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PROVISIONAL APPLICATION FOR PATENT COVER SHEET - Page 1 of 2

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53 (c).

Express Mail Label No. EB 618524923 US

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Additional inventors are being named on the _____ separately numbered sheets attached hereto

TITLE OF THE INVENTION (500 characters max)

MULTI-VOLTAGE AND MULTI-POWER AC LED CIRCUITS AND DEVICES

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ENCLOSED APPLICATION PARTS (check all that apply)

☐ Application Data Sheet. See 37 CFR 1.76

☒ Drawing(s) Number of Sheets 21

☐ CD(s), Number of CDs _____

☒ Specification (e.g. description of the invention) Number of Pages 9

☐ Other (specify) _____

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☒ Applicant claims small entity status. See 37 CFR 1.27.

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\$110

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SIGNATURE _____

Date 5/28/2008

TYPED or PRINTED NAME MIKE MISKIN

REGISTRATION NO. _____

(if appropriate)

TELEPHONE 847-783-0123 _____

Docket Number: PO052809-1 _____

MULTI-VOLTAGE AND MULTI-POWER AC LED CIRCUITS AND DEVICES

RELATED APPLICATIONS

[Para 1]

TECHNICAL FIELD

[Para 2] The present invention generally relates to light emitting diodes ("LEDs") for AC operation. The present invention specifically relates to multiple voltage level AC driven light emitting diode circuits, devices and packages.

FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

[Para 3] None.

BACKGROUND OF THE INVENTION

[Para 4] 1. Field of the Invention

[Para 5] The present invention generally relates to light emitting diodes ("LEDs") for AC operation. The present invention specifically relates to multiple AC voltage driven light emitting diode circuits, devices and packages. This invention comprises multiple AC voltage "multi-voltage" single chip AC LED and multiple chip "multi-chip" AC LED circuits and LED packages that are adaptable to multiple AC voltage level operation.

[Para 6] 2. Description of the Related Art

[Para 7] LEDs are semiconductor devices that produce light when a current is supplied to them. LEDs are intrinsically DC devices that only pass current in one polarity and historically have been driven by DC voltage sources using resistors, current regulators and voltage regulators to limit the voltage and current delivered to the LED. Some LEDs have resistors built into the LED package providing a higher voltage LED typically driven with 5V DC or 12V DC.

[Para 8] With proper design considerations LEDs may be driven more efficiently with AC than with DC drive schemes. AC LED based lighting may be used for general lighting, specialty lighting, signs and decoration such as for Christmas tree lighting. For example,

[Para 9] Patent application number US2004/0080941 entitled Light Emitting Diodes For High AC Voltage Operation And General Lighting discloses that a plurality of opposing parallel series strings of LEDs can be integrated into a single chip and driven with high voltage low frequency mains AC power sources as long as there are enough LEDs in each opposing parallel series string of LEDs to drop the total source voltage across the series LEDs within the chip. Patent numbers WO2004023568 and JP2004006582 disclose that a plurality of opposing parallel series strings or opposing parallel series matrix of LEDs can be integrated into a single chip and mounted on an insulating substrate and driven with a high drive voltage and low drive current as long as there are enough LEDs in each opposing parallel series string of LEDs to drop the total source voltage across the series LEDs within the chip. These patents and application disclose that for single chip or packaged LED circuits a plurality of opposing parallel series strings are required with the total number of LEDs in each series string needing to be equal to or greater than the AC voltage source in order to drop the total forward voltage and provide the required drive current when driven direct with low frequency AC mains power sources. This LED circuit is also designed for operation over only one voltage level. The voltage levels for the general lighting infrastructure vary throughout the world.

[Para 10] Some of these voltages include 12VAC, 24VAC, 100VAC, 110VAC, 120VAC 220VAC, 230VAC, 240VAC and 277VAC. Therefore, it would be advantageous to have a single chip LED or multi-chip single package LED that could be easily configured to operate at multiple voltages by simply selecting a soldering and/or wiring scheme in production, in the field and/or in the finished product.

[Para 11] The present invention addresses the above-noted shortcomings of the prior art while providing additional benefits and advantages

SUMMARY OF THE INVENTION

According to one broad aspect of the invention a single chip multi-voltage AC LED is provided having at least two LED circuits. Each LED circuit has at least two diodes connected to each other in opposing parallel relation, at least one of which such diodes is an LED thus forming an AC LED circuit that is integrated on a single chip. Each LED circuit is designed to be driven with the same matching forward voltage such as 12VAC, 24VAC, 120VAC, or other AC voltages level. Each multi-voltage single chip would be designed to operate on two different forward voltages that typically would comprise a first forward voltage drive level and a second forward voltage drive level that is twice the forward voltage drive level of the first forward voltage drive level. The multi-voltage single chip AC LED would therefore have

example forward voltage operating values of 12VAC and 24VAC "12/24VAC", 120VAC and 240VAC "120/240VAC" and other commercially useful multi-voltage values. Each multi-voltage single chip AC LED device and/or package can then be configured to connect the at least two circuits in parallel to match the first forward voltage drive level or in series to match the second forward voltage drive level of the multi-voltage single chip AC LED. The multi-voltage single chip AC LED is integrated into an LED package and pre-wired within the AC LED package or wired externally of the AC LED package at the circuit board or other assembly process based on the requirement of when the multi-voltage single chip AC LED needs to be configured to the specific drive voltage level.

[Para 12] According to another broad aspect of the invention a multi-chip multi-voltage AC LED device and/or package is provided having at least two LED circuits. Each LED circuit has at least two diodes connected to each other in opposing parallel relation, at least one of which such diodes is an LED thus forming an AC LED circuit that is integrated within a single multi-voltage AC LED package. Each LED circuit is designed to be driven with the same matching forward voltage such as 12VAC, 24VAC, 120VAC, or other AC voltages level. Each multi-chip multi-voltage AC LED device and/or package would be designed to operate on two different forward voltages that typically would comprise a first forward voltage drive level and a second forward voltage drive level that is twice the forward voltage drive level of the first forward voltage drive level. The multi-chip multi-voltage AC LED device and/or package would therefore have example forward voltage operating values of 12VAC and 24VAC "12/24VAC", 120VAC and 240VAC "120/240VAC" and other commercially useful multi-voltage values. Each multi-chip multi-voltage AC LED device and/or package can then be configured to connect the at least two circuits in parallel to match the first forward voltage drive level or in series to match the second forward voltage drive level of the multi-voltage single chip AC LED. Each multi-chip multi voltage AC LED package can be mounted onto a printed circuit board assembly and/or other substrate and electrically configured to be driven at the first or second forward drive voltage level desired and provided by the multi-chip multi voltage AC LED package.

[Para 13] According to another broad aspect of the invention a multi-brightness single chip AC LED is provided having at least two LED circuits. Each LED circuit has at least two diodes connected to each other in opposing parallel relation, at least one of which such diodes is an LED thus forming an AC LED circuit that is integrated on a single chip. Each LED circuit within the multi-brightness single chip AC LED is designed to be driven in parallel with the same matching forward voltage such as 12VAC, 24VAC, 120VAC, or other AC voltages level. Each multi-brightness single chip AC LED is designed to operate on

at least one single circuit integrated within the multi-brightness single chip AC LED. The multi-brightness single chip AC LED operates on a switch having at least two positions each of which is connected to at least one circuit within the multi-brightness single chip AC LED.

[Para 14] It should be noted that “package” or “packaged” is defined herein as an integrated unit meant to be used as a discrete component in either of the manufacture, assembly, installation, or modification of an LED lighting device or system. Such a package includes LED’s of desired characteristics with capacitors and or resistors sized relative to the specifications of the chosen opposing parallel LED’s to which they will be connected in series and with respect to a predetermined AC voltage and frequency.

[Para 15] Preferred embodiments of a package may include an insulating substrate whereon the LEDs, capacitors and or resistors are formed or mounted. In such preferred embodiments of a package the substrate will include electrodes or leads for uniform connection of the package to a device or system associated with an AC driver or power source. The electrodes, leads, and uniform connection may include any currently known means including mechanical fit, and/or soldering. The substrate may be such as sapphire, silicon carbide, gallium nitride, ceramics, printed circuit board material, or other materials for hosting circuit components.

[Para 16] A package in certain applications may preferably also include a heat sink, a reflective material, a lens for directing light, phosphor, nano-crystals or other light changing or enhancing substances. In sum, according to one aspect of the invention, the LED circuits and AC drivers of the present invention permit pre-packaging of the LED portion of a lighting system to be used with standardized drivers of known specified voltage and frequency output. Such packages can be of varied make up and can be combined with each other to create desired systems given the scalable and compatible arrangements possible with, and resulting from, the invention.

[Para 17] According to one aspect of the invention, AC driven LED circuits (or “driven circuits”) permit or enable lighting systems where LED circuits may be added to or subtracted (either by choice or by way of a failure of a diode) from the driven circuit without significantly affecting the pre-determined desired output range of light from any individual LED and, without the need to: (i) change the value of any discrete component; or, (ii) to add or subtract any discrete components, of any of the pre-existing driven circuit components which remain after the change. During design of a lighting system, one attribute of the LEDs chosen will be the amount of light provided during operation. In this context, it should be understood that depending on the operating parameters of the driver chosen, the stability or range of the voltage and frequency of the driver will vary from the nominal specification based upon

various factors including but not limited to, the addition or subtraction of the LED circuits to which it becomes connected or disconnected. Accordingly, as sometimes referred to herein, drivers according to the invention are described as providing “relatively constant” or “fixed” voltage and frequency. The extent of this relative range may be considered in light of the acceptable range of light output desired from the resulting circuit at the before, during, or after a change has been made to the lighting system as a whole. Thus it will be expected that a pre-determined range of desired light output will be determined within which the driven LED circuits of the invention will perform whether or not additional or different LED circuits have been added or taken out of the driven circuit as a whole.

[Para 18] According to an aspect of the invention, an LED circuit driver provides a relatively fixed voltage and relatively fixed frequency AC output such as mains power sources. The LED circuit driver output voltage and frequency delivered to the LED circuit may be higher or lower than mains power voltage and frequencies by using an LED circuit inverter driver.

[Para 19] The higher frequency LED circuit inverter driver may be a electronic transformer, halogen or high intensity discharge (HID) lamp type driver with design modifications for providing a relatively fixed voltage as the LED circuit load changes. Meaning if the LED circuit inverter driver is designed to have an output voltage of 12V LED circuit driver would provide this output as a relatively constant output to a load having one or more than one LED circuits up to the wattage limit of the LED circuit driver even if LED circuits were added to or removed from the output of the LED circuit driver.

[Para 20] The higher frequency inverter having a relatively fixed voltage allows for smaller components to be used and provides a known output providing a standard reference High Frequency LED circuit driver.

[Para 21] Prior art for single chip LED circuits, for example those disclosed in O2004023568 and JP2004006582 do not provide a way to reduce the number of LEDs within the chip below the total forward voltage drop requirements of the source. The present invention however, enables an LED circuit to be made with any number of LEDs within a single chip, package or module by using capacitors or RC networks to reduce the number of LEDs needed to as few as one single LED. Improved reliability, integration, product and system scalability and solid state lighting design simplicity may be realized with LED circuits and the LED circuit drivers. Individual LED circuits being the same or different colors, each requiring different forward voltages and currents may be driven from a single source LED circuit driver. Each individual LED circuit can self-regulate current by matching the capacitor or RC network value of the LED circuit to the known relatively fixed voltage and frequency of the LED circuit driver whether the LED circuit driver is a mains power source, a high frequency LED circuit driver or other LED circuit driver

capable of providing a relatively fixed voltage and relatively fixed frequency output.

[Para 22] According to other aspects of the invention, the LED circuit driver may be coupled to a dimmer switch that regulates voltage or frequency or may have integrated circuitry that allows for adjustability of the otherwise relatively fixed voltage and/or relatively fixed frequency output of the LED circuit driver. The LED circuits get brighter as the voltage and/or frequency of the LED circuit driver output is increased to the LED circuits.

BRIEF DESCRIPTION OF THE DRAWINGS

- [Para 23]** Figure 1 shows a schematic view of a preferred embodiment of the invention;
 - [Para 24]** Figure 2 shows a schematic view of a preferred embodiment of the invention;
 - [Para 25]** Figure 3 shows a schematic view of a preferred embodiment of the invention;
 - [Para 26]** Figure 4 shows a schematic view of a preferred embodiment of the invention;
 - [Para 27]** Figure 5 shows a schematic view of a preferred embodiment of the invention;
 - [Para 28]** Figure 6 shows a schematic view of a preferred embodiment of the invention;
 - [Para 29]** Figure 7 shows a schematic view of a preferred embodiment of the invention;
 - [Para 30]** Figure 8 shows a schematic view of a preferred embodiment of the invention;
 - [Para 31]** Figure 9 shows a schematic view of a preferred embodiment of the invention;
 - [Para 32]** Figure 10 shows a schematic view of a preferred embodiment of the invention;
 - [Para 33]** Figure 11 shows a schematic view of a preferred embodiment of the invention;
 - [Para 34]** Figure 12 shows a schematic view of a preferred embodiment of the invention;
 - [Para 35]** Figure 13 shows a schematic view of a preferred embodiment of the invention;
 - [Para 36]** Figure 14 shows a schematic view of a preferred embodiment of the invention;
 - [Para 37]** Figure 15 shows a schematic view of a preferred embodiment of the invention;
 - [Para 38]** Figure 16 shows a schematic view of a preferred embodiment of the invention;
 - [Para 39]** Figure 17 shows a schematic view of a preferred embodiment of the invention;
 - [Para 40]** Figure 18 shows a schematic view of a preferred embodiment of the invention;
 - [Para 41]** Figure 19 shows a schematic view of a preferred embodiment of the invention;
 - [Para 42]** Figure 20 shows a schematic view of a preferred embodiment of the invention;
- and,
- [Para 43]** Figure 21 shows a schematic view of a preferred embodiment of the invention;

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[Para 44] Figure 1 discloses a schematic diagram of a light emitting device 10 for an AC

CLAIMS

What is claimed is:

1. An AC LED Lighting Device Comprising:

According to one broad aspect of the invention a single chip multi-voltage AC LED is provided having at least two LED circuits. Each LED circuit has at least two diodes connected to each other in opposing parallel relation, at least one of which such diodes is an LED thus forming an AC LED circuit that is integrated on a single chip. Each LED circuit is designed to be driven with the same matching forward voltage such as 12VAC, 24VAC, 120VAC, or other AC voltages level. Each multi-voltage single chip would be designed to operate on two different forward voltages that typically would comprise a first forward voltage drive level and a second forward voltage drive level that is twice the forward voltage drive level of the first forward voltage drive level. The multi-voltage single chip AC LED would therefore have example forward voltage operating values of 12VAC and 24VAC "12/24VAC", 120VAC and 240VAC "120/240VAC" and other commercially useful multi-voltage values. Each multi-voltage single chip AC LED device and/or package can then be configured to connect the at least two circuits in parallel to match the first forward voltage drive level or in series to match the second forward voltage drive level of the multi-voltage single chip AC LED. The multi-voltage single chip AC LED is integrated into an LED package and pre-wired within the AC LED package or wired externally of the AC LED package at the circuit board or other assembly process based on the requirement of when the multi-voltage single chip AC LED needs to be configured to the specific drive voltage level.

[Para 45] According to another broad aspect of the invention a multi-chip multi-voltage AC LED device and/or package is provided having at least two LED circuits. Each LED circuit has at least two diodes connected to each other in opposing parallel relation, at least one of which such diodes is an LED thus forming an AC LED circuit that is integrated within a single multi-voltage AC LED package. Each LED circuit is designed to be driven with the same matching forward voltage such as 12VAC, 24VAC, 120VAC, or other AC voltages level. Each multi-chip multi-voltage AC LED device and/or package would be designed to operate on two different forward voltages that typically would comprise a first forward voltage drive level and a second forward voltage drive level that is twice the forward voltage drive level of the first forward voltage drive level. The multi-chip multi-voltage AC LED device and/or package would therefore have example forward voltage operating values of 12VAC and 24VAC "12/24VAC",

120VAC and 240VAC "120/240VAC" and other commercially useful multi-voltage values. Each multi-chip multi-voltage AC LED device and/or package can then be configured to connect the at least two circuits in parallel to match the first forward voltage drive level or in series to match the second forward voltage drive level of the multi-voltage single chip AC LED. Each multi-chip multi voltage AC LED package can be mounted onto a printed circuit board assembly and/or other substrate and electrically configured to be driven at the first or second forward drive voltage level desired and provided by the multi-chip multi voltage AC LED package.

According to another broad aspect of the invention a multi-brightness single chip AC LED is provided having at least two LED circuits. Each LED circuit has at least two diodes connected to each other in opposing parallel relation, at least one of which such diodes is an LED thus forming an AC LED circuit that is integrated on a single chip. Each LED circuit within the multi-brightness single chip AC LED is designed to be driven in parallel with the same matching forward voltage such as 12VAC, 24VAC, 120VAC, or other AC voltages level. Each multi-brightness single chip AC LED is designed to operate on at least one single circuit integrated within the multi-brightness single chip AC LED. The multi-brightness single chip AC LED operates on a switch having at least two positions each of which is connected to at least one circuit within the multi-brightness single chip AC LED.

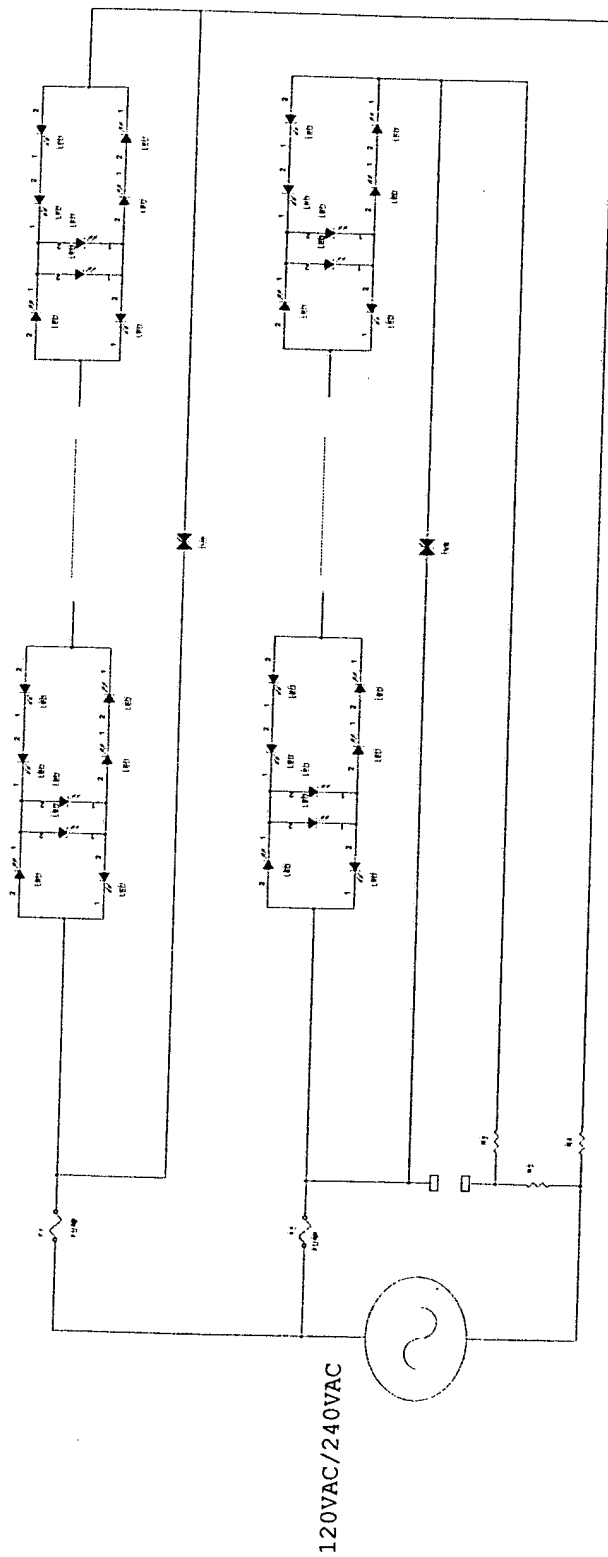


Fig. 1

FOR 120 VAC - LEAVE R1 OPEN. USE 0 OHM
 FOR R3 AND USE REQUIRED VALUES FOR R2
 AND R4. USE BOTH F1 AND F2.

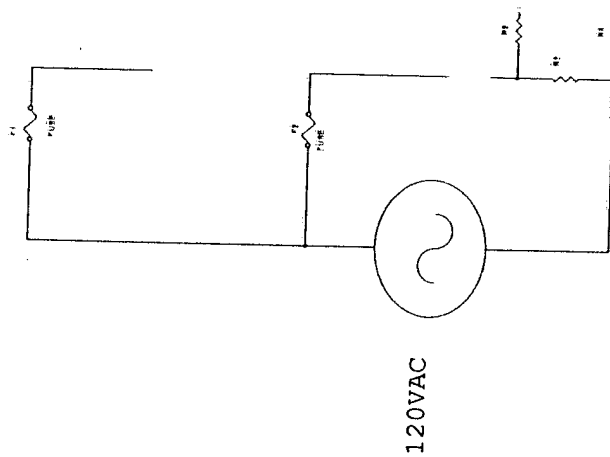


Fig. 2

FOR 240 VAC - LEAVE R3 OPEN. USE 0 OHM
 FOR R1 AND USE REQUIRED VALUES FOR R2
 AND R4. USE ONLY F1 AND LEAVE F2 OPEN.

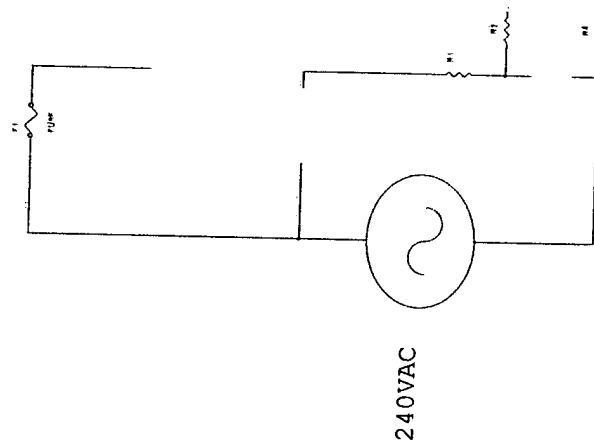


Fig. 3

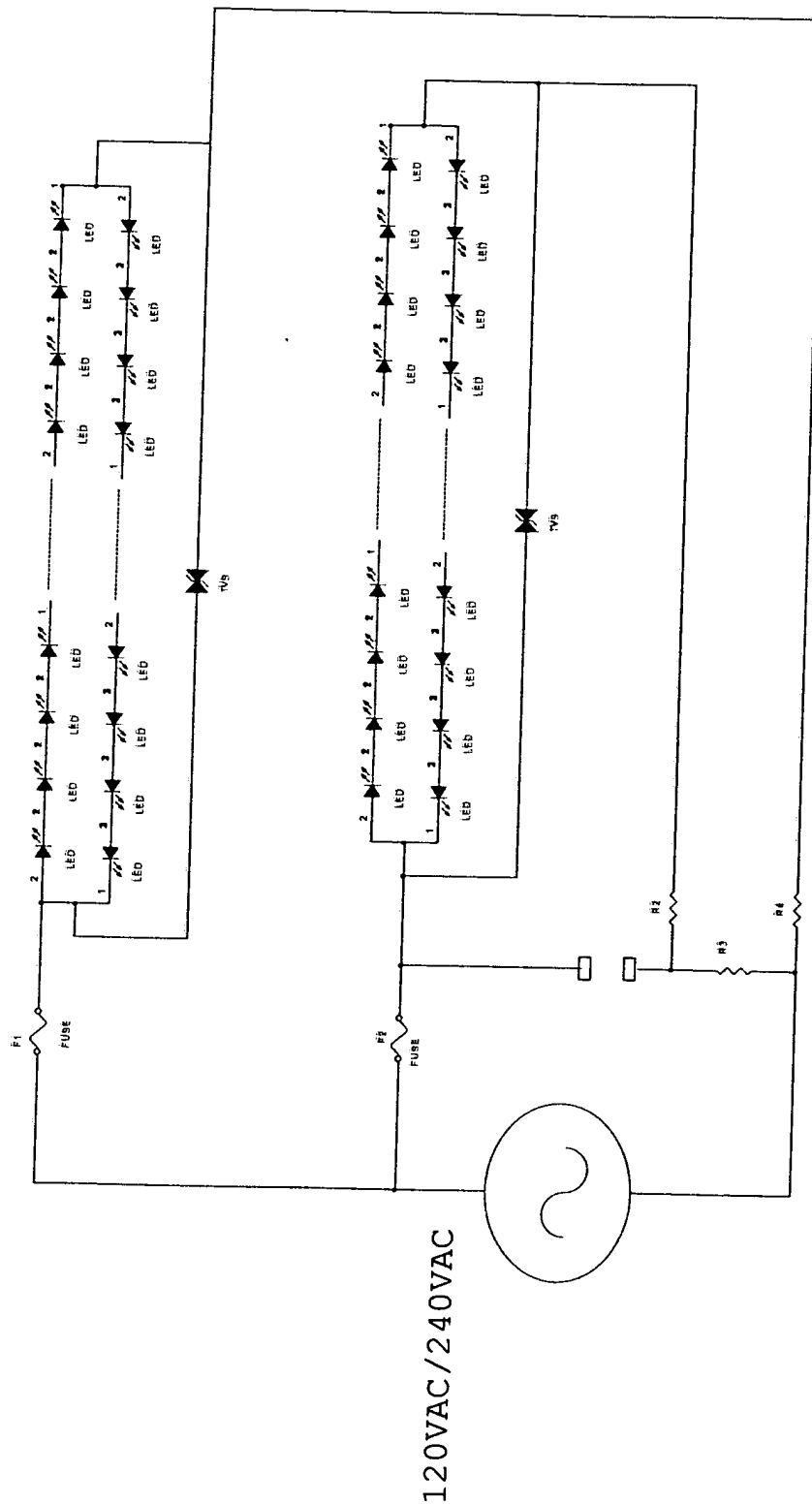


Fig. 4

120/240 VAC SINGLE CHIP

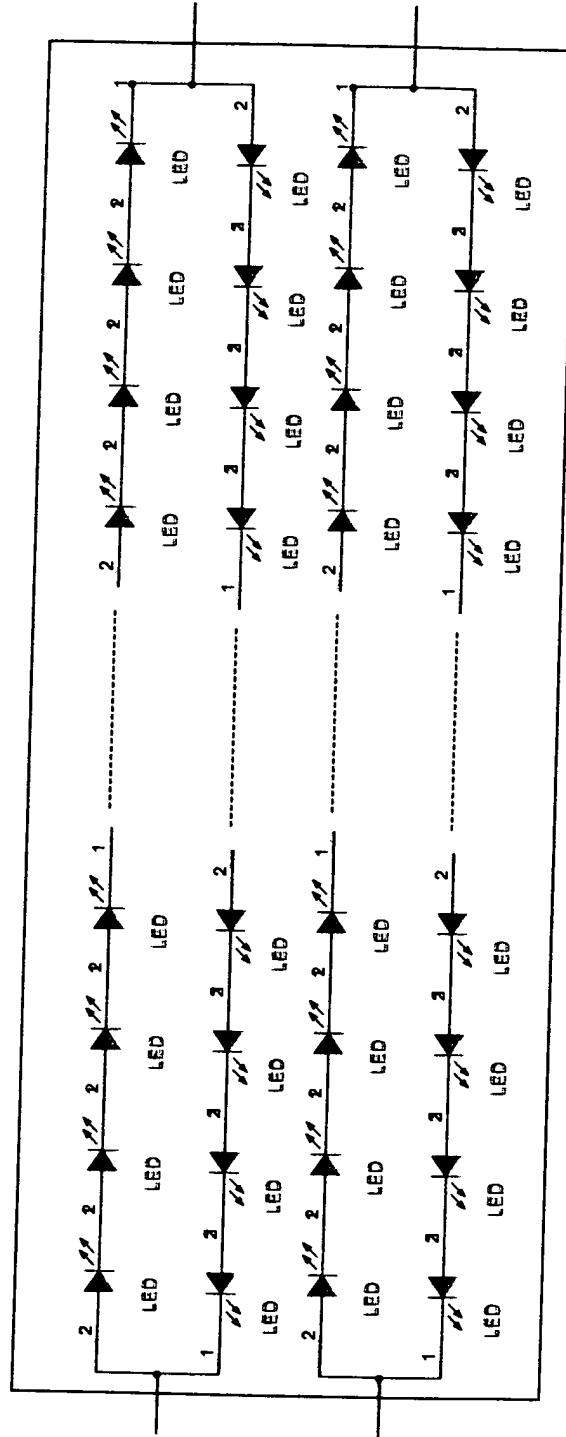


Fig. 5

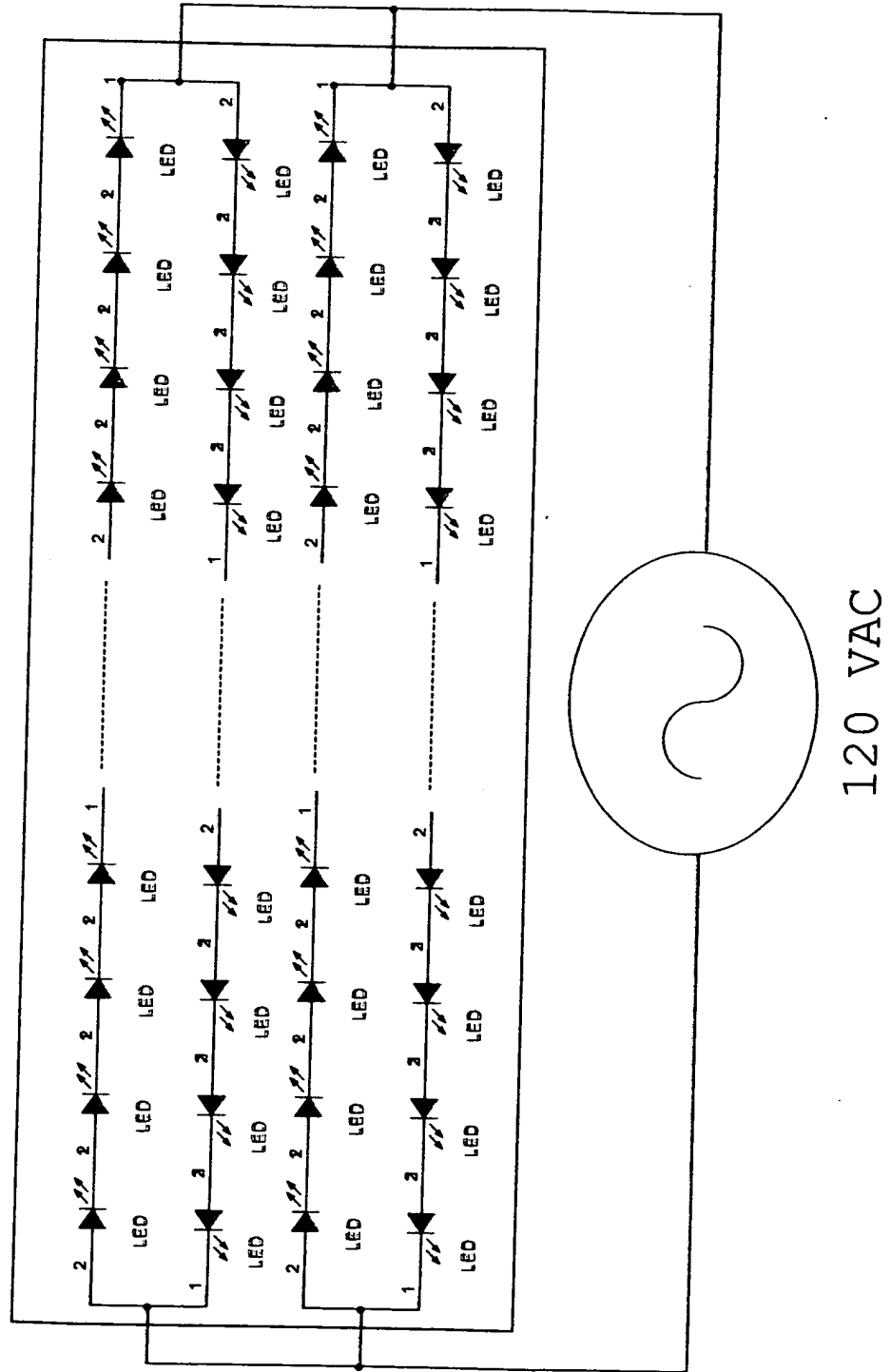


Fig. 6

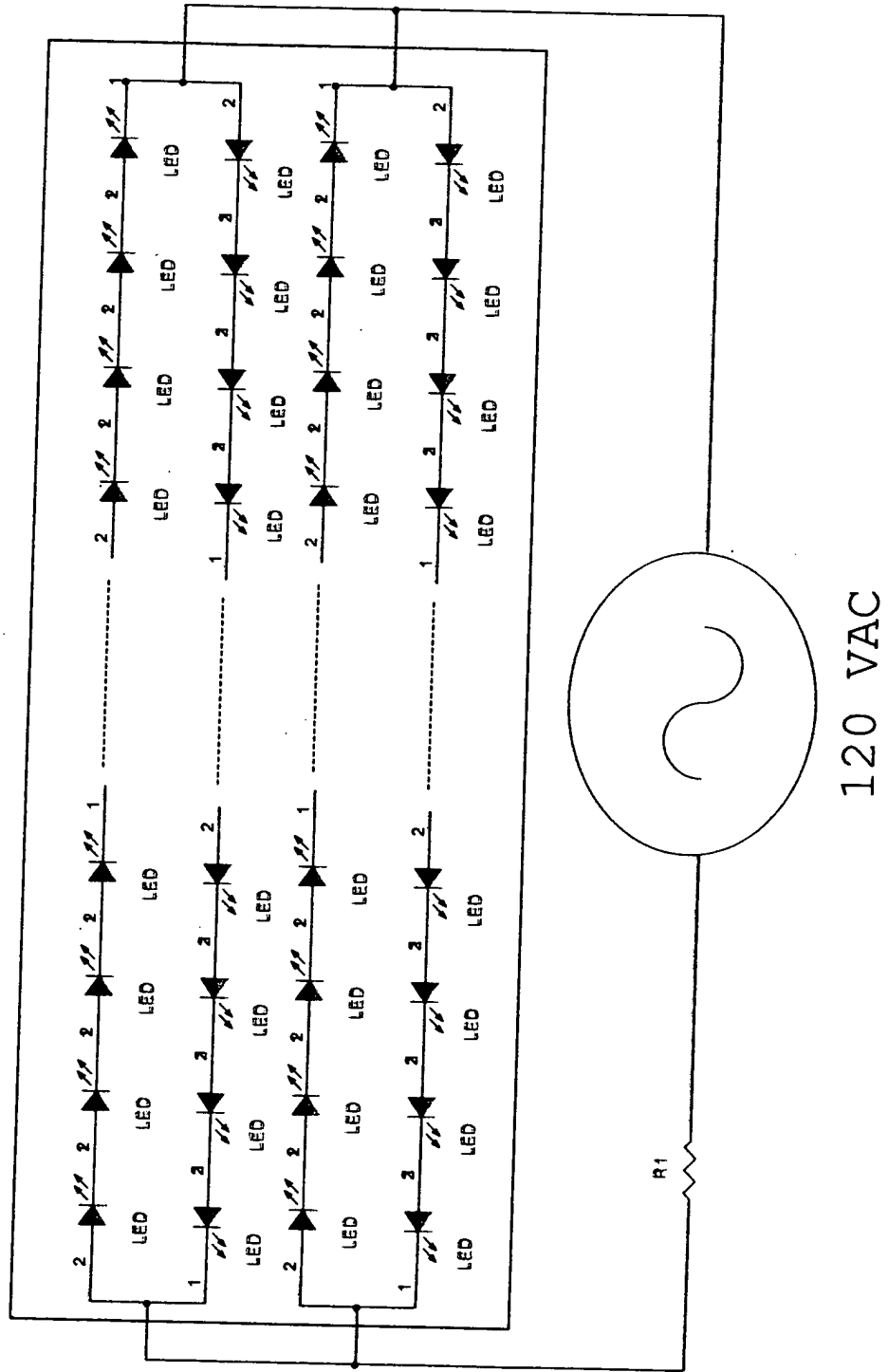


Fig. 7

120/240 VAC SINGLE CHIP

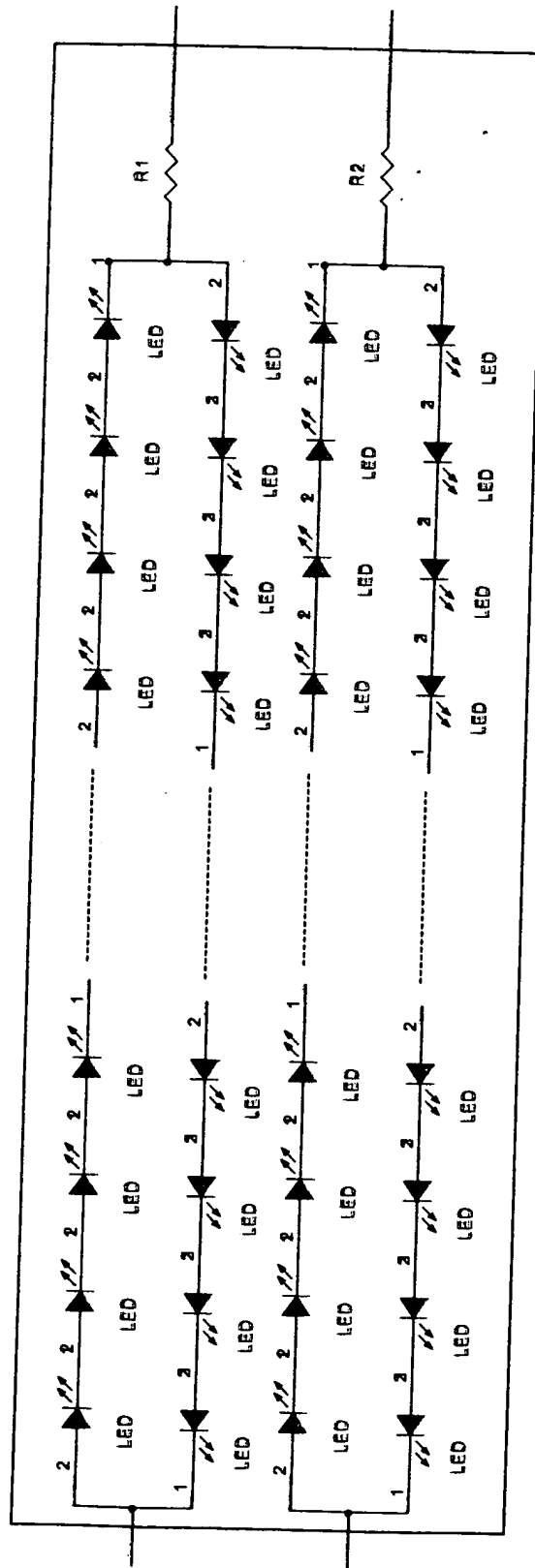


Fig. 8

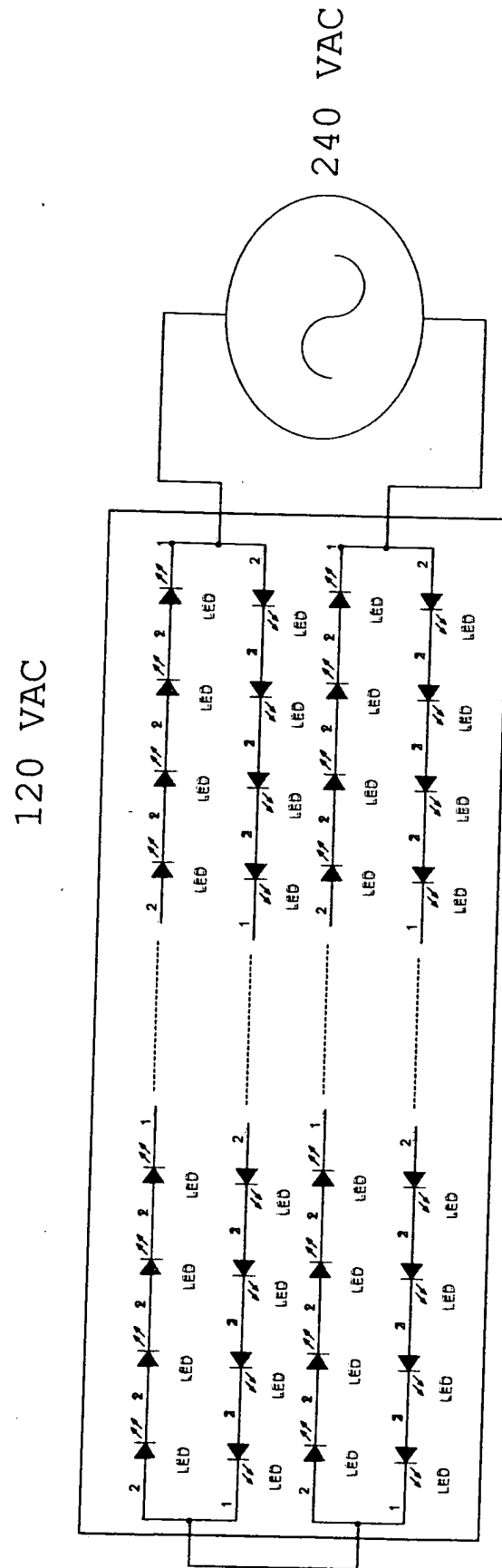


Fig. 9

2-WAY SINGLE CHIP AC LED FOR 2-WAY BULB

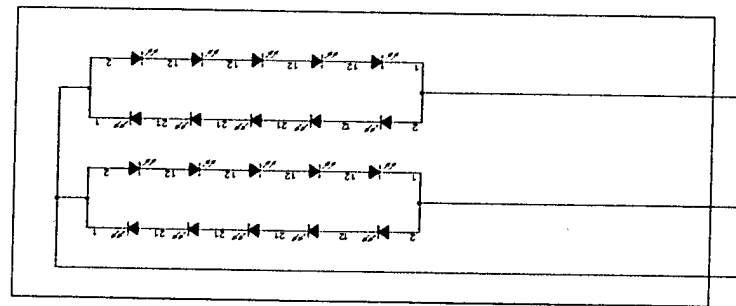


Fig. 10

3-WAY SINGLE CHIP AC LED FOR 3-WAY BULB

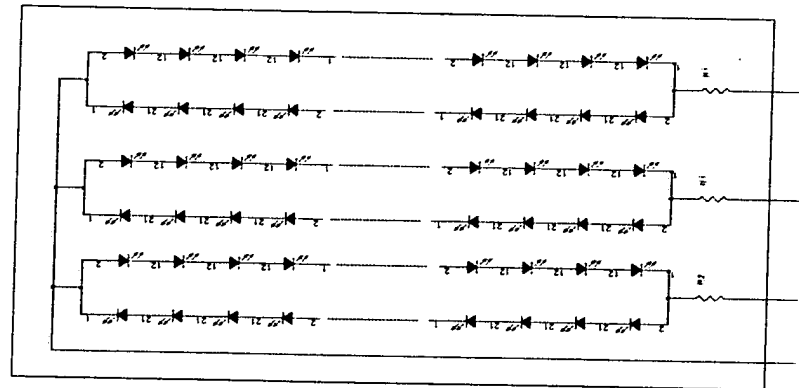


Fig. 11

2-WAY SINGLE CHIP AC LED FOR 2-WAY BULB

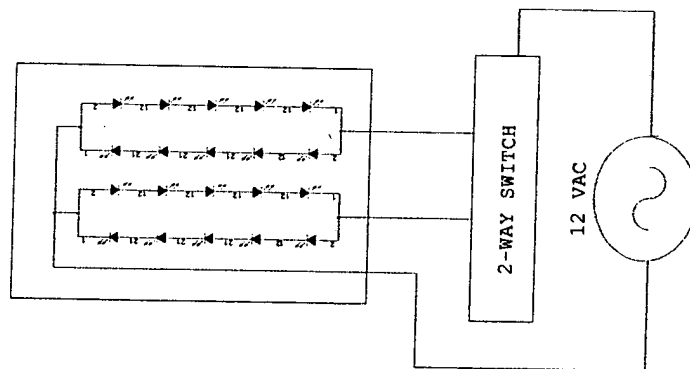


Fig. 12

2-WAY SINGLE CHIP 12V AC LED FOR 2-WAY BULB

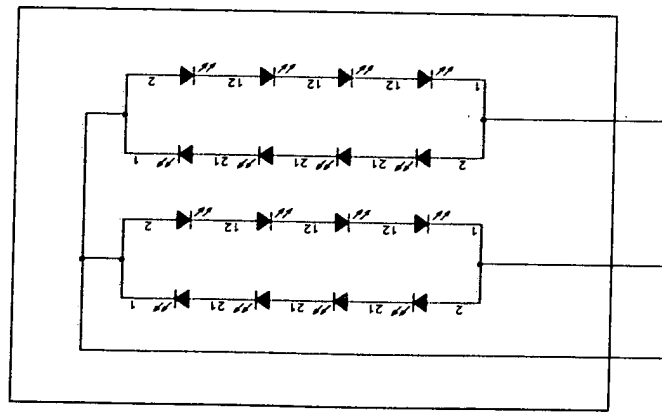
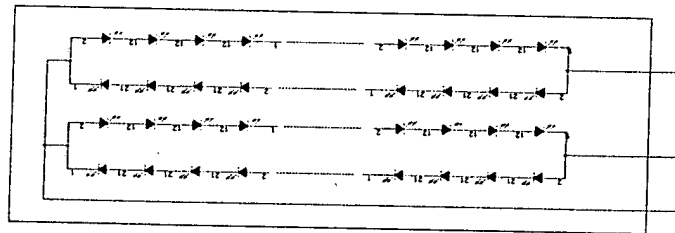


Fig. 13



2-WAY SINGLE CHIP 120V AC LED FOR 2-WAY BULB

Fig. 14

3-WAY SINGLE CHIP AC LED FOR 3-WAY BULB

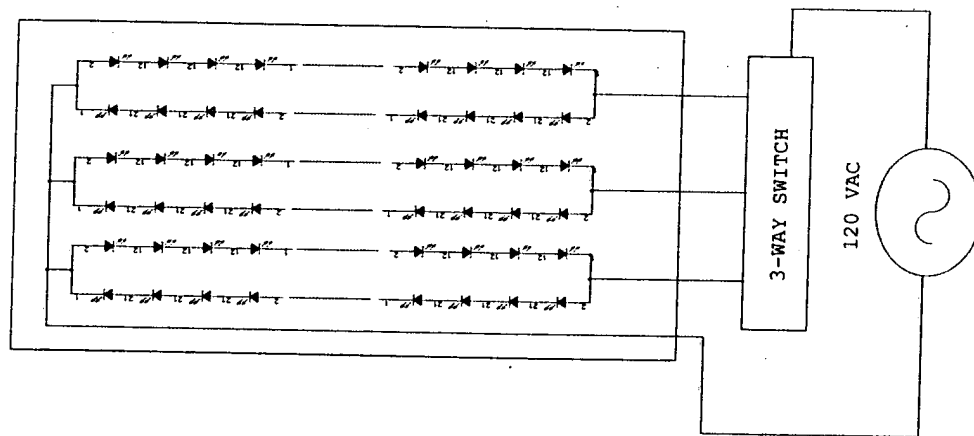


Fig. 15

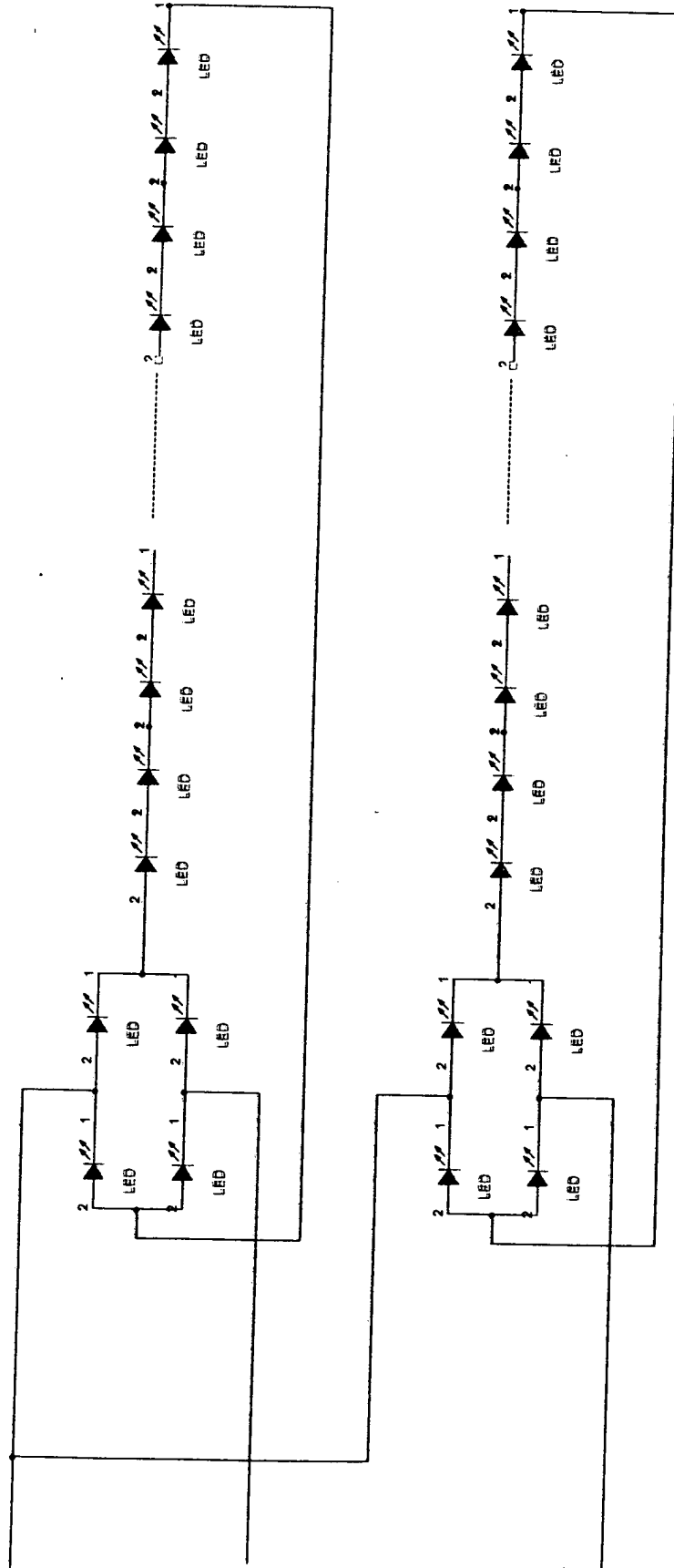


Fig. 16

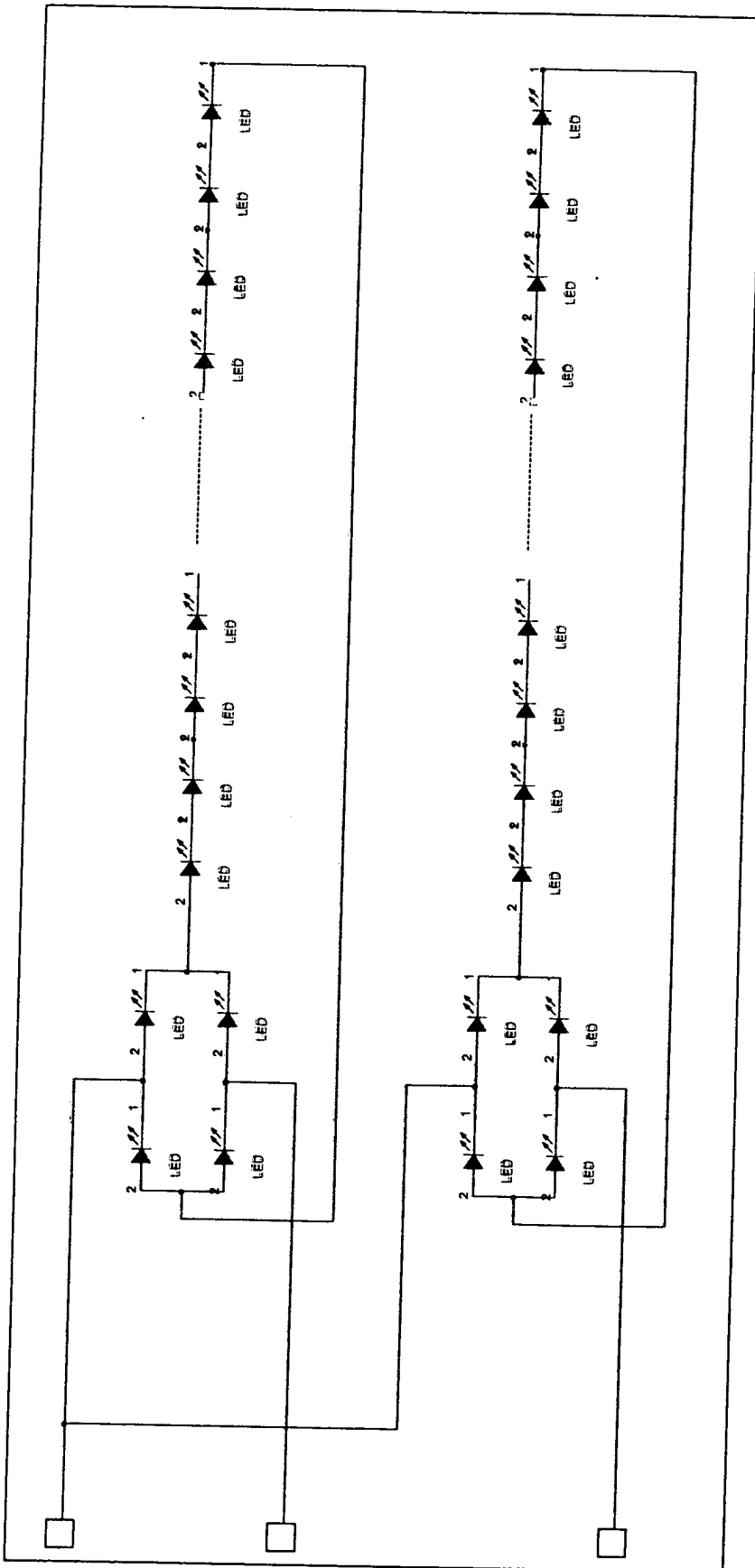


Fig. 17

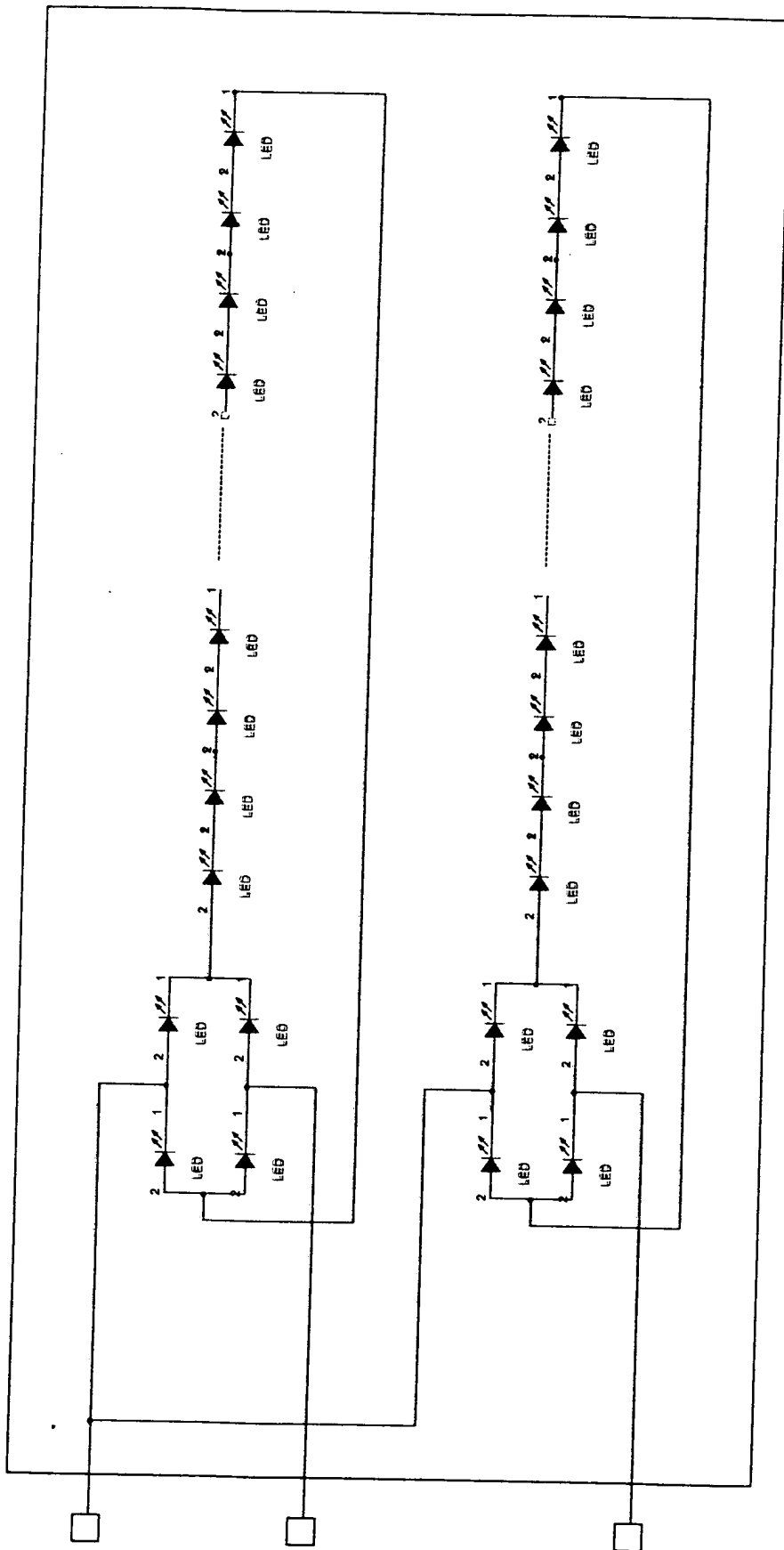


Fig. 18

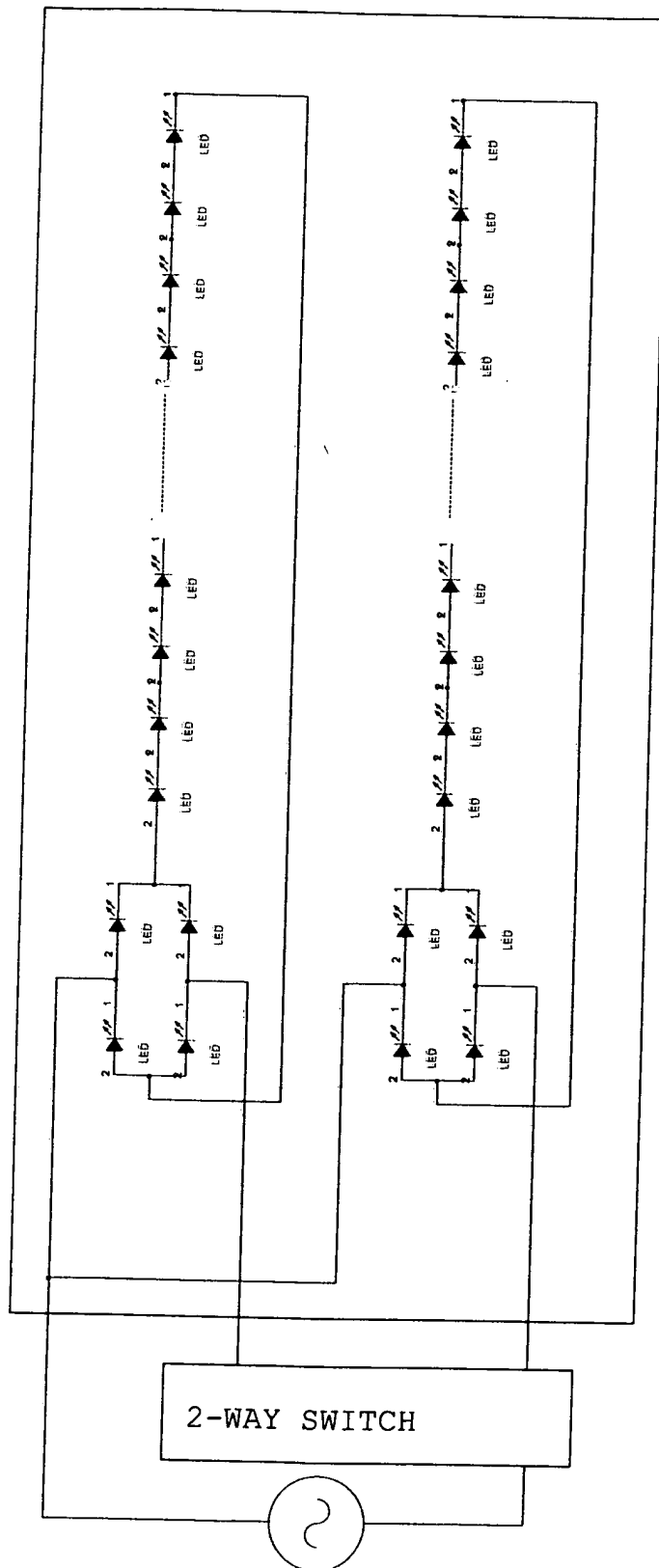
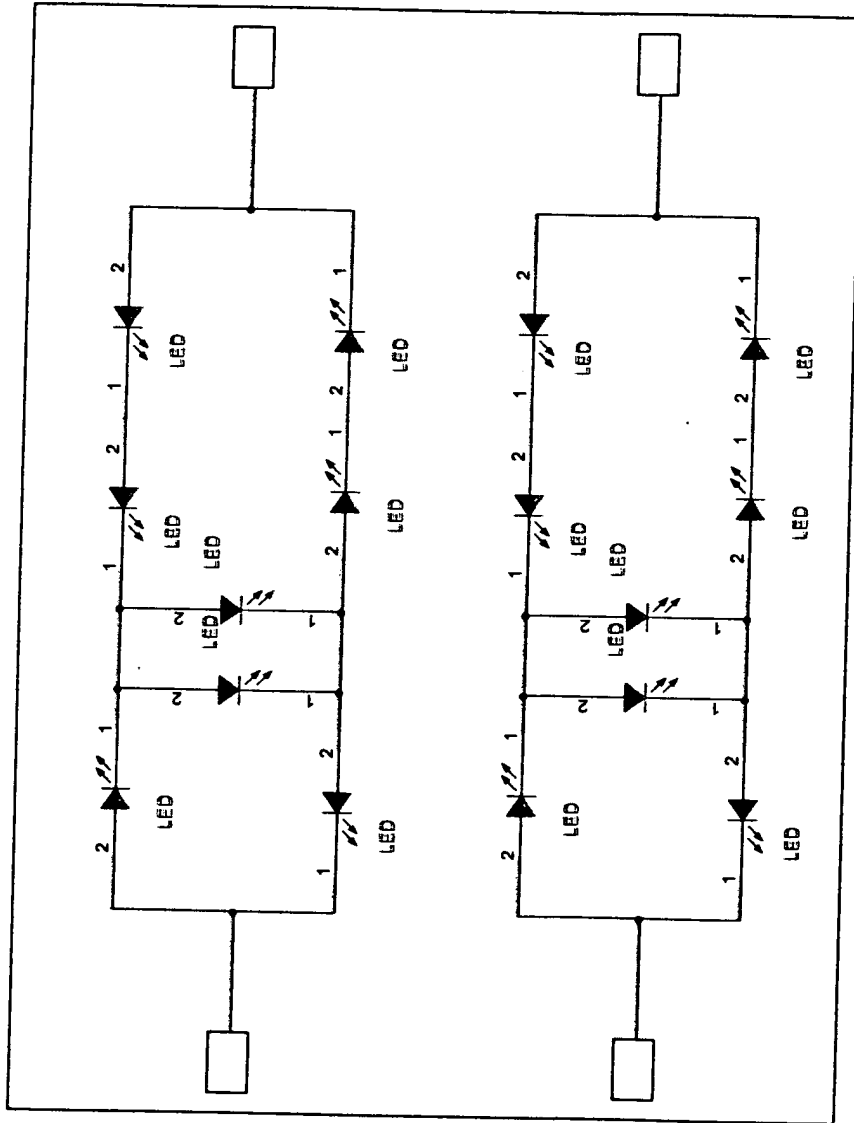


Fig. 19



12/24 VAC
SINGLE CHIP

Fig. 20

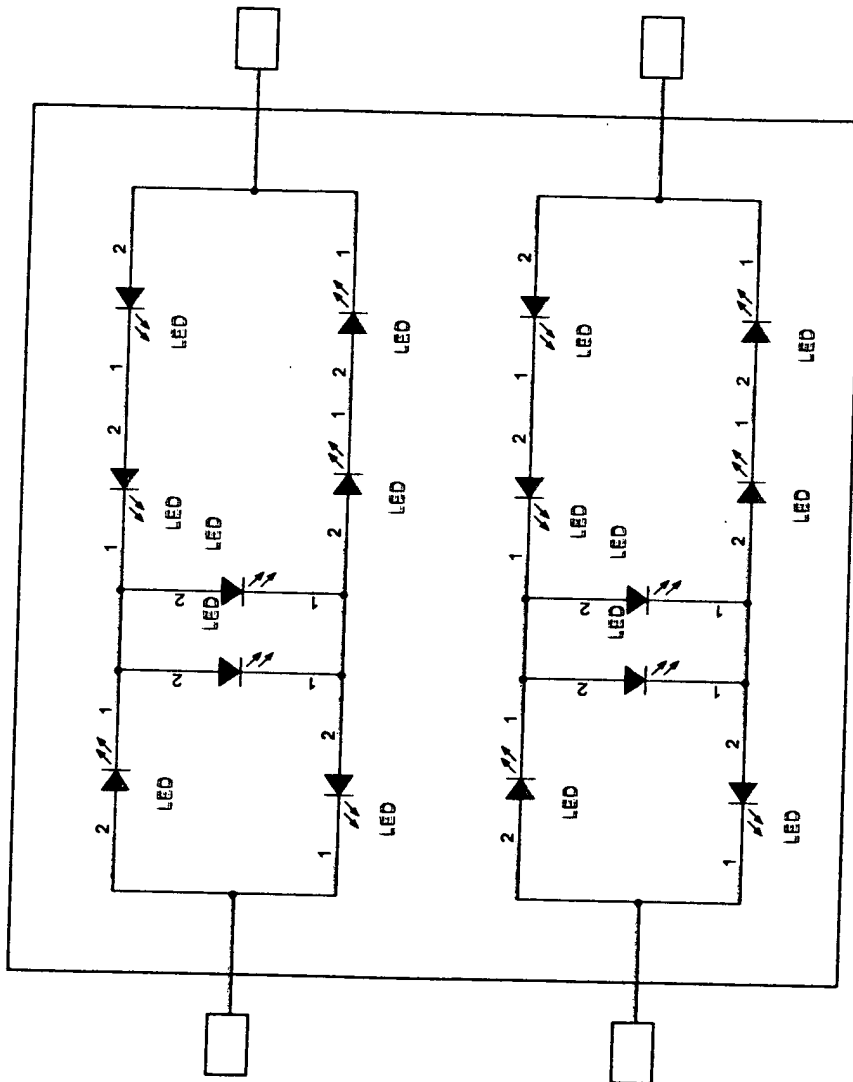


Fig. 21