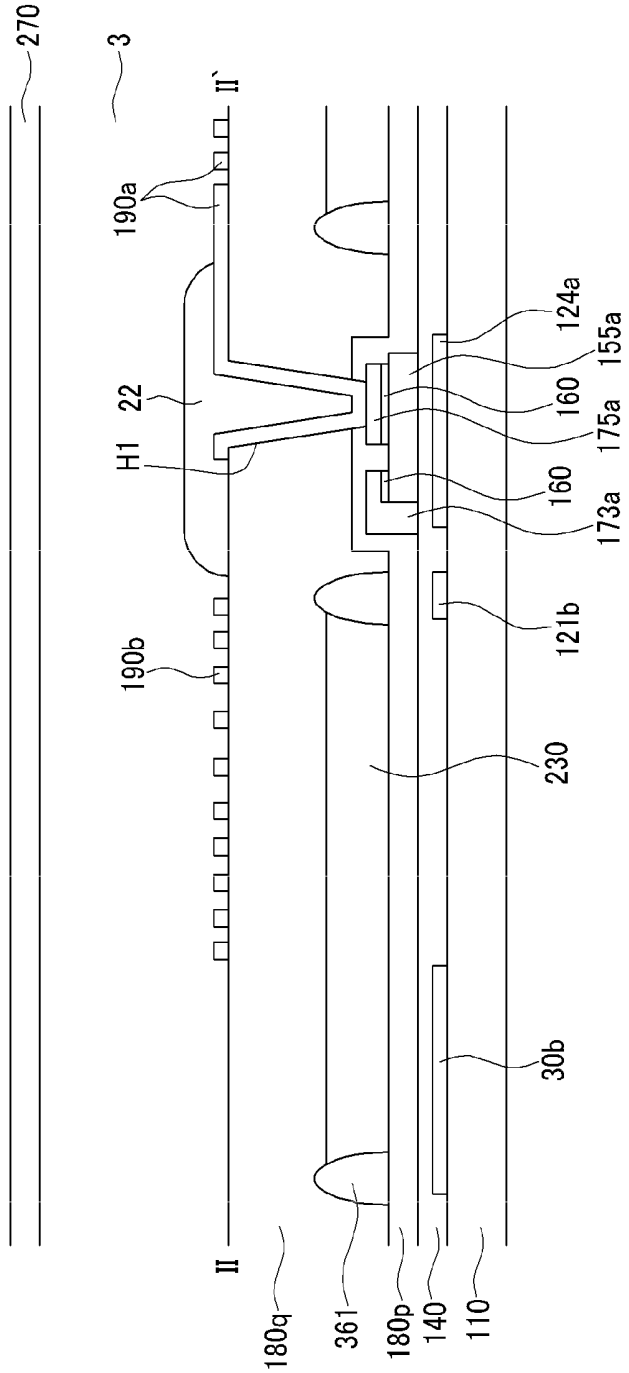

270
3
II`
190a
22
H1
190b
II
180q
361
180p
140
110
30b
230
121b
173a
160
175a
160
155a
124a

FIG.9

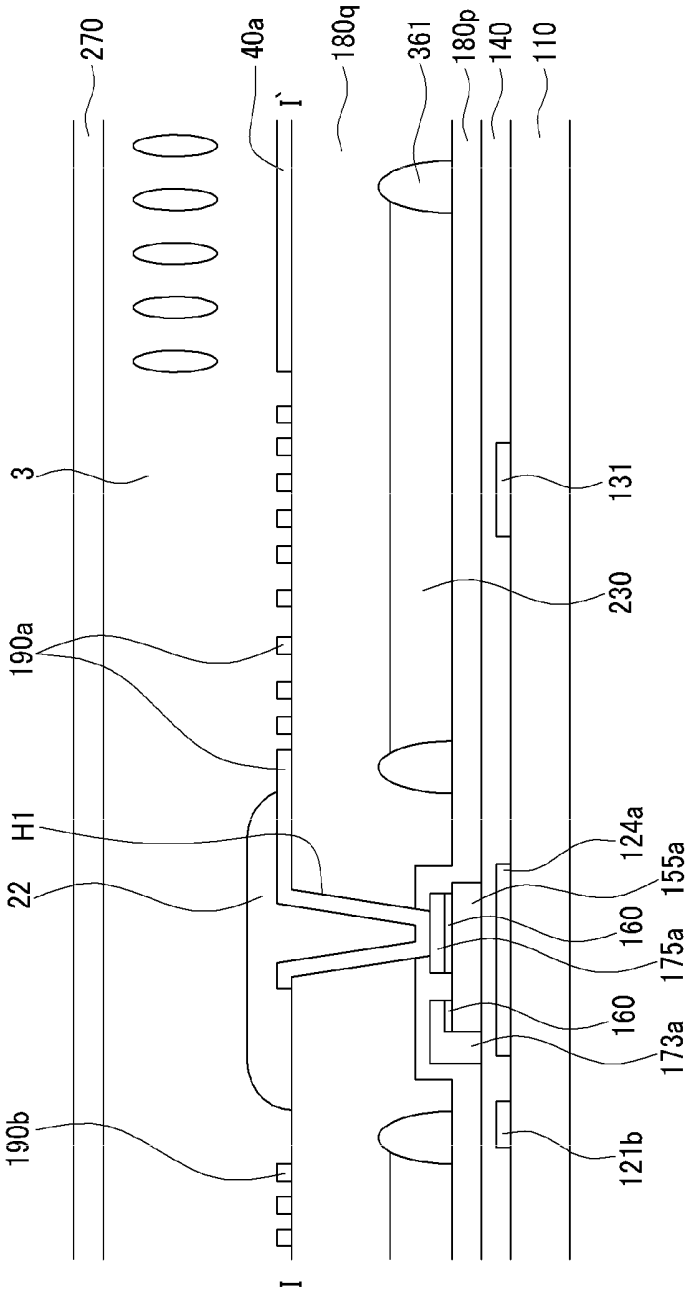

270
3
190a
H1
22
190b
I
40a
I`
180q
361
180p
140
110
131
230
124a
155a
160
175a
160
173a
121b

FIG.10

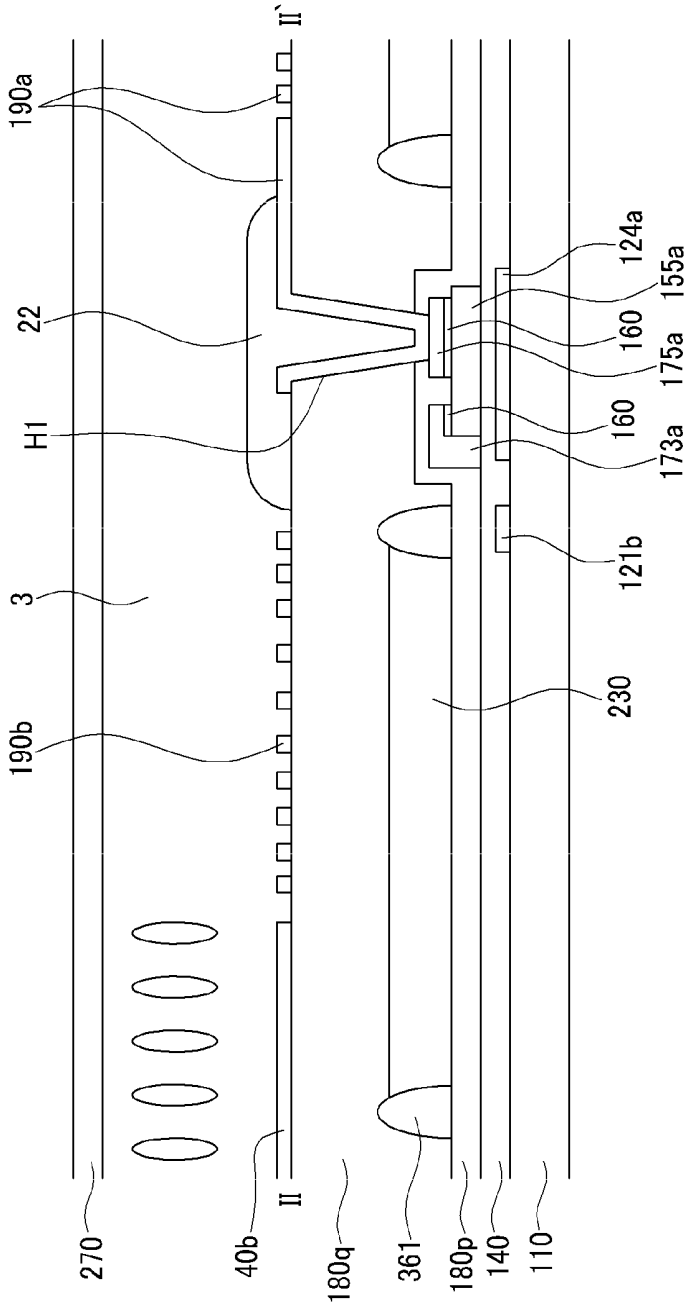
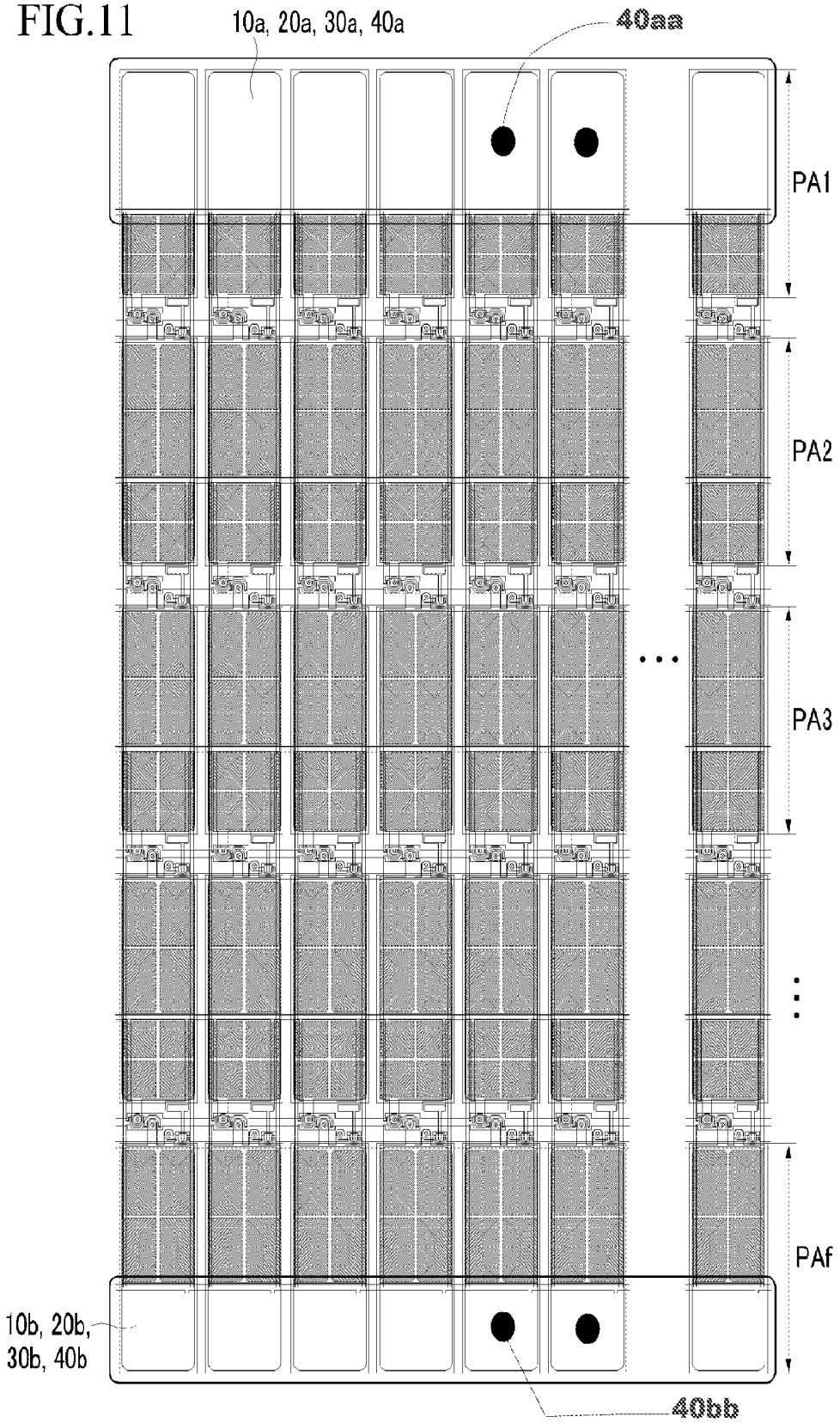

190a
22
H1
3
190b
270
40b
II
180q
361
180p
140
110
II'
124a
155a
160
175a
160
173a
121b
230

FIG.11



LIQUID CRYSTAL DISPLAY DEVICE

CROSS-REFERENCE TO RELATED APPLICATION

This application claims priority to and the benefit of Korean Patent Application No. 10-2009-0027562 filed in the Korean Intellectual Property Office on Mar. 31, 2009, the entire contents of which are incorporated herein by reference.

BACKGROUND

(a) Field of the Invention

The present invention relates to a liquid crystal display and, more particlualy, to a liquid crystal display having high efficiency for preventing light leakage.

(b) Discussion of Related Art

Currently, various flat panel displays have been developed and used, including a liquid crystal display with a liquid crystal layer formed between a lower panel and an upper panel. In general, such liquid crystal displays includes a plurality of pixel areas where color filters are disposed. However, when the color filters are formed in the pixel areas through Inkjet printing, severe light leakage is generated at the pixel areas disposed on the edge.

Therefore, there is a need for flat panel displays that reduce the amount of light leakage from the edge.

The information disclosed in this Background section is only for the enhancement of understanding of the background of the invention. It therefore may contain information that does not constitue prior art that is already known in this country to a person of ordinary skill in the art.

SUMMARY

In accordance with some embodiments of the invention, a flat panel display is disclosed that substantially reduces the amount of light leakage at first pixel areas and final pixel areas that are disposed on the edge of the display. According to some embodiments of the present invention, a liquid crystal display can include a lower panel having a first pixel area including a first pixel electrode and a first light leakage preventing member; a final pixel area including a second pixel electrode and a second light leakage preventing member; and middle pixel areas arranged between the first pixel area and the final pixel area, the middle pixel areas each including a first middle pixel electrode and a second middle pixel electrode.

In some embodiments, the second pixel electrode may be larger than the first pixel electrode, and the second light leakage preventing member may be smaller than the first light leakage preventing member. The size of the first light leakage preventing member may be the same as that of the second pixel electrode, and the size of the second light leakage preventing member may be the same as that of the first pixel electrode.

In some embodiments, a light blocking member disposed between the pixel areas and including an organic material having black pigments may be further included. The first light leakage preventing member and the second light leakage preventing member may be formed with the same material as the light blocking member.

In some embodiments, the liquid crystal display may further include a substrate, a partition disposed on the substrate and enclosing the first, final, and middle pixel areas, a color filter disposed inside the partition, and an insulating layer disposed on the partition and the color filter, wherein the first light leakage preventing member and the second light leakage preventing member may be disposed on the insulating layer.

In some embodiments, the liquid crystal display may further include a substrate, a partition disposed on the substrate and enclosing the first, final, and middle pixel areas, a color filter disposed inside the partition, and an insulating layer disposed on the partition and the color filter, and the first light leakage preventing member and the second light leakage preventing member are disposed on the insulating layer.

In some embodiments, the liquid crystal display may further include a driving circuit unit disposed between the pixel areas and including at least one transistor. The first light leakage preventing member and the second light leakage preventing member may be formed with the same layer as the drain electrode or the source electrode of the transistor. The first light leakage preventing member and the second light leakage preventing member may be formed using the same material as the drain electrode or the source electrode. The transistor may include a gate electrode, a gate insulating layer disposed on the gate electrode, a semiconductor pattern overlapping the gate electrode on the gate insulating layer, a drain electrode disposed on the semiconductor pattern, a source electrode disposed on the semiconductor pattern, and ohmic contact layers disposed between the drain electrode and the semiconductor pattern, and the source electrode and the semiconductor pattern. A passivation layer disposed on the transistor and the gate insulating layer may be further included, and the first light leakage preventing member and the second light leakage preventing member may be disposed between the gate insulating layer and the passivation layer.

In some embodiments, the first light leakage preventing member and the second light leakage preventing member may be disposed with the same layer as the gate electrode of the transistor. In addition, the first light leakage preventing member and the second light leakage preventing member may include the same material as the gate electrode of the transistor. The liquid crystal display may further include a storage electrode line disposed with the same layer as the gate electrode, and the first light leakage preventing member and the second light leakage preventing member may be coupled to the storage electrode line.

In some embodiments, the transistor may include a substrate, a gate electrode disposed on the substrate, a gate insulating layer disposed on the gate electrode, a semiconductor pattern overlapping the gate electrode on the gate insulating layer, a drain electrode disposed on the semiconductor pattern, a source electrode disposed on the semiconductor pattern, and ohmic contact layers disposed between the drain electrode and the semiconductor pattern, and the source electrode and the semiconductor pattern, and the first light leakage preventing member and the second light leakage preventing member, may be disposed between the substrate and the gate insulating layer.

In some embodiments, the liquid crystal display may further include a liquid crystal layer disposed on the lower panel, and an upper panel disposed on the liquid crystal layer and having a common electrode, wherein the first light leakage preventing member and the second light leakage preventing member include a transparent electrode material, and a voltage difference between the common electrode and the first light leakage preventing member, and the common electrode and the second light leakage preventing member, is "0". The common electrode may be electrically coupled to the first light leakage preventing member, and the common electrode may be electrically coupled to the second light leakage preventing member.

In some embodiments, the lower panel may include a substrate, a partition disposed on the substrate and corresponding to the outer of the pixel areas, a color filter disposed inside the partition, and an insulating layer disposed on the partition and the color filter, and the first light leakage preventing member and the second light leakage preventing member may be disposed on the insulating layer.

The first pixel area, the middle pixel areas, and the final pixel area may be sequentially arranged in all pixel columns. At least two first light leakage preventing members may be coupled to each other, and at least two second light leakage preventing members may be coupled to each other. The first light leakage preventing members may be integrally formed, and the second light leakage preventing members may be integrally formed. Accordingly, the first light leakage preventing member and the second light leakage preventing member may be disposed at the first pixel area and the final pixel area that are disposed on the edge. Accordingly, the light leakage may be effectively prevented at the edge of the pixel area. Also, in some embodiments, the neighboring first light leakage preventing members can be coupled to each other, or the neighboring second light leakage preventing members can be coupled to each other, such that the region for preventing the light leakage is extended, thereby increasing the light leakage preventing efficiency.

These and other embodiments are further discussed below with respect to he following figures.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** shows a top plan view of a lower panel of a liquid crystal display according to an exemplary embodiment of the present invention.

FIG. **2** shows an enlarged view of a driving circuit unit shown in FIG. **1**.

FIG. **3** shows a cross-sectional view taken along the line I-I' of FIG. **1**.

FIG. **4** shows a cross-sectional view taken along the line II-IP of FIG. **1**.

FIGS. **5** and **6** illustrate cross-sectional views of a lower panel of a liquid crystal display according to some embodiments of the present invention.

FIGS. **7** and **8** illustrate cross-sectional views of a lower panel of a liquid crystal display according to some embodiments of the present invention.

FIGS. **9** and **10** illustrate cross-sectional views of a liquid crystal display according to some embodiments of the present invention.

FIG. **11** shows a top plan view of an arrangement of pixel areas included in a lower panel of a liquid crystal display according to some embodiments of the present invention.

DETAILED DESCRIPTION

Exemplary embodiments of the present invention will be hereinafter described in detail with reference to the accompanying drawings. The structural shapes, sizes, ratios, numbers, etc. are schematically illustrated in the accompanying drawings such that they may be altered more or less. The drawings are shown from the viewpoint of observation such that the direction or location of view in the drawings may be variously changed, depending upon the position of the observer. Even when reference is made to different elements, like reference numerals may be used to designate those elements. When the terms "include," "have," "consist of," or the like are used, the relevant subject may include other parts unless the term "only" is used to define the contents thereof. When explanation is made by way of a singular term, it may be interpreted in a plural manner as well as in a singular manner. Even when the numerical values, shapes, size comparisons, positional relations, etc. are not explained with the adverb "about" or "substantially," they may be so interpreted to include the common error ranges. Even when the terms of "after," "before," "and," "here," "subsequently," or the like are introduced, they are not meant to define temporal sequences. The terms of "the first," "the second," . . . , etc. are used only for convenience in distinction selectively, commutatively, or repeatedly, and are not meant to be read in any defined manner. It will be understood that when an element is referred to as being "on," "over," "above," "below," or "beside" another element, it can be directly on the other element or one or more intervening elements may also be present between the two elements. When the connective "or" is used to connect two elements, it is meant to indicate the respective elements and a combination thereof, but when the quantifier "any one of" is attached to the connective, it is meant to indicate only the respective elements.

FIG. **1** shows a top plan view of a lower panel of a liquid crystal display according to some embodiments of the present invention. FIG. **2** shows an enlarged view of a driving circuit unit such as that shown in FIG. **1**. FIG. **3** shows a cross-sectional view taken along the line I-I' of FIG. **1**. FIG. **4** shows a cross-sectional view taken along the line II-IP of FIG. **1**. Amongst other elements, FIGS. **1-4** show a liquid crystal layer **3** (FIGS. **3** and **4**), a first light leakage preventing member **10***a* (FIGS. **1** and **3**), a second light leakage preventing member **10***b* (FIGS. **1** and **4**), a substrate **110** (FIGS. **3** and **4**), a first gate electrode **124***a* (FIGS. **2-4**), a storage electrode line **131** (FIG. **3**), a storage electrode **133** (FIG. **2**), a gate insulating layer **140** (FIGS. **3** and **4**), a first semiconductor pattern **155***a* (FIGS. **2-4**), an ohmic contact layer **160** (FIGS. **3** and **4**), a first source electrode **173***a* (FIGS. **2-4**), a first drain electrode **175***a* (FIGS. **2-4**), a passivation layer **180***p* (FIGS. **3** and **4**), an insulating layer **180***q* (FIGS. **3** and **4**), a first pixel electrode **190***a* (FIGS. **1-4**), a second pixel electrode **190***b* (FIGS. **1-4**), a color filter **230** (FIGS. **3** and **4**), a common electrode **270** (FIGS. **3** and **4**), and a partition **361** (FIGS. **3** and **4**).

Referring to FIG. **1**, a pixel as one formation unit U includes a first pixel electrode **190***a*, a second pixel electrode **190***b* that is larger than the first pixel electrode **190***a*, and a driving circuit unit D disposed between the first pixel electrode **190***a* and the second pixel electrode **190***b*, the driving unit D including a transistor Tr (Tr**1** and Tr**2** are shown). Formation unit U is continuously formed according to one direction by Inkjet printing.

As shown in FIG. **1**, a region of substantially the same size where the pixel electrodes are disposed is defined as a pixel area PA. In the case where the first pixel electrode **190***a*, the second pixel electrode **190***b*, and the driving circuit unit D are formed as one formation unit U by using the Inkjet printing, pixel areas PA_2, through PA_{f-1}, which are disposed on the middle position between the first pixel area PA_1 where the first pixel shown in FIG. **1** is started and the final pixel area PA_f where the final pixel is ended, include first pixel electrode **190***a* and second pixel electrode **190***b*. However, as shown in FIG. **1**, the first pixel area PA_1 only includes first pixel electrode **190***a* and final pixel area PA_f only includes second pixel electrode **190***b*.

According to some embodiments of the present invention, a light leakage preventing member can be disposed in the portion where the first pixel electrode **190***a* is not occupied in the first pixel area PA_1, where the first pixel is started, and the portion where the second pixel electrode **190***b* is not occupied

in the final pixel area PA_f, where the final pixel is ended. Further, for convenience of explanation only, five pixel areas PA are shown in FIG. **1**, however there may be any number of pixel areas PA and there may be substantially more than five.

As shown in FIGS. **3** and **4**, driving circuit unit D is disposed on a substrate **110**. As shown in FIG. **2**, in some embodiments, driving circuit unit D can include a first transistor Tr_1, a second transistor Tr_2, a third transistor Tr_3, and a down capacitor C for realizing a charge sharing method, however it is not limited thereto. For example, driving circuit unit D may include a charge pump, which would utilize a different structure.

Referring to FIG. **2**, driving circuit unit D can include a storage electrode line **131**, a storage electrode **133**, a capacitor lower electrode **134**, a first gate line **121***a*, a first gate electrode **124***a*, a second gate electrode **124***b*, a third gate electrode **124***c*, and a second gate line **121***b*. As shown in FIGS. **3** and **4**, driving circuit unit D is disposed on substrate **110**. As shown in FIGS. **3** and **4**, storage electrode line **131**, first gate line **121***a*, and second gate line **121***b* are separated in a first direction, defined as shown in FIG. **1**, and are sequentially arranged. Also, storage electrode line **131**, first gate line **121***a*, and second gate line **121***b* are extended in a second direction intersecting the first direction, as defined in FIG. **1**.

Storage electrode **133** may be a pair and extends from storage electrode line **131** in the first direction. The capacitor lower electrode **134** is extended from the storage electrode **133** in the second direction.

As illustrated in FIG. **2**, first gate electrode **124***a* and the second gate electrode **124***b* are coupled to first gate line **121***a*. A portion of first gate line **121***a* having a wide width may be used as first gate electrode **124***a* and as second gate electrode **124***b*. Third gate electrode **124***c* is coupled to second gate line **121***b*. A portion of second gate line **121***b* having a wide width may be used as third gate electrode **124***c*.

As shown in FIGS. **3** and **4**, a gate insulating layer **140** is formed on storage electrode line **131**, storage electrode **133**, capacitor lower electrode **134**, first gate line **121***a*, first gate electrode **124***a*, second gate electrode **124***b*, third gate electrode **124***c*, and second gate line **121***b*. As shown in FIG. **2**, a first semiconductor pattern **155***a*, a second semiconductor pattern **155***b*, and a third semiconductor pattern **155***c* are respectively disposed on first gate electrode **124***a*, second gate electrode **124***b*, and third gate electrode **124***c* on gate insulating layer **140**.

As shown in FIG. **2**, a first data line **171***a* is disposed on the left side of the pixel area PA on gate insulating layer **140**. A second data line **171***b* is disposed on the right side of the pixel area PA on gate insulating layer **140**. First data line **171***a* is extended in the first direction and is disposed further outside than first and second semiconductor patterns **155***a* and **155***b*. Second data line **171***b* is disposed at the right side of the pixel area PA on gate insulating layer **140**. Second data line **171***b* is extended in the first direction.

As shown in FIG. **2**, a first source electrode **173***a* is extended from first data line **171***a*. As shown in FIG. **3**, first source electrode **173***a* partially overlaps first semiconductor pattern **155***a*. A second source electrode **173***b* is extended from first source electrode **173***a*, thereby partial overlapping second semiconductor pattern **155***b*. A third source electrode **173***c* partially overlaps third semiconductor pattern **155***c*.

As shown in FIG. **3**, first drain electrode **175***a* is separated from first source electrode **173***a* on first semiconductor pattern **155***a*. As illustrated in FIG. **2**, second drain electrode **175***b* is separated from the second source electrode **173***b* on second semiconductor pattern **155***b*. A third drain electrode **175***c* is separated from third source electrode **173***c* on the third semiconductor pattern **155***c*.

As shown in FIG. **2**, a contact region **139** has a shape extending from third source electrode **173***c*. Also, a capacitor upper electrode **135** is extended from the third drain electrode **175***c* and overlaps capacitor lower electrode **134**.

As shown in FIGS. **3** and **4**, a passivation layer **180***p* is formed on the above-described structures. Also, an insulating layer **180***q* is formed on passivation layer **180***p*. Insulating layer **180***q* and passivation layer **180***p* have a first hole H_1 (shown in FIGS. **2** through **4**), a second hole H_2 (shown in FIG. **2**), and a third hole H_3 (shown in FIG. **2**) respectively exposing a first drain electrode **175***a*, a second drain electrode **175***b*, and contact region **139**, respectively.

As shown in FIGS. **3** and **4**, first pixel electrode **190***a* and second pixel electrode **190***b* are disposed on insulating layer **180***q*. As shown in FIGS. **2** through **4**, first pixel electrode **190***a* and second pixel electrode **190***b* are disposed between first data line **171***a* and second data line **171***b*, and are opposite to each other via first and second semiconductor patterns **155***a* and **155***b*.

As shown in FIGS. **2** and **3**, first pixel electrode **190***a* has an extension al. Extensional of first pixel electrode **190***a* is coupled to first drain electrode **175***a* through first hole H_1. As shown in FIG. **2**, second pixel electrode **190***b* includes a first extension b**1** and a second extension b**2**. First extension b**1** of second pixel electrode **190***b* is coupled to the second drain electrode **175***b* through second hole H_2. Second extension b**2** of second pixel electrode **190***b* is coupled to the contact region **139** through third hole H_3.

As shown in FIG. **2**, first gate electrode **124***a*, first source electrode **173***a*, first drain electrode **175***a*, and first semiconductor pattern **155***a* form first transistor Tr_1. Second gate electrode **124***b*, second source electrode **173***b*, second drain electrode **175***b*, and second semiconductor pattern **155***b* form second transistor Tr_2. Third gate electrode **124***c*, third source electrode **173***c*, third drain electrode **175***c*, and third semiconductor pattern **155***c* form third transistor Tr_3. Capacitor lower electrode **134**, gate insulating layer **140**, and capacitor upper electrode **135** form a down capacitor C.

Third transistor T**3** may realize a charge sharing effect between first pixel electrode **190***a* and second pixel electrode **190***b*. Third transistor Tr_3 is turned on in a state where first and second transistors Tr_1 and Tr_2 are turned on, and charges are moved from second pixel electrode **190***b* to down capacitor C. In that case, the voltage of first pixel electrode **190***a* is maintained higher than the voltage of second pixel electrode **190***b*. Accordingly, problems such as lateral visibility may be solved through creating a voltage difference between first pixel electrode **190***a* and second pixel electrode **190***b*.

Referring to FIGS. **1** and **3**, first transistor Tr_1 of driving circuit unit D includes first gate electrode **124***a* on substrate **110**, gate insulating layer **140** on first gate electrode **124***a*, first semiconductor pattern **155***a* overlapping first gate electrode **124***a* on gate insulating layer **140**, first drain electrode **175***a* on first semiconductor pattern **155***a*, first source electrode **173***a* on first semiconductor pattern **155***a*, an ohmic contact layer **160** between first drain electrode **175***a* and first semiconductor pattern **155***a*, first source electrode **173***a*, and first semiconductor pattern **155***a*. Passivation layer **180***p* is disposed on substrate **110** and driving circuit unit D. Also, a partition **361** is disposed on passivation layer **180***p*. Partition **361** is disposed to correspond to the outer part of the pixel area PA. That is, partition **361** encloses pixel area PA. A color filter **230** is also formed in pixel area PA and disposed inside partition **361**.

As shown in FIGS. **3** and **4**, insulating layer **180***q* is formed on passivation layer **180***p*, color filter **230**, and partition **361**. First pixel electrode **190***a* is coupled to first drain electrode **175***a* of first transistor Tr_1 by passing through insulating layer **180***q*. Passivation layer **180***p* is disposed to be extended to the portion of the first pixel area PA_1 on insulating layer **180***q*.

Also, as shown in FIG. **3**, a first light leakage preventing member **10***a* is disposed on the portion of insulating layer **180***q* in first pixel area PA_1 where first pixel electrode **190***a* does not exist. In some embodiments, first light leakage preventing member **10***a* includes an organic material include black pigments Here, the size of the first light leakage preventing member **10***a* may be substantially the same as that of second pixel electrode **190***b*.

Also shown in FIG. **3**, second pixel electrode **190***b* is extended to the portion of second pixel area PA_2 on insulating layer **180***q*. Also, first pixel electrode **190***a* is positioned at the portion where second pixel electrode **190***b* is not disposed among the portion of insulating layer **180***q* corresponding to second pixel area PA_2. That is, first pixel area PA_1 includes first pixel electrode **190***a* and first light leakage preventing member **10***a* shown in FIG. **3**, and second pixel area PA_2 includes second pixel electrode **190***b* shown in FIG. **3**, as well as first pixel electrode **190***a* of second pixel area PA_2 that is not shown in FIG. **3**. As shown in FIGS. **3** and **4**, a light blocking member **22** on insulating layer **180***q* is disposed in driving circuit unit D between pixel areas PA. Light blocking member **22** may include substantially the same material as first light leakage preventing member **10***a*. Light blocking member **22** may be positioned on the portion of first pixel electrode **190***a* coupled to first drain electrode **175***a* of first transistor Tr_1 above driving circuit unit D. In this case, first pixel electrode **190***a* may fill the contact hole of insulating layer **180***q*.

Referring to FIGS. **1** and **4**, first pixel electrode **190***a* and second pixel electrode **190***b* are disposed on middle pixel areas PA_2, through PA_{f-1} between first pixel area PA_1 and final pixel area PA_f. However, second pixel electrode **190***b* is disposed to be extended to the portion of the final pixel area PA_f on insulating layer **180***q* in final pixel area PA_f. Also, a second light leakage preventing member **10***b*, which may be made of an organic material including black pigments, is disposed on the portion where second pixel electrode **190***b* does not exist on insulating layer **180***q* corresponding to final pixel area PA_f. In some embodiments, the size of second light leakage preventing member **10***b* may be smaller than that of first light leakage preventing member **10***a*. For example, the size of second light leakage preventing member **10***b* may be substantially the same as that of first pixel electrode **190***a*.

FIGS. **5** and **6** are cross-sectional views of a lower panel of a liquid crystal display according to some embodiments of the present invention. FIGS. **5** and **6** are cross-sectional view taken along the lines I-I' and II-IP shown in FIG. **1**. As shown in FIGS. **5** and **6**, a lower panel of a liquid crystal display according to embodiments as shown is substantially the same as the embodiments illustrated in FIGS. **1** through **4**, except for the light leakage preventing member. Accordingly, the same components are indicated by the same reference numerals, and the description thereof is omitted.

Referring to FIG. **5**, a first light leakage preventing member **20***a* is disposed in first pixel area PA_1 under the portion where the first pixel electrode **190***a* does not exist. First light leakage preventing member **20***a* is formed on insulating layer **140** and insulating layer **180***q* is then deposited over insulating layer **140** and first leakage preventing member **20***a*. Here, the size of the first light leakage preventing member **20***a* may be substantially the same as that of second pixel electrode **190***b*.

First light leakage preventing member **20***a* may be formed through the same process as drain electrode **175** or source electrode **173** of one transistor Tr included in driving circuit unit D. In this case, first light leakage preventing member **20***a* includes the same material as drain electrode **175** or the source electrode **173**, and is disposed between gate insulating layer **140** and passivation layer **180***p* like drain electrode **175** or source electrode **173**.

In some embodiments, first light leakage preventing member **20***a* may be formed through the same process as first drain electrode **175***a* or first source electrode **173***a* of first transistor Tr_1. As another example, first light leakage preventing member **20***a* may be formed through the same process as second drain electrode **175***b* or second source electrode **173***b* of second transistor Tr_2. As another example, first light leakage preventing member **20***a* may be formed through the same process as third drain electrode **175***c* or third source electrode **173***c* of third transistor Tr_1, and the first light leakage preventing member **20***a* may be separated from drain electrode **175** and source electrode **173**.

Referring to FIG. **6**, a second light leakage preventing member **20***b* is disposed in pixel area PA_f on the portion where the second pixel electrode **190***b* is not positioned. Here, the size of the second light leakage preventing member **20***b* may be smaller than that of the first light leakage preventing member **20***a*. In some embodiments, the size of the second light leakage preventing member **20***b* may be substantially the same as that of the first pixel electrode **190***a*.

The second light leakage preventing member **20***b* may be formed through the same process as that forming drain electrode **175** or that forming source electrode **173** of one transistor Tr included in driving circuit unit D. In this case, second light leakage preventing member **20***b* includes the same material as drain electrode **175** or source electrode **173**. Further, second light leakage preventing member **20***b* is disposed between gate insulating layer **140** and passivation layer **180***p* like drain electrode **175** or source electrode **173**.

In some embodiments, second light leakage preventing member **20***b* may be formed through the same process as first drain electrode **175***a* or first source electrode **173***a* of first transistor Tn. In some embodiments, second light leakage preventing member **20***b* may be formed through the same process as second drain electrode **175***b* or second source electrode **173***b* of second transistor Tr_2. In some embodiments, second light leakage preventing member **20***b* may be formed through the same process as third drain electrode **175***c* or third source electrode **173***c* of third transistor Tr_1. Also, second light leakage preventing member **20***b* may be separated from drain electrode **175** and source electrode **173**.

FIGS. **7** and **8** are cross-sectional views of a lower panel of a liquid crystal display according to some embodiments of the present invention. Here, FIGS. **5** and **6** are cross-sectional view taken along the lines I-I' and II-IP shown FIG. **1**. The lower panel of the liquid crystal display shown in FIGS. **7** and **8** is substantially the same as that shown in FIGS. **1** to **4**, except for the light leakage preventing member. Accordingly, the same components are indicated by the same reference numerals, and the description thereof is omitted.

Referring to FIG. **7**, a first light leakage preventing member **30***a* is disposed on first pixel area PA_1 in the portion where first pixel electrode **190***a* does not exist. Here, the size of the first light leakage preventing member **30***a* may be substantially the same as that of second pixel electrode **190***b*. First light leakage preventing member **30***a* may be formed through the same process as that used to form gate electrode **124** of one transistor Tr included in driving circuit unit D. In this case, first light leakage preventing member **30***a* includes the

same material as gate electrode **124**, and is disposed between gate insulating layer **140** and passivation layer **180***p*, like gate electrode **124**. In some embodiments, first light leakage preventing member **30***a* may be coupled to gate electrode **124**, or first light leakage preventing member **30***a* may be separated from gate electrode **124**.

In some embodiments, first light leakage preventing member **30***a* may be formed through the same process as that forming first gate electrode **124***a* of first transistor Tn. In some embodiments, first light leakage preventing member **30***a* may be formed through the same process as that forming second gate electrode **124***b* (referring to FIG. **2**) of second transistor Tr_2. In some embodiments, first light leakage preventing member **30***a* may be formed through the same process as that forming third gate electrode **124***c* (referring to FIG. **2**) of third transistor Tr_1. Also, first light leakage preventing member **30***a* may be separated or electrically coupled with gate electrodes **124**.

Further, in some embodiments, storage electrode line **131** may be formed with the same layer as first gate electrode **124***a* in the process of forming first gate electrode **124***a*. Here, storage electrode line **131** may be coupled to first light leakage preventing member **30***a*.

Referring to FIG. **8**, a second light leakage preventing member **30***b* is disposed in pixel area PA_f on the portion where second pixel electrode **190***b* is not positioned. Here, the size of second light leakage preventing member **30***b* may be smaller than that of first light leakage preventing member **30***a*. For example, the size of second light leakage preventing member **30***b* may be substantially the same as that of first pixel electrode **190***a*. Second light leakage preventing member **30***b* may be formed through the same process as that forming gate electrode **124** of one transistor Tr included in driving circuit unit D. In this case, second light leakage preventing member **30***b* includes the same material as gate electrode **124**. Further, second light leakage preventing member **30***b* is disposed between gate insulating layer **140** and passivation layer **180***p* like gate electrode **124**. Also, second light leakage preventing member **30***b* may or may not be coupled to gate electrode **124**.

In some embodiments, second light leakage preventing member **30***b* may be formed through the same process as that forming first gate electrode **124***a* of first transistor Tn. In some embodiments, second light leakage preventing member **30***b* may be formed through the same process as that forming second gate electrode **124***b* (referring to FIG. **2**) of second transistor Tr_2. In some embodiments, second light leakage preventing member **30***b* may be formed through the same process as that forming third gate electrode **124***c* (referring to FIG. **2**) of third transistor Tr_1. Also, second light leakage preventing member **30***b* may be separated from the gate electrodes **124** or may be coupled to gate electrodes **124**.

Further, in some embodiments storage electrode line **131** may be formed with the same layer as first gate electrode **124***a* in the process forming first gate electrode **124***a*. In some embodiments, storage electrode line **131** may be coupled to second light leakage preventing member **30***b*.

FIGS. **9** and **10** show cross-sectional views of a liquid crystal display according to some embodiments of the present invention. FIGS. **9** and **10** are cross-sectional view taken along the lines I-I' and II-II' shown FIG. **1**, respectively. A lower panel of a liquid crystal display shown in FIGS. **9** and **10** is substantially the same as that shown in FIGS. **1** to **4**, except for the light leakage preventing member. Accordingly, the same components are indicated by the same reference numerals, and the description thereof is omitted. Also, FIGS. **9** and **10** show a liquid crystal layer **3** and an upper panel **270** for explanation of the operation of the light leakage preventing member as well as the lower panel of the liquid crystal display.

Referring to FIG. **9**, a first light leakage preventing member **40***a* is disposed on insulating layer **180***q* in first pixel area PA_1 in the portion where first pixel electrode **190***a* is not disposed. Here, the size of first light leakage preventing member **40***a* may be substantially the same the as that of second pixel electrode **190***b*. First light leakage preventing member **40***a* may include a transparent electrode material such as indium tin oxide (ITO).

An upper panel including a common electrode **270** is disposed to face the lower panel of the liquid crystal display. A liquid crystal layer **3** is disposed between common electrode **270** and layer **180***q* of the lower panel of the liquid crystal display. Also, an alignment layer (not shown) may be disposed between the lower panel and the liquid crystal layer **3**, and the upper panel and the liquid crystal layer **3**.

Referring to FIG. **10**, a second light leakage preventing member **40***b* is disposed on the portion where the second pixel electrode **190***b* is not disposed, on the portion of insulating layer **180***q* in final pixel area PA_f. The size of second light leakage preventing member **40***b* may be smaller than that of first light leakage preventing member **40***a*. For example, the size of second light leakage preventing member **40***a* may be substantially the same as that of first pixel electrode **190***a*. Second light leakage preventing member **40***b* may, for example, include a transparent electrode material such as ITO.

An upper panel including a common electrode **270** is disposed to face the lower panel of the liquid crystal display. The liquid crystal layer **3** is disposed between the common electrode **270** and the lower panel of the liquid crystal display. Also, an alignment layer (not shown) may be disposed between the lower panel and the liquid crystal layer **3**, and the upper panel and the liquid crystal layer **3**.

A voltage difference is not generated between the first light leakage preventing member **40***a* and the common electrode **270**. That is, the first light leakage preventing member **40***a* may be electrically coupled to common electrode **270**. In this case, the liquid crystal molecules of liquid crystal layer **3** are not inclined between the first light leakage preventing member **40***a* and common electrode **270**, thereby realizing the light leakage preventing effect.

FIG. **11** shows a top plan view of pixel areas included in a lower panel of a liquid crystal display according to some embodiments of the present invention. Referring to FIG. **11**, the pixel areas are arranged in the row direction and the column direction. Pixel areas of the same kind are arranged in the row direction, and the first pixel area PA_1, the middle pixel areas PA_2 through PA_{f-1}, and the final pixel area PA_f are sequentially arranged in the column direction. That is, the first pixel area PA_1, the middle pixel areas PA_2 through PA_{f-1}, and the final pixel area PA_f may be sequentially arranged in all pixel columns.

As described in FIGS. **1** to **11** the first pixel area PA_1 includes the first light leakage preventing members **10***a*, **20***a*, **30***a*, and **40***a*, and the final pixel area PA_f includes the second light leakage preventing members **10***b*, **20***b*, **30***b*, and **40***b*. In some embodiments, at least two first light leakage preventing members **10***a*, **20***a*, **30***a*, and **40***a* are coupled in the row direction. Also, at least two second light leakage preventing members **10***b*, **20***b*, **30***b*, and **40***b* are coupled in the row direction. Further, the first light leakage preventing members **10***a*, **20***a*, **30***a*, and **40***a* are integrally formed. Also, the second light leakage preventing members **10***b*, **20***b*, **30***b*, and **40***b* are integrally formed. The structure in which the first light leak-

age preventing members **10***a*, **20***a*, **30***a*, and **40***a*, and the second light leakage preventing members **10***b*, **20***b*, **30***b*, and **40***b* are connected in the row direction has the extended area such that the light leakage may be efficiently prevented. For the case of the respective first and second leakage preventing members **40***a* and **40***b* of the embodiments of respective FIGS. **9** and **10**, corresponding, to-the-common-electrode connection points **40***aa* and **40***bb* may be provided as shown by exemplary pairs of such to-the-common-electrode connection points **40***aa* and **40***bb* in FIG. **11** whereby the respective first and second leakage preventing members **40***a* and **40***b* are connected to the common electrode **270** and also to each other.

While this disclosure of invention has been provided in connection with what is presently considered to be practical exemplary embodiments, it is to be understood that the present teachings are not limited to the disclosed embodiments, but, on the contrary, they are intended to cover various modifications and equivalent arrangements included within the spirit and scope of the teachings.

What is claimed is:

1. A liquid crystal display comprising a lower panel,

wherein the lower panel includes a display area that has opposed edges and that is longitudinally populated between its opposed edges by pixel areas of equal lengths, where a succession of the pixel areas extending longitudinally from a first to a second of the opposed edges comprises:

a first pixel area including in respective portions of its length, a first pixel electrode and a first light leakage preventing member, the first pixel area being proximate to the first of the opposed edges of the display area;

a final pixel area including in respective portions of its length, a second pixel electrode and a second light leakage preventing member, the second pixel area being proximate to the second of the opposed edges of the display area; and

middle pixel areas arranged between the first pixel area and the final pixel area, the middle pixel areas each respectively including in respective portions of its corresponding length, a respective first middle pixel electrode and a respective but electrically separate second middle pixel electrode but not an equivalent of either of the first and second light leakage preventing members.

2. The liquid crystal display of claim **1**, wherein

the second pixel electrode is larger than the first pixel electrode, and

the second light leakage preventing member is smaller than the first light leakage preventing member.

3. The liquid crystal display of claim **2**, wherein

the respective portion of the pixel area length occupied by the first light leakage preventing member is the same as that of the second pixel electrode, and

the respective portion of the pixel area length occupied by the second light leakage preventing member is the same as that of the first pixel electrode.

4. The liquid crystal display of claim **1**, further comprising

respective light blocking members disposed between successive ones of the pixel areas, each of the light blocking members including an organic material having a black pigment.

5. The liquid crystal display of claim **4**, wherein

the first light leakage preventing member and the second light leakage preventing member are formed with the same material as the light blocking members.

6. The liquid crystal display of claim **5**, further comprising:

a substrate;

a partition disposed on the substrate and enclosing the first, final, and middle pixel areas;

a color filter disposed inside the partition; and

an insulating layer disposed on the partition and the color filter,

wherein the first light leakage preventing member and the second light leakage preventing member are disposed on the insulating layer.

7. The liquid crystal display of claim **1**, further comprising

respective driving circuit units interposed between adjacent ones of the pixel areas, with each respective driving circuit unit including at least one transistor operatively coupled to control charging of a respective at least one and adjacent pixel electrode of the corresponding first and second pixel electrodes of the respective and adjacent ones of the pixel areas between which the respective driving circuit unit is interposed.

8. The liquid crystal display of claim **7**, wherein

the first light leakage preventing member and the second light leakage preventing member are formed in a same layer as that of a drain electrode or a source electrode of an at least one of the transistors of the driving circuit units.

9. The liquid crystal display of claim **8**, wherein

the first light leakage preventing member and the second light leakage preventing member are formed using the same material as the drain electrode or the source electrode.

10. The liquid crystal display of claim **9**, wherein

the respective at least one transistors of the driving circuit units each includes a gate electrode, a gate insulating layer disposed on the gate electrode, a semiconductor pattern overlapping the gate electrode and disposed on the gate insulating layer, the said drain electrode disposed on the semiconductor pattern, the said source electrode disposed on the semiconductor pattern, and respective ohmic contact layers respectively disposed between the drain electrode and the semiconductor pattern, and between the source electrode and the semiconductor pattern,

a passivation layer is disposed on each of the respective at least one transistors and on the gate insulating layer, and

the first light leakage preventing member and the second light leakage preventing member are disposed under the passivation layer.

11. The liquid crystal display of claim **10**, wherein

the first light leakage preventing member and the second light leakage preventing member are disposed in a same layer as that of the gate electrode of an at least one of the transistors.

12. The liquid crystal display of claim **11**, wherein

the first light leakage preventing member and the second light leakage preventing member include the same material as the gate electrode of an at least one of the transistors.

13. The liquid crystal display of claim **12**, further comprising

a storage electrode line disposed with the same layer as the gate electrode.

14. The liquid crystal display of claim **13**, wherein

the first light leakage preventing member and the second light leakage preventing member are disposed between the substrate and the gate insulating layer.

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

a liquid crystal layer disposed on the lower panel; and

an upper panel disposed on the liquid crystal layer and having a common electrode,

wherein the first light leakage preventing member and the second light leakage preventing member include a transparent electrode material, and

a connection is provided to cause a voltage difference between the common electrode and the first light leakage preventing member, and the common electrode and the second light leakage preventing member, to be "0".

16. The liquid crystal display of claim **15**, wherein

the common electrode is electrically connected to the first light leakage preventing member, and

the common electrode is electrically connected to the second light leakage preventing member.

17. The liquid crystal display of claim **16**, wherein

the lower panel includes:

a substrate;

a partition disposed on the substrate and corresponding to the outer part of the pixel areas;

a color filter disposed inside the partition; and

an insulating layer disposed on the partition and the color filter,

wherein the first light leakage preventing member and the second light leakage preventing member are disposed on the insulating layer.

18. The liquid crystal display of claim **1**, wherein, in addition to a first column of pixel areas formed by said succession of the pixel areas extending longitudinally from the first to the second of the opposed edges, the display area is populated by alike and side by side further successions of pixel areas such that said arrangement of the first pixel area, the middle pixel areas, and the final pixel area is provided in all display area columns.

19. The liquid crystal display of claim **18**, wherein

at least two first light leakage preventing members of adjacent columns are connected to each other, and at least two second light leakage preventing members of adjacent columns are connected to each other.

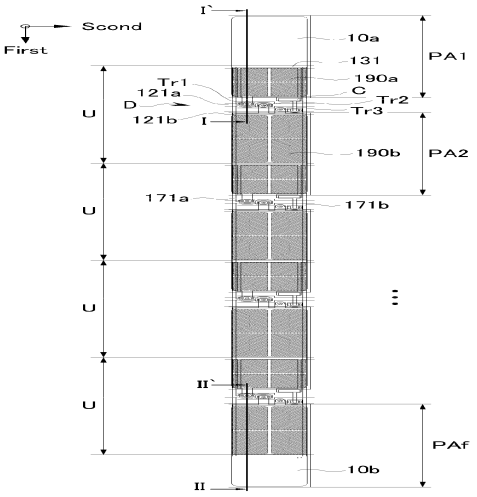
20. The liquid crystal display of claim **19**, wherein

the first light leakage preventing members are integrally formed, and

the second light leakage preventing members are integrally formed.

* * * * *

专利名称(译)	液晶显示装置		
公开(公告)号	US8648985	公开(公告)日	2014-02-11
申请号	US12/612620	申请日	2009-11-04
[标]申请(专利权)人(译)	金容焕 KIM JANG SOO 侑香SUK 比克升洙 OH HWA YEUL 崔宰豪 金正日在 JANG HEE SANG		
申请(专利权)人(译)	金容焕 金章洙 侑香-SUK BAEK SEUNG-SOO OH HWA-YEUL 崔在HO 金正日-IN JANG SANG-HEE		
当前申请(专利权)人(译)	三星DISPLAY CO.，LTD.		
[标]发明人	KIM YONG HWAN KIM JANG SOO YOO HONG SUK BAEK SEUNG SOO OH HWA YEUL CHOI JAE HO KIM JONG IN JANG SANG HEE		
发明人	KIM, YONG-HWAN KIM, JANG-SOO YOO, HONG-SUK BAEK, SEUNG-SOO OH, HWA-YEUL CHOI, JAE-HO KIM, JONG-IN JANG, SANG-HEE		
IPC分类号	G02F1/1343 G02F1/1368		
CPC分类号	G02F1/136209		
审查员(译)	NGUYEN，龚便		
优先权	1020090027562 2009-03-31 KR		
其他公开文献	US20100245698A1		
外部链接	Espacenet USPTO		

摘要(译)

液晶显示器本发明涉及液晶显示器。液晶显示器具有下面板，该下面板包括具有第一像素电极和第一光泄漏防止构件的第一像素区域，具有第二像素电极和第二光泄漏防止构件的最终像素区域，以及设置在其间的中间像素区域。在第一像素区域和最终像素区域中，每个中间像素区域包括第一中间像素电极和第二中间像素电极。因此，可以在设置在边缘上的第一像素区域和最终像素区域处有效地防止漏光。