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(54) **Method for demonstrating video images and apparatus therefor**

(57) A method for demonstrating video images during mass-events such as a stadium or stage performance is proposed. The method includes assembling a large-area display in a field by positioning a plurality of stand-alone video display panels (14) adjacent one another; displaying corresponding video image sections at each display panel (14) at an appropriate time, in accordance with control signals transmitted from a main control unit

(16) thereby forming a desired overall video image on the large-area display; and disassembling the large-area display and removing the panels (14) from the field, wherein during the steps of assembling, displaying and disassembling the panels (14) are being carried and supported by men (58). A video display panel (14) and a large-area display system (10) for carrying out the method are also disclosed.

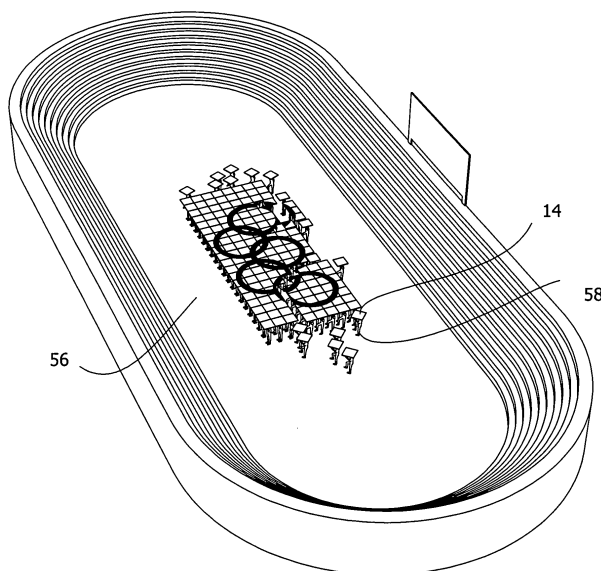


FIG. 5B

Description

FIELD OF INVENTION

[0001] This invention relates to video display systems and more particularly to large-area video display systems composed of a plurality of display panels.

BACKGROUND OF INVENTION

[0002] Large-area display systems are widely used for displaying pictures and information in sports fields, recreation grounds, outdoor and indoor advertisements, and also more and more in area of public events and shows.

[0003] Such display systems have commonly been constructed of numbers of light emitting elements, such as light emitting diodes (LEDs) mounted on flat panels. These light-emitting elements may be selectively turned on and off to create patterns, graphics, and video images for both informational and aesthetic purposes. It is well known to construct such displays of panels or tiles each containing a plurality of light emitting elements. Examples of such systems are disclosed in U.S. Pat Nos. 5,990,802 and 6,314,669. Such systems are typically heavy and time-consuming to install, and once in position they are not easily altered. In addition, such systems are typically difficult to remove.

[0004] However, as modern show becomes more and more technologically advanced, the classic fixed structure of the LED video panels may become a limitation. Designers and producers may desire more flexibility and versatility in use.

[0005] It is often necessary for a given event, theatrical production or stadium performances to use such a display but to have the display easily removed. For example, it may be desirable to have the display removed between the scenes of a play or theatrical event or as the needs of the production otherwise dictate.

[0006] Moreover, it is popular and in other words, traditional, to arrange a short time performance between games during basketball break in the USA. It is also become popular to show advertisement between football games in Europe. All these performances are limited in time, and thus require a new technology and equipment that allow fast assembly, displaying and dismantling.

[0007] A display constructed as a large panel or as a series of large tiles cannot easily be removed in this manner. Typically, as noted above, such displays are large and heavy and require significant support machinery, time, and storage space to move and install. For example, U. S. Pat. No. 6,704,989 discloses a system where individual display sections are lifted out of storage cases using a lifting truss, and are thereafter joined and stacked.

[0008] In view of the high cost and complexity of setting up temporary facilities for mass events there continues to be a need for a system which can be quickly and cost effectively assembled and disassembled, a system which is versatile enough to be used in a variety of mass

events, and a system which can attract the attention of spectators at such events.

SUMMARY OF INVENTION

[0009] The general purpose of the present invention is to provide a video display system for mass events, such as stadium performances, and a method of demonstrating video images during such events.

[0010] In one aspect, embodiments disclosed herein relate to a method for demonstrating video images. The method includes assembling a large-area display in a field by positioning a plurality of stand-alone video display panels adjacent one another; displaying corresponding video image sections at each display panel at an appropriate time, in accordance with control signals transmitted from a main control unit thereby forming a desired overall video image on the large-area display; and disassembling the large-area display and removing the panels from the field, wherein during the steps of assembling, displaying and disassembling the panels are being carried and supported by men.

[0011] In some embodiments, the step of displaying begins before the completion of the assembling step. In other embodiments the step of disassembling begins before the completion of the displaying step.

[0012] In another embodiment, the method further comprises the step of pre-recording the video images to be displayed during the event into video content storage memory in each of the panels.

[0013] In another aspect, embodiments disclosed herein relate to a display panel. A video display panel capable of being assembled together with similar display panels into a large-area display is disclosed. The panel comprises: a plurality of pixels disposed on a surface of the display panel, wherein the plurality of pixels are configured to receive an electrical signal and power; a plurality of vents formed on the surface of the display panel between the pixels; a panel control unit configured to control the plurality of pixels to display a video image in accordance with the control signals from a main control unit; and a wireless communication interface connected to the controller for receiving control signals from the main control unit, wherein the display panel is adapted to be carried and supported during operation by a man.

[0014] Preferably the pixels comprises light emitting diodes (LEDs).

[0015] In some embodiments, the panel further comprises positioning means facilitating mutual arrangement of the panels in a position adjacent one another.

[0016] In another embodiment, the panel further comprises video content storage memory for storing a video program to be displayed during a show.

[0017] In yet another aspect, embodiments disclosed herein relate to a large-area display system. The system includes a main control unit equipped with wireless transmitter for communicating control signals to a plurality of stand-alone video display panels. Wherein the plurality

of stand-alone video display panels each comprises: a plurality of pixels disposed on a surface of the display panel, wherein the plurality of pixels are configured to receive an electrical signal and power; a plurality of vents formed on the surface of the display panel between the pixels; a panel control unit configured to control the plurality of pixels to display a video image in accordance with the control signals from the main control unit; and a wireless communication interface connected to the controller for receiving control signals from the main control unit, wherein the display panels are adapted to be carried and supported during operation by men.

[0018] In some embodiments, the display panels are arranged into a two-dimensional array.

[0019] In another embodiment, the display panels are arranged to form a large-area display having a three-dimensional display surface.

BRIEF DESCRIPTION OF DRAWINGS

[0020]

FIG. 1 illustrates a functional block diagram of a large-area display system in accordance with the present invention;

FIG. 2 illustrates a functional block diagram of a base station;

FIG. 3 illustrates a functional block diagram of a display panel;

FIG. 4A shows a front perspective view of a display panel;

FIG. 4B shows a back perspective view of a display panel;

FIG. 4C shows an enlarged partial view of two adjacent display panels;

FIG. 5A shows an assembled large-area display;

FIG. 5B shows a semi-assembled large-area display;

FIG. 6A shows a man holding a display panel in operational position;

FIG. 6B shows a group of people assembling a large-area display of complex form;

FIG. 6C shows a group of people assembling a large-area display of complex non-planar form.

PREFERRED EMBODIMENT

[0021] The invention is illustrated by the following examples.

[0022] FIG. 1 illustrates functional block diagram of a large-area display system 10 in accordance with present invention. The display system 10 comprises a base station 12 and multiple video display panels 14 capable of being arranged into a large-area display.

[0023] FIG. 2 illustrates a functional block diagram of the base station 12. The base station 12 includes a main control unit 16 and a wireless transmitter 18, with an antenna 20.

[0024] The main control unit 16 provides processing of control data or signals to be transmitted to the multiple display panels 14. The control data can be supplied from an external source (not shown), for example a personal computer, or control data can also be generated by simple "on/off" push button operation. The control data, after formatting and modulating in the main control unit 16, are transmitted to the multiple video display panels 14 by the transmitter 18. Formatting of control data may include encoding thereof for security purpose.

[0025] In the preferred embodiment the transmitter 18 is a radio frequency transmitter, which outputs modulated radio signals via antenna 20 to the display panels 14. The output power of the transmitter 18 should be high enough to provide coverage of the all area where the event takes place, for example, a football field or an Olympic stadium.

[0026] One main control unit 16 controls operation of all video display panels 14 forming a large-area display, wherein each display panel 14 shows a part or a segment of the overall large-area image.

[0027] In order to use the method of the present invention appropriate video display panels 14 are required. First of all, such a panel should be capable of being carried and supported during operation by one or several persons, therefore, the most general requirements that can be imposed upon the panels are:

the panels should be large enough to reduce a number of panels required to form the large-area display, in the preferred embodiment the panels are of size 1x1 m;

the panel should be battery operated and provided with wireless control to allow unrestrained by cables movement of people carrying the panels;

the panels should have a large enough number of pixels for the composite large-area video image being of reasonable quality, in the preferred embodiment, each panel comprises an array of 24x24 pixels (576 pixels) thus to produce the video image comparable with standard TV image quality an array of at least of 10x7 panels is required;

the panels should be lightweight to be easily carried and held by a human being, the panel described herein weights less than 9 kg, with a battery sufficient for half an hour performance;

the panels should be sufficiently transparent to light and air in order to reduce a wind-load on the panel and not to limit severely user's visibility, the panel described herein has transparency of about 85%;

preferably the panels should have a positioning means facilitating mutual arrangement of neighboring or adjusting panels;

preferably the panels should have pixels bright enough to be clearly visible in daylight, in the preferred embodiment in pixels are used light-emitting-diodes that are bright enough to be seen in daylight.

[0028] The display elements of screen or pixels may be emissive, transmissive, or reflective and the invention is not limited in scope to any particular display element.

[0029] A functional block diagram of a display panel 14 in accordance with the invention is shown on FIG. 3.

[0030] The display panel 14 comprises four display boards 22, each board 22 comprising a plurality of pixels, and a panel control unit 28. The display boards 22 are connected to output connectors 42 of the panel control unit 28 by cables 30. The panel control unit 28 further comprises a wireless communication interface 34, an antenna 32, a data upload input 36, a power input 38, a DC battery 40, a controller 16, and a video content storage memory 46.

[0031] The wireless communication interface 34 is electrically connected to an antenna 32, and electrically connected to the controller 44. In the preferred embodiment the wireless communication interface 34 is equipped with a standard radio frequency (RF) receiver. The interface 34 receives control signals from the main control unit 16, and after decoding sends them to the controller 44.

[0032] The data upload input 36 is used to upload video image data or a video program into the video content storage memory 46 of the display panel 14. The data upload input 36 is implemented as a high speed USB communication channel. However, other implementation of the data upload input 36 is possible, for example, RS485 channel.

[0033] The DC battery 40 is used to supply direct current to the display panel 14. The capacity of the battery 40 is enough to provide stable operation of the display panel 14 during relatively short period of time, preferably half an hour. The battery 40 supplies DC power to the panel control unit 28 and to the display boards 22.

[0034] The power input 38 is used to recharge the DC battery 40 before or after operation of the display panel 14. The power input 38 can also be used for direct DC power supply to the display panel 14. This allows using the display panels 14 without a need to recharge the batteries in those applications where a direct supply of DC power is available. For example, a plurality of display panels 14 can be distributed around tribunes of a stadium, and can be then used for advertisement. In this case the display panels 14 can be powered from external DC sources, distributed around the stadium.

[0035] Alternatively, an external battery may be carried on a body of the person operating the display panel 14 and connected to the panel 14 through the power input 38.

[0036] The video content storage memory 46 is an on-board memory for storing a video program to be displayed during a performance. The video program is recorded

and stored as a sequence of uncompressed video files (video data). The resolution of the stored video files is equal to the display panel resolution.

[0037] There is a possibility either upload video into a panel on-board memory or communicate it by radio together with the control signals, however, to simplify the control circuitry in the preferred embodiment the video data are pre-loaded into the on-board video content storage memory 46.

[0038] The video files or video data are recorded into the memory 46 from an external source, for example, a personal computer (PC), via the data upload input 36. In the preferred embodiment, the data upload input 36 is a USB compatible port, which is very fast and reliable, and allows fast upload of the video data.

[0039] The video content storage 12 is realized as a non-volatile memory. According to present invention, the internal non-volatile memory is a NAND type memory. The reason to use a NAND flash memory is that it is characterized in high capacity, long life time, high speed of data transfer - i.e. data recording in and data reading out of the memory. Its low cost and commercial availability is also an advantage of this type of memory. In the preferred embodiment, the non-volatile NAND flash memory can be, for example, flash type 64Mb K9F1208U0B, manufactured by Samsung Electronics, Korea.

[0040] The panel control unit 28 also comprises a serial number chipset (not shown), for example DS2401, manufactured by Dallas Semiconductor, USA. The serial number chipset stores a unique 6-bytes number, which is used for the display panel 14 identification within the overall large-area display. This is necessary for appropriate data upload procedure of video content into display panels 14.

[0041] The video content storage memory 46 is connected directly to the controller 44. The controller 44 performs interpretation of control signals received from communication interface 34, performs reading of video image data from the video content storage memory 46 in accordance with the received control signals from the communication interface 34, and output pixel image data to the display boards 22. Thus it makes possible static and dynamic image in various of colors to be displayed on the display panel 14.

[0042] The controller 44 may be, for example, a field programmable gate array XC3S200, manufactured by Xilinx Inc., USA.

[0043] The panel control unit 28 provides all the power regulation, processing of image data and control data, which is necessary for proper operation of the display panel 14. The panel control unit 28 also includes standard electronic components, necessary for correct operation of the display panel 14, for example, buffers, three-state line drivers, and electronic filtering components, such as capacitors and resistors.

[0044] The panel control unit 28 is connected to four display boards 22 each of which comprising a plurality

of pixels 24. In the preferred embodiment, each board 22 contains 144 pixels 24 disposed in array 12x12 on the front surface of the board 22. Therefore, each display panel 14 contains 576 pixels (24x24).

[0045] The display board 22 may be a printed circuit board made of a monolith single piece fibreglass material. The board 22 has see-through windows or vents 26, made by milling or other method, known to those skilled in the art. The front side of the board 22 is populated with pixels 24. The pixels 24 may be a light emitting diodes (LEDs).

[0046] In the preferred embodiment each pixel 24 comprises LEDs of three primary colors in 3-in-1 package also known as RGB LEDs and corresponding LED drivers. In the preferred embodiment are used NSSM016A LEDs, manufactured by Nichia, Japan.

[0047] FIG. 4A shows a front perspective view of the display panel 14 and FIG. 4B shows a back perspective view of the display panel 14, respectively. The display panel 14 comprises four display boards 22 electrically connected with the panel control unit 28 by cables 30, the support frame 48, two holders 50, positioning pins 19, positioning receptacles 20.

[0048] The support frame 48 consists of a number of metal tubes, mechanically joined together to form a strong and stable construction. The support frame 17 further comprises holders 50 which allow a man to hold the display panel 14 in his or her hands during operation.

[0049] The support frame 48 may be made of a thin, rigid, lightweight material such as a metal so that the entire frame is very lightweight. Such metals can include aluminum or other lightweight metals. In addition, plastic, fiberglass, carbonaceous materials and other lightweight materials and combination of thereof can be used.

[0050] Positioning pins 52 and positioning receptacles 54 are used for fast and easy positioning of the display panels 14 during assembly and for keeping precise distance between pixels 24 of neighboring display panels 14 during operation. The positioning pins 52 and receptacles 54 also facilitate load distribution.

[0051] The positioning pin 19 has a spherically shaped end whereas the positioning receptacle 54 has a spherically shaped concave cup. Referring to FIG. 4C showing an enlarged perspective partial view of two display panels 14 positioning adjacent one another or side-by-side, having the positioning pin 52 is placed inside positioning receptacles 54. Thus, the display panels 14 cannot move relative to each other, and the distance between pixels 24 keeps constant.

[0052] Other positioning means may be used to facilitate mutual positioning of neighboring panels 14, for example magnets.

[0053] FIG. 5A shows a large-area display 56 assembled at a stadium in the play field. The large-area display 56 in the center of the stadium consists of a large array of stand-alone video display panels 14. A group of men 58 or individual performers is standing in rectangular formation in the field; each of the men 58 is holding one

video display panel 14 over his/her head. The neighbouring display panels 14 are held adjacent one another thus forming a large-area display 56.

[0054] FIG. 5B shows a semi-assembled large-area display 56. Various visual effects may be shown during the process of assembling, for example the panels 14 may synchronously change colors, or running color waves may be shown. As each display panel 14 is capable of showing video images, the possible visual effects are limited only by imaginativeness of the producer. Demonstration of more complex visual effects or video images may begin during the process of assembling before the all large-area display 56 is completed.

[0055] FIG. 6A shows a man holding the panel overhead in horizontal position. In the preferred embodiment, the display panel is a square 1x1 m, however a person skilled in the art will appreciate that the display panels 14 may be rectangular, pentagonal, hexagonal or have any other form known in the art.

[0056] A person skilled in the art will also appreciate that the large-area display 56 may have a non-rectangular form or even more complex form. For example FIG. 6B shows a group of people 58 assembling a large-area display having formed as figure six, any other form is possible, as well. Although, all large-area displays described above have a flat display surface, the large-area displays with may have a non-planar surface, as is shown, for example, on FIG. 6C, are within the scope of the present invention as well.

[0057] In operation, the main control unit 16 sends a command to the plurality of display panels 14. The RF receiver receives and demodulates the command, and sends it to the controller 44. The controller 44 interprets the command, reads appropriate pixel image data from the video content storage memory 46, modulates and outputs the modulated data to the display boards 22.

[0058] For example: command No. N makes the display panels to play video file No. N from the video content storage memory 46; command No. N+1 makes the display panels to lower brightness; command No. N+2 makes the display panels to increase brightness.

[0059] In the preferred embodiment, there is no unique address associated with each display panel 14, so all panels 14 will interpret and perform commands in the same manner.

METHOD

[0060] This invention comprises a method for demonstrating video images during mass-events such as a stadium or stage performance. The method consists of the following steps:

Step 1: assembling a large-area display in a field by positioning a plurality of stand-alone video display panels adjacent one another to form the large-area display, wherein, in the preferred embodiment, assembling includes carrying the plurality of the stand-

alone video display panels into the field and positioning the panels adjacent one another to form the large-area display.

Step 2: displaying corresponding video image sections at each display panel, in the preferred embodiment, the corresponding segments of overall video image are prerecorded into each panel video content storage memory. Alternatively, the video image may be transmitted wirelessly by any means known in the art, for example by radio or by optical means.

Step 3: disassembling the large-area display and removing the panels from the field.

[0061] The method may optionally include the step of pre-recording the video images to be displayed during the event into the video content storage memory in each of the panels. Pre-recording of the video images into internal panel memory allows using simple narrow-band radio receivers because there is no need to transmit video signal by radio.

[0062] As the panels have no connecting cables or wires and are not fixed to any external structure the process of assembling and disassembling can be made very rapidly. The group of specially trained people carries out the panels into the field and arranges the panels side-by-side to form a large-area display. During the demonstration of the video program the people hold the panels over their heads. As the panels have no connecting cables they are ready for operation immediately after switching on, thus the demonstration of video or visual effects may begin in the process of assembling the large-area display and it may continue during the process of disassembling and carrying the panels out of the field.

The method is illustrated by the following example.

EXAMPLE

[0063] Practical application of the method of the present invention can be found in a proposed scenario of Olympic Game opening ceremony, for example.

[0064] Traditionally, an Opening ceremony takes place at Olympic stadium with great audience, located at tribunes around the stadium.

[0065] According to the proposed opening scenario, a group of trained people has to create a large-area display in the center of the stadium. Display size is 20 by 50 meters, measure total 1000 sq. meters. The display must be assembled, and then operated to display video of Olympic flame, Olympic rings, etc. After main displaying, some colorful effects will be also displaying during disassembling of the large-area display. Total time of displaying video is 10 minutes.

[0066] To perform this action, it will be necessary to have 1000 trained people. Each of them will bear one display panel 1x1 meter.

[0067] 1 day before the performance:

It will be necessary to split the overall video to be displayed on the large-area display into 1000 separate video files. A number of well-known video software can do this work.

[0068] 1 hour before the performance:

The video files must be uploaded in each display panel. To perform this operation, a display panels are positioned vertically, 20 rows by 20 columns, close to each other, but not too close to allow workers to walk free between them to allow easy uploading.

It is also necessary to have 20 special trained workers who will upload files. It will takes for them approximately 30 min to upload files into 1000 display panels.

[0069] 15 min before the performance:

Trained workers stand in front of opposite side of the display panels and wait for common command to pick the panels up.

[0070] 2 min before performance:

Each trained worker picks up the display panel and hold it in front of his stomach.

[0071] Beginning of the performance:

Trained workers of the first row (20 people) lift their display panels above their heads, and start moving to their predetermined position at the stadium field. The next row of trained workers also lifts display panels and follows the first row with a 2-step distance. Thus, all together are moving with distance of 2 steps between rows.

Then, the first row stops at its position. The next row comes closer to the first row and connects display panels to each other by placing connecting pins into connecting receptacles or cups. Using strong NIB magnets inside the pins and cups is recommended.

Thus, during this process, 20 separate columns of display panels will be created.

At last, display columns must be joined together. This is performed by moving columns to each other. For example, Columns No. 10 and No. 11 must be joined together first. Then, column No. 9 moves to column No. 10 and column No. 12 moves to column No. 11 and so on. This movement is performed by doing side steps.

[0072] After the assembly process, the main video program is started displaying. A common synchronization signal is sent from base station in the form of, for example, radio impulse, to all display panels. Each synchronization impulse makes each display to start playing video file, stored in its memory. Next synchronization impulse makes to play next video file and so on.

[0073] Disassembly process:

Trained workers perform the same side step movement to split display into separate columns. After columns are separated, workers can move to go out of stadium. Some video or visual effects can also be shown during the go-out process.

PARTS LIST

[0074]

10 large-area display system;
12 base station;
14 video display panel;
16 main control unit;
18 transmitter;
20 antenna (base station);
22 display board;
24 pixel;
26 vent;
28 panel control unit;
30 cable;
32 antenna (display panel);
34 wireless communication interface;
36 data upload input;
38 power input;
40 DC battery;
42 output connector;
44 controller;
46 video content storage memory;
48 support frame;
50 holder;
52 positioning pin;
54 positioning receptacle;
56 large-area display;
58 man.

Claims

1. A method for demonstrating video images during mass-events such as a stadium or stage performance comprising the steps of:
 - a) assembling a large-area display (56) in a field by positioning a plurality of stand-alone video display panels (14) adjacent one another;
 - b) displaying corresponding video image sections at each display panel (14) at an appropriate

time, in accordance with control signals transmitted from a main control unit (16) thereby forming a desired overall video image on the large-area display (56);

c) disassembling the large-area display (56) and removing the panels (14) from the field,

wherein during the steps of assembling, displaying and disassembling the panels (14) are being carried and supported by men (58).

2. The method of claim 1 in which the step of displaying begins before the completion of the assembling step.
3. The method of claim 1 in which the step of disassembling begins before the completion of the displaying step.

4. The method of claim 1 further comprising the step of pre-recording the video images to be displayed during the event into a video content storage memory (46) in each of the panels (14).

5. The method of claim 1 in which the step of displaying comprises communicating video data to each of the panels (14) by wireless communication means.

6. The method of claim 1 in which the step of assembling comprises carrying the plurality of video display panels (14) into the field.

7. The method of claim 1 in which the step of disassembling comprises carrying the plurality of video display panels (14) out of the field.

8. A video display panel (14) capable of being assembled together with similar display panels (14) into a large-area display (56), the panel (14) comprising:

a plurality of pixels (24) disposed on a surface of the display panel (14),

wherein the plurality of pixels (24) are configured to receive an electrical signal and power;

a plurality of vents (26) formed on the surface of the display panel (14) between the pixels (24); a panel controller (44) configured to control the plurality of pixels (24) to display a video image in accordance with control signals from a main control unit (16); and a wireless communication interface (11) connected to the controller (44) for receiving the control signals from the main control unit (16), wherein the display panel (14) is adapted to be carried and supported during operation by a man (58).

9. The video display panel (14) of claim 8 further comprising positioning means (52, 54) facilitating mutual arrangement of the panels (14) in a position adjacent one another. 5
10. The video display panel (14) of claim 8 further comprising a video content storage memory (46) for storing a video program to be displayed during a show.
11. The video display panel (14) of claim 8 wherein the pixels comprise LEDs. 10
12. A large-area display system (10) comprising:
- a main control unit (16) equipped with a wireless transmitter (18) for communicating control signals to a plurality of stand-alone video display panels (14); 15
- wherein each of the plurality of stand-alone video display panels (14) comprises: 20
- a plurality of pixels (24) disposed on a surface of the display panel (14), 25
- wherein the plurality of pixels (24) are configured to receive an electrical signal and power;
- a plurality of vents (26) formed on the surface of the display panel (14) between the pixels (24); 30
- a panel controller (44) configured to control the plurality of pixels (24) to display a video image in accordance with the control signals from the main control unit (16); and
- a wireless communication interface (11) connected to the controller (44) for receiving the control signals from the main control unit (16), wherein the display panels (14) are adapted to be carried and supported during operation by men (58). 35 40
13. The large-area display system (10) of claim 12 wherein the display panels (14) are arranged into a two-dimensional array. 45
14. The large-area display system (10) of claim 12 wherein the display panels (14) are arranged to form a large-area display having a three-dimensional display surface. 50
- 55

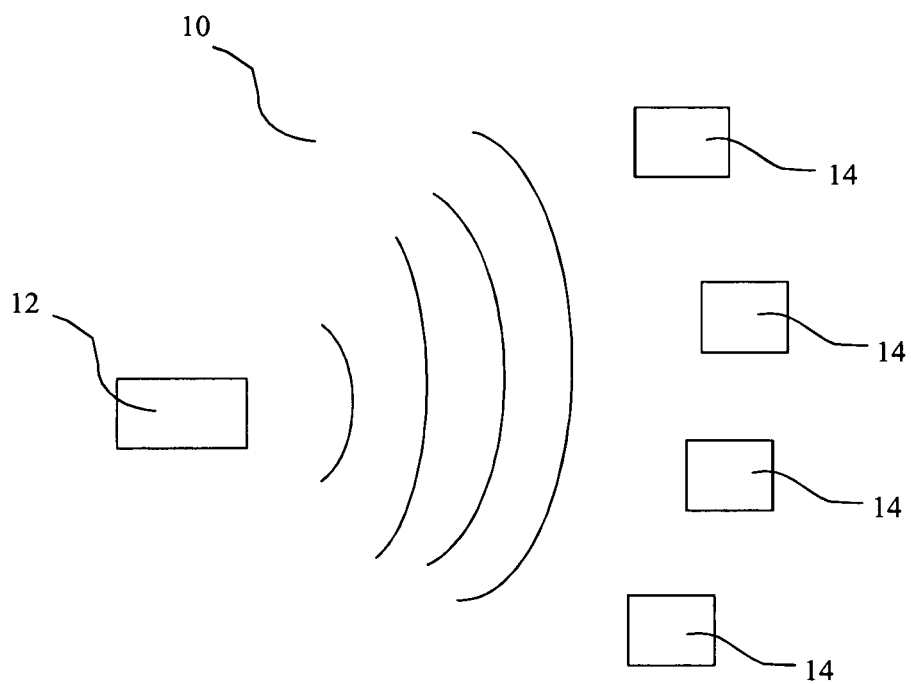


FIG.1

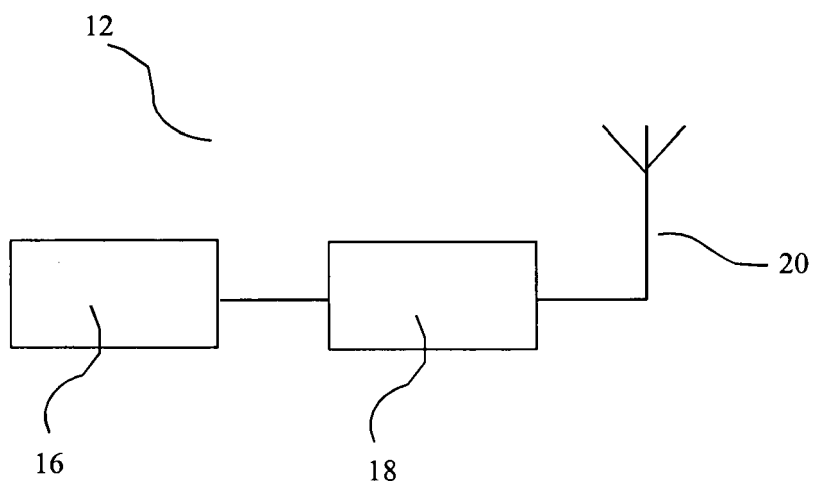


FIG.2

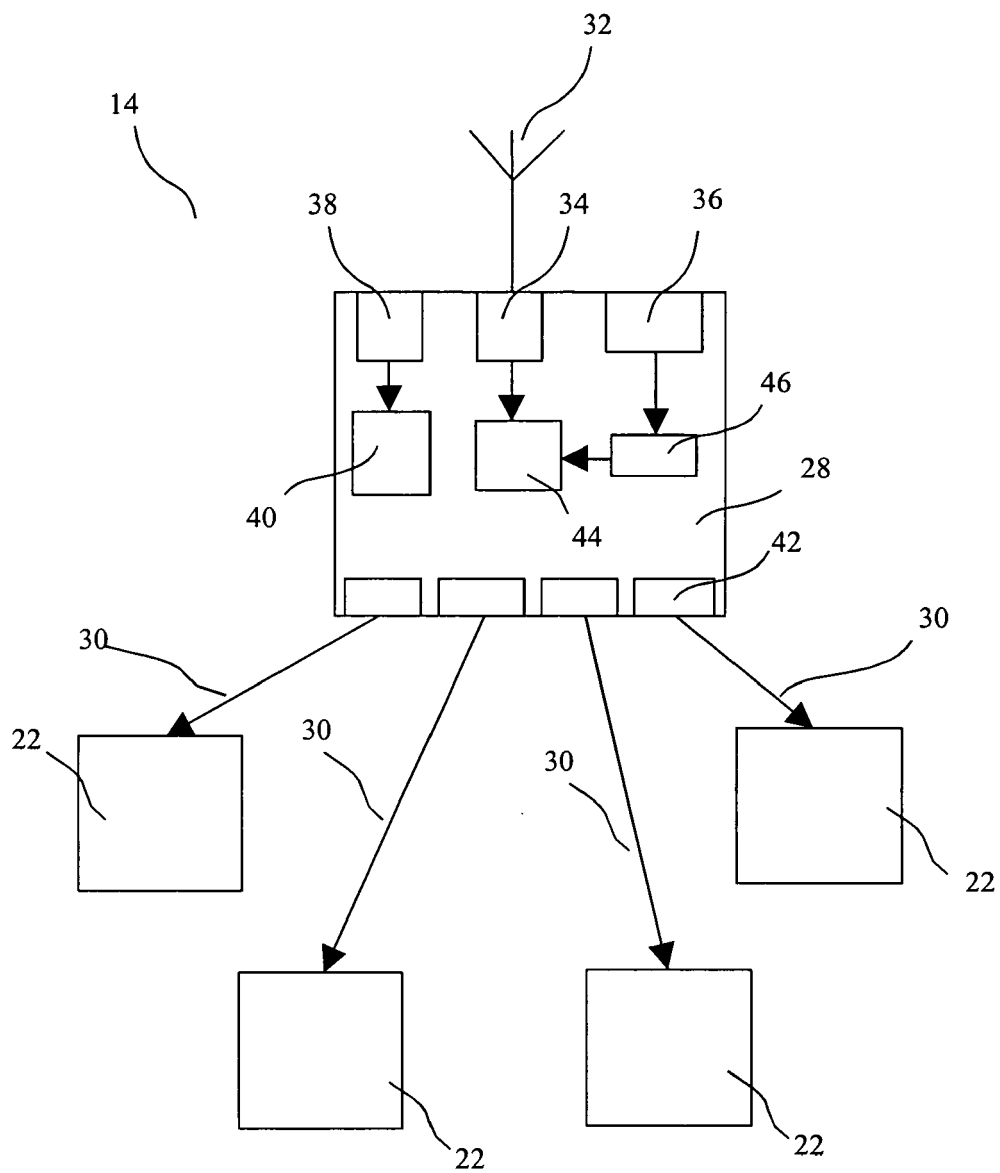


FIG. 3

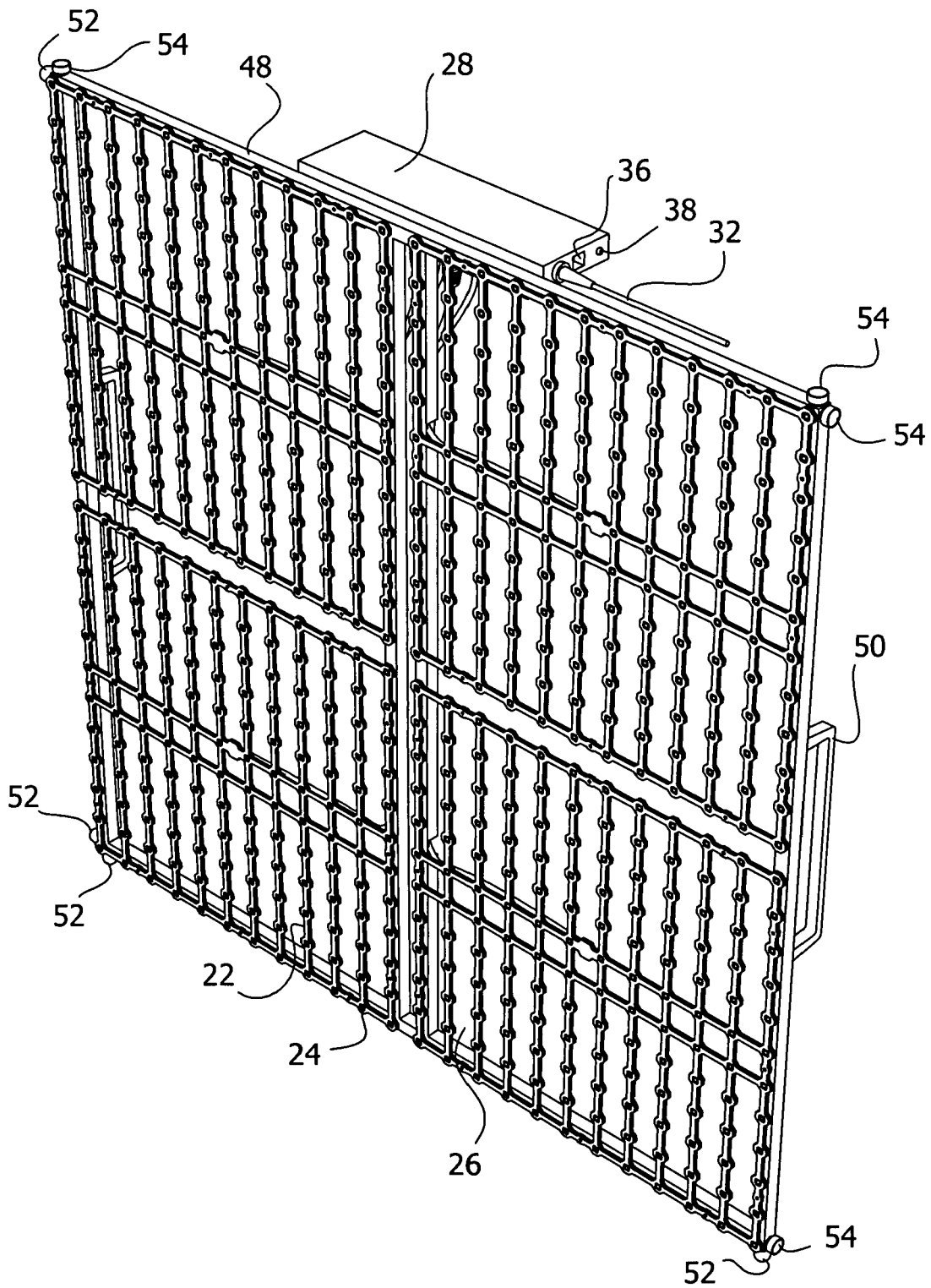


FIG. 4A

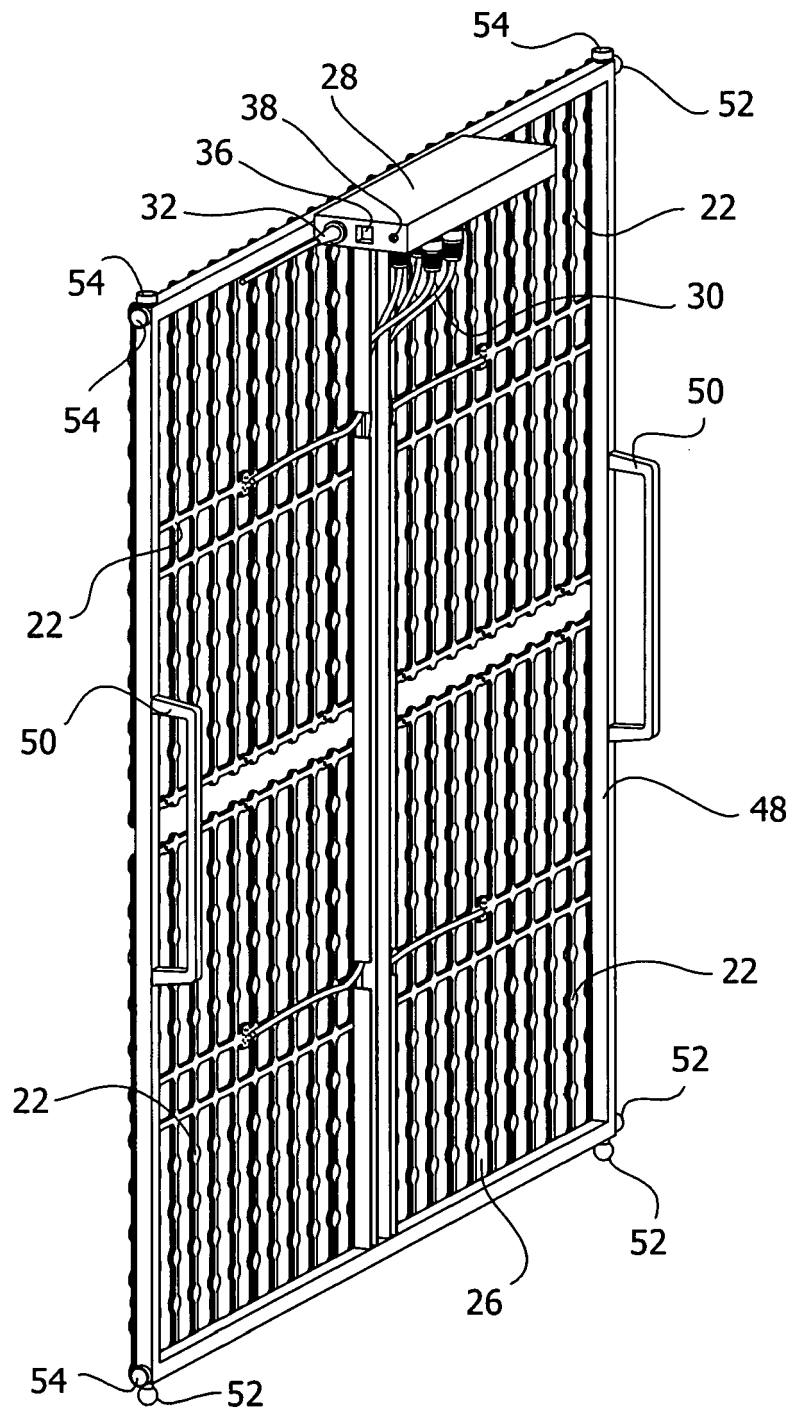


FIG. 4B

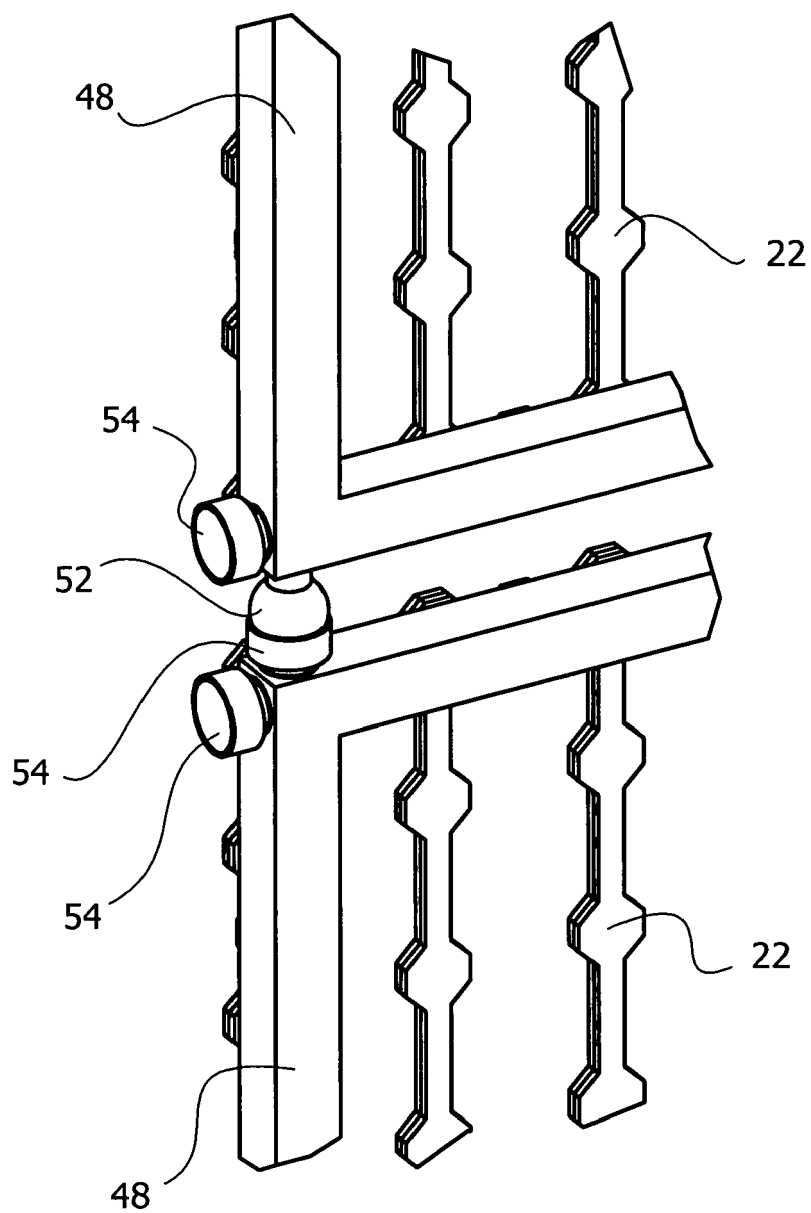


FIG. 4C

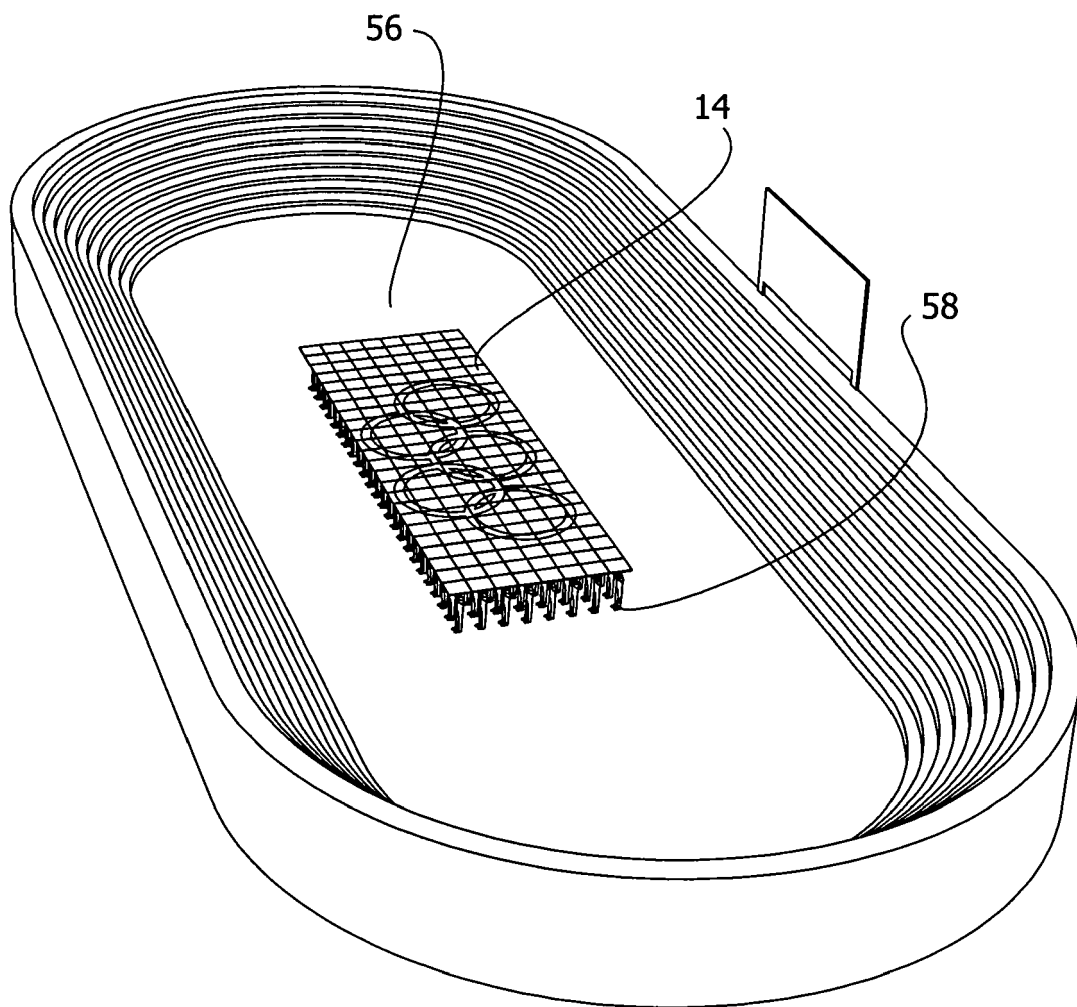


FIG. 5A

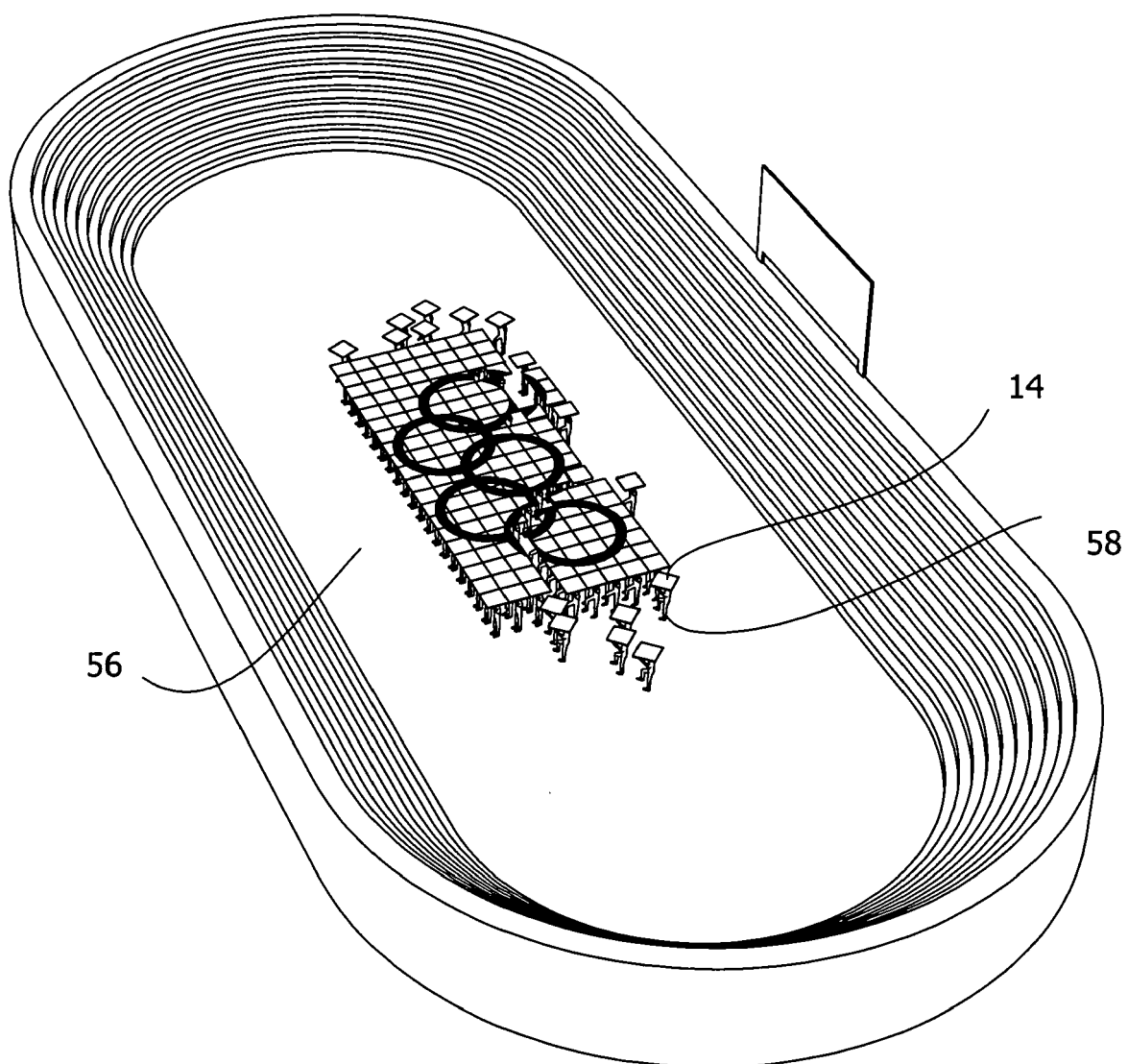


FIG. 5B

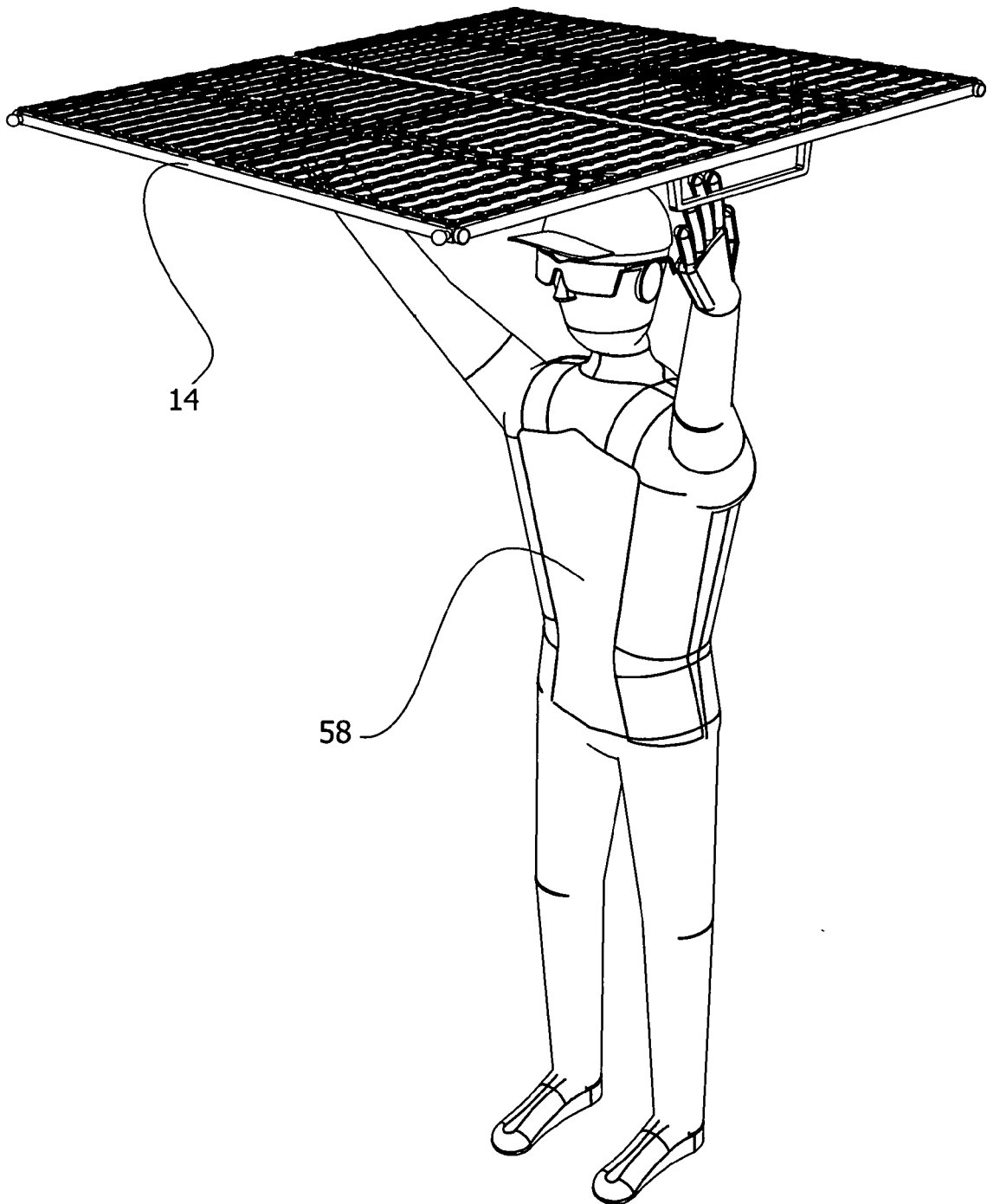


FIG. 6A

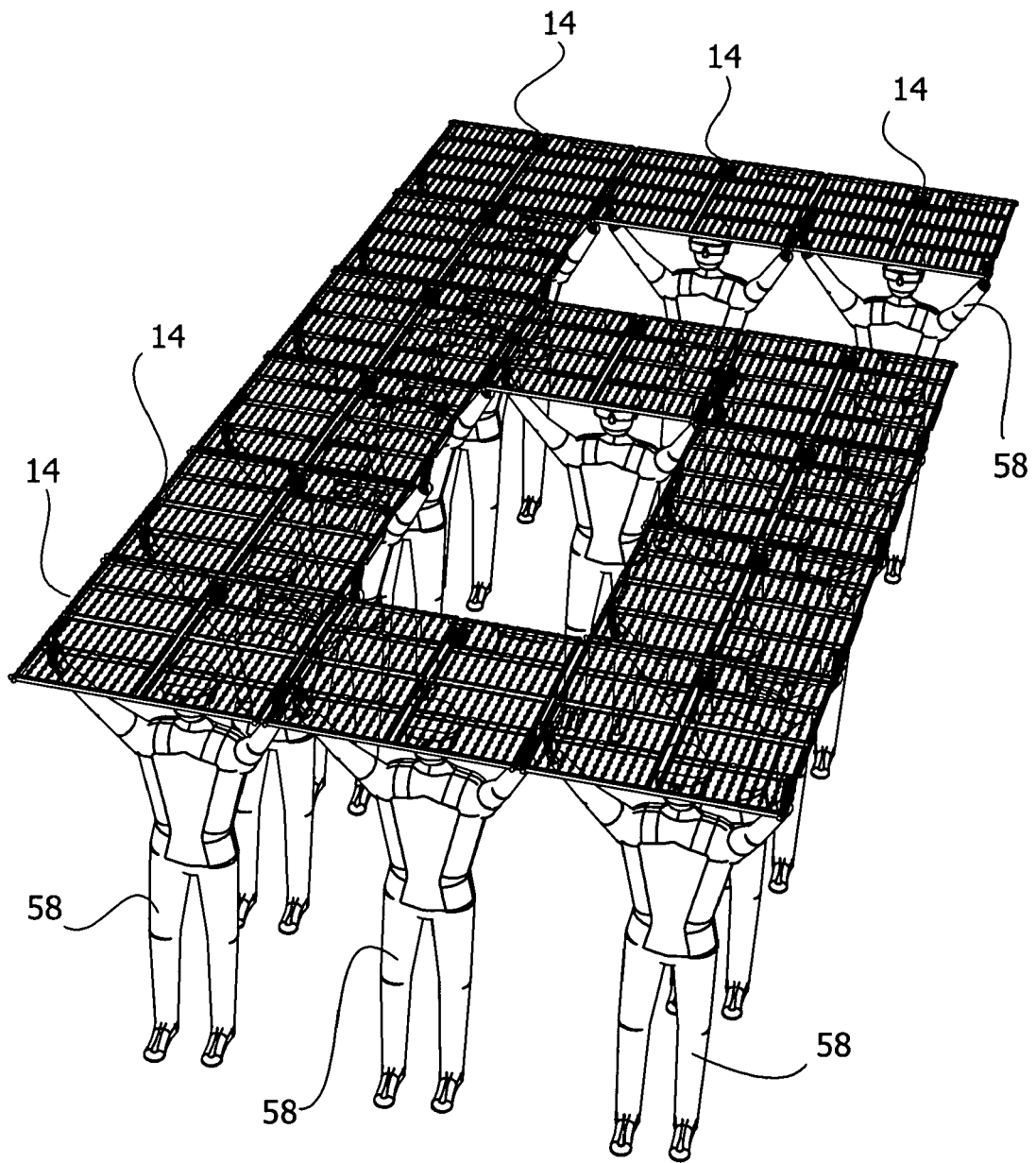


FIG. 6B

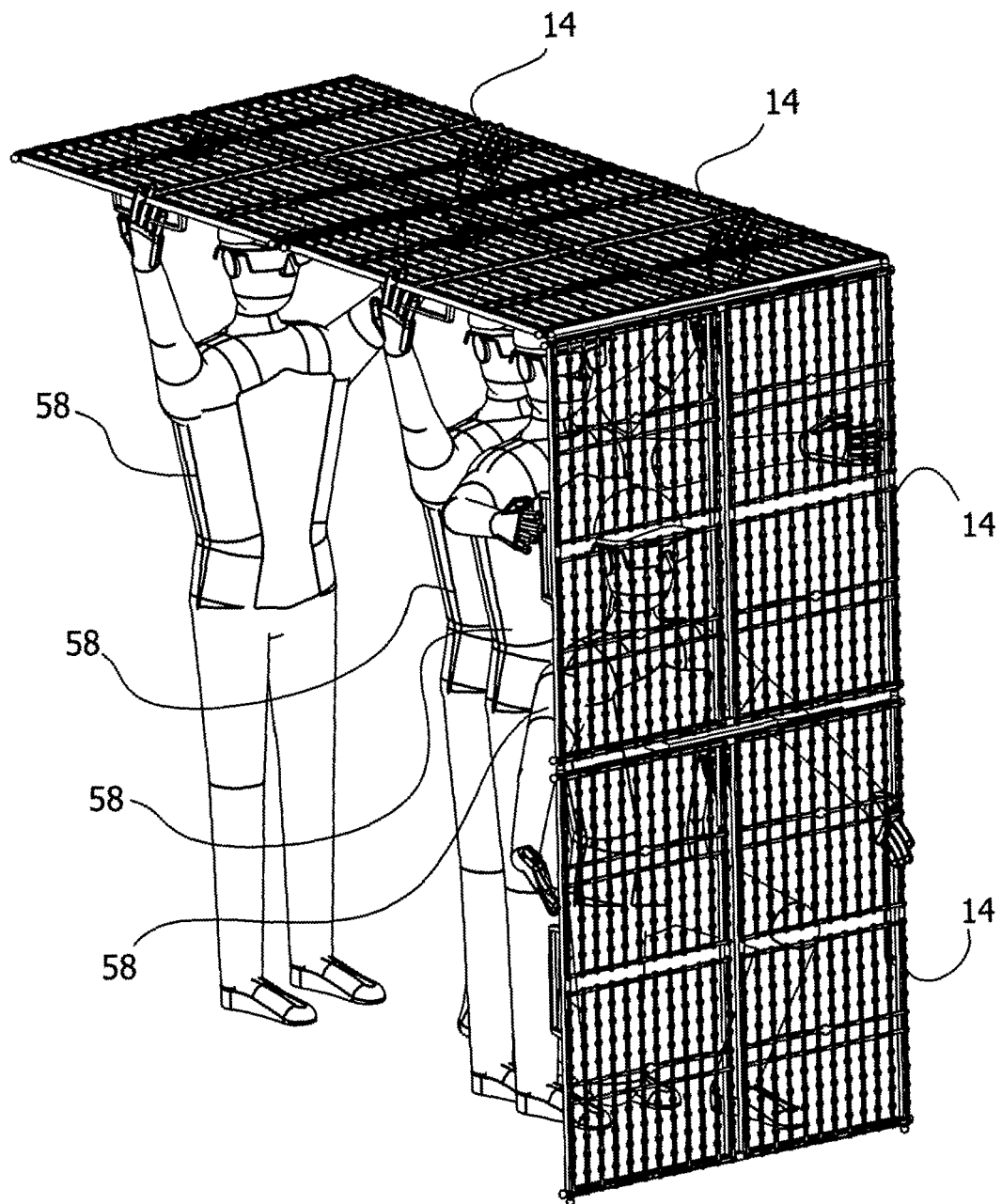


FIG. 6C



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EUROPEAN SEARCH REPORT

Application Number
EP 08 00 7486

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2

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