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de Peralta

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(54) **CONTROL SYSTEM FOR OPTICAL MEDIA IN A LUMINAIRE**

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(52) **U.S. Cl.** **362/321**; 362/320; 362/268; 362/352; 362/282
(58) **Field of Search** 362/268, 321, 362/320, 352, 282, 283, 284

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,555,264 A * 1/1971 Schimmelpfennig 362/284
4,777,566 A * 10/1988 Lowell et al. 362/3
5,073,847 A * 12/1991 Bornhorst 362/293
5,347,432 A * 9/1994 Chiavetta 362/18
5,432,683 A * 7/1995 Brown 362/16

* cited by examiner

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(57) **ABSTRACT**

A zoom lens system includes a motor driven lens assembly that is movable on a track in a normal movement range for adjusting the light beam range angle of a luminaire. A pair or doors are pivoted to opposite sides of the frame of the lens assembly and are normally biased to an inactive position where the doors are parallel to and outside of the light path in the luminaire. The doors hold optical media such as diffuser gels. The lens assembly can be moved beyond the normal movement range to an actuation position where projections on the doors engage actuation abutments adjacent the track to move the doors to an active position overlying the lens with the optical media in the light path. A latch holds the door in the active position. The lens assembly can be moved beyond the actuation position to a deactivation position where a deactivation abutment releases the latch freeing the doors to return to the inactive positions.

15 Claims, 5 Drawing Sheets

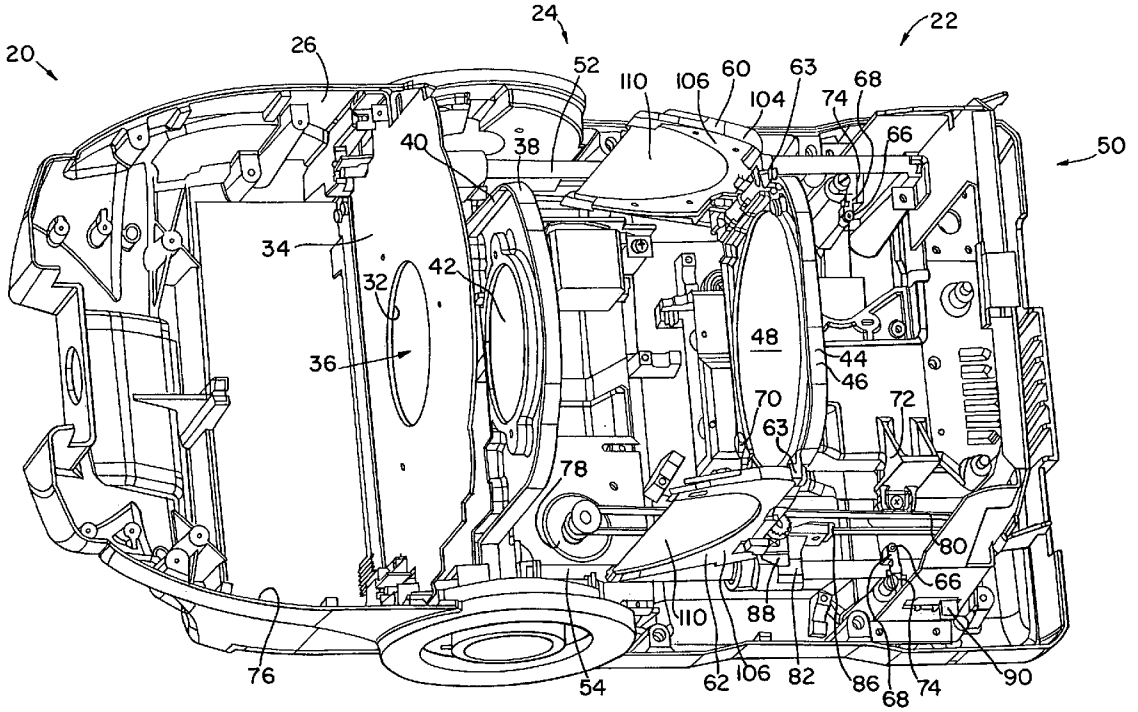


FIG. 1

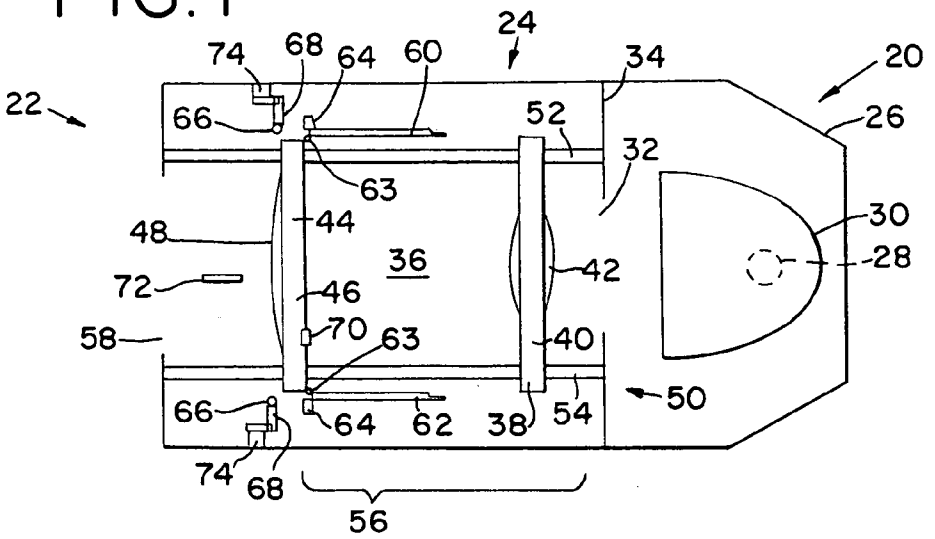


FIG. 2

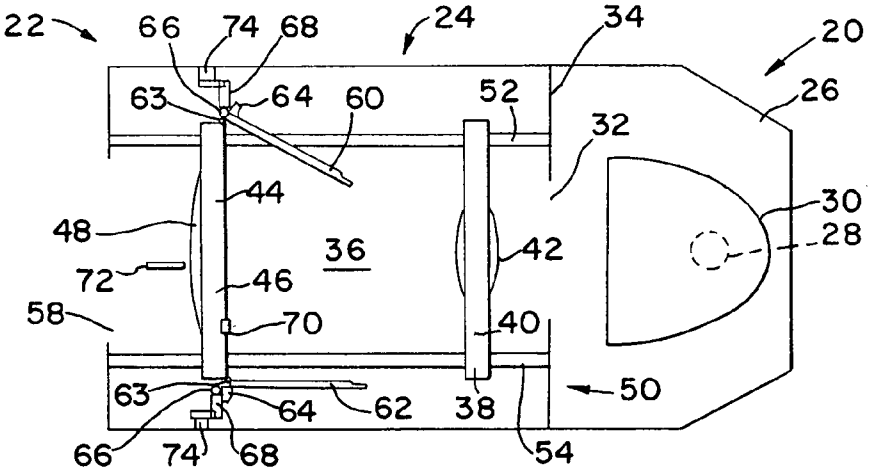


FIG. 3

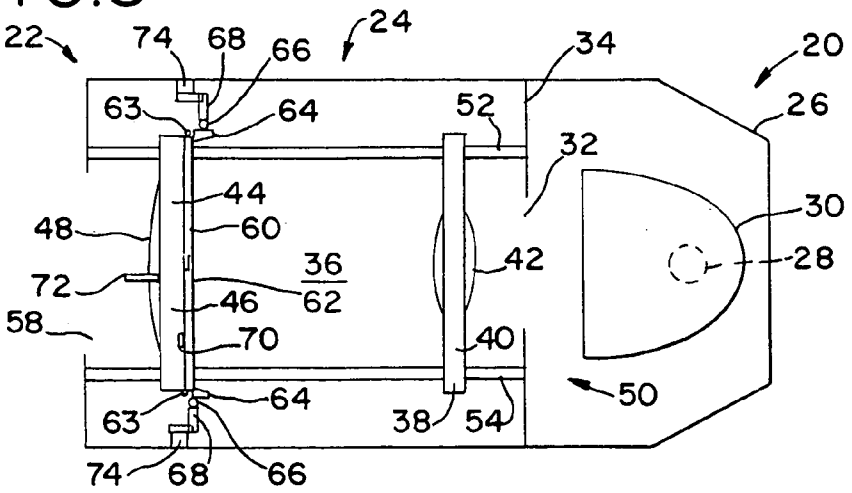


FIG.4

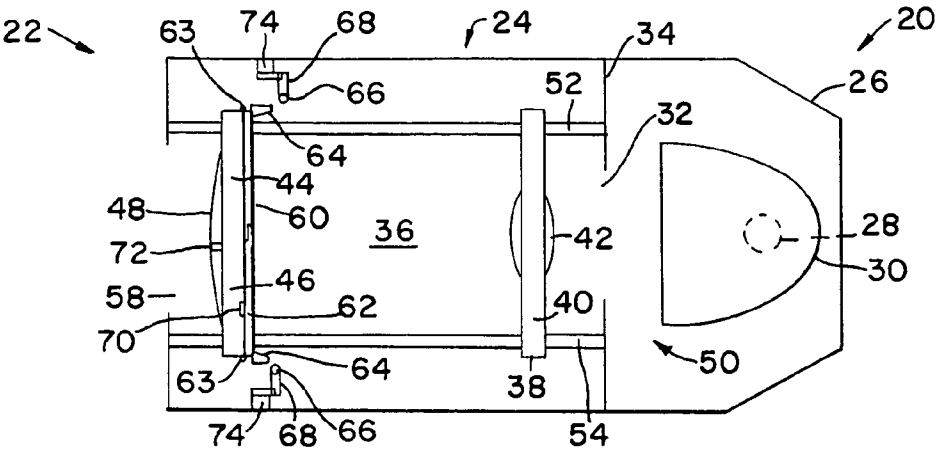


FIG.5

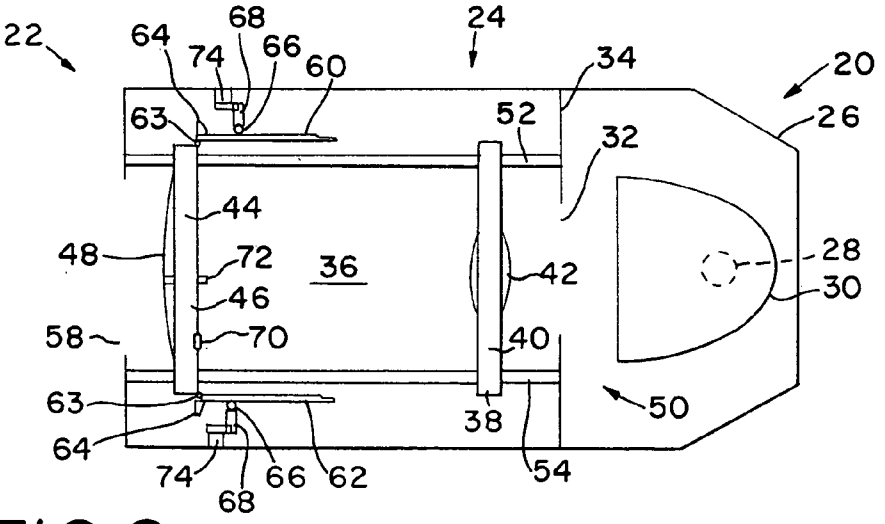
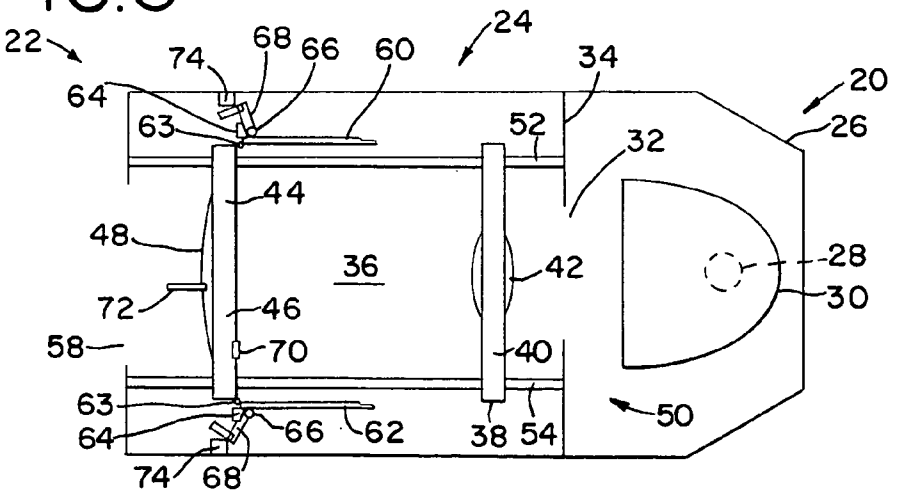


FIG.6



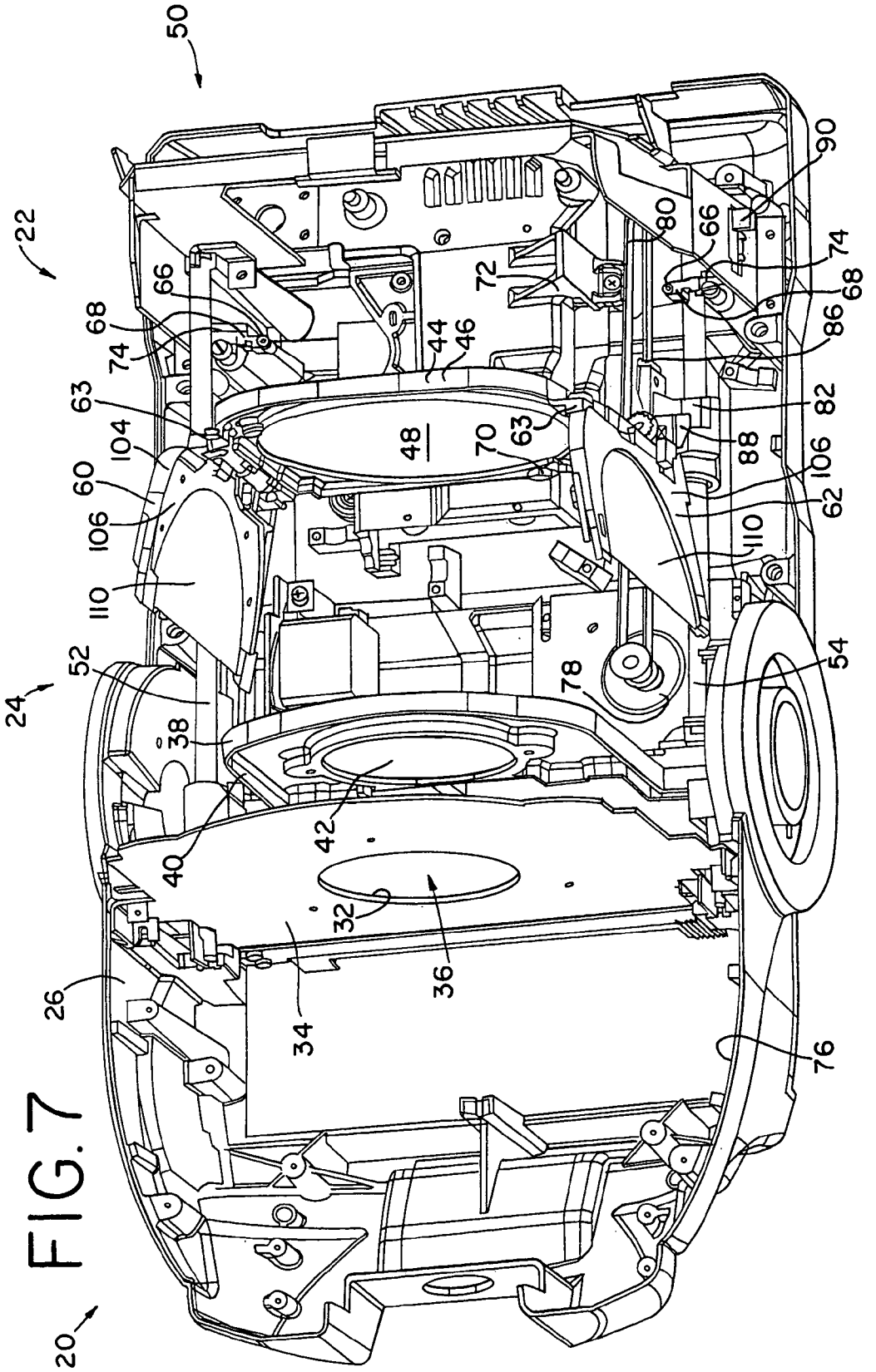

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FIG. 7

FIG. 8

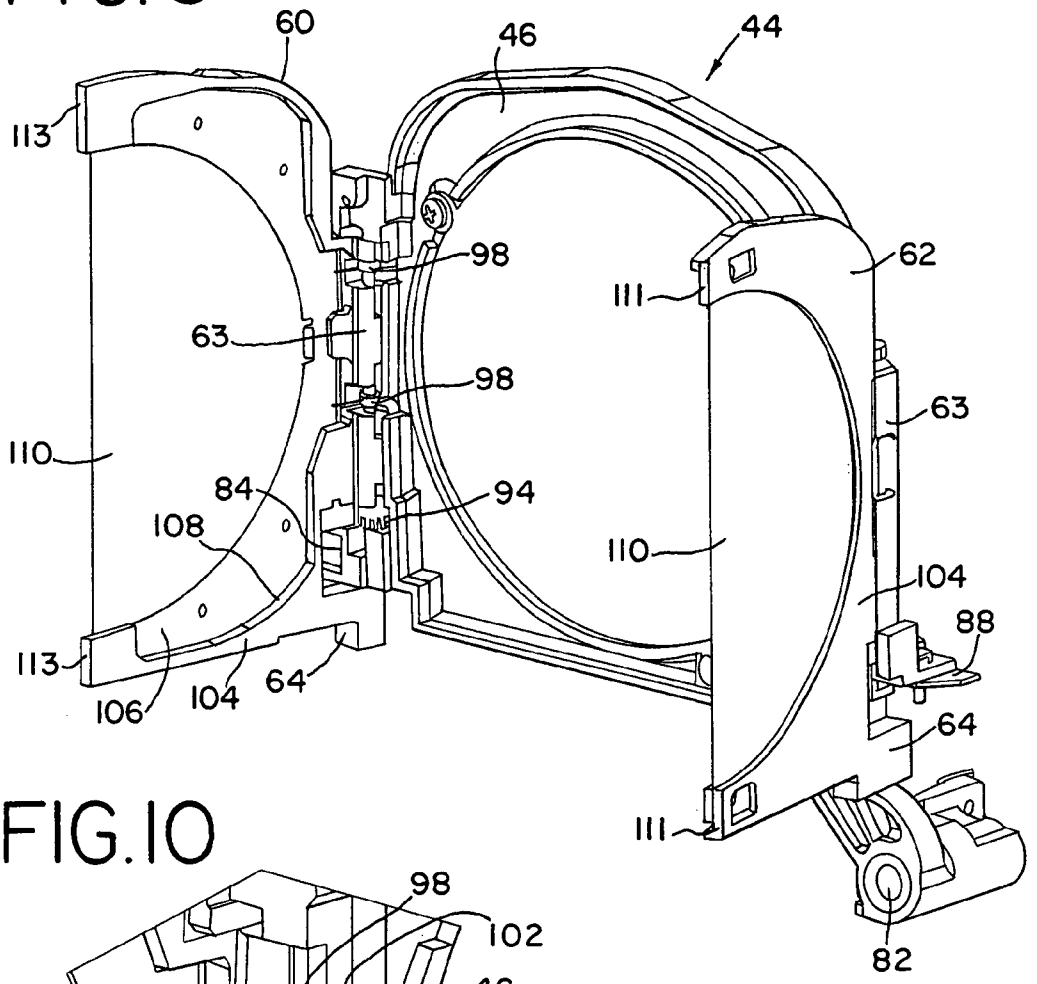
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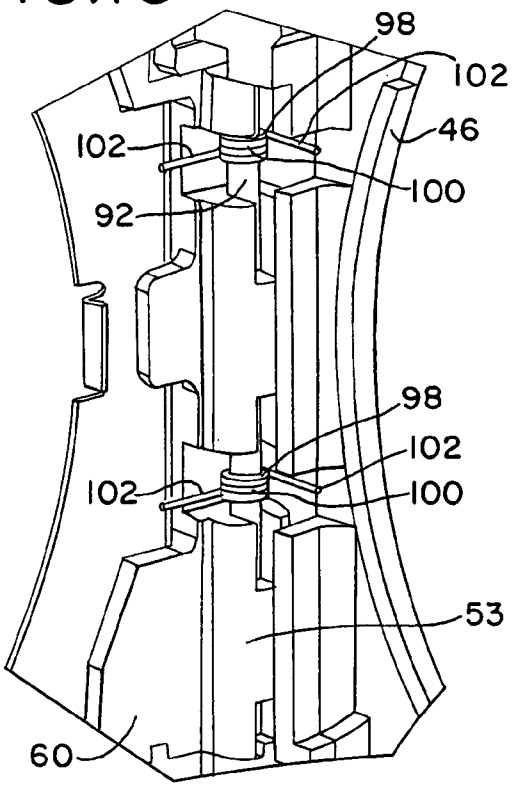
FIG. 10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46
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FIG. 9

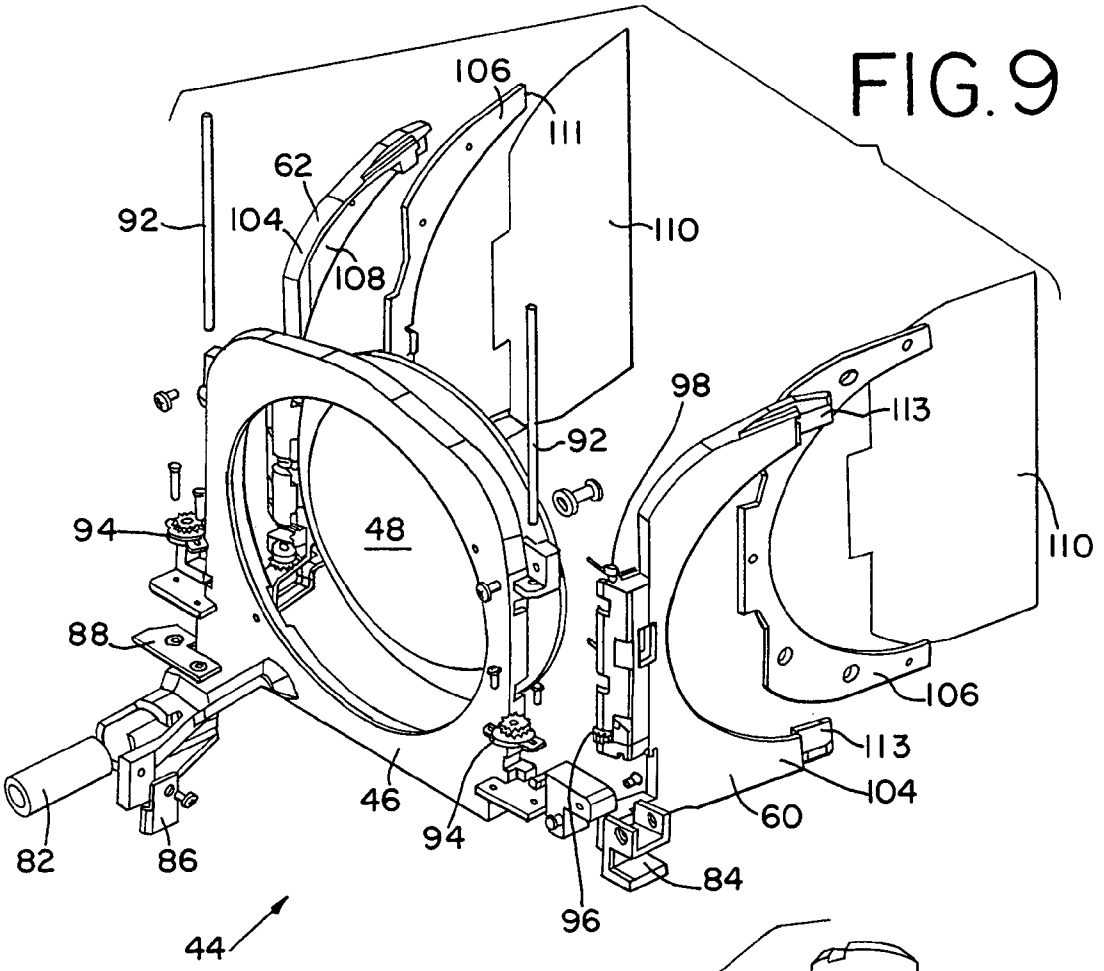
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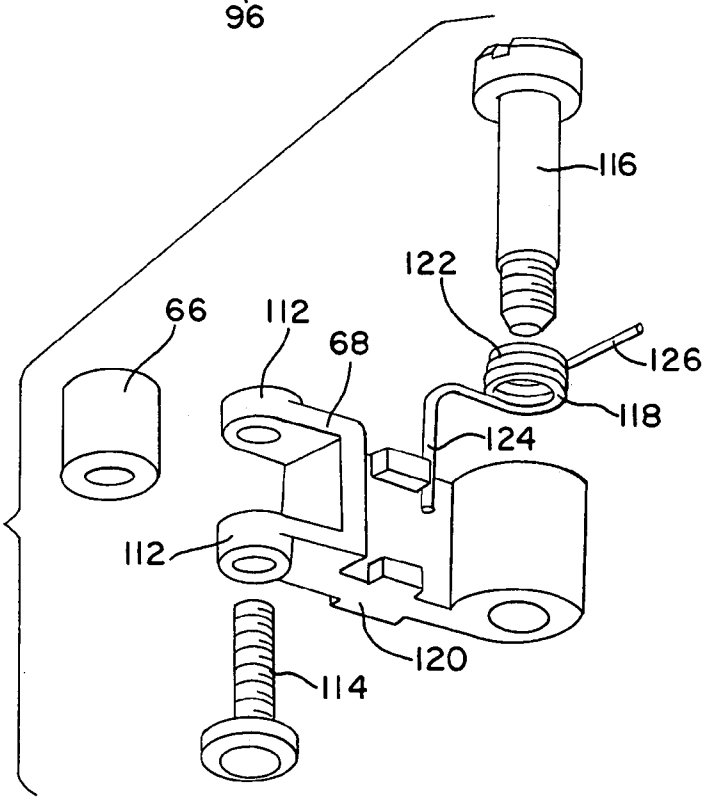
FIG. 11


116
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120
114

CONTROL SYSTEM FOR OPTICAL MEDIA IN A LUMINAIRE

FIELD OF THE INVENTION

The present invention relates to an improved system for controlling the position of an optical medium, such as a diffuser gel, in a luminaire.

DESCRIPTION OF THE PRIOR ART

Luminaires for theatrical applications such as stage and studio lighting typically include a housing with a light source providing a beam of light that travels along a light path from the light source to an exit opening in the housing. A projection optics system may be used to control the projected beam of light. Known theatrical luminaires can have a zoom lens assembly for varying the light beam field angle. In an automated, remotely controllable zoom lens system, one or more lenses are moved by one or more drive motors forward and back in the direction of the light path axis.

In many circumstances it is desirable to place an optical medium in the light path within the luminaire in order to create an optical effect. Optical media used for this purpose include colored gels, diffusers such as diffuser gels, glass media such as dichroic elements and apertured baffles such as beam shaping annular baffles known as donuts.

For example, a luminaire that normally serves as a spot, projecting a focused, coherent beam of light, can be transformed into a wash, projecting a diffused, soft light beam. This transformation is done by placing a diffuser into the light path. In known luminaires, a diffuser gel in a frame or support can be manually inserted into or attached to a luminaire to provide a wash effect, and the diffuser can be removed to provide a spot effect. In other approaches, to avoid the need for inconvenient manual operations, a wheel or scroll containing a variety of optical media such as colored gels, diffusers and others can be motor driven and remotely operated to place a diffuser or other selected medium in the light path.

Known arrangements for controlling the presence and absence of a diffuser or other optical medium in the light path of a luminaire are subject to disadvantages. Manual systems are inconvenient and are not capable of automation. Power operated systems used in the past have been complex and expensive. In particular, known systems that use a dedicated motor to move a diffuser or similar medium are expensive, complex and add substantial undesirable weight to the luminaire. There is an unfilled need for a control system for optical media in a luminaire that is reliable yet inexpensive and simple.

SUMMARY OF THE INVENTION

A primary object of the present invention is to provide an improved control system for optical media in a luminaire. Other objects are to provide a control system that is simple and inexpensive, that is capable of being remotely controlled and automated, that does not require a dedicated drive motor, and that overcomes disadvantages of known luminaire diffuser systems.

In brief, in accordance with the invention there is provided a control system for optics in a luminaire having a light path. The control system includes a luminaire housing and a track extending along the light path in the housing. A lens assembly includes a lens frame mounted for movement along the track and also includes a lens in the light path. A drive system includes a drive motor for moving the lens frame. A pair of doors are pivotally mounted at opposite sides of the lens frame for movement between an inactive position generally parallel to the light path and an active position wherein the doors overlie the lens in the light path. A pair of actuation abutments are located adjacent the track. Each of the doors includes a projection engageable with one of the actuation abutments in response to movement of the lens frame toward the actuation abutments. The actuation abutments and the projections are constructed and arranged to move the doors from the inactive positions to the active positions in response to engagement of the projections with the actuation abutments.

BRIEF DESCRIPTION OF THE DRAWING

The present invention together with the above and other objects and advantages may best be understood from the following detailed description of the preferred embodiment of the invention illustrated in the drawings, wherein:

FIG. **1** is a simplified diagram showing a luminaire having an optical media control system constructed in accordance with the present invention, with doors holding optical media in the inactive position;

FIG. **2** is a view like FIG. **1** showing the system with the doors being moved toward the active position by contact with the actuation pawls;

FIG. **3** is a view like FIGS. **1** and **2** showing the system with the doors in the active position;

FIG. **4** is a view like FIGS. **1–3** showing the system with the doors approaching the deactivation stop;

FIG. **5** is a view like FIGS. **1–4** showing the system with the doors returned to the inactive position;

FIG. **6** is a view like FIGS. **1–5** showing the system with the doors deflecting the activation pawls;

FIG. **7** is a rear, top and side isometric view of a luminaire having an optical media control system constructed in accordance with the present invention;

FIG. **8** is rear isometric view of the front lens and door assembly;

FIG. **9** is an exploded front isometric view of the front lens and door assembly;

FIG. **10** is an enlarged, fragmentary isometric view showing portions of a door and the lens frame with part of the hinge and door spring; and

FIG. **11** is an exploded isometric view of components of an actuation pawl assembly.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Having reference to the drawings, and initially to FIGS. **1–6**, these are highly simplified diagrams of a luminaire **20** provided with a media control system generally designated as **22** and constructed in accordance with the principles of the present invention. The luminaire **20** includes a zoom lens system **24**. In accordance with the present invention, the control system **22** is operated by the lens system **24** and as a result is simple, light in weight, and does not require its own motor or other power system.

The luminaire **20** includes a housing **26** containing a light source in the form of a bulb **28** and reflector **30** that emit a beam of light through an aperture **32** in a baffle **34** and along a light path **36**. The lens system **24** includes a rear lens assembly **38** having a frame **40** and lens **42** and a forward lens assembly **44** having a frame **46** and lens **48**. The

forward and rear lens assemblies **44** and **38** are movable along a track **50** having a spaced pair of guide rods **52** and **54** extending axially alongside the light path **36**. Motors and drive systems described below in connection with FIGS. **7–10** move the forward and rear lens assemblies **44** and **38** through a range of normal movement indicated by bracket **56** in FIG. **1** in order to vary the range angle of the light beam projected through a light exit opening **58** in the housing **26**.

The media control system **22** includes a pair of doors **60** and **62** pivotally connected to the forward lens frame **46** by hinges **63**. As appears below, each door **60** and **62** carries an optical medium. In the illustrated preferred embodiment of the invention, the medium is a diffuser gel, but the doors **60** and **62** could carry other types of optical media. The doors **60** and **62** can be rotated to an inactive position seen in FIGS. **1**, **5** and **6** in which the doors **60** and **62** are generally parallel to, and out of the light path **36**. In this position, the luminaire **20** operates as a spot, projecting a focused, coherent beam of light.

As seen in FIGS. **3** and **4**, the doors **60** and **62** can be rotated to an active position in which the doors **60** and **62** and the media carried by the doors intersect the entire light path **36**. When the optical medium is a diffuser, the light beam is diffused by the diffuser, and with the doors **60** and **62** in the active position, the luminaire **20** operates as a wash fixture, projecting a soft, diffuse beam of light.

The doors **60** and **62** are moved between the active and inactive positions in response to movement of the front lens assembly **44** forward beyond the normal focusing range of movement **56**. The doors **60** and **62** include projecting actuating lever portions **64**. As the frame **46** moves forward beyond the normal range **56**, the lever portions **64** engage rollers **66** carried by actuation pawls **68**. As seen in FIG. **2**, the engagement of the forward moving levers **64** with the pawl rollers **66** rotates the doors **60** and **62** from the inactive to the active positions.

The pawls **68** are slightly offset in the axial direction so that the door **60** reaches the active position, generally perpendicular to the light path axis, before the door **62**. This staggered or timed movement is seen in FIG. **2** where door **60** is moving ahead of door **62**. When the doors **60** and **62** reach their active positions, the free edge of door **62** overlies the free edge of door **60** as seen in FIG. **3**.

A latch **70** holds the door **62** in the active position. Door **62** holds the door **60** in the active position. Preferably the latch **70** is a magnet that is contacted by a magnetic metal portion of the door **72**.

After the doors **60** and **62** are moved to and are latched into the active position, the front lens assembly **44** is returned rearwardly to any elected position in the range **56** of normal movement. Both lens assemblies **38** and **44** can operate normally with the diffuser doors **60** and **62** latched in the active positions.

To return the doors **60** and **62** to their inactive positions, the forward lens assembly **44** is again moved forward beyond the normal motion range **56**. As seen in FIG. **4**, the forward lens frame **46** moves forward beyond the pawl actuating position seen in FIG. **3**. In the fully forward position of FIG. **4**, the door **62** strikes a deactivation stop **72**. The stop **72** causes the forward moving door **62** to move away from the latch magnet **70**. When the door **62** moves free of the magnet latch **70**, a door biasing spring returns the door **62** to its inactive position. When the the door **60** is released from the door **62** a door biasing spring returns the door **60** to its inactive position.

With the doors **60** and **62** in the inactive positions, the forward lens assembly **44** is returned to the normal movement range **56**. The pawls **68** are normally held by pawl springs described below against pawl stops **74**. As the lens frame **46** moves rearward past the pawls **68**, the lever portions **64** engage the pawl rollers **66** and rotate the pawls away from the stops **72** as seen in FIG. **6**. This retraction of the pawls **68** permits the doors **60** and **62** in the inactive position to move rearward past the pawls **68**. When the forward lens assembly **44** returns to the normal range of motion, both lens assemblies **38** and **44** can operate normally with the diffuser doors **60** and **62** in the inactive positions.

Details of the luminaire **20**, diffuser control system **22** and zoom lens system are seen in FIGS. **7–11** where the same reference characters are used for elements common to FIGS. **1–6**.

FIG. **7** illustrates the luminaire **20** with the cover for housing **26** removed to expose the interior components. The light source is also removed from a light section **76** of the housing **26**. Reference may be had to copending U.S. patent application Ser. No. 10/294,209 filed on Nov. 14, 2002, incorporated herein by reference, for a description of the light source beyond that helpful to an understanding of the present invention.

The illustrated base of housing **26** is a metal part incorporating the pawl stops **74** and the activation stop **72**, and supporting and positioning the components of the media control system **22** and the zoom lens system **24**. The housing **26** supports the guide rods **52** and **54** parallel to one another and extending parallel to and below the light path **36**. The forward lens assembly **44** is moved forward and back along the drive rods **52** and **54** by a drive motor **78** and drive belt **80**.

The forward lens assembly **44** is illustrated in FIGS. **8** and **9**. It includes a guide bearing **82** that slides along the guide rod **54**, and a float bushing **84** that receives and slides along the other guide rod **52**. The float bushing **84** is open sided to permit free motion of the lens assembly **44** even if the guide rods **52** and **54** are inadvertently misaligned. A belt clamp **86** fastens the lens frame **46** to the drive belt **80** so that rotation of the drive motor results in sliding movement of the forward lens assembly **44** along the track **50**. A sensor flag **88** cooperates with a sensor **90** in the housing **26** (FIG. **7**) to provide position feedback to a control system for the luminaire **20**.

The hinges **53** include hinge pins **92** for pivotal mounting of the doors **60** and **62** at the opposite sides of the lens frame **46**. A pair of rotary dampers **94** mounted to the frame **44** have gears meshing with gear teeth **96** formed on the doors **60** and **62** so that the doors **60** and **62** move slowly and quietly from the active positions to the inactive positions. The doors **60** and **62** are normally held in their inactive positions by door springs **98** (FIG. **10**). Each door spring **98** includes a spring coil **100** around the corresponding hinge pin **92**, and free ends **102** bearing against the lens frame **44** and door **60** or **62**.

Each door **60** and **62** includes a door frame **104** and a magnetic metal media holder **106** that is fastened into a recess **108** in the door frame **104**. An optical medium **110** is clamped into each media holder **106** before the media holder **106** is fastened in place. The user can use the media holder **106** as a template to prepare any desired optical medium for use in the media control system. The latch magnet **70** contacts the metal media holder **106** and holds the door **62** in the active position of the door **62**. The ends **111** of the frame **104** of door **62** overlie the ends **113** of the frame **104** of door **60** to hold the door in the active position. The edges

of the optical media **110** are inset slightly from the frame ends **111** and **113** so that the edges of the optical media are aligned but not overlapping in the active positions of the doors **60** and **62**.

As seen in FIG. **11**, each of the two actuation pawls **68** includes a pair of arms **112** cooperating with a fastener **114** for holding the pawl roller **66**. The pawl **68** is mounted to the housing **26** with another fastener **116**. A pawl spring **118** continuously biases the pawl **68** toward its normal position wherein a stop abutment **120** on the pawl engages the corresponding pawl stop **74**. The pawl spring **118** includes a spring coil **122** surrounding the fastener **116**, a first end **124** engaging the pawl **68** and a second end **126** engaging a fixed reaction surface on the housing **26**.

While the present invention has been described with reference to the details of the embodiment of the invention shown in the drawing, these details are not intended to limit the scope of the invention as claimed in the appended claims.

What is claimed is:

1. A control system for optics in a luminaire having a light path, said control system comprising:

a luminaire housing:

a track extending along the light path in said housing;

a lens assembly including a lens frame mounted for movement along said track and including a lens in the light path;

a drive system including a drive motor for moving said lens frame;

a pair of doors pivotally mounted at opposite sides of said lens frame for movement between an inactive position generally parallel to said light path and an active position wherein said doors overlie said lens in the light path; and

a pair of actuation abutments adjacent said track;

each of said doors including a projection engageable with one of said actuation abutments in response to movement of said lens frame toward said actuation abutments;

said actuation abutments and said projections being constructed and arranged to move said doors from the inactive positions to the active positions in response to engagement of said projections with said actuation abutments.

2. A control system as claimed in claim **1**, further comprising a door latch on said lens frame retaining said doors in the active position.

3. A control system as claimed in claim **2**, said latch comprising a magnet.

4. A control system as claimed in claim **2**, said track including a normal movement range for said lens assembly and said actuation abutments being located in an actuation position beyond said normal movement range.

5. A control system as claimed in claim **4**, further comprising a deactivation abutment located adjacent said track in a deactivation position, said actuation position being located between said deactivation position and said normal movement range, said deactivation abutment being in the path of said doors for releasing said latch in response to movement of said doors into said deactivation position.

6. A control system as claimed in claim **5**, said actuation abutments being retractable to permit movement of said doors from said deactivation position to said normal movement range.

7. A control system as claimed in claim **6**, said actuation abutments comprising pivotally mounted pawls.

8. A control system as claimed in claim **2**, further comprising a deactivation abutment adjacent said track in the path of movement of said doors for releasing said latch in response to contact of said doors with said deactivation abutment.

9. A control system as claimed in claim **1**, further comprising optical media held by said doors.

10. A control system as claimed in claim **9**, said optical media comprising gels.

11. A control system as claimed in claim **10**, said gels comprising diffusers.

12. An apparatus for controlling an optical medium in a luminaire having a light path for a beam of light, said apparatus comprising:

a track in the luminaire extending along the light path;

a support mounted for movement along the track;

a motor for moving the support along the track;

a door pivotally mounted on said support for movement between an inactive position and an active position intersecting the light path;

said door including a carrier for the optical medium;

said door including an abutment surface; and

an actuator mounted adjacent said track in the path of said abutment surface for pivoting said door in response to contact between said abutment sand said actuator.

13. The apparatus of claim **12**, said support comprising a lens frame for a lens.

14. The apparatus of claim **12**, said door being pivotally mounted at one side of support, a second door pivotally mounted at an opposed side of said support.

15. A diffuser control system for a luminaire having a light path with a longitudinal axis, said diffuser control system comprising:

a lens frame positioned generally perpendicular to the light path axis;

a lens held by said frame in the light path;

a door including a diffuser medium;

said door being mounted to said lens frame for pivotal movement between an inactive position out of said light path and an active position wherein said diffuser medium intersects said light path;

an abutment;

an elongated support extending in the axial direction along the light path;

said lens frame being mounted on said support for movement of said lens frame and door in the axial direction along said support;

an abutment in the path of movement of said door;

said door including an actuating lever portion contacting said abutment for moving said door between said inactive and active positions.

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