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(54) **FLUORESCENT LAMP ASSEMBLY HAVING MULTIPLE SETTINGS AND METHOD**

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(22) Filed: **Mar. 31, 2011**

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Filed: **Nov. 21, 2007**

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See application file for complete search history.

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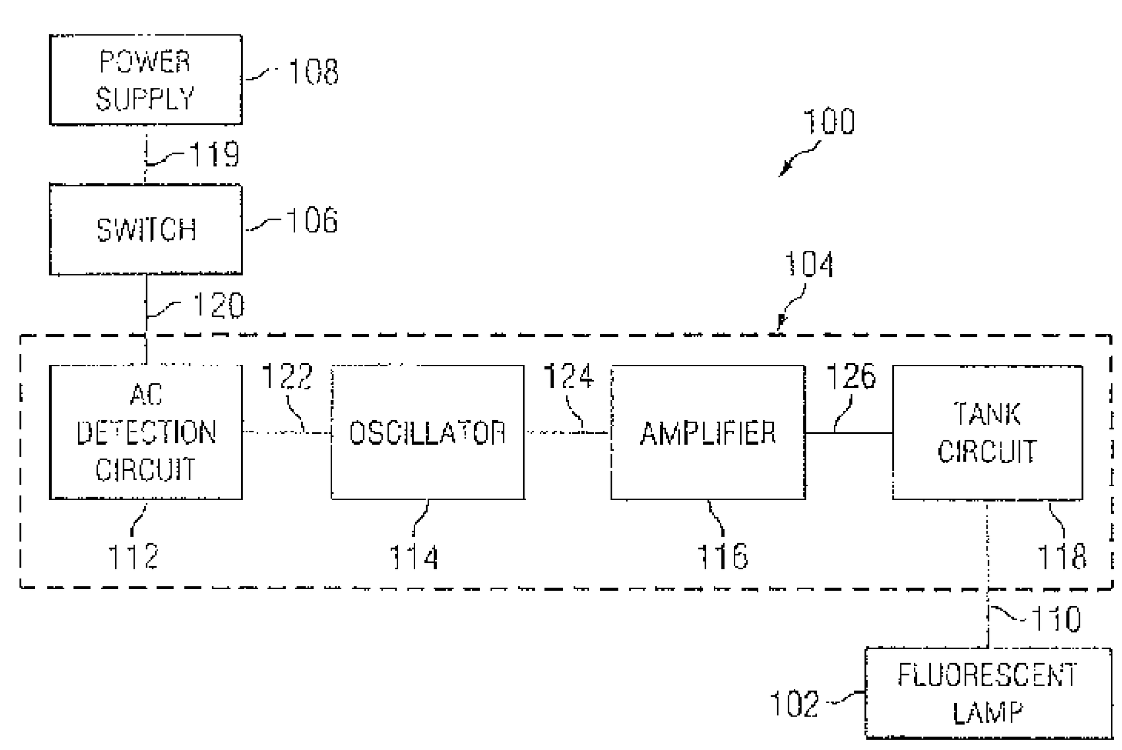
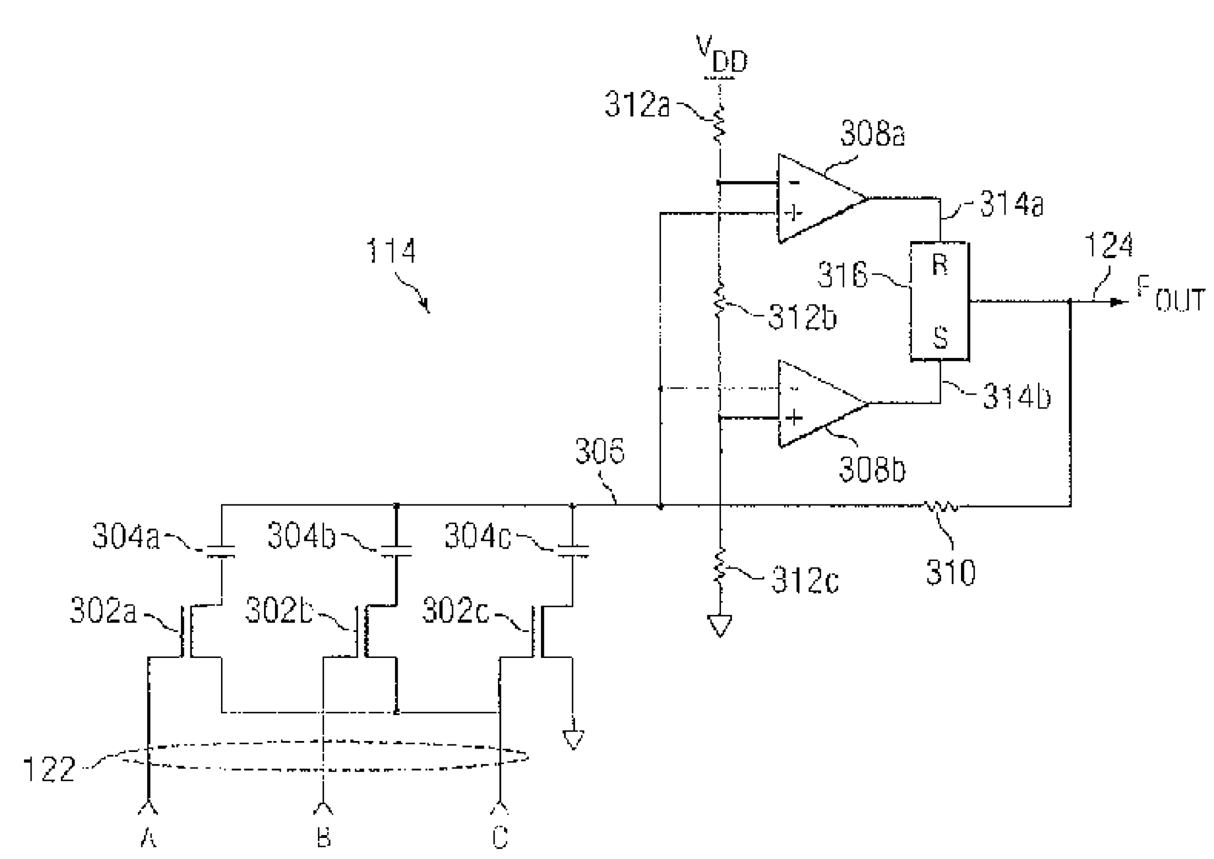
(57) **ABSTRACT**

A fluorescent lamp assembly includes a fluorescent lamp ballast capable of detecting at least one of a plurality of input signals and generating an output signal. The output signal is associated with a power level that is based on the at least one detected input signal. The fluorescent lamp assembly also includes a fluorescent lamp capable of receiving the output signal and generating light. An intensity of the light is based on the power level associated with the output signal.

20 Claims, 2 Drawing Sheets





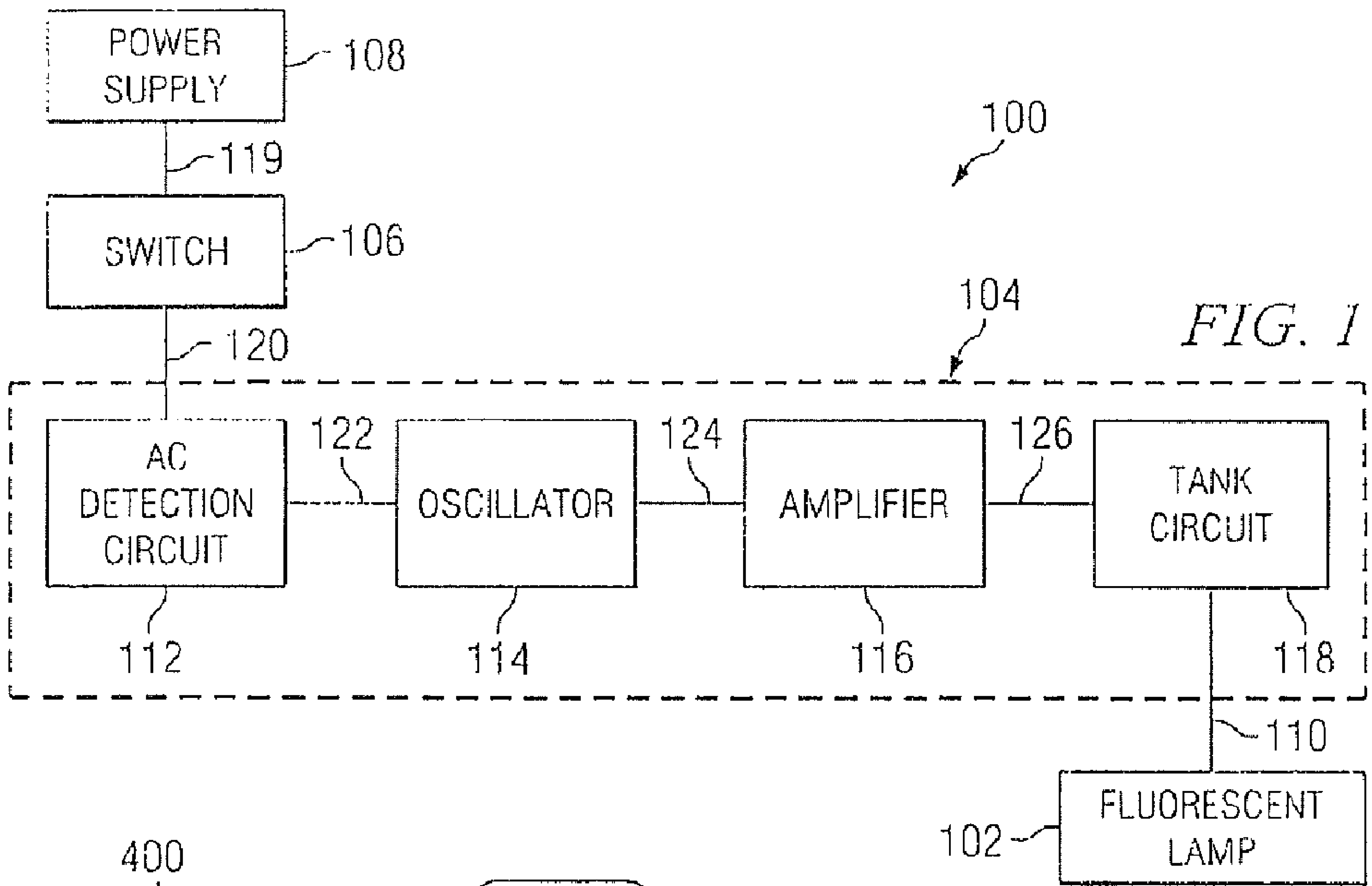

POWER SUPPLY
108
119
SWITCH
106
100
104
120
AC DETECTION CIRCUIT
122
OSCILLATOR
124
AMPLIFIER
126
TANK CIRCUIT
112
114
116
118
110
FLUORESCENT LAMP
102

FIG. 1

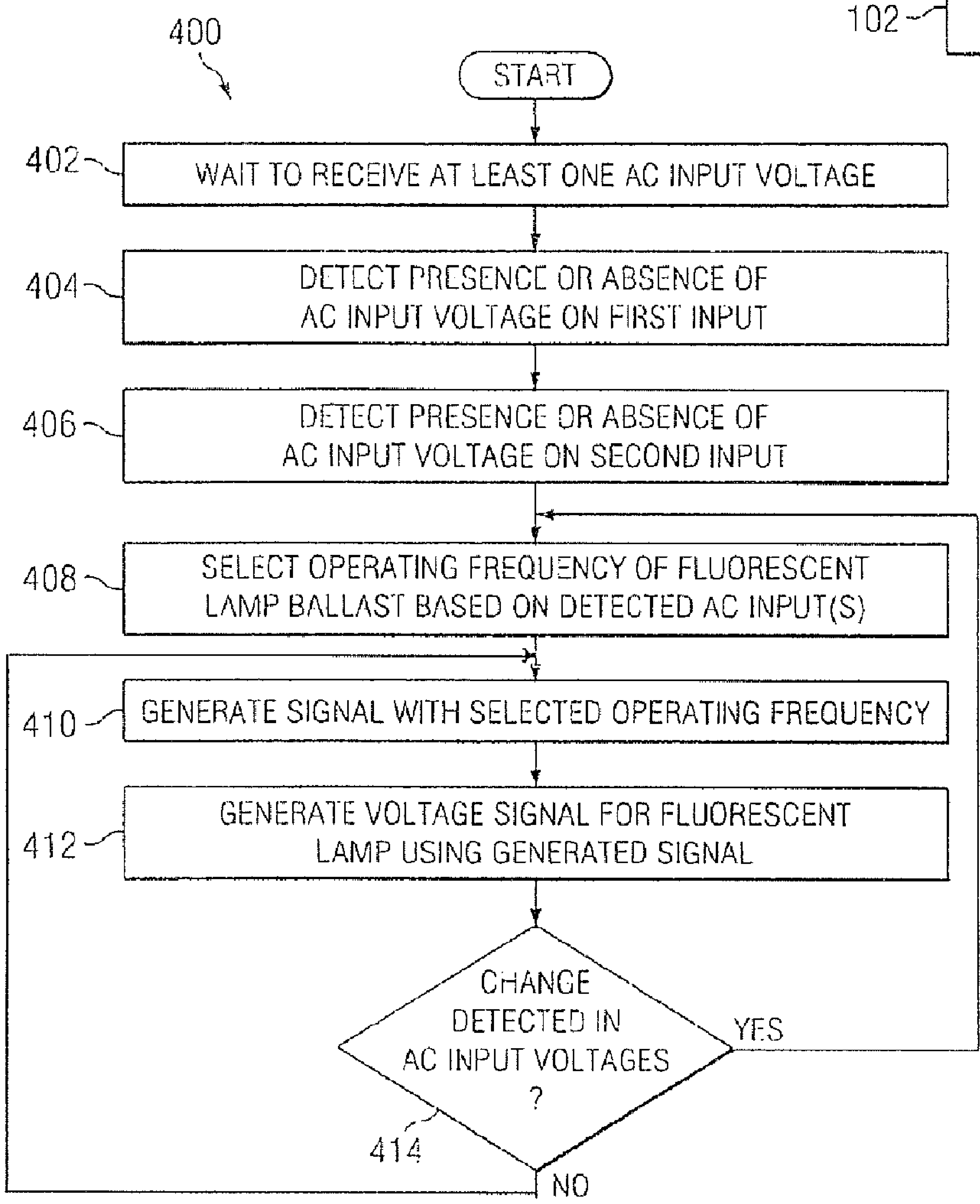
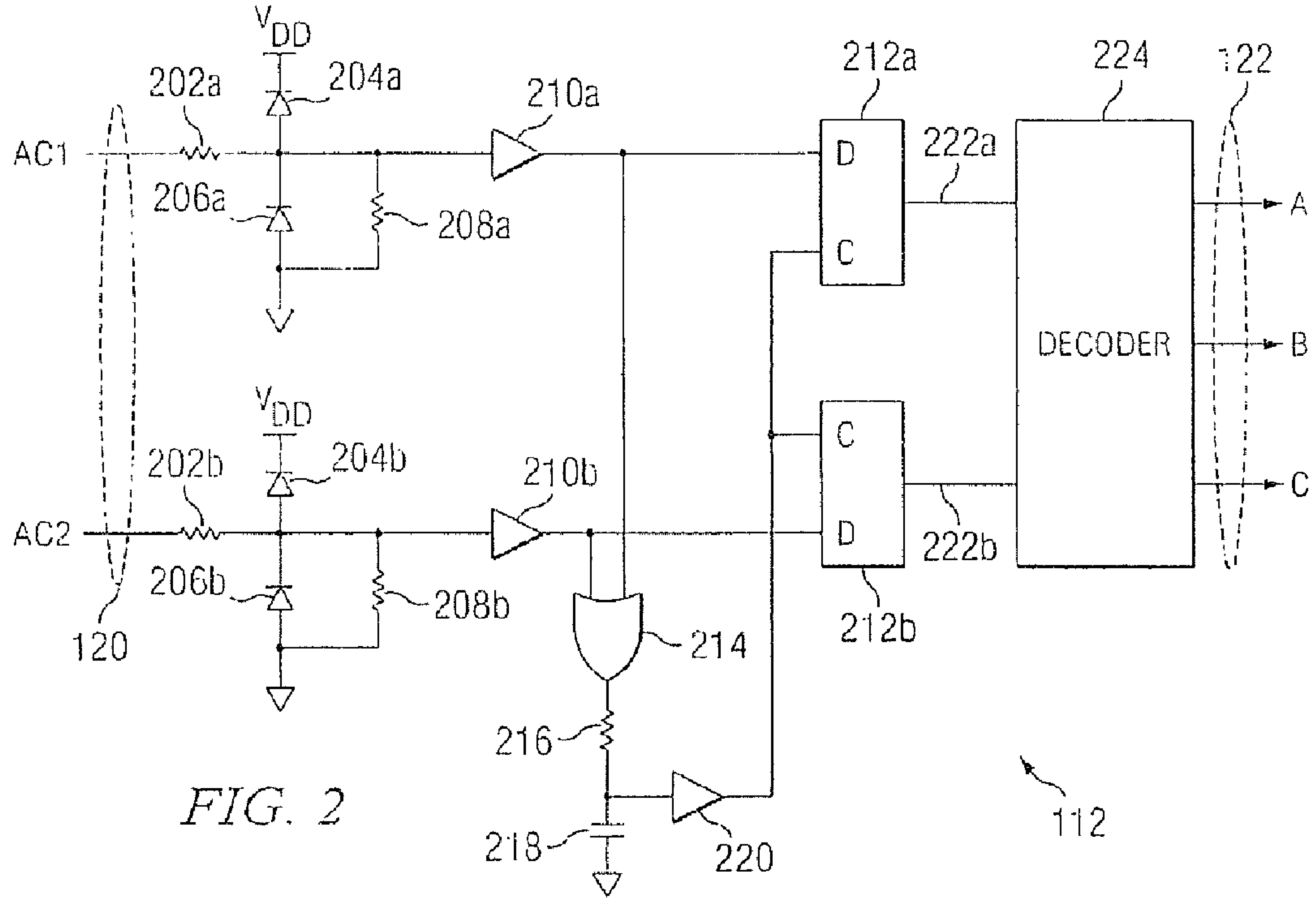
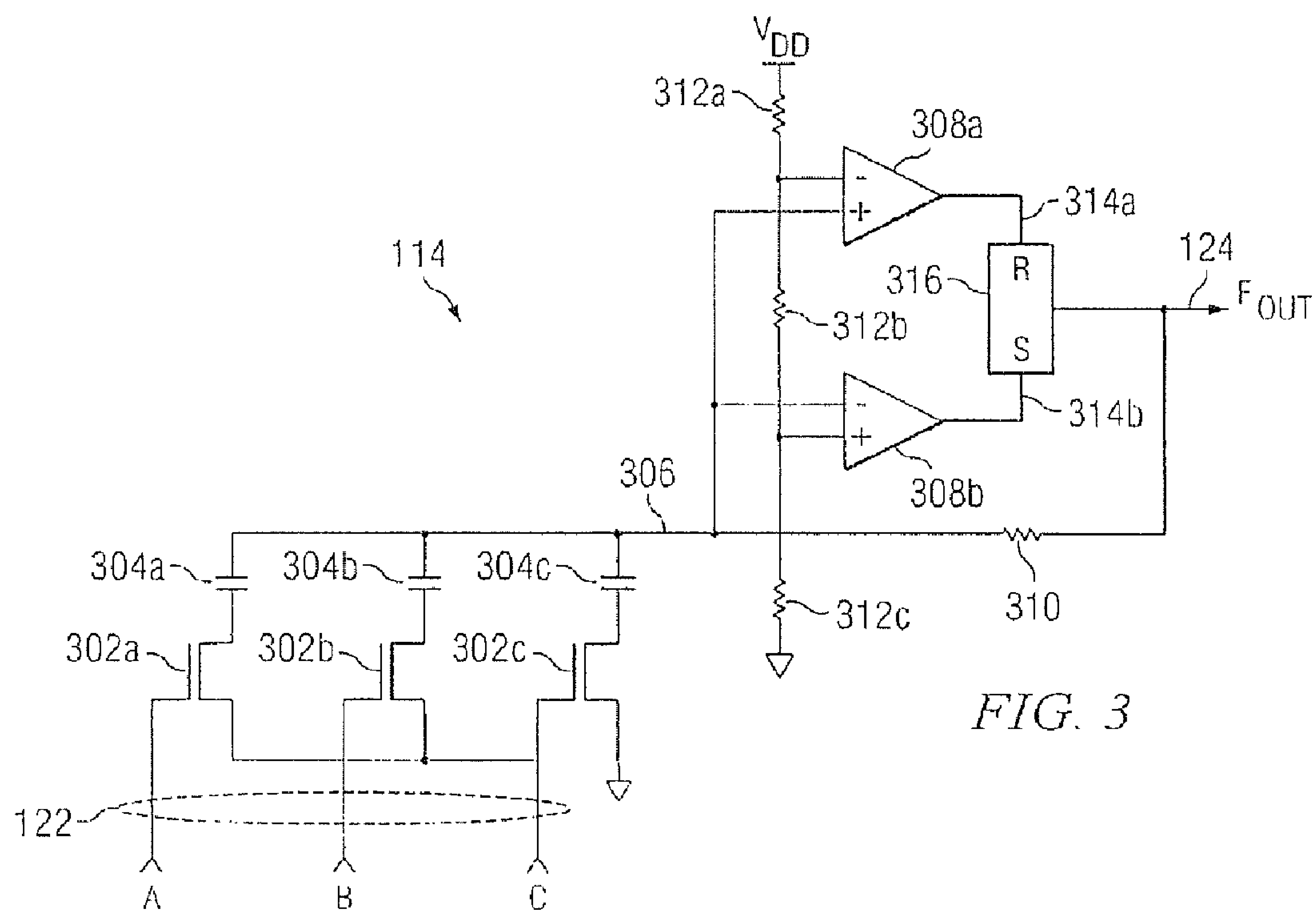

400
START
402
WAIT TO RECEIVE AT LEAST ONE AC INPUT VOLTAGE
404
DETECT PRESENCE OR ABSENCE OF AC INPUT VOLTAGE ON FIRST INPUT
406
DETECT PRESENCE OR ABSENCE OF AC INPUT VOLTAGE ON SECOND INPUT
408
SELECT OPERATING FREQUENCY OF FLUORESCENT LAMP BALLAST BASED ON DETECTED AC INPUT(S)
410
GENERATE SIGNAL WITH SELECTED OPERATING FREQUENCY
412
GENERATE VOLTAGE SIGNAL FOR FLUORESCENT LAMP USING GENERATED SIGNAL
CHANGE DETECTED IN AC INPUT VOLTAGES ?
YES
414
NO

FIG. 4



VDD
202a
204a
210a
212a
224
122
AC1
206a
208a
222a
D
C
DECODER
A
B
C
VDD
202b
204b
210b
AC2
206b
208b
222b
212b
120
214
216
218
220
112

FIG. 2



VDD
312a
308a
314a
114
316
R
S
124
FOUT
312b
314b
308b
306
304a
304b
304c
310
312c
302a
302b
302c
122
A
B
C

FIG. 3

FLUORESCENT LAMP ASSEMBLY HAVING MULTIPLE SETTINGS AND METHOD

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

This application is a divisional of prior U.S. patent application Ser. No. 11/059,955 filed on Feb. 17, 2005 now U.S. Pat. No. 7,323,823.

TECHNICAL FIELD

This disclosure is generally directed to fluorescent lighting systems and more specifically to a fluorescent lamp assembly having multiple settings and method.

BACKGROUND

Incandescent light bulbs or lamps are often capable of producing different levels of illumination. For example, conventional three-way incandescent lamps are often capable of producing light at three different intensities. As a specific example, conventional three-way incandescent lamps typically include two different filaments, such as a fifty watt filament and a one hundred watt filament. A conventional three-way incandescent lamp is typically inserted into a base structure that includes two switches, each switch capable of connecting one of the filaments to a power supply. Different combinations of opened and/or closed switches may produce light outputs of fifty watts from the first filament, one hundred watts from the second filament, or one hundred fifty watts from both filaments.

This type of base structure is typically not suited for use with conventional fluorescent lamps. Typical fluorescent lamp bases or "ballasts" operate by rectifying alternating current ("AC") inputs and then using a high frequency inverter to drive fluorescent tubes. As a result, a conventional base structure that uses different switches to connect a fluorescent lamp to a power supply would be incapable of altering the light intensity produced by the fluorescent lamp. This is due to the fact that the AC inputs would be rectified and the same inverter would drive the fluorescent lamp regardless of the switch settings.

SUMMARY

This disclosure provides a fluorescent lamp assembly having multiple settings and method.

In one aspect, a fluorescent lamp assembly includes a fluorescent lamp ballast capable of detecting at least one of a plurality of input signals and generating an output signal. The output signal is associated with a power level that is based on the at least one detected input signal. The fluorescent lamp assembly also includes a fluorescent lamp capable of receiving the output signal and generating light. An intensity of the light is based on the power level associated with the output signal.

In another aspect, a fluorescent lamp ballast includes a detector capable of detecting at least one of a plurality of input signals. The fluorescent lamp ballast also includes an oscillator capable of generating a signal having a frequency based on the at least one detected input signal. The fluorescent lamp ballast further includes an amplifier capable of amplifying the signal generated by the oscillator to produce an amplified signal. In addition, the fluorescent lamp ballast includes a tank circuit capable of generating an output signal using the amplified signal and providing the output signal to a fluorescent lamp. The output signal is associated with a power level that is based on the frequency of the amplified signal. The fluorescent lamp is capable of receiving the output signal and generating light, where an intensity of the light is based on the power level associated with the output signal.

In yet another aspect, a method includes detecting at least one of a plurality of input signals at a fluorescent lamp ballast. The method also includes selecting an operating frequency of the fluorescent lamp ballast based on the at least one detected input signal. In addition, the method includes providing power to a fluorescent lamp based on the operating frequency of the fluorescent lamp ballast. The fluorescent lamp is capable of generating light having an intensity that is based on the power provided to the fluorescent lamp.

Other technical features may be readily apparent to one skilled in the art from the following figures, descriptions, and claims.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of this disclosure and its features, reference is now made to the following description, taken in conjunction with the accompanying drawings, in which:

FIG. **1** illustrates an example fluorescent lamp assembly having multiple settings according to one embodiment of this disclosure;

FIG. **2** illustrates an example detection circuit in a fluorescent lamp assembly having multiple settings according to one embodiment of this disclosure;

FIG. **3** illustrates an example oscillator in a fluorescent lamp assembly having multiple settings according to one embodiment of this disclosure; and

FIG. **4** illustrates an example method for providing multiple settings in a fluorescent lamp assembly according to one embodiment of this disclosure.

DETAILED DESCRIPTION

FIG. **1** illustrates an example fluorescent lamp assembly **100** having multiple settings according to one embodiment of this disclosure. The embodiment of the fluorescent lamp assembly **100** shown in FIG. **1** is for illustration only. Other embodiments of the fluorescent lamp assembly **100** may be used without departing from the scope of this disclosure.

In this example, the fluorescent lamp assembly **100** includes a fluorescent lamp **102**, a fluorescent lamp ballast **104**, a switch **106**, and a power supply **108**. The fluorescent lamp **102** receives a voltage signal **110** from the fluorescent lamp ballast **104** and generates light using the voltage signal **110**. The fluorescent lamp **102** represents any lamp or collection of lamps capable of generating light. For example, the fluorescent lamp **102** could represent one or more lamps that use argon and mercury vapor to generate visible light.

The fluorescent lamp ballast **104** is coupled to the fluorescent lamp **102** and the switch **106**. The fluorescent lamp ballast **104** receives power from the power supply **108** through the switch **106**. The fluorescent lamp ballast **104** also generates and provides a voltage signal **110** to the fluorescent lamp **102**, which uses the voltage signal **110** to generate light. In addition, the fluorescent lamp ballast **104** alters the power provided by the voltage signal **110**, which adjusts the intensity of light produced by the fluorescent lamp **102**. The fluorescent lamp ballast **104** includes any hardware, software, firmware, or combination thereof for generating signals **110** used by a fluorescent lamp **102** to generate light.

In the illustrated example, the fluorescent lamp ballast **104** includes an alternating current ("AC") detection circuit **112**, an oscillator **114**, an amplifier **116**, and a tank circuit **118**. The switch **106** is coupled to the power supply **108** and the detection circuit **112**. The switch **106** receives an input power signal **116** from the power supply **108**. The switch **106** also provides one or more AC signals **120** to the detection circuit **112**, and the detection circuit **112** detects the presence of any of the AC signals **120**. The AC signals **120** represent the desired setting or illumination level of the fluorescent lamp **102**.

In some embodiments, the switch **106** provides up to N different AC signals **120**, which represent 2^N possible settings of the fluorescent lamp **102**. For example, the switch **106** may provide up to two different AC signals **120** that represent four different settings. In this example, each setting could be associated with an intensity of light produced by the fluorescent lamp **102**. As a particular example, when no AC signals **120** are output by the switch **106**, the fluorescent lamp **102** may be turned off. When only a first AC signal **120** is output by the switch **106**, the fluorescent lamp **102** may generate light having a first, lower intensity. When only a second AC signal **120** is output by the switch **106**, the fluorescent lamp **102** may generate light having a second, higher intensity. When both AC signals **120** are output by the switch **106**, the fluorescent lamp **102** may generate light having a maximum intensity. In this document, the term "each" refers to every of at least a subset of the identified item.

The switch **106** represents any structure capable of outputting one or multiple signals representing multiple settings of a fluorescent lamp **102**. For example, the switch **106** could represent a combination of switches, each of which receives the input power signal **119**, that may be opened or closed to provide the desired number of AC signals **120**. As a particular example, the switch **106** could act as a three-way switch that provides three different intensity settings and an additional "off" setting.

The detection circuit **112** is coupled to the switch **106** and the oscillator **114**. The detection circuit **112** detects the presence or absence of the AC signals **120** from the switch **106**. The detection circuit **112** then generates one or more oscillator control signals **122** based on any detected AC signals **120**. For example, the detection circuit **112** could enable one of multiple oscillator control signals **122**, depending on which AC signals **120** are detected. The oscillator control signals **122** identify the frequency of a signal to be produced by the oscillator **114**.

As described above, in some embodiments, the switch **106** outputs up to two different AC signals **120**. In particular embodiments, the detection circuit **112** outputs three different oscillator control signals **122**. In these embodiments, if only the first AC signal **120** is detected, the detection circuit **112** enables a first of the oscillator control signals **122**. If only the second AC signal **120** is detected, the detection circuit **112** enables a second of the oscillator control signals **122**. If both AC signals **120** are detected, the detection circuit **112** enables a third of the oscillator control signals **122**. The detection circuit **112** provides the oscillator control signals **122** to the oscillator **114**, which uses the control signals **122** to generate a signal at an appropriate frequency.

The detection circuit **112** represents any hardware, software, firmware, or combination thereof for detecting one or multiple inputs and generating one or more control signals. One example embodiment of the detection circuit **112** is shown in FIG. **2**, which is described below. In some embodiments, the detection circuit **112** is arranged so it can be connected to a conventional base structure used to connect an incandescent lamp to a power supply.

The oscillator **114** is coupled to the detection circuit **112** and the amplifier **116**. The oscillator **114** generates a signal **124** that is provided to the amplifier **116**. The frequency of the signal **124** represents the operating frequency of the fluorescent lamp ballast **104**. The frequency of the signal **124** is based, at least in part, on the oscillator control signals **122** received from the detection circuit **112**. For example, the oscillator **114** could generate a signal **124** having one of three different frequencies, and three oscillator control signals **122** identify which of the three frequencies is used by the oscillator **114**. The frequency of the signal **124** may control the intensity of light produced by the fluorescent lamp **102**. By adjusting the frequency of the signal **124**, the intensity of light generated by the fluorescent lamp **102** is also adjusted.

The oscillator **114** may use any suitable technique to alter the frequency of the signal **124**. For example, the oscillator **114** could use an adjustable capacitance and/or an adjustable resistance to alter the frequency of the signal **124**. The oscillator **114** could also use an adjustable current source to charge a capacitor, where the current source is adjusted to alter the frequency of the signal **124**. In addition, the oscillator **114** could represent a voltage controlled oscillator, where a control voltage is modified to provide the desired frequency.

The oscillator **114** represents any hardware, software, firmware, or combination thereof for generating a signal having a controllable frequency. One example embodiment of the oscillator **114** is shown in FIG. **3**, which is described later herein.

The amplifier **116** is coupled to the oscillator **114** and the tank circuit **118**. The amplifier **116** receives the signal **124** generated by the oscillator **114** and amplifies the signal **124**. The amplifier **116** then outputs an amplified signal **126**, which is provided to the tank circuit **118**. The amplifier **116** represents any suitable amplifier capable of amplifying signals, such as a power amplifier.

The tank circuit **118** is coupled to the amplifier **116** and the fluorescent lamp **102**. The tank circuit **118** receives the amplified signal **126** from the amplifier **116** and generates the voltage signal **110**. The fluorescent lamp **102** uses the voltage signal **110** to generate light. For example, the voltage signal **110** may energize the fluorescent lamp **102** and cause the fluorescent lamp **102** to produce light. The tank circuit **118** also allows the fluorescent lamp ballast **104** to adjust the intensity of light generated by the fluorescent lamp **102**. As an example, varying the frequency of the amplified signal **126** causes the tank circuit **118** to generate voltage signals **110** having different power levels at different frequencies. Because the fluorescent lamp ballast **104** provides voltage signals **110** at different power levels, the fluorescent lamp **102** generates light at different intensities. As a result, by adjusting the frequency of the signal **124** produced by the oscillator **114**, the intensity of light generated by the fluorescent lamp **102** is also adjusted.

The tank circuit **118** includes any hardware, software, firmware, or combination thereof for generating voltage signals having different power levels. The tank circuit **118** may, for example, represent an inductor-capacitor ("LC") resonant tank circuit.

The power supply **108** is coupled to the fluorescent lamp ballast **104** through the switch **106**. The power supply **108** provides operating power for the fluorescent lamp assembly **100**. The power supply **108** could represent any power supply, such as an AC power supply. Although shown as part of the fluorescent lamp assembly **100**, the power supply **108** could reside external to the fluorescent lamp assembly **100** and be coupled to the fluorescent lamp ballast **104** or the switch **106** by a power cord or other coupler.

The fluorescent lamp assembly **100** shown in FIG. **1** is capable of adjusting the intensity of light generated by the fluorescent lamp **102**. A user sets the switch **106** to an appropriate setting, and the switch **106** produces one or more AC signals **120**, such as a combination of up to N different AC signals **120**. In this document, the term "combination" refers to at least one of two or more elements. The detection circuit **112** detects the AC signal(s) **120** and generates one or more oscillator control signals **122** that correspond to the selected setting. The oscillator **114** generates a signal **124** having a frequency corresponding to the oscillator control signals **122**. The signal **124** is amplified and provided to the tank circuit **126**, which uses the amplified signal **126** to generate a voltage signal **110**. The voltage signal **110** provides power to the fluorescent lamp **102**, and the fluorescent lamp **102** generates light. The amount of power provided by the voltage signal **110** is dependent on the frequency of the signal **124**, and the amount of power controls the intensity of light produced by the fluorescent lamp **102**. This process may be repeated if and when the user changes the setting of the switch **106**. In this way, the intensity of light generated by the fluorescent lamp **102** may be controlled and adjusted. Moreover, this mechanism may operate in conjunction with conventional base structures ordinarily used to control incandescent lamps.

Although FIG. **1** illustrates one example of a fluorescent lamp assembly **100** having multiple settings, various changes may be made to FIG. **1**. For example, the functional division shown in FIG. **1** is for illustration only. Various components in FIG. **1** may be combined or omitted and additional components could be added according to particular needs.

FIG. **2** illustrates an example detection circuit **112** in a fluorescent lamp assembly **100** having multiple settings according to one embodiment of this disclosure. The embodiment of the detection circuit **112** shown in FIG. **2** is for illustration only. Other embodiments of the detection circuit **112** may be used in the fluorescent lamp assembly **100** without departing from the scope of this disclosure.

In this example, the detection circuit **112** detects the presence of up to two different AC input signals **120**. The AC input signals **120** represent the signals provided by the switch **106** in FIG. **1**. The detection circuit **112** then generates three different control signals **122**. The control signals **122** represent the signals provided to the oscillator **114** in FIG. **1**.

In this example embodiment, the first AC input signal ("AC**1**") **120** is provided to a resistor **202**a, and the second AC input signal ("AC**2**") **120** is provided to a resistor **202**b. The resistor **202**a is coupled to a diode **204**a, a diode **206**a, a pull-down resistor **208**a, and a buffer **210**a. Similarly, the resistor **202**b is coupled to a diode **204**b, a diode **206**b, a pull-down resistor **208**b, and a buffer **210**b, The diodes **204**a-**204**b are coupled to a source voltage V_{DD}, and the diodes **206**a-**206**b and the pull-down resistors **208**a-**208**b are coupled to ground. The resistors **202**a-**202**b, **208**a-**208**b may have any suitable resistances. For example, the resistors **202**a-**202**b could represent 100 kΩ resistors, and the pull-down resistors **208**a-**208**b could represent 10 kΩ resistors. Also, the diodes **204**a-**204**b, **206**a-**206**b could represent any suitable diodes. Further, the buffers **210**a-**210**b could represent any suitable buffers, such as one or more operational amplifiers. In addition, the source voltage V_{DD} could represent any suitable voltage, such as a voltage between five volts and twenty volts inclusive.

The buffers **210**a-**210**b are coupled to two flip-flops **212**a-**212**b, respectively, and to an OR gate **214**. The OR gate **214** is coupled to a resistor **216**, which is coupled to a capacitor **218** and a buffer **220**. The buffer **220** is also coupled to the flip-flops **212**a-**212**b.

The flip-flops **212**a-**212**b receive and sample outputs produced by the buffers **210**a-**210**b. The flip-flops **212**a-**212**b represent any hardware, software, firmware, or combination thereof capable of sampling and holding an input value. As a particular example, the flip-flops **212**a-**212**b may represent D flip-flops, where the "D" inputs receive the outputs of the buffers **210**a-**210**b and the clock or "C" inputs receive the output of the buffer **220**.

The resistor **216** and the capacitor **218** may have any suitable resistance and capacitance, respectively. For example, the resistor **216** and the capacitor **218** could provide a delay in the detection circuit **112**. Any suitable delay may be provided, such as a delay of one or several milliseconds or tens of microseconds. The resistance and capacitance of the resistor **216** and the capacitor **218** could be selected to provide the appropriate delay.

The flip-flops **212**a-**212**b in the detection circuit **112** generate two signals **222**a-**222**b. The signals **222**a-**222**b indicate the presence or absence of the AC signals **120**. For example, if both AC signals **120** are present, both signals **222**a-**222**b may have a high logical value. If only one of the AC signals **120** is present, one of the signals **222**a-**222**b may have a high logical value and the other may have a low logical value.

The signals **222**a-**222**b are provided to a decoder **224**. The decoder **224** uses the signals **222**a-**222**b to generate the control signals **122** for the oscillator **114**. For example, the decoder **224** could generate a high logical value in one of the control signals **122** depending on which of the AC signals **120** are present. The control signals **122** are then provided to the oscillator **114**, which generates a signal **124** having a frequency that is based on the control signals **122**.

As a specific example, if the signal **222**a has a high logical value but the signal **222**b has a low logical value, this may indicate that the first AC signal **120** is present but the second AC signal **120** is not. In this case, the first control signal ("A") **122** may have a high logical value and the other two control signals **122** may have a low logical value. If the signal **222**a has a low logical value and the signal **222**b has a high logical value, this may indicate that the second AC signal **120** is present but the first AC signal **120** is not. In that case, the second control signal ("B") **122** may have a high logical value and the other control signals **122** may have a low logical value. In addition, if both signals **222**a-**222**b have a high logical value, this may indicate that both AC signals **120** are present. The third control signal ("C") **122** may have a high logical value while the other controls signals **120** have a low logical value. This represents one possible way in which the decoder **224** generates the control signals **122**. The decoder **224** may use other techniques to generate the control signals **122** depending on, for example, the mechanism used by the oscillator **114** to adjust the frequency of the signal **124**.

The decoder **224** includes any hardware, software, firmware, or combination thereof for generating control signals. In some embodiments, the switch **106** in FIG. **1** provides a different combination of AC input signals **120** for different settings, and the decoder **224** generates control signals **122** that correspond to the different settings of the switch **106**.

Although FIG. **2** illustrates one example of a detection circuit **112** in a fluorescent lamp assembly **100** having multiple settings, various changes may be made to FIG. **2**. For example, the detection circuit **112** could be used to detect the presence or absence of any suitable number of AC input signals **120**. Also, other embodiments of the detection circuit **112** may be used to detect the presence or absence of one or more AC input signals.

FIG. **3** illustrates an example oscillator **114** in a fluorescent lamp assembly **100** having multiple settings according to one embodiment of this disclosure. The embodiment of the oscillator **114** shown in FIG. **3** is for illustration only. Other embodiments of the oscillator **114** may be used in the fluorescent lamp assembly **100** without departing from the scope of this disclosure.

In this example, the oscillator **114** receives three control signals **122** from the detection circuit **112**. The control signals **122** collectively represent one of multiple frequencies, and the oscillator **114** generates a signal **124** having the frequency identified by the control signals **122**.

In this example embodiment, the control signals **122** are provided to three transistors **302**a-**302**c. In particular, the control signals **122** are provided to the gates of the transistors **302**a-**302**c. The sources of the transistors **302**a-**302**c are coupled to one another and to ground, and the drains of the transistors **302**a-**302**c are coupled to capacitors **304**a-**304**c, respectively. The transistors **302**a-**302**c represent any suitable transistors, such as field effect transistors ("FETs").

A signal **306** is provided to two comparators **308**a-**308**b and a resistor **310**. The signal **306** represents the voltage stored on the capacitors **304**a-**304**c. The comparators **308**a-**308**b also receive different reference voltages produced by a voltage divider represented by three resistors **312**a-**312**c, which are coupled in series between a source voltage V_{DD} and ground. The comparators **308**a-**308**b compare two input voltages (one of the reference voltages and the signal **306**) and generate two output signals **314**a-**314**b. Each of the output signals **314**a-**314**b indicates whether the voltage received at the positive terminal of the corresponding comparator exceeds the voltage at the negative terminal. The comparators **308**a-**308**b represent any hardware, software, firmware, or combination thereof for comparing voltages. Also, the resistors **312**a-**312**b may have any suitable resistance(s), such as a resistance of 10 kΩ each.

The output signals **314**a-**314**b produced by the comparators **308**a-**308**b are provided to an RS flip-flop **316**. Through the "R" input, the RS flip-flop **316** is configured so that it is reset when the voltage stored on the capacitors **304**a-**304**c exceeds two thirds of the source voltage V_{DD}. Through the "S" input, the RS flip-flop **316** is configured so that it is set when the voltage stored on the capacitors **304**a-**304**c exceeds one third of the source voltage V_{DD}. In this way, the RS flip-flop **316** acts as a bi-stable oscillator and produces the signal **124**.

In this embodiment, the frequency of the signal **124** produced by the RS flip-flop **316** depends on the capacitance of the capacitors **304**a-**304**c and the resistance of the resistor **310**. In this example, the resistance of the resistor **310** is fixed, and the capacitance of the capacitors **304**a-**304**c varies depending on which of the transistors **302**a-**302**c is conductive.

In some embodiments, only one of the control signals **122** may be enabled at any given time. This allows the oscillator **114** to produce up to three different frequencies in the signal **124**. In these embodiments, the capacitors **304**a-**304**c may have different capacitances. By enabling different ones of the transistors **302**a-**302**c, the capacitance, provided by the RC network (formed of capacitors **304**a-**304**c and resistor **310**) may vary.

In other embodiments, multiple ones of the control signals **122** may be enabled at any given time. This allows the oscillator **114** to produce up to eight different frequencies in the signal **124**. In these embodiments, different combinations of capacitors **304**a-**304**c may be used in the RC network by enabling different combinations of transistors **302**a-**302**. This also varies the capacitance in the RC network.

Altering the capacitance in the RC network varies the speed at which the charge on the capacitors **304**a-**304**c exceeds one third of the supply voltage V_{DD} and two thirds of the supply voltage V_{DD}. For a lower frequency, the capacitors **304**a-**304**c charge more slowly, which lengthens the amount of time between setting and resetting the RS flip-flop **316**. Similarly, for a higher frequency, the capacitors **304**a-**304**c charge more quickly, decreasing the amount of time between setting and resetting the RS flip-flop **316**.

Although FIG. **3** illustrates one example of an oscillator **114** in a fluorescent lamp assembly **100** having multiple settings, various changes may be made to FIG. **3**. For example, FIG. **3** illustrates the use of three capacitors **304**a-**304**c that can be individually selected or selected in combination based on three control signals **122**. In other embodiments, the oscillator **114** could include a different number of capacitors that can be selected individually or in combination based on any number of control signals **122**. Also, the oscillator **114** could support any number of operating frequencies represented using any number and/or combination of capacitors. Further, other mechanisms may be used to adjust the operating frequency of the oscillator **114** instead of or in addition to adjusting the capacitance in the oscillator **114**. These other mechanisms include, for example, adjusting the resistance of the resistor **310** and using an adjustable current source to charge one or more of the capacitors **304**a-**304**c. In addition, other embodiments of the oscillator **114** may be used, such as by using a voltage controlled oscillator where a control voltage may be modified to provide the desired frequency.

FIG. **4** illustrates an example method **400** for providing multiple settings in a fluorescent lamp assembly according to one embodiment of this disclosure. For ease of explanation, the method **400** is described with respect to the fluorescent lamp assembly **100** in FIG. **1**. The method **400** could be used with any other lamp assembly without departing from the scope of this disclosure.

The fluorescent lamp assembly **100** waits to receive at least one AC input voltage at step **402**. Until at least one AC input voltage **120** is received, the fluorescent lamp assembly **100** may perform no actions. In particular, until at least one AC input voltage **120** is received, the fluorescent lamp assembly **100** (particularly the fluorescent lamp ballast **104**) may lack power to perform any actions.

Once at least one AC input voltage is received, the fluorescent lamp assembly **100** detects the presence or absence of a first AC input voltage on a first input at step **404**. This may include, for example, the detection circuit **112** detecting the presence or absence of a first AC signal ("AC**1**") **120**. The fluorescent lamp assembly **100** detects the presence or absence of a second AC input voltage on a second input at step **406**. This may include, for example, the detection circuit **112** detecting the presence or absence of a second AC signal ("AC**2**") **120**.

The fluorescent lamp assembly **100** selects an operating frequency of the fluorescent lamp ballast at step **408**. This may include, for example, the detection circuit **112** generating one or multiple control signals **122** based on the detected AC input signal(s) **120**. As a particular example, this may include the detection circuit **112** enabling a first control signal ("A") **122** if only the first AC input signal **120** is detected, enabling a second control signal ("B") **122** if only the second AC input signal **120** is detected, and enabling a third control signal ("C") **122** if both AC input signals **120** are detected.

This may also include the oscillator **114** using the control signals **122** to adjust the capacitance used by the oscillator **114**.

The fluorescent lamp assembly **100** generates a signal having the selected operating frequency at step **410**. This may include, for example, the oscillator **114** generating a signal **124** using the capacitance selected using the control signals **122**.

The fluorescent lamp assembly **100** generates a voltage signal for a fluorescent lamp using the generated signal at step **412**. This may include, for example, the oscillator **114** providing the generated signal **124** to the amplifier **116** for power amplification. This may also include the amplifier **116** providing the amplified signal **126** to the tank circuit **118**. This may further include the tank circuit **118** generating a voltage signal **110** and providing the voltage signal **110** to the fluorescent lamp **102**. The voltage signal **110** has a power level based on the frequency of the amplified signal **126**. The power provided by the voltage signal **110** determines the intensity of light generated by the fluorescent lamp **102**.

If and when one of the AC input voltages changes at step **414**, the fluorescent lamp assembly **100** returns to step **408** to select a new operating frequency and generate a new voltage signal **110** providing the appropriate power level. This may include, for example, the detection circuit **112** detecting the presence of a new AC input signal **120** or the absence of an existing AC input signal **120**. This alters the intensity of light produced by the fluorescent lamp **102**.

Although FIG. **4** illustrates one example of a method **400** for providing multiple settings in a fluorescent lamp assembly, various changes may be made to FIG. **4**. For example, the detection steps **404**-**406** may occur in parallel. Also, the fluorescent lamp **102** could be controlled by more than two AC input voltages.

It may be advantageous to set forth definitions of certain words and phrases used in this patent document. The terms "include" and "comprise," as well as derivatives thereof, mean inclusion without limitation. The term "or" is inclusive, meaning and/or. The phrases "associated with" and "associated therewith," as well as derivatives thereof, may mean to include, be included within, interconnect with, contain, be contained within, connect to or with, couple to or with, be communicable with, cooperate with, interleave, juxtapose, be proximate to, be bound to or with, have, have a property of, or the like. The term "controller" means any device, system, or part thereof that controls at least one operation. A controller may be implemented in hardware, firmware, or software, or a combination of at least two of the same. It should be noted that the functionality associated with any particular controller may be centralized or distributed, whether locally or remotely.

While this disclosure has described certain embodiments and generally associated methods, alterations and permutations of these embodiments and methods will be apparent to those skilled in the art. Accordingly, the above description of example embodiments does not define or constrain this disclosure. Other changes, substitutions, and alterations are also possible without departing from the spirit and scope of this disclosure, as defined by the following claims.

What is claimed is:

1. A method, comprising:

detecting at least one of a plurality of input signals at a fluorescent lamp ballast;

selecting an operating frequency of the fluorescent lamp ballast by generating [at least one] *a plurality of* control [signal] *signals* based on the at least one detected input signal and setting at least one of a resistance and a capacitance in a resistor-capacitor (RC) network based on [the] at least one *of the* control [signal] *signals*, the RC network affecting the operating frequency of the fluorescent lamp ballast; and

providing power to a fluorescent lamp based on the operating frequency of the fluorescent lamp ballast, the fluorescent lamp capable of generating light having an intensity that is based on the power provided to the fluorescent lamp.

2. The method of claim **1**, wherein selecting the operating frequency comprises:

generating a signal at an oscillator based on the at least one control signal, the signal having the operating frequency, the oscillator comprising the RC network.

3. The method of claim **2**, wherein providing power to the fluorescent lamp comprises:

amplifying the signal generated by the oscillator to produce an amplified signal;

generating a voltage signal using the amplified signal; and

providing the voltage signal to the fluorescent lamp, the voltage signal providing the power to the fluorescent lamp.

4. The method of claim **1**, further comprising:

selecting a second operating frequency of the fluorescent lamp ballast; and

providing a different power to the fluorescent lamp based on the second operating frequency of the fluorescent lamp ballast, the fluorescent lamp capable of generating light having a second intensity based on the different power.

5. The method of claim **1**, [wherein] *further comprising*:

within the RC network [comprises], *coupling each of* a plurality of capacitors[, each capacitor coupled] to one of a plurality of transistors, each transistor having a gate operable to receive one of [a] *the* plurality of control signals; and

selecting the operating frequency of the fluorescent lamp ballast [comprises] *by* setting an overall capacitance in the RC network by enabling one or more of the transistors.

6. A method, comprising:

detecting at least one of a plurality of input signals received at a fluorescent lamp ballast including a plurality of sample and hold circuits and a decoder, each of the sample and hold circuits configured to output a value identifying a presence or absence of one of the input signals;

generating an output signal, the output signal associated with a power level that is based on a plurality of control signals generated by the decoder based on the values from the sample and hold circuits; and

receiving the output signal at a fluorescent lamp configured to generate light, wherein an intensity of the light is based on the power level associated with the output signal.

7. The method of claim 6, wherein each combination of the plurality of input signals corresponds to a different power level and the fluorescent lamp ballast is configured to generate an output signal for each of the different power levels.

8. The method of claim 6, wherein a detector within the fluorescent lamp ballast is configured to detect the at least one of the plurality of input signals, the detector comprising the sample and hold circuits and the decoder, the method further comprising:

generating a signal at an oscillator having a frequency based on at least one of the control signals.

9. The method of claim 8, further comprising:

amplifying the signal generated by the oscillator to produce an amplified signal; and

generating the output signal in a tank circuit using the amplified signal.

10. The method of claim 9, wherein the fluorescent lamp ballast includes a power amplifier amplifying the signal, and wherein the tank circuit comprises an inductor-capacitor resonant tank circuit.

11. The method of claim 8, wherein the frequency of the signal generated by the oscillator is based on at least one of the control signals.

12. The method of claim 11, wherein each of the control signals is configured to adjust at least one of: a capacitance in the oscillator, a resistance in the oscillator, an adjustable current source used to charge a capacitance in the oscillator, and a control voltage used by the oscillator, and wherein the oscillator generates the signal such that the frequency of the signal is based on at least one of: the capacitance in the oscillator, the resistance in the oscillator, a current provided by the adjustable current source, and the control voltage.

13. The method of claim 7, wherein the plurality of control signals adjust the capacitance in the oscillator, wherein the oscillator comprises a plurality of transistors coupled to a plurality of capacitors, the transistors having gates each configured to receive one of the plurality of control signals.

14. The method of claim 6, wherein the plurality of input signals comprise alternating current input voltages.

15. A method, comprising:

detecting at least one of a plurality of input signals using a plurality of sample and hold circuits and a decoder, each of the sample and hold circuits configured to output a value identifying a presence or absence of one of the input signals, the decoder configured to generate a plurality of control signals based on the values from the sample and hold circuits;

generating a signal having a frequency based on the control signals and responsive to the at least one detected input signal;

amplifying the signal to produce an amplified signal;

generating an output signal using the amplified signal; and

providing the output signal to a fluorescent lamp, the output signal associated with a power level that is based on the frequency of the amplified signal, the fluorescent lamp configured to receive the output signal and generate light, wherein an intensity of the light is based on the power level associated with the output signal.

16. The method of claim 15, further comprising:

detecting the at least one of the plurality of input signals by detecting whether a first input voltage is present on a first input and detecting whether a second input voltage is present on a second input.

17. The method of claim 16, wherein the sample and hold circuits comprise:

a first flip-flop configured to output a first value indicating whether the first input voltage is present on the first input; and

a second flip-flop configured to output a second value indicating whether the second input voltage is present on the second input.

18. The method of claim 17, wherein the control signals adjust at least one of: a capacitance in an oscillator generating the signal, a resistance in the oscillator, an adjustable current source used to charge a capacitance in the oscillator, and a control voltage used by the oscillator.

19. The method of claim 18, wherein the control signals adjust the capacitance in the oscillator, and wherein the oscillator comprises a plurality of transistors coupled to a plurality of capacitors, the transistors having gates configured to receive the plurality of control signals, wherein a capacitance provided by the plurality of capacitors is varied using the control signals and the plurality of transistors.

20. The method of claim 19, wherein the oscillator further comprises a plurality of comparators configured to compare a charge stored on the plurality of capacitors to a plurality of reference voltages and a flip-flop configured to receive outputs from the plurality of comparators and generate the signal.

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