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(54) ILLUMINATION OBSCUREMENT DEVICE

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Related U.S. Application Data

(60) Continuation of application No. 09/724,588, filed on Nov. 28, 2000, now Pat. No. 6,536,922, which is a division of application No. 09/711,355, filed on Nov. 9, 2000, now Pat. No. 6,601,974, which is a division of application No. 09/108,263, filed on Jul. 1, 1998, now Pat. No. 6,220,730.

(51) **Int. Cl.**
F21V 17/02 (2006.01)

(52) **U.S. Cl.** **362/321**; 362/290; 362/283; 362/281; 362/297; 362/293; 359/892

(58) **Field of Classification Search** 362/293, 362/321, 318, 343, 283, 281, 892, 323, 290, 362/297; 359/892
See application file for complete search history.

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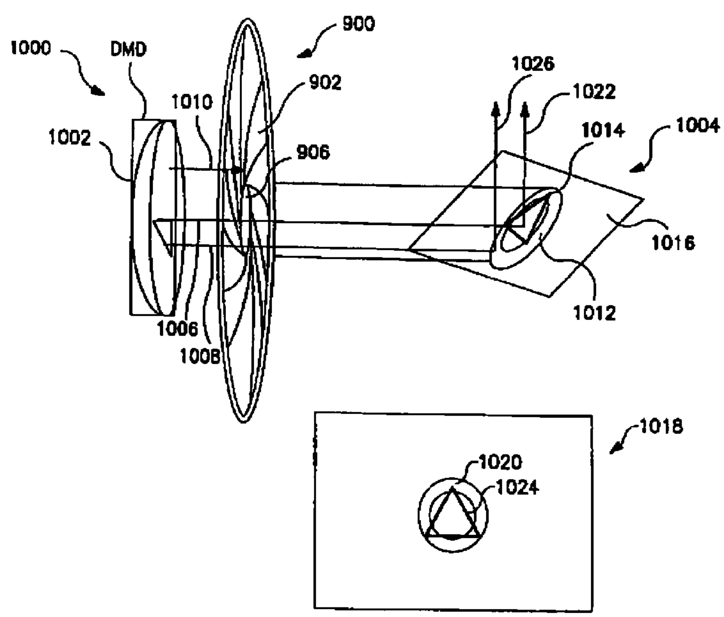
(57) **ABSTRACT**

An illumination obscurement device for controlling the obscurement of illumination from a light source which is optimized for use with a rectangular, arrayed, selective reflection device. In a preferred embodiment, a rotatable shutter with three positions is placed between a light source and a DMD. The first position of the shutter is a mask, preferably an out of focus circle. This out of focus circle creates a circular mask and changes any unwanted dim reflection to a circular shape. The second position of the shutter is completely open, allowing substantially all the light to pass. The third position of the shutter is completely closed, blocking substantially all the light from passing. By controlling the penumbra illumination surrounding the desired illumination, DMDs can be used in illumination devices without creating undesirable rectangular penumbras.

47 Claims, 11 Drawing Sheets



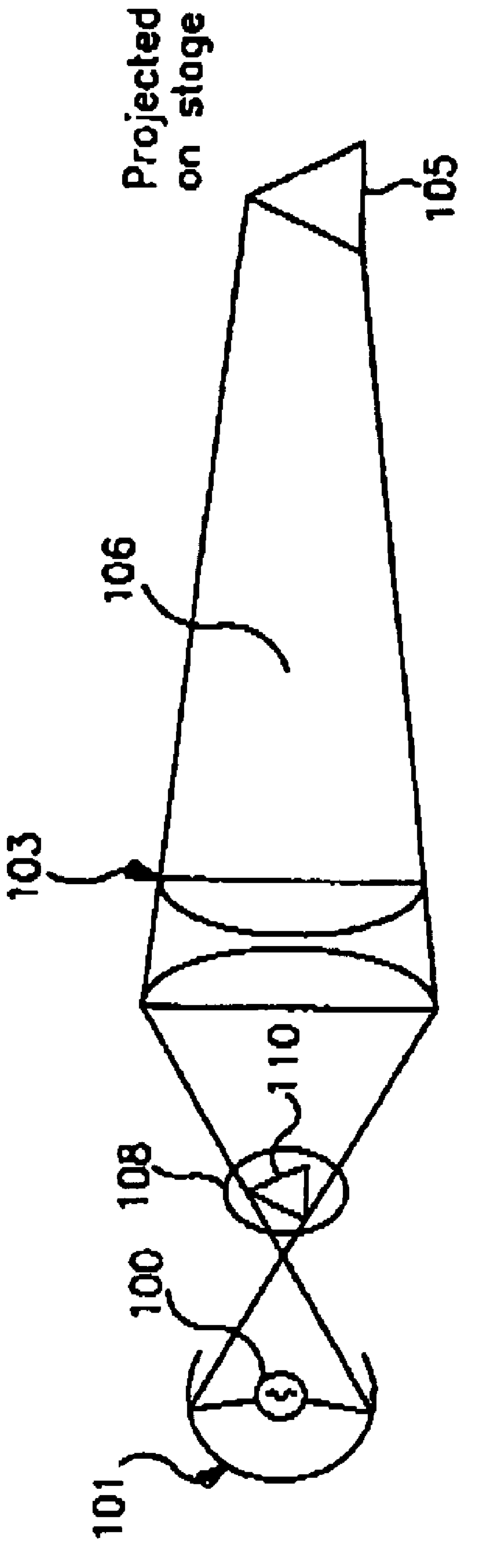


FIG. 1

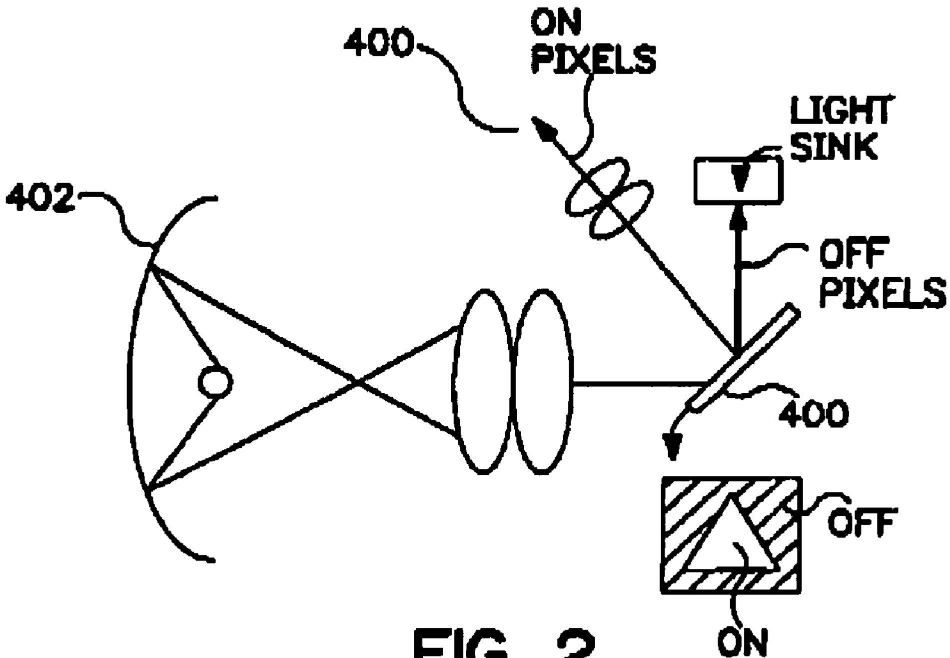


FIG. 2
PRIOR ART

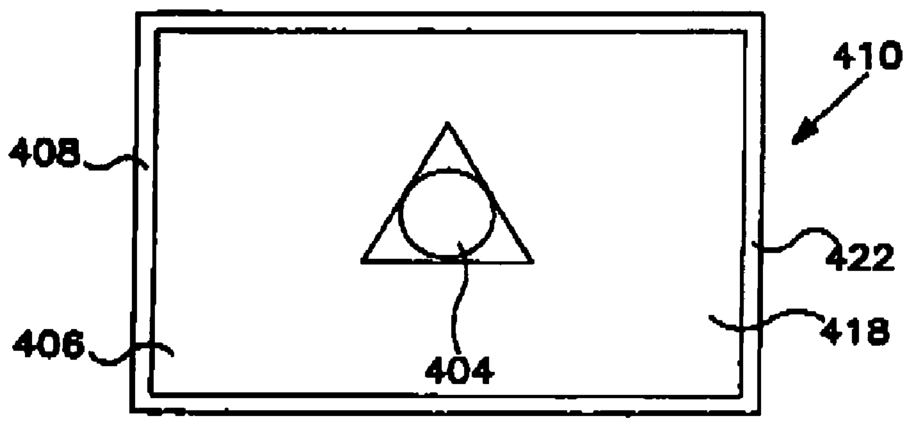


FIG. 3A

PRIOR ART

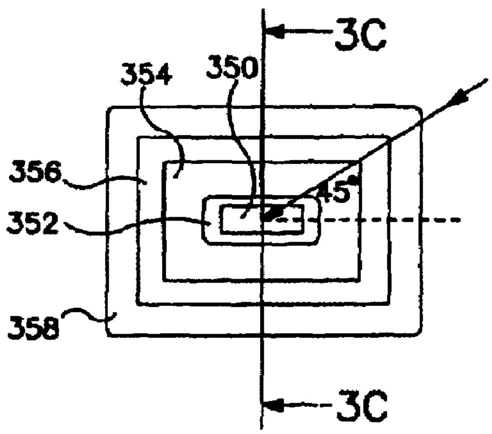


FIG. 3B

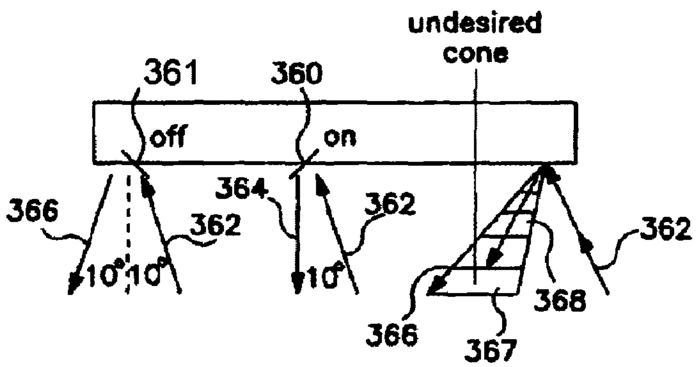


FIG. 3C

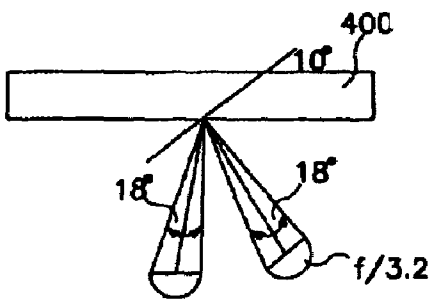


FIG. 3D

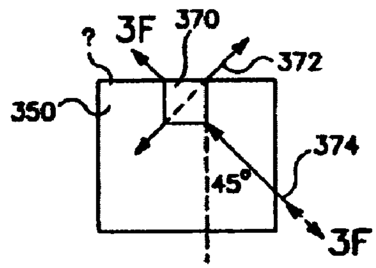


FIG. 3E

FIG. 3F

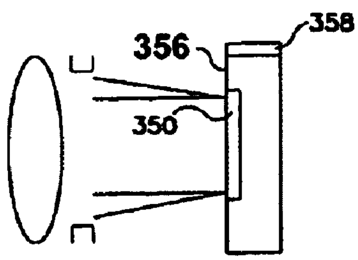


FIG. 3G

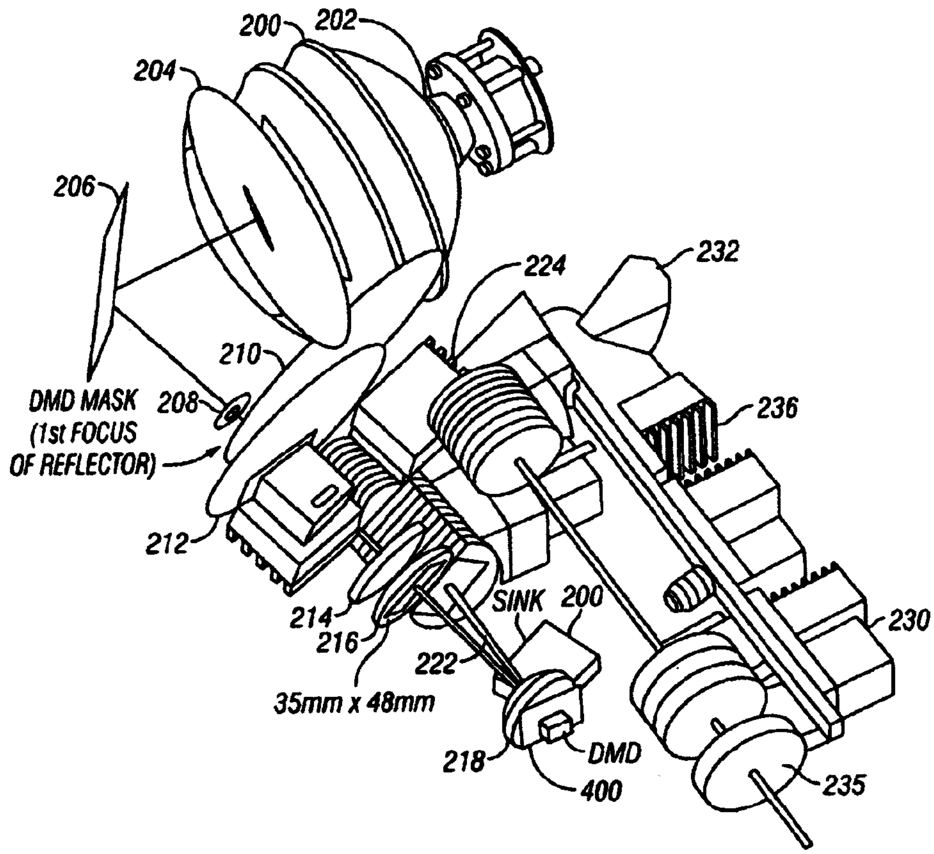

200
202
204
206
224
232
210
DMD MASK
(1st FOCUS
OF REFLECTOR)
208
236
212
214
216
SINK
200
230
222
35mm x 48mm
218
DMD
400
235

FIG. 4

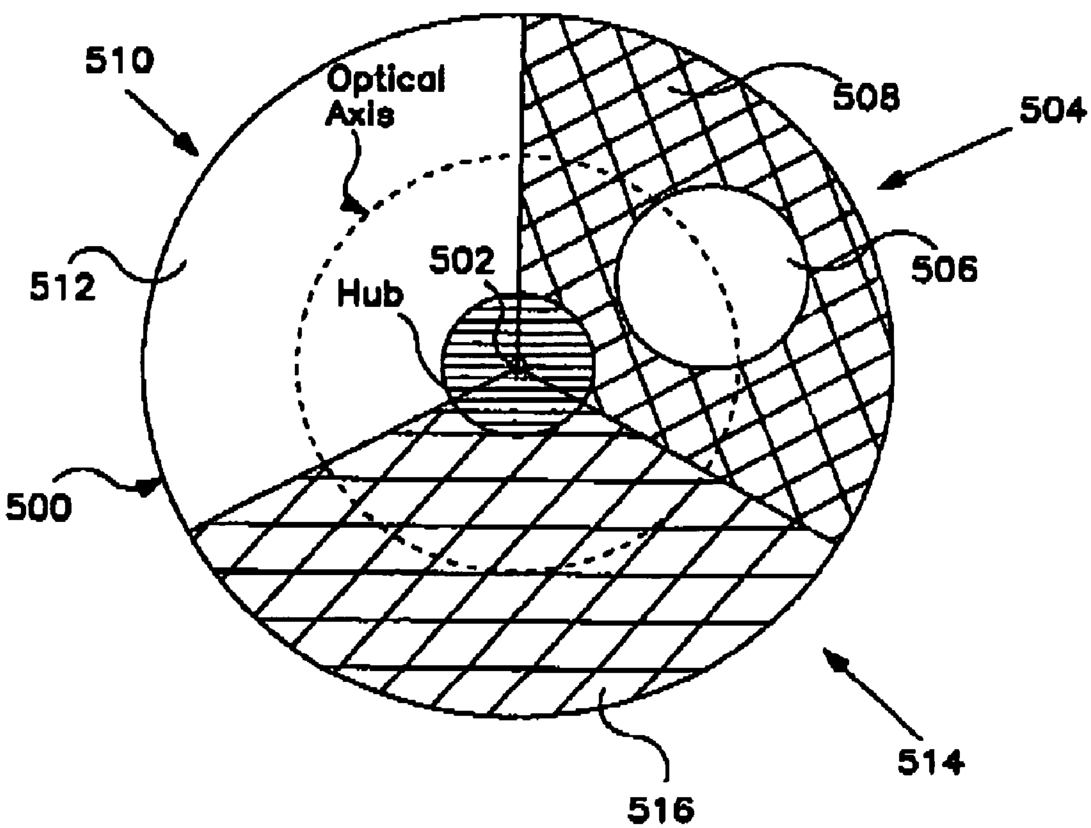


FIG. 5

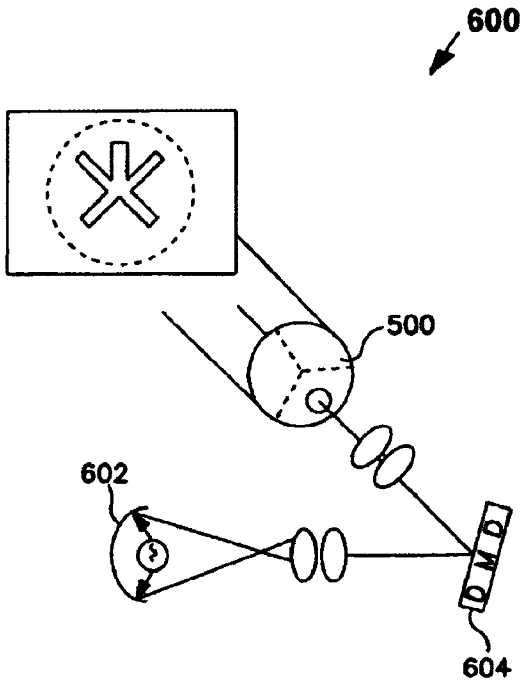


FIG. 6A

FIG. 6B

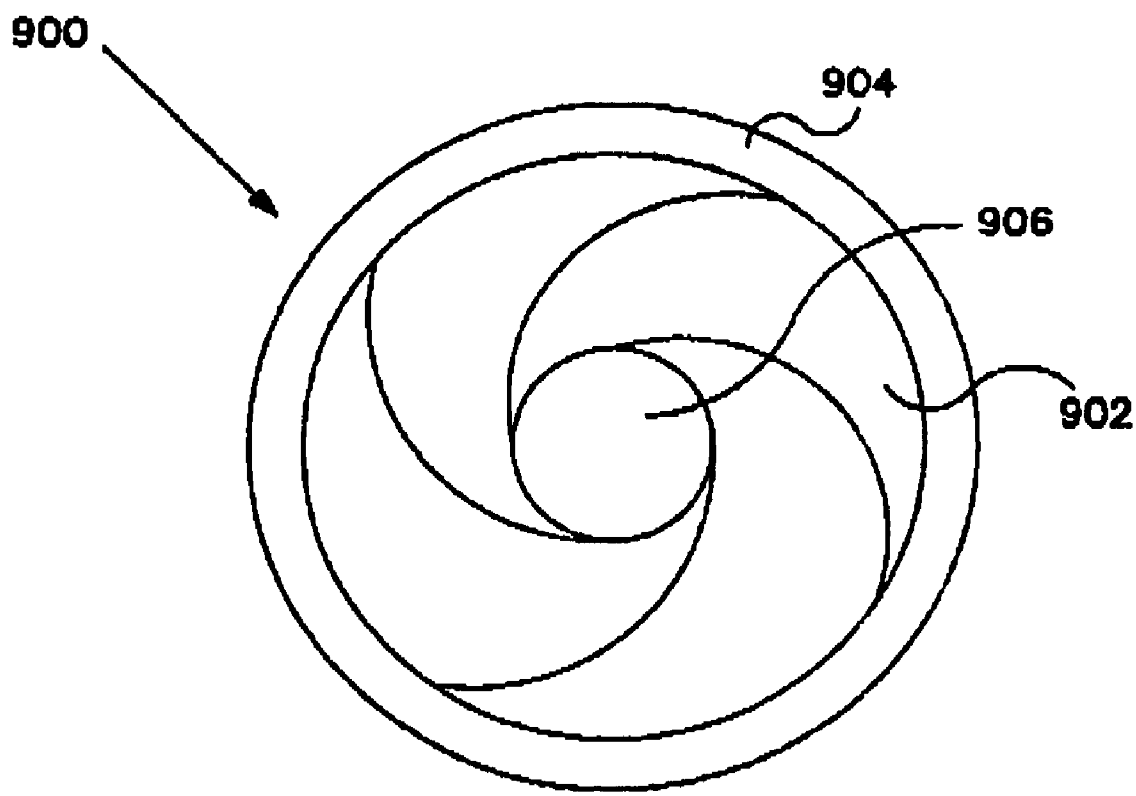


FIG. 7

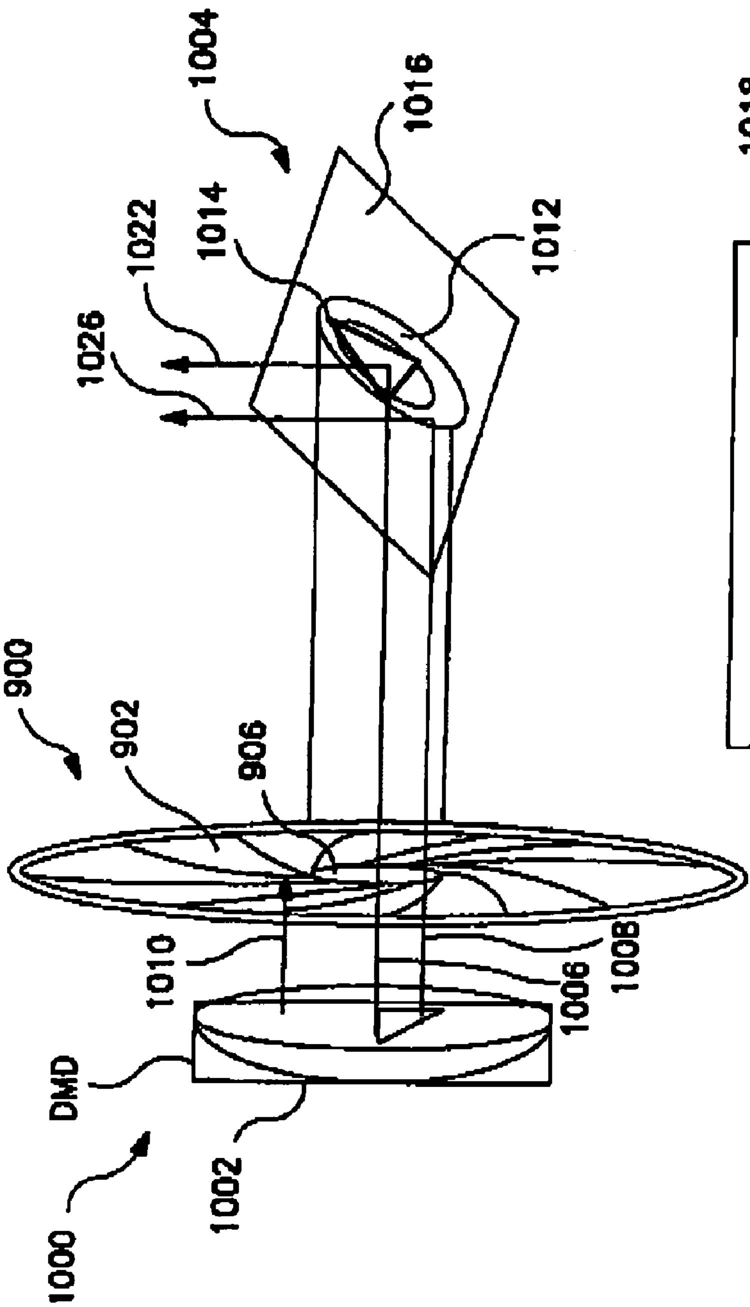

1000
DMD
1002
1010
1006
1008
900
902
906
1004
1016
1014
1022
1026
1012

FIG. 8A

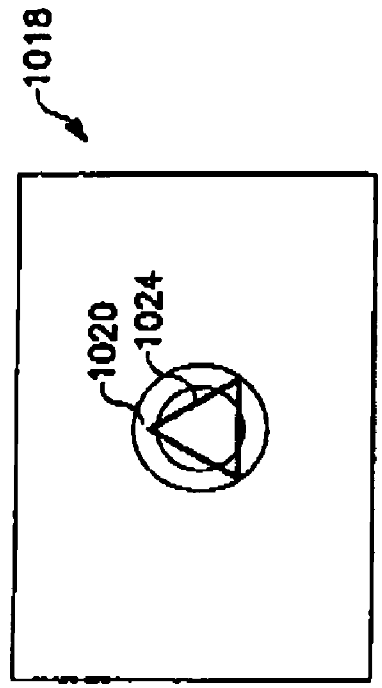

1018
1020
1024

FIG. 8B

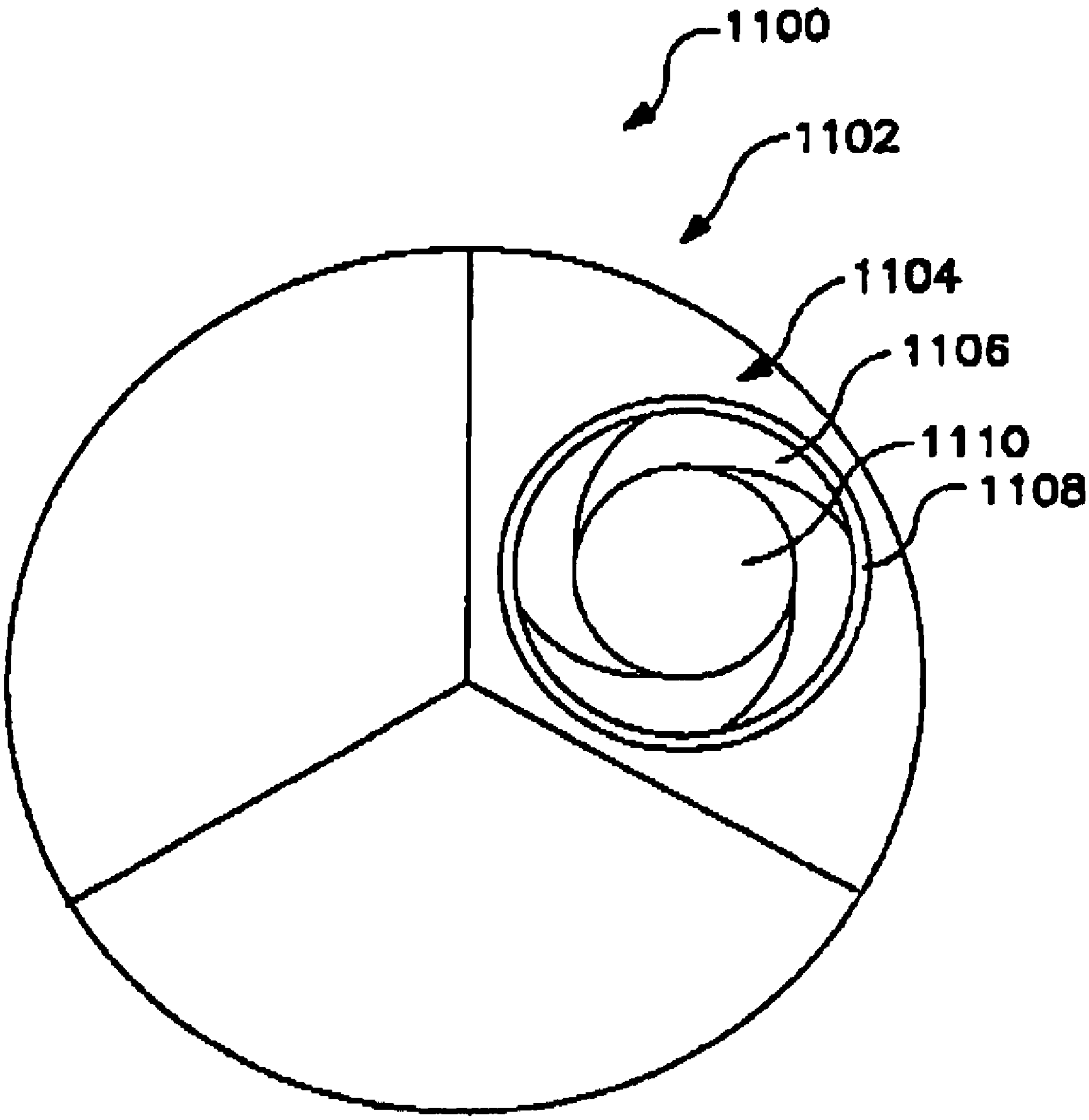


FIG. 9

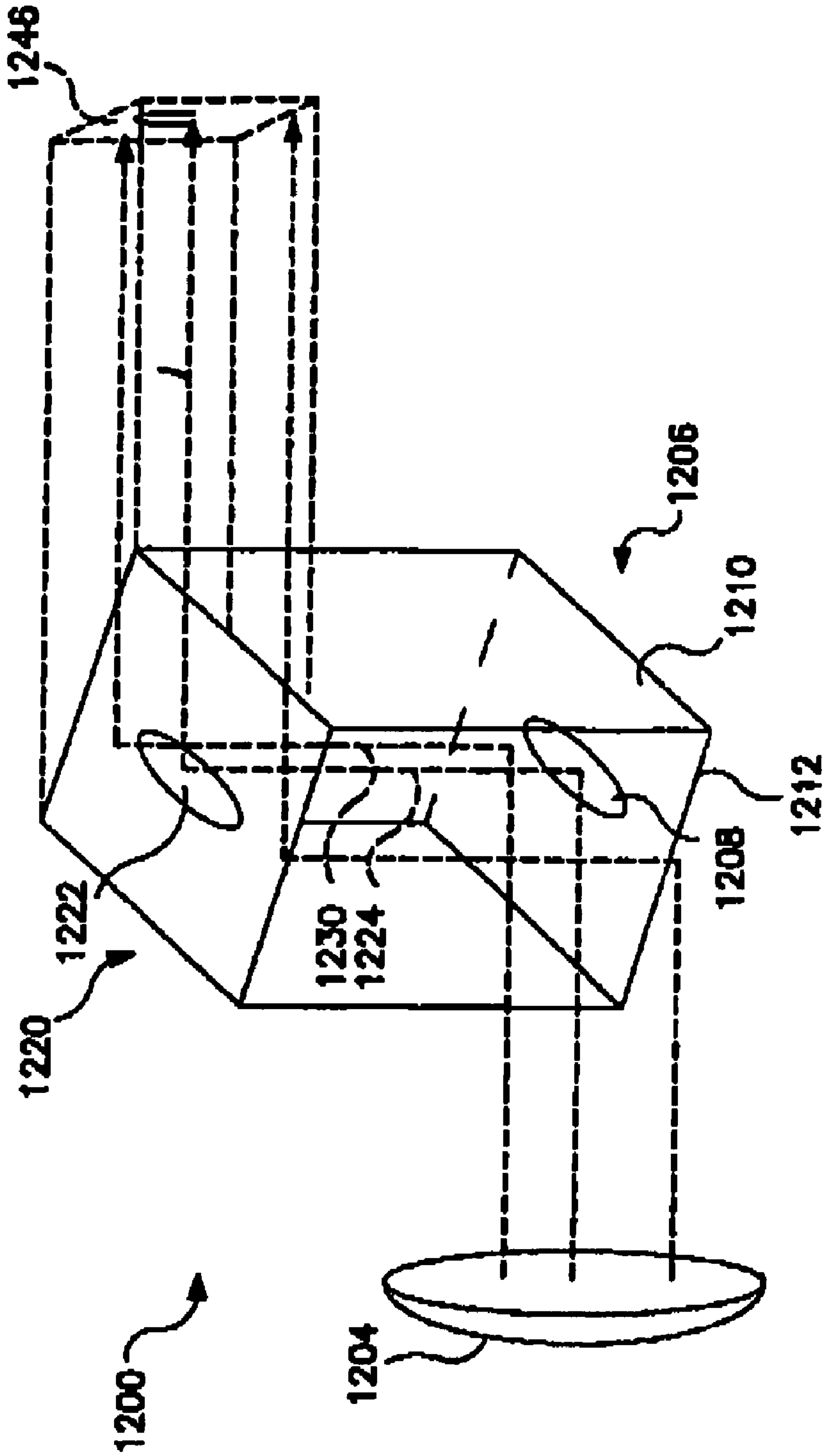


FIG. 10

ILLUMINATION OBSCUREMENT DEVICE

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation of U.S. application Ser. No. 09/724,588, filed Nov. 28, 2000 now U.S. Pat. No. 6,536,922, which is a divisional of U.S. application Ser. No. 09/711,355, filed Nov. 9, 2000 now U.S. Pat. No. 6,601,974, which is a divisional of U.S. application Ser. No. 09/108,263, filed Jul. 1, 1998 now U.S. Pat. No. 6,220,730.

TECHNICAL FIELD

The present disclosure describes a special image obscurement device for a light source.

BACKGROUND

In live dramatic performances controlled lighting is often used to illuminate a performer or other item of interest. The illuminated area for live dramatic performance is conventionally a circular beam of light called a "spot light." This spot light has been formed from a bulb reflected by a spherical, parabolic, or ellipsoidal reflector. The combination forms a round beam due to the circular nature of reflectors and lenses.

The beam is often shaped by gobos. FIG. **1** shows a light source **100** with reflector **101** projecting light through a triangular gobo **108** to the target **105**. The metal gobo **108** as shown is a sheet of material with an aperture **110** in the shape of the desired illumination. Here, that aperture **110** is triangular, but more generally it could be any shape. The gobo **108** restricts the amount of light which passes from the light source **100** to the imaging lenses **103**. As a result, the pattern of light **106** imaged on the stage **105** conforms to the shape of the aperture **110** in the gobo **108**.

Light and Sound Design, the assignee of this application, have pioneered an alternate approach of forming the gobo from multiple selected reflective silicon micromirrors. One such array is called a digital mirror device ("DMD") where individual mirrors are controlled by digital signals. See U.S. Pat. No. 5,828,485 the disclosures of which are herein incorporated by reference. DMDs have typically been used for projecting images from video sources. Because video images are typically rectangular, the mirrors of DMDs are arranged in a rectangular array of rows and columns.

The individual mirrors **370** of a DMD are rotatable. Each mirror is mounted on a hinge **372** such that it can rotate in place around the axis formed by the hinge **372**. Using this rotation, individual mirrors **370** can be turned "on" and "off" to restrict the available reflective surface.

FIG. **2** shows an example of using a DMD **400** to project a triangular illumination by turning "off" some of the mirrors in the DMD **400**. The surface of the DMD **400** exposed to a light source **402** comprises three portions. The individual mirrors which are turned "on" (toward the light source **402**) make up an active portion **404**. In FIG. **3**A, the active portion **404** is triangular. The individual mirrors which are turned "off" (away from the light source **402**) make up an inactive portion **406**. These pixels are reflected. The third portion is a surrounding edge **408** of the DMD **400**. Each of these portions of the DMD **400** reflects light from the light source **402** to different degrees.

FIG. **3**A shows a resulting illumination pattern **410** with the active area **404** inactive area **406** and cage **408**.

SUMMARY

The inventors recognize that light reflected from the inactive portion **406** of the DMD **400** generates a dim rectangular penumbra **418** area is surrounding the bright desired area **404**. Light reflected from the edge **408** of the DMD **400** generates a dim frame area. The inventors recognized that this rectangular penumbra **418** is not desirable.

The inventors also recognized that a circular penumbra is much less noticeable in the context of illumination used in dramatic lighting.

Accordingly the inventors have determined that it would be desirable to have a device which would provide a circular illumination without a rectangular penumbra while using a rectangular arrayed device as an imaging surface. The present disclosure provides such capabilities.

This disclosure describes controlling illumination from a light source. The disclosed system is optimized for use with a rectangular, arrayed, selective imaging device.

In a preferred embodiment, a rotatable shutter with three positions is placed between a DMD and the imaging optical system. The first position of the shutter is a mask, preferably a circle, placed at a point in the optical system to be slightly out of focus. This circle creates a circular mask and changes any unwanted dim reflection to a circular shape. The second position of the shutter is completely open, allowing substantially all the light to pass. The third position of the shutter is completely closed, blocking substantially all the light from passing.

An alternate embodiment for blocking the rectangular penumbra by changing any penumbra to round uses an iris shutter placed between a DMD and increases optics. The iris shutter creates a variable aperture which ranges from completely closed to completely open. Intermediate settings include circles of varying diameter, resulting in similar projections as with the first position of the shutter embodiment.

Another alternate embodiment for blocking the rectangular penumbra by changing any penumbra to round uses two reflective surfaces. The first reflective surface is a DMD. The second reflective surface is preferably a light-sensitive reflective surface such as a polymer. If the light striking a portion of the reflective surface is not sufficiently bright, that portion will not reflect the full amount of that light.

By controlling the penumbra illumination surrounding the desired illumination, DMDs and other pixel-based rectangular elements can be used in illumination devices without creating undesirable rectangular penumbras.

DESCRIPTION OF DRAWINGS

FIG. **1** shows a conventional illumination device including a gobo.

FIG. **2** shows an illumination device including a DMD.

FIGS. **3**A–**3**G shows a illumination patterns.

FIG. **4** show the optical train.

FIG. **5** shows a three position shutter according to a preferred embodiment of the present invention.

FIG. **6**A shows an illumination device including a three position shutter according to a preferred embodiment of the present invention which is set to a mask position.

FIG. **6**B shows an illumination pattern resulting from the device shown in FIG. **6**A.

FIG. **7** shows an iris-type shutter.

FIGS. **8**A and **8**B show use of the adjustable iris in a DMD system.

FIG. **9** shows a three-position shutter with an iris system.

FIG. **10** shows an embodiment with a light.

DETAILED DESCRIPTION

The structure and operational parameters of preferred embodiments will be explained below making reference to the drawings.

The present system uses two different operations to minimize the viewable effect of the unintentional illumination, or penumbra, discussed previously. A first operation forms the optics of the system in a way which prevents certain light from being focused on the DMD and hence prevents that light from being reflected. By appropriately masking the incoming light to the DMD, certain edge portions the penumbra can be masked. A second part of the system uses a special illumination shutter to provide different shaped penumbras when desired.

The overall optical system is shown in FIG. **4**. The bulb assembly **200** includes a high wattage bulb, here an MSR 1200 SA Xenon bulb **202** and retroreflectors **204** which capture some of the output from that bulb. The output of the bulb is coupled to a dichroic or "cold" mirror **206** which reflects the visible light while passing certain portions of the infrared. The first focus of the reflector is at Point **208**. A DMD mask is located at that point. The DMD mask is preferably rectangular, and substantially precisely the shape of the inner area **418** of the DMD. The image of the mask is also focused onto the DMD: such that if one were looking at the mask from the position of the DMD, one would see the mask clearly and in focus.

A first color system includes an RGB system **210** and a parametric color system **212**. The light passes through all of these elements and is then further processed by an illumination relay lens **214** and then by an imaging relay lens **216**. The image relay lens **216** has an aperture of 35 millimeters by 48 millimeters. The output is focused through a field lens **218** to the DMD **400**. The off pixels are coupled to heat sink **220**, and the on pixels are coupled via path **222** back through the imaging relay **216** folded in the further optics **224** and finally coupled to zoom elements **230**. The zoom elements control the amount of zoom of the light beam. The light is colored by a designer color wheel **232** and finally focused by a final focus element **235** controlled by motor assembly **236**.

The way in which the outer penumbra is removed will be explained with reference to FIGS. **3**A and **8**B.

FIG. **3**B shows the front surface of the DMD. This includes a relatively small inner active portion **350** which includes the movable mirrors. Active portion **350** is surrounded by a white inactive portion **352** which is surrounded by packaging portion **354**, a gold package **356**, and a ceramic package **358**. Light is input at a 20° angle from the perpendicular. The reason why becomes apparent when one considers FIG. **3**C. The mirrors in the DMD tip by 10°.

FIG. **3**C shows two exemplary mirrors, one mirror **360** being on, and the other mirror **362** being off. Input light **362** is input at a 20° angle. Hence, light from the on mirror emerges from the DMD perpendicular to its front surface shown as **364**. However, the same light **362** impinging on an off mirror emerges at a different angle shown as **366**. The difference between those two angles forms the difference **367** between undesired light and desired light. However, note in FIG. **3**C what happens when the incoming light **362** hits a flat surface. Note the outgoing beam **368** is at a different angle than either the off position or the on position. The hypothetical beam **366** from an off mirror is also shown.

The inventors recognize, therefore, that a lot of this information falls within an undesired cone of light. All light

which is input (e.g. 362 rays can be filtered by removing the undesired cone. This is done according to the present disclosure by stopping down the cone of light to about 18° on each side. The final result is shown in FIG. **3**D. The incoming light is stopped down to a cone of 18° by an F/3.2 lens. The incoming light is coupled to the surface of the DMD **400**, and the outgoing light is also stopped to a cone of 18°. These cones in the optical systems are identified such that the exit cone does not overlap with the undesired cone **367** shown in FIG. **3**C.

This operation is made possible by appropriate two-dimensional selection of the incoming light to the digital mirror. FIG. **3**E shows the active portion **350** of the digital mirror. Each pixel is a rectangular mirror **370**, hinged on axis **372**. In order to allow use of this mirror and its hinge, the light needs to be input at a 45° angle to the mirror, shown as incident light ray **374**. The inventors recognized, however, that light can be anywhere on the plane defined by the line **374** and perpendicular to the plane of the paper in FIG. **3**E. Hence, the light of this embodiment is input at the FIG. **3**F which represents a cross section along the line **3**F–**3**F. This complex angle enables using a plane of light which has no interference from the undesired portions of the light. Hence, by using the specific desired lenses, reflections of random scattered illumination is bouncing off the other parts is removed. This masking carried out by at least one of the DMD mask **208** and the DMD lens **218**. By appropriate selection of the input light, the output light has a profile as shown in FIG. **3**G. **350** represents the DMD active area, **356** represents the package edge, and **358** represents the mount. The light output is only from the DMD active area and is stopped and focused by appropriate lenses as shown in FIG. **3**G.

FIG. **5** shows a planar view of a shutter **500** according to a preferred embodiment of the invention. The preferred configuration of the shutter **500** is a disk divided into three sections. Each section represents one position to which the shutter **500** may be set. The shutter **500** is preferably rotated about the center point **502** of the shutter. The gate of the light is off center, to allow it to interact with one of the three sections. Rotation is preferred because rotation allows efficient transition between positions. Alternately, the shutter **500** may slide vertically or horizontally to change from one position to another. A round shape is preferred because of efficiency in material and space use. Alternately, the shutter **500** may be rectangular or some other polygonal shape.

Three positions are preferred because each position is rotatably equidistant from the other positions. However, a shutter **500** with three positions provides more positions than a shutter **500** with only two positions.

In a preferred embodiment, a first position is a mask position **504**. The mask position **504** includes an open or transparent aperture **506** and an opaque mask portion **503** which is not permeable to light. Preferably, material is removed from the shutter **500** leaving a shaped aperture **506** and a mask portion **508**.

The second position is an open position **510**. The open position **510** includes an opening **512**. Preferably the opening **512** is formed by removing substantially all material from the shutter **500** in the section of the open position **510**.

The third position is a closed position **514**. The closed position **514** includes a opaque barrier portion **516**. Preferably, the barrier portion **516** is just a solid block of material.

FIG. **6**A shows a preferred embodiment of an illumination system. A shutter **500** of the type shown in FIG. **5** is rotatably mounted between a light source **602**/DMD **604** such that substantially all the light from the light source **602** strikes only one section of the shutter **500** at a time. The shutter **500** is rotatably positioned to the mask position **504**. Thus, when the light source **602** is activated, light from the light source **602** reflected by DMD **604** strikes only the mask position **504** of the shutter **500**.

Using digital control signals, the DMD **604** is set so is that an active portion **612** of the individual mirrors are turned "on" and an inactive portion of the individual mirrors are turned "off" (see FIG. **4**A). The shape of the active portion **612** is set to conform to the desired shape of the bright portion of the illumination reflected by the DMD **604** shown in FIG. **6**B, described below.

FIG. **6**B shows an illumination pattern generated by the illumination device **600** configured as shown in FIG. **6**A.

Returning to FIGS. **3**A and **3**B, when the shutter **500** is not interposed between the DMD **400** and the stage. All portions of the DMD **400** reflect the light and create the undesirable illumination pattern shown in FIG. **3**A. In particular, the bright circular area **404** is surrounded by an undesirable dim rectangular penumbra **418** and slightly brighter frame **422**.

As described above, the illumination pattern shown in FIG. **6**B does not include a dim rectangular penumbra **418** and a slightly brighter frame **422**. These undesirable projections are substantially eliminated by using the shutter **500** and the aperture **506**. A dim penumbra illumination is generated by light reflecting from the inactive portion **604** of the DMD **604**. This dim circular penumbra illumination is more desirable than the dim rectangular penumbra and slightly brighter frame **422** of FIG. **3**A because the shape of the dim penumbra illumination is controlled by the shape of the aperture **506**. Accordingly, the dim penumbra illumination can be conformed to a desirable shape.

FIG. **7** shows an alternate embodiment for an iris shutter **900**. Preferably, a series of opaque plates **902** are arranged inside a ring **904** to form an iris diaphragm. By turning the ring **904** the plates **902** move so that an iris aperture **906** in the center of the iris shutter **900** varies in diameter. The iris aperture **906** preferably varies from closed to a desired maximum open diameter. Preferably the iris shutter **900** can transition from closed to a maximum diameter (or the reverse) in 0.1 seconds or less.

FIG. **8**A shows an illumination device **1000** including an iris shutter **900** as shown in FIG. **7**. The iris shutter **900** is positioned between a DMD **1004** and a stage **1002**. In FIG. **8**A, the iris shutter **900** is partially open such that the iris aperture **906** allows part of the light **1006**, **1008** from the light source **1002** to pass through, similar to the mask position **504** of the three position shutter **500** shown in FIG. **5**. One difference between the mask position **504** and the iris shutter **900** is that the iris aperture **906** is variable in diameter while the aperture **506** of the mask position **504** is fixed. The remainder of the light **1010** from the light source **1002** is blocked by the plates **902** of the iris shutter **900**. The light **1006**, **1008** which passes through the iris aperture **906** strikes the DMD **1004** in a pattern **1012** which is the same shape as the shape of the iris aperture **906**. Through digital control signals, some of the individual mirrors of the DMD **1004** are turned "on" to form an active portion **1014**, and some of the individual mirrors are turned "off" to form an inactive region **1016**. Preferably, the pattern **1012** is at least as large as the active portion **1014** of the DMD.

FIG. **10**B shows an illumination pattern **1018** generated by the illumination device **1000** shown in FIG. **10**A. Similar to FIGS. **6**A and **6**B, a bright illumination **1020** is generated by light **1022**, **1020** reflected from the active portion **1014** of the DMD **1004**. A dim penumbra illumination **1024** is generated by light **1026** reflected from the inactive portion **1016** of the DMD **1004**. By varying the diameter of the iris aperture **906**, the size of the pattern **1012** on the DMD **1004** changes. As the pattern **1012** changes the amount of the inactive portion **1016** of the DMD **1004** which is struck by light **1008** from the light source **1002** changes and so the dim penumbra **1024** changes as well.

FIG. **9** shows an alternate embodiment of a shutter **1100** which combines features of a three position shutter **500** with an iris shutter **900**. The overall configuration of this shutter **1100** is that of the three position shutter **500**. However, instead of the mask portion **504** as shown in FIG. **5** and FIG. **6**A, one of the positions is an iris portion **1102**. The iris portion **1102** has an iris diaphragm **1104** inserted into the material of the shutter **1100**. Similar to the iris shutter **900** of FIG. **7**, the iris diaphragm **1104** is made from a series of opaque plates **1106** arranged inside a ring **1108**. By turning the ring **1108** the plates **1106** move so that an iris aperture **1110** in the center of the iris diaphragm **1104** varies in diameter. This configuration operates in most respects similarly to the three position shutter **500** as shown in FIG. **5** and FIG. **6**A. Because of the iris diaphragm **1104**, the amount of light blocked by the iris portion **1102** is variable.

FIG. **10** shows an alternate embodiment of an illumination device **1200** which includes a second reflective surface **1202**. A light source **1204** projects light onto a DMD **1206** which has an active portion **1208** and an inactive portion **1210**. Light reflects off the DMD **1206** and strikes the second reflective surface **1220**. The second reflective surface **1220** acts to reduce the dim penumbra and frame created by the inactive portion **1210** and edge **1212** of the DMD **1206** (recall FIGS. **3**A and **3**B), leaving the active portion **1222**, to project image **1246**.

In the embodiment shown in FIG. **10**, the second reflective surface **1220** is a light sensitive surface such as an array of light trigger cells. Only light of a certain brightness is reflected. If the light striking a cell is insufficiently bright, substantially no light is reflected by that cell. Alternately, the second reflective surface **1220** may be made of a polymer material that only reflects or passes light of sufficient brightness. Light **1214** reflected from the active portion **1208** of the DMD **1206** is preferably bright enough to be reflected from the second reflective surface **1202**. Light **1216**, **1218** reflected from the inactive portion **1210** and the edge **1214** of the DMD **1206** is preferably not bright enough to be reflected from the second reflective surface **1202**. Thus, only light **1214** from the active portion **1208** of the DMD **1206** will be reflected from the second reflective surface **1202**. As described above, the undesirable dim rectangular penumbra **418** and slightly brighter frame **422** (recall FIG. **4**B) would be created by light **1216**, **1218** reflected from the inactive portion **1210** and edge **1212** of the DMD **1206**. The second reflective surface **1202** does not reflect this dim light **1216**, **1218** and so wholly eliminates the dim penumbra and frame from the resulting illumination.

A number of embodiments of the present invention have been described which provide controlled obscurement of illumination. Nevertheless, it will be understood that various modifications may be made without departing from the spirit and scope of the invention. For example, filters or lenses might be introduced to the illumination device **600** shown in FIG. **6**A between the shutter **500** and the DMD **604**. Alternately, the light source might be a video projection device or a laser.

While this disclosure describes blocking the light before impinging on the DMD, it should be understood that this same device could be used anywhere in the optical train, including downstream of the DMD. Preferably the blocking is at an out of focus location to soften the edge of the penumbra, but could be in-focus.

The light reflecting device could be any such device, including a DMD, a grating light valve ("GLV"), or any other arrayed reflecting device which has a non-circular shape.

All such modifications are intended to be encompassed in the following claims.

What is claimed is:

1. A method, comprising:

producing a beam of light;

reflecting said beam of light from a first reflection part which includes a central desired reflection part, and an outer part which undesirably reflects; and

reducing an amount of reflection from the undesirably reflects part, without correspondingly reducing an amount of reflection from at least part of said first reflection part.

2. A method as in claim **1**, wherein said reducing comprises first masking the beam of light at an area optically upstream of said first reflection part.

3. A method as in claim **2**, wherein said first masking comprises using a mask that has substantially the shape of said central desired reflection part, and at an in focus location.

4. A method as in claim **1**, wherein said reducing comprises second masking the beam of light at an area optically downstream of said first reflection part.

5. A method as in claim **4**, wherein said second masking comprises using a mask which is of a different shape than the shape of said central desired reflection part.

6. A method as in claim **1**, wherein said reducing comprises first masking the beam of light at a first area optically upstream of said first reflection part, and second masking at a second area optically downstream of said second reflection part.

7. A method as in claim **6**, wherein said first masking comprises using a mask that is substantially the shape of said central desired reflection part, and said second masking comprises using a mask that is of a different shape than said central desired reflection part.

8. A method as in claim **7**, wherein said different shape is substantially round.

9. A method as in claim **8**, wherein said different shape is a variable size shape, and further comprising changing a size of the round shape.

10. A method as in claim **1**, wherein said reducing an amount of reflection comprises actively masking a portion of the reflection using a controllable reflector.

11. A method as in claim **10**, wherein said controllable reflector is responsive to a brightness of light.

12. A method as in claim **1**, wherein said first reflection part is digitally controllable to change the shape of light beam reflected.

13. A method as in claim **12**, wherein said first reflection part allows each of a plurality of pixels of the light beam to be selectively reflected.

14. A method as in claim **12**, wherein said first reflection part is rectangular in shape.

15. A lighting system comprising;

a controllable reflector, which reflects an input light beam, which has a central part that reflects light, and an outer part which undesirably reflects light that is impinging thereon;

an optical training, which directs beam of light from an entrance location, to said central part of said controllable reflector, and from said controllable reflector, to an output; and

a masking part, which mask as at least a portion of the reflection from said outer part of said controllable reflector.

16. A system as in claim **15**, wherein said controllable reflector is digitally controllable to change a shape of light reflected thereby from a first projected shape, to a second test shape.

17. A system as in claim **16**, wherein said controllable reflector allows each of a plurality of pixels to be either reflected are not reflected.

18. A system as in claim **17**, wherein said controllable reflector includes a digital micro mirror device.

19. A system as in claim **17**, wherein said central part of said controllable reflector is substantially rectangular in shape.

20. A system as in claim **15**, wherein said masking part is optically upstream of the controllable reflector.

21. A system as in claim **20**, wherein said masking part includes a first mask.

22. A system as in claim **21**, wherein said first mask is in an in focus location.

23. A system as in claim **21**, wherein said first mask is in an output of focus location.

24. A system as in claim **21**, wherein said first mask is of substantially the same shape as a shape of said central part.

25. A system as in claim **15**, wherein said masking part is optically downstream of the controllable reflector.

26. A system as in claim **25**, wherein said masking part includes a second mask, which is of the different shape than the shape of said central part.

27. A system as in claim **26**, wherein said different shape is round.

28. A system as in claim **26**, wherein said different shape is round, and has a variable diameter.

29. A system as in claim **15**, wherein said masking part includes a first part that is optically upstream from the controllable reflector, and a second masking part which is optically downstream from the controllable reflector.

30. A system as in claim **29**, wherein said first and second masking parts are of different shapes.

31. A system as in claim **30**, wherein said first masking part is of substantially the same shape as said central part, and said second masking part is substantially round in shape.

32. A system as in claim **31**, wherein said central part and said first masking part or substantially rectangular in shape.

33. A system as in claim **15**, wherein said masking part is electrically controllable.

34. A system as in claim **15**, wherein said masking part is electrically controllable.

35. A lighting system comprising;

an optical train, which directs beam of light from an entrance location, along an optical path, and to an output; and

means for masking only an undesirable portion of a reflection that is caused along said optical path and prevent a masked part from reaching said output, without preventing a desirable part from reaching said output.

36. A system as in claim **35**, further comprising a controllable reflector which is digitally controllable to change a shape of light reflected thereby from a first projected shape, to a second selected shape, and wherein said undesirable portion is a portion caused by an edge of said controllable reflector.

37. A system as in claim **36**, wherein said controllable reflector includes a digital micro mirror device.

38. A system as in claim **37**, wherein said controllable reflector has a central reflecting part which is substantially rectangular in shape.

39. A system as in claim **36**, wherein said masking means is optically upstream of the controllable reflector.

40. A system as in claim **36**, wherein said masking part is optically downstream of the controllable reflector.

41. A system as in claim **36**, wherein said masking part includes a first part that is optically upstream from the controllable reflector, and a second masking part which is optically downstream from the controllable reflector.

42. A system as in claim **41**, wherein said first and second masking parts are of different shapes.

43. A system as in claim **42**, further comprising a controllable reflector which is digitally controllable to change a shape of light reflected thereby, and which has a central part which is controllable, and wherein said first masking part is of substantially the same shape as said central part, and said second masking part is substantially round in shape.

44. A system as in claim **41**, wherein first and second masking parts are substantially rectangular in shape.

45. A lighting system comprising;

a controllable reflector, which is digitally controllable, to individually control each of a plurality of pixels there are to reflect an input light beam, which has a central part that includes said pixels and which reflects light, and an outer part which undesirably reflects light that is impinging thereon;

an optical train, which directs beam of light from an entrance location, to said central part of said controllable reflector, and from said controllable reflector, to an output; and

a masking part, which masks at least a portion of the reflection from said outer part of said controllable reflector, wherein said masking part includes a first part that is optically upstream from the controllable reflector, and a second masking part which is optically downstream from the controllable reflector and, wherein said first and second masking parts are of different shapes.

46. A lighting system as in claim **45**, wherein said first masking part is substantially rectangular, said central part of said controllable reflector is also substantially rectangular, and said second masking part is substantially circular.

47. A lighting system as in claim **46**, wherein said masking part is controllable, and has a variable diameter.

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