FLARE ELIMINATION IN VIDEO CONFERENCING

This invention relates to a method and apparatus for eliminating camera flare caused by strong illumination. In particular, it relates to a method and apparatus for eliminating camera flare in front projection video conference facilities.

BACKGROUND TO THE INVENTION

Video conference systems are known for providing two-way communication between remote parties. The early systems required a high bandwidth link for exchange of video and audio signals between the remote sites. Typically, an ISDN or fiber-optic connection was a minimum requirement. Improvements in compression algorithms have reduced the bandwidth requirements and made video conferencing more widely available at more reasonable cost.

A typical video conference facility consists of a fixed video camera having a field of view that takes in the conference participants at one site. There are usually multiple microphones to capture separate voice input from each participant. There may be additional cameras for transmitting supplementary images such as documents or drawings. There may be additional graphic devices such as electronic white boards.

There is also a projector that projects images from the remote site onto a screen and speakers for playing the audio signals.

Conventional video conference facilities use a rear projection video system in which the video projector is behind the screen relative to the viewing position of the participants. In order to provide reasonable eye contact between participants at the remote sites, the camera is positioned at approximately chest height of a seated user

of the facility. In order to achieve this arrangement it is necessary to position the camera behind the screen looking towards the participant. This arrangement causes a problem because the camera casts a shadow in the projected image from the remote site. This problem will be particularly significant for small screens.

An alternate arrangement is to use a front projection arrangement. This overcomes the shadow problem and has the added advantage of requiring less space than the rear projection arrangement. This latter advantage provides a significant impetus in favour of the front projection arrangement. In the front projection arrangement the camera is still positioned behind the screen in order to achieve good eye contact. Unfortunately, this leads to a problem with flare in the camera caused by projection into the camera from the video projector.

Attempts have been made to address the flare problem by using a lens hood on the camera to shade the camera lens from direct projection but this has proven ineffective since it is not possible to effectively shade the camera without obscuring the field of view.

Another method of eliminating the flare problem is to hang a disc in mid-air in the video conference room to block the direct line between the projector and the camera. Although the concept works, it is an aesthetically unsatisfactory solution. The disc is also subject to damage and misalignment.

Front projection video conference facilities are preferred but the flare problem requires solution.

DISCLOSURE OF THE INVENTION

In one form, although it need not be the only or indeed the broadest form, the invention resides in a flare-reduced front projection video conference facility comprising:

a screen;

a camera viewing a scene from the vicinity of said screen;

a projector projecting a remote screen onto said screen; and

means for electronically preventing flare in said camera from said projector.

In one form the means for electronically preventing flare is a modification to the camera to avoid viewing the projector.

In another form the means for electronically preventing flare is a modification to the projector to avoid projecting into the field of view of the camera.

Preferably the system further compromises a video production unit in signal connection with the projector and the means for electronically preventing flare is a modification to the video production unit.

BRIEF DESCRIPTION OF THE DRAWINGS

To assist in understanding the invention, preferred embodiments will be described with reference to the following figures in which:

FIG 1 shows a schematic of a first embodiment of a front projection video conference system;

FIG 2 shows a schematic of a second embodiment of a front projection video conference facility;

FIG 3 shows scenes with flare; and

FIG 4 shows the same scene without flare.

DETAILED DESCRIPTION OF THE DRAWINGS

Referring to FIG 1, there is shown a schematic of a typical video conference facility employing a front projection arrangement.

The facility consists of a room 1 in which a user 2 sits on a chair 3 at a desk 4. In front of the user 2 is a screen 5 upon which is projected an image of a similar video conference room at a remote location.

The image is projected onto the screen 5 from a video projector 6. Video production unit 7 generates signals to the video projector 6 from signals received on lines 8 from a remote similar facility. A camera 9 is positioned in the screen 5 at approximately eye level with respect to the user 2. As can be seen in FIG 1, the video projector 6 projects into the field of view of the camera 9. This is virtually unavoidable if the camera 9 is to have a sufficiently wide angle lens to provide a full field of view at the remote facility.

The inventor has found that the problem can be eliminated, or at least considerably reduced, by modifying the system to avoid projection into the camera. This may be achieved by modifying the video projector 6 so that it does not project into the area of the screen that is filled by the camera 9. This requires a modification of the projector 6. Alternatively, the camera 9 can be modified so that it does not view the area of the scene that contains the projector 6. This requires a modification of the camera 9.

In both of the examples, the modification may be physical or electronic. For example, a black spot may be located in the optical train of either the camera or projector to eliminate the offending region. This physical approach is essentially identical to the approach described in the background. Alternatively, certain pixels in the camera or projector may be disabled. This electronic approach requires specific modification of the camera or projector for the specific video conference facility.

A preferred approach is to modify the CODEC in the video production unit so that it does not fill the pixels that project onto the camera. This approach is completely flexible and can be used with any projector/camera combination. The inventor considers that a small

modification to existing video production units would allow on-the-fly modification of the CODEC to eliminate the flare problem.

The principle of operation is exemplified in the schematic of FIG 2. A mixer 10 is included between the video production unit 7 and the video projector 6. The mixer alters the video signal on the fly and places a blank region over the camera. The inclusion of a mixer requires no modification of the usual hardware of a video conference facility and may therefore be implemented in new or existing facilities. Notwithstanding this advantage, the inventor considers that the modified video production unit is the preferred embodiment of the invention.

The following pseudocode explains the algorithm required to blank the relevant pixels.

```
For row=0 to maxrows
        For col=0 to maxcols
                If (overcamera(row,col)) then
                        Outputpixel(row,col)=black
        Else
                        Outputpixel(row,col)=inputpixel(row,col)
```

Where

overcamera is a Boolean function that returns true if the arguments row,col are in the area of the camera lens.

The effectiveness of the invention is evident in the images of FIG 3 and FIG 4. FIG 3 is a photograph of a screen of a video conference facility of the type depicted schematically in FIG 1 and FIG 2. The screen 11 is displaying a scene of a remote video conference facility. The projector 6 at the remote facility is not visible due to flare 12. The flare 12 also masks other aspects of the scene to some degree. It will be appreciated that in a small facility the problem will be magnified.

Fig 4 is a photograph of the same screen 11 shown in FIG 3 but the flare has been removed by applying the invention. The camera 6 is clearly visible in FIG 4. A mixer has been used to modify the video signal to eliminate the flare visible in FIG 3. The same result is obtained with other embodiments of the invention.

Dated this Fourth Day of October 2000

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By their Patent Attorneys

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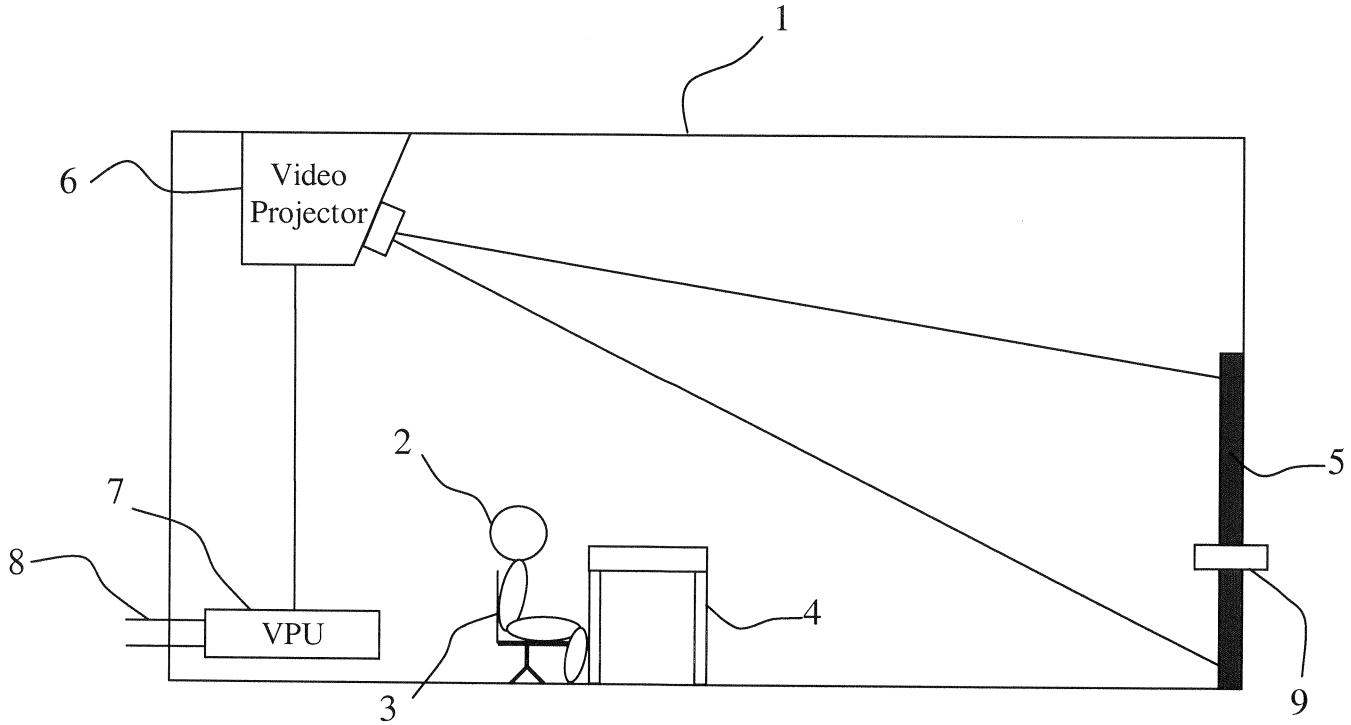
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6
Video
Projector
2
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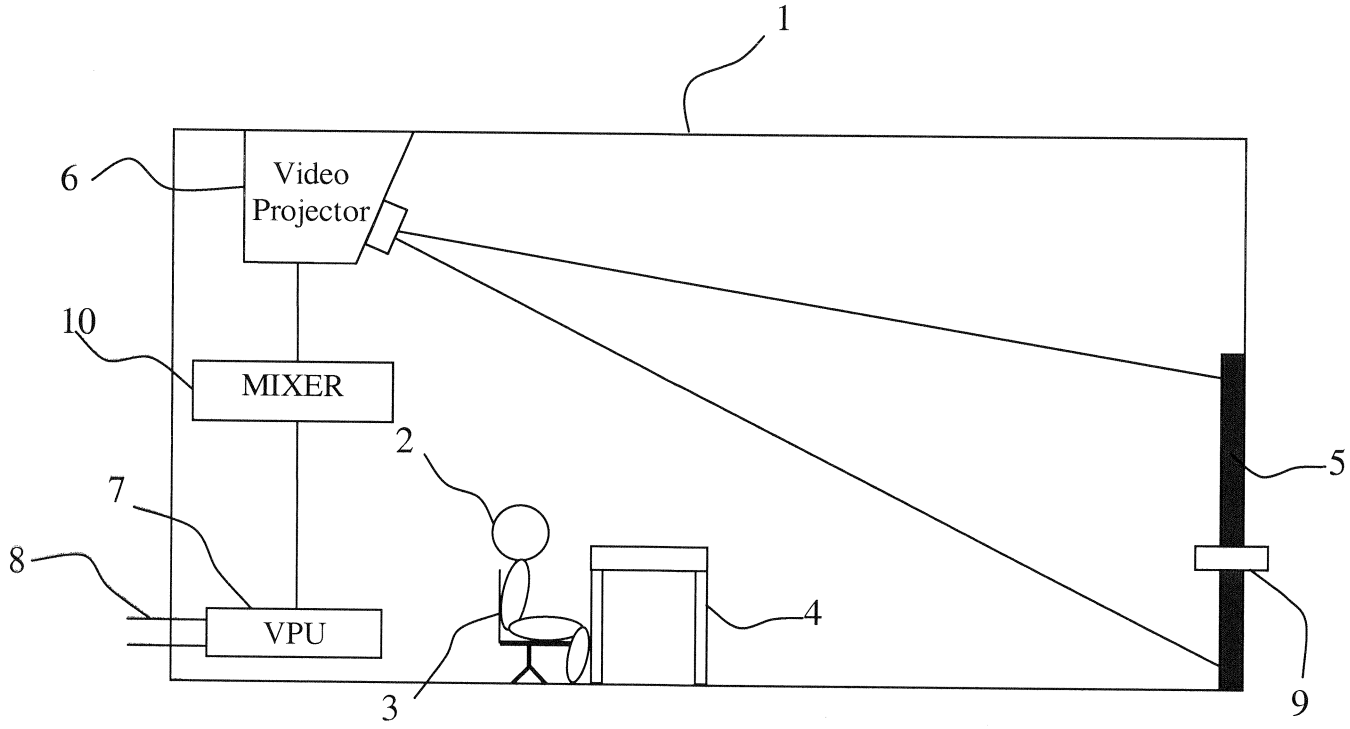
VPU
4
3
9

FIG 1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Projector
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8
VPU
4
3
9

FIG 2

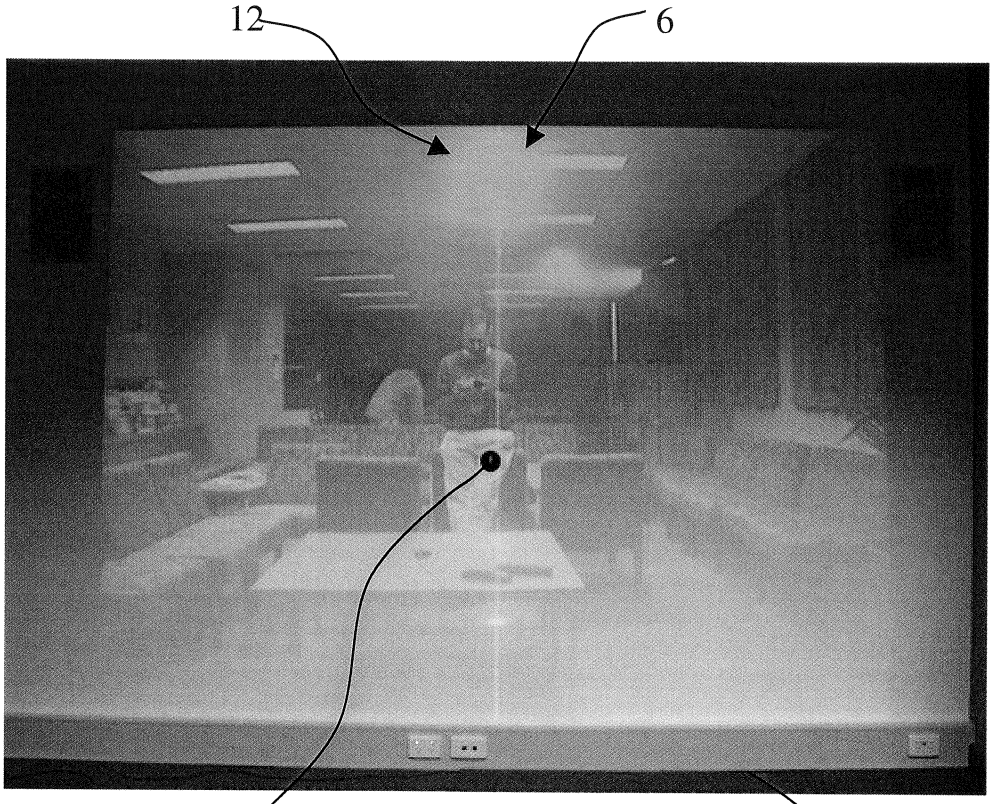

FIG 3

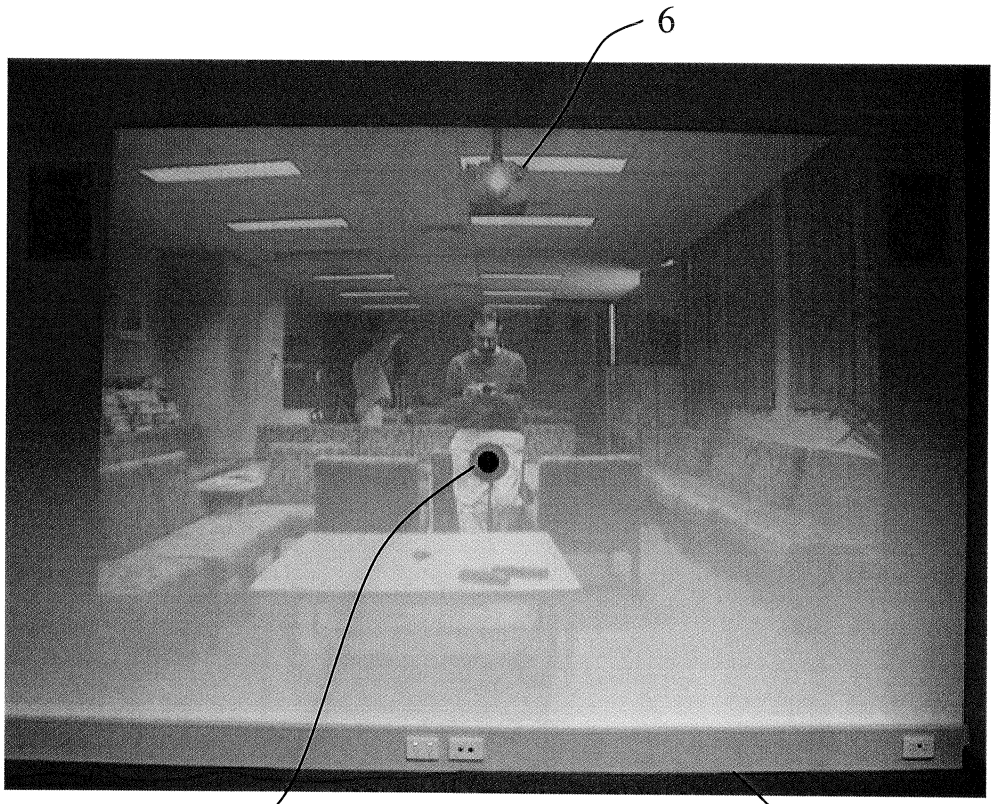

FIG 4

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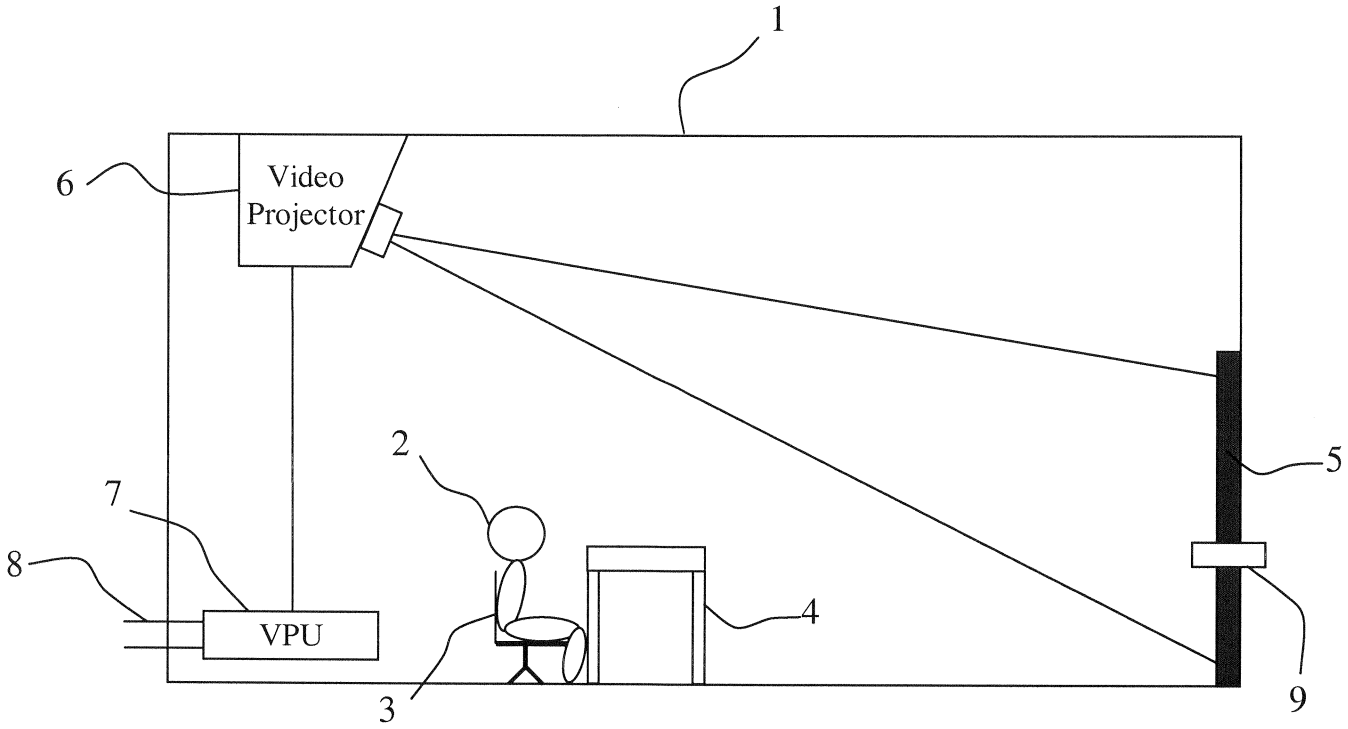
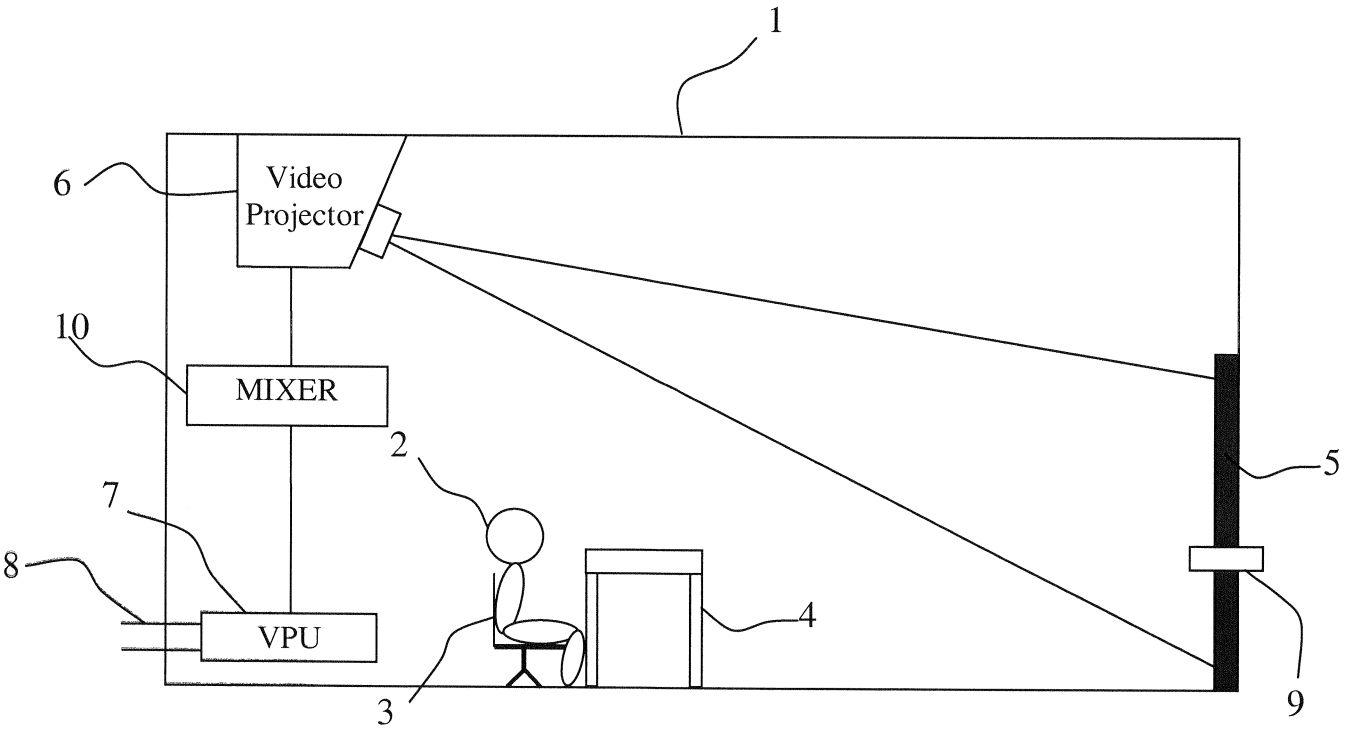

1
6
Video
Projector
2
5
7
8
VPU
4
3
9

FIG 1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6
Video
Projector
10
MIXER
2
5
7
8
VPU
4
3
9

FIG 2

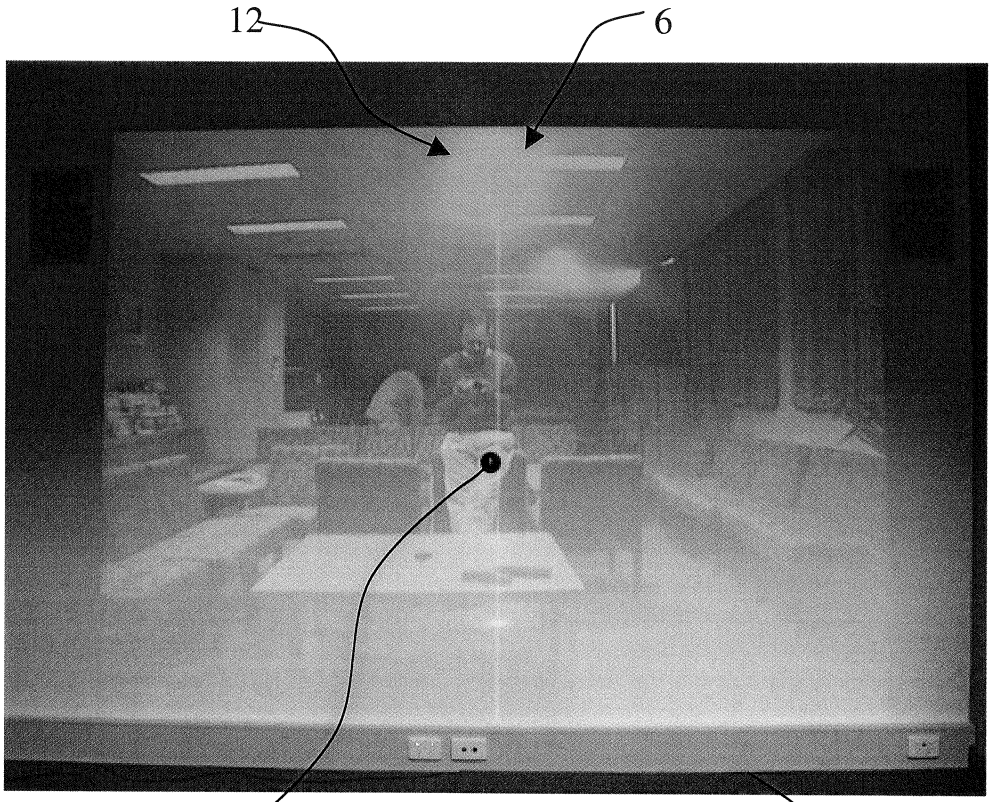

FIG 3

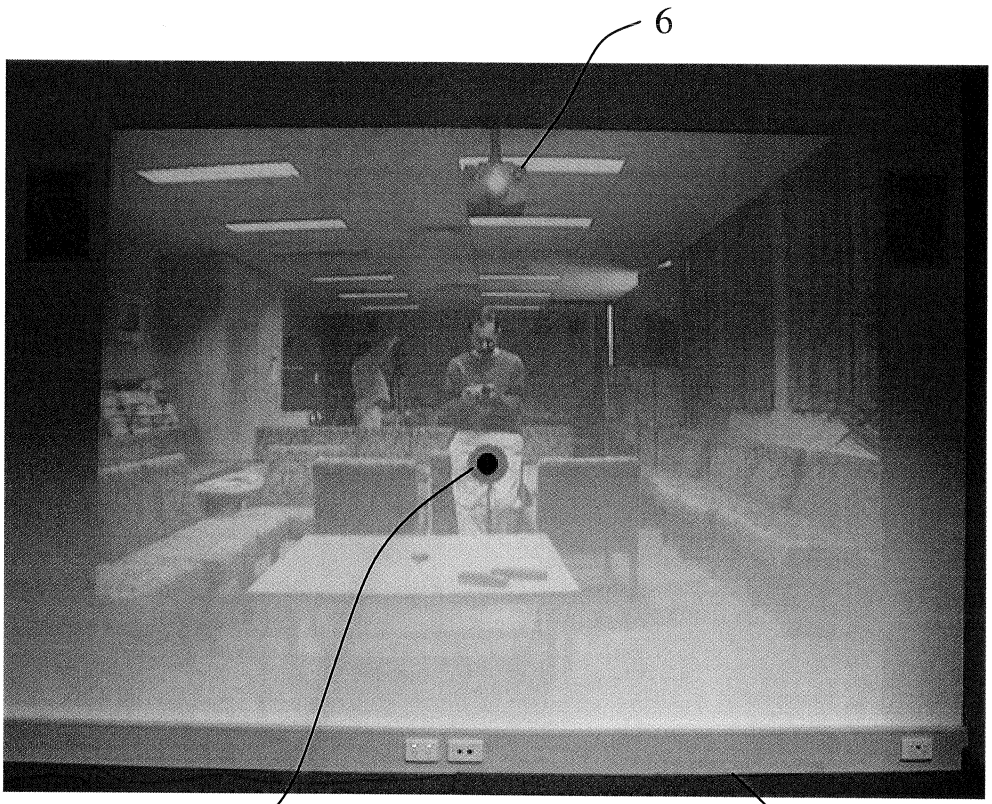

FIG 4