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Attorneys for Plaintiffs Hologram USA, Inc., Musion Das Hologram Limited and Uwe Maass

UNITED STATES DISTRICT COURT

DISTRICT OF NEVADA

HOLOGRAM USA, INC., a Delaware corporation; MUSION DAS HOLOGRAM LIMITED, a corporation organized under the laws of the United Kingdom; and UWE MAASS, an individual,

Plaintiffs,

v.

PULSE ENTERTAINMENT, INC., a Georgia corporation; JOHN C. TEXTOR, an individual; PROMETHEUS GLOBAL MEDIA, LLC, a Delaware limited liability company; DICK CLARK PRODUCTIONS, INC., a Delaware corporation; JOHN BRANCA and JOHN MCCLAIN, Executors of the Estate of Michael J. Jackson; MJJ PRODUCTIONS, INC., a California corporation, and DOES 1 through 10,

Defendants.

Case No.:

COMPLAINT; and

DEMAND FOR JURY TRIAL

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INTRODUCTION

1. In 1862, John Pepper and Henry Dircks invented "Pepper's Ghost," an illusion technique, which, over the last 150 years, has appeared in movies, concerts, magic shows and amusement park rides. Many of us have sat with Pepper's Ghost in Disneyland's Haunted Mansion. Today a new incarnation of Pepper's Ghost exists – Musion Eyeliner. Musion Eyeliner uses a patented system to project three-dimensional images virtually indistinguishable from real-life bodies. Musion Eyeliner has gained notoriety around the world for the quality of its holographic projections.

2. In 2012, Musion Eyeliner was used at the Coachella Music Festival to create a three-dimensional image of deceased rapper Tupac Shakur, a performance that is still widely discussed and has been viewed almost 30 million times on YouTube. Employing Musion Eyeliner to produce a similar image of Michael Jackson during the international television broadcast of the Billboard Music Awards will undoubtedly garner even greater attention around the globe. Because that planned performance has not been authorized and will infringe Plaintiffs' patents, Plaintiffs seek this Court's assistance in foiling Defendants' infringing conduct.

3. On or about May 15, 2014, it was reported in the press that Defendants plan to misappropriate the Musion Eyeliner technology and infringe the Patents At Issue by creating a hologram of Michael Jackson who would "dance across the stage" at the Billboard music awards, on May 18, 2014. Plaintiffs have never authorized any of the Defendants to use their patented Musion Eyeliner technology. But that has not stopped Defendants from flagrantly exploiting Plaintiffs' intellectual property rights to prominently promote the unauthorized display of Jackson "like you've never seen him before."

4. Musion Eyeliner is protected by U.S. Patent No. 5,865,519 (the "'519 patent") and U.S. Patent No. 7,883,212 (the "'212 patent" and, along with the '519 patent, the "Patents At Issue"). Plaintiff Uwe Maass holds the '519 patent. Plaintiff Musion Das Hologram holds the '212 patent. Maass and Musion DH have licensed certain rights to practice the Patents At Issue to Plaintiff Hologram USA, Inc.

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5. Defendants' infringement of the Patents At Issue has damaged and continues to damage Plaintiffs. Plaintiffs seek to enjoin Defendants' wrongful conduct. Plaintiffs also seek damages they have incurred as a result of Defendants' infringing conduct.

THE PARTIES

6. Plaintiff Hologram USA, Inc. also known as "Musion" ("Hologram USA") is a corporation organized and existing under the laws of the State of Delaware, having a principal place of business at 301 N. Canon Drive, Beverly Hills, California 90210.

7. Plaintiff Musion Das Hologram Limited ("Musion DH") is a corporation organized and existing under the laws of the United Kingdom, having a principal place of business at 90 High Holborn, London, United Kingdom WC1V 6XX.

8. Plaintiff Uwe Maass is a citizen of Germany and an individual residing in Dubai in the United Arab Emirates.

9. On information and belief, defendant Pulse Entertainment, Inc. ("Pulse") is a corporation organized and existing under the laws of State of Georgia, having a principal place of business at 2886 Bob White Dr., Atlanta, Georgia 30311.

10. On information and belief, defendant John C. Textor is citizen of the United States residing in Florida. He is the Chief Executive Officer of Pulse.

11. On information and belief, Prometheus Global Media, LLC ("Prometheus") is a Delaware limited liability company with its principal place of business in New York City. The Billboard Music Awards is run by the Magazine Billboard, which is a division of Prometheus.

12. On information and belief, defendant Dick Clark Productions, Inc. ("Dick Clark Productions") is a corporation organized and existing under the laws of the State of Delaware, having a principal place of business in Santa Monica, California. Dick Clark Productions is the producer of the 2014 Billboard Music Awards, which is being held at the MGM Grand Hotel & Casino in Las Vegas on May 18, 2014.

13. On information and belief, defendants John G. Branca and John McClain are individuals residing in Los Angeles, California, who have been appointed as the Executors of the Estate of Michael J. Jackson (the "Estate"). They are being sued in their capacities as executors of

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the Estate.

14. On information and belief, defendant MJJ Productions, Inc. is a corporation organized and existing under the laws of California, having a principal place of business in Hollywood, California.

15. The true names and capacities, whether individual, corporate, associate, or otherwise, of the defendants sued in this complaint as DOES 1-10 (collectively, the "Doe Defendants") (collectively with Pulse, Textor, Prometheus, Dick Clark Productions and the Estate, the "Defendants"), are presently unknown to Plaintiffs, who therefore sue them by fictitious names. Plaintiffs will amend the complaint to allege their true names and capacities when ascertained. Plaintiffs are informed and believe and therefore allege that all Defendants, which include the Doe Defendants, were or are, in some way or manner, responsible for and liable to Plaintiffs for the events, happenings, and damages alleged in this complaint.

16. Plaintiffs are informed and believe and thereon allege that at all times mentioned each Defendant was the agent, servant, employee, co-venturer, representative, or co-conspirator of each of the other defendants, and acted with the knowledge, consent, ratification, authorization and/or at the direction of each defendant, or is otherwise responsible in some manner for the occurrences alleged in this complaint.

JURISDICTION AND VENUE

17. This is a civil action for patent infringement arising under the Patent Laws of the United States of America, 35 U.S.C. § 101, *et seq*.

18. This Court has jurisdiction over the subject matter of this Complaint pursuant to 28 U.S.C. §§ 1331 and 1338.

19. This Court has personal jurisdiction over Defendants for at least the following reasons: (i) Defendants regularly do business or solicit business, engage in other persistent courses of conduct, and/or derive substantial revenue from products and/or services provided to individuals in this District and in this State; (ii) and Defendants have purposefully established substantial, systematic, and continuous contacts with this District and expect or should reasonably expect to be in court here. Thus, this Court's exercise of jurisdiction over Defendants will not offend traditional

notions of fair play and substantial justice.

20. Venue is proper in this judicial district pursuant to 28 U.S.C. §§ 1391(b)-(c) and 1400(b) because Defendants do business in this District, Defendants are subject to personal jurisdiction in this District and a substantial portion of the events giving rise to the claims for relief stated in this Complaint occurred in this district.

FACTUAL ALLEGATIONS

A. Musion Eyeliner

21. The Musion Eyeliner system is an amazing new technique of projecting video to create the illusion of life-size, full color, 3D moving images. All of the images used in this system are three-dimensional, but are projected as two-dimensional images into a three-dimensional stage set.

22. Musion Eyeliner is protected by patents in the United States. As described in the '519 and '212 patents, Musion Eyeliner is a proprietary high definition video projection system that allows moving images to appear within a live stage setting. A white projection screen or other reflecting surface is placed on the floor of the stage. An image source (preferably, a computer-controlled intelligent light amplifier) projects an image onto the reflecting surface, which projects the image onto a thin transparent foil arranged on stage at an angle of about 45 degrees. From the audience's perspective, the image produced on the foil appears as a life-like three-dimensional image.

23. Hologram USA has licensed the exclusive right to exploit the Musion Eyeliner system (including the Patents At Issue) in all markets in the United States and Canada, with the exception of adult entertainment. Accordingly, Hologram USA has the exclusive right to use the Musion Eyeliner system and to sublicense its use to third parties in those territories for use in performances such as the performance at issue in this case.

B. The 2014 Billboard Music Awards

24. On Sunday, May 18, 2014, the Billboard Music Awards are scheduled to take place at the MGM Grand Garden Arena in Las Vegas, Nevada. This music awards ceremony, which will air live on ABC, is a major media event. It is scheduled to include performances by popular and

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acclaimed entertainers, including Miley Cyrus, Ricky Martin, Jennifer Lopez, Pitbull, 5 Seconds of Summer, Florida Georgia Line, Jason Derulo, Imagine Dragons, Luke Bryan, John Legend, OneRepublic, Miranda Lambert and Carrie Underwood.

25. On or about May 8, 2014, Billboard issued a press release in which it promised "to be one the year's stand-out music events." Although Billboard did not disclose that a hologram-like image of Michael Jackson would perform at the awards ceremony, it promised to "raise the bar even higher with a world premier experience featuring the late King of Pop." It announced that "[t]he Estate of Michael Jackson created the spot, which will present the superstar 'like you've never seen him before.' It's sure to be a thriller, but the finer details remain under lock-and-key." *See* http://www.billboard.com/articles/events/bbma-2014/6077688/michael-jackson-to-unleash-world-premiere-experience-at-billboard.

26. Several days later, beginning on or about May 15, 2014, various media outlets began to report on "a rumor swirling that a Michael Jackson hologram will appear at the 2014 Billboard Music Awards" for a "performance" of a new, never-before released Jackson song called "Slave to the Rhythm." *See* http://www.idolator.com/7518371/michael-jackson-hologram-billboard-music-awards-rumor. Another report stated that "[a] hologram of Michael Jackson will reportedly dance across the stage at Sunday's Billboard music awards. The digital rendering of the late pop star has been booked to perform one of his 'new' songs, Slave to the Rhythm." *See* http://www.theguardian.com/music/2014/may/15/michael-jackson-hologram-billboard-music-awards-2014.

27. Based on information and belief, the producer for the Billboard Music Awards, Dick Clark Productions, hired Pulse to create the hologram-like image of Michael Jackson. Indeed, one news source reported that Pulse's Chief Executive Officer, John Textor, "is said to be digitally resurrecting the late pop star." *See* http://www.theguardian.com/music/2014/may/15/michael-jackson-hologram-billboard-music-awards-2014.

28. Textor is no stranger to Musion Eyeliner. In 2012, Textor was CEO of Digital Domain. Although he was fired that same year, at or about the time Digital Domain went bankrupt, Textor served as CEO of Digital Domain when the company, along with AV Concepts, produced the

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Tupac Shakur hologram for the Coachella Music Festival. Textor does not conceal his familiarity with Musion Eyeliner to potential investors. In attempting to raise money for Pulse, he circulated an investor memo that falsely claimed a company called VFX had produced the Tupac hologram while Textor served as Chairman and CEO. A copy of that investor memo is attached as Exhibit D. Further, in the weeks and months leading up to the 2014 Billboard Music Awards, Textor sent numerous emails to Plaintiffs, seeking to license Musion Eyeliner. Plaintiffs refused those requests. Undeterred, Textor has now concocted the story he will employ a different technology to achieve the same result. That illusion does not withstand scrutiny.

29. Based on information and belief, Defendants will use the patented Musion Eyeliner system to create the three-dimensional projection of Michael Jackson during the 2014 Billboard Music Awards. Textor is familiar with that technology and he has recently actively sought to license it.

30. Defendants did not obtain any authorization from Hologram USA to use the patented Musion Eyeliner technology. Hologram USA has placed Defendants on notice of their infringing activities, but Defendants refuse to stop using Musion Eyeliner.

31. Based on information and belief, Defendants are infringing on one or more of the claims of the Patents At Issue.

32. Defendants' infringement of the '519 and '212 patents has caused and will continue to cause monetary and other damages to Plaintiffs.

FIRST CLAIM FOR RELIEF – Against All Defendants

(Infringement of Patent No. 5,865,519)

33. Plaintiffs incorporate by reference the preceding averments set forth in the preceding paragraphs.

34. U.S. Patent No. 5,865,519 ("the '519 patent") duly and lawfully issued on February 2, 1999, to Uwe Maass and is titled "Device For Displaying Moving Images In The Background Of A Stage." The claims of the '519 patent are directed at a device or apparatus for representing three-dimensional moving images in the background of a stage or the like using an image source. A true and correct copy of the '519 patent is attached as Exhibit A.

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35. Maass is the owner of the '519 patent, and Hologram USA has licensed the exclusive right to exploit this patent in all markets in the U.S. and Canada with the exception of adult entertainment. Maass and Hologram USA have the right to bring this suit for injunctive relief and damages.

36. On information and belief, Defendants have been, are currently and, unless enjoined, will continue to directly infringe one or more claims of the '519 patent by making, using, offering to sell, and selling within the United States the patented invention. Defendants' products and services embody and/or practice one or more claims of the '519 patent.

37. Defendants' infringing activities have caused and will continue to cause Plaintiffs irreparable harm, for which it has no adequate remedy at law, unless Defendants' infringing activities are enjoined by this Court in accordance with 35 U.S.C. § 283.

38. Plaintiffs have been and continue to be damaged by Defendants' infringement of the '519 patent in an amount to be determined at trial.

39. Defendants willfully and deliberately infringe the '519 patent in disregard of Plaintiffs' rights.

SECOND CLAIM FOR RELIEF – Against All Defendants

(Infringement of Patent No. 7,883,212)

40. Plaintiffs incorporate by reference the preceding averments set forth in the preceding paragraphs.

41. U.S. Patent No. 7,883,212 ("the '212 patent") duly and lawfully issued on February 8, 2011, to Ian O'Connell and James Rock and is titled "Projection Apparatus And Method For Pepper's Ghost Illusion." The claims of the '212 patent are directed at a projection apparatus arranged to project an image of an object upon an inclined, partially reflective screen so as to give a false perception of depth and a method for constructing such an apparatus. A true and correct copy of the '212 patent is attached as Exhibit B.

42. In or about September 2006, Ian O'Connell and James Rock assigned all their interests in the anticipated application for the '212 patent to Musion Systems Limited. A true and correct copy of the Patent Assignment Abstract of Title is attached as Exhibit C.

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43. In or about September 2013, Musion Systems Limited assigned all its interests in the '212 patent to Musion DH.

44. Musion DH is the owner of the '212 patent, and Hologram USA has licensed the exclusive right to exploit this patent in all markets in the U.S. and Canada with the exception of adult entertainment. Musion DH and Hologram USA have the right to bring this suit for injunctive relief and damages.

45. On information and belief, Defendants have been, are currently and, unless enjoined, will continue to directly infringe one or more claims of the '212 patent by making, using, offering to sell, and selling within the United States the patented invention. Defendants' products and services embody and/or practice one or more claims of the '212 patent.

46. Defendants' infringing activities have caused and will continue to cause Plaintiffs irreparable harm, for which it has no adequate remedy at law, unless Defendants' infringing activities are enjoined by this Court in accordance with 35 U.S.C. § 283.

47. Plaintiffs have been and continue to be damaged by Defendants' infringement of the '212 patent in an amount to be determined at trial.

48. Defendants willfully and deliberately infringe the '212 patent in disregard of Plaintiffs' rights.

THIRD CAUSE OF ACTION – Against All Defendants

(PRELIMINARY AND PERMANENT INJUNCTION)

49. Plaintiffs incorporate by reference the preceding averments set forth in the preceding paragraphs.

50. Immediate and irreparable injury will result to Plaintiffs unless this Court enters a Temporary Restraining Order and Injunction, pursuant to FRCP 65, enjoining all Defendants and their agents, servants, employees, attorneys, subsidiaries and any other individual or entity in active concert or participation with them who receives actual notice of the order, from infringing, inducing others to infringe, or contributing to the infringement of the '519 and '212 Patents, including the manufacture, use, sale, importation, and offer to sell any holographic equipment or services related to the use of such holographic equipment subject to the '519 and '212 Patents.

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51. Plaintiffs have a likelihood of success on the merits given that there is no dispute that Defendants have directly infringed and continue to infringe the '519 and '212 Patents, by using and selling this patented technology to create a holographic-like image of Michael Jackson who will "perform" a never-before released song for the 2014 Billboard Music Awards. Defendant Textor's attempts to acquire rights to Musion Eyeliner in the days leading up to the Billboard Music Awards belie any self-serving attempt to now claim another technology will be employed.

52. As a result of Defendants' unlawful activities, Plaintiffs have suffered and will suffer irreparable harm. Hologram USA has spent several million dollars building the Hologram USA name and brand. For instance, Hologram USA spent millions of dollars to build a Beverly Hills showroom to display and market the Eyeliner technology to potential customers.

53. The acts of the Defendants have already caused Plaintiffs significant harm. By advertising and promoting a Michael Jackson holographic image at the 2014 Billboard Music Awards, Defendants have created significant confusion in the marketplace. That confusion has diluted the value of the Hologram USA brand by causing confusion among potential customers. The actions of the Defendants have interfered with numerous potential business deals between Hologram USA and potential customers.

54. If Defendants are permitted to continue their infringing conduct, including but not limited to the display of a Michael Jackson holographic image at the 2014 Billboard Music Awards, the irreparable harm suffered by Hologram USA will be immeasurable. The publicity associated with such a display cannot be reduced to monetary terms.

55. Defendants' actions will irreparably harm Plaintiffs' business reputation and brand by creating consumer confusion as to the true owner of the patented technology. No adequate remedy at law will alleviate this harm.

REQUEST FOR RELIEF

WHEREFORE, Plaintiffs respectfully request that:

a. Judgment be entered that Defendants have infringed one or more claims of the '212 and '519 patents;

b. Judgment be entered permanently enjoining Defendants, their directors, officers,

agents, servants, and employees, and those acting in privity or in concert with them, and their subsidiaries, divisions, successors and assigns, from further acts of infringement of the '212 and '519 patents;

c. Judgment be entered that Defendants' infringement has been willful;

d. Judgment be entered awarding Plaintiffs all damages adequate to compensate it for Defendants' infringement of the '212 and '519 patents, including all pre-judgment and post-judgment interest at the maximum rate permitted by law, and including a trebling of such damages due to Defendants' willful infringement.

e. For reasonable attorneys' fees incurred in bringing and litigating this action;

f. For costs of suit herein; and

g. Judgment be entered awarding all other relief as the Court deems proper.

DEMAND FOR JURY TRIAL

Please take notice that Plaintiffs demand trial by jury in this action.

DATED this 15th day of May, 2014.

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EXHIBIT A

US005865519A

United States Patent [19]

Maass

[11] **Patent Number: 5,865,519**

[45] **Date of Patent: Feb. 2, 1999**

[54] **DEVICE FOR DISPLAYING MOVING IMAGES IN THE BACKGROUND OF A STAGE**

[76] Inventor: **Uwe Maass**, Lindlarer Strasse 107, D-51491, Overath, Germany

[21] Appl. No.: **836,911**

[22] PCT Filed: **Aug. 31, 1996**

[86] PCT No.: **PCT/EP96/03832**

§ 371 Date: **Jul. 7, 1997**

§ 102(e) Date: **Jul. 7, 1997**

[87] PCT Pub. No.: **WO97/11405**

PCT Pub. Date: **Mar. 27, 1997**

[30] **Foreign Application Priority Data**

Sep. 20, 1995 [DE] Germany ..... 295 15 073 U

[51] **Int. Cl.**[6] **G03B 21/28**

[52] **U.S. Cl.** **353/28**; 359/630; 472/58

[58] **Field of Search** 353/28, 98, 30, 353/29, 10; 359/478, 630; 472/58, 61, 63

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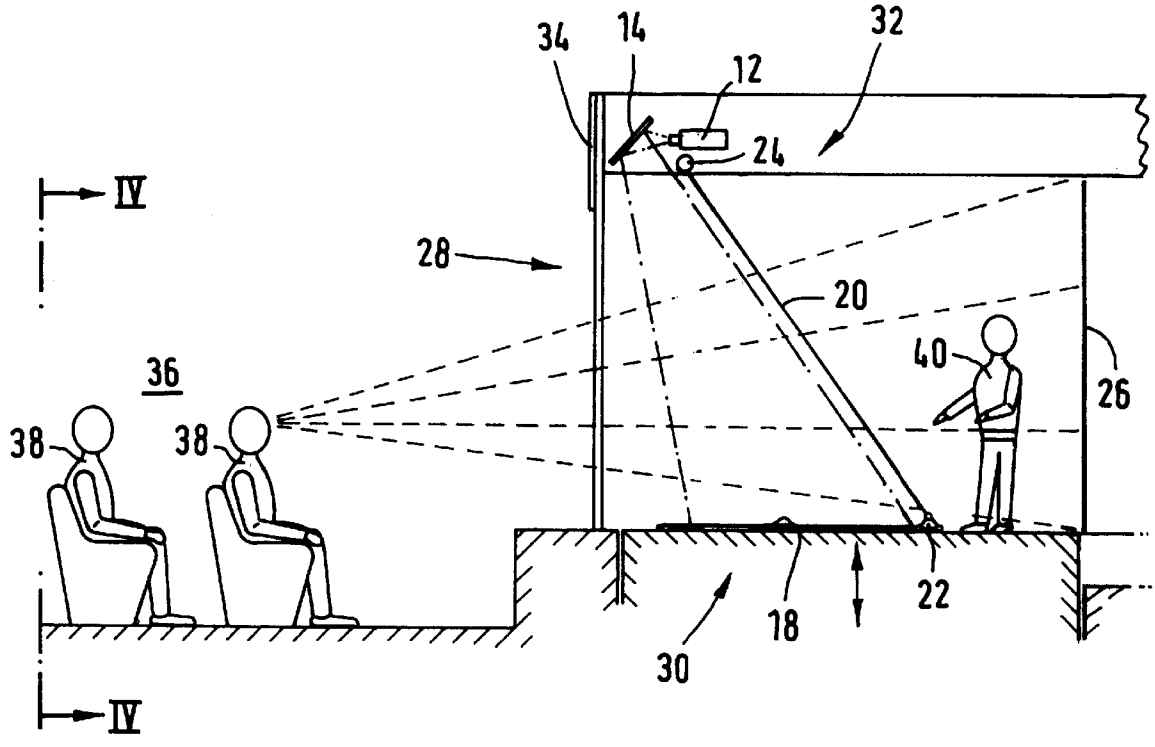
Primary Examiner—William Dowling
Attorney, Agent, or Firm—Klauber & Jackson

[57] **ABSTRACT**

An article such as for example a motor vehicle at a publicity function is to be represented in front of different viewers **(38)** in the background of a stage **(28)** in the form of a virtual image **(26)**. A presenter **(40)** is to stand in the image and give explanations. Disposed above the stage **(28)** is an image source **(12, 14)**. It projects an image, a film, on to a reflecting surface **(18)** on the floor **(30)** of the stage **(28)**. Behind that reflecting surface **(18)** a transparent smooth foil **(20)** extends at 45° from the ceiling **(32)** to the floor **(30)**. The image produced by the image source **(12, 14)** appears to the viewers **(38)** as a virtual image **(26)** behind the foil **(20)**. The presenter **(40)** stands behind the foil **(20)** and in the middle of the image.

15 Claims, 5 Drawing Sheets



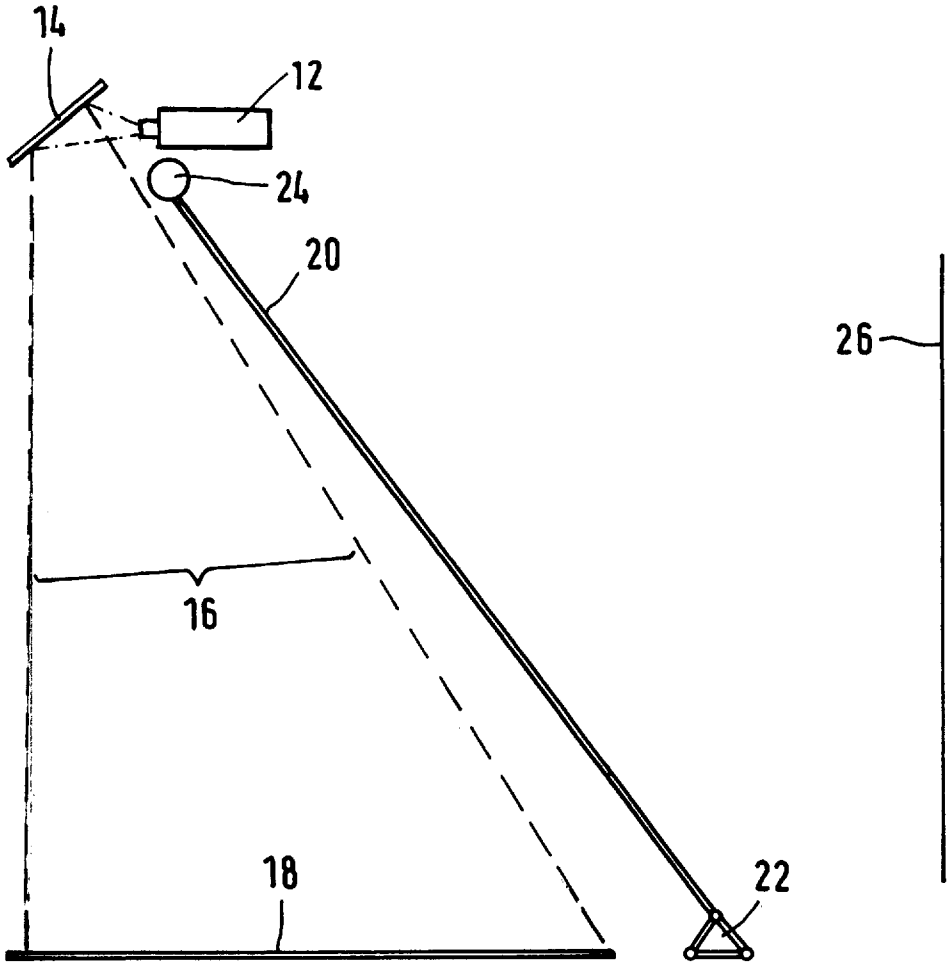


FIG.1

FIG. 2

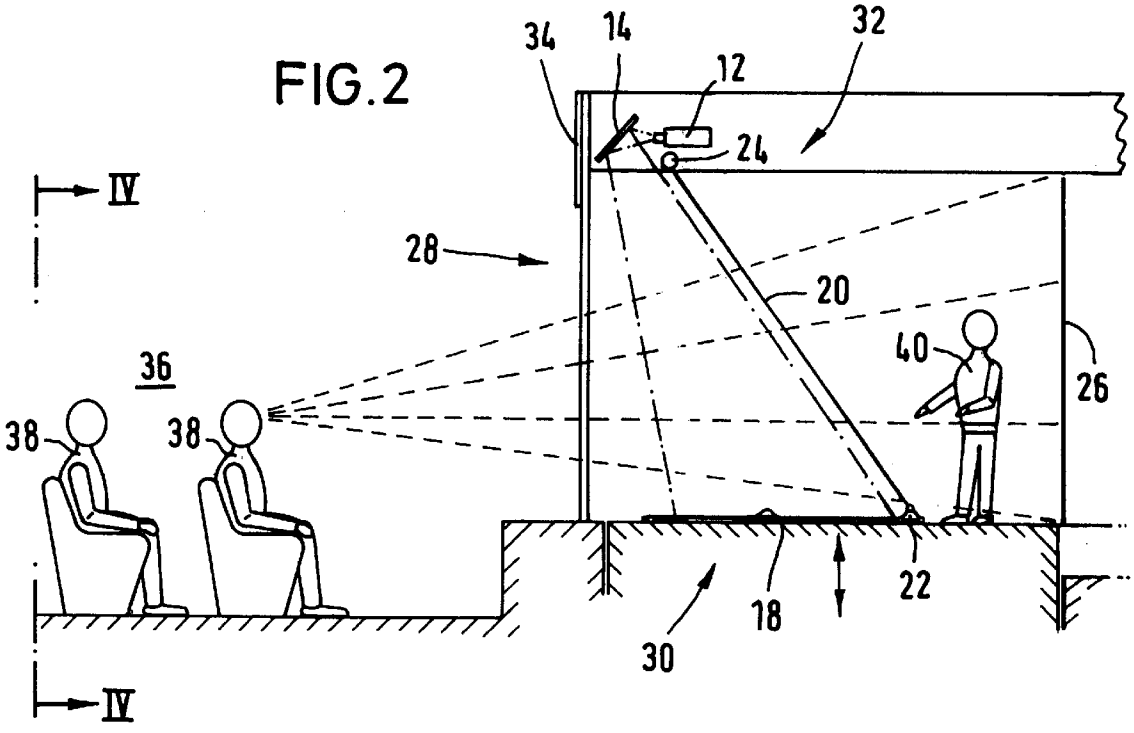

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FIG. 3

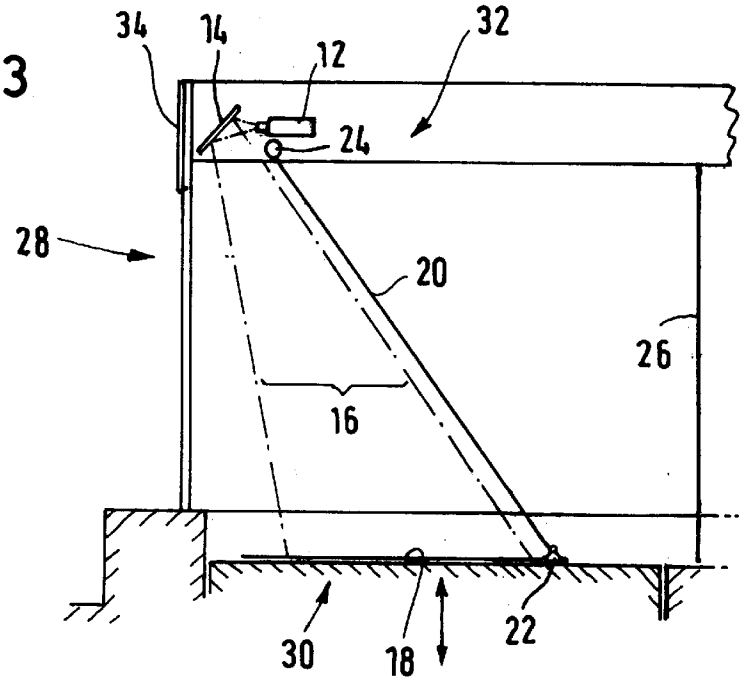
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FIG.4

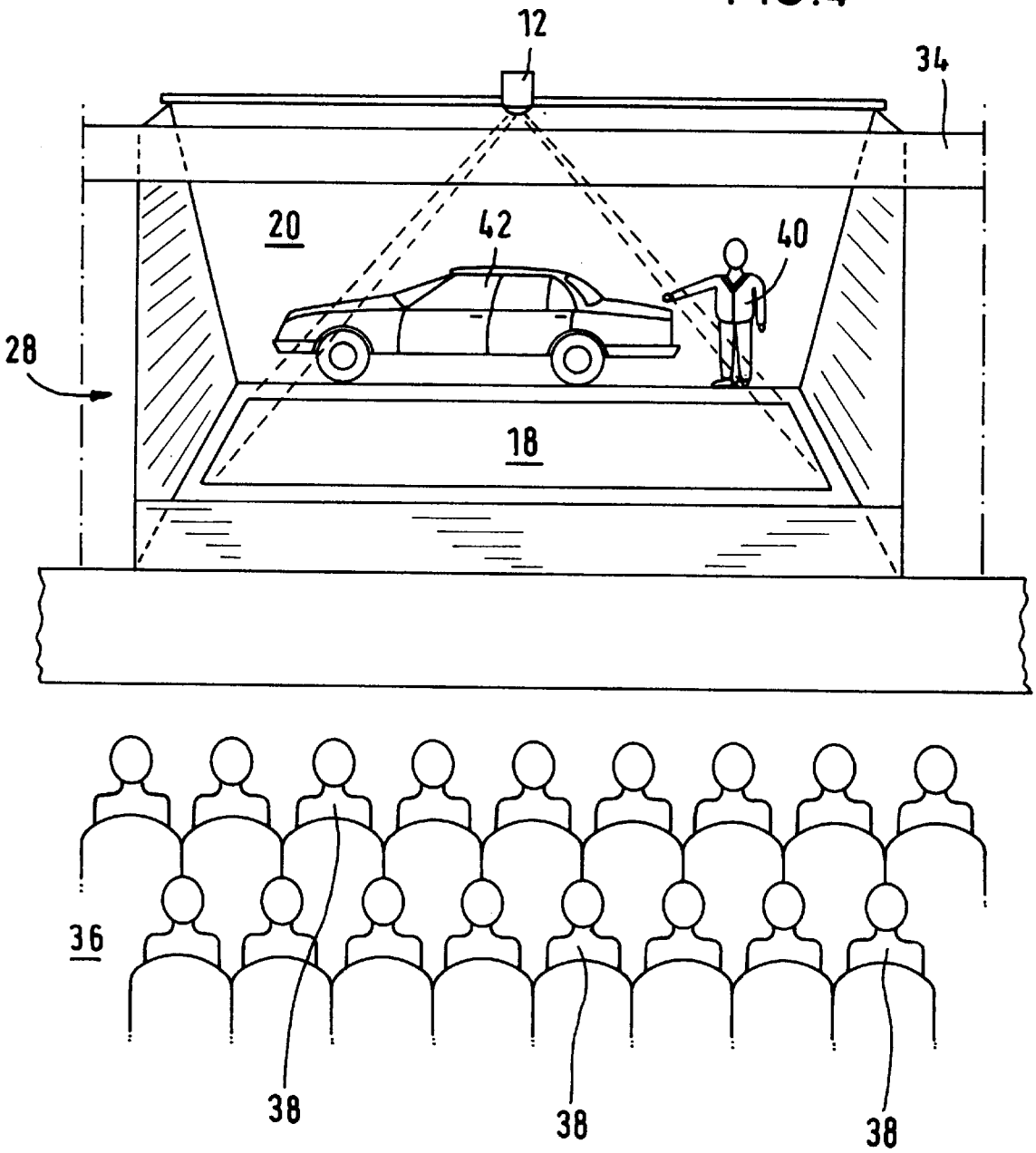


FIG.5

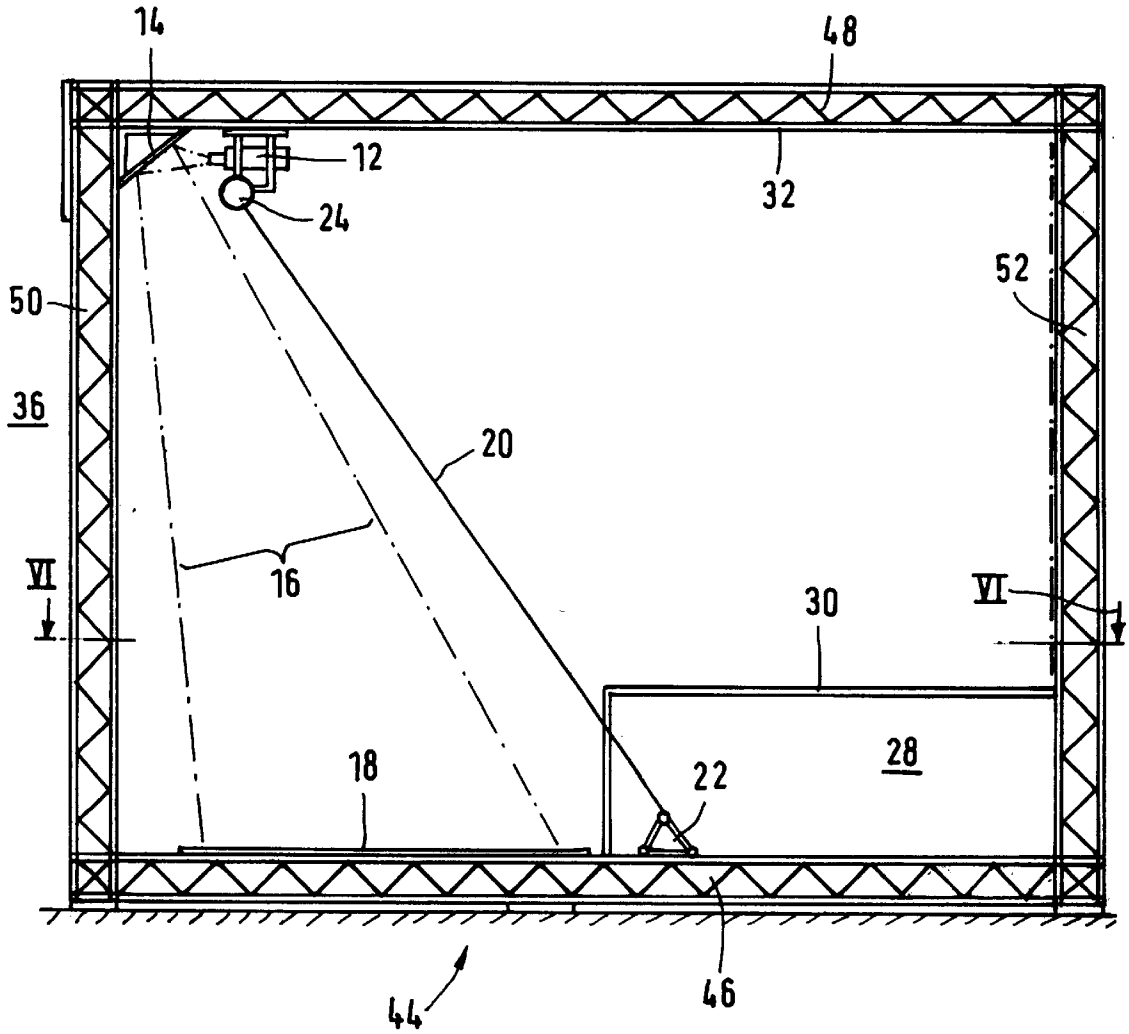
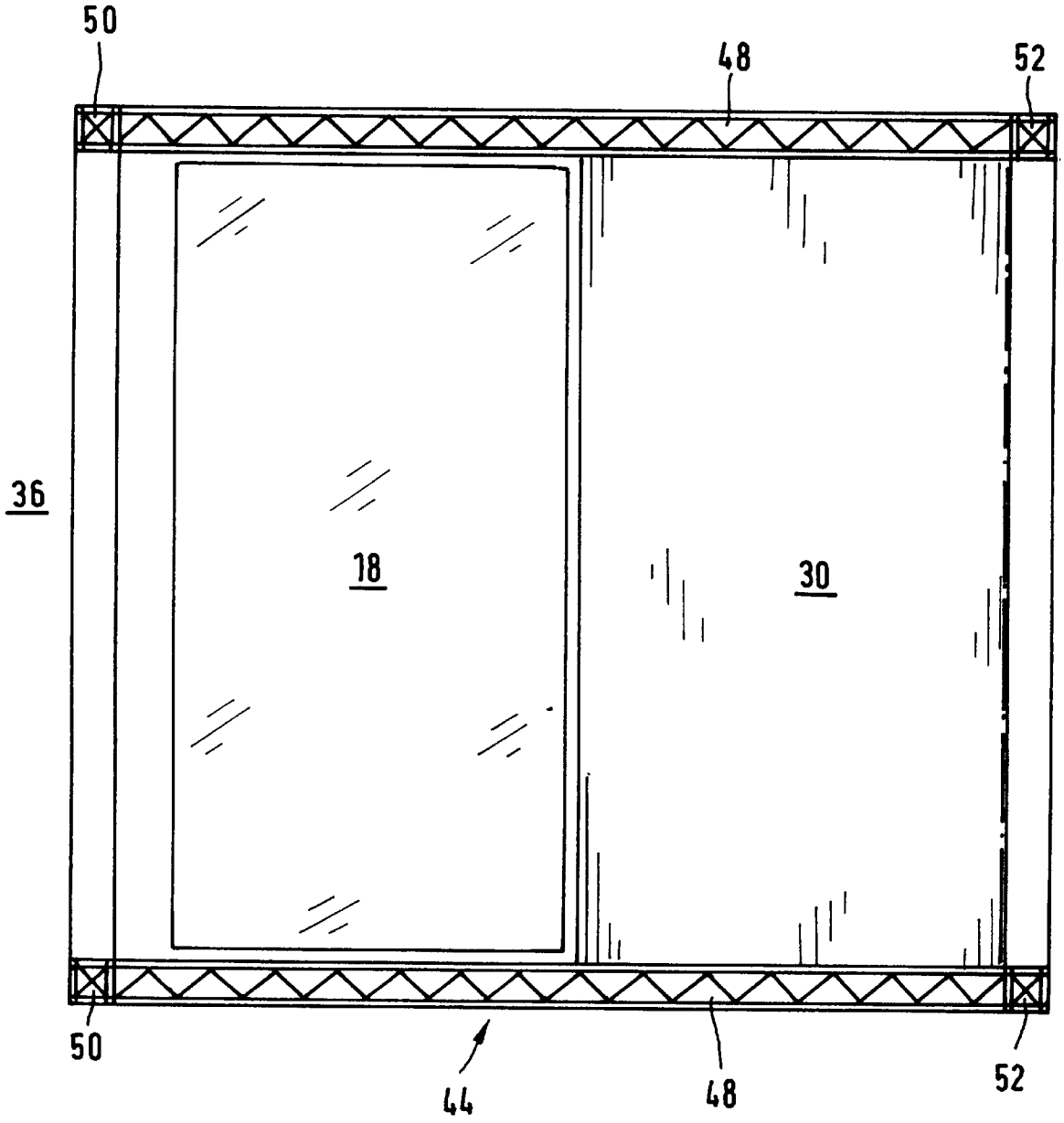


FIG.6



DEVICE FOR DISPLAYING MOVING IMAGES IN THE BACKGROUND OF A STAGE

The invention concerns an apparatus for representing moving images in the background of a stage or the like using an image source.

Transparency lectures or presentations are known, and that expression is a well-established piece of terminology. In a transparency presentation the presenter projects still images or pictures on to a projection screen. The presenter himself stands outside the light cone between the projector and the projection screen and comments on the images. Instead of the transparency projector the presenter can also use a film apparatus. In that case moving images appear on the projection screen and the presenter comments thereon. In both cases the presenter stands outside the light cone. He does not appear on or in the image himself. If he were to move into the light cone he would mask off a part of the light beam. Instead of the image, the shadow of the presenter would then appear on the projection screen. If the presenter wants to direct the attention of his viewers to a given point in the image he uses for that purpose a pointer or a light with a sharply focussed light beam.

The foregoing kind of presentation is sufficient for image and film presentations for photographic and film amateurs. Travellers who show films or transparencies of their travels to a wide circle of viewers can also use that kind of presentation without detriment. The viewers are only interested in the film or the transparencies and the words of the presenter. They attribute only slight significance to the manner of presentation and the technical equipment involved.

The position is different if the viewers do not have any particular interest in the articles to be shown and an interest first has to be aroused. The position is also different when the film presentation is to take place at a high technical level, for overriding reasons. The situation is also different if the film presentation is to be made more relaxed and less monotonous and linked to so-called display effects.

A theatre production is described as a ghost trick in the literature (for example Bühnentechnische Rundschau, BTR 3/1990, pages 24 and 25), involving disposing a pane of glass inclinedly in the front region of the stage. An actor is positioned beneath the pane of glass and in a lowered part of the stage. He is bedecked with wide white garments and represents the ghost. He is lit by a spotlight which is also disposed under the stage. The image of that actor representing the ghost is projected on to the pane of glass and appears to the viewers behind the pane of glass a virtual image. In that theatre presentation a second actor is on the stage. He represents a hero or sorcerer who conjures up the ghost.

On the basis thereof, the object of the present invention is an apparatus with which film and image presentations can be made relaxed and the presenter himself can move into the image without thereby interfering with reproduction of the image on a projection screen or generally on a surface. In accordance with the invention, that object is attained in an apparatus of the kind set forth in the opening part of this specification, in that a reflecting surface is arranged on the floor of the stage in the central region thereof, a transparent smooth foil extends between the floor and the top or ceiling of the stage over the entire width thereof in such a way that its lower end is held to a position between the reflecting surface and the background and its upper end is held to the ceiling at a position which is disposed further forwardly, and the image source is arranged at the ceiling in front of the upper end of the foil which is held there, and is directed on to the reflecting surface.

The apparatus according to the invention makes use of the physical principle that any motor car driver experiences on the windshield of his vehicle. An article lying on the storage surface in front of the windshield is reflected therein in such a way that it seems to the motor car driver to be disposed in front of the windshield, as viewed in the direction of travel. In the case of the apparatus according to the invention the article to be represented is projected by the image source on to the reflecting surface which corresponds to the above-mentioned support surface, and it is then reflected in the transparent smooth foil in such a way that it appears to the viewer on the background of the stage. The foil which extends over the entire width of the stage and which is held to the floor and ceiling thereof acts like the windshield in a motor vehicle. A viewer at any point in the auditorium believes that he is seeing any article reflected by the reflecting surface on to the foil, behind same. The presenter stands on the stage outside the light cone of the image source. As viewed from the auditorium, he stands behind the reflecting surface. That means that his image is not formed on the background, nor does he disturb the image representation thereon. He can draw the attention of the viewers to given details in the image representation, without making use of a pointer or a light. He can likewise move with the images and interpret the reproduction thereof by virtue of his body language.

Desirably the foil extends at an angle of about 45° relative to the floor of the stage. The image source can be a display screen tube with a very high degree of resolution. It can be controlled by a computer. That means that the image can also be electronically influenced. Desirably a computer-controlled intelligent light amplifier (also known as an ILA) is used as the image source. It is oriented horizontally and emits light in the direction of the auditorium. Accordingly its longest extent lies in the horizontal and it can be easily concealed from the viewers. So that the light which it radiates reaches the reflecting surface, a further embodiment provides that a mirror is arranged in front of the computer-controlled light amplifier and the latter is directed on to the mirror and the mirror receives the light emitted by the light amplifier, is directed on to the reflecting surface and projects the light on to same.

If possible the viewer should not notice how the image in the background of the stage is produced. Therefore the light amplifier and the mirror are desirably covered over forwardly by a curtain or a board which extends over the entire width of the stage. The foil itself is under a very high tensile stress of up to 8t. In that way it is held tautly smooth and the image is not distorted. The foil is preferably without any inclusions. It is also to be very smooth on its front side and its rear side. It is also to be very thin. Finally the foil is to reflect between 30 and 50%, preferably 30%, of the light impinging on it. Such a foil is particularly well suited for the purposes according to the invention. The absence of inclusions and the smooth front and rear sides thereof result in very slight and imperceptible distortion effects. The fact that the foil is very thin serves the same purpose. Reflection phenomena at the front and rear sides thereof thus coincide. The foil used for the purposes according to the invention is generally subjected to further processing as transparency or 35 mm films. When used as a transparency film, it is cut up into the format of the transparency or 35 mm films. When it is used for the invention the foil has a surface area of at least 3 m times 4 m.

In a desirable embodiment the foil is rolled on to a winding tube. It is suspended therewith at the ceiling of the

stage. Desirably it is fixed to the ceiling, together with the intelligent light amplifier. The free end of the foil can be pulled off the winding tube and is fixed to the floor of the stage. A support mounting arranged on the floor of the stage is used for that purpose.

The reflecting surface may be a white projection screen which is to be laid on to the floor of the stage. The reflecting surface however may also be a simple white coat of paint. As the presenter moves outside it and more specifically behind it, it retains its reflecting properties for a very long period of time.

The apparatus according to the invention is advantageously used in connection with a stage with a floor which can be raised and lowered. The reflecting surface, the projection screen, the coat of paint or the like, is disposed on that part of the floor, which can be raised and lowered. When the floor is lowered the spacing between the image source and the reflecting surface is increased. As a result the virtual image which appears in the background of the stage is displaced rearwardly.

The apparatus according to the invention is to be easy to transport from one location to another and to set up at different locations. For that purpose, in a desirable embodiment, the invention provides that its components are enclosed by a lattice frame and can be secured thereto. Desirably, the lattice frame has units which can be set up on the two sides of the apparatus or the stage thereof and which each have a lower girder portion, an upper girder portion, a front girder portion and a back girder portion. The lattice frame units which can be set up on the two sides of the apparatus or stage can be connected together by transversely extending struts.

Desirably the winding tube is secured to the upper girder portions by way of brackets while the mounting support which holds the free end of the foil is fixed to the lower girder portions.

The invention will now be further described by way of the example of the embodiments illustrated in the drawing in which:

FIG. **1** is a simplified diagrammatic side view of the apparatus according to the invention,

FIG. **2** is a more detailed diagrammatic side view of the apparatus according to the invention, simultaneously showing the auditorium,

FIG. **3** is a side view of the stage similarly to the illustration in FIG. **2** with the floor lowered,

FIG. **4** is a view of the auditorium and the stage looking in the direction of the line IV—IV in FIG. **2**,

FIG. **5** is a side view of the apparatus according to the invention when using the lattice frames surrounding it, and

FIG. **6** is a view in the direction of the line VI—VI.

FIG. **1** shows the physical principle of the apparatus according to the invention with the computer-controlled intelligent light amplifier **12** which acts as an image source, the mirror **14** which in the view in FIG. **1** is arranged to the left in front of it and which projects the light radiated on to it from the light amplifier **12** on to the reflecting surface **18** in the form of a light cone **16** as indicated by two broken lines, the foil **20** with its lower holding means in the form of a mounting bracket **22** and its upper holding means in the form of a winding tube **24** and the virtual image **26** which is represented in the background of the stage. The computer-controlled intelligent light amplifier **12** projects a moving image on to the mirror **14**. This projects it on to the reflecting surface **18** which projects it on to the foil **20**. From the point of view of a viewer who is at the left in FIG. **1**—see FIG. **2**—a moving image appears in the background as a virtual image **26**.

FIGS. **2** and **3** show a practical application of the apparatus according to the invention at a presentation or lecture function. More specifically FIG. **2** again shows the stage **28**, the floor **30** thereof and the ceiling **32** thereof. Extending under the ceiling **32** of the stage **28** over the entire width thereof is a curtain or a cover rail or board **34**. It covers over in a forward direction the computer-controlled intelligent light amplifier **12** and the mirror **14**. The viewers **38** sit in the auditorium **36**. The presenter or lecturer **40** stands on the stage **28** behind the reflecting surface **18**. The reflecting surface **18** is for example a projection screen or a coat of white paint. The double-headed arrow shown under the floor **30** is intended to indicate that it can be raised and lowered. FIG. **2** shows the floor **30** at its normal height. The virtual image **26** appears in the background of the stage **28** at a given location. FIG. **3** shows the same stage **28** with the floor **30** lowered. When the floor **30** is lowered the virtual image **26** moves rearwardly, towards the right when looking at FIGS. **2** and **3**.

FIG. **4** shows a practical application of the apparatus according to the invention in a presentation function relating to motor vehicles. FIG. **4** shows a presentation article **42**, in this example being a motor vehicle. The viewers **38** see it in the background as a virtual image. They do not recognise that this involves a reflection at the reflecting surface **18** and the foil **20**. They only see how the presenter **40** moves freely in front of the motor vehicle, points with his arms and hands to the motor vehicle and parts thereof, explains details in words, and in so doing neither interferes with nor in any way influences the reproduction of the motor vehicle in the background in the form of the virtual image **26**.

FIGS. **5** and **6** show the transportable embodiment of the apparatus according to the invention, which can be set up at any desired location. Lattice frames **44** which can be set up at both sides of the apparatus serve for that purpose. Each lattice frame comprises a lower girder portion **46**, an upper girder portion **48**, a front girder portion **50** and a back girder portion **52**. Lattice frames of that kind are known. Each girder portion comprises a plurality of parts which can be releasably connected together. For the purposes of erecting the apparatus, the parts of the girder portions are fitted together and joined together. For transportation purposes they are separated from each other and can be transported in the form of comparatively small units on a truck or the like. As shown in FIG. **5** the computer-controlled intelligent light amplifier **12** and the winding tube **24** are fixed to a bracket. The bracket is in turn fixed to a transverse strut which connects the two upper girder portions **48**. The same applies in regard to the mirror **14**. When the apparatus is erected the foil **20** is pulled off the winding tube **24**, fixed to the mounting bracket **22** and then tensioned. The reflecting surface **18** is laid on the floor in the form of a plate or the like which is coated or painted white, or in the form of a projection screen. The stage **28** on which the presenter **40** stands when making his presentation is composed of parts which are known per se on their own and it is erected in the rearward region of the apparatus.

I claim:

1. Apparatus for representing moving images in the background of a stage using an image source, said stage including a floor, a ceiling disposed vertically above said floor and a background disposed therebetween, said apparatus characterised in that a reflecting surface **(18)** is arranged on said floor **(30)** of said stage **(28)** in the central region thereof, a transparent smooth foil **(20)** extends between said floor **(30)** and said ceiling **(32)** at a position which is disposed further forwardly, and the image source is arranged at the ceiling

(32) in front of the upper end of the foil (20) which is held there, and is directed on to the reflecting surface (18).

2. Apparatus as set forth in claim 1 characterised in that the foil (18) extends at an angle of about 45° relative to the floor (30) of the stage (28).

3. Apparatus as set forth in claim 1 or claim 2 characterised in that the image source is a computer-controlled intelligent light amplifier (12).

4. Apparatus as set forth in claim 3 characterised in that a mirror (14) is arranged in front of the computer-controlled light amplifier (12) and said light amplifier is directed on to the mirror (14) and the mirror (14) receives the light radiated from the light amplifier (12), is directed on to the reflecting surface (18) and projects the light on to said reflecting surface.

5. Apparatus as set forth in claim 4 characterised in that the light amplifier (12) and the mirror (14) are covered over forwardly by a curtain extending over the entire width of the stage (28).

6. Apparatus as set forth in claim 1 characterised in that the foil is subject to a tensile stress.

7. Apparatus as set forth in claim 6 characterised in that the foil (20) has a surface area of at least 3 m times 4 m.

8. Apparatus as set forth in claim 7 characterised in that the foil (20) is rolled on a winding tube (24) and can be pulled off same and can be fixed with its free end in a support mounting (22).

9. Apparatus as set forth in claim 1 characterised in that the reflecting surface (18) is a coat of white paint.

10. Apparatus as set forth in claim 1 characterised in that the reflecting surface (18) is a white projection screen.

11. Apparatus as set forth in claim 1 characterised in that the floor (30) of the stage (28) can be raised and lowered.

12. Apparatus as set forth in claim 4 characterised in that light amplifier (12), mirror (14), reflecting surface (18), foil (20) and stage (28) are enclosed by a lattice frame (44) and can be fixed thereto.

13. Apparatus as set forth in claim 12 characterised in that the lattice frame (44) includes two units which can be set up on both sides of the stage (28) and each unit has a lower girder portion (46), an upper girder portion (48), a front girder portion (50) and a back girder portion (52).

14. Apparatus as set forth in claim 13 characterised in that the two lattice frame units which can be set up on both sides of the stage (28) can be connected by transversely extending struts.

15. Apparatus as set forth in claim 4 characterised that the light amplifier (12) and the mirror (14) are covered over forwardly by a cover bar (34) extending over the entire width of the stage (28).

* * * * *

EXHIBIT B

US007883212B2

(12) **United States Patent**
O'Connell et al.

(10) **Patent No.: US 7,883,212 B2**
(45) **Date of Patent: Feb. 8, 2011**

(54) **PROJECTION APPARATUS AND METHOD FOR PEPPER'S GHOST ILLUSION**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1129 days.

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(86) PCT No.: **PCT/GB2004/001414**

§ 371 (c)(1),
(2), (4) Date: **Sep. 30, 2006**

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PCT Pub. Date: **Oct. 13, 2005**

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G02B 27/22	(2006.01)
A63G 31/00	(2006.01)
A63J 5/00	(2006.01)

(52) **U.S. Cl.** **353/10**; 359/449; 359/478; 472/63

(58) **Field of Classification Search** 353/10, 353/74, 79, 119, 122, 28; 359/443, 449, 359/447, 478, 479, 630; 472/58, 61, 63
See application file for complete search history.

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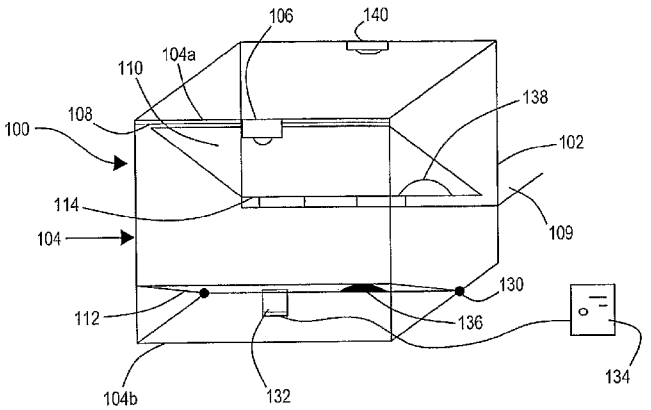
Primary Examiner—Georgia Y Epps
Assistant Examiner—Ryan Howard
(74) *Attorney, Agent, or Firm*—Thomas, Kayden, Horstemeyer & Risley, LLP; Larry W. Brantley

(57) **ABSTRACT**

An image projection apparatus (**100**) comprises a projector (**106**), a frame (**108**), and a partially transparent screen (**110**). The frame (**108**) retains the screen (**110**) under tension, such that the screen (**110**) is inclined at an angle with respect to a plane of emission of light from the projector (**106**). The screen (**110**) has a front surface arranged such that light emitted from the projector (**106**) is reflected therefrom. The projector (**106**) projects an image such that light forming the image impinges upon the screen (**11**) such that a virtual image is created from light reflected from the screen (**110**), the virtual image appearing to be located behind the screen (**110**).

18 Claims, 4 Drawing Sheets



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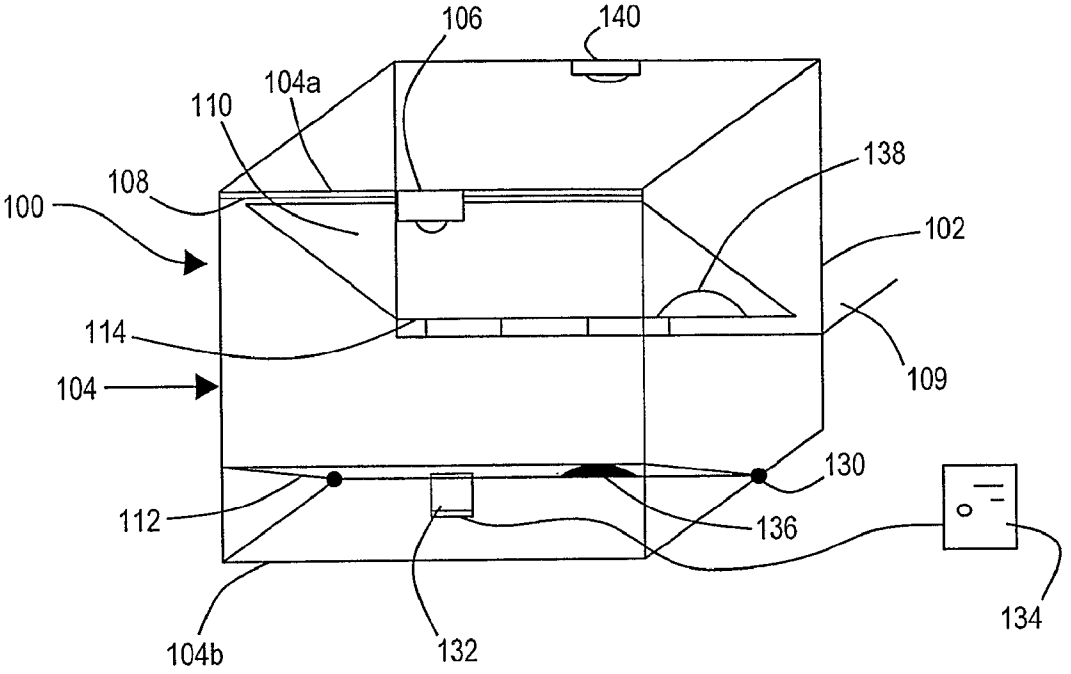
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104b
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Fig.1

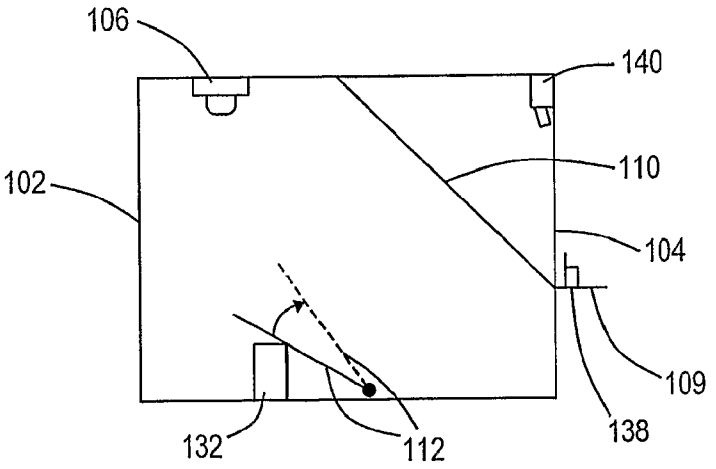
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Fig.2

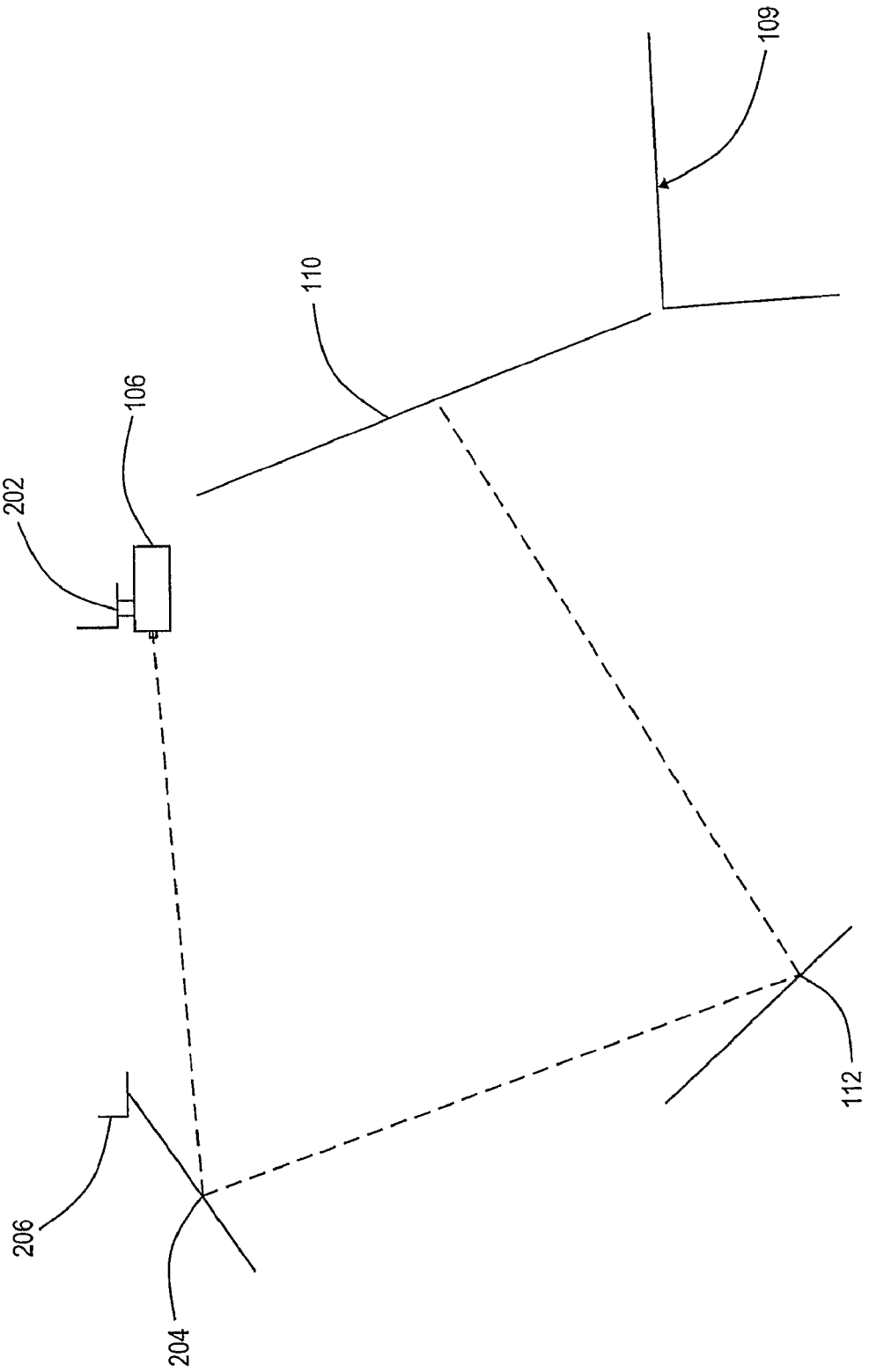
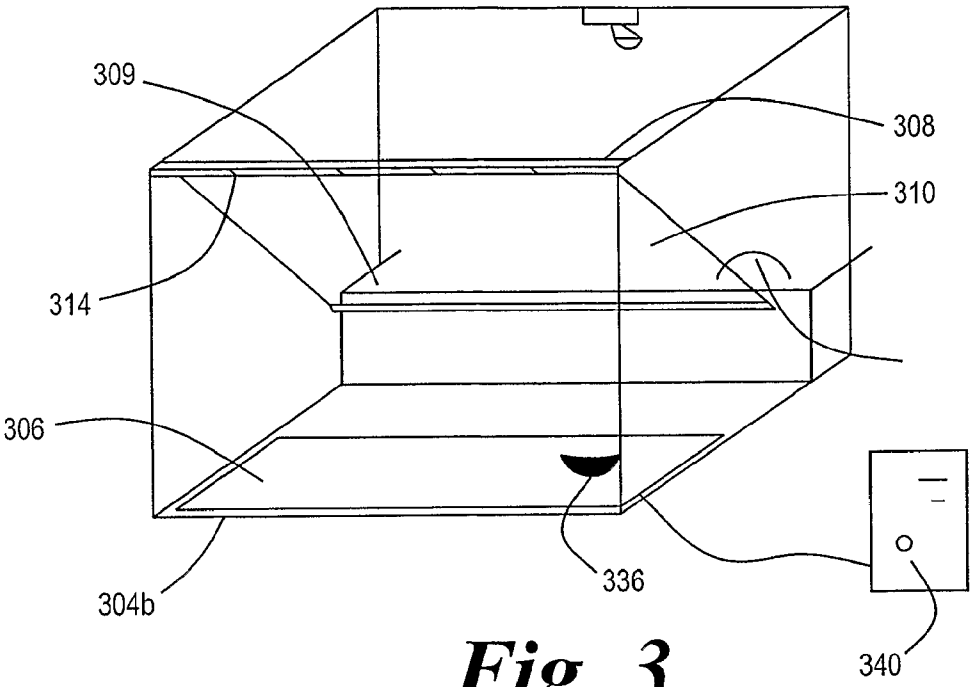


Fig. 2a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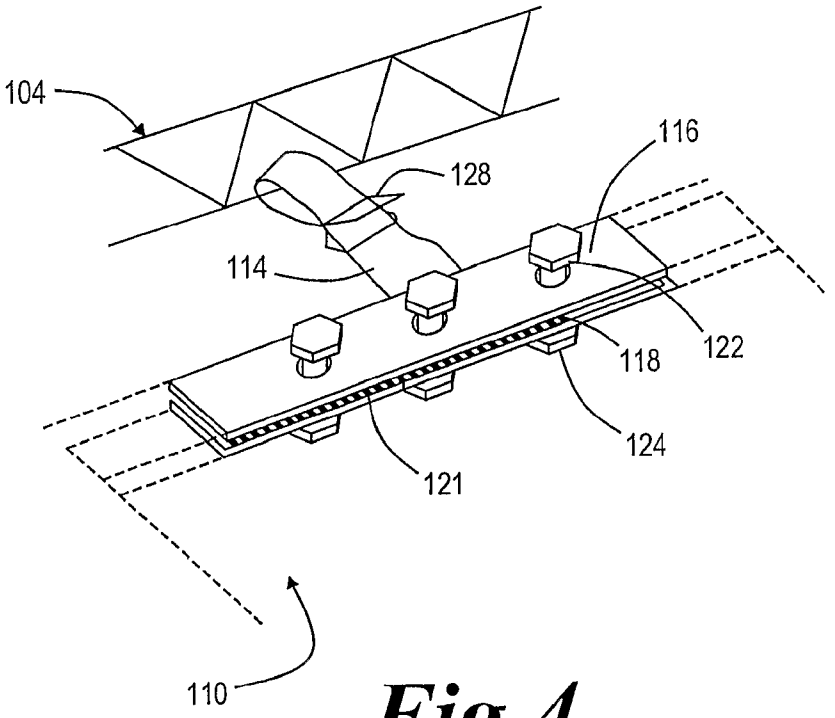
314
306
304b
336
340

Fig. 3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118
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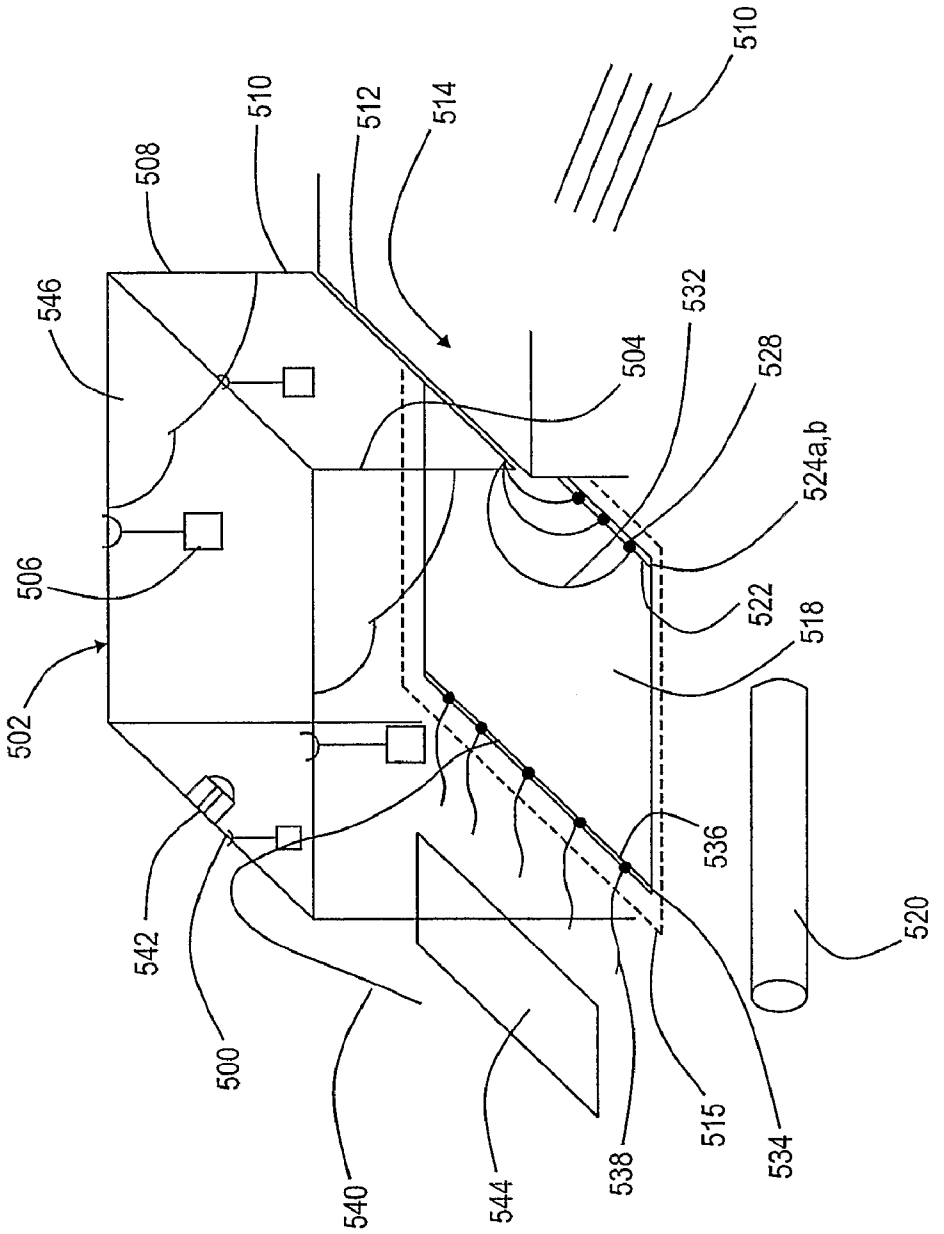
110

Fig.4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512
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534

Fig. 5

PROJECTION APPARATUS AND METHOD FOR PEPPER'S GHOST ILLUSION

This invention relates to a projection apparatus and method. More particularly, but not exclusively, it relates to a projection apparatus arranged to project an image of an object upon an inclined, partially reflective, screen so as to give a false perception of depth and a method for constructing such an apparatus.

BACKGROUND OF THE INVENTION

The projection of an image upon a partially reflective screen such that is observable by a viewer positioned in front of the screen is known, the so-called "Peppers ghost" arrangement that is known form fairground shows.

This has been applied to publicity and promotional displays where a presenter resides behind an inclined, partially reflective screen, typically a tensioned foil, onto which an image of, for example, a motor vehicle is projected, via at least one reflective surface, see for example EP 0799436. The location of the presenter behind the projected image has a number of inherent advantages over systems where the presenter stands in front of a screen, not least of which is that the presenter does not obscure the projected image when walking across the projected image. Additionally, the use of an inclined screen results in a viewer of the image perceiving the image as having depth rather than merely being a two dimensional image, for example where a motor vehicle is seen to rotate upon a turntable.

However, current image projection apparatus' do have a number of problems associated with them, for example, mounting of the foil can prove difficult which in turn leads to uneven tensioning of the foil and wrinkles upon the foil, that impair the viewed quality of the image projected onto the foil. Also, in mounting the foil the foil must be laid out upon a clean dust free piece of cloth or plastic sheet, which is larger than the foil, in order to prevent particles adhering to the foil, such particles can scratch the surface of the foil and impair the viewed quality of the projected image or act as scattering centres from which projected light is incoherently scattered, thereby detracting from the viewed quality of the image as this scattered light does not contribute to the viewed image.

Also, as the illusion of peppers ghost relies on the reflected image formed by light contrasting with its immediate surroundings and background. The stronger the reflected image, the more solid that reflected image looks, the more vibrant the colours will be, and the more visible the reflected image is to an audience. In circumstances where the presenter may be unable to control high levels of ambient light forward of the foil, e.g. from an auditorium at a trade show, the high level of ambient light results in significant levels of reflection of the ambient light from the screen detracting from the strength of the reflected image over the background. In these circumstances a bright projector (8000 lumens+) is desirable. However, the use of a bright projector results in unwanted light hitting the projection surface and reflecting through the foil to create a milky hue upon the stage and around the area where the reflected image appears.

Another problem with current image projection apparatus is that projectors used with such apparatus are very powerful, typically 8,000 to 27,000 lumens and consequently project a significant amount of light into areas of an image where there is no object within the image. This is an inherent feature of projectors and results in low contrast ratios which leads to a milky hue spread over the part of the film where the projector is creating an image when the projector is switched on. The

milky hue is clearly undesirable as it detracts from the viewer's perception that there is no screen present.

The level of the milky hue relative to the brightness of the image is, at least partially, determined by the level of contrast ratio offered in the projector. The higher the contrast ratio, then the brighter the image can be relative to the brightness level of the milky hue. Even projectors with contrast rations as high as 3000:1 still emit a milky light hue when used in a "Pepper's Ghost" arrangement.

A further problem associated with some projectors is the "keystone" effect, in which distorted, typically elongated, images (up and down) occur due to angled projection. This is of particular relevance where depth perception is of importance. The solution employed in modern, expensive projectors is to employ digital correction of keystone distortions. However, older, less-expensive or even some specialist High Definition projectors do not employ such digital keystone correction and are therefore difficult to configure for use with current image projection apparatus. High definition (HD) projectors do not offer keystone adjustment because when keystone correction is attempted in conjunction with the increased number of pixels about an image's edge causes the pixels about the edge of the image to appear 'crunched'. Additionally, when processing moving images HD projectors compromise projector processing speed. When the processing power is used to carry out both keystone correction and motion processing the image is seen to jerk during movements, an effect known as "chokking". In general, it can be said that the use of electronic keystone correction to alter a video image will result in the degradation of picture quality compared to an image which is not subject to such a process.

Additionally, current systems do not allow for the projected image to apparently disappear and re-appear from behind a solid 3D object placed upon the stage, as the screen lies in front of the presenter and closest to the viewing audience.

BRIEF SUMMARY OF THE INVENTION

According to a first aspect of the present invention there is provided a image projection apparatus comprising a projector, a frame, and an at least partially transparent screen:

the frame being arranged to retain the screen under tension, such that the screen is inclined at an angle with respect to a plane of emission of light from the projector;

the screen having a front surface arranged such that light emitted from the projector is reflected therefrom; and

the projector being arranged to project an image such that light forming the image impinges upon the screen such that a virtual image is created from light reflected from the screen, the virtual image appearing to be located behind the screen.

Such an apparatus is advantageous over present systems in that the screen need not be coated with an expensive, partially reflective coating, an angular dependence of reflectivity of transparent dielectric materials can be used to bring about partial reflectance of the projected image. Thus, this apparatus simplifies the manufacture of such systems and also reduces their production costs. Additionally, the use of a frame frees the screen from having to be fixed directly to a ceiling, or a floor, and therefore increases the utility of apparatus over the prior art systems.

The screen may be a foil. The foil may be rolled about a cylinder when not in use. The screen may be inclined at approximately 45° to the plane of emission of light from the projector. The screen may comprise a partially reflective layer upon the front surface.

The use of a foil screen reduces the weight of the apparatus, this allows ready transportation of the apparatus between sites. Rolling the foil onto a cylinder when not in use serves to protect the foil from damage during transportation and also allows ready transportation of the apparatus between sites. The use of a partially reflective screen can increase the degree of light reflected from the screen and can increase the audience perceived strength of the virtual image.

The screen may be attached to the frame at the screen's upper and/or lower edges. The frame may comprise first and second retention members arranged to sandwich an edge region of the screen therebetween. At least one of the first and second retention members may comprise an abrasive coating, typically sandpaper, arranged to contact the screen. The first and second retention members may comprise respective openings therethrough that may be arranged to collocate with openings in respective jaws of clamping members attached to tensioning straps, the openings may be arranged to receive a fixing means so as to clamp the screen between the first and second retention members. The tensioning straps may be attached to a truss arrangement and may be adjustable such that the tension of the screen within the truss arrangement can be varied about the periphery of the screen. Preferably, the retention members are substantially parallel to truss members comprising the truss arrangement.

The use of a variable tensioning arrangement allows wrinkles upon the screen to be minimised, and ideally eradicated to present a smooth surface for upon which the image can be projected. An abrasive surface upon at least one of the retention members increases the grip between the retention member and the screen thereby reducing the likelihood of the screen slipping when held by the retention member.

The apparatus may comprise a pigmented reflective member in an optical pathway between the projector and the screen. The pigmented member may reflect only part of the visible spectrum of light, typically the pigmented member will appear grey or white to a viewer.

It has been found that the use of a grey reflective member in the optical pathway between the projector and the screen reduces the outline of the reflective member upon the screen compared to when a white reflective member is used, and also reduces the level of the milky white hue associated with the projector emitting light where there is no image of an object to be projected.

The pigmented reflective member may be inclined at an angle with respect to the plane of emission of light from the projector. The angle of inclination of the member with respect to the plane of emission of light from the projector may be variable. The member may comprise a plurality of sections each of which may have an independently variable angle of inclination with respect to the plane of emission of light from the projector.

The inclination of the reflective member can compensate, at least partially and in some instances completely, for keystone effect. The variation of the angle of inclination or distance of the reflective member allows for a variation of the apparent depth and/or position of an object when projected upon the screen. This is because the virtual image appears as far behind the screen as the real image is in front of the screen.

There may be a reflective device, typically a mirror, arranged to direct light projected from the projector on to the reflective member. Typically, the reflective device is mounted upon an upper part of the framework. The reflective member may be parallel, or substantially parallel, to the reflective device. In some embodiments the projector may be mounted upon an upper truss of the framework and may be aligned with the horizontal, typically light projected from the projector is directed on to the reflective device.

Such an arrangement compliments the keystone correction achievable by the inclination of the screen and the reflective member and is particularly useful where an HD projector is used in order to compensate for the keystone effect without the use of the projector's processing power.

The reflective member may comprise a mask corresponding to the apparent location of a prop in the screen to an audience. Typically, the mask will absorb light over at least a fraction of the visible spectrum and preferably the mask will be black. The mask may be arranged to produce an area upon the screen upon which the image is not projected. The mask may vary in extent and shape, for example by the use of a sliding element that is moved in and out of position upon the reflective member.

The mask can be used to make the illusion of an article disappearing and reappearing behind a prop that is placed upon a stage, either behind or in front of the screen.

The apparatus may comprise a light source arranged to selectively illuminate an area of stage comprising the prop. The light source may be a white light source Lighting the prop causes the prop to become more visible and better defined against the dark, typically black, background. This enhances the three dimensional effect of the projected image interacting with the prop.

Also directing bright light upon the prop serves to reduce the contrast ratio of the projected image upon the prop, which typically remains slightly visible even when a mask is used in the prop's shadow upon the reflective member, thus enhancing the illusion of the projected image disappearing behind the prop.

The apparatus may comprise a light source arranged to illuminate at least part of a stage. The light source may be located to the rear of the screen, typically along a top edge of the frame and/or along either side of the stage. The apparatus may comprise a plurality of light sources. The apparatus may comprise a lighting desk equipped with faders arranged to control the level of each light source, or selection means arranged to selectively control the supply of power to each light source.

Such a light source is used in order that the colour and light levels of the area immediately surrounding the peppers ghost image, the stage background, can most closely match the colour of the projection surface background, excluding the area on both which is carrying the image. This, reduces the milky hue perceived by the audience. The use of a plurality of light sources increases the uniformity of lighting of the stage, in order to produce a similar effect to the way light emitted from a projector hits the projection screen. By controlling each light source separately the lighting levels upon the stage can be controlled to closely match the levels of light as dictated by the show performance, or the levels of unwanted light hitting the projection surface of the screen.

The projector may comprise a standard projector, for example a JVC ML4000, or a Barco G5. Alternatively, the projector may comprise an LCD, or a television display. The display may comprise at least one element arranged to be non-emitting in response to control from a processor. The at least one element may form a mask arranged to produce an area upon the screen upon which the image is not projected. The mask may correspond to the shape and location of a prop upon stage. The prop may be three dimensional.

According to a second aspect of the present invention there is provided a method of providing a projection apparatus comprising the steps of:

(i) resting a frame upon a number of elevation means;

(ii) attaching leg sections to the frame;

(iii) increasing the height of the elevation means;

(iv) adding further leg sections;

(vi) attaching a lower edge of a screen to a lower rear piece of the frame;

(vii) raising an upper edge of the screen to adjacent an upper front section of the frame; and

(vii) attaching the upper edge of the screen to the upper front section of the frame.

The method may comprise providing the elevation means in the form of a jack.

The method may comprise providing the screen in the form of a film. The method may comprise removing a roll of screen film from a protective cylindrical casing. The method may comprise laying the screen upon a dust-free protective sheet.

The method may comprise placing the lower edge of the screen between jaws of a first retention member and may further comprise securing the screen in position using a fixing means passing through the retention member and the screen and a locking means arranged to lock the fixing means being arranged to secure the locking means in position. The method may comprise providing the fixing means in the form of a bolt and the locking means in the form of a nut.

The method may comprise attaching tensioning means to the retention member adjacent at least some of the fixing means.

The method may comprise attaching the tensioning means to the lower rear piece of the frame.

The method may comprise attaching a second retention member to an upper edge of the film screen, typically in the same manner as the first retention member is attached to the lower edge. The method may comprise attaching tensioning means to the second retention member. The method may comprise providing the tensioning members in the form of ratchet straps.

The method may comprise attaching a rope to the second retention member and passing the rope over the upper frame and using the rope in step (vii) to raise the screen.

The method may include tensioning each of the tensioning means such that the screen is flat and substantially wrinkle free.

The method may include depending a projector from the upper frame.

The method may include placing a pigmented reflective board between the screen and a front edge of the frame. The method may comprise reflecting light emitted by the projector from the board onto the screen.

The method may comprise forming the frame form a truss work.

According to a third aspect of the present invention there is provided a projection apparatus constructed according to the second aspect of the present invention.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

The invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

FIG. **1** is a schematic representation of a first embodiment of a projection apparatus according to at least an aspect of the present invention;

FIG. **2** is a side view of a the projection apparatus of FIG. **1** showing a pigmented reflective member in first and second positions;

FIG. **2***a* is a schematic representation of an alternative projection arrangement, suitable for use with the apparatus of FIGS. **1** and **2**;

FIG. **3** is a schematic representation of a second embodiment of a projection apparatus according to at least an aspect of the present invention;

FIG. **4** is a perspective view of a screen clamping arrangement of FIGS. **1**, **2** and **3**; and

FIG. **5** is a schematic view of a projection apparatus being constructed according to the second aspect of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to FIGS. **1**, **2** and **4**, a projection apparatus **100** comprises a box frame **102** formed of trusses **104**, a projector **106**, a support frame **108**, a screen **110** held within the support frame **108** and a grey pigmented reflective board **112**.

The projector **106** depends from a front upper cross-piece truss **104***a* of the box frame **102**. The board **112** lies below the projector **106** at the base of the box frame **102**. The screen **110**, is inclined at approximately 45° to the horizontal and the front edge of the screen **110** is proximate the front upper cross-piece truss **104***a* of the box frame **102** and the rear edge of the screen is proximate a stage **109** that lies to the rear of the box frame **102**.

The screen **110** is typically a polymeric foil, which can have a partially reflective coating upon a front face of the foil. The screen **110** is retained within the box frame **102** by means of tensioning straps **114** attached to the box frame **102**, at the top and bottom edges of the screen **110**. At a free end of each of the tensioning straps **114** there is pair of clamp jaws **116** which have respective openings **118**, **120** passing therethrough. The faces of the jaws **116** are optionally coated with an abrasive **121**, such as sandpaper, in order to enhance the grip of the jaws **116** upon the screen **110**.

Edges of the screen **110** are placed between the jaws **116** and a bolt **122** is placed through the openings **118**, **120** and passes through the screen **110**. A nut **124** is threaded onto the bolt **122** and tightened to hold the screen **110** between the jaws **116**. The tensioning straps **114** pass through the trusses **104** and are tightened using a friction locking buckle arrangement **128**.

Each of the tensioning straps **114** can be tightened or loosened individually so as to allow an even tension to be applied over the whole surface of the screen **110** thereby reducing, and ideally eliminating, the formation of wrinkles upon the screen **110** which reduce the quality of an image projected upon the screen **110**.

The reflective board **112** lies below the projector **106** adjacent to a lower front cross-piece truss **104***b* of the box frame **102**. The projector **106** is directed such that light emitted by the projector **106** strikes the reflective board **112**. The board **112** is inclined so that the light emitted by the projector **106** is reflected upwards from the board **112** onto the screen **110**. The use of a grey, or otherwise coloured board **112** reduces the milky hue associated with light from the projector where there is no image to be projected.

A fraction of the projected light striking the screen **110** is reflected from the front surface of the screen **110** where is can

be viewed by an audience. A presenter upon the stage **109** behind the screen **110** can also be viewed by the audience but does not interfere with the viewing of the image by the audience.

The board **112** is connected to a hinge arrangement **130** along a rear edge thereof. The hinge arrangement **130** allows the board **112** to be raised and lowered, typically be a hydraulic ramp **132** controlled by a computer **134**, in order to compensate for the 'keystone' effect. Alternatively, the board **112** can be raised and lowered by the person pulling upon a string, or an electric motor to drive the board up and down.

The raising and lowering of the board **112** also allows for the audience's perception of the positional depth upon the stage of an element of a projected image to be altered by varying the height of the element of the image upon the screen **110**. It is envisaged that the board **112** may comprise a number of individual sections each of which may be raised an lowered individually in order to allow the perceived depth of an individual element of an image to be varied independently of other elements of the image.

A non-reflective mask **136** in the shape of a prop **138**, in this example a rock, is placed upon the board **112**. The prop **138** is place upon the stage **109**, typically behind the screen **110**. The mask **136** is placed such that the board **112** is obscured in a region corresponding to where the prop **138** is located with respect to the screen **110**. This arrangement of mask **136** and prop **138** results in an image, or part of the image, projected upon the screen **110** apparently disappearing as the image, or part of the image, passes over prop **138** and reappearing once the image, or part of the image has passed over the prop **138** as the mask **136** prevents light being reflected onto the region of the screen **110** corresponding to the location of the prop **138**. The mask **136** can be variable in size and shape, for example by means of a sliding panel that is moved into location and varied in size according to the size of the prop **138**. This also allows for the depth perception of props to be varied as their apparent effect upon variable depth image elements, as discussed hereinbefore, can be varied appropriately, for example a given size of rock will obscure proportionately more of a distant image than the same rock will of a near image.

A light source **140** is mounted upon the box frame **102** and illuminates the prop **138** in order to reduce the effect of any residual light reflected from the board **112** onto the prop.

Referring now to FIG. **2***a*, an alternative projection arrangement **200**, suitable for use with the apparatus of FIGS. **1** and **2** with an additional truss, comprises the projector **106** depending from a truss **202** forward of the screen **110**, an inclined mirror **204** of variable inclination depending from a second truss **206** forward of projector **110**. The projector **106** projects an image on to the mirror **204** such that the image is projected on to the reflective board **112** and on to the screen **110**. The mirror **204** is typically arranged to be perpendicular to the board **112**, and in embodiments where the board **112** has a variable angle of inclination the mirror **204** will usually be arranged to track, synchronously, with any variation in the angle of inclination of the board **112**.

It will be appreciated that the term mirror is used herein to describe any reflective surface that reflects substantially all, typically in excess of 50% preferably in excess of 80%, light impinging upon it.

Referring now to FIG. **3**, a projection apparatus **300** is substantially similar to that of FIGS. **1** and **2** accordingly identical parts to those of FIGS. **1** and **2** are accorded similar reference numerals in the three hundred series.

A projection screen **306** resides in front of the screen **310** adjacent the lower front cross-piece truss **304***b*. The projection screen **306** is typically a liquid crystal display (LCD) screen or a television screen. The projection screen **306** projects an image upwards onto the front surface of the screen **310**. The use of a projection screen **306** removes the 'keystone' effect associated with conventional projectors.

A mask **336** can be formed upon the screen by use of a computer **340** to control the projection screen **306** to black out the appropriate part of the projection screen **306** electronically. This removes the need for a physical mask to be produced. The computer **340** can be used to switch of areas of the projection screen **306** which do not contain part of an image to be projected, this reduces the milky white hue associated with such areas when using conventional projectors. Also, the use of a computer **340** to control the projection screen **306**, together with image sizing in relation to image movement allows an image to be readily scaled and positioned upon the projection screen **306** to enhance an audience's perception of depth and movement of a projected image using known image processing techniques. Alternatively, the projection screen **306**, or sections of the projection screen **306**, can be raised and lowered under the control of the computer **340** in order to enhance the audience's perception of depth of the projected image.

Referring now to FIG. **5**, a box truss framework **500** comprises a square upper truss work **502** and leg trusses **504**. In constructing the framework **500** the upper truss work **502** rests upon a number of jacks **506**. First sections **508** of the leg trusses **504** that extend at right angles to the upper truss work **502** are added at the corners of the upper truss work **502**. The height of the jacks **506** is increased to allow additional sections **510** of the leg trusses **504** to be added until the desired height of the box truss framework **500** is achieved.

A cross-piece truss **512** is fixed to two of the leg trusses **504** such that it horizontally spans the gap therebetween at a height close to, and typically slightly below, the level of a stage floor **514**. The leg trusses **504** spanned by the cross-piece truss **512** constitute the rear legs of the framework **500** and are located adjacent the front of the stage floor **514**.

A dust-free protective plastic sheet **515** is laid across the width of the stage floor **514** in front of the rear legs of the framework **500**. A roll of screen film **518** is removed from a protective cylindrical casing **520** and is unwound across the width of the stage floor **514**. The film **518** is placed upon the sheet **515** in order to prevent damage to the surface from dust particles or other sharp protrusions.

A lower edge **522** of the film **518** is placed between jaws **524***a,b* of a retention member **526**, each jaw **524***a,b* having opposed openings therethrough spaced at approximately 0.5 m intervals. Bolts **528** are placed through the openings, and through the film **518**, and secured in position using respective nuts. Ratchet straps **532** are attached to the retention member **526** adjacent alternate bolts **528**, having a spacing of approximately 1 m, and are then attached to the cross-piece truss **512**.

A second retention member **534** is attached to an upper edge **536** of the film **518** in a similar manner to how the retention member **526** is attached to the lower edge **522**. Ratchet straps **538** are attached to the second retention member **534**.

A rope **540** is tied to the second retention member **534** and is passed over the upper truss work **502** opposite the cross-piece truss **512**. The film raised into position using the rope **540** and the ratchet straps **538** are attached to the upper truss work **502**. Both sets of ratchet straps **532**, **538** are tightened individually until the screen film is tensioned such that the film **518** is flat and, ideally, free from wrinkles.

A projector **542** is depended from the upper truss work **502** and a pigmented reflective board **544** is placed between the

screen **518** and the front edge of the box truss framework **500** such that light emitted by the projector **542** is reflected from the board **544** onto the screen **518**. The screen **518** reflects at least part of the light from a front surface thereof away from the stage and into an auditorium to be viewed by and audience.

In order to prevent the audience observing the projection apparatus both side and front drapes **546** are used to screen the apparatus from the audience.

The invention claimed is:

1. An image projection apparatus, comprising:

a projector, a frame, a light source and an at least partially transparent screen;

the frame being arranged to retain the screen under tension, such that the tension of the screen can be varied at a plurality of positions along at least one edge of said screen such that the screen is substantially wrinkle free;

the light source arranged to illuminate at least part of the apparatus;

the screen inclined at an angle with respect to a plane of emission of light from the projector and the screen having a front surface arranged such that light emitted from the projector is reflected therefrom; and

the projector being arranged to project an image such that light forming the image impinges upon the screen such that a virtual image is created from light reflected from the screen, the virtual image appearing to be located behind the screen, wherein the screen is foil and the frame comprises first and second retention members each arranged to sandwich an edge region of the screen therebetween, the first and second retention members comprising respective openings therethrough arranged to collocate with respective openings in the screen, wherein the openings are arranged to receive a fixing means so as to clamp the screen between the first and second retention members, and wherein at least one of the first and second retention members is attached to tensioning straps.

2. The apparatus of claim **1**, wherein the screen is attached to the frame at the screen's upper edge, lower edge, or both.

3. The apparatus of claim **1**, wherein the tensioning straps are attached to a truss arrangement or a fixed mounting point located in a permanent structure such as a wall, floor or ceiling and are adjustable such that the tension of the screen within the truss arrangement can be varied about the periphery of the screen.

4. The apparatus of claim **3**, wherein the retention members are substantially parallel to truss members comprising the truss arrangements.

5. The apparatus of claim **1**, wherein the screen is inclined at approximately 45° to the plane of emission of light from the projector.

6. The apparatus of claim **1**, wherein the light source is located to the rear of the screen, along a top edge of the frame, along either side of a stage, or some combination thereof.

7. An image projection apparatus, comprising:

a projector, a frame or fixed mounting points, and an at least partially transparent screen;

the frame or fixed mounting points being arranged to retain the screen under tension, such that the screen is inclined at an angle with respect to a plane of emission of light from the projector;

the screen having a front surface arranged such that light emitted from the projector is reflected therefrom; and

the projector being arranged to project an image such that light forming the image impinges upon the screen such that a virtual image is created from light reflected from the screen, the virtual image appearing to be located behind the screen, and wherein the frame comprises first and second retention members arranged to sandwich an edge region of the screen therebetween, and wherein a plurality of fixing means pass through the first retention member and through the screen and clamp the screen between the first and second retention members, and optionally locking means is provided adapted to lock the fixing means;

wherein the screen is a polymeric transparent foil that is held taught and substantially wrinkle-free by the retention members, the retention members having generally parallel faces which clamp an edge region of the foil between them, and wherein individually variable foil tensioning mechanisms are provided at spaced apart locations around the periphery of the foil to enable the foil to have tensioning force independently varied at the said spaced apart locations around the periphery of the foil, and wherein the first and second retention members are connected to one or more flexible tensioning means, which extend from the frame or fixed mounting points to the foil-gripping members, the foil, flexible tensioning means and the frame or fixed mounting points lying in a common inclined plane, with the tension on the foil being applied in the plane of the flexible tensioning means, and the foil, the tensioning mechanisms comprising straps and ratchet strap tensioners, or straps and a friction-locking buckle arrangement.

8. The apparatus according to claim **7**, wherein respective locking means are provided for the fixing means.

9. The apparatus according to claim **8**, wherein the locking means is provided in the form of nuts, to lock the fixing means in position, the fixing means extending through the retention members and the screen.

10. The apparatus according to claim **7**, wherein the first and second retention members comprise a plurality of respective openings, with the fixing means extending through the openings.

11. The apparatus according to claim **7**, wherein an abrasive surface is provided on at least one of the retention members to increase the grip between the retention member and the screen, thereby reducing the likelihood of the screen slipping when held by the retention member.

12. The apparatus according to claim **11**, wherein the abrasive surface comprises sandpaper.

13. The apparatus according to claim **7**, wherein the screen is a foil.

14. An image projection apparatus, comprising:

a projector, a frame or fixed mounting points, and an at least partially transparent screen;

the frame or fixed mounting points being arranged to retain the screen under tension, such that the screen is inclined at an angle with respect to a plane of emission of light from the projector;

the screen having a front surface arranged such that light emitted from the projector is reflected therefrom; and

the projector being arranged to project an image such that light forming the image impinges upon the screen such that a virtual image is created from light reflected from the screen, the virtual image appearing to be located behind the screen, and wherein the frame comprises first and second retention members arranged to sandwich an edge region of the screen therebetween, the first and second retention members being connected to one or more flexible tensioning means, which extend from the frame or fixed mounting points, the foil, flexible tensioning means and the frame or fixed mounting points lying

in a common inclined plane, with the tension on the foil being applied in the plane of the flexible tensioning means and the foil, and wherein a plurality of fixing means pass through the first retention member and through the screen and clamp the screen between the first and second retention members, optionally locking means is provided adapted to lock the fixing means, and the first and second retention members comprise respective openings therethrough arranged to collocate with openings in respective jaws of clamping members attached to tensioning straps.

15. The apparatus according to claim **14**, wherein the screen comprises a partially reflective layer upon the front surface and is inclined at approximately 45° to the plane of emission of light from the projector.

16. The apparatus according to claim **14**, wherein the screen is attached to the frame at the screen's upper edge, lower edge, or both.

17. The apparatus according to claim **14**, wherein the tensioning straps are attached to a truss arrangement or a fixed mounting point located in a permanent structure such as a wall, floor or ceiling and are adjustable such that the tension of the screen within the truss arrangement can be varied about the periphery of the screen.

18. The apparatus according to claim **17**, wherein the retention members are substantially parallel to truss members comprising the truss arrangement.

* * * * *

EXHIBIT C

United States Patent and Trademark Office

Assignments on the Web > Patent Query

Patent Assignment Abstract of Title

NOTE:Results display only for issued patents and published applications. For pending or abandoned applications please consult USPTO staff.

Total Assignments: 2

Patent #: 7883212 **Issue Dt:** 02/08/2011 **Application #:** 10599553 **Filing Dt:** 09/30/2006

Publication #: 20070201004 **Pub Dt:** 08/30/2007

Inventors: Ian O'Connell, James Rock

Title: PROJECTION APPARATUS AND METHOD FOR PEPPER'S GHOST ILLUSION

Assignment: 1

Reel/Frame: 018419/0258 **Recorded:** 10/21/2006 **Pages:** 5

Conveyance: ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).

Assignors: O'CONNELL, IAN **Exec Dt:** 09/08/2006

ROCK, JAMES **Exec Dt:** 09/11/2006

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Assignment: 2

Reel/Frame: 031615/0800 **Recorded:** 11/11/2013 **Pages:** 12

Conveyance: ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).

Assignor: MUSION SYSTEMS LIMITED **Exec Dt:** 09/26/2013

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Search Results as of: 03/13/2014 09:35 PM

If you have any comments or questions concerning the data displayed, contact PRD / Assignments at 571-272-3350. v.2.3.4

Web interface last modified: Jul 8, 2013 v.2.3.4

EXHIBIT D

Pulse Entertainment Corporation

The Digital Celebrity Company.

KEY DATA

Industry: Entertainment & Media - $479B annually

Specialization: High-impact applications of computer-generated digital humans

Customers: General audiences, major & mini studios, networks, ad agencies, Fortune 500 companies

Funding Plan: $15MM preferred stock equity funding; further information and terms available to accredited investors

Location: West Palm Beach, Florida

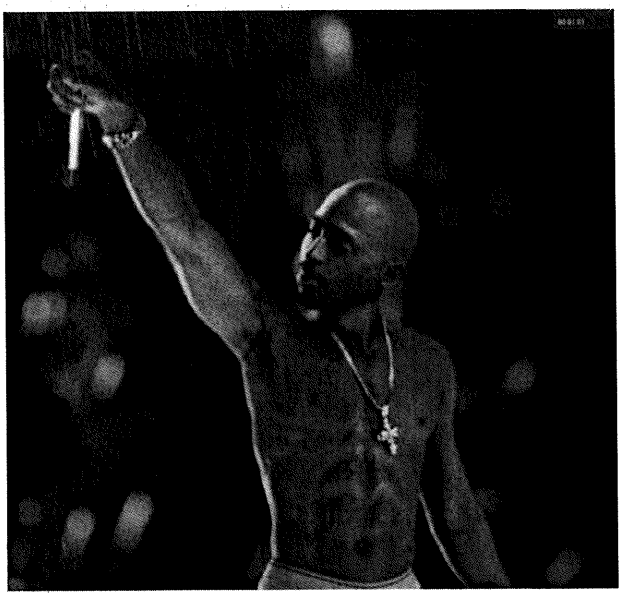
($000)	Year 1	Year 2	Year 3	Year 4	Year 5
Total Rev	$7,916	$31,081	$67,096	$109,670	$161,948
Direct Exp	$4,517	$15,343	$27,930	$42,081	$58,639
EBITDA	$1,587	$12,953	$35,225	$61,985	$94,725

Introduction – Pulse Entertainment Corporation ("Pulse or the Company") is a creatively driven, digital production company, focusing on virtual performances. Pulse produces specialized, high-impact applications of computer-generated celebrity and world figure likenesses in virtual live and holographic concerts, advertising, branded content, family-focused animation feature films, live-action feature films and education. The Company's goal is to be the world's leading developer and producer of computer generated human likeness. Today, the obvious applications of digital humans are in high demand in the entertainment sector. Tomorrow, digital humans will drive globally relevant – and far more lucrative – uses in surgical simulation, military simulation and telecommunications.

The Marketplace - The U.S. entertainment and media market generated revenues of $479.23 billion in 2012. According to business editor Paul Bond of "The Hollywood Reporter," revenues are expected to grow to more than $632.09 billion, and $2.152 trillion worldwide, by 2017. Pulse is set to produce digital media product that will penetrate every sector of this industry, and will be consumed by global audiences on the growing variety of screens and stages available today – from theaters and television, tablets and phones, to stages and dynamic live performance venues around the world. Pulse intends to further develop a new, globally relevant virtual performance industry that has recently emerged in part because of its principals' leadership in ground-breaking performances of photo-realistic digital humans in films, such as *Tron: Legacy* and *The Curious Case of Benjamin Button*, and in live music concerts, such as the 2012 Coachella Valley Music Festival, which featured the digital resurrection of late rapper *Tupac Shakur* as a 'holographic' performer.

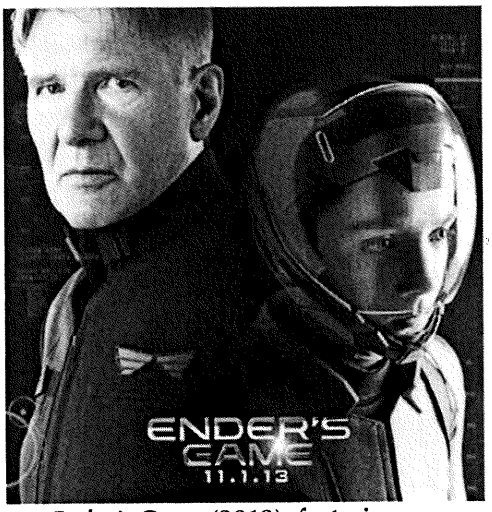
The Business - Pulse is leveraging its expertise, relationships and market position to develop, produce and exploit entertainment media in three distinct and complementary business verticals: *Pulse Productions*, *The Head Shop*, and *On-Point*. Common to all three divisions is the Company's expertise in the development and production of story-based entertainment. However, each division focuses on distinct opportunities that represent significant areas of market growth in the entertainment industry:

- **Pulse Productions** – *IP Investments* – the investment and services division that focuses on the production of photo-realistic, digital likeness performers, representing the world's top tier celebrities and late celebrities, for whom there is demand for live holographic performances in venues around the world. The resulting IP will be exploited in all media and markets worldwide. Pulse will derive revenues from two key activities: 1) the production of computer-generated celebrities and 2) the presentation of virtual celebrities on the variety of screens and stages available today.
- **The Head Shop** – *CG Services* – a services-only division that focuses on the production of photo-realistic, digital likeness performers, representing high impact late celebrities and world celebrities, whose associated celebrity estates can be enhanced by digital likeness appearances, but do not have the appropriate risk-reward balance to justify Pulse investment. In addition to celebrity performers, this division will also be willing to create animated human heads, fictional or otherwise, for use in feature films, commercials and branded entertainment.



Tupac Shakur *- Pulse Chairman served as Chairman & CEO of VFX company that produced this digital resurrection and holograph-like performance in front of a live audience at the Coachella Valley Music Festival in 2012. Seen by more than 100 million viewers over YouTube, this media inspired demand from press worldwide for the digital return of many other late celebrities*

- **On-Point** – *Branded Entertainment* – a division that brokers the Company's virtual performance productions and digital human production capabilities to top corporations and advertising agencies, enabling brands to exploit photo-realistic, digital likeness celebrities.



***Ender's Game* (2013), featuring Harrison Ford and Asa Butterfield**

The Management – Pulse principals are known leaders in the entertainment industry, who are well positioned to exploit the demand for live and recorded branded and original entertainment. They have founded and operated successful production and media companies, produced large-scale feature films, worked with talent to launch lucrative careers, and overseen and produced some of the world's most visually stunning computer generated imagery. With collective senior visual effects experience in more than 50 major studio feature films, they also have Producer and Executive Producer experience in the development, finance and production of major market feature films, such as the recently released *Ender's Game* (directed by Gavin Hood, starring Harrison Ford), released in November 2013.

They are also globally recognized for their leadership of the most groundbreaking holographic, virtual performance projects known to date, including the digital resurrection of late rapper Tupac Shakur as a 'holographic' performer at the 2012 Coachella Valley Music Festival, and memorable performances of digital humans in the high profile feature films *Tron: Legacy* and *The Curious Case of Benjamin Button*.

John Textor, Executive Chairman of the Board - Former Chairman and CEO of Digital Domain, creators of holographic *Tupac* and digital characters for *Curious Case of Benjamin Button* and *Tron: Legacy*, and Producer/Executive Producer of *Ender's Game* (released November 2013).

Frank Patterson, Chief Executive Officer - A 25-year veteran of the entertainment industry who has served as a founder, CEO and/or President of several successful film and commercial production companies including Envisage Media Group, Inc., The Houston Cinema Group, Inc., and Red Hills Releasing, LLC, a feature film marketing and distribution company. Has directed and/or written seven feature films, shot more than 100 commercials and a variety of broadcast content. He serves as Dean of highly regarded Florida State University College of Motion Picture Arts.

Jim Berney, President and Head of Studio - Former Head of Studio at Digital Domain; Academy Award®-nominated visual effects supervisor at Sony Pictures Imageworks, responsible for supervision of notable films including *Green Lantern, I Am Legend, and The Chronicles of Narnia*, for which he was nominated for an Academy Award for Outstanding Visual Effects, *The Matrix Reloaded*, The Matrix Revolutions, *The Lord of the Rings: The Two Towers* and *Harry Potter and the Sorcerer's Stone*. Jim also served as CG supervisor for *Hollow Man* (2000 Academy Award® nominee, Best Visual Effects).

KEYS TO SUCCESS

Pulse Entertainment intends to deliver the most visually stunning, globally recognized human animation and holographic performances in the entertainment industry. Pulse is uniquely qualified to succeed in a large, fast-growing market segment that its principals helped start.

Notable Company and Market Attributes Include:

- Global Audience for New Form of Entertainment
- High Margin Products/Services in High Growth Market
- Demand is Far in Excess of Industry Capacity
- Globally Recognized Innovators Lead Company
- Rights Acquisition Strategy Creates Competitive Barrier
- First to Market Leadership Position
- 'New Real Estate' in exploitation of likeness rights
- Opportunity for Multiple Streams of Revenue

Funding Requirements – To successfully execute the business plan, Pulse Entertainment is seeking $15 million in equity funding. During the first 2 years of operation – Pulse projects it will acquire the digital likeness rights for 3 Top Tier Celebrities, execute 2-3 high profile Top Tier Celebrity entertainment productions, and deliver numerous other revenue producing projects involving Second Tier Celebrities and Branded Entertainment.

USE OF FUNDS

$15MM in capital will be used for:

• Startup / Early Stage Capital Expenditures	$2,500,000
• 1st Celebrity Digital Asset Construction	$3,000,000
• 2nd Celebrity Digital Asset Construction	$3,000,000
• 3rd Celebrity Digital Asset Construction	$3,000,000
• Working Capital & Contingency	$3,500,000