



US 20100300006A1

(19) **United States**
(12) **Patent Application Publication**
Magpuri

(10) **Pub. No.: US 2010/0300006 A1**
(43) **Pub. Date: Dec. 2, 2010**

(54) **VIRTUAL REALITY DOME THEATER**

Publication Classification

(76) Inventor: **Cecil Magpuri**, Windermere, FL (US)

(51) **Int. Cl.**
E04H 3/30 (2006.01)
E04H 3/12 (2006.01)
E04B 7/10 (2006.01)
(52) **U.S. Cl.** **52/8; 52/173.1; 52/80.1**

Correspondence Address:
PERKINS COIE LLP
POST OFFICE BOX 1208
SEATTLE, WA 98111-1208 (US)

(57) **ABSTRACT**

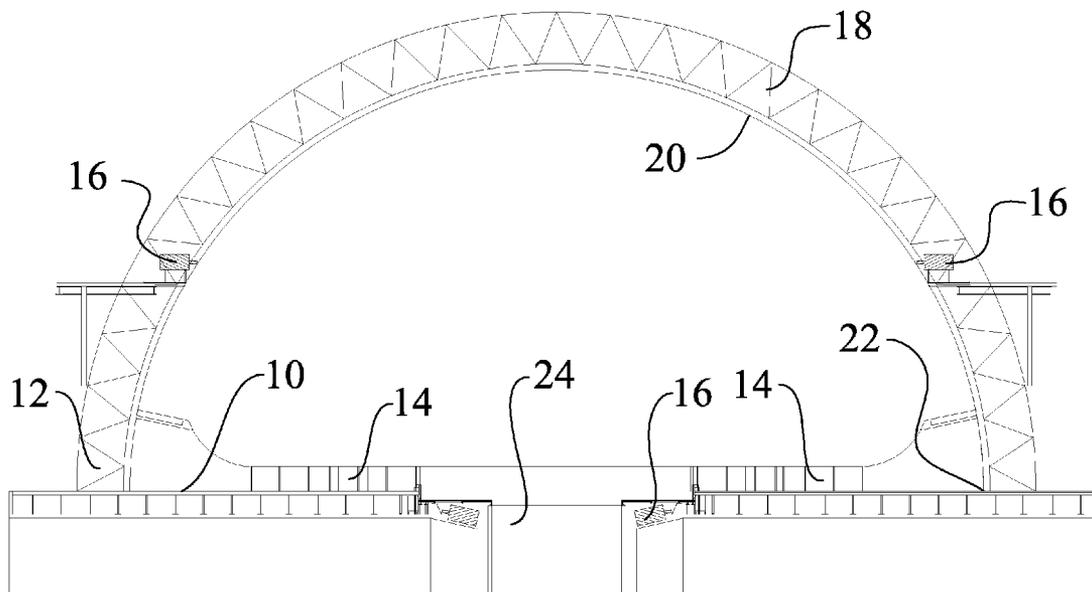
A dome shape theater has a reflective floor. Audience members may sit or stand on a central platform viewing area surrounded by the screen. Audience members may access the viewing area via a tunnel passing under the reflective floor, by a movable bridge, or by passageways between divided sections of the reflective floor. A compound curved screen may alternatively lower from above to surround the viewing area. A 2D/3D projection system may be used to create images on the screen. Integrated special effects located throughout the theater can be synchronized with the media presentation.

(21) Appl. No.: **12/789,182**

(22) Filed: **May 27, 2010**

Related U.S. Application Data

(60) Provisional application No. 61/182,553, filed on May 29, 2009.



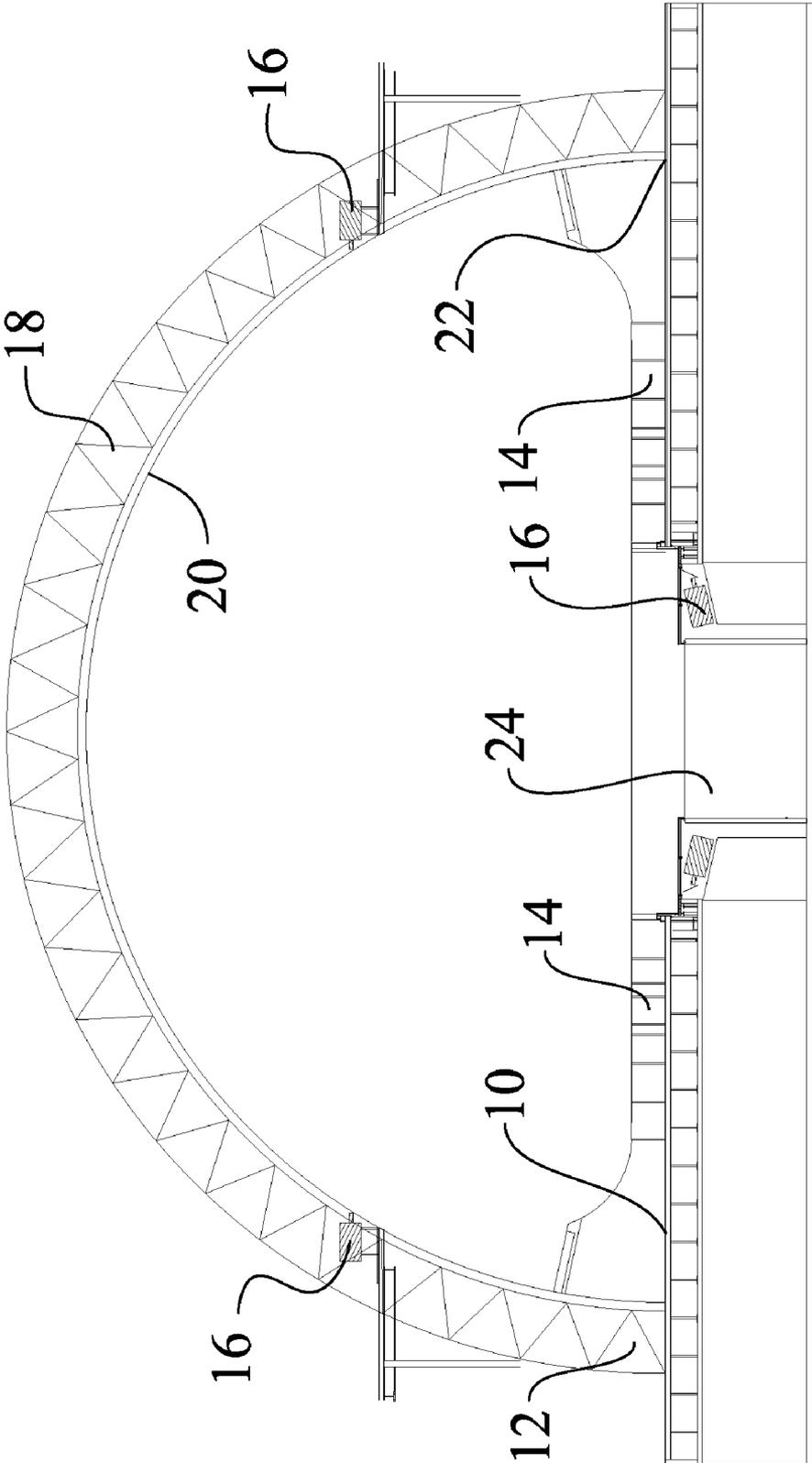


FIG. 1

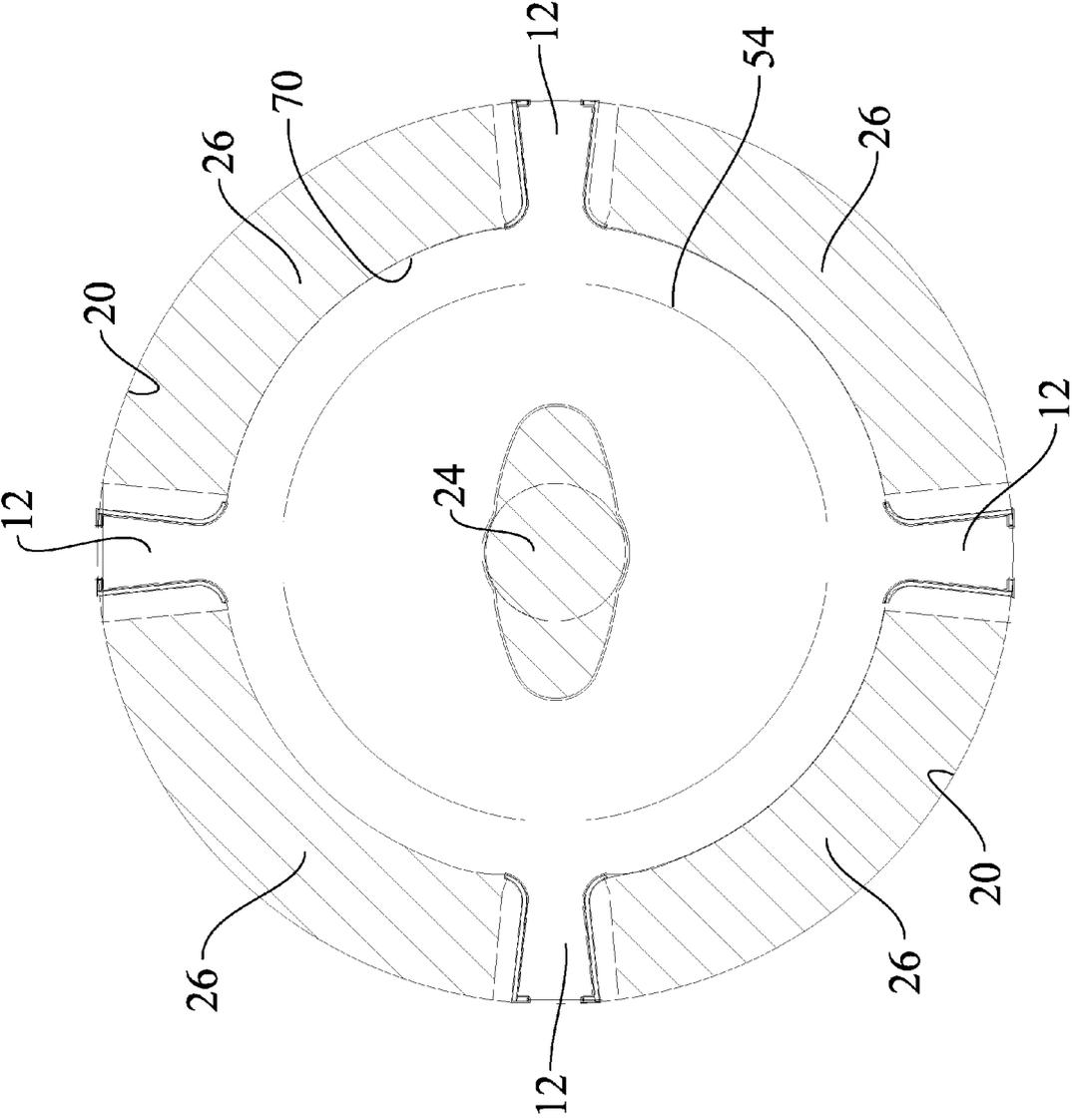


FIG. 2

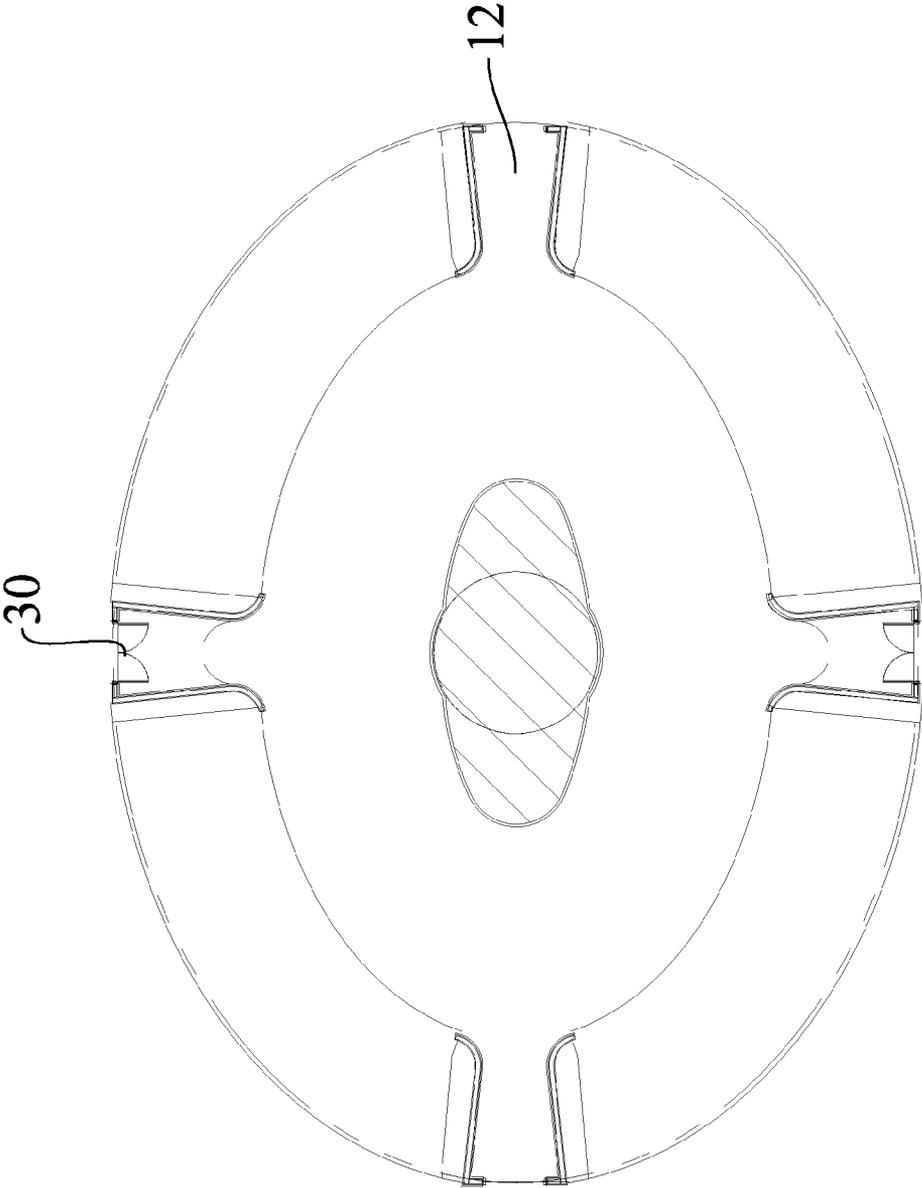


FIG. 3

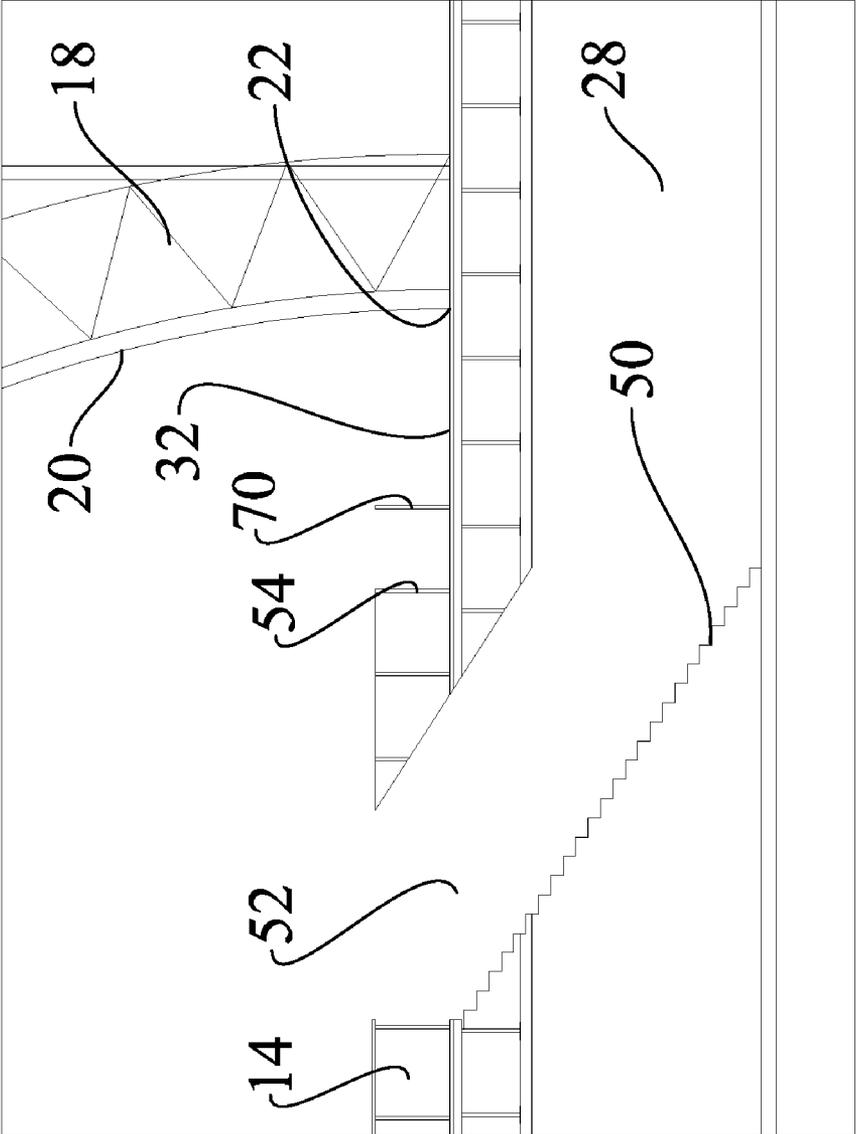


FIG. 5

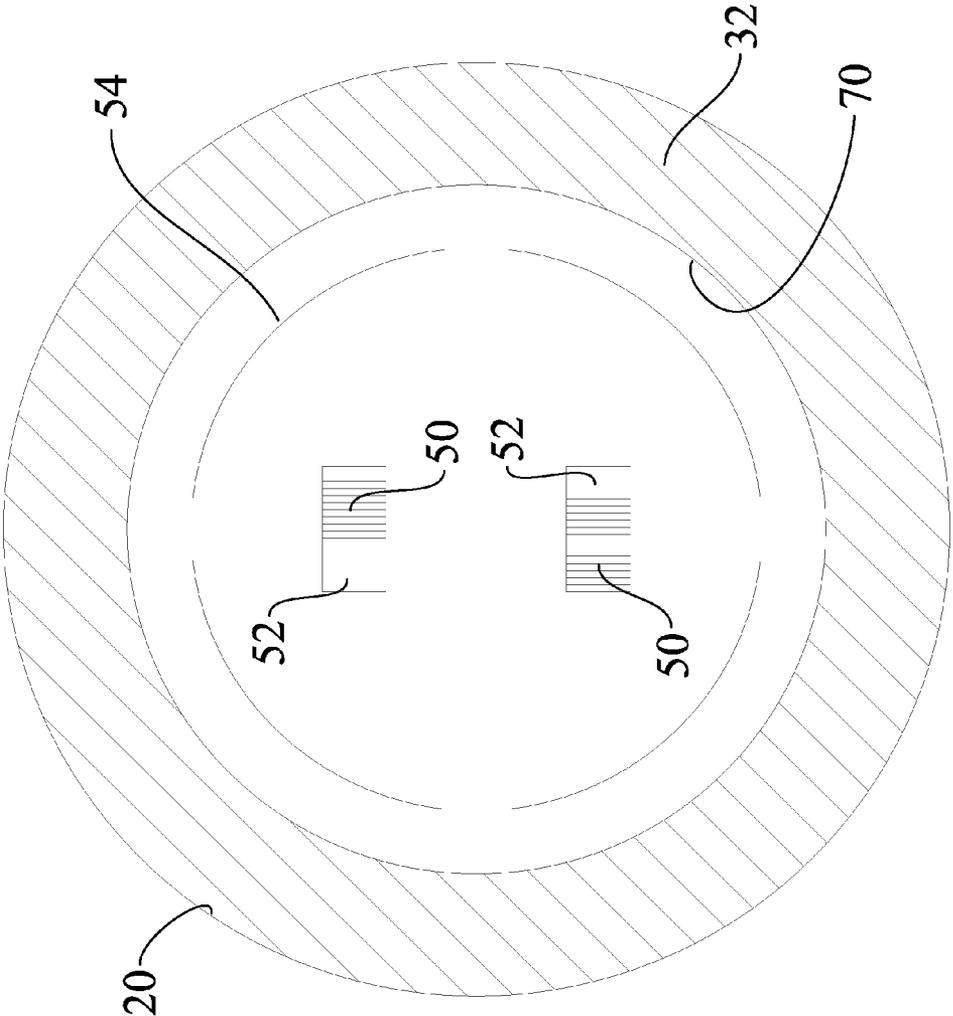


FIG. 7

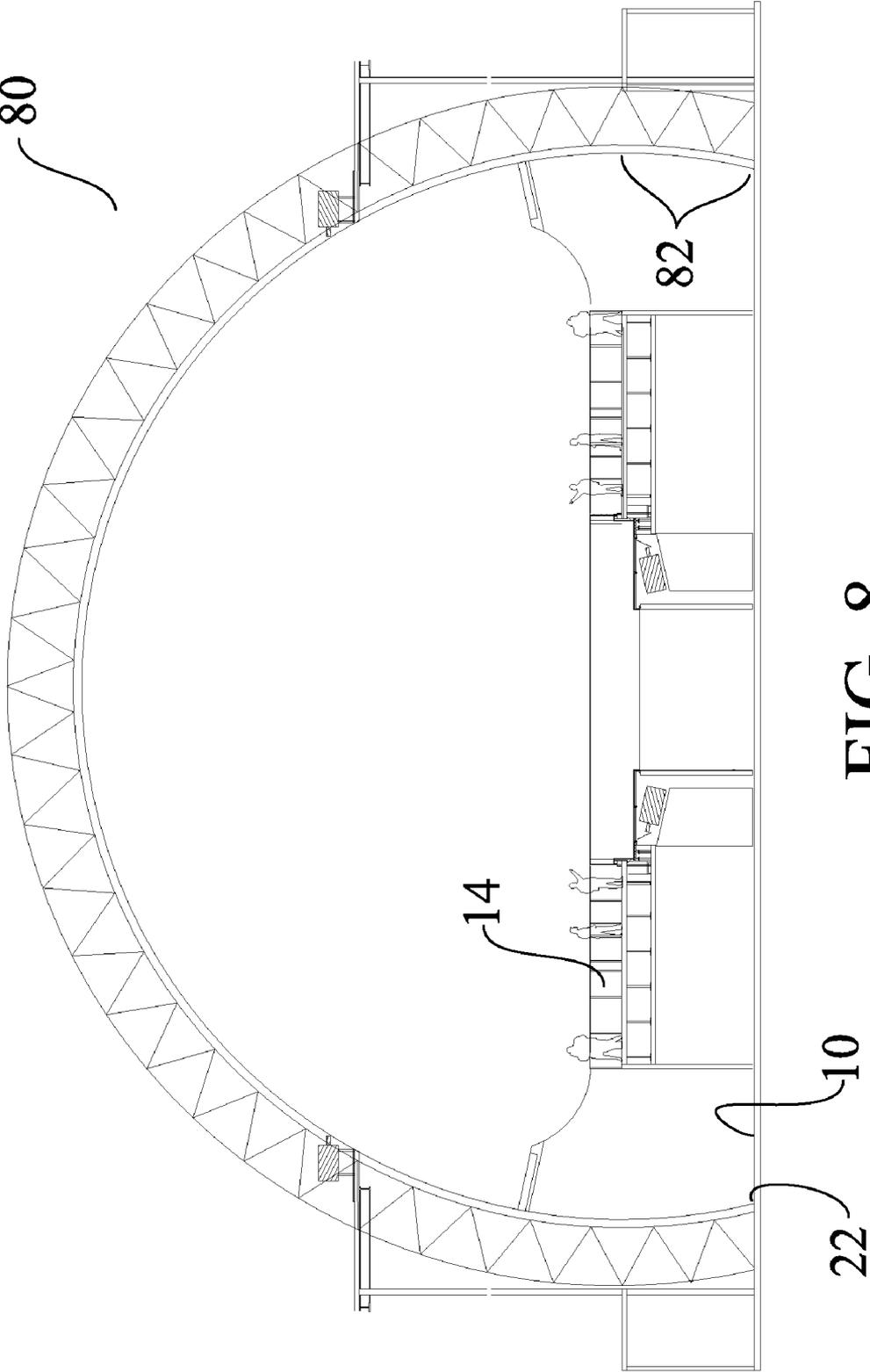


FIG. 8

VIRTUAL REALITY DOME THEATER

PRIORITY CLAIM

[0001] This application claims priority to U.S. Provisional patent application No. 61/182,553 filed May 29, 2009, and incorporated herein by reference.

TECHNICAL FIELD

[0002] This invention relates generally to cinema theaters, and more particularly to structures providing sensory immersion in a motion picture presentation.

BACKGROUND

[0003] Traditionally, cinematic or motion picture theaters have a stationary rectangular screen, and with all of the theater seats facing forward towards the screen. Theaters have been built with various shapes including round, elliptical or polygonal shapes. Various types of dome-shaped theaters or planetariums have also been used. In these theaters, the audience is generally seated across the floor of the theater space and the audience views the screen above and around them.

[0004] In recent years, cinematic theaters have provided a progressively wider field of view. For example, the recent "IMAX" format offers a large image allowing the viewer to feel somewhat immersed in the on-screen images. The "IMAX Dome" is similar to a typical planetarium and has a hemispherical screen, which provides more of a virtual reality setting than a conventional flat screen theatre. In the IMAX dome, if a person in the audience looks to the left, or to the right, or up, that person will typically see the screen. However, since the screen is a hemisphere, when looking straight ahead, the person may also see the side walls and spaces of the theater below the level of the screen. This is undesirable because, at one moment, the person could be looking up at an image of the sky, and then at the next moment, the person might look horizontally or downwardly and see the theater walls or the floor. Allowing the audience to see these non-screen areas of the theater degrades the immersive virtual reality experience provided by the theater.

SUMMARY

[0005] It is an object of the invention to provide an improved motion picture experience capable of showing a screen image to an audience, where the audience will perceive an illusion that they are viewing the images within a sphere or an ovoid.

[0006] A virtual reality theater with a viewing and screen arrangement provides an image throughout substantially the audience member's or users complete sight line. The user's line of sight generally does not depart from the virtual reality image displayed. A reflective floor surface can be used to create an optical illusion that the theater is a continuous sphere or ovoid. The theater provides a large viewing angle, as well as an illusion of being within a sphere or oval. Regardless of the viewing direction or angle, the audience perceives that they are within a continuous sphere or oval. The screen may extend beyond the audience member's field of view, and may be supplemented with a separate reflective surface. Consequently, the sensation of being immersed in or being part of the motion picture is enhanced. Other media besides motion pictures may also be projected or formed on the screen. For example the present theater may also be used with video

games, planetarium shows, flight simulators, or other applications involving visual media.

[0007] An entertainment structure in the form of a dome-shaped theater has a screen formed in a circular or elliptical shape. The size of the theater can vary based on the specific application of the theater and the visual content to be used. The interior of the structure may generally be a circular, near circular or elliptical shape. Members of an audience may enter the theater through subterranean, surface level or elevated bridges or tunnels before the cinematic presentation begins. Alternatively, the audience may be mechanically moved into the theater on seating (or standing) platforms.

[0008] Rather than just having tier upon tier of stadium seating, the present theater may have an elevated and tiered viewing area in the center of the theater so that the audience, whether seated or standing within the viewing area, feels immersed in the images on the screen. If the viewing area is tiered, each member of the audience has a generally unobstructed view of the screen. In addition, if the audience views the presentation while standing up, rather than being seated, the audience members can more freely turn to view any area of the screen, including the areas directly behind them.

[0009] The screen generally curves above and over the head of the standing or sifting audience members in the viewing area. The screen also curves in front of, to the left, to the right and behind the audience. The screen may also curve partially below the audience, so that when they look down, their line of sight will intersect with the screen. Specifically, the lower edge of the screen may be positioned at, or just a few centimeters above, the theater floor on which the audience is seated or standing.

[0010] A reflective floor surface, such as a mirror, may be provided around the perimeter of the theater, so that it substantially completely surrounds the viewing area. The reflective floor surface reflects the image on the screen. Thus, even if the audience looks directly down towards the bottom edge of the screen, the reflected image appears to extend beyond the plane of the actual floor. Hence, the audience has a greatly extended viewing, and perceives the illusion that the theater is a continuous sphere or ovoid. The image projected onto the lower section of the screen may be adapted for this purpose. For example, the lower section of the image may be a landscape, seascape, outer-space scene, or similar image where the reflected image from the floor surface is visually consistent with the media program.

[0011] Whether it is a circular or elliptical shape, the screen generally entirely encircles the audience viewing area, providing continuous 360-degree+image viewing. The screen may be moveable relative to seating or the standing space in the viewing area. For example, the screen may be moveable from a raised position, when the audience enters and exits the theater, to a lowered position during the cinematic presentation. Conversely, the screen may be fixed and the audience viewing area lifted up to the screen, after the audience is seated or moved onto the standing space of the viewing area.

[0012] Viewing for members of an audience may be provided on an elevated platform located in the center of the theater. Audience members may stand in a tiered arrangement equipped with lean bars. Audience members may sit in seats arranged in various configurations. The seats may be equipped with a variety of special effects such as scent, neck blast, wind blast, leg tickler and seat rumble. A 2D and/or 3D projection system may be oriented within the structure to project images on the entire screen. Projection overlap and

image edge blending may be used. Alternatively, other non-projecting image forming techniques may be used, such as having the screen itself generate the images, for example via LCD, plasma, DLP, etc.

[0013] An electronic control system may be used to synchronize the sound, lighting, and special effects with the visual images on the screen, to give the viewer a vivid sensation of being completely immersed in the images on the screen, as if being there. The system may include a number of variations including a variety of seating orientations, as well as visual, visceral, tactile and audible sensations which simulate the sensations of being in a particular environment, storyline, experience, and/or action.

[0014] The viewing area may have capacity for one or more audience members, up to several hundred audience members, or more. The audience members may be standing or sitting in the viewing area and face radially inwardly or outwardly. The sitting or standing arrangement may also range in circumference from 180 degrees to 360. If seats are used in the theater, they can be equipped with a variety of effects including, scent, neck blast, wind blast, leg tickler and seat rumble.

[0015] A tunnel or similar walkway may be located at one location or at two or more locations of the theater, to provide access for audience into the theater. The tunnel or walkway can be subterranean, so that audience members may walk below the surface level of the theater to reach the audience viewing area or platform. The tunnel or walkway can be on the surface level of the theater, allowing audience members to walk onto the audience viewing platform without walking across the reflective floor surface. Thus, the silhouettes of the audience members do not interfere with the lighting or projected images on the screen. The locations and number of tunnels used may be varied, as the type, number and location of the walkways is not essential to the theater.

[0016] The dome theater described may be used for cinematic entertainment and educational purposes. It may include a 360-degree compound curved screen extending upwardly in a dome shape from the floor of the theater. The screen may be hidden in a ceiling mount. At the appropriate time, the screen may be lowered into position within and/or around the audience viewing platform. When the presentation is ended the screen may be raised and restored to its original position. The screen and the viewing area may also be stationary.

[0017] The controller may be operatively integrated with the media presentation, and operable in response to a signal or signals embedded in the media or emanating from the projection system. Most conveniently, the controller includes a microprocessor for which, in either case, the projector or projector system is cued by the microprocessor. The electronic control system thus may be synchronized with the sound and the projected media to give the viewer a vivid sensation of being completely immersed in the action on the screen, as if being there.

[0018] In one form, the entertainment structure may have surround sound audio components with a multi-channel system including a respective speaker unit on each channel of the system. Speakers may be mounted for the optimal level of audience immersion.

[0019] The screen may be embedded with source lights in the form of strobes, LEDs or any other lighting elements. Lighting elements may also be located in other areas of the theater such as in the flooring or around the perimeter of the

audience viewing platform. Such lighting elements may be operated independently or synchronized with the media presentation being viewed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] In the drawings, wherein the same reference number indicates the same element in each of the views:

[0021] FIG. 1 is a side view of a new theater design.

[0022] FIG. 2 is a plan view of the theater shown in FIG. 1.

[0023] FIG. 3 is a plan view of an alternative shape theater.

[0024] FIG. 4 is an enlarged view of a section of the theater shown in FIG. 1.

[0025] FIG. 5 is an enlarged view of a section of alternative theater design.

[0026] FIG. 6 is a side view of another alternative theater design.

[0027] FIG. 7 is a plan view of the theater shown in FIG. 5 or 6.

[0028] FIG. 8 is a side view of a further alternative embodiment.

DETAILED DESCRIPTION OF THE DRAWINGS

[0029] As shown in FIG. 1, a theater has a dome shaped screen 20 supported by a screen structure 18. In the design shown, the dome shaped screen 20 is a half sphere and extends for 180 degrees. The theater floor adjacent to the screen is a reflective floor 10. The reflective floor 10 substantially surrounds an audience viewing area 14, where the audience is seated or standing during the show. The lower edge 22 of the screen may start at, or a few centimeters above, the reflective floor 10. The lower edge of the screen 22 may be resting on, or otherwise in contact with, the reflective floor 10. The reflective floor 10 may have a mirror surface. The reflective floor 10 may also be a one-way mirror with sub-floor lighting 34 projecting up through the floor.

[0030] Turning to FIG. 2, the theater may have one or more entrances and exits 12 to allow the audience members to enter and exit the audience viewing area 14. If the theater is set up for the audience to stand in the viewing area 14, lean or guide handrails or bars may be provided in the viewing area, typically in concentric rings. FIG. 2 shows a single hand rail ring 54 for purpose of illustration. As shown in FIG. 2, the reflective floor 10 is provided in sectors 26 that are separated by the entrance/exit passageways 12. The passageways 12 are conventional non-reflective floor materials, such as carpeting, since the audience walks on these surfaces. A barrier rail or other structure may be provided between the reflective floor sectors 26 and the audience viewing area 14, to discourage or prevent the audience from walking or standing on the sectors 26.

[0031] A special effects core 24 may be provided at the center of the theater. The special effects core 24 may include projectors, and special effects equipment such as fog generators, lasers, sound equipment, etc. Additional projectors 16 may be located at other positions in the theater, and/or behind the screen 20 to provide rear image projection.

[0032] FIGS. 1 and 2 show a half-spherical screen 20. The screen 20 and the theater may be also made oval or elliptical, as shown in FIG. 3. Also as shown in FIG. 3, doors may be provided at the entrances/exits. As shown in FIG. 4, the reflective floor 10 may be spaced apart above the structure floor 60 on risers 62, with sub-floor lighting 34 provided below the reflective floor 10 and above the structure floor 60.

[0033] FIGS. 5 and 7 show an alternative design which allows for a continuous reflective floor ring 32 uninterrupted by any entrance or exit. As shown in FIG. 5, the audience enters the viewing area 14 via a tunnel 28 below the reflective floor 10. Stairs, ramps, escalators or elevators 50 then lead up from the tunnel 28 to entrances/exits 52 in the viewing area 14. The entrances/exits 12 that interrupt the reflective floor 10 are not used or needed, and the reflective floor 10 may then be provided as a continuous ring 32.

[0034] FIG. 6 shows another design which also allows for the reflective floor to be provided as a continuous ring 32. In FIG. 6, the audience enters and exits the viewing area 14 via a movable bridge 40. During audience movement into or out of the viewing area 14, the bridge is down and extends over the reflective floor through a bridge door in the screen 20. The section of screen 46 at the bridge doorway 44 is temporarily lifted up or to one side and out of the way by an actuator 48. After the audience is in the viewing area 14, the bridge is lifted up, and/or pulled back and out of the bridge doorway 44 via a bridge mover 42. The actuator moves the screen section 46 into the bridge doorway 44. The show in the theater then begins. After the show, the bridge 40 is moved back into the bridge doorway 44. FIG. 6 shows a pivoting bridge 40, although other types of moving bridges may also be used.

[0035] Referring to FIG. 7, the reflective floor 10 extends radially inwardly from the screen 20 by a dimension DD. Dimension DD may vary depending on the dimensions of the theater and the type of image formation techniques used. With projected images, if an audience member gets too close to the screen 20, the projected images may be blocked or degraded due to interference by audience member. The barrier rail 70, if used, and the radial dimension DD of the reflective floor 10, are then positioned to prevent the audience from getting close enough to the screen to interfere with the image formation on the screen.

[0036] The audience viewing area 14 may be at a single level, or it may be provided in tiers, with the highest tier towards the center of the theater and the lowest tier closest to the reflective floor 10.

[0037] FIG. 8 shows an alternative design 80 where the audience viewing area 14 is raised up from the theater floor 10. For example, the viewing area may be 1-10 meters above the floor. The screen 20 extends below the viewing area 14, with the bottom edge 22 of the screen near or at the floor 10. The viewing area may be arranged so that the section 82 of the screen below the viewing area is visible, but the floor 10 is not. Alternatively, a reflective surface may be provided on the floor 10 between the screen 22 and the viewing area.

[0038] Thus, novel designs have been shown and described. Various changes and substitutions can of course be made without departing from the spirit and scope of the invention. The invention, therefore, should not be limited, except to the following claims, and their equivalents.

1. A theater comprising:
 - a domed structure;
 - a raised viewing area in the center of the structure;
 - a substantially continuous domed screen around the viewing area; and
 - a reflective floor surface around the perimeter of the structure.
2. The theater of claim 1 wherein the structure is circular.
3. The theater of claim 1 wherein the structure is elliptical.
4. The theater of claim 1 further comprising an audience standing area within the theater.
5. The theater of claim 1 further comprising audience seating within the theater.
6. The theater of claim 1 with the theater further comprising an entrance tunnel and an exit tunnel leading to the viewing area.
7. The theater of claim 1 further comprising 2D and/or 3D projector(s) arranged to provide substantially seamless edge blended images on the screen.
8. The theater of claim 4 further comprising concentric circular handrail sections on tiers in the viewing area.
9. The theater of claim 1 further comprising a control system operable to coordinate the media presentation with integrated special effects.
10. The theater of claim 1 further comprising projectors adjacent to a central location of the theater, with the projectors projecting images radially outwardly and onto the screen.
11. The theater of claim 1 with the screen curved and continuous around and over the seats.
12. The theater of claim 1 further comprising a screen lifter for lifting and the lowering of the screen vertically.
13. The theater of claim 1 further comprising a reflective surface around the perimeter of the theater configured to create the illusion of a continuous sphere or ovoid.
14. A theater comprising:
 - a viewing area raised up off of a theater floor;
 - a substantially continuous domed screen around the viewing area, with a section of the domed screen below the viewing area; and
 - with the viewing area having a line of sight to the section of the domed screen below the viewing area, providing audience members on the viewing area with an elevation angle field of view of the screen greater than 180°.

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