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(71) Applicant: **Shenzhen Glass-Free VR Tech Co., Ltd.**  
**Shenzhen Guangdong 518103 (CN)**

(72) Inventor: **CHEN, Gang**  
**Shenzhen, Guangdong 518103 (CN)**

(74) Representative: **Kutzenberger, Helga**  
**Kutzenberger Wolff & Partner**  
**Waidmarkt 11**  
**50676 Köln (DE)**

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(54) **LED DISPLAY SCREEN IN IGLOO-SHAPED ARRANGEMENT**

(57) The present invention discloses an LED display screen arranged in an Eskimo ice house-like shape, wherein the LED display screen is a spherical display screen, and a plurality of display unit boards are provided to be divided with respect to the equatorial line of the spherical display screen and distributed along the warp direction and latitude direction of the spherical display screen respectively. The plurality of display unit boards are arranged evenly in rows in a fan shape in the latitude direction, and the number of each row of the plurality of display unit boards is sequentially decreased from the equatorial line toward the south pole and the north pole respectively; in the latitude direction, every two rows of the plurality of display unit boards are symmetrically distributed with respect to the equatorial line; in the positions of the North pole and the South pole of the spherical display screen, two of the plurality of display unit boards, which are half-circular, are arranged; a plurality of LED lamp beads are arranged on the side of each of the plurality of display unit boards facing the inside of the spherical display screen. It is beneficial to adopt an installation method, according to which, a hyperboloid display with an Eskimo ice house shape with connected lines of latitude and lines of longitude in the direction of the south pole and the north pole cross joint can be formed, so that the splicing seam of the display unit boards is unrecognizable to the naked eye, which is more suitable for multi-viewing and panoramic image experience.

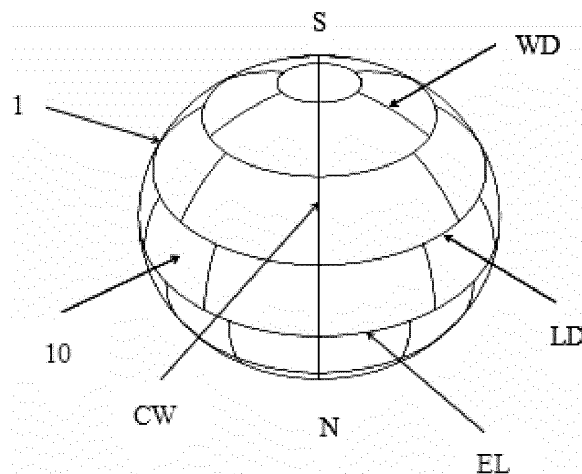


Figure 1

## Description

### FIELD

[0001] The invention relates to the technical field of LED display, particularly to an LED display screen arranged in an Eskimo ice house-like shape.

### BACKGROUND

[0002] The arrangement structure of the melon scoop is divided into straight lines in the latitude direction, and the pixels in the display unit board are also arranged in a straight line so that when the spherical display unit boards is viewed from the overall spherical vision, it is a polyhedron rather than a smooth sphere. In addition, in the melon scoop display unit board arrangement structure, the number of the display unit boards in different latitudes is same, thus the width of one of the display unit boards is reduced proportionally as the length of the corresponding latitude is reduced. The length of the display unit board adjacent to the North and South poles is too small, so the pixel cannot be arranged at a uniform pixel pitch, and thus the pitch is different in adjacent unit boards so that the serrated jags are found when being viewed from a user's eye. The arrangement structure of triangle display unit board and the arrangement structure of hexahedral display unit board belong to a block arrangement, therefore the pixel arrangement between the blocks cannot implement the uniform arrangement rule. Thus the red, the green, the blue color lamp beads in the same vertical line or the same horizontal line are towards different directions, resulting in a color difference in adjacent areas.

### SUMMARY

[0003] In view of the above described problems in the prior art, the present invention provides a LED display screen arranged in an Eskimo ice house-like shape.

[0004] The specific technical solutions are as follows: An LED display screen arranged in an Eskimo ice house-like shape, wherein the LED display screen is a spherical display screen, and a plurality of display unit boards are provided to be divided with respect to the equatorial line of the spherical display screen and distributed along the wrap direction and latitude direction of the spherical display screen respectively, so as to form the spherical display screen, comprising:

the plurality of display unit boards are arranged evenly in rows in a fan shape in the latitude direction, and the number of each row of the plurality of the display unit boards is sequentially decreased from the equatorial line toward the south pole and the north pole respectively;  
in the latitude direction, every two rows of the plurality of display unit boards are symmetrically distributed

with respect to the equatorial line;  
in the positions of the north pole and the south pole of the spherical display screen, two of the plurality of display unit boards, which are half-circular, are arranged;  
a plurality of LED lamp beads are arranged on the side of each of the plurality of display unit boards facing the inside of the spherical display screen.

[0005] Preferably, there is a preset pixel pitch between the central points of every two of the plurality of LED lamp beads;  
the plurality of LED lamp beads are arranged in rows sequentially from top to bottom in each of the plurality of display unit boards;

[0006] The number of the lateral rows of the plurality of LED lamp beads is obtained according to the following formula:

$$Z = Y/X ;$$

wherein,

Z represents the number of the lateral rows of the LED lamp beads;

Y represents half of the circumference of the spherical display screen;

X represents the preset pixel pitch.

[0007] The number of the lateral rows of the plurality of LED lamp beads is an integer.

[0008] Preferably, in the direction of the lines of latitude, the numbers of the display unit boards in every two rows symmetrical with respect to the equatorial line are same, and are both even numbers.

[0009] Preferably, in the wrap direction, each two of the plurality of display unit boards are symmetrically positioned with respect to a central wrap.

[0010] Preferably, the height of each of the plurality of display unit boards is integral multiples of the pixel pitch.

[0011] Preferably, in each of the plurality of display unit boards, the LED lamp beads arranged at the edge of that of the plurality of display unit boards are used as edge lamp beads;

the distance from the central point of each of the edge lamp beads to the edge of that of the plurality of display unit boards is half of the pixel pitch.

[0012] Preferably, in the direction of the lines of latitude, the maximum width of each of the plurality of display unit boards is no more than 370mm.

[0013] Preferably, the maximum height of each of the plurality of display unit boards is no more than 370mm.

[0014] Preferably, in each of the plurality of display unit boards, the plurality of LED lamp beads are arranged in rows sequentially from top to bottom;  
the number of the plurality of LED lamp beads per row

is obtained by the following formula:

$$H = \left\lfloor L / X - 1 \right\rfloor;$$

wherein,

H represents the number of one row of the plurality of LED lamp beads;  
L represents the arc length of one of the plurality of display unit boards corresponding to that row of the plurality of LED lamp beads;  
X represents the preset pixel pitch.

**[0015]** Preferably, in each of the plurality of display unit boards, the plurality of LED lamp beads are arranged in sequence from top to bottom;  
the number of the plurality of LED lamp beads per row is obtained by the following formula:

$$H = \left\lfloor L / X - 1 \right\rfloor;$$

wherein,

H represents the number of one row of the plurality of LED lamp beads;  
L represents the arc length of one of the plurality of display unit boards corresponding to that row of the plurality of LED lamp beads;  
X represents the preset pixel pitch.

**[0016]** The beneficial effects of the present invention are as follows: adopting an installation method, forms a hyperboloid display like an Eskimo ice house with connected lines of latitude and lines of longitude in the direction of the south pole and the north pole cross joint, so that the color difference caused by the different emitting directions of the red, the green, the blue color unit lamp particles in the pixel lamp beads is avoided, and when the image is formed, the splicing seam of the display unit boards is unrecognizable by the naked eye, making the hyperboloid display more suitable for multi-viewing and panoramic image experience, in the meantime, the connected line of latitude is beneficial to final-period management and playback.

#### Brief description of the drawings

**[0017]** The embodiments of the present invention will be more described with reference to the accompanying drawings. However, the attached drawings are only for illustration and explanation and do not limit the scope of the invention.

Figure 1 is a schematic view of an overall structure

of an LED display screen according to the present invention;

Figure 2 is a top view of an LED display screen according to the present invention;

Figure 3 is a front view of an LED display screen according to the invention;

Figure 4 is a schematic structural view of a display unit board according to the present invention.

#### 10 Description of exemplary embodiments

**[0018]** Further solutions in the embodiments will be described more clearly and completely with reference to the drawings. Apparently, the described embodiments are only part of the embodiments according to the present invention rather than all. All other embodiments obtained by skills in the art based on the embodiments of the present invention without creative efforts shall fall within the protection scope of the present invention.

**[0019]** It should be noted that under the circumstance of no conflict, the embodiments in the present invention and the features in the embodiments can be combined with each other.

**[0020]** The present invention will be further described below with reference to the accompanying drawings and specific embodiments, but it should not be construed as limiting the invention.

**[0021]** The present invention comprises an LED display screen arranged in an Eskimo ice house-like shape, wherein the LED display screen is a spherical display screen1, and a plurality of display unit boards10 are provided to be divided with respect to the equatorial line (EL) and distributed along the latitude direction (LD) and warp direction (WD) respectively, so as to form the spherical display screen1, comprising:

the plurality of display unit boards 10 are arranged evenly in rows in a fan shape in the latitude direction (LD), and the number of each row of the plurality of display unit boards 10 is sequentially decreased from the equatorial line toward the south and the north pole respectively;

in the latitude direction (LD), every two rows of the plurality of display unit boards 10 are symmetrically distributed with respect to the equatorial line (EL);  
in the positions of the North pole (N) and the South pole(S) of the spherical display screen 1, two of the plurality of display unit boards10, which are half-circular, are arranged;

a plurality of LED lamp beads 11 are arranged on the side of each of the plurality of display unit boards 10 facing the inside of the spherical display screen.

**[0022]** With the above mentioned technical solution of the LED display screen in the Eskimo ice house-like shape, as shown in figures 1, 2 and 3, the LED display screen1 is installed using the Eskimo ice house-like method, so that the spherical display screen1 divided

with respect to the equator line (EL), distributed along the latitude direction (LD) and warp direction (WD), is formed.

**[0023]** Further, the plurality of display unit boards 10 are arranged evenly in rows in the fan shape along the latitude direction(LD), and the number of one row of the plurality of display unit boards 10 is sequentially decreased from the equatorial line toward the south pole and the north pole respectively. In the positions of the north pole (N) and the south pole (S) of the spherical screen 1, two half-circular display unit boards 10 are arranged, forming a hyperboloid display with connected latitudes and warps in the direction of the South and North poles cross joint, so that when the image is formed, the splicing seam of the display unit boards 10 is unrecognizable to the naked eye, and the color difference caused by the different emitting directions of the red, the green, the blue color unit lamp particles in the pixel lamp beads is avoided, making the display unit boards 10 more suitable for multi-viewing and panoramic image experience, in the meantime, the connected line of latitude is beneficial to final-period management and playback.

**[0024]** In a preferred embodiment, there is a preset pixel pitch between the center points of every two of the plurality of LED lamp beads 11; the plurality of LED lamp beads 11 are arranged in rows sequentially from top to bottom in each of the plurality of display unit boards 10;

**[0025]** The number of the lateral rows of the plurality of LED lamp beads 11 is processed according to the following formula:

$$Z = Y/X ;$$

wherein,

Z represents the number of the lateral rows of the LED lamp beads 11;

Y represents half of the circumference of the spherical display screen 1;

X represents the preset pixel pitch.

**[0026]** The number of the lateral rows of the plurality of LED lamp beads is an integer.

**[0027]** Specifically, as shown in figure 4, the plurality of LED lamp beads are arranged in sequence from top to bottom in each display unit board 10. According to the requirement of the resolution per unit area of each display unit board 10, the pixel pitch between every two LED lamp beads 11 is preset. The lateral rows of the plurality of LED lamp beads on each display unit board 10 can be calculated by the formula:  $Z=Y/X$ , wherein Z represents the number of the lateral rows of the LED lamp beads 11, Y represents half of the circumference of the spherical display screen 1, and X represents the preset pixel pitch. The number of the lateral rows of the plurality of LED

lamp beads is an integer, so that the uniform pixel pitch between the plurality of LED lamp beads 11 can be realized. At the same time, the same orientation of the light of the LED lamp beads 11 in the same horizontal or same longitudinal direction can be realized, which improves the color difference issue in the adjacent areas effectively and further improves people's panoramic image experience.

**[0028]** In a preferred embodiment, in the latitude direction (LD), the numbers of the display unit boards 10 in every two rows symmetrical with respect to the equatorial line are same, and are both even numbers.

**[0029]** Specifically, as shown in figure 1, 2 and 3, in the latitude direction (LD), the numbers of the display unit boards 10 in every two rows symmetrical with respect to the equatorial line are same, and are both even numbers. Viewed from outside, the spherical display screen 1 is a round ball in its overall visual appearance. Viewed from inside, when the LED lamp beads 11 are imaged, the stitching seam of the display unit board 10 cannot be recognized by the naked eye, so it is more suitable for a cinema, an auditorium, a theater, an Urban Planning Center or a product launch conference, etc. In this case, a panoramic image experience that many people watch the display unit boards at the same time is achieved.

**[0030]** In a preferred embodiment, in the warp direction (WD), each two of the plurality of display unit boards 10 are symmetrically positioned with respect to a central wrap (CW).

**[0031]** Specifically, as shown in figures 1, 2 and 3, in the warp direction (WD), each two of the plurality of display unit boards 10 are symmetrically positioned with respect to a central wrap (CW), and a hyperboloid display with connected lines of latitude and lines of longitude in the direction of the South and North poles cross joint is formed, so that the stitching seam of the display unit boards 10 cannot be recognized by the naked eye when it is seen from inside of the spherical display screen 1. In the meantime, as the LED lamp beads 11 are arranged uniformly, the pixel pitch between each two LED lamp beads 11 is uniformed, thereby the orientation of light of the LED lamp beads in the same horizontal direction or same longitudinal direction is identical, which further avoids the color difference caused by different emitting directions of the red, the green, the blue colors in the pixel, and enhances people's experience.

**[0032]** In a preferred embodiment, the height of each of the plurality of display unit board 10 is integral multiples of the pixel pitch.

**[0033]** Specifically, as shown in figure 4, in order to achieve the same orientation of light of the LED lamp beads 11 in the same horizontal or same longitudinal direction, and to avoid the color difference caused by different emitting directions of the red, green and blue unit lamp particles in the pixel lamp beads, the height of each display unit board 10 is integral multiples of the pixel pitch according to the resolution requirements of unit area of each display unit board 10.

[0034] In a preferred embodiment, in each of the plurality of display unit boards 10, the LED lamp beads 11 arranged at the edge of that of the plurality of display unit board 10 are used as edge lamp beads;

the distance from the central point of each of the edge lamp beads to the edge of that of the plurality of display unit boards 10 is half of the pixel pitch.

[0035] Specifically, as shown in figure 4, in order to uniform the pixel pitch between each two of a plurality of the LED lamp beads, and to achieve the uniformed arrangement, and at the same time, to achieve the same orientation of light of the LED lamp beads 11 in the same horizontal or same longitudinal direction, the distance from the central point of each of the edge lamp beads to the edge of the display unit board 10 is half of the pixel pitch according to the resolution requirements of unit area of each display unit board 10. The pixel pitch between each two of the LED lamp beads 10 is preset, which is, for example, X, the display pixel of the edge lamp beads is half of the pixel pitch, which is, for example, K, then  $K=X/2$ , which further avoids the color difference caused by the orientation of light of the red, green and blue lamp particles in the pixel lamp beads, and improves the user's experience.

[0036] In a preferred embodiment, in the latitude direction, the maximum width of each of the plurality of display unit boards is no more than 370mm.

[0037] Specifically, as shown in figure 4, in the latitude direction of each of the display unit boards 10, A is used to represent the maximum width, wherein A is no more than 370mm.

[0038] In a preferred embodiment, the maximum height of each of the plurality of display unit boards is no more than 370mm.

[0039] Specifically, as shown in figure 4, in the warp direction of each of the display unit boards 10, B is used to represent the maximum width, wherein B is no more than 370mm.

[0040] In a preferred embodiment, in each of the plurality of display unit boards 10, the plurality of LED lamp beads 11 are arranged in sequence from top to bottom.

[0041] The number of the plurality of LED lamp beads 11 per row is obtained by the following formula:

$$H = \lfloor L / X - 1 \rfloor;$$

wherein,

H represents the number of one row of LED lamp beads 11;

L represents the arc length of one of the plurality of display unit boards 10 corresponding to that row of the plurality of LED lamp beads 11;

X represents the preset pixel pitch.

[0042] In a preferred embodiment, in each of the plu-

ality of display unit boards 10, the plurality of LED lamp beads 11 are arranged in sequence from top to bottom.

[0043] The number of the plurality of LED lamp beads 11 per row is obtained by the following formula:

$$H = \lceil L / X - 1 \rceil;$$

wherein,

H represents the number of one row of the plurality of LED lamp beads 11;

L represents the arc length of one of the plurality of display unit boards 10 corresponding to that row of the plurality of LED lamp beads 11;

X represents the preset pixel pitch.

[0044] Specifically, as shown in figure 4, the plurality of LED lamp beads 11 are arranged in sequence from top to bottom in each of the plurality of display unit boards 10. The number of the LED lamp beads 11 per row is calculated from the formula  $H = \lfloor L / X - 1 \rfloor$  (1) or formula  $H = \lceil L / X - 1 \rceil$  (2), wherein H represents the number of one row of the plurality of LED lamp beads 11, L represents the arc length of one of the plurality of display unit boards 10 responding to that row of the plurality of LED lamp beads 11, and X represents the preset pixel pitch.

[0045] Further, the number of LED lamp beads 11 per row is a rounding number, wherein in the formula  $H = \lfloor L / X - 1 \rfloor$  (1) is a rounding up symbol, indicating the largest one in the integers not exceeding the  $L/X - 1$ ; in the formula  $H = \lceil L / X - 1 \rceil$  (2) is a rounding down symbol, indicating the smallest one in the integers not less than  $L/X - 1$ .

[0046] The foregoing is only the preferred embodiments of the invention, not thus limiting embodiments and scope of the invention. Those skilled in the art should be able to realize that the schemes obtained from the modifications and changes based on the content of specification and figures of the invention all fall within the scope of the invention.

## Claims

1. An LED display screen arranged in an Eskimo ice house-like shape, **characterized in that** the LED display screen is a spherical display screen, and a plurality of display unit boards are provided to be divided with respect to the equatorial line of the spherical display screen and distributed along the warp direction and latitude direction of the spherical display screen respectively, so as to form the spherical display screen, comprising:

the plurality of display unit boards are arranged evenly in rows in a fan shape in the latitude direction, and the number of each row of the plu-

rality of display unit boards is sequentially decreased from the equatorial line towards the south pole and the north pole respectively; in the latitude direction, every two rows of the plurality of display unit boards are symmetrically distributed with respect to the equatorial line; in the positions of the north pole and the south pole of the spherical display screen, two of the plurality of display unit boards, which are half-circular, are arranged; a plurality of LED lamp beads are arranged on the side of each of the plurality of display unit boards facing the inside of the spherical display screen.

2. The LED display screen according to claim 1, **characterized in that** a preset pixel pitch between the center points of every two of the plurality of LED lamp beads; the plurality of LED lamp beads are arranged in sequence from top to bottom in each of the plurality of display unit boards; The number of the lateral rows of the plurality of LED lamp beads is obtained according to the following formula:

$$Z = Y/X ;$$

wherein,

Z represents the number of the lateral rows of the LED lamp beads;  
 Y represents half of the circumference of the spherical display screen;  
 X represents the preset pixel pitch;

The number of the lateral rows of the plurality of LED lamp beads is an integer.

3. The LED display screen according to claim 1, **characterized in that** in the latitude direction, the numbers of the display unit boards in every two rows symmetrical with respect to the equatorial line are same, and are both even numbers.
4. The LED display screen according to claim 1, **characterized in that** in the warp direction, each two of the plurality of display unit boards are symmetrically positioned with respect to a central wrap.
5. The LED display screen according to claim 2, **characterized in that** the height of each of the plurality of display unit boards is integral multiples of the pixel pitch.
6. The LED display screen according to claim 2, **char-**

**acterized in that** in each of the plurality of display unit boards, the LED lamp beads arranged at the edge of that of the plurality of display unit boards are used as edge lamp beads;

the distance from the central point of each of the edge lamp beads to the edge of that of the plurality of display unit boards is half of the pixel pitch.

7. The LED display screen according to claim 1, **characterized in that** in the latitude direction, the maximum width of each of the plurality of display unit boards is no more than 370mm.
8. The LED display screen according to claim 1, **characterized in that** the maximum height of each of the plurality of display unit boards is no more than 370mm.
9. The LED display screen according to claim 2, **characterized in that** in each of the plurality of display unit boards, the plurality of LED lamp beads are arranged in rows sequentially from top to bottom; the number of the plurality of LED lamp beads per row is obtained by the following formula:

$$H = \left\lfloor L / X - 1 \right\rfloor ;$$

wherein,

H represents the number of one row of the plurality of LED lamp beads;  
 L represents the arc length of one of the plurality of display unit boards corresponding to that row of the plurality of LED lamp beads;  
 X represents the preset pixel pitch.

10. The LED display screen according to claim 2, **characterized in that** in each of the plurality of display unit boards, the plurality of LED lamp beads are arranged in rows sequentially from top to bottom; the number of the plurality of LED lamp beads per row is obtained by the following formula:

$$H = \left\lfloor L / X - 1 \right\rfloor ;$$

wherein,

H represents the number of one row of the plurality of LED lamp beads;  
 L represents the arc length of one of the plurality of display unit boards corresponding to that row of the plurality of LED lamp beads;  
 X represents the preset pixel pitch.

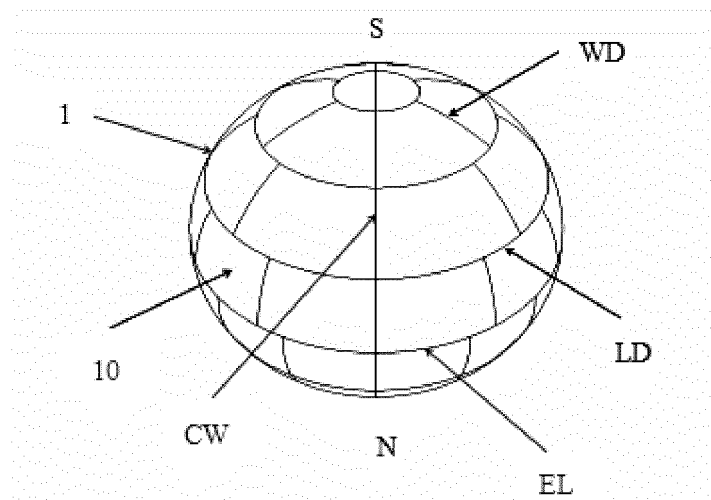


Figure 1

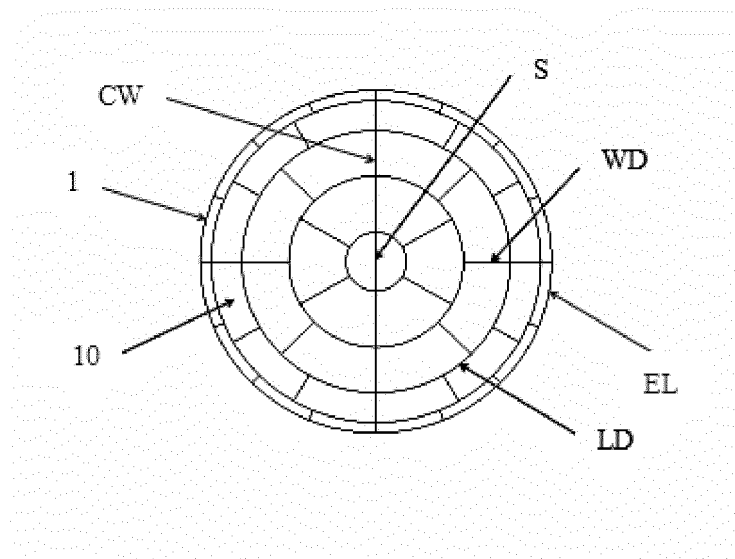


Figure 2

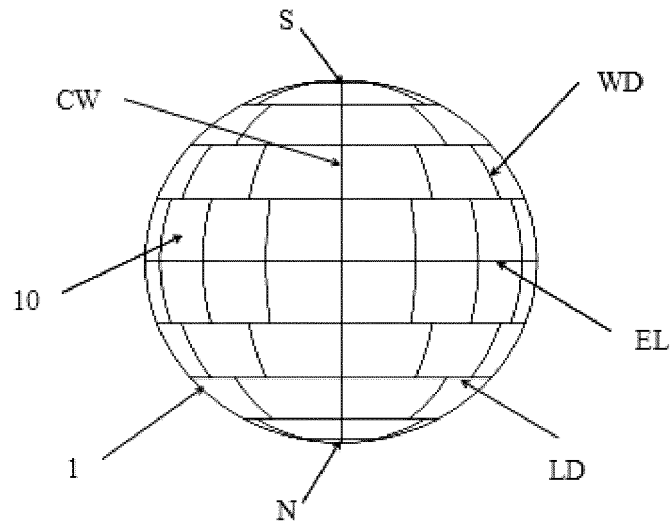


Figure 3

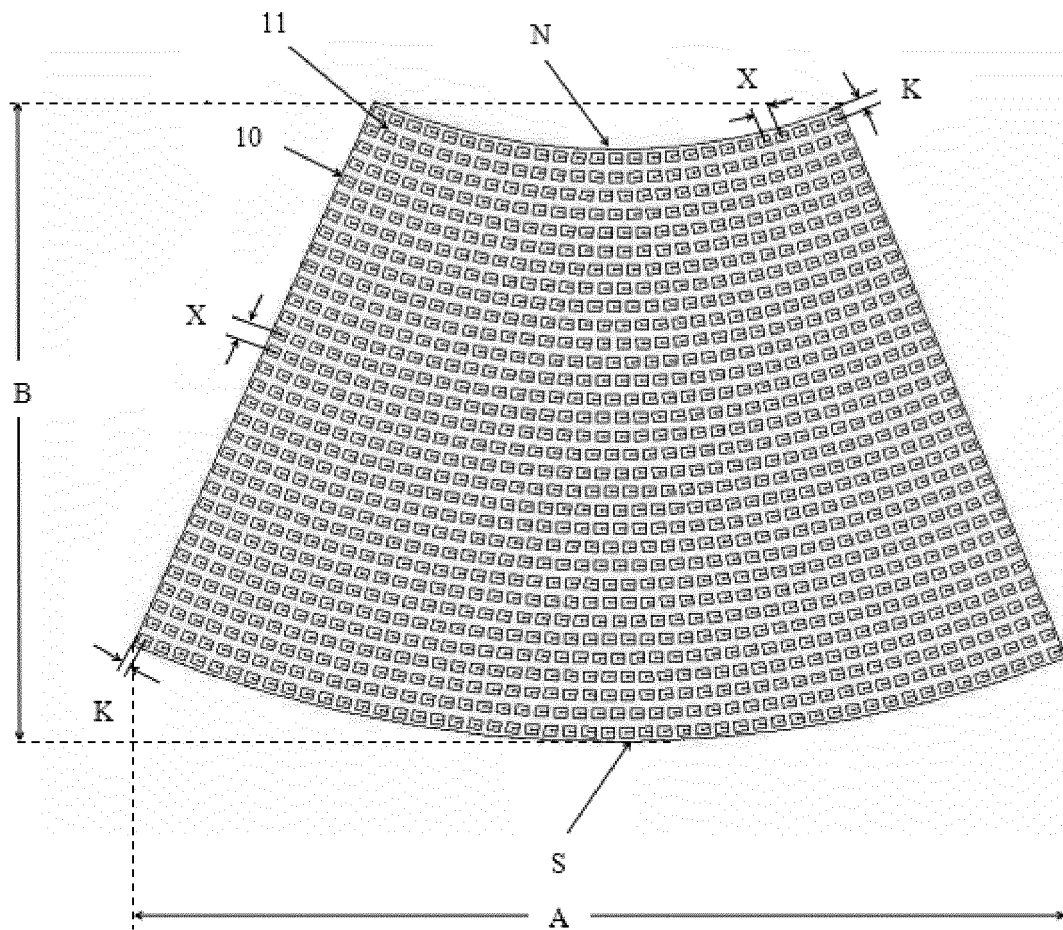


Figure 4



## INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2018/089265

| <b>A. CLASSIFICATION OF SUBJECT MATTER</b><br>G09F 9/33(2006.01)i<br><br>According to International Patent Classification (IPC) or to both national classification and IPC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                              |                                                                                    |                       |   |                                                                                                                                              |      |   |                                                                                                                |      |   |                                                                                                       |      |   |                                                                                                            |      |   |                                                                             |      |   |                                                                              |      |
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| <b>B. FIELDS SEARCHED</b><br>Minimum documentation searched (classification system followed by classification symbols)<br>G09F; G09G<br><br>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 practicable, search terms used)<br>CNABS, CNTXT, VEN; 球形屏, 球形显示屏, 球形, 球面, 曲面, 对称, LED, 灯珠, 灯条, 像素, 间距, 依次, 顺序, 减小, 交错, 错缝, spherical, sphericity, roundness, globular, sphere, screen, curved, symmetry, symmetric, lamp, light, pixel?, space, sequentially, decreas+, staggered                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                              |                                                                                    |                       |   |                                                                                                                                              |      |   |                                                                                                                |      |   |                                                                                                       |      |   |                                                                                                            |      |   |                                                                             |      |   |                                                                              |      |
| <b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                              |                                                                                    |                       |   |                                                                                                                                              |      |   |                                                                                                                |      |   |                                                                                                       |      |   |                                                                                                            |      |   |                                                                             |      |   |                                                                              |      |
| <table border="1"> <thead> <tr> <th>Category*</th> <th>Citation of document, with indication, where appropriate, of the relevant passages</th> <th>Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>CN 102646371 A (GLUX (BEIJING) CREATIVE-TECHNOLOGY CO., LTD.) 22 August 2012 (2012-08-22)<br/>description, paragraphs 42-59, and figures 1-15</td> <td>1-10</td> </tr> <tr> <td>A</td> <td>CN 202523339 U (GLUX (BEIJING) CREATIVE-TECHNOLOGY CO., LTD.) 07 November 2012 (2012-11-07)<br/>entire document</td> <td>1-10</td> </tr> <tr> <td>A</td> <td>CN 201429939 Y (SHANDONG ECHUANG ELECTRONICS CO., LTD.) 24 March 2010 (2010-03-24)<br/>entire document</td> <td>1-10</td> </tr> <tr> <td>A</td> <td>CN 104134410 A (SHENZHEN APEXLS OPTOELECTRONIC CO., LTD.) 05 November 2014 (2014-11-05)<br/>entire document</td> <td>1-10</td> </tr> <tr> <td>A</td> <td>CN 104505004 A (PAN, SHANGFA) 08 April 2015 (2015-04-08)<br/>entire document</td> <td>1-10</td> </tr> <tr> <td>A</td> <td>TW 251239 U (LAI, YINLIANG) 21 November 2004 (2004-11-21)<br/>entire document</td> <td>1-10</td> </tr> </tbody> </table>                                                                                                                                                                                                                  | Category*                                                                                                                                    | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. | A | CN 102646371 A (GLUX (BEIJING) CREATIVE-TECHNOLOGY CO., LTD.) 22 August 2012 (2012-08-22)<br>description, paragraphs 42-59, and figures 1-15 | 1-10 | A | CN 202523339 U (GLUX (BEIJING) CREATIVE-TECHNOLOGY CO., LTD.) 07 November 2012 (2012-11-07)<br>entire document | 1-10 | A | CN 201429939 Y (SHANDONG ECHUANG ELECTRONICS CO., LTD.) 24 March 2010 (2010-03-24)<br>entire document | 1-10 | A | CN 104134410 A (SHENZHEN APEXLS OPTOELECTRONIC CO., LTD.) 05 November 2014 (2014-11-05)<br>entire document | 1-10 | A | CN 104505004 A (PAN, SHANGFA) 08 April 2015 (2015-04-08)<br>entire document | 1-10 | A | TW 251239 U (LAI, YINLIANG) 21 November 2004 (2004-11-21)<br>entire document | 1-10 |
| Category*                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Citation of document, with indication, where appropriate, of the relevant passages                                                           | Relevant to claim No.                                                              |                       |   |                                                                                                                                              |      |   |                                                                                                                |      |   |                                                                                                       |      |   |                                                                                                            |      |   |                                                                             |      |   |                                                                              |      |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | CN 102646371 A (GLUX (BEIJING) CREATIVE-TECHNOLOGY CO., LTD.) 22 August 2012 (2012-08-22)<br>description, paragraphs 42-59, and figures 1-15 | 1-10                                                                               |                       |   |                                                                                                                                              |      |   |                                                                                                                |      |   |                                                                                                       |      |   |                                                                                                            |      |   |                                                                             |      |   |                                                                              |      |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | CN 202523339 U (GLUX (BEIJING) CREATIVE-TECHNOLOGY CO., LTD.) 07 November 2012 (2012-11-07)<br>entire document                               | 1-10                                                                               |                       |   |                                                                                                                                              |      |   |                                                                                                                |      |   |                                                                                                       |      |   |                                                                                                            |      |   |                                                                             |      |   |                                                                              |      |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | CN 201429939 Y (SHANDONG ECHUANG ELECTRONICS CO., LTD.) 24 March 2010 (2010-03-24)<br>entire document                                        | 1-10                                                                               |                       |   |                                                                                                                                              |      |   |                                                                                                                |      |   |                                                                                                       |      |   |                                                                                                            |      |   |                                                                             |      |   |                                                                              |      |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | CN 104134410 A (SHENZHEN APEXLS OPTOELECTRONIC CO., LTD.) 05 November 2014 (2014-11-05)<br>entire document                                   | 1-10                                                                               |                       |   |                                                                                                                                              |      |   |                                                                                                                |      |   |                                                                                                       |      |   |                                                                                                            |      |   |                                                                             |      |   |                                                                              |      |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | CN 104505004 A (PAN, SHANGFA) 08 April 2015 (2015-04-08)<br>entire document                                                                  | 1-10                                                                               |                       |   |                                                                                                                                              |      |   |                                                                                                                |      |   |                                                                                                       |      |   |                                                                                                            |      |   |                                                                             |      |   |                                                                              |      |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | TW 251239 U (LAI, YINLIANG) 21 November 2004 (2004-11-21)<br>entire document                                                                 | 1-10                                                                               |                       |   |                                                                                                                                              |      |   |                                                                                                                |      |   |                                                                                                       |      |   |                                                                                                            |      |   |                                                                             |      |   |                                                                              |      |
| <input type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                              |                                                                                    |                       |   |                                                                                                                                              |      |   |                                                                                                                |      |   |                                                                                                       |      |   |                                                                                                            |      |   |                                                                             |      |   |                                                                              |      |
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| Date of the actual completion of the international search<br><br><b>30 January 2019</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Date of mailing of the international search report<br><br><b>14 February 2019</b>                                                            |                                                                                    |                       |   |                                                                                                                                              |      |   |                                                                                                                |      |   |                                                                                                       |      |   |                                                                                                            |      |   |                                                                             |      |   |                                                                              |      |
| Name and mailing address of the ISA/CN<br><br><b>National Intellectual Property Administration, PRC (ISA/CN)<br/>No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088<br/>China</b><br><br>Facsimile No. (86-10)62019451                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Authorized officer<br><br><br><br><br><br><br><br><br><br>Telephone No.                                                                      |                                                                                    |                       |   |                                                                                                                                              |      |   |                                                                                                                |      |   |                                                                                                       |      |   |                                                                                                            |      |   |                                                                             |      |   |                                                                              |      |

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INTERNATIONAL SEARCH REPORT  
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International application No.

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| Patent document cited in search report |           |   | Publication date (day/month/year) | Patent family member(s) |           |   | Publication date (day/month/year) |
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| CN                                     | 201429939 | Y | 24 March 2010                     | None                    |           |   |                                   |
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