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(54) BACKLIGHT ASSEMBLY AND LIQUID CRYSTAL DISPLAY DEVICE HAVING THE SAME

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(52) **U.S. Cl.** **315/312**; 315/324

(57) **ABSTRACT**

A connection of electrode lines of lamps for supplying a light source for a backlight assembly of a liquid crystal display (LCD) device is improved to minimize the size of the LCD device while reducing the manufacturing cost. The LCD device includes the backlight assembly having a light emitting unit formed by plural lamps for generating light and a light controlling unit for guiding the light from the light emitting unit, and a display unit placed to the upper plane of the light controlling unit for receiving the light from the light emitting unit via the light controlling unit to display an image. A driving unit is further provided for converting an external power source of a DC component into an AC component to supply first and second driving signals having phases respectively different from each other to the light emitting unit. Plural lamps respectively have two electrodes which include a first electrode directly connected to the electrode of at least one adjacent lamp and selectively have a second electrode supplied with the externally-provided driving signals. Thus, the wiring of the electrode lines of the plural lamps is simplified to decrease the size of the backlight assembly and LCD device while reducing the manufacturing cost.

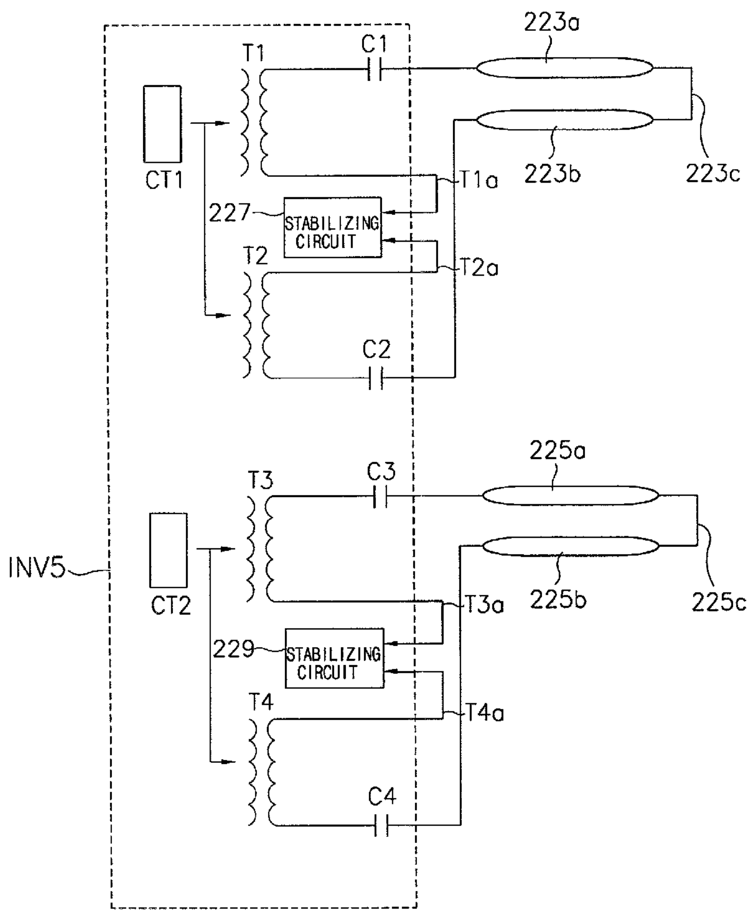


FIG. 1
(PRIOR ART)

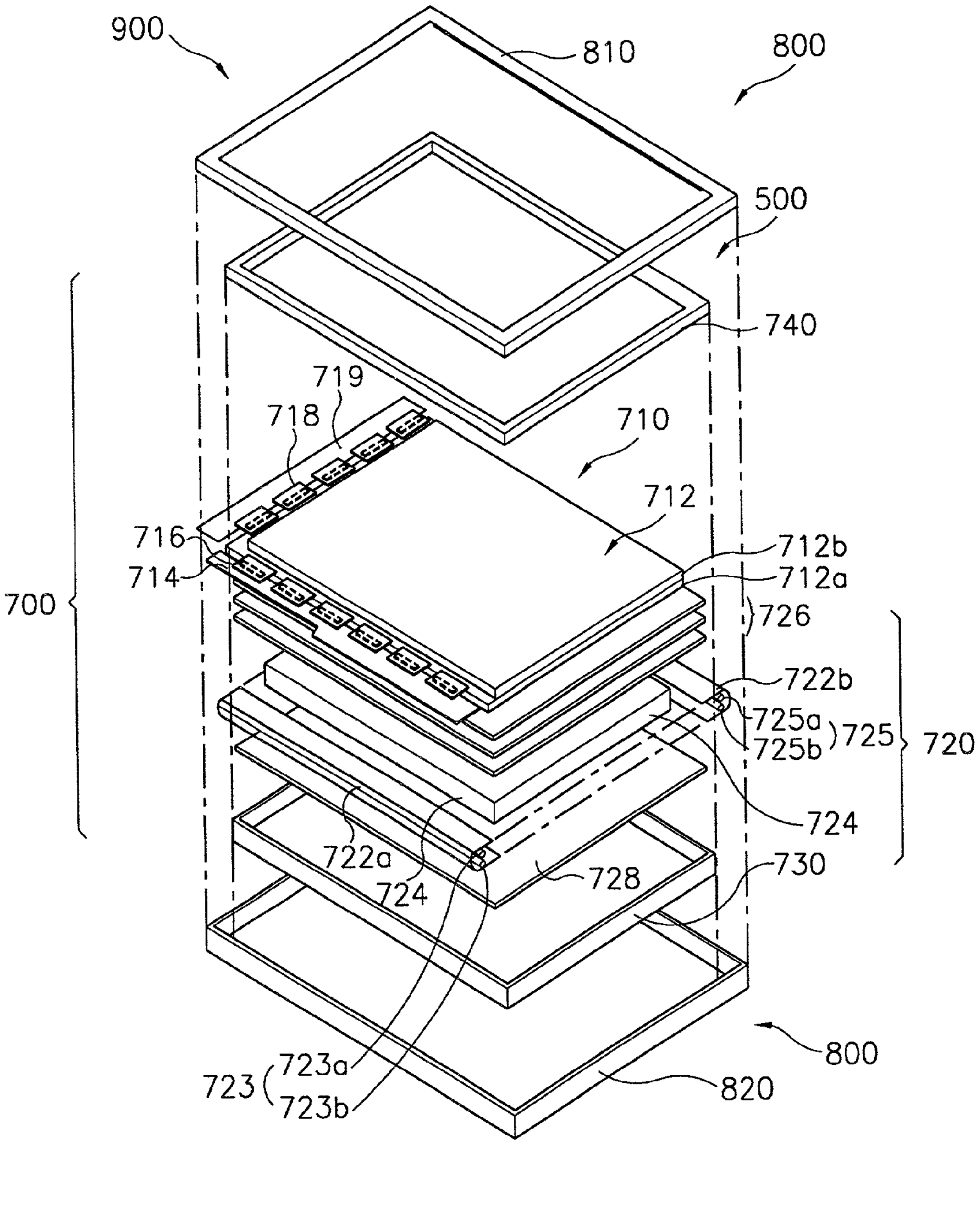


FIG. 2
(PRIOR ART)

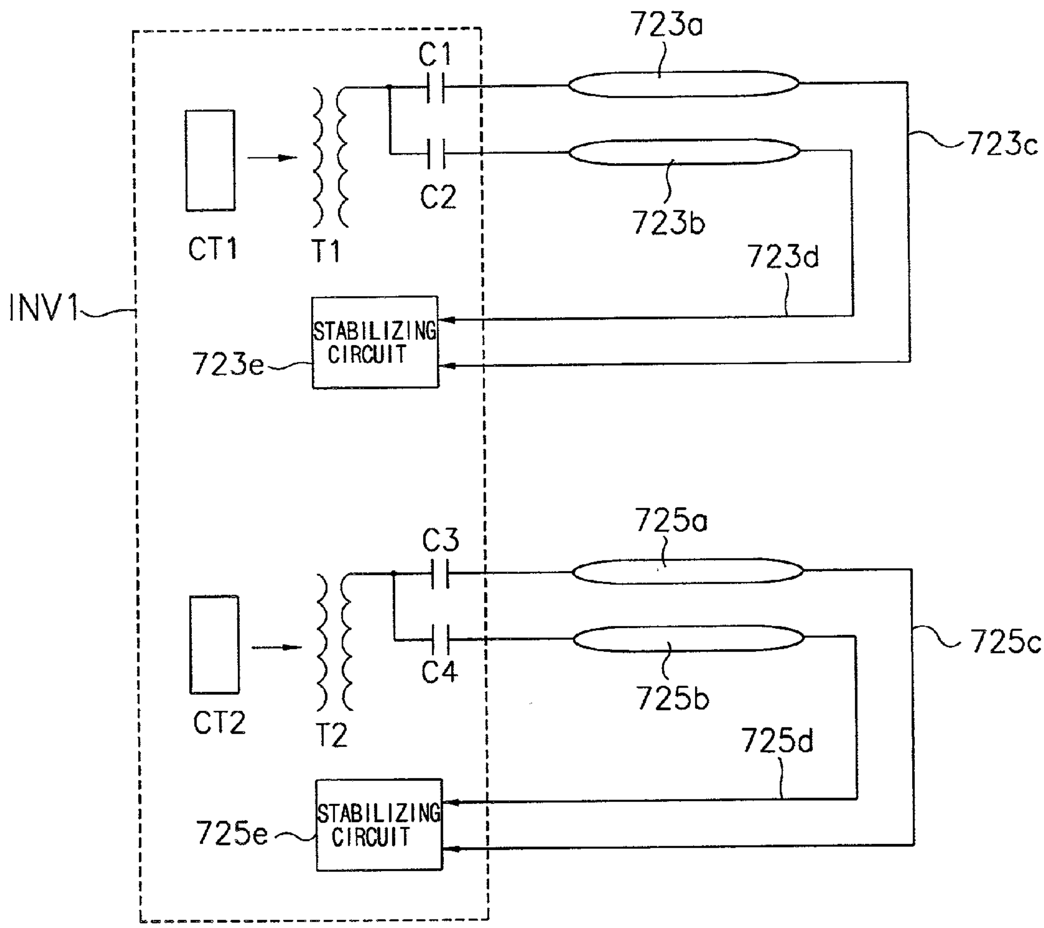


FIG. 3
(PRIOR ART)

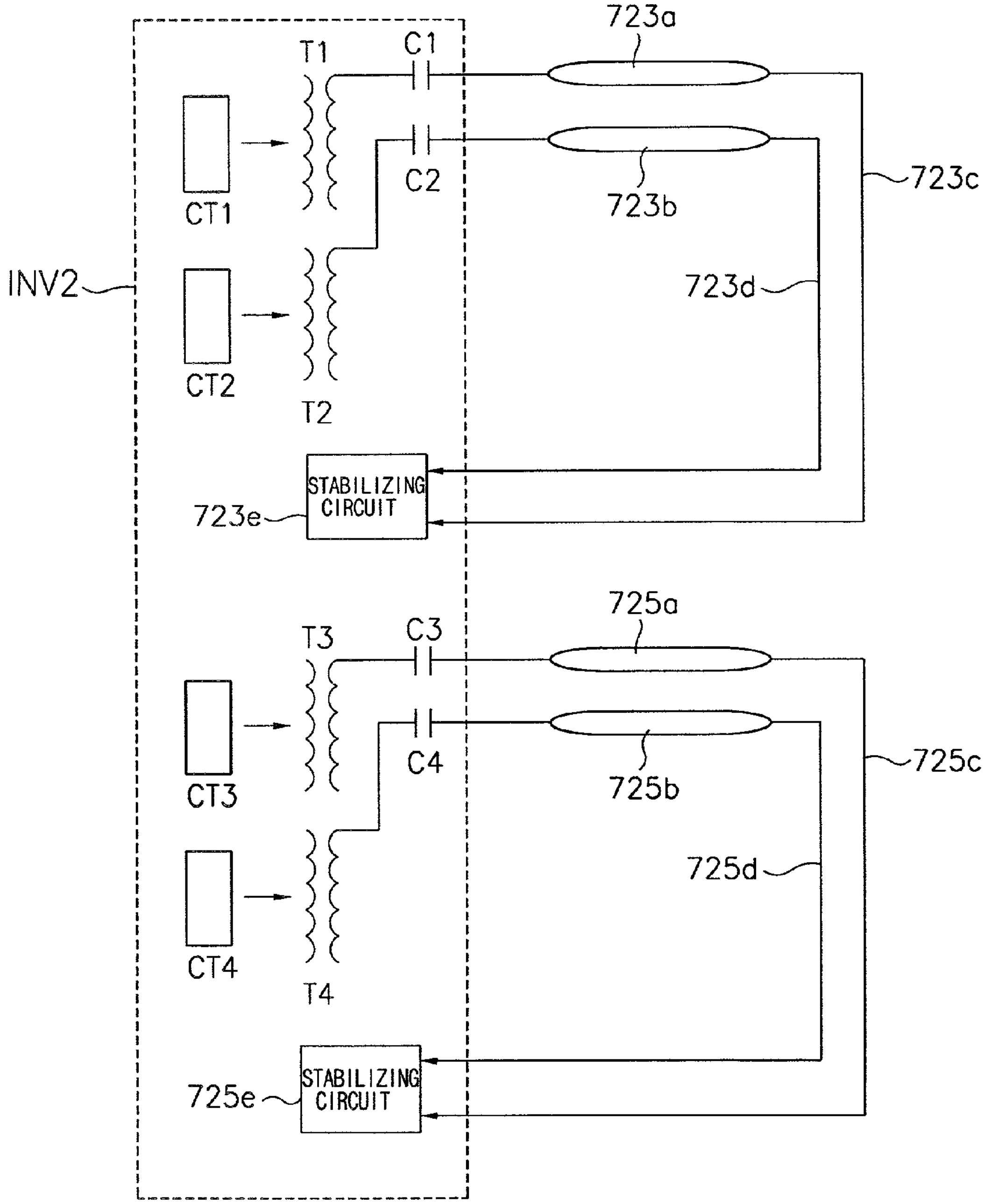
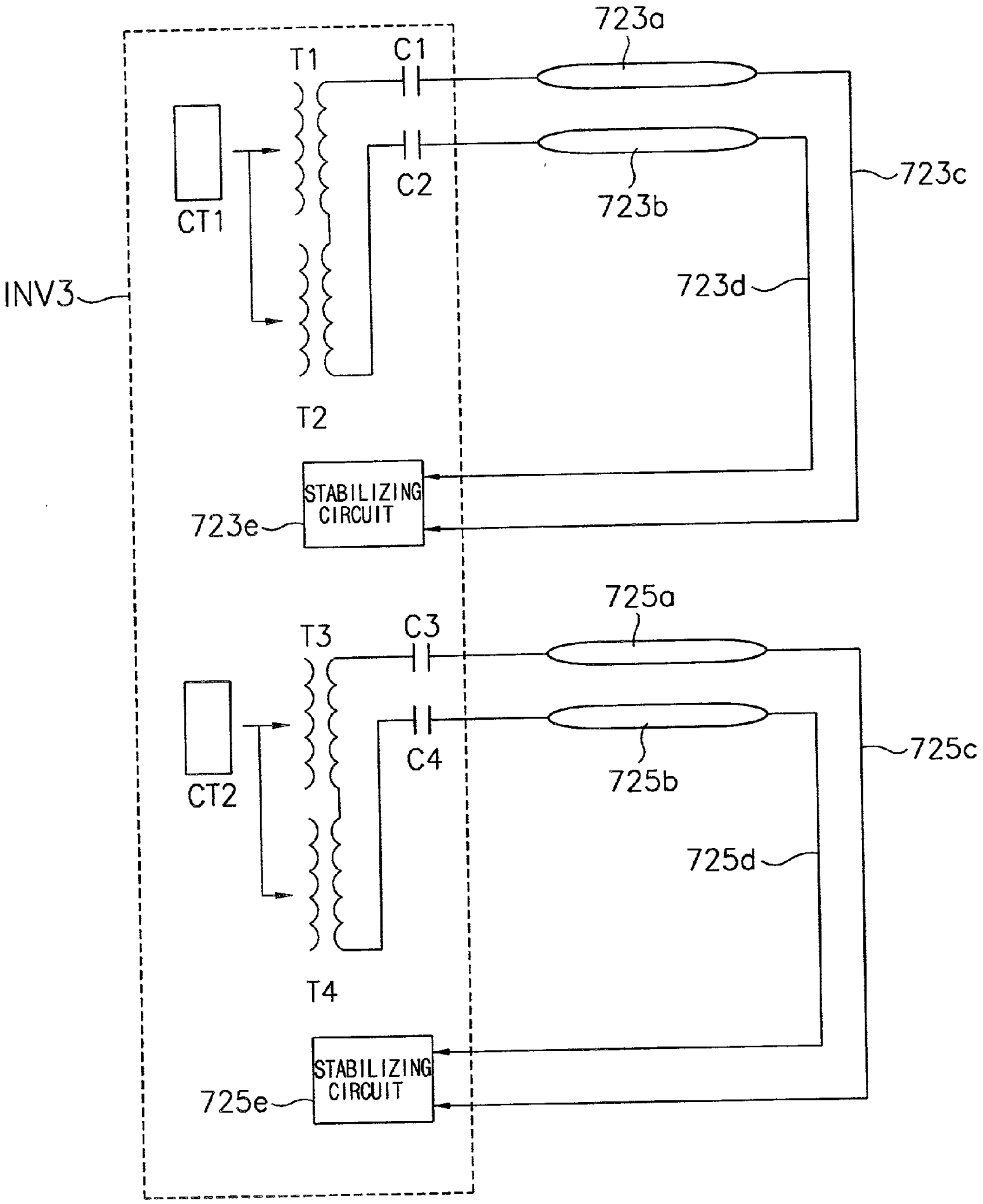


FIG. 4
(PRIOR ART)



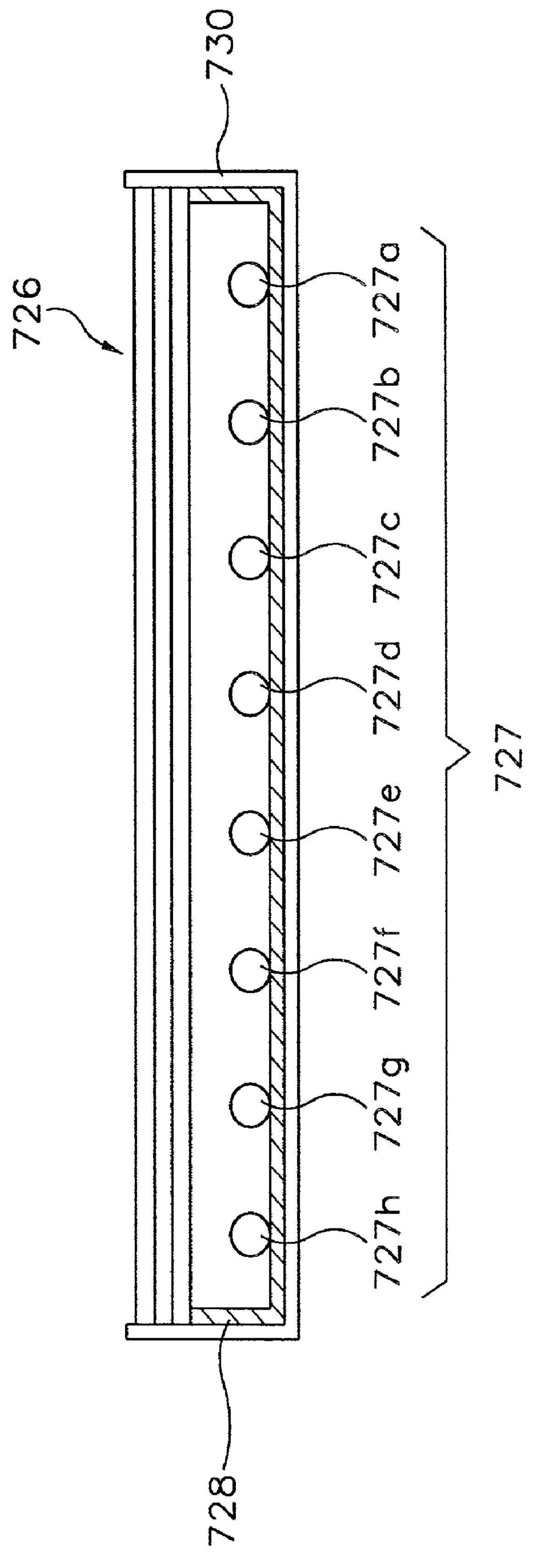


FIG. 5A
(PRIOR ART)

FIG. 5B
(PRIOR ART)

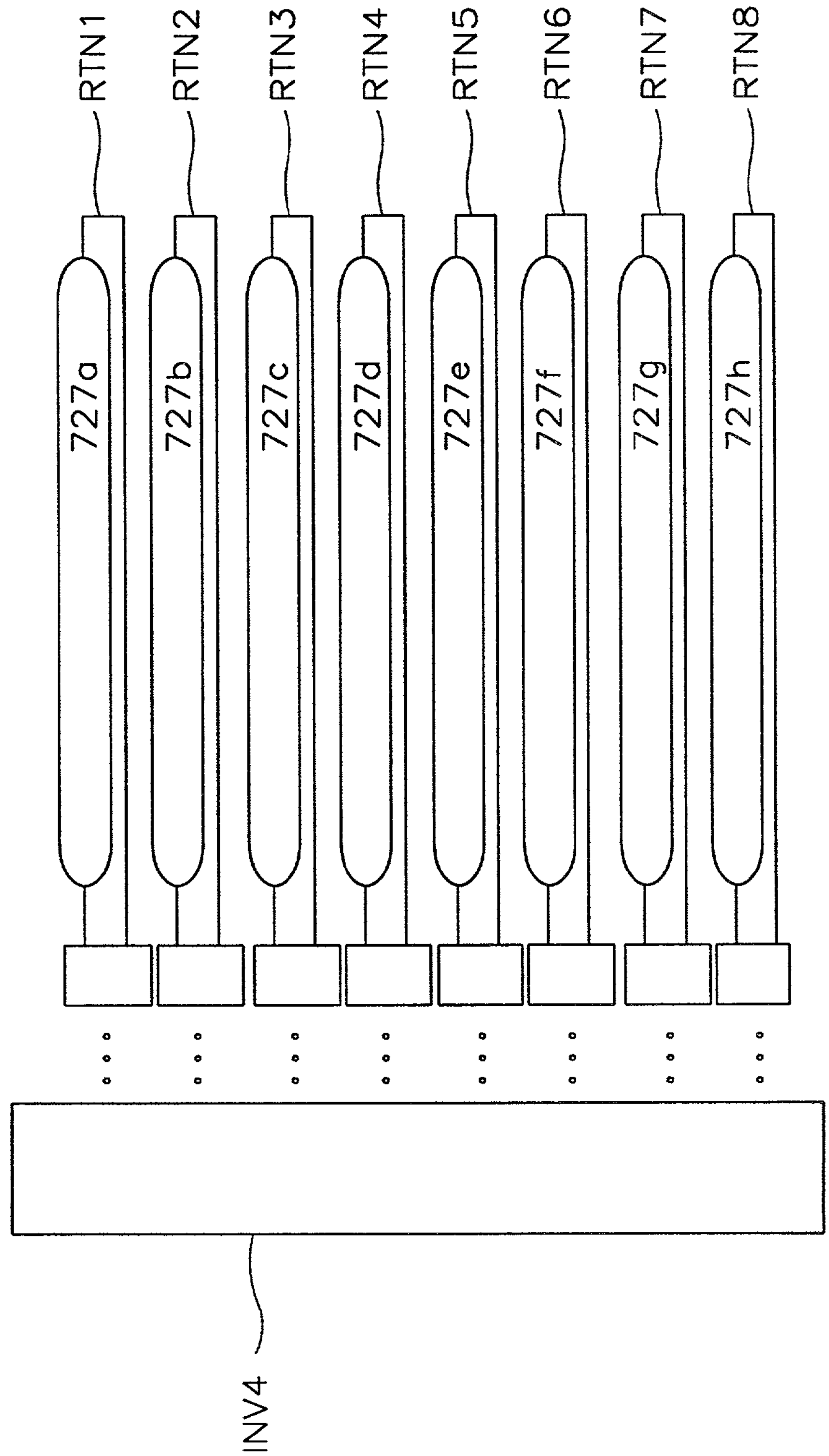


FIG. 6

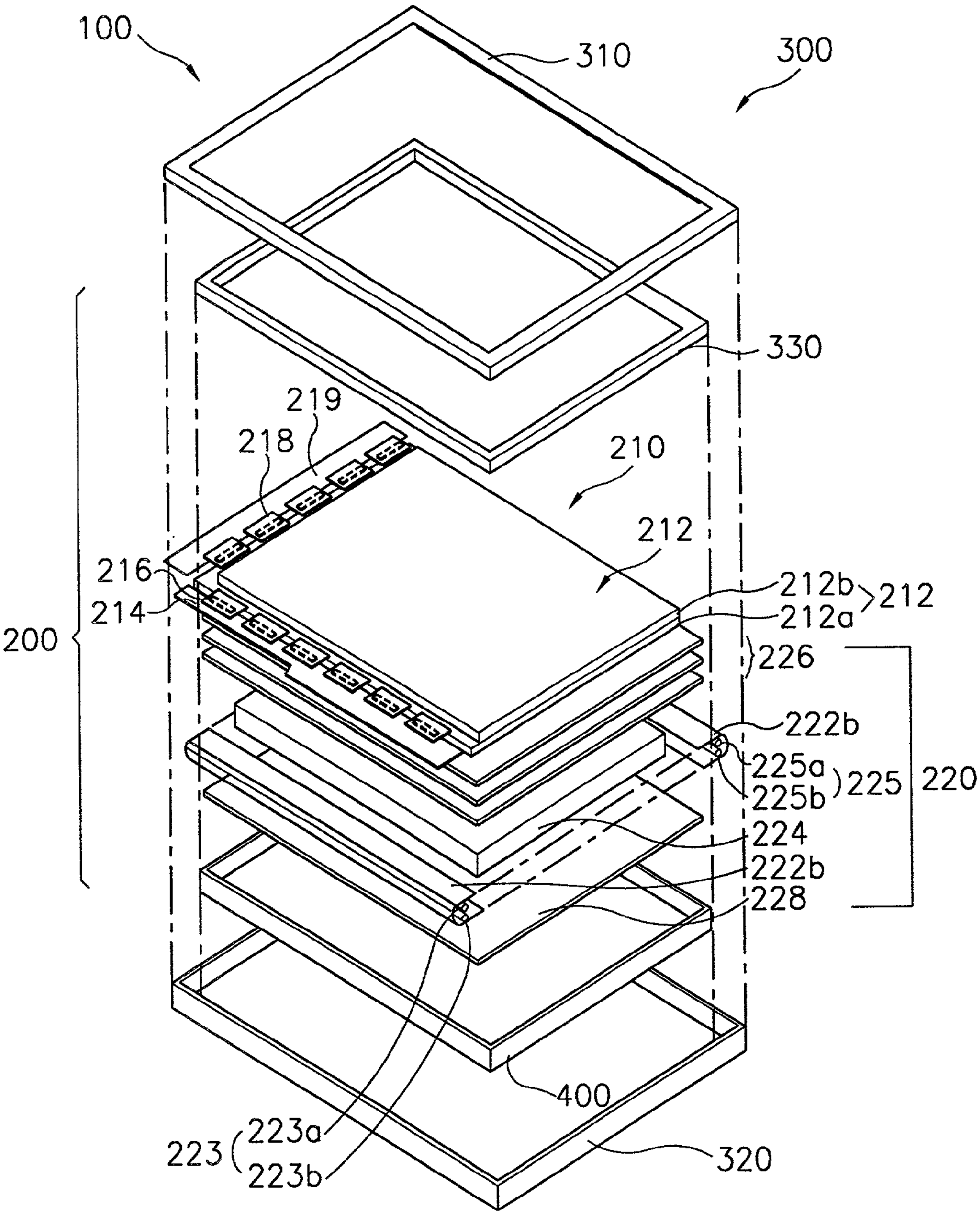

100
310
300
330
219
218
210
212
216
214
212b
212a
212
200
226
222b
225a
225b
225
220
224
222b
228
400
223
223a
223b
320

FIG. 7

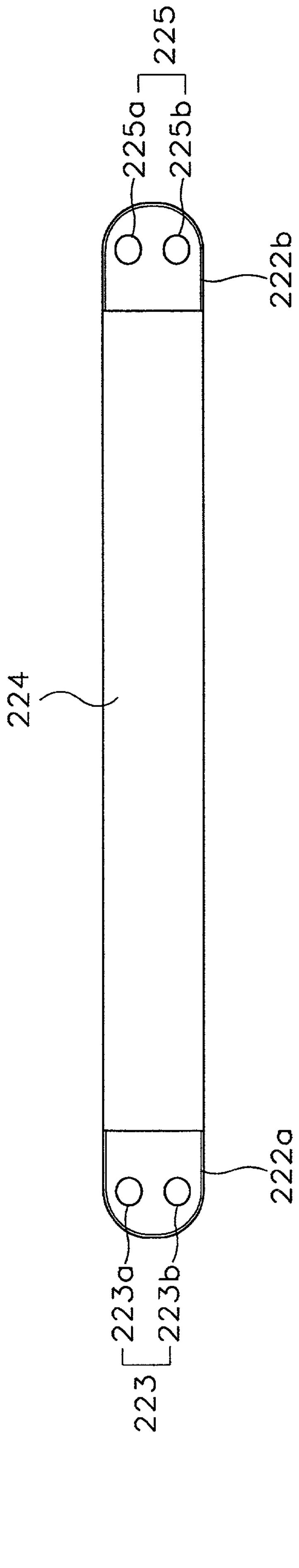


FIG. 8

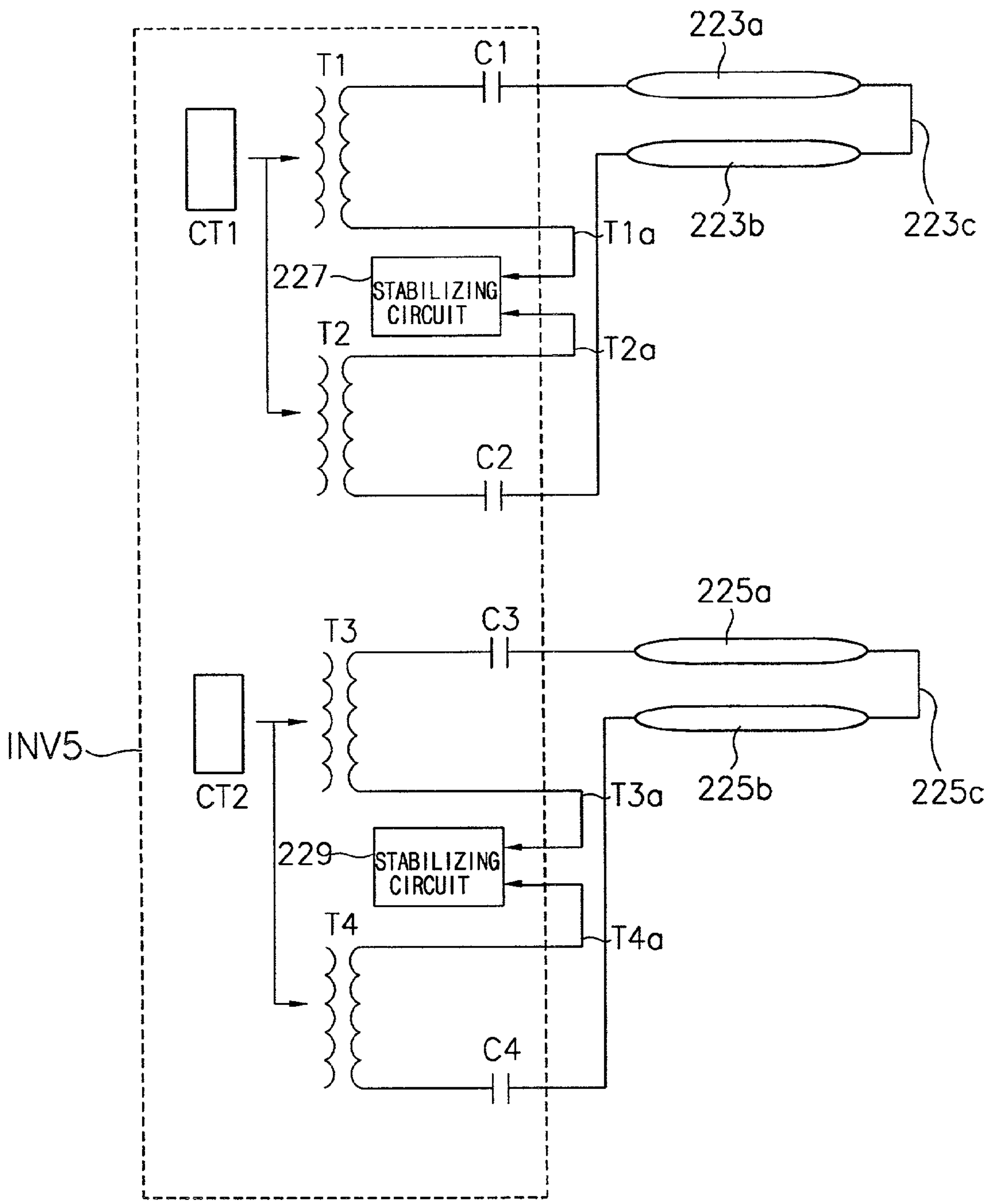

223a
C1
T1
CT1
223b
223c
T1a
227
STABILIZING CIRCUIT
T2
T2a
C2
225a
C3
T3
INV5
CT2
225b
225c
T3a
229
STABILIZING CIRCUIT
T4
T4a
C4

FIG. 9

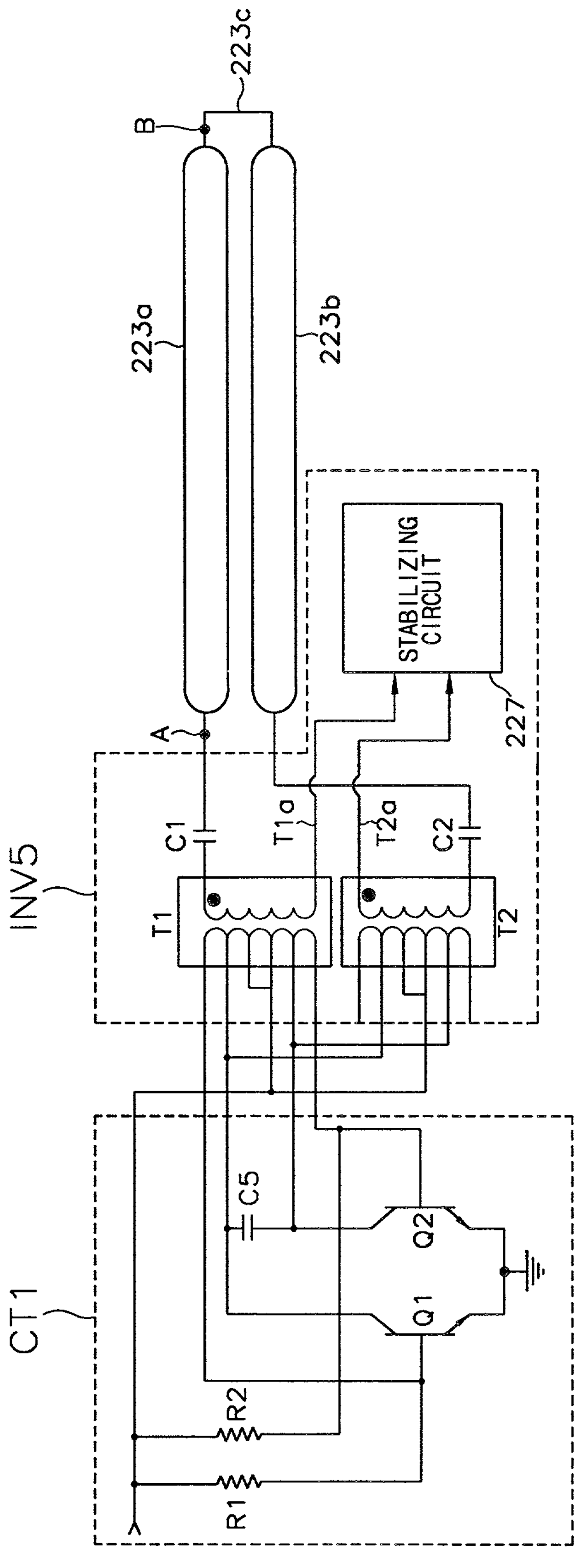

223c
B
223a
223b
STABILIZING CIRCUIT
227
A
INV5
C1
T1a
T2a
C2
T1
T2
CT1
C5
Q2
Q1
R2
R1

FIG. 10

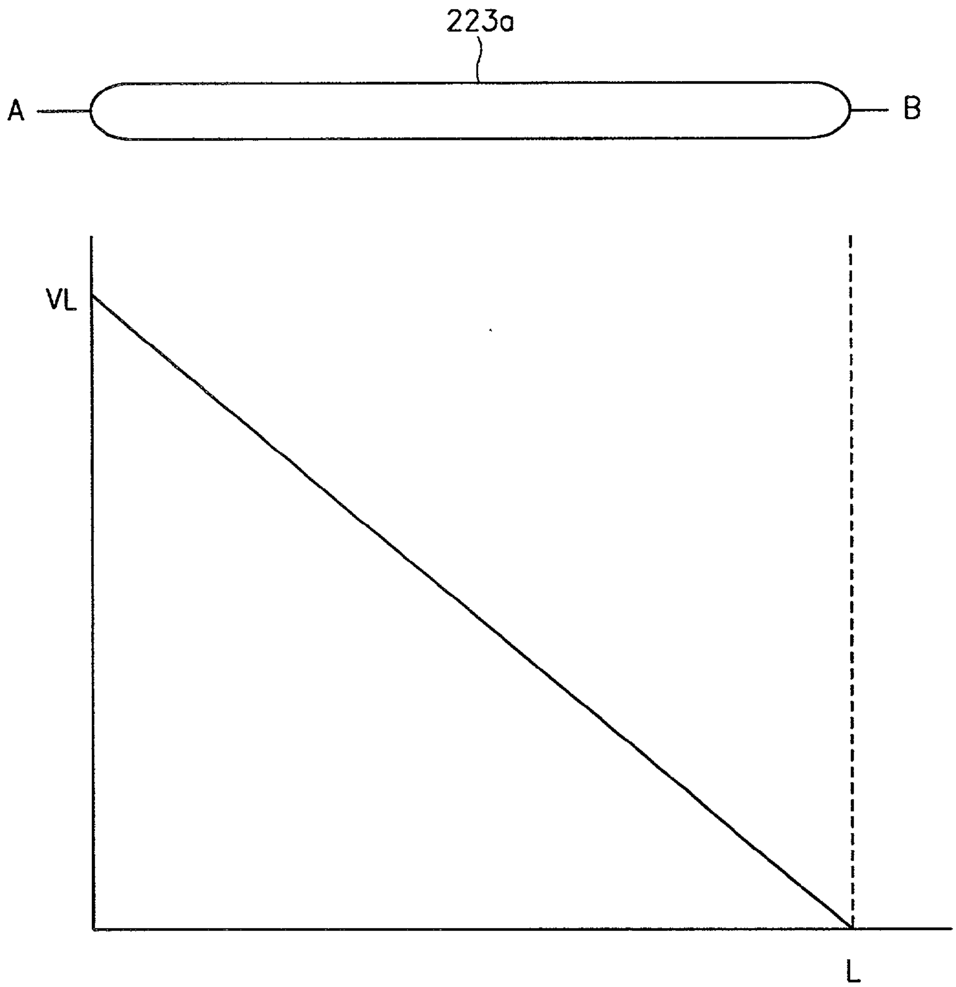


FIG. 11

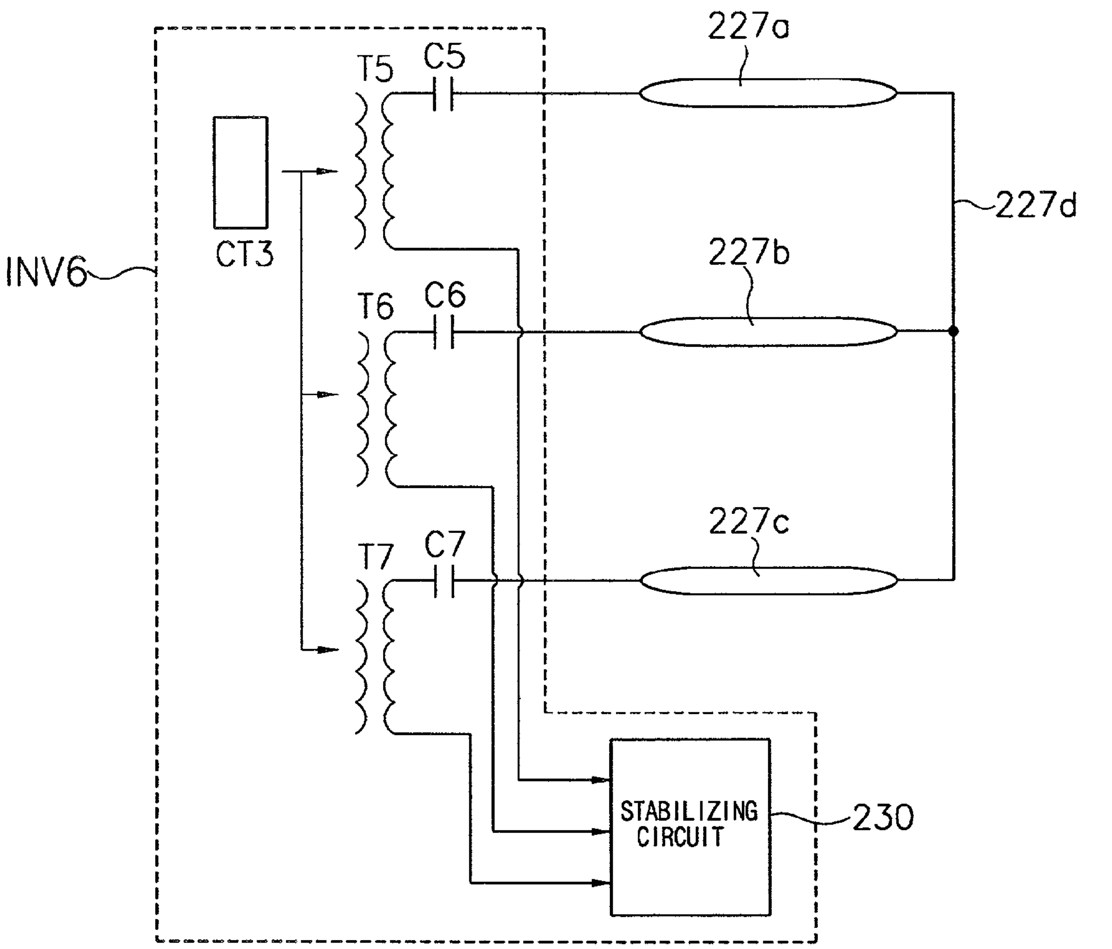

227a
T5
C5
CT3
227d
INV6
227b
T6
C6
227c
T7
C7
STABILIZING CIRCUIT
230

FIG. 12

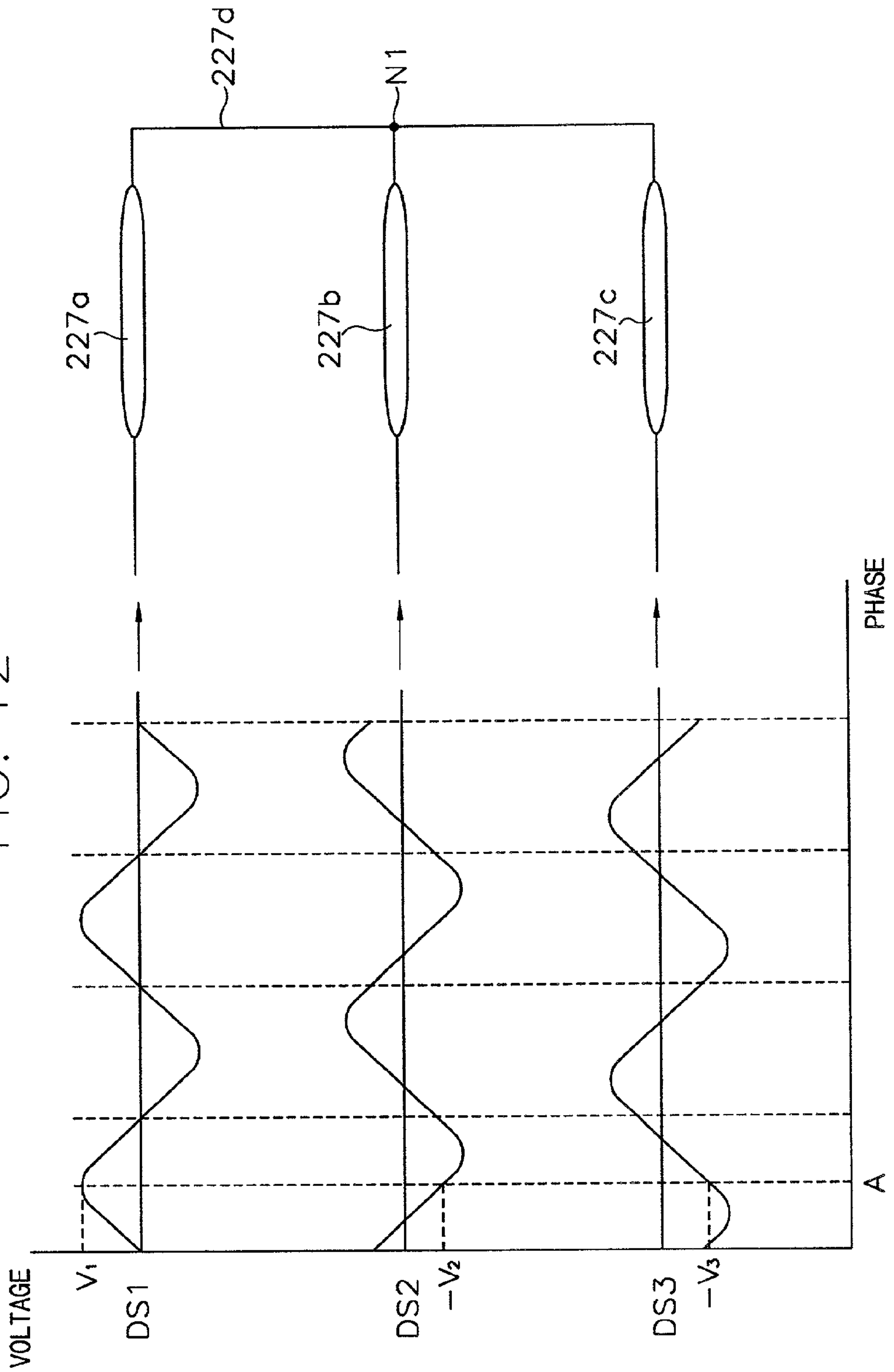


FIG. 13

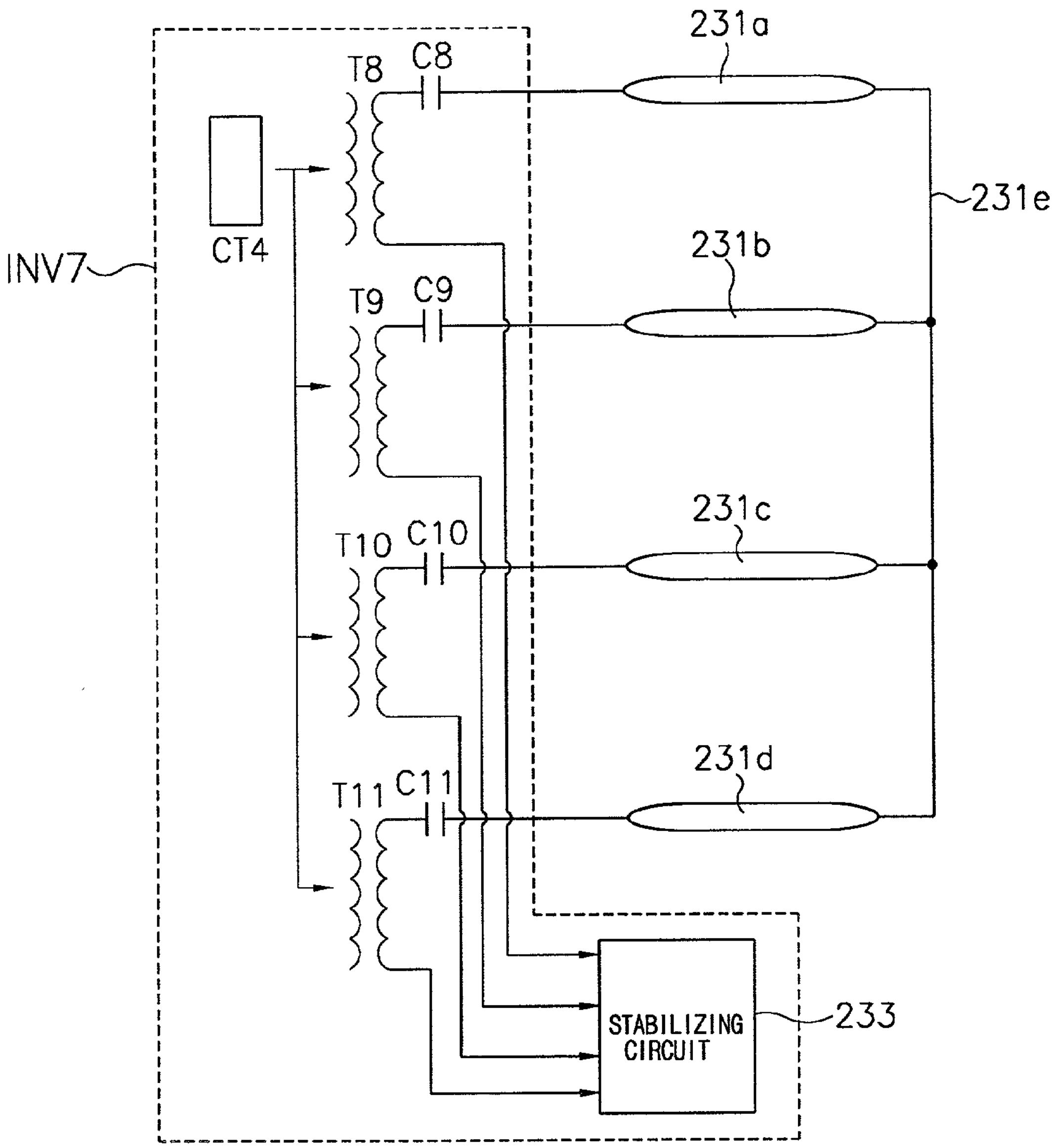
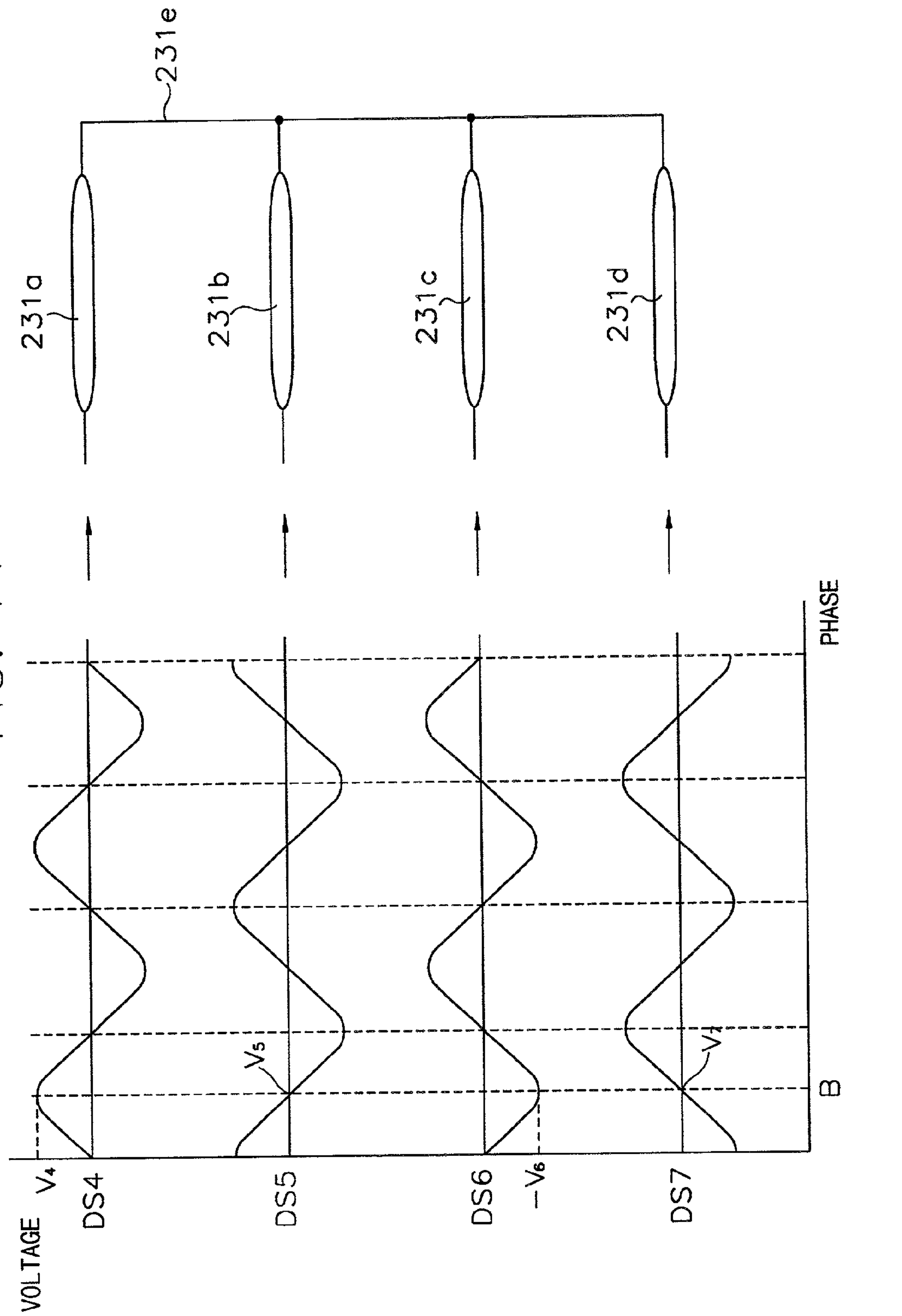

231a
T8
C8
CT4
231e
INV7
231b
T9
C9
231c
T10
C10
231d
T11
C11
STABILIZING
CIRCUIT
233

FIG. 14


231e
231a
231b
231c
231d
VOLTAGE
V4
DS4
DS5
DS6
−V6
DS7
V5
V7
B
PHASE

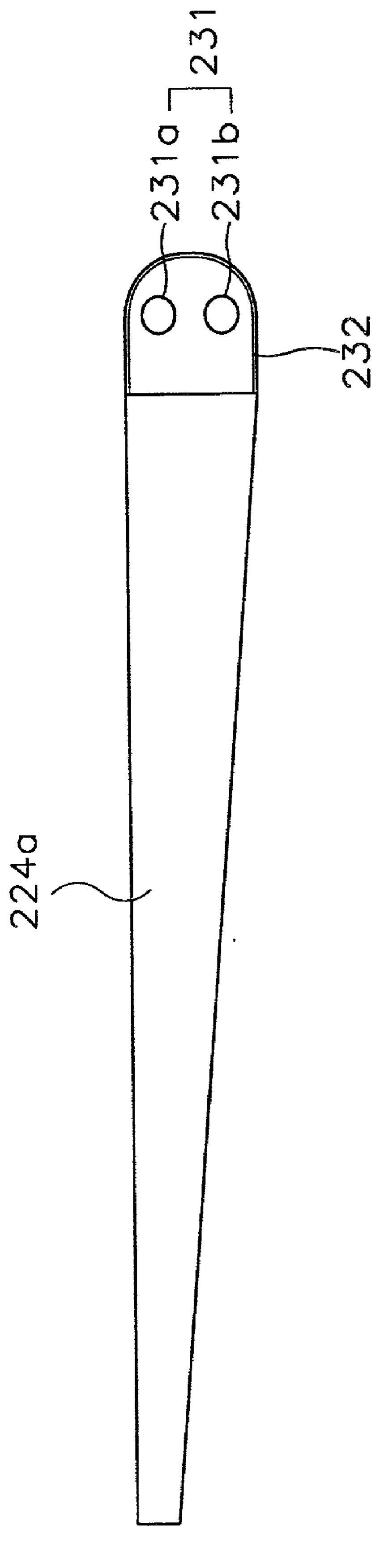


FIG. 15

FIG. 16

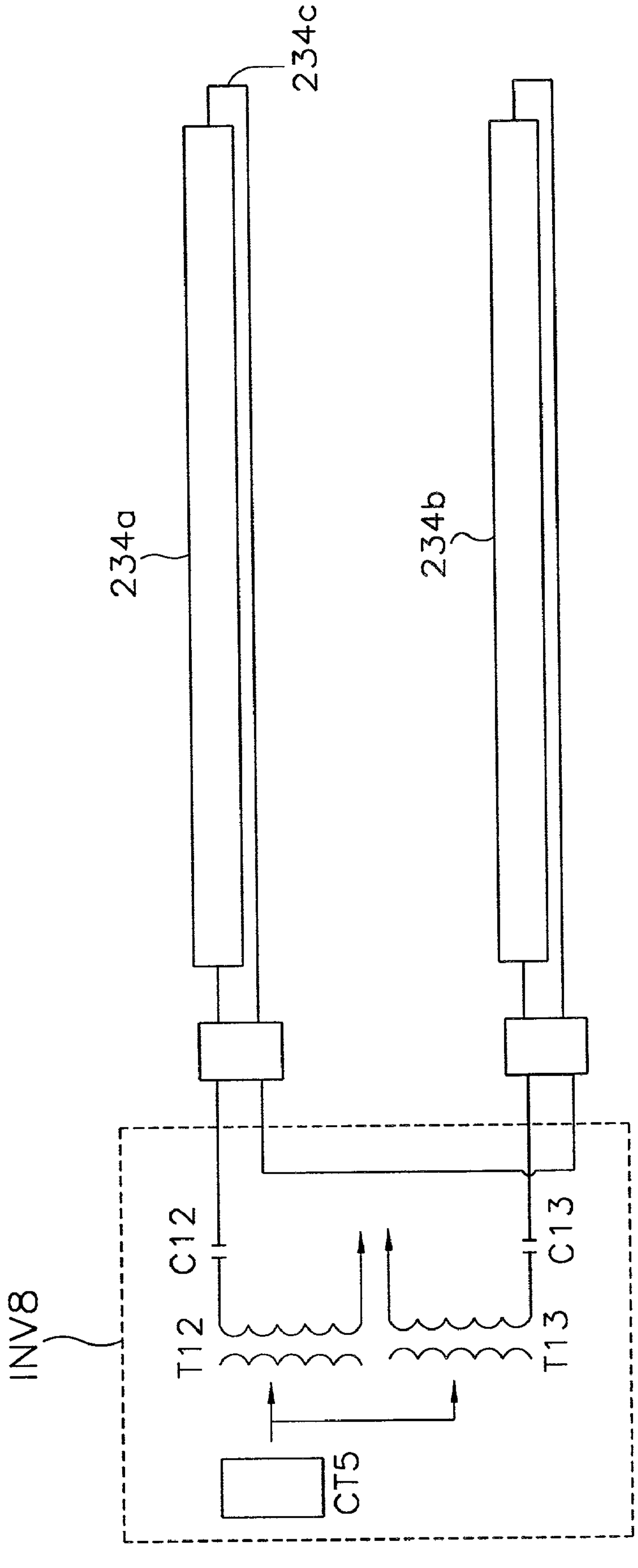


FIG. 17

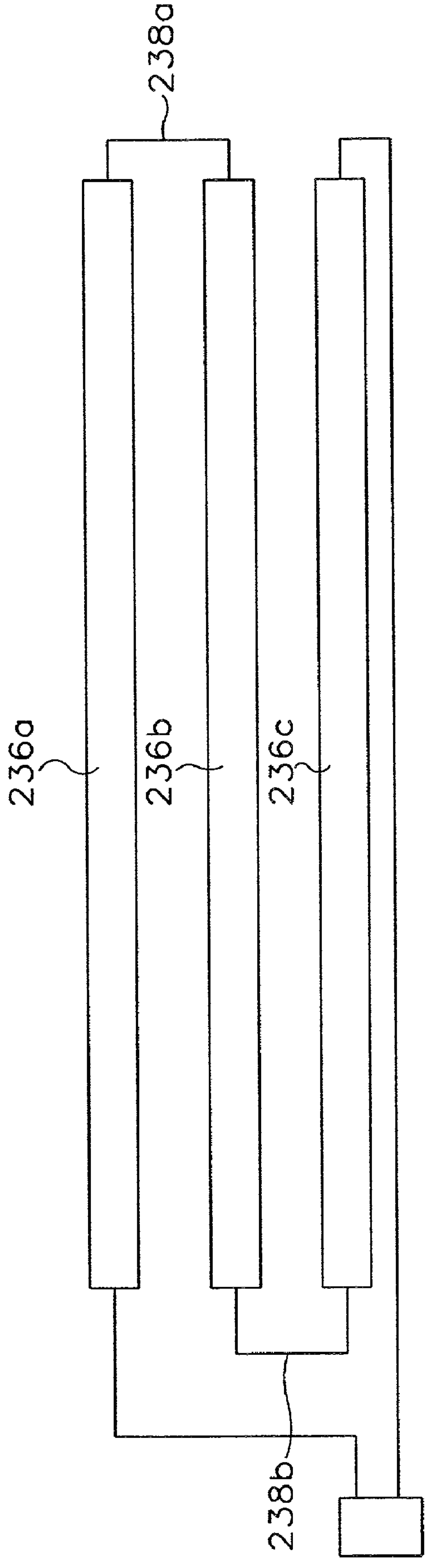


FIG. 18

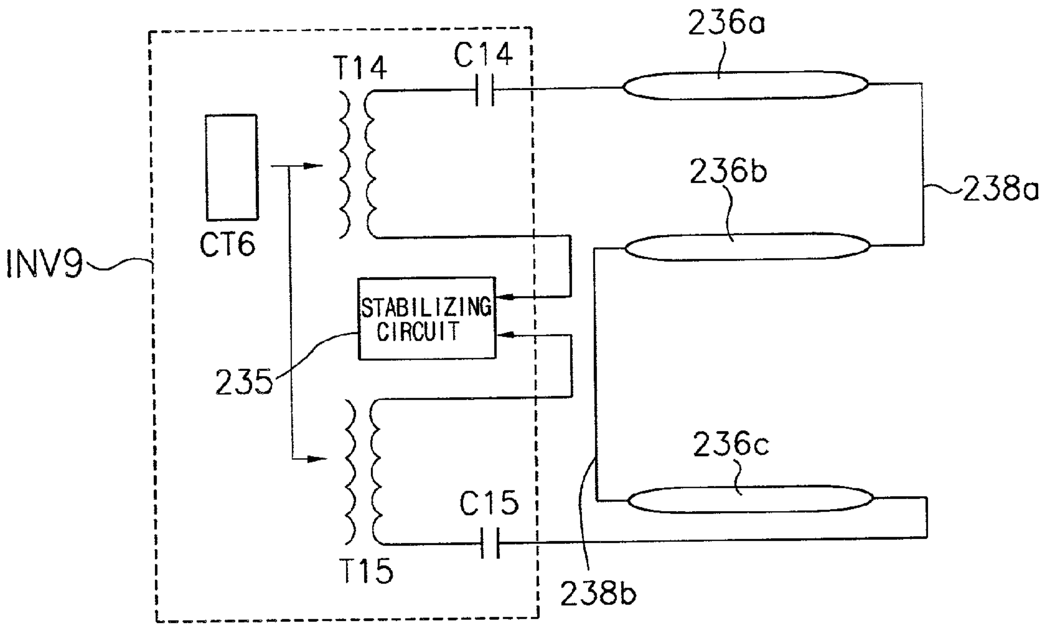

236a
C14
T14
CT6
236b
238a
INV9
STABILIZING CIRCUIT
235
236c
C15
T15
238b

FIG. 19

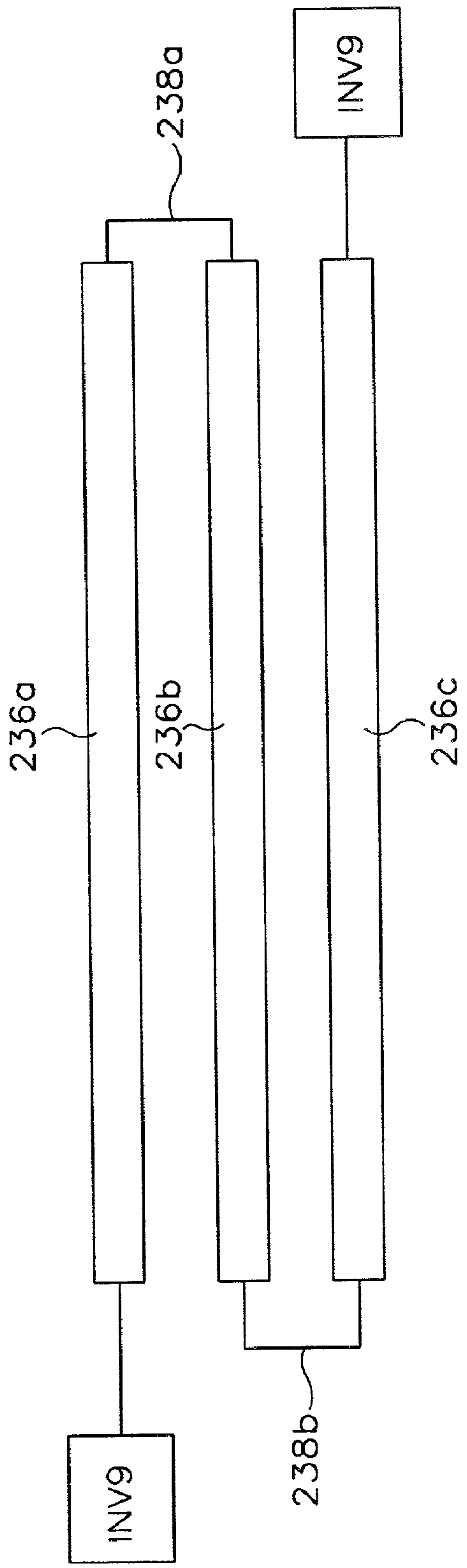


FIG. 20

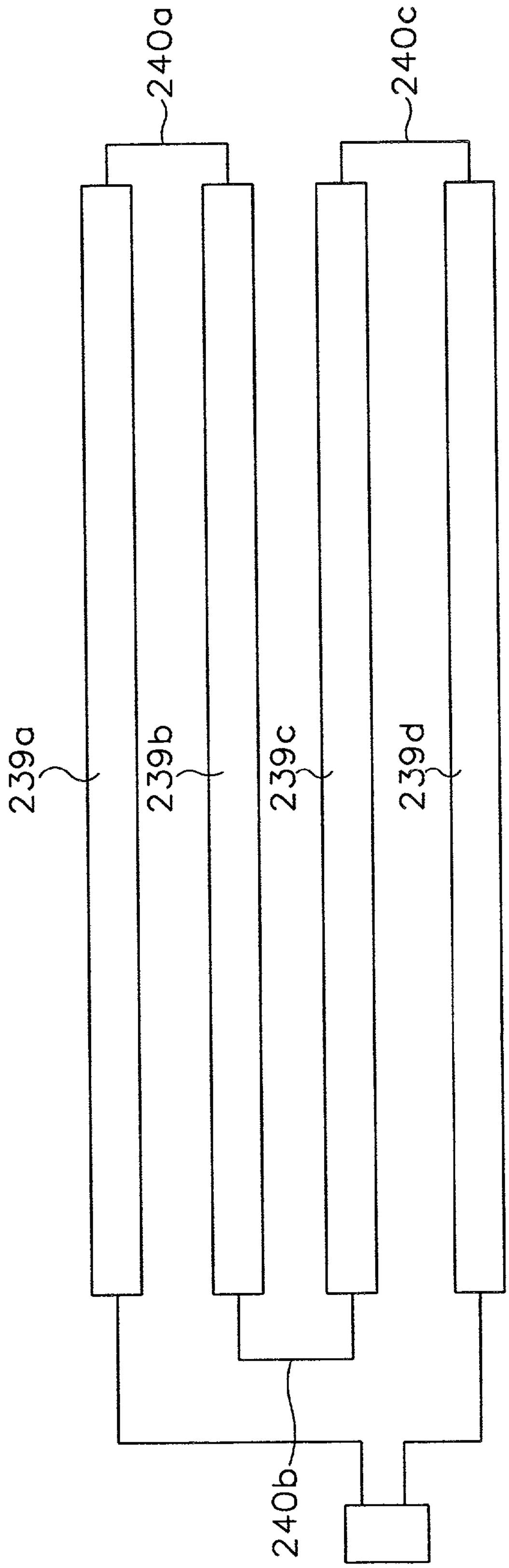


FIG. 21

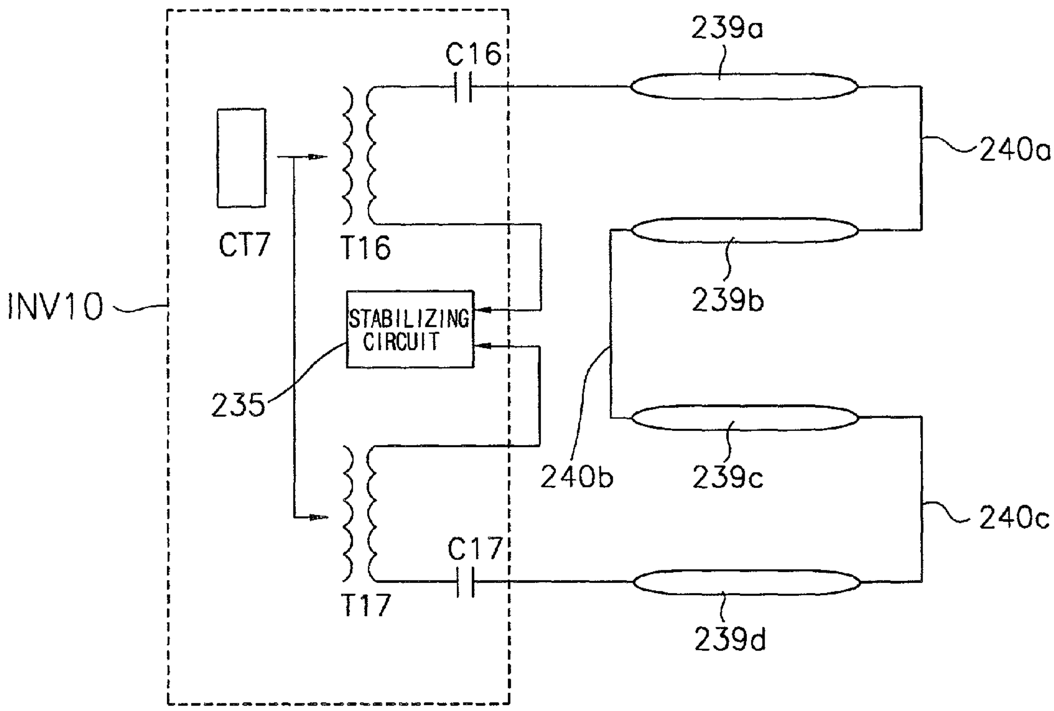

239a
C16
240a
CT7
T16
INV10
STABILIZING CIRCUIT
239b
235
240b
239c
240c
C17
T17
239d

FIG. 22

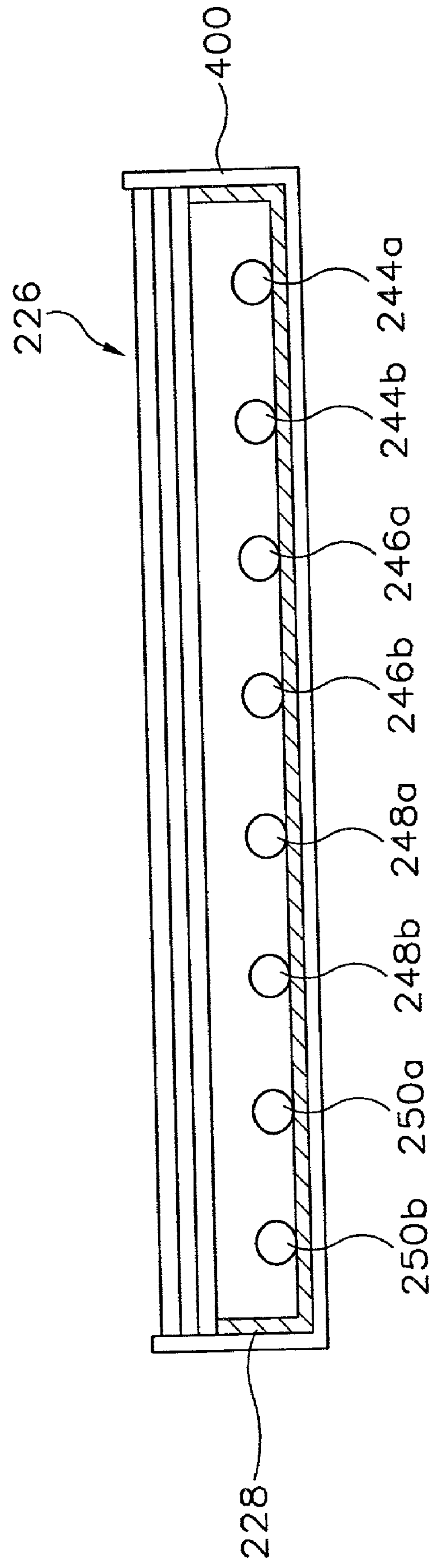


FIG. 23

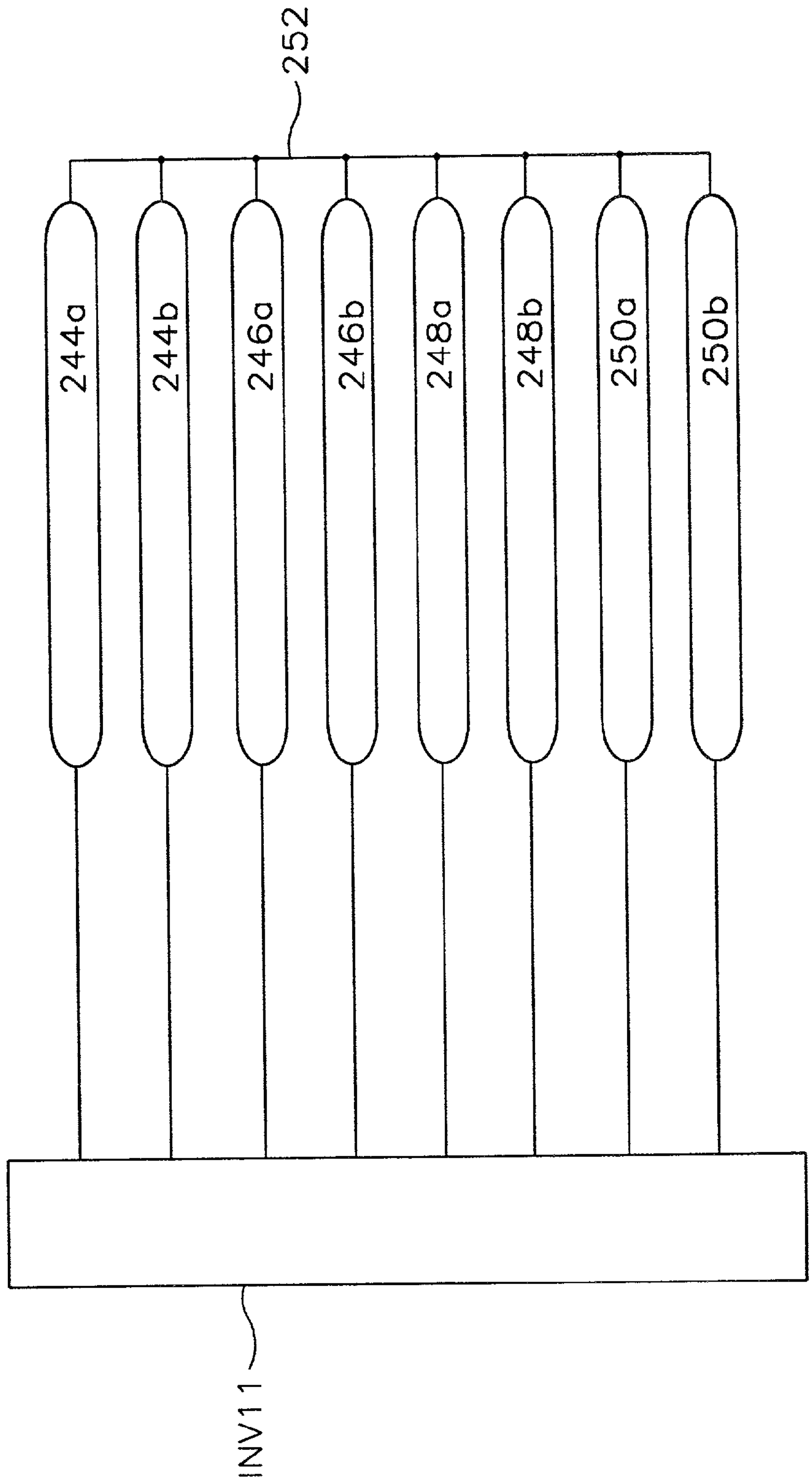


FIG. 24

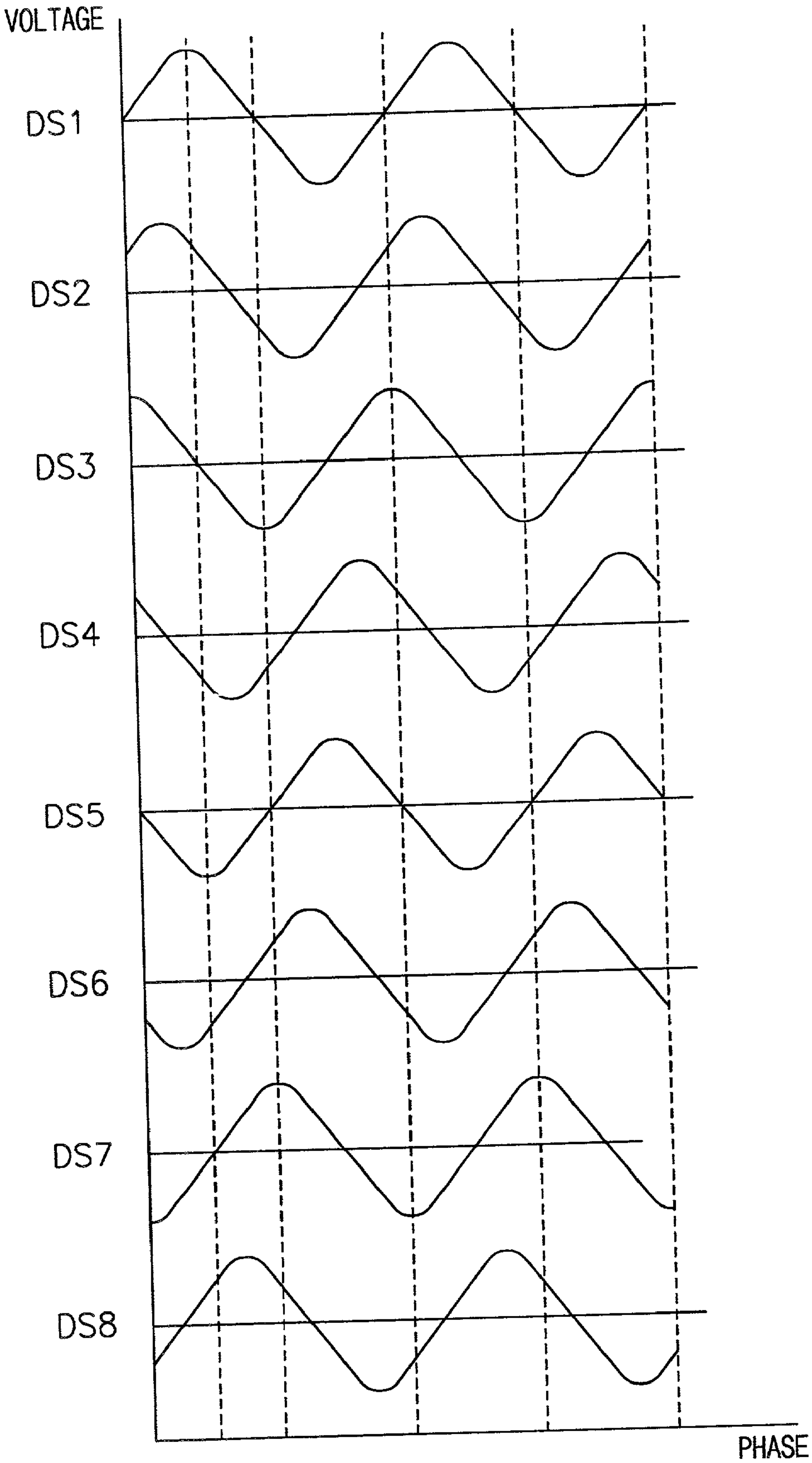
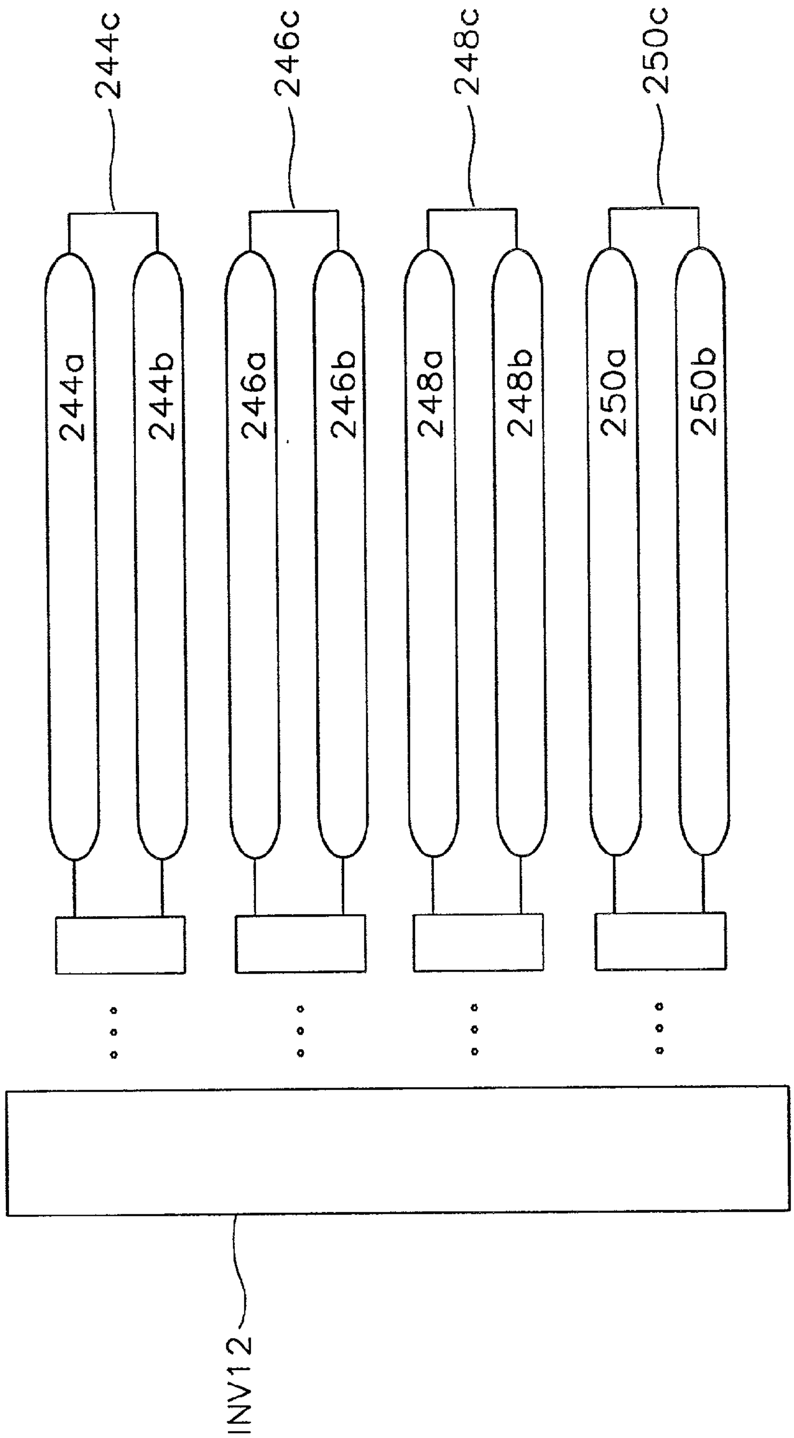


FIG. 25


244c
246c
248c
250c
244a
244b
246a
246b
248a
248b
250a
250b
INV12

BACKLIGHT ASSEMBLY AND LIQUID CRYSTAL DISPLAY DEVICE HAVING THE SAME

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to a liquid crystal display (hereinafter referred to as "LCD") device, and more particularly to a backlight assembly and an LCD device having the same for improving a wiring connection of electrode lines of lamps that provide the light source for the backlight of the LCD device to minimize the size of the LCD device and to reduce the manufacturing cost.

[0003] 2. Description of the Related Art

[0004] In recent years, information processing appliances have been rapidly developed to have a variety of forms and finctions and faster information processing speed. The information processed in such an information processing apparatus has an electrical signal format. A display device serving as an interface is required for a user to confirm the information processed in the information processing apparatus by the naked eyes.

[0005] Currently, an LCD device having functions of manifesting full-color and attaining high resolution while attaining lightweight and small size compared with the conventional CRT-type display device. As the result, the LCD device has been widely available as a computer monitor that is a representative information processing apparatus, a household wall-hanging television and so on.

[0006] The LCD device applies electric fields to a liquid crystal layer to convert its molecular arrangement. Then, the LCD device converts the changes of the optical properties such as birefringence, optical linearity, dichroism and optical scattering characteristic of liquid crystal cells according to the molecular arrangement, and uses the modulation of the light by the liquid crystal cells.

[0007] The LCD device is largely sorted into a TN (Twisted Nematic) type and a STN (Super-Twisted Nematic) type. The liquid crystal display device is, according to the driving method, sorted into an active matrix display type, which uses a switching device and a TN liquid crystal, and a passive matrix type, which uses an STN liquid crystal.

[0008] A distinguishable difference of two types is that the active matrix display type is applied to a TFT-LCD that drives the LCD by using a TFT and the passive matrix display type does not use a complicated circuit associated with a transistor.

[0009] Also, according to a method of using a light source, it is classified into a transmissive LCD device using a backlight and a reflective LCD using an external light source.

[0010] Despite the increased weight and volume, the transmissive LCD device using the backlight as the light source is widely used, because it can independently display images without using an external light source.

[0011] **FIG. 1** is an exploded perspective view schematically showing a conventional LCD device. **FIGS. 2, 3** and **4** are circuit diagrams more specifically showing lamps of the backlight assembly shown in **FIG. 1** and configurations of an inverter module for driving the lamps.

[0012] Referring to **FIG. 1**, an LCD device **900** is formed by an LCD module **700** for displaying an image by being supplied with an image signal, and a face panel case **810** and a rear panel case **820** for retaining LCD module **700**. Here, LCD module **700** has a display unit **710** including an LCD panel **712** for displaying the image.

[0013] Display unit **710** includes LCD panel **712**, a data-side printed circuit board (PCB) **714**, a gate-side PCB **719**, a data-side tape carrier package **716** and a gate-side tape carrier package **718**.

[0014] LCD panel **712** has a thin film transistor (TFT) substrate **712***a*, a color filter substrate **712***b* and a liquid crystal (not shown).

[0015] TFT substrate **712***a* is a transparent glass substrate formed with thin film transistors on a matrix. Source terminals of the TFTs are connected with data lines, and gate terminals are connected with gate lines. Also, drain terminals are formed with pixel electrodes consisting of a transparent conductive material such as Indium-Tin-Oxide (ITO).

[0016] Once electrical signals are supplied to the data lines and gate lines, the source terminals and gate terminals of respective TFTs receive the electrical signals. In accordance with the input of the electrical signals, the TFTs are turned-on or turned-off to supply the electrical signals required for forming the pixels to the drain terminals.

[0017] A color filter substrate **712***b* is provided facing TFT substrate **712***a*. Color filter substrate **712***b* is formed via a thin film processing of RGB pixels that display predetermined colors when light goes through. Color filter substrate **712***b* is coated with a common electrode formed of ITO over the front surface thereof.

[0018] When the power is supplied to the gate terminals and source terminals of the transistors on the aforementioned TFT substrate **712***a*, an electric field is formed between the pixel electrode and common electrode of color filter substrate **712***b*. This electric field changes the alignment angle of the liquid crystal injected between TFT substrate **712***a* and color filter substrate **714***b*. The light transmissivity changes in accordance with the alignment angle. This allows to have a desired pixel status.

[0019] In order to control the alignment angle of the liquid crystal of LCD panel **712** and the period of aligning the liquid crystal, a driving signal and a timing signal are supplied to the gate line and data line of the TFT. As shown in the drawing, tape carrier package **716** that is one of a soft circuit board that determines the period of applying the data driving signal is attached to the source side of LCD panel **712**. Also, gate-side tape carrier package **718** that is one of the soft circuit board that determines the period of applying the gate driving signal is attached to the gate side thereof.

[0020] Data-side PCB **714** and a gate-side PCB **719** for respectively supplying the driving signals to the gate line and data line after being externally received with an image signal out of LCD panel **712** are respectively connected to data tape carrier package **716** on the data line side of LCD panel **712** and gate tape carrier package **718** on the gate line side thereof. Data-side PCD **714** is formed of a source portion that receives the image signal generated from an external information processing apparatus (not shown) such as a computer to supply a data driving signal to LCD panel

712. Also, gate-side PCB **719** is formed with a gate portion for supplying a gate driving signal to the gate line of LCD panel **712**. In other words, data-side PCB **714** and gate-side PCB **719** generate the gate driving signal and data signal for driving the LCD device and a plurality of timing signals for supplying the driving signals at the appropriate period, so that the gate driving signal is supplied to the gate line of LCD panel **712** via gate-side tape carrier package **718** and the data signal is supplied to the data line of LCD panel **712** via data tape carrier package **716**.

[**0021**] A backlight assembly **720** for supplying the consistent light to display unit **710** is provided under the display unit **710**. Backlight assembly **720** includes 1st and 2nd lamp units **723** and **725** equipped at both ends of LCD module **700** for generating the light. 1 st and 2 nd lamp units **723** and **725** are respectively formed by 1st and 2nd lamps **723***a* and **723***b* and 3 rd and 4 th lamps **725***a* and **725***b* , which are respectively shielded by first and second lamp covers **722***a* and **722***b*.

[**0022**] Light guide plate **724** is large enough to correspond to LCD panel **712** of display unit **710** to underlie LCD panel **712** for changing the path of light while guiding the light generated from 1st and 2nd lamp units **723** and **725** toward display unit **710**. In **FIG. 1**, light guide plate **724** is of an edge-type having a uniform thickness, which has lamp units at both ends of light guide plate **724** for enhancing the light efficiency. The number of first and second lamp units **723** and **725** may be properly set to be arranged by considering the overall balance of LCD device **900**.

[**0023**] A plurality of optical sheets **726** are provided to the upper side of light guide plate **724** to make the luminance of light outgoing from light guide plate **724** toward LCD panel **712** consistent. A reflecting plate **728** is installed at the lower side of light guide plate **724** to reflect the light leaking from light guide plate **724** toward light guide plate **724** so as to enhance the light efficiency.

[**0024**] Display unit **710** and backlight assembly **720** are fixedly supported by a mold frame **730** which is a receiving container. Mold frame **730** is shaped as a rectangular box with the upper plane opened. Additionally, a chassis **740** is provided for externally bending data-side PCB **714** and gate-side PCB **719** of display unit **710** to fix them to the lower plane of mold frame **730** while preventing the deviation of display unit **710**. Chassis **740** is opened for exposing LCD panel **710**, of which sidewall portion is inwardly bent in the perpendicular direction to cover the upper periphery of LCD panel **710**.

[**0025**] Meantime, even not shown in **FIG. 1**, LCD device **900** is equipped with a 1st inverter INV1 as shown in **FIG. 2** for driving 1st , 2nd, 3rd and 4th lamps **723***a*, **723***b*, **723***c* and **723***d*.

[**0026**] Referring to **FIG. 2,** 1st inverter INV1 has 1st and 2nd transformers T1 and T2, and 1st and 2nd stabilizing circuits **723***e* and **725***e*. An output terminal at the high voltage level of a secondary side of 1st transformer T1 is connected to respective input sides of 1st and 2nd lamps **723***a* and **723***b*, i.e., the first electrode. 1st and 2nd ballast capacitors C1 and C2 are interposed between the output terminal at the high voltage level of the secondary side of 1st transformer T1 and the first electrodes of 1st and 2nd lamps **723***a* and **723***b*. In association with output sides of 1st and 2nd lamps **723***a* and **723***b*, i.e., second electrodes, 1st and 2nd return wires (hereinafter referred to as "RTN") **723***c* and **723***d* respectively extend long to 1st stabilizing circuit **723***e* within 1st inverter INV1. 1st and 2nd RTNs **723***c* and **723***d* are connected to 1st stabilizing circuit **723***e* to supply a feedback current. Referring to **FIG. 2**, first electrodes of 3rd and 4th lamps **725***a* and **725***b* are connected to output terminals at the high voltage level of a secondary side of 2nd transformer T2 by interposing 3rd and 4th ballast capacitors C3 and C4. Second electrodes of 3rd and 4th lamps **725***a* and **725***b* are connected to 2nd stabilizing circuit **725***e* within 1st inverter INV1 via 3rd and 4th RTNs **725** c and **725** d which extend toward 1st inverter INV1, thereby supplying the feedback current.

[**0027**] However, when a single transformer is utilized to drive the plurality of lamps and the electrodes of the lamps are connected in parallel with each other as described above, the current supplied from single transformer is separately supplied to respective lamps. Accordingly, the current applied to respective lamps has a current difference as indicated by the Table 1 below due to a variable load property of the lamp and a difference of a leakage current. Such a current difference becomes large as the lamp current supplied from the transformer becomes lower. Consequently, if the total current of the lamp is low, one side of the lamp is not driven to differ the durability of respective lamps.

TABLE 1

(units: mArms)

Total Lamp Current	Current of Lamp 1 (723a)	Current of Lamp 2 (723b)	Current Difference of Lamps	Average Current
12.7	6.9	5.8	1.1	6.35
11.2	6.6	4.6	2.0	5.60
9.7	7.5	2.2	5.3	4.85
8.0	7.0	1.0	6.0	4.00
5.8	5.8	0	5.8	2.90
4.0	4.0	0	4.0	2.00

[**0028**] In order to solve this problem, as shown in **FIG. 3, a** driving system for corresponding the lamp and transformer one by one has been suggested.

[**0029**] Referring to **FIG. 3, a** 2nd inverter INV2 has 1st , 2nd, 3rd and 4th transformers T1, T2, T3 and T4 and 1st and 2nd stabilizing circuits **723***e* and **725***e*. 1st , 2nd, 3rd and 4th transformers T1, T2, T3 and T4 are respectively driven by 1st , 2nd, 3rd and 4th controllers CT1, CT2, CT3 and CT4. The first electrodes of 1st and 2nd lamps **723***a* and **723***b* are connected to the output terminals at the high voltage level of the secondary sides of 1st and 2nd transformers T1 and T2 by interposing 1st and 2nd ballast capacitors C1 and C2. Also, the second electrodes of respective 1st and 2nd lamps **723***a* and **723***b* are serially connected to 1st stabilizing circuit **723***e* within 2nd inverter INV2 by means of respective 1st and 2nd RTNs **723***c* and **723** d. In the same way, the first electrodes of 3rd and 4th lamps **725***a* and **725***b* are respectively connected to the output terminals at the high voltage level of the secondary sides of 3rd and 4th transformers T3 and T4 by interposing 3rd and 4th ballast capacitors C3 and C4. In addition, the second electrodes of 3rd and 4th lamps **725***a* and **725***b* are serially connected to

2nd stabilizing circuit **725***e* within 2nd inverter INV2 by means of 3rd and 4th RTNs **725***c* and **725***d*, respectively. However, if the lamps are driven by one-to-one corresponding transformers as shown in **FIG. 3**, the frequency among respective transformers of the inverter is not easily synchronized. Therefore, the lamp generates light flickering, making it impossible to obtain a suitable light source as backlight of the LCD device.

[**0030**] In order to solve the above problem, as shown in **FIG. 4, a** method has been proposed in which the lamp corresponds to the transformer one by one and the transformers are coupled in pairs.

[**0031**] More specifically, referring to **FIG. 4, a** 3rd inverter INV**3** is formed by 1st , 2nd, 3rd and 4th transformers T**1**, T**2**, T**3** and T**4** and 1st and 2nd stabilizing circuits **723***e* and **725***e* . Low voltage level terminals of the secondary sides of 1st and 2nd transformers T**1** and T**2** are directly connected to low voltage level terminals of the secondary sides of 3rd and 4th transformers T**3** and T**4**. 1st and 2nd transformers T**1** and T**2** are driven by 1st controller CT**1**, and 3rd and 4th transformers T**3** and T**4** are driven by 2nd controller CT**2**.

[**0032**] On the other hand, the first electrode of 1st lamp **723***a* is connected to the output terminal at the high voltage level of 1st transformer T**1** by interposing 1st ballast capacitor C**1**, and the first electrode of 2nd lamp **723***b* is connected to the output terminal at the high voltage level of 2nd transformer T**2** by interposing 2nd ballast capacitor C**2**. The second electrodes of 1st and 2nd lamps **723***a* and **723***b* are serially connected to 1st stabilizing circuit **723***e* within 3rd inverter INV**3** by means of 1st and 2nd RTNs **723***c* and **723***d*, respectively. Similarly, the first electrode of 3rd lamp **725***a* is connected to the output terminal at the high voltage level of 3rd transformer T**3** by interposing 3rd ballast capacitor C**3**. Also, the first electrode of 4th lamp **725***b* is connected to the output terminal at the high voltage level of 4th transformer T**4** by interposing 4th ballast capacitor C**4**. The second electrodes of 3rd and 4th lamps **725***a* and **725***b* are serially connected to 2nd stabilizing circuit **725***e* within 3rd inverter INV3 by means of 3rd and 4th RTNs **725***c* and **725***d* , respectively However, although the above-described difficulty of synchronizing the frequency and problem of the flickering phenomenon are solved by coupling the transformers in pairs, the second electrodes of respective lamps are still connected to the stabilizing circuit on the electrical basis by means of the RTN that extends long toward the inverter side. Hence, any increase in the number of lamps not only produces a difficulty in the electrical wiring but also involves a problem of higher manufacturing costs of the backlight assembly.

[**0033**] **FIGS. 5A and 5B** show the configuration of the lamps and inverter module of the direct-type LCD device.

[**0034**] As shown in **FIG. 5**A, the LCD device is formed in a manner that lamp **727** that provides the light is arranged on the bottom plane of a mold frame **730** with a reflecting plate **728** interposed therebetween. Because lamp **727** supplies the light source at the rear side of a display unit **710**, no light guide plate **724** for guiding the side light source toward display unit **710** side is employed, unlike the edge-type LCD device as shown in **FIG. 1**.

[**0035**] By reflecting the structural feature, direct-type LCD device **900**, as shown in **FIG. 5**B, is capable of employing a plurality of lamps **727***a*, **727***b*, **727***c*, **727***d*, **727***e*, **727***f*, **727***g* and **727***h*. A 4th inverter INV**4** shown in **FIG. 5B** adopts the configuration of 2nd or 3rd inverter INV**2** or INV**3** shown in **FIG. 3** or **FIG. 4**, in which the connection with the first electrodes of plurality of lamps **727***a*, **727***b*, **727***c*, **727***d*, **727***e*, **727***f*, **727***g* and **727***h* is identical to that of 2nd or 3rd inverter INV**2** or INV**3**. Similarly, the second electrodes of plurality of lamps **727***a*, **727***b*, **727***c*, **727***d*, **727***e*, **727***f*, **727***g*and **727***h* are connected to a stabilizing circuit (not shown) within 4th inverter INV**4** by means of respective RTNs RTN**1**, RTN**2**, RTN**3**, RTN**4**, RTN**5**, RTN**6**, RTN**7** and RTN**8**.

[**0036**] Also in the direct-type LCD device shown in **FIG. 5**, the second electrodes of the plurality of lamps are connected to the stabilizing circuit of the inverter via separately-provided RTNs as the driving system shown in **FIG. 3** or **FIG. 4**. Consequently, the lamp unit becomes bulky as the number of RTNs increases. Further, the manufacturing cost of the backlight assembly increases as the number of RTNs increases.

SUMMARY OF THE INVENTION

[**0037**] In order to solve the above-mentioned problems of the prior art, an object of the present invention is to provide a backlight assembly capable of improving a connection of electrode lines of lamps that supply a light source for backlight of the LCD device to minimize the size of an LCD device and reduce the manufacturing cost.

[**0038**] Another object of the present invention is to provide an LCD device having a backlight assembly capable of improving a connection of electrode lines of lamps that supply a light source for backlight of the LCD device to minimize the LCD device size and reduce the manufacturing cost thereof.

[**0039**] To achieve the above object of the present invention, there is provided a backlight assembly including a light emitting unit formed of a plurality of lamps for generating light, and a light controlling unit for enhancing luminance of the light supplied from the light emitting unit. Here, each of the plurality of lamps respectively have two electrodes that include a first electrode directly connected to an electrode of at least one adjacent lamp and selectively have a second electrode supplied with externally provided driving signals.

[**0040**] A liquid crystal display device for achieving the above object of the present invention includes a backlight assembly having light emitting unit formed of a plurality of lamps for generating light, and light controlling unit for enhancing luminance of the light supplied from the light emitting unit. In addition, a display unit placed on an upper plane of the light controlling unit receives the light from the light emitting unit via the light controlling unit to display an image. Here, each of the plurality of lamps respectively have two electrodes, and the two electrodes include a first electrode directly connected to an electrode of at least one adjacent lamp and selectively have a second electrode supplied with externally-provided driving signals.

[**0041**] At this time, the driving signals are of first and second driving signals having a phase difference of 180° from each other, or N (where N is a constant larger than or the same as 2)—numbered driving signals respectively having a phase difference as many as a value obtained by dividing 360° by the number of the plurality of lamps. At this time, when the driving signals is N-numbered, the sum of respective phases of the N-numbered driving signals is zero.

[0042] Preferably, the light emitting unit has at least two lamps, the at least two lamps are serially connected to each other, and electrodes of the most preceding lamp and the finally succeeding lamp are supplied with the first and second driving signals, respectively.

[0043] More preferably, the backlight assembly further has a driving unit for converting the external power source of a DC component into an AC component, and generating the first and second driving signals having the phase different from each other. Also, the driving unit further has a stabilizing circuit for stabilizing current of the plurality of lamps. Thus, low voltage sides of respective secondary sides of the plurality of transformers are connected to the stabilizing circuit, so that the feedback current for stabilizing the current of the plurality of lamps is supplied to stabilizing circuit.

[0044] At this time, the light emitting unit is placed to contact one end or both ends of the light controlling unit. When the light emitting unit is placed to one end of the light controlling unit, the light controlling unit is a wedge-type light guide plate that becomes thinner as advancing from one end placed with the light emitting unit to the other opposing end.

[0045] Moreover, the light emitting unit may be placed to the lower plane of the light controlling unit. In this case, the light controlling unit is formed by a plurality of optical sheets for making the luminance of the light supplied from the light emitting unit to the display unit consistent.

[0046] According to the above-described backlight assembly and liquid crystal display device, the first electrodes of the lamps are respectively connected to the output terminals at the high voltage level of the secondary sides of the corresponding transformers among the transformers constituting the driving unit. Also, the second electrodes of the lamps are directly connected to one another on the electrical basis. The output terminals at the low voltage level of the secondary sides of the transformers are directly connected to the stabilizing circuit to supply the feedback current for stabilizing the current of the lamps to the stabilizing circuit.

[0047] Therefore, because the second electrodes of respective lamps are not required to extend to the stabilizing circuit of the inverter module so as to supply the feedback current to the stabilizing circuit, no RTN is utilized. For this reason, the wiring structure of the electrode lines of the lamps employed to the backlight assembly is simplified to to reduce the size of the backlight assembly while reducing the manufacturing cost of the backlight assembly and LCD device.

BRIEF DESCRIPTION OF THE DRAWINGS

[0048] The above objects and other advantages of the present invention will become more apparent by describing in detail preferred embodiments thereof with reference to the attached drawings:

[0049] **FIG. 1** is an exploded perspective view schematically showing a conventional liquid crystal display device.

[0050] **FIG. 2** is a circuit diagram showing a configuration of lamps of the backlight assembly shown in **FIG. 1** and an inverter module for driving the lamps in more detail.

[0051] **FIG. 3** is a circuit diagram showing another example of the configuration of the lamps of the backlight assembly shown in **FIG. 1** and inverter module.

[0052] **FIG. 4** is a circuit diagram showing still another example of the configuration of the lamps of the backlight assembly shown in **FIG. 1** and inverter module.

[0053] **FIGS. 5A and 5B** are views showing the configuration of the lamps and inverter module of a direct-type liquid crystal display device.

[0054] **FIG. 6** is an exploded perspective view showing a liquid crystal display device according to a preferred embodiment of the present invention.

[0055] **FIG. 7** is a sectional view showing the sectional structure of the light guide plate and lamp unit shown in **FIG. 6**.

[0056] **FIG. 8** is a circuit diagram showing a first embodiment of the configuration of the lamps of the backlight assembly shown in **FIG. 6** and inverter module for driving the lamps.

[0057] **FIG. 9** is a circuit diagram showing the configuration of the lamps and inverter module according to the first embodiment shown in **FIG. 8** in more detail.

[0058] **FIG. 10** is a graph for illustrating the potential difference at both ends of the lamp according to the first embodiment shown in **FIG. 8**.

[0059] **FIG. 11** is a circuit diagram showing a second embodiment of the configuration of the lamps of the backlight assembly shown in **FIG. 6** and inverter module for driving the lamps.

[0060] **FIG. 12** is a view representing a phase difference of the driving signals supplied to respective lamps of the second embodiment shown in **FIG. 11**.

[0061] **FIG. 13** is a circuit diagram showing a third embodiment of the configuration of the lamps of the backlight assembly shown in **FIG. 6** and inverter module for driving the lamps.

[0062] **FIG. 14** is a view representing a phase difference of the driving signals supplied to respective lamps according to the third embodiment shown in **FIG. 13**.

[0063] **FIG. 15** is a sectional view showing another example of the sectional structure of the light guide plate and lamp unit shown in **FIG. 6**.

[0064] **FIG. 16** is a view for showing a fourth embodiment of the configuration of the lamp of the backlight assembly shown in **FIG. 6** and inverter module for driving the lamps.

[0065] **FIG. 17** is a view showing a fifth embodiment of the configuration of the lamps of the backlight assembly shown in **FIG. 6** and inverter module for driving the lamps.

[0066] **FIG. 18** is a circuit diagram showing the configuration of the lamps and inverter module according to the fifth embodiment shown in **FIG. 17**.

[0067] **FIG. 19** is a view showing a modified example of the configuration of the lamps and inverter module according to the fifth embodiment shown in **FIG. 17**.

[0068] **FIG. 20** is a view showing a sixth embodiment of the configuration of the lamps of the backlight assembly shown in **FIG. 6** and inverter module for driving the lamps.

[0069] **FIG. 21** is a circuit diagram showing the configuration of the lamps shown in **FIG. 6** and inverter module according to the sixth embodiment in more detail.

[0070] **FIG. 22** is a sectional view showing the sectional structure of the lamp unit of the direct-type liquid crystal display device according to a preferred embodiment of the present invention.

[0071] **FIG. 23** is a view showing the configuration of the lamps shown in **FIG. 22** and inverter module for driving the lamps.

[0072] **FIG. 24** is a view representing a phase difference of driving signals supplied to respective lamps shown in **FIG. 23**.

[0073] **FIG. 25** is a view showing another example of the configuration of the lamps shown in **FIG. 16** and inverter module for driving the lamps.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0074] **FIG. 6** is an exploded perspective view for schematically showing an LCD device according to a preferred embodiment of the present invention.

[0075] Referring to **FIG. 6**, an LCD device **100** includes an LCD module **200** for displaying an image by receiving an image signal, and a case **300** formed by a front case **310** and a rear case **32** for accommodating LCD module **200** therein.

[0076] LCD module **200** has a display unit **210** including an LCD panel **212** for displaying the image.

[0077] Display unit **210** includes LCD panel **212**, a data-side PCB **214**, a data-side tape carrier package **216**, a gate-side PCB **219** and a gate-side tape carrier package **218**.

[0078] LCD panel **212** is formed of a TFT substrate **212***a*, a color filter substrate **212***b* and a liquid crystal (not shown).

[0079] TFT substrate **212***a* is a transparent glass substrate formed with TFTs in the matrix form. Source terminals of the TFTs are connected with data lines, and gate terminals are connected with gate lines. Additionally, drain terminals are formed with pixel electrodes consisting of the ITO that is a transparent conductive material.

[0080] Once an electrical signal is supplied to the data lines and gate lines, the source terminals and gate terminals of respective TFTs receive the electrical signal. In accordance to the electrical signal, the TFTs are turned-on or turned-off to provide the electrical signal for the pixels via the drain terminals.

[0081] Color filter substrate **212***b* is formed facing TFT substrate **212***a*. Color filter substrate **212***b* has the RGB pixels that displays predetermined colors when the light passes through. The RGB pixels are formed by a thing film processing. The common electrode formed of ITO is coated over the whole surface of color filter substrate **212***b*.

[0082] When the electric power is supplied to the gate terminal and source terminal of the TFT on TFT substrate **212***a* to turn on the TFT, an electrical field is formed between the pixel electrode and common electrode of the color filter substrate. This electrical field changes the alignment of the liquid crystal injected between TFT substrate **212***a* and color filter substrate **214***b*. Then the changed alignment alters the light transmissivity, to obtain a desired pixel.

[0083] In order to control the alignment angle and period of the liquid crystal of LCD panel **212**, a driving signal and a timing signal are supplied to the gate line and data line of the TFT.

[0084] As shown in the drawing, the source side of LCD panel **212** is attached with data tape carrier package **216** which is one of a soft circuit board that determines the period of supplying the data driving signal, and the gate side thereof is attached with gate tape carrier package **218** for determining the period of supplying the gate driving signal.

[0085] Data-side PCB **214** and gate-side PCB **219** for receiving the image signal from outside of LCD panel **212** to respectively supply the driving signals to the gate line and data line are respectively connected to data tape carrier package **214** at the data line side of LCD panel **212** and gate tape carrier package **210** at the gate line side thereof. Data-side PCB **214** is formed with a source portion for receiving the image signal generated from an external information processing apparatus (not shown) such as a computer to supply the data driving signal to LCD panel **212**. Gate-side PCB **219** is formed with a gate portion for receiving the image signal generated from the external information processing apparatus to supply the gate driving signal to the gate line of LCD panel **212**.

[0086] In other words, data-side PCB **214** and gate-side PCB **219** generates the gate driving signal and data signal for driving the LCD device and the plurality of timing signals for supplying the driving signals at the appropriate time. They supply the gate driving signal to the gate line of LCD panel **212** via gate tape carrier package **218** and the data signal to the data line of LCD panel **212** via data tape carrier package **216**.

[0087] A backlight assembly **220** is provided under display unit **210** for providing consistent light to display unit **210**. Backlight assembly **220** includes 1st and 2nd lamp units **223** and **225** installed to one side of LCD module **200** for generating the light. 1st and 2nd lamp units **223** and **225** are formed by 1st & 2nd lamps **223***a* & **223***b* and 3rd & 4th lamps **225***a* & **225***b*, which are respectively shielded by first and second lamp covers **222***a* and **222***b*.

[0088] A light guide plate **224** has a size corresponding to LCD panel **212** of display unit **210** and underlies LCD panel **212** for changing the path of light generated from 1st and 2nd lamp units **223** and **225** while guiding the light toward display unit **210** side. In **FIG. 6**, light guide plate **224** is of an edge-type with constant thickness, and 1st and 2nd lamp units **223** and **225** are installed at both ends of light guide plate **224** to enhance the light efficiency. The number of lamps in 1st and 2nd lamp units **223** and **225** may be properly arranged by considering the overall balance of LCD device **100**.

[0089] A plurality of optical sheets **226** are provided over light guide plate **224** for making the luminance of the light emitted from light guide plate **224** and reflecting toward LCD panel **212** consistent. A reflecting plate **228** is provided below light guide plate **224** for reflecting the light leaking from light guide plate **224** to light guide plate **224** for enhancing the efficiency of the light.

[**0090**] Display unit **210** and backlight assembly **220** are fixedly supported by a mold frame **400** that is a retaining container. Mold frame **400** is a box-like rectangle with an upper plane opened. In addition to these, a chassis **330** is formed for externally bending data tape carrier package **216** and gate tape carrier package **218** of display unit **210** out of mold frame **400** while fixing data PCB **214** and gate PCB **219** to the bottom plane of mold frame **400** to prevent the deviation of display unit **210**. Chassis **330** is opened for exposing LCD panel **210** and the sidewall thereof is inwardly bent in the perpendicular direction to cover the upper periphery portion of LCD panel **210**.

[**0091**] **FIG. 7** is a sectional view showing the sectional structure of the light guide plate and lamp unit shown in **FIG. 6**.

[**0092**] Referring to **FIG. 7**, one end of light guide plate **224** is coupled with first lamp cover **222***a*, and 1st and 2nd lamps **223***a* and **223***b* are arranged up and down in the interior of first lamp cover **222***a*. Additionally, second lamp cover **222***b* is coupled to the other end opposing to one end of light guide plate **224**, and 3rd and 4th lamps **225***a* and **225***b* are arranged up and down in the interior of second lamp cover **222***b*.

[**0093**] The up and down arrangement of two lamps such as 1st and 2nd lamps **232***a* and **232***b* shown in **FIG. 7** may be identically applied to the wedge-type light guide plate which becomes thinner as advancing from one end toward the other end. The difference is that the lamp unit is installed only at one end of the light guide plate in the wedge-type light guide plate. The wedge-type light guide plate will be described later.

[**0094**] Meanwhile, although not shown in **FIG. 6**, aforementioned LCD device **100** is formed with a 5th inverter INV**5** that supplies an AC signal for driving 1st , 2nd, 3rd and 4th lamps **223***a* , **223***b* , **225***a* and **225***b* as shown in **FIG. 8**.

[**0095**] **FIG. 8** is a circuit diagram showing the configuration of the lamps of the backlight assembly shown in **FIGS. 6 and 7** and the inverter module for driving the same. **FIG. 9** is a circuit diagram showing the lamps and inverter module shown in **FIG. 8** in more detail. **FIG. 10** is a graph for explaining a potential difference at both ends of the lamp shown in **FIG. 8**.

[**0096**] Referring to **FIG. 8, 5** th inverter INV**5** has 1st , 2nd, 3rd and 4th transformers **T1**, **T2**, **T3** and **T4** numbering the same as the number of lamps employed to the backlight assembly. Here, 1st and 2nd transformers **T1** and **T2** are driven by the driving signal from a 1st controller CT**1**, and 3rd and 4th transformers **T3** and **T4** are driven by the driving signal of a 2nd controller CT**2**.

[**0097**] The output terminal at the high voltage level of the secondary side of 1st transformer **T1** is connected to the input side, i.e., first electrode, of 1st lamp **223***a*. A 1st ballast capacitor C**1** for stabilizing the current of 1st lamp **223***a* is interposed between the output terminal at the high voltage level of the secondary side of 1st transformer TI and first electrode of 1st lamp **223***a*.

[**0098**] The output terminal at the high voltage level of the secondary side of 2nd transformer T**2** is connected to the input side, i.e., first electrode, of 2nd lamp **223***b*. A 2nd ballast capacitor C**2** for stabilizing the current of 2nd lamp **223***b* is interposed between the output terminal at the high voltage level of the secondary side of 2nd transformer T**2** and first electrode of 2nd lamp **223***b*.

[**0099**] On the other hand, the output sides, i.e., second electrode **223***c*, of 1st and 2nd lamps **223***a* and **223***b* are directly connected to each other on the electrical basis. Also, respective output terminals T**1**a and T**2**a at the low voltage level of the secondary sides of 1st and 2nd transformers **T1** and T**2** are directly connected to a stabilizing circuit **227** formed by a capacitor and a resistor within 5th inverter INV**5**. That is, the feedback current for stabilizing the current of 1st and 2nd lamps **223***a* and **223***b* is supplied via the output terminals at the low voltage level of the secondary sides of 1st and 2nd transformers **T1** and **T2**.

[**0100**] In the same manner, the output terminal at the high voltage level of the secondary side of 3rd transformer T**3** is connected to the first electrode of 3rd lamp **225***a*. A 3rd ballast capacitor C**1** for stabilizing the current of 3rd lamp **225***a* is interposed between the output terminal at the high voltage level of the secondary side of 3rd transformer **T3** and first electrode of 3rd lamp **225***a*.

[**0101**] The output terminal at the high voltage level of the secondary side of 4th transformer **T4** is connected to the first electrode of 4th lamp **225***b*. A 4th ballast capacitor C**4** for stabilizing the current of 4th lamp **225***b* is interposed between the output terminal at the high voltage level of the secondary side of 4th transformer **T4** and first electrode of 4th lamp **225***b*.

[**0102**] Furthermore, second electrodes **225***c* of 3rd and 4th lamps **225***a* and **225***b* are directly connected to each other on the electrical basis. Respective output terminals T**3**a and T**4**a at the low voltage level of the secondary sides of 3rd and 4th transformers **T3** and **T4** are directly connected to stabilizing circuit **229** within 5th inverter INV**5** to supply the feedback current for stabilizing the current of 3rd and 4th lamps **225***a* and **225***b* to stabilizing circuit **229**.

[**0103**] Referring to **FIG. 9,** 1st controller **CT1** is provided at the preceding stage of 1st and 2nd transformers **T1** and T**2**. 1st controller **CT1** includes first and second bias resistors **R1** and **R2** of which one ends are parallel connected with an input terminal of an external signal connected to 1st and 2nd transformers **T1** and **T2**. Also included as parts are a first transistor **Q1** having a base terminal connected to the other end of first bias resistor **R1** to be commonly connected to 1st transformer **T1**, an emitter terminal grounded and a collector terminal connected to 1st and 2nd transformers **T1** and **T2**, and a second transistor **Q2** having a base terminal commonly connected to 1st transformer **T1** with the other end of second bias resistor **R2**, an emitter terminal commonly grounded with the emitter terminal of 1st transistor **Q1** and a collector terminal connected to 1st transformer **T1**. In addition to these, an oscillating capacitor C**5** has one end connected to 1st transformer **T1** to be commonly with the collector terminal of 2nd transistor **Q2**, and the other end connected to the collector terminal of first transistor Q1. 1st controller CT1 having the above-described construction operates as a Royer circuit for converting the externally-supplied DC signal into the AC signal.

[0104] Meanwhile, the first electrodes of 1st and 2nd lamps **223***a* and **223***b* are respectively connected to the output terminals at the high voltage level of 1st and 2nd transformers T1 and T2 via 1st and 2nd ballast capacitors C1 and C2. At this time, the output terminals at the high voltage level of 1st and 2nd transformers T1 and T2 respectively connected to the first electrodes of 1st and 2nd lamps **223***a* and **223***b* have the coils wound in the reverse direction opposite to each other.

[0105] In more detail, the output terminal at the high voltage level of 1st transformer T1 electrically connected to the first electrode of 1st lamp **223***a* is set as the starting point of wiring the coil. Whereas the output terminal at the high voltage level of 2nd transformer T2 electrically connected to the first electrode of 2nd lamp **223***b* is set as the ending point of wiring the coil.

[0106] Therefore, the AC signals respectively applied to 1st lamp **223***a* and 2nd lamp **223***b* from 1st and 2nd transformers T1 and T2 have a phase difference of 180° from each other. At this time, the output terminals at the low voltage level of the secondary sides of 1st and 2nd transformers T1 and T2 directly connected to stabilizing circuit **227** on the electrical basis supply the feedback current for stabilizing the current flowing through 1st and 2nd lamps **223***a* and **223***b* to respective 1st and 2nd lamps **223***a* and **223***b*.

[0107] When the phase difference of the AC signals respectively supplied to 1st and 2nd lamps **223***a* and **223***b* is 180° from each other as stated above, a virtually zero voltage is generated at the second electrodes portion of 1st and 2nd lamps **223***a* and **223***b* which are directly connected on the electrical basis.

[0108] Accordingly, as shown in **FIG. 10, a** potential difference is generated between the first electrode and second electrode of 1st lamp **223***a* at the portions denoted by reference alphabets "A" and "B" to allow 1st and 2nd lamps **223***a* and **223***b* to carry out the light emitting operation.

[0109] The following Table 2 represents the operational characteristics of the conventional lamp driving system as shown in **FIG. 4** and the lamp driving system according to the present invention as shown in **FIG. 8**.

[0110] Referring to Table 2, the conventional driving system shown in **FIG. 4** and driving system according to the present invention shown in **FIG. 8** have little difference in terms of the power dissipation of the inverter and leakage current of the lamp. In view of the luminance of the backlight, they show similar luminance at the current values of respective lamps.

TABLE 2

Respective	Backlight Luminance (nits)		Inverter Power Dissipation (W)		Lamp Leakage Current (mArms)	
Lamp Current (mArms)	Prior Art (FIG. 4)	Present Invention (FIG. 8)	Prior Art (FIG. 4)	Present Invention (FIG. 8)	Prior Art (FIG. 4)	Present Invention (FIG. 8)
6.0	1965	1958	19.3	19.3	1.3	1.3
5.0	1785	1778	17.2	17.2	1.7	1.7
4.0	1545	1545	15.1	15.2	2.2	2.2

[0111] When considering the result of measuring, the conventional lamp driving system as shown in **FIG. 4** and the lamp driving system according to the present invention as shown in **FIG. 8** display the similar result in the backlight luminance, power dissipation of the inverter and leakage current of the lamp. However, in the lamp driving system according to the present invention as shown in **FIG. 8**, the second electrodes of respective lamps are not connected to the stabilizing circuit within the interior of the inverter unlike the conventional lamp driving system. Instead, the second electrodes are directly connected to each other on the electrical basis. This reduces the space occupied by the wiring of the RTN as well as the manufacturing cost of the LCD device.

[0112] On the other hand, as shown in **FIG. 7**, because two driving signals are utilized when two lamps are arranged up and down, the driving signals respectively applied to 1st and 2nd lamps **223***a* and **223***b* has the phase difference of 180° from each other. However, the number of lamps may be further increased as required. In this case, the phase of the driving signals supplied to the lamps is variably set in accordance with the number of lamps. **FIGS. 11, 12, 13** and **14** show another examples of the construction of the lamps shown in **FIG. 7**.

[0113] Referring to **FIG. 11**, the backlight assembly employs three lamps, i.e., 5th, 6th and 7th lamps **227***a*, **227***b* **227***c*, as the light source of backlight. A 6th inverter INV6 for driving 5th, 6th and 7th lamps **227***a*, **227***b* and **227***c* has the transformers, i.e., 5th, 6th and 7th transformers T5, T6 and T7, numbering the same as the number of 5th, 6th and 7th lamps **227***a*, **227***b* and **227***c*. 5th, 6th and 7th transformers T5, T6 and T7 are driven by the driving signals from 3rd controller CT3.

[0114] The connection of 5th, 6th and 7th transformers T5, T6 and T7 and 5th, 6th and 7th lamps **227***a*, **227***b* and **227***c* is the same as that of two lamps. More specifically, the output terminals at the high voltage level of the secondary sides of 5th, 6th and 7th transformers T5, T6 and T7 are respectively connected to the first electrodes of 5th, 6th and 7th lamps **227***a*, **227***b* and **227***c*. 5th, 6th and 7th ballast capacitors C5, C6 and C7 for stabilizing the current of 5th, 6th and 7th lamps **227***a*, **227***b* and **227***c* are respectively interposed between the first electrodes of 5th, 6th and 7th lamps **227***a*, **227***b* and **227***c*and the output terminals at the high voltage level of the secondary sides of 5th, 6th and 7th transformers T**5**, T**6** and T**7**. Additionally, the output terminals at the low voltage level of the secondary sides of 5th, 6th and 7th transformers T**5**, T**6** and T**7** are directly connected to stabilizing circuit **230** for stabilizing the current of 5th, 6th and 7th lamps **227***a*, **227***b* and **227***c* to supply the feedback current. Furthermore, the output sides, i.e., second electrodes, of 5th, 6th and 7th lamps **227***a*, **227***b* and **227***c* are directly connected to one another on the electrical basis.

[**0115**] In case of forming by three lamps as described above, the phase difference of the driving signals supplied to respective lamps is determined by the number of lamps. As shown in **FIG. 12**, the driving signal supplied to 5th, 6th and 7th lamps **227***a*, **227***b* and **227***c* is provided to have a phase difference as many as a value obtained by diving 360° by the number of lamps. That is, if 1st driving signal DS**1** supplied to 5th lamp **227***a* is provided in the form of a sine waveform starting from zero degree, 2nd driving signal DS**2** supplied to 6th lamp **227***b* has a phase delayed as many as 120° from 1st driving signal DS**1** and 3rd driving signal DS**3** supplied to 7th lamp **227***c*has a phase delayed as many as 120° from 2nd driving signal DS**2**.

[**0116**] Therefore, the sum of the voltage values at respective phases of 1st , 2nd and 3rd driving signals DS**1**, DS**2** and DS**3** is always zero. For example, in **FIG. 12**, phases of 1st , 2nd and 3rd driving signals DS**1**, DS**2** and DS**3** at a point denoted by a reference alphabet "A" are 90°, −210° and −330° when viewed from 1st driving signal DS**1** as a reference. If it is converted into the voltage value at the corresponding phase, respective voltage values of 1st , 2nd and 3rd driving signals DS**1**, DS**2** and DS**3** can be denoted by V**1**, −V**2** and −V**3**. Therefore, the sum of the voltage values at respective phases of 1st , 2nd and 3rd driving signals D**1**, D**2** and D**3** in the output side of connecting respective second electrodes of 5th, 6th and 7th lamps **227***a*, **227***b* and **227***c* becomes zero to drive 5th, 6th and 7th lamps **227***a*, **227***b* and **227***c*.

[**0117**] **FIG. 13** shows an example of employing four lamps, i.e., 8th, 9th, 10th and 11th lamps **231***a*, **231***b*, **231***c* and **231***d*, as the light source of the backlight assembly. **FIG. 14** shows the phase difference of 4th, 5th, 6th and 7th driving signals DS**4**, DS**5**, DS**6** and DS**7** respectively supplied to 8th, 9th, 10th and 11th lamps **231***a*, **231***b*, **231***c* and **231***d*.

[**0118**] As illustrated, a 7th inverter INV**7** for driving 8th, 9th, 10th and 11th lamps **231***a*, **231***b*, **231***c* and **231***d* has 8th, 9th, 10th and 11th transformers T**8**, T**9**, T**10** and T**11** numbering the same as the number of 8th, 9th, 10th and 11th lamps **231***a*, **231***b*, **231***c* and **231***d*. 8th, 9th, 10th and 11th transformers T**8**, T**9**, T**10** and T**11** are driven by 4th, 5th, 6th and 7th driving signals DS**4**, DS**5**, DS**6** and DS**7** from a 4th controller CT**4**.

[**0119**] In the same manner, the output terminals at the high voltage level of the secondary sides of 8th, 9th, 10th and 11th transformers T**8**, T**9** T**10** and T**11** are connected to the first electrodes of 8th, 9th, 10th and 11th lamps **231***a*, **231***b*, **231***c* and **231***d*. 8th, 9th, 10th and 11th ballast capacitors C**8**, C**9**, C**10** and C**11** for stabilizing the current of 8th, 9th, 10th and 11th lamps **231***a*, **231***b*, **231***c* and **231***d* are respectively interposed between the first electrodes of 8th, 9th, 10th and 11th lamps and output terminals at the high voltage level of the secondary sides of 8th, 9th, 10th and 11th transformers T**8**, T**9**, T**10** and T**11**. Also, the output terminals at the low voltage level of the secondary sides of 8th, 9th, 10th and 11th transformers T**8**, T**9**, T**10** and T**11** are directly connected to a stabilizing circuit **233** for stabilizing the current of 8th, 9th, 10th and 11th lamps **231***a*, **231***b*, **231***c* and **231***d* to supply the feedback current. The output sides, i.e., second electrodes, of 8th, 9th, 10th and 11th lamps **231***a*, **231***b*, **231***c* and **231***d* are directly connected to one another on the electrical basis.

[**0120**] In case of forming by four lamps as described above, the phase difference of the driving signals supplied to respective lamps is determined by the number of lamps. As shown in **FIG. 14**, 4th, 5th, 6th and 7th driving signals DS**4**, DS**5**, DS**6** and DS**7** supplied to 8th, 9th, 10th and 11th lamps **231***a*, **231***b*, **231***c* and **231***d* are supplied to have the phase difference having a value of dividing 360° by the number of lamps. In describing with reference to **FIG. 14**, if 4th driving signal DS**4** supplied to 8th lamp **231** a is provided in the form of the sine waveform starting from zero degree, 5th driving signal DS**5** supplied to 9th lamp **231***b* has a phase delayed by 90° from 4th driving signal DS**4**. Then, 6th driving signal DS**6** supplied to 10th lamp **231***c* has a phase delayed by 90° from 5th diving signal DS**5**, and 7th driving signal DS**7** supplied to 11th lamp **231***d* has a phase delayed by 90° from 6th driving signal DS**6**.

[**0121**] Therefore, the sum of respective phases of 4th, 5th, 6th and 7th driving signals DS**4**, DS**5**, DS**6** and DS**7** is always zero. For example, in **FIG. 14**, the phases of 4th, 5th, 6th and 7th driving signals DS**4**, DS**5**, DS**6** and DS**7** are respectively 90°, 0°, −270° and 0° at the point of reference alphabet "B" from the point of supplying the signals. When these are converted into the voltage values at corresponding phases, 4th, 5th, 6th and 7th driving signals DS**4**, DS**5**, DS**6** and DS**7** respectively have voltage values of V**4**, V**5**, −V**6** and V**7**. Consequently, the sum of the voltage values at respective phases of 4th, 5th, 6th and 7th driving signals D**4**, D**5**, D**6** and D**7** on the output sides of connecting respective second electrodes of 8th, 9th, 10th and 11th lamps **231***a*, **231***b*, **231***c* and **231***d* becomes zero to drive 8th, 9th, 10th and 11th lamps **231***a*, **231***b*, **231***c* and **231***d*.

[**0122**] While the number of lamps is two to four with reference to FIGS. **7** to **14** described hereinbefore, the connecting method of the lamps and transformers and method of deciding the phase difference of the driving signals supplied from the transformers to the lamps are identical even if the number of lamps is increased to four or more. In other words, since the driving signals supplied to respective lamps are provided in the sine waveform to have the phase difference obtained by dividing 360° by the number of overall lamps, the directly-connected second electrode sides of respective lamps has the voltage value of zero. Accordingly, the RTNs extending from the second electrodes of the lamps toward the inverter module side prior to being connected to the stabilizing circuit can be eliminated free from the number of lamps to make it possible to shrink overall size of the backlight assembly and economize the manufacturing cost.

[**0123**] Meantime, the above-described lamp driving system may be identically applied to a wedge-type light guide plate **224** a as shown in **FIG. 15** as well as the edge-type LCD device in which the lamps are installed to both ends of light guide plate **224** as shown in **FIG. 7**.

[0124] In more detail, the second electrodes of **12** th and **13** th lamps **231***a*and **231***b* protected by a third lamp cover **232** on one end of wedge-type light guide plate **224** a to be installed up and down are directly connected to each other on the electrical basis as shown in **FIG. 8**. Additionally, the first electrodes of 12th and 13th lamps **231***a*and **231***b* are, as shown in **FIG. 8**, respectively connected to the separate output terminals at the high voltage level of transformers, and the output terminals at the low voltage level of respective transformers are connected to the stabilizing circuit within the inverter. Consequently, in case of the wedge-type light guide plate **224** a as shown in **FIG. 15**, the RTNs of 12th and 13th lamps **231***a*and **231***b* are also eliminated to obtain the same effect as of **FIG. 8**.

[0125] **FIG. 16** is a view showing another example of the configuration of the lamps of backlight assembly as shown in **FIG. 6** and the inverter module for driving the same.

[0126] Respective second electrodes of the pairs of 1st & 2nd lamps **223***a* & **223***b* and 3rd & and 4th lamps **225***a* & **225***b* shown in FIGS. **7** may be connected by extending long toward an 8th inverter INV**8** side.

[0127] When giving **14**th and **15**th lamps **234***a* and **234***b* shown in **FIG. 16** as an example, the first electrodes of **14**th and **15**th lamps **234***a* and **234***b* are connected to the output terminals at the high voltage level of the secondary sides of 12th and 13th transformers T**12** and T**13** respectively forming 8th inverter INV**8**. 12th and 13th ballast capacitors C**12** and C**13** for stabilizing the current of 14th and 15th lamps **234***a* and **234***b* are interposed between them.

[0128] The second electrode of 14th lamp **234***a* extends long to the interior of 8th inverter INV**8**, which in turn extends toward the second electrode side of 15th lamp **234***b* from the interior of 8th inverter INV**8**, thereby being directly connected to the second electrode of 15th lamp **124***b* on the electrical basis.

[0129] A stabilizing circuit (not shown) for stabilizing the current of 14th and 15th lamps **234***a* and **234***b* is furnished within the interior of 8th inverter INV**8** as shown in **FIG. 9**. The feedback current supplied to the unshown stabilizing circuit for stabilizing the current of 14th and 15th lamps **234***a* and **234***b* is applied via the output terminals at the low voltage level of the secondary side of 12th and 13th transformers T**12** and T**13**.

[0130] In the examples described hereinbefore, the second electrodes of the lamps employed to the backlight assembly of the LCD device shown in **FIG. 6** are directly connected to each other, and the transformers of the inverter module numbers the same as the number of lamps to allow the first electrodes of the lamps to be supplied with the driving signals having the phase difference different from each other from the corresponding transformers. However, the plurality of lamps may be driven by using just two transformers regardless of the number of lamps in association with the combination of the electrodes of the plurality of lamps.

[0131] **FIG. 17** is a view showing another example of the configuration of the lamps of the backlight assembly shown in **FIG. 6** and the inverter for driving the same, which describes a case that the plurality of lamps are serially connected to one another. **FIG. 18** is a circuit diagram more specifically showing the configuration of the lamp shown in **FIG. 13** and the inverter module. **FIG. 19** shows a modification of the configuration of the lamps shown in **FIG. 13** and inverter module. If the plurality of lamps are serially connected, the circuit configuration may have the same form regardless of the number of lamps. Here, a case of utilizing three or four lamps is taken as an example for more detailed description.

[0132] As shown in **FIG. 17, 18** and **19**, a 9th inverter INV**9** has a 6th controller CT**6** and 14th and 15th transformers T**14** and T**15** driven in response to the driving signals from 6th controller CT**6**. 15th, 16th and 17th lamps **236***a*, **236***b* and **236***c* are serially connected to one another, in which the first electrode of 15th lamp **236***a*and the first electrode of 17th lamp **236***c* are arranged to oppose to each other.

[0133] Thus, as shown in **FIG. 18**, the first electrode of 15th lamp **236***a*is connected to the output **20** terminal at the high voltage level of the secondary side of 14th transformer T**14** by interposing a 14th ballast capacitor C**14**. Also, the first electrode of 17th lamp **236***a* extends long to 9th inverter INV**9** side to be connected to the output terminal at the high voltage level of the secondary side of 15th transformer T**15** by interposing 15th ballast capacitor C**15** between them.

[0134] In the same manner, a stabilizing circuit **235** as shown in **FIG. 9** is furnished within 9th inverter INV**9**. The output terminals at the low voltage level of the secondary sides of 14th and 15th transformers T**14** and T**15** are directly connected to stabilizing circuit **235**, and the feedback current for stabilizing the current of 15th, 16th and 17th lamps **236***a*, **236***b* and **236***c* is supplied to stabilizing circuit **235** via the output terminals at the low voltage level of the secondary sides of 14th and 15th transformers T**14** and T**15**.

[0135] At this time, the driving signals respectively supplied to the first electrodes of 15th and 17th lamps **236***a*and **236***c* from the output terminals at the high voltage level of the secondary sides of 14th and 15th transformers T**14** and T**15** via 14th and 15th ballast capacitors C**14** and C**15** have the phase difference of 180° from each other. This is because, even if the number of lamps is three, 15th, 16th and 17th lamps **236***a*, **236***b* and **236***c* are serially connected to one another, and just the first electrode of 15th lamp that is the most preceding lamp and the first electrode of 17th lamp **236***c* that is the finally succeeding lamp are respectively supplied with the driving signals from 14th and 15th transformers T**14** and T**15**. In other words, when the plurality of lamps are serially connected, always two driving signals are utilized regardless of the number of lamps. For this reason, it is enough to maintain the phase difference of 180° between two driving signals.

[0136] In such a lamp driving system, 9th inverter INV**9** for driving 15th, 16th and 17th lamps **236***a*, **236***b* and **236***c* is installed to any one side of 15th, 16th and 17th lamps **236***a*, **236***b* and **236***c* as illustrated. Due to this fact, the first electrode of 15th lamp **236***a*or the first electrode of 17th lamp **236***c* inevitably extends long toward 9th inverter INV**9** side depending on the installing position of 9th inverter INV**9**.

[0137] However, when considering that the input stage of the lamps, i.e., first electrodes of 15th, 16th and 17th lamps **236***a*, **236***b* and **236***c* , for the backlight of the LCD device, as shown in **FIG. 19,** 14th and 15th transformers T**14** and T**15** forming 9th inverter INV**9** may be separately arranged to place to be near to the first electrodes of 15th and 17th lamps **236***a*and **236***c*.

[0138] FIGS. 20 and 21 show an example of serially connecting four lamps.

[0139] As shown in FIGS. 20 and 21, a 10th inverter INV10 has a 7th controller CT7, and 16th and 17th transformers T16 and T17 driven in response to the driving signal from 7th controller CT7. 18th, 19th, 20th and 21st lamps 239*a*, 239*b*, 239*c* and 239*d* are serially connected to one another, which are even-numbered. Accordingly, unlike the three lamps shown in FIG. 17, the first electrode of 18th lamp 239*a*and the first electrode of 21st lamp 239*d* are arranged in the same direction.

[0140] As shown in FIG. 21, the first electrode of 18th lamp 239*a* is connected to the output terminal at the high voltage level of the secondary side of 16th transformer T16 by interposing a 16th ballast capacitor C16. Also, the first electrode of 21st lamp 239*d* extends long toward 10th inverter INV10 side to be connected to the output terminal at the high voltage level of the secondary side of 17th transformer T17 by interposing a 17th ballast capacitor C17.

[0141] Similarly, a stabilizing circuit 235 as shown in FIG. 9 is furnished within 10th inverter INV10 as shown in FIG. 9. Also, the output terminals at the low voltage level of the secondary sides of 16th and 17th transformers T16 and T17 are directly connected to stabilizing circuit 235. The feedback current for stabilizing the current of 18th, 19th, 20 th and 21st lamps 239*a*, 239*b*, 239*c* and 239*d* is supplied to stabilizing circuit 235 via the output terminals at the low voltage level of the secondary sides of 16th and 17th transformers T16 and T17.

[0142] At this time, the driving signals respectively supplied to the first electrodes of 18th and 21st lamps 239*a* and 239*d* from the output terminals at the high voltage level of the secondary sides of 16th and 17th transformers T16 and T17 via 16th and 17th ballast capacitors C16 and C17 have the phase difference of 180° from each other. This is because, when the plurality of lamps are serially connected, just two driving signals are always utilized regardless of the number of lamps even if the lamps number four. Therefore, it is enough for two driving signals to maintain the phase difference of 180°.

[0143] Here, it is described by giving examples of three and four lamps which are serially connected to one another, but the driving signals are supplied to only the first electrode of the most preceding lamp and the first electrode of the finally succeeding lamp among the plurality of serially-connected lamps, even though the number of lamps increases to four or more. Therefore, by supplying the driving signals having the phase difference of 180° from each other to the first electrodes of the most preceding lamp and the finally succeeding lamp by using two transformers, the driving effect identical to the above-described case can be obtained.

[0144] FIG. 22 is a sectional view showing the sectional structure of the lamp unit of the direct-type LCD device according to a preferred embodiment of the present invention. FIG. 23 is a view schematically showing the configuration of the lamps shown in FIG. 22 and inverter module for driving the same. FIG. 24 is a waveform for showing the waveforms of the driving signals supplied to respective lamps from the inverter module shown in FIG. 23. FIG. 25 is a view showing another example of the configuration of the lamps shown in FIG. 22 and inverter for driving the same.

[0145] As shown in FIG. 22, the direct-type LCD device is formed having a plurality of lamps 244*a*, 244*b*, 244*a*, 244*b*, 248*a*, 248*b*, 250*a* and 250*b* arranged to be separated from one another by a predetermined distance on the bottom plane of mold frame 400 by interposing reflecting plate 228. At this time, the LCD device utilizes no light guide plate 224 for guiding the side light source toward display unit 210 as in the edge-type LCD device as shown in FIG. 6 because lamps 244*a*, 244*b*, 244*a*, 244*b*, 248*a*, 248*b*, 250*a* and 250*b* provide the light source from the rear plane of display unit 210. Diffuision sheet members 226 as a light controlling unit for adjusting the luminance of the light and so on are coupled to the upper plane of lamps 244*a*, 244*b*, 244*a*, 244*b*, 248*a*, 248*b*, 250*a* and 250*b* by securing a predetermined space for advancing the light from lamps 244*a*, 244*b*, 244*a*, 244*b*, 248*a*, 248*b*, 250*a* and 250*b*.

[0146] By reflecting the foregoing structural characteristic, the direct-type LCD device shown in FIG. 22 can employ a plurality of lamps 244*a*, 244*b*, 244*a*, 244*b*, 248*a*, 248*b*, 250*a* and 250*b* as shown in FIG. 23. That is, it is easy to vary the number of lamps in accordance with the area of the LCD panel in the direct-type LCD device.

[0147] 11th inverter INV11 shown in FIG. 23 employs the formation of 5th inverter INV5 as shown in FIG. 8, in which the coupling structure of the first electrodes of plurality of lamps 244*a*, 244*b*, 244*a*, 244*b*, 248*a*, 248*b*, 250*a* and 250*b* and the plurality of transformers (not shown) forming 11th inverter INV1 is identical to that of 1st , 2nd, 3rd and 4th lamps 223*a*, 223*b*, 225*a* and 225*b* and 5th inverter INV5 shown in FIG. 8. In other words, 11th inverter INV11 has the same number of transformers as the number of lamps 244*a*, 244*b*, 244*a*, 244*b*, 248*a*, 248*b*, 250*a* and 250*b*.

[0148] Additionally, the first electrodes of plurality of lamps 244*a*, 244*b*, 244*a*, 244*b*, 248*a*, 248*b*, 250*a* and 250*b* are connected to the output terminals at the high voltage level of the secondary sides of corresponding transformers among the plurality of transformers in 11th inverter INV11. Also, the second electrodes of plurality of lamps 244*a*, 244*b*, 244*a*, 244*b*, 248*a*, 248*b*, 250*a* and 250*b* are directly connected to one another on the electrical basis.

[0149] In the same manner, the output terminals at the low voltage level of the respective secondary sides of the plurality of transformers constituting 11th inverter INV11 are directly connected to a stabilizing circuit (not shown) furnished to the interior of 11th inverter INV11 to supply the feedback current for stabilizing the current of plurality of lamps 244*a*, 244*b*, 244*a*, 244*b*, 248*a*, 248*b*, 250*a* and 250*b* to the stabilizing circuit.

[0150] Here, 1st , 2nd, 3rd , 4th, 5th, 6th, 7th and 8th driving signals DS1, DS2, DS3, DS4, DS5, DS6, DS7 and DS8 respectively provided from the unshown plurality of transformers of 11th inverter INV11 to plurality of lamps 244*a*, 244*b*, 244*a*, 244*b*, 248*a*, 248*b*, 250*a* and 250*b* respectively have the phase difference different from one another as described with reference to FIGS. 11, 12, 13 and 14. In more detail, when being formed by eight lamps as illustrated, 1st , 2nd, 3rd , 4th, 5th, 6th, 7th and 8th driving signals DS1, DS2, DS3, DS4, DS5, DS6, DS7 and DS8 are supplied to have the phase difference of 360° divided by eight.

[0151] In describing the phase with reference to FIG. 24, first driving signal DS1 has the phase of zero degree at the supplying point of 1st, 2nd, 3rd , 4th, 5th, 6th, 7th and 8th driving signals **DS1**, **DS2**, **DS3**, **DS4**, **DS5**, **DS6**, **DS7** and **DS8**. Similarly, 2nd, 3rd , 4th, 5th, 6th, 7th and 8th driving signals **DS2**, **DS3**, **DS4**, **DS5**, **DS6**, **DS7** and **DS8** respectively have the phase values of 45°, 90°, 135°, 0°, −225°, −270° and −315° when viewed from 1st driving signal **DS1** as a reference. If these are converted into the voltage values at the corresponding phases, the sum of the voltage values of respective phases of 1st , 2nd, 3rd , 4th, 5th, 6th, 7th and 8th driving signals **DS1**, **DS2**, **DS3**, **DS4**, **DS5**, **DS6**, **DS7** and **DS8** on the output sides connected to the second electrodes of plurality of lamps **244***a*, **244***b*, **244***a*, **244***b* **248***a*, **248***b*, **250***a* and **250***b* become zero. Consequently, the sum of the voltage values of respective phases of 4th, 5th, 6th and 7th driving signals **DS4**, **DS5**, **DS6** and **DS7** becomes zero to drive plurality of lamps **244***a*, **244***b*, **244***a*, **244***b*, **248***a*, **248***b*, **250***a* and **250***b*.

[0152] On the other hand, lamps **244***a*, **244***b*, **244***a*, **244***b* **248***a*, **248***b*, **250***a* and **250***b* may be, as shown in **FIG. 25**, formed by combining adjacent two lamps as pairs, and directly connecting the second electrodes of two lamps in a single pair on the electrical basis.

[0153] In **FIG. 25, a** 12th inverter INV**12** is formed by transformers (not shown) numbering the same as the number of plurality of lamps **244***a*, **244***b*, **244***a*, **244***b*, **248***a*, **248***b*, **250***a* and **250***b* and a stabilizing circuit (not shown). The output terminals at the low voltage level of the secondary sides of the plurality of transformers constituting 12th inverter INV**12** are directly connected to the stabilizing circuit to supply the feedback current for stabilizing the current of plurality of lamps **244***a*, **244***b*, **244***a*, **244***b*, **248***a*, **248***b*, **250***a* and **250***b* to the stabilizing circuit.

[0154] At this time, the driving signals respectively supplied to the first electrodes of plurality of lamps **244***a*, **244***b*, **244***a*, **244***b*, **248***a*, **248***b*, **250***a* and **250***b* are identical to those shown in **FIG. 17**. That is, the driving signals are supplied from the plurality of transformers of 12th inverter INV**12** to be fed to each of the lamp pairs, e.g., lamps **244***a*& **244***b*, lamps **244***b* & **244***a*, lamps **244***a*& **244***b*, lamps **244***b*& **248***a*, lamps **248***a*& **250***a* and lamps **250***a* & **250***b* , which are directly connected among plurality of lamps **244***a*, **244***b*, **244***a*, **244***b* **248***a*, **248***b*, **250***a* and **250***b* to have the phase difference of 180° from each other.

[0155] According to the backlight assembly and LCD device having the same as described above, the lamps employed to the backlight assembly for supplying the light are driven by the AC signals from the inverter module consisting of the transformers, controllers and stabilizing circuit.

[0156] At this time, the numbers of the lamps and the transformers in the inverter module are the same or two transformers may be used. If the numbers of the lamps and the transformers number the same, the first electrodes of the lamps are respectively connected to the output terminals at the high voltage level of the secondary sides of the corresponding transformers among the plurality of transformers within the inverter module, and the second electrodes of the lamps are directly connected to the other on the electrical basis. In addition, when two transformers are employed, the plurality of lamps are serially connected to allow the first electrodes of the most preceding lamp and finally succeeding lamp to be connected to the output terminals at the high voltage level of the secondary sides of two transformers.

[0157] Furthermore, the output terminals at the low voltage level of the secondary sides of the plurality of transformers are directly connected to the stabilizing circuit within the inverter module to supply the feedback current for stabilizing the current of the lamps to the stabilizing circuit. Also, when the plurality of lamps are serially connected, the AC signals supplied from the inverter module to the lamps are provided to have the phase difference of 180° in the lamps adjacent to each other. Unlike this, if the first electrodes of the plurality of lamps are respectively supplied with the driving signals from the corresponding transformers while the second electrodes are directly connected to each other, respective first electrodes of the plurality of lamps are supplied with the driving signals to have the phase difference of one period of the AC signals in the sine waveform, i.e., the value obtained by dividing 360° by the number of lamps.

[0158] As a result, respective second electrodes of the lamps are not required to extend to the stabilizing circuit of the inverter module for supplying the feedback current to the stabilizing circuit regardless of the number of lamps, thereby employing no RTNs.

[0159] Therefore, the wiring structure of the electrode lines of the lamps employed into the backlight assembly is simplified to reduce not only the size of the backlight assembly but also the manufacturing cost of the backlight assembly and LCD device.

[0160] While the present invention has been particularly shown and described with reference to particular embodiment thereof, it will be understood by those skilled in the art that various changes in form and details may be effected therein without departing from the spirit and scope of the invention as defined by the appended claims.

What is claimed is:

1. A backlight assembly, comprising:

a light source having a plurality of lamps and

a light controlling device that enhances luminance of light supplied from the light source,

wherein each of the plurality of lamps respectively have two electrodes, and the two electrodes include a first electrode directly connected to an electrode of at least one adjacent lamp and selectively have a second electrode that receives externally-provided driving signals.

2. The backlight assembly as claimed in claim 1, wherein the driving signals are a first driving signal and a second driving signal having phases different from each other.

3. The backlight assembly as claimed in claim 2, wherein the first driving signal and the second driving signal have a phase difference of 180° from each other.

4. The backlight assembly as claimed in claim 3, wherein the light source comprises at least two lamps connected to each other in series, and wherein electrodes of a most preceding lamp and a finally succeeding lamp receive the first driving signal and the second driving signal, respectively.

5. The backlight assembly as claimed in claim 2, further comprising a driver that converts an external power source of a DC component into an AC component, and generates the first driving signal and the second driving signal having the phase different from each other.

6. The backlight assembly as claimed in claim 5, wherein the driver is comprised of two transformers for respectively generating the first driving signal and the second driving signal.

7. The backlight assembly as claimed in claim 6, wherein the driver further comprises a stabilizing circuit stabilizes a current of the lamps.

8. The backlight assembly as claimed in claim 7, wherein low voltage sides of respective secondary sides of the two transformers are connected to the stabilizing circuit.

9. The backlight assembly as claimed in claim 8, wherein a feedback current for stabilizing the current of the lamps is supplied to the stabilizing circuit from the low voltage sides of the respective secondary sides of the transformers.

10. The backlight assembly as claimed in claim 1, wherein the driving signals are as many as the lamps.

11. The backlight assembly as claimed in claim 10, wherein the driving signals are comprised of at least N (where N is a constant no less than 2)-numbered driving signals respectively having different phases.

12. The backlight assembly as claimed in claim 11, wherein the N-numbered driving signals are provided to have a phase difference as many as a value obtained by dividing 360° by the number of the lamps.

13. The backlight assembly as claimed in claim 12, wherein a sum of respective phases of the N-numbered driving signals is zero.

14. The backlight assembly as claimed in claim 11, further comprising a driver that converts an external power source of a DC component into an AC component, and generates the N-numbered driving signals having phases respectively different from one another.

15. The backlight assembly as claimed in claim 14, wherein the driver is comprised of as many transformers as the lamps in the light source.

16. The backlight assembly as claimed in claim 14, further comprising a stabilizing circuit that stabilizes the current of the lamps.

17. The backlight assembly as claimed in claim 16, wherein low voltage sides of respective secondary sides of the transformers are connected to the stabilizing circuit.

18. The backlight assembly as claimed in claim 17, wherein a feedback current for stabilizing the current of the lamps is supplied to the stabilizing circuit from the low voltage sides of the respective secondary sides of the transformers.

19. A liquid crystal display device, comprising:

a backlight assembly having a light source with a plurality of lamps, and a light controlling device for enhancing luminance of light supplied from the light source; and

a display unit placed to an upper plane of the light controlling device, for receiving the light from the light source through the light controlling means and displaying an image,

wherein each of the lamps respectively have two electrodes, and the two electrodes include a first electrode directly connected to an electrode of at least one adjacent lamp and selectively have a second electrode that receives externally-provided driving signals.

20. The liquid crystal display device as claimed in claim 19, wherein the driving signals are a first driving signal and the second driving signal having a phase different from each other.

21. The liquid crystal display device as claimed in claim 20, wherein the first driving signal and the second driving signal have a phase difference of 180° from each other.

22. The liquid crystal display device as claimed in claim 21, wherein the light source includes at least two lamps connected to each other in series, and wherein electrodes of a most preceding lamp and a finally succeeding lamp receives the first driving signal and the second driving signal, respectively.

23. The liquid crystal display device as claimed in claim 20, further comprising a driver that converts an external power source of a DC component into an AC component, and generates the first driving signal and the second driving signal having the phase different from each other.

24. The liquid crystal display device as claimed in claim 23, wherein the driver is comprised of two transformers for respectively generating the first driving signal and the second driving signal.

25. The liquid crystal display device as claimed in claim 24, wherein the driver further comprises a stabilizing circuit that stabilizes a current of the lamps.

26. The liquid crystal display device as claimed in claim 25, wherein low voltage sides of respective secondary sides of the two transformers are connected to the stabilizing circuit.

27. The liquid crystal display device as claimed in claim 26, wherein a feedback current for stabilizing the current of the lamps is supplied to the stabilizing circuit from the low voltage sides of the respective secondary sides of the transformers.

28. The liquid crystal display device as claimed in claim 19, wherein the driving signals are as many as the lamps.

29. The liquid crystal display device as claimed in claim 28, wherein the driving signals are comprised of at least N (where N is a constant no less than 2)-numbered driving signals respectively having different phases.

30. The liquid crystal display device as claimed in claim 29, wherein the N-numbered driving signals are provided to have a phase difference as many as a value obtained by dividing 360° by the number of the lamps.

31. The liquid crystal display device as claimed in claim 30, wherein a sum of respective phases of the N-numbered driving signals is zero.

32. The liquid crystal display device as claimed in claim 28, further comprising a driver that converts an external power source of a DC component into an AC component, and generates the N-numbered driving signals having phases respectively different from one another.

33. The liquid crystal display device as claimed in claim 32, wherein the driver is comprised of as many transformers as the lamps in the light source.

34. The liquid crystal display device as claimed in claim 32, further comprising a stabilizing circuit that stabilize the current of the plurality of lamps.

35. The liquid crystal display device as claimed in claim 34, wherein low voltage sides of respective secondary sides of the transformers are connected to the stabilizing circuit.

36. The liquid crystal display device as claimed in claim 34, wherein a feedback current for stabilizing the current of the lamps is supplied to the stabilizing circuit from the low voltage sides of the respective secondary sides of the transformers.

37. The liquid crystal display device as claimed in claim 19, wherein the light source is placed to contact one end of the light controlling device.

38. The liquid crystal display device as claimed in claim 37, wherein the light controlling device is a wedge-type light guide plate that becomes thinner as advancing from a first end close to the light source to a second end opposing the first end.

39. The liquid crystal display device as claimed in claim 19, wherein the light source is placed to contact both ends of the light controlling means, and the light controlling device is an edge-type light guide plate that has the same thickness at both ends close to the light source.

40. The liquid crystal display device as claimed in claim 19, wherein the light source is placed to the lower portion of the light controlling means.

41. The liquid crystal display device as claimed in claim **40**, wherein the light controlling device is comprised of a plurality of optical sheets that makes the luminance of light supplied from the light source to the display unit consistent.

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专利名称(译)	背光组件和具有该背光组件的液晶显示装置		
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摘要(译)

用于为液晶显示（LCD）装置的背光组件提供光源的灯的电极线的连接被改进，以最小化LCD装置的尺寸，同时降低制造成本。 LCD装置包括：背光组件，具有由多个用于产生光的灯形成的发光单元;以及用于引导来自发光单元的光的光控制单元，以及放置在光控制单元的上平面用于接收的显示单元来自发光单元的光经由光控制单元显示图像。还提供驱动单元，用于将DC分量的外部电源转换为AC分量，以将具有分别彼此不同的相位的第一和第二驱动信号提供给发光单元。多个灯分别具有两个电极，这两个电极包括直接连接到至少一个相邻灯的电极的第一电极，并且选择性地具有提供有外部提供的驱动信号的第二电极。因此，简化了多个灯的电极线的布线，以减小背光组件和LCD装置的尺寸，同时降低制造成本。