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THE PATENTS ACT  
(CHAPTER 221)

**CERTIFICATE OF GRANT OF PATENT**

In accordance with section 35 of the Patents Act, it is hereby certified that a patent having the P-No. 125787 [WO 2005/096095] has been granted in respect of an invention having the following particulars:

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

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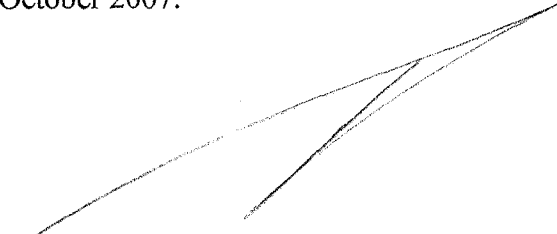
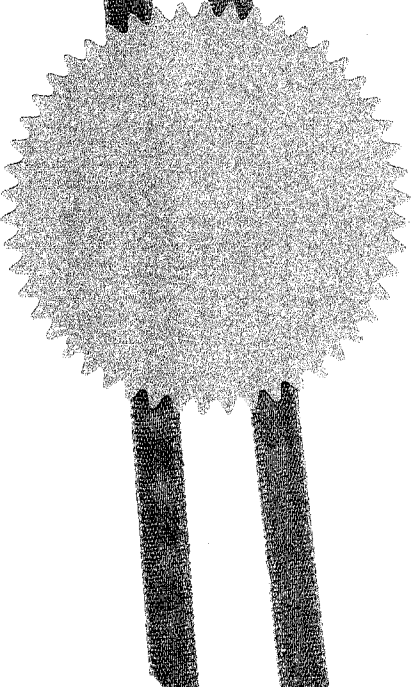
Priority Data : -

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## 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  
5 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.

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

This has been applied to publicity and promotional displays where a presenter resides behind an inclined, partially reflective screen, typically  
15 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  
20 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.

25 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  
30 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  
5 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  
10 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  
15 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  
20 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  
25 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  
30 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  
5 contrast ratios 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)  
10 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  
15 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,  
20 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  
25 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  
30 upon the stage, as the screen lies in front of the presenter and closest to the viewing audience.

