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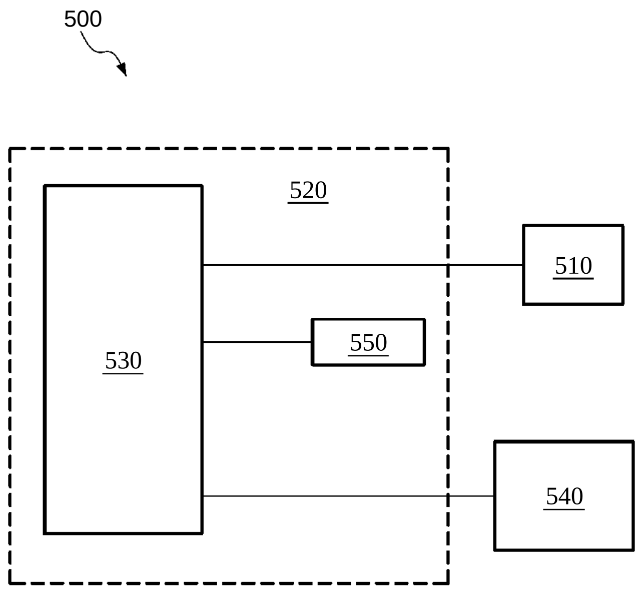

FIG. 5

(57) **Abstract:** A lighting system having a light source (540), a controller (520) configured to control at least two light attributes of the light source (540) based on a predetermined relationship, and to change the relationship.

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Personalized dimming controller

The present invention relates to an interaction or control system for controlling at least two light attributes of the light source based on a predetermined relationship and to change the relationship.

Advanced lighting systems are able to mimic natural changes in intensity and color of daylight throughout the day. This enables a particular space, such as an office or a shop, to become a more natural environment by creating dynamic lighting conditions familiar to people. This is especially beneficial in environments that are relatively closed and/or windowless, such as shops, shopping malls, meeting rooms and cubicle offices.

Conventional lighting systems allow control of light sources, such as dimming, switching on/off and color adjustments in order to provide an enriching experience and improve productivity, safety, efficiency and relaxation.

In early studies of lighting systems, A. A. Kruithof (Philips Technical Review, vol.6, 65-96, 1941) found that there is a relationship between color temperature, intensity and the 'pleasant" quality of an illumination source. According to a 'Kruithof curve', an observer prefers lower color temperature lighting when the light intensity level is lower and prefers a higher color temperature when the light intensity level is higher.

Furthermore, results from lighting system end user tests, where observers may choose their preferred light setting with a two-axis control unit, indeed show a positive correlation between color temperature and light output. With such a control unit, observers or users may choose color temperature and light output independently, which provides ample choice but at the expense of complexity where users may become frustrated during the process of independently color temperature and light output or intensity to achieve a desired light effect.

Light systems are becoming more advanced, flexible and integrated. This holds especially for professional domains like the retail domain, but new lights or light systems will also enter the home domain. This change is stimulated by the advent of LED lighting (or Solid State lighting). This new type of light will soon be equally or more efficient than today's common light source, and LED lighting makes the use of colored light much more convenient.

As observed, users would like to use certain intensity levels in combination with certain color temperature levels to create nice ambiences or desired light effects, but it remains unclear how to easily control such light systems. Normally, adding features (color, but also controllable beam width for instance) to such systems adds to the complexity of controlling such systems for professionals, let-alone for average users. A good interaction or lighting control solution is required for such systems to become widespread.

What is lacking in conventional light control systems is a simple user interface and controller that controls and changes multiple light features, and allows for customizable adjustments to easily control and achieve the desired illumination to produce a desired overall net lighting effect.

Within the total range of light output and color temperature, it is difficult for users to find their preferred balance for a particular activity when users must navigate on two axes with two different controls, to independently control two light attributes such as color and intensity. People like to adjust their light with a two-axis control, but on the other hand people want such control to find their preferred light balance to be as easy as possible.

For example, one of the problems with conventional systems is a user must individually and independently control each of a plurality of different light attributes to produce an overall desired light effect or ambience. Adding additional lighting control features, such as color, simply adds to the complexity of controlling such systems. The user cannot easily influence the lighting atmosphere without separately adjusting and readjusting the light control attributes. Accordingly, there is a need for simple light control systems that controls light sources to provide a desired light effect.

One object of the present systems and methods is to overcome the disadvantages of conventional control systems.

According to illustrative embodiments, a lighting system comprises a light source, and a controller configured to control at least two light attributes of the light source based on a predetermined relationship, for example, and to change the relationship.

Further areas of applicability of the present systems and methods will become apparent from the detailed description provided hereinafter. It should be understood that the detailed description and specific examples, while indicating exemplary embodiments of the systems and methods, are intended for purposes of illustration only and are not intended to limit the scope of the invention.

These and other features, aspects, and advantages of the apparatus, systems and methods of the present invention will become better understood from the following description, appended claims, and accompanying drawing where:

Figs. 1-3B show charts depicting observers' preferences of adjusted Tc (K) versus adjusted light output (Im) according to various embodiments;

Fig. 4 shows a user interface of a light interaction or control system according to one embodiment; and

Fig. 5 shows a block diagram of a control system according to a further embodiment.

The following description of certain exemplary embodiments is merely exemplary in nature and is in no way intended to limit the invention, its applications, or uses. In the following detailed description of embodiments of the present systems and methods, reference is made to the accompanying drawings which form a part hereof, and in which are shown by way of illustration specific embodiments in which the described systems and methods may be practiced. These embodiments are described in sufficient detail to enable those skilled in the art to practice the presently disclosed systems and methods, and it is to be understood that other embodiments may be utilized and that structural and logical changes may be made without departing from the spirit and scope of the present system.

The following detailed description is therefore not to be taken in a limiting sense, and the scope of the present system is defined only by the appended claims. The leading digit(s) of the reference numbers in the figures herein typically correspond to the figure number, with the exception that identical components which appear in multiple figures are identified by the same reference numbers. Moreover, for the purpose of clarity, detailed descriptions of well-known devices, circuits, and methods are omitted so as not to obscure the description of the present system.

Fig. 1 shows a graph 100 where the y-axis is adjusted light output or intensity in lumens (or lm), and the x-axis is adjusted color temperature Tc in degrees Kelvin (or K). As indicated in Fig. 1, people's individual preference data points 110 of different light intensities and color temperature levels Tc mostly occur within a certain bandwidth 120 around a mean value line 130. The mean value line 130 is indicated by a solid line between dashed lines that delineate approximate ends of the bandwidth 120. That is, individual preferences of people or observers are substantially around the mean 130 and variations are substantially confined to be within the bandwidth 120. The data points 110 show the observers' individually preferred light settings (preferred color temperature at various light intensity levels). As a reference, Fig. 1 further shows a dimming curve 140 of a normal GLS or incandescent lamp which is depicted as a series of dark circles.

Fig. 2 shows another chart 200 depicting color temperature on the x-axis versus light level or intensity in lumens (lm) on the y-axis that includes observers' or system users' data points 210. In Fig. 2, the straight line 220 indicates the path followed using a "one button" control for simultaneously controlling the two light attributes, such as the light intensity and color. By contrast, the stepped line 230 indicates the path followed when "two buttons" are used to independently control each light attribute. That is, if the user uses two buttons, such as separate x-direction and y-direction manual buttons or dials, to move along a path approximating the mean, then the stepped line 230 may represent the path that such a user would try to achieve a desired light output, e.g., to follow or achieve the mean path through the observers' data 210.

The step-like path 230 of Fig. 2 shows the result of using a two button system where a user would have to create and navigate to achieve a desired light output, such as to stay within the zone or bandwidth of desired color temperature and intensity combinations. By contrast, the straight line 220 may be one illustrative path that may be followed using a control system having a single button to simultaneously control and change both the color and intensity of the light output. Accordingly, an interface or controller as will be described in connection with Figs. 4-5 has such a single or main button 410 (which may by any type of button, key or switch such as a rotary dial or slider a switch), where the single button 410 may be configured to simultaneously change the light level and color temperature (or any two or more light attributes) according to the straight line 220, or any other predetermined and changeable relationship (e.g., changeable via a personal deviation button(s) 420, 430 as will be described in connection with Fig. 4).

Of course, any desired predetermined or programmable relationship may be used in lieu of or in addition to, e.g., in combination with, a linear relationship. Illustratively, the path 220 may be a polynomial equation, an exponential equation or another type equation. For a one button interface, for example, the path 220 may be linear and may be represented by a linear equation y=mx +b, where m is the slope of the line 230, and b is the y-intercept. The linear path 230 may be fitted to the empirical data 210 by any means, such as a best fit straight line using the well-known least square method, for example.

Fig. 3A shows another chart 300 depicting color temperature versus light level according to illustrative embodiments. Fig. 3 shows data points 310, solid dimming curves 320 and 330, and dashed bandwidth lines 340, 350 delineating a personal deviation band 360. In this embodiment, the present systems and methods allow a user to move a generic or predetermined curve 320 parallel along the Tc axis (e.g., the x-axis). In other words, such embodiments of the present systems and methods allow moving or changing the x-intercept and/or the y-intercept of the predetermined curve 320 to result in a modified curve 330, which has the same slope as the original predetermined curve 320, for example.

Fig. 3B represents a plot 370 of a curve 320' fit of the algorithm of the generic dimming curve 320 shown in Fig 3A. The line 320' is calculated from the median data of the light level shown as circles 380 and may be represented by the following equation:

$$Tc=1855+0.472(\text{light output})$$

where Tc is the color temperature in degree Kelvin on the x-axis of the plot 370, and 'light output' in lumens is the y-axis. In Fig. 3B, color temperature or Tc is used as the independent variable but it should be understood than any other light attribute may be used, such as the x-chromaticity or other color parameter.

One or more buttons 420, 430 shown in Fig. 4 may be used to change or move the predetermined curve 320, e.g., change its x and/or y intercept. Thus, the predetermined relationship between at least two light attributes, such as the intensity and color temperature, may be changed (e.g., by changing the x and/or y intercept) by one or more buttons 420, 430 of a user interface or controller 400 shown in Fig. 4. The one or more buttons 420, 430 may also be referred to as personal deviation button(s). Activating another button(s) 410 of the user interface or controller 400 shown in Fig. 4 may change the at least two light attributes, such as intensity and color temperature, by moving along the modified curve 330 shown in Fig. 3.

The personal deviation buttons 420, 430 shown in Fig. 4 may be configured to allow the generic, predetermined or programmable intensity-color curve 320 of Fig. 3, to be easily changed or shifted to accommodate the end user wishes or taste in lighting in accordance with the end user's personal preference. The generic dimming curve 320 may also be adjusted by the user, or pre-adjusted by a system installer or manufacturer, based on various factors such as cultural preferences. For example, users in southern countries prefer cooler light (instead of warmer light) so users, administrators, installer, and/or manufacturers may adjust the personal deviation to reflect the local preferences.

Other embodiments may be configured so that the personal deviation buttons 420, 430 change the generic curve 320 by changing other attributes besides the x and/or y intercept(s), such as by changing the slope or shape of the generic curve 320, for example. Of course, any two light attributes may be linked by a predetermined or generic relationship or curve to be simultaneously changed, such as any combination of intensity, color, color temperature, hue, diffuseness, focus, directivity and/or saturation, for example. Further, instead of a two dimensional relationship or curve to link or simultaneously control or change two light attributes, multi-dimensional relationship(s) or curve(s) may be used to link or simultaneously control more than two light attributes. Illustratively, a three-dimensional relationship or curve may be defined to link or simultaneously control three light attributes, and is movable or changeable to fit a desired personal preference using the personal adjuster or button(s) 420, 430, for example.

Fig. 4 shows a light control interface 400 according to one embodiment of the present light control system. In Fig. 4, a main button 410 may be configured to control at least two or three light attributes, such as intensity and color temperature, simultaneously. The main button 410 may be configured to increase the light level or intensity and the color temperature simultaneously when pressed on the top, and to decrease the light intensity and the color temperature simultaneously when pressed on the bottom. The light intensity and color temperature may be increased or decreased simultaneously in accordance to a relationship that links the controlled attributes, such as the linear relationship or curve 320 shown in Fig. 3, for example.

The user interface 400 may also include at least one additional (personal deviation) button to change the relationship or curve 320. Illustratively, two personal deviation buttons 420, 430 are shown in Fig. 4, which may be configured to move the x and/or y intercept of the linear equation representing the relationship or curve 320. For example, one button 420 may be configured to move the curve 320 (or change its x-intercept) to the left when pressed or activated, and the other button 430 may be configured to move the curve (or x-intercept) to the right when pressed. Thus, activating or pressing one of buttons 420, 430 moves the entire curve 320 horizontally, thereby changing the relationship or providing a new relationship between the linked attributes, e.g., between the intensity and color temperature, so that activating the main button or switch 410 changes the intensity and color temperature emanating from a controllable light source by following the path along the changed curve 330, for example. Illustratively, if the curve 320 is toggled or moved to the right, then same intensity level will have a higher color temperature.

There are, of course, many other embodiments and button configurations, such as replacing the main button 410 with an up button and a down button, and/or replacing the two personal deviation buttons 420, 430 with a single personal deviation button that may be toggled in different directed (e.g., right and left). Of course, a single button may be used having four controllable sections that may be independently activated or pressed, such as up and down sections that replace the main button, and right and left sections that replace the personal deviation buttons 420, 430

The user interface 400 of Fig. 4 may be, for example, located on a hand-held remote controller, or on a wall, or may be a soft switch such as displayed on a screen for control with any input device, such as a mouse or pointer in the case the screen is a touch sensitive screen. Further, touch sensitive strips (e.g., capacitively coupled strips) or touch sensitive circular elements may be used instead of or in addition to the various buttons of the user interface.

The configuration or user interface 400 in Fig. 4 may also be part of a master control system that may control various aspects of an environment, such as lighting, temperature, humidity, etc. Further, light interface 400 may be configured to control any combination of light attributes such as intensity, color, color temperature, hue, diffuseness, focus, directivity, chromaticity, luminance, and/or saturation.

The main button 410 (e.g., on a remote controller) may be configured to not only control the light output, but at the same time may be configured to make the light 'warmer' according the generic algorithm or equation. Further, the personal deviation button(s) 420, 430 may be configured to adjust in detail the preferred color temperature Tc or personal deviation, so that a bit cooler or warmer light is provided with same light output or intensity, i.e., to shift the generic curve 320 along the color temperature axis or x-axis shown in Fig. 3.

Other embodiments and user interfaces are possible, for example, similar to those described in Patent Application Serial Number EP 07106845.6, filed in the European Patent Office on April 24, 2007, entitled "User Interface for Multiple Light Control Dimensions" (Attorney Docket No. 007928), which is incorporated herein by reference in its entirety, describes a slider that controls multiple light features. Another example, WO 2006/056958A2 assigned to Koninklijke Philips Electronics N.V., WO 03/096761A1 and WO 01/36864A2, which are incorporated herein by reference in its entirety, describe systems for controlling light intensity, color and other light features. EP 1 422 975Al, WO 2006/048916A2 and U.S. Patent No. 5,559,631, which are incorporated herein by reference in its entirety, describe systems that control different spectral characteristics, color and brightness.

Thus, instead of a controller that covers the whole range of possibilities with independent control of light levels/intensities and color temperature levels, a controller according to the present systems and methods is configured to dim lights by following an algorithm of the generic curve 320. Further, users may easily adjust, change or shift the generic curve 320 to their preferred color temperature. This makes it easier for users to find their preferred light setting by activating the personal deviation button(s) 420, 430 to change "whiteness" or color temperature associated with one or more intensity levels, for example.

Other embodiments and other configurations may exist. For example, a device may be configured to have only one button or other switches such as a slider or rotary switch that moves up and down to change the light attributes simultaneously and same slider moves horizontally to move the personal deviation bar to the right or left or perform the manipulation of the initial dimming curve. Such a configuration may use only a single slider to accomplish light attribute control.

Another embodiment may include a slider switch configured to move up and down to change the light intensity and a dial or rotary switch configured to adjust the personal deviation that moves the x-intercept to the right or left, or otherwise adjusts the intensity/color temperature algorithm, or any other relationship between at least two or three light attributes.

Further, the light control interface 400 may be configured in different manners. Thus, other embodiments are possible, and the dimming curve may be a polynomial equation, non-linear equation having exponents equal or greater than two, an exponential equation or another type of equation. For example, activating the personal deviation buttons 420, 430 may change the exponent of the equation, instead of the slope, the y-intercept and/or the x-intercept.

The personal deviation bar may be configured to change the point of inflection where the dimming curve may curve away from the point being manipulated. In other words, the bar may turn a straight line into a point on a radius of a semicircular line, for example, where activating the personal deviation buttons 420, 430 changes the radius of the semicircle to form a new dimming curve or equation.

In addition to buttons, slideable or rotary switches, the user interface 400 may also include one or more display device(s) for user input and to provide feedback to the user. A display may be mounted on a wall near the movable selector and used to display the indicators, for example.

Fig. 5 shows a block diagram of a light interaction system 500 that includes an input device 510 that may include the user interface 400 shown in Fig. 4. The input device 510 is operationally coupled to a controller 520 which may include any type of processor 530 or control unit, for example. The controller 520 or processor 530 is operationally coupled to controllable light source(s) 540, such as LEDs, for controlling and changing attributes of light emanating therefrom.

Light emitting diodes (LEDs) are particularly well suited light sources to contra llably provide light of varying attributes, as LEDs may easily be configured to provide light with changing colors, intensity, hue, saturation and other attributes, and typically have electronic drive circuitry for control and adjustment of the various light attributes. However, any controllable light source may be used that is capable of providing lights of various attributes, such as various intensity levels, different colors, hues, saturation and the like, such as incandescent, fluorescent, halogen, or high intensity discharge (HID) light and the like, which may have a ballast or drivers for control of the various light attributes.

Further, the controller 520 includes or is operationally coupled to a memory 550 which is operationally coupled to the processor 530. The memory 550 may be configured to store application data for proper operation of the controller 520 and other data, such as the equation or algorithm associated with the curve 320 shown in Fig. 3, for example.

It should be understood that the various components of the interactive lighting control system 500 may be interconnected through a bus, for example, or operationally coupled to each other by any type of link, including wired or wireless link(s), for example. Further, the controller 520 and memory 550 may be centralized or distributed among the various system components where, for example, multiple LED light sources 540 may each have their own controller and/or memory.

Of course, as it would be apparent to one skilled in the art of communication in view of the present description, various elements may be included in the system or network components for communication, such as transmitters, receivers, or transceivers, antennas, modulators, demodulators, converters, duplexers, filters, multiplexers etc. The communication or links among the various system components may be by any means, such as wired or wireless for example. The system elements may be separate or integrated together, such as with the processor. As is well-known, the processor executes instruction stored in the memory, for example, which may also store other data, such as predetermined or programmable settings related to system control.

Various modifications may also be provided as recognized by those skilled in the art in view of the description herein. The operation acts of the present methods are particularly suited to be carried out by a computer software program. The application data and other data are received by the controller or processor for configuring it to perform operation acts in accordance with the present systems and methods. Such software, application data as well as other data may of course be embodied in a computer-readable medium, such as an integrated chip, a peripheral device or memory, such as the memory or other memory coupled to the processor of the controller.

The computer-readable medium and/or memory may be any recordable medium (e.g., RAM, ROM, removable memory, CD-ROM, hard drives, DVD, floppy disks or memory cards) or may be a transmission medium (e.g., a network comprising fiber-optics, the world-wide web, cables, and/or a wireless channel using, for example, time-division multiple access, code-division multiple access, or other wireless communication systems). Any medium known or developed that can store information suitable for use with a computer system may be used as the computer-readable medium and/or memory.

Additional memories may also be used. The computer-readable medium, the memory, and/or any other memories may be long-term, short-term, or a combination of long- and-short term memories. These memories configure the processor/controller to implement the methods, operational acts, and functions disclosed herein. The memories may be distributed or local and the processor, where additional processors may be provided, may be distributed or singular. The memories may be implemented as electrical, magnetic or optical memory, or any combination of these or other types of storage devices. Moreover, the term "memory" should be construed broadly enough to encompass any information able to be read from or written to an address in the addressable space accessed by a processor. With this definition, information on a network, such as the Internet, is still within memory, for instance, because the processor may retrieve the information from the network.

The controllers/processors and the memories may be any type. The processor may be capable of performing the various described operations and executing instructions stored in the memory. The processor may be an application-specific or general-use integrated circuit(s). Further, the processor may be a dedicated processor for performing in accordance with the present system or may be a general-purpose processor wherein only one of many functions operates for performing in accordance with the present system. The processor may operate utilizing a program portion, multiple program segments, or may be a hardware device utilizing a dedicated or multi-purpose integrated circuit. Each of the above systems utilized for identifying the presence and identity of the user may be utilized in conjunction with further systems.

Finally, the above-discussion is intended to be merely illustrative of the present system and should not be construed as limiting the appended claims to any particular embodiment or group of embodiments. Thus, while the present system has been described in particular detail with reference to specific exemplary embodiments thereof, it should also be appreciated that numerous modifications and alternative embodiments may be devised by those having ordinary skill in the art without departing from the broader and intended spirit and scope of the present system as set forth in the claims that follow. The specification and drawings are accordingly to be regarded in an illustrative manner and are not intended to limit the scope of the appended claims.

In interpreting the appended claims, it should be understood that:

a) the word "comprising" does not exclude the presence of other elements or acts than those listed in a given claim;

b) the word "a" or "an" preceding an element does not exclude the presence of a plurality of such elements;

c) any reference signs in the claims do not limit their scope;

d) several "means" may be represented by the same or different item or hardware or software implemented structure or function;

e) any of the disclosed elements may be comprised of hardware portions (e.g., including discrete and integrated electronic circuitry), software portions (e.g., computer programming), and any combination thereof;

f) hardware portions may be comprised of one or both of analog and digital portions;

g) any of the disclosed devices or portions thereof may be combined together or separated into further portions unless specifically stated otherwise; and

h) no specific sequence of acts or steps is intended to be required unless specifically indicated.

CLAIMS:

1. A lighting system comprising:

a light source (540);

a controller (520) configured to control at least two light attributes of the light source (540) based on a relationship, and to change the relationship.

2. The light system of claim 1, wherein the controller (520) includes a button configured to change the at least two light attributes based on the relationship and to change the relationship.

3. The lighting system of claim 1, wherein a first adjustment of the controller (520) changes the at least two light attributes based on the relationship, and a second adjustment of the controller (520) changes the relationship.

4. The light system of claim 3, wherein the relationship is a linear equation and the second adjustment changes a slope of the linear equation.

5. The light system of claim 3, wherein the relationship is a polynomial equation and the second adjustment changes an exponent of the polynomial equation.

6. The lighting system of claim 1, wherein the relationship is linear having a slope and an intercept with at least one axis, the controller (520) being configured to change the relationship by changing at least one of the slope and the intercept.

7. The light system of claim 1, wherein the relationship is at least one of a polynomial and an exponential relationship.

8. The lighting system of claim 1, wherein the at least two light attributes are selected from intensity, color, color temperature, hue, diffuseness, and saturation.

9. The light system of claim 1, wherein an adjustment of the controller (520) changes the at least two attributes simultaneously.

10. A controller (520) comprising a processor (530) configured to control at least two light attributes of a light source (540) based on a relationship, and to change the relationship.

11. The controller (520) of claim 10, further comprising a button configured to change the at least two light attributes based on the relationship and to change the relationship.

12. The controller (520) of claim 10, wherein a first adjustment of the controller (520) changes the at least two light attributes based on the relationship, and a second adjustment of the controller (520) changes the relationship.

13. The light system of claim 12, wherein the relationship is a linear equation and the second adjustment changes a slope of the linear equation.

14. The controller (520) of claim 12, wherein the relationship is a polynomial equation and the second adjustment changes an exponent of the polynomial equation.

15. The controller (520) of claim 10, wherein the relationship is linear having a slope and an intercept with at least one axis, the processor (530) being configured to change the relationship by changing at least one of the slope and the intercept.

16. The controller (520) of claim 10, wherein the relationship is at least one of a polynomial and an exponential relationship.

17. The controller (520) of claim 10, wherein the at least two light attributes are selected from intensity, color, color temperature, hue, diffuseness, and saturation.

18. The controller (520) of claim 10, wherein the processor (530) is configured to change the at least two attributes simultaneously.

19. A method of controlling a light source (540) a comprising:

producing a light output from the light source (540);

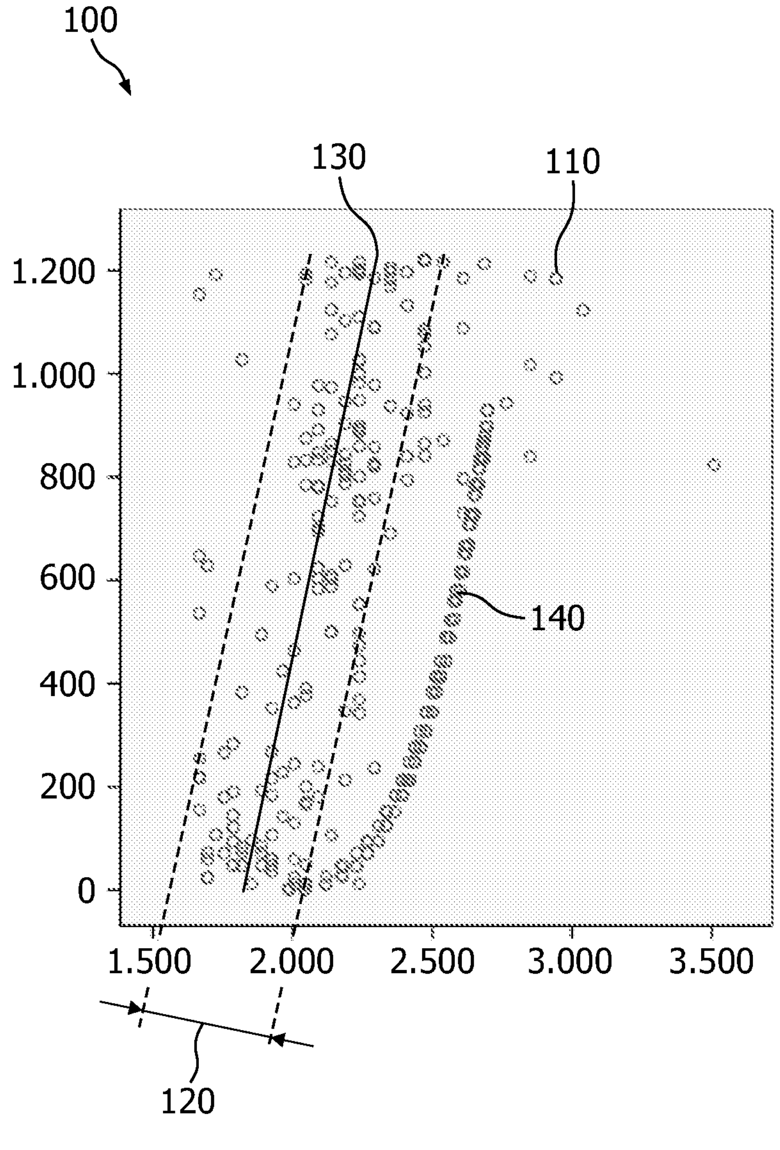
controlling at least two light attributes of the light source (540) based on a relationship, and

changing the relationship.

20. The method of claim 19, wherein the relationship includes an equation having at least one of a slope and an intercept with at least one axis, the changing act changing the at least one of the slope and the intercept.

21. A computer program enabled to carry out the method according to claim 19 or 20 when executed by a computer.

22. A record carrier storing a computer program according to claim 21.


100
130
110
1.200
1.000
800
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120

FIG. 1

2/4

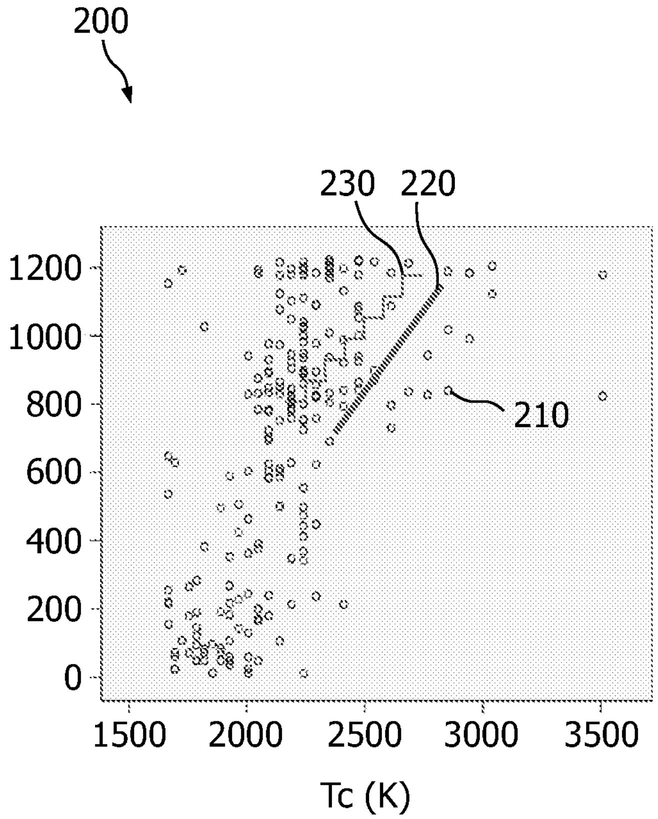


FIG. 2

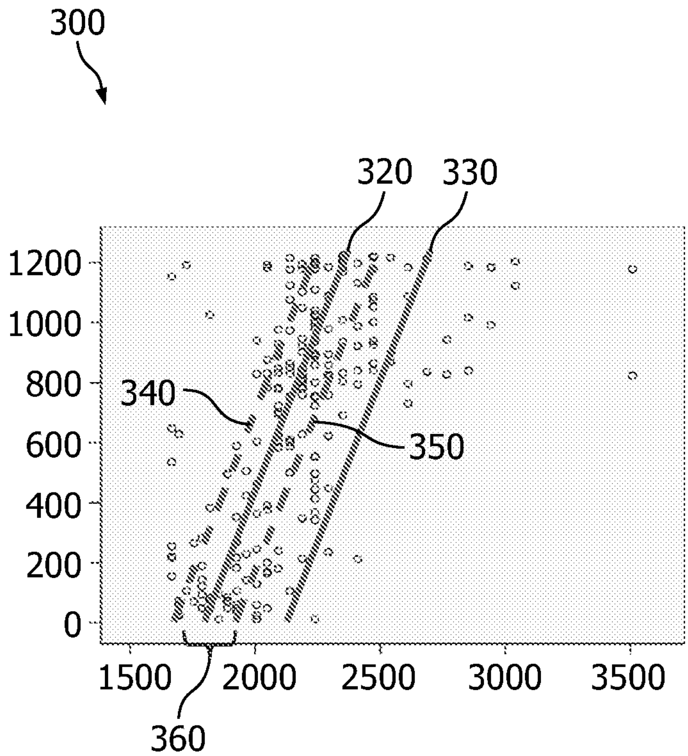
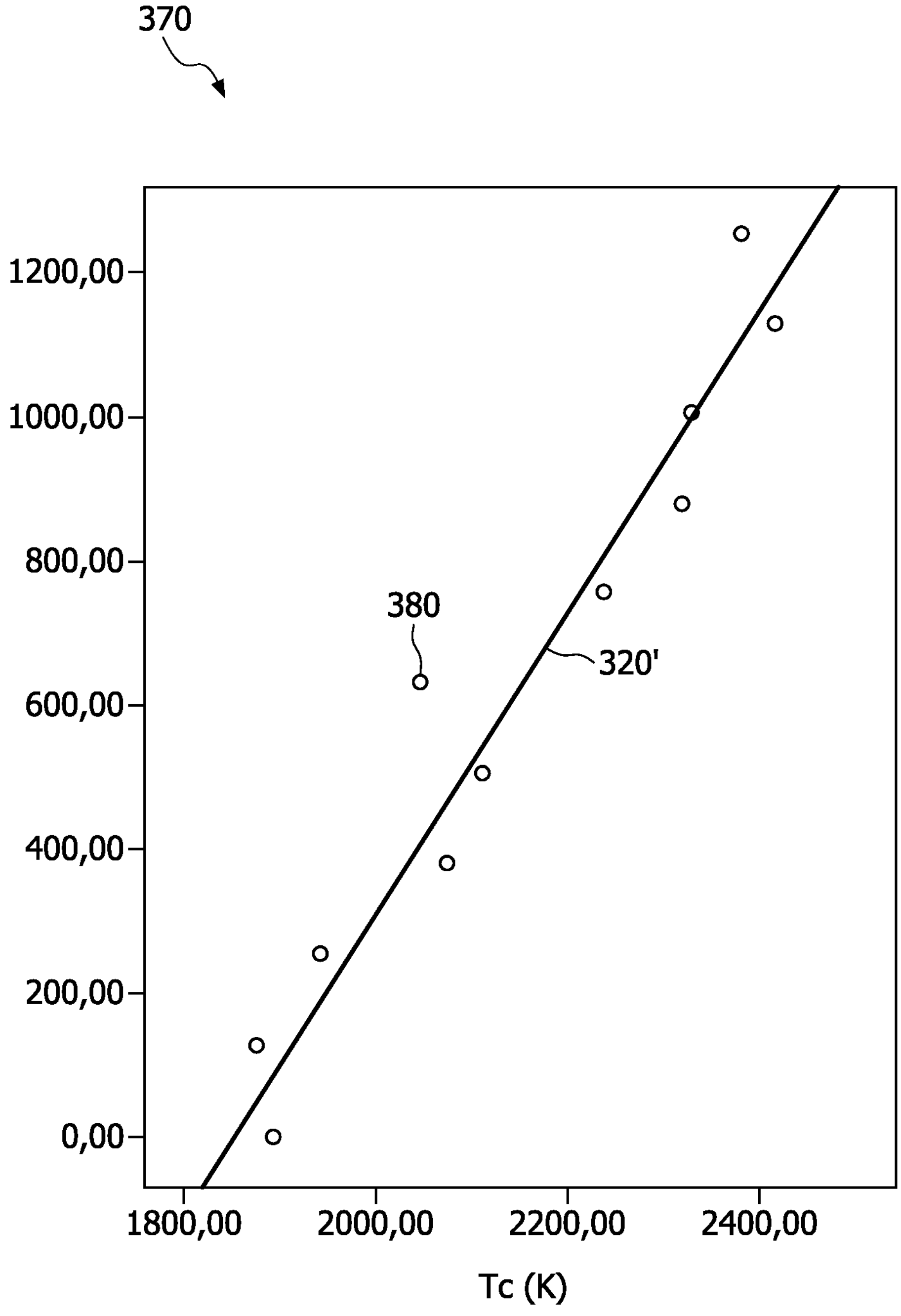


FIG. 3A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380
320'
1200,00
1000,00
800,00
600,00
400,00
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1800,00
2000,00
2200,00
2400,00
Tc (K)

FIG. 3B

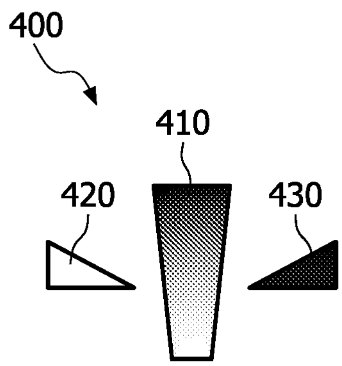

FIG. 4

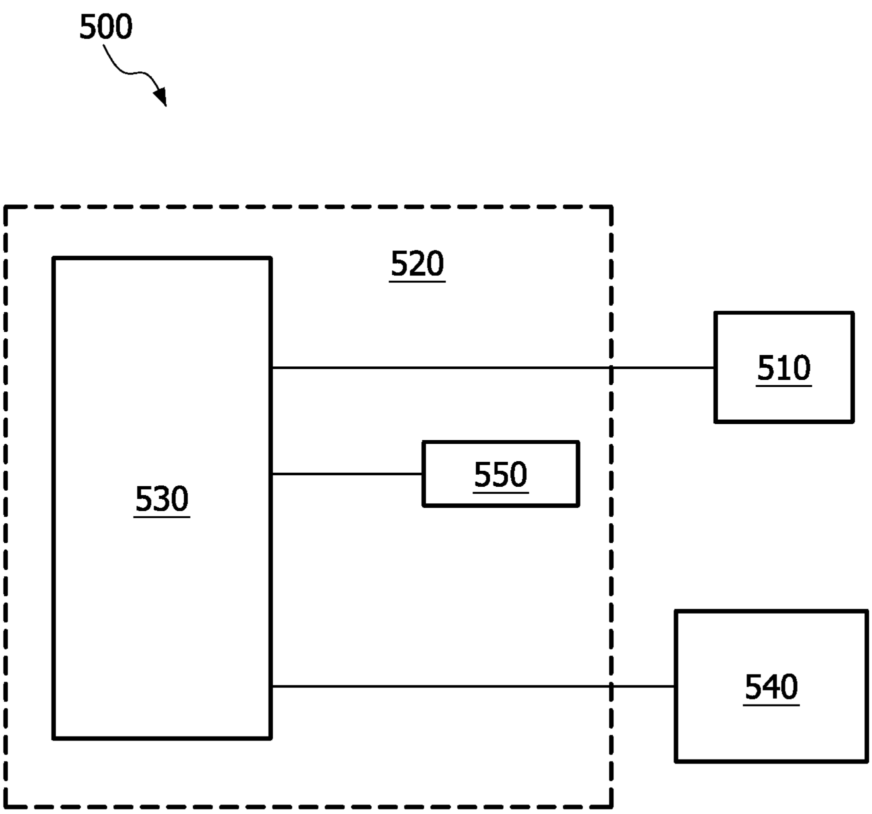

FIG. 5

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2008/051929

A. CLASSIFICATION OF SUBJECT MATTER
INV. H05B37/02

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H05B

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

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

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication,' where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2007/026170 A (MOOD CONCEPTS LTD [GB]; SUMMERLAND DAVID THOMAS [GB] LIGHT LTD E [GB];) 8 March 2007 (2007-03-08) pages 5-14; figure 1	1-22
X	US 2004/212321 Al (LYS IHOR A [US] ET AL) 28 October 2004 (2004-10-28) page 6 ; figure 1	1-22
X	US 2004/105264 Al (SPERO VECHEZKAL EVAN [IL]) 3 June 2004 (2004-06-03) paragraph [0099] - paragraph [0149]; figure 10	1-22
X	US 2006/022214 Al (MORGAN FREDERICK M [US] ET AL) 2 February 2006 (2006-02-02) paragraph [0349]; figure 26	1-22

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

[X] See patent family annex.

* Special categories of cited documents :

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the International filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"&" document member of the same patent family

Date of the actual completion of the international search.	Date of mailing of the international search report
8 October 2008	15/10/2008

Name and mailing address of the ISA/.	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswi]k Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Morri sh, Ian

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IB2008/051929

Patent document cited in search report		Publication date	patent family member(s)		Publication date
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