

Description

This invention relates to a lighting system in which at least the orientation of a selected one of a plurality of light sources and/or the colour of the light therefrom is remotely controlled, the system comprising controller means which provides an input of information including data representing a predetermined orientation, colour of light, or both of a selected one of the light sources and which transmits the information to receiver means associated with each of the light sources, the receiver means reading the data representing the predetermined orientation, colour of light, or both of the selected light source in order to vary the same accordingly.

The invention has a particular application to the lighting of a stage or theatre.

In conventional lighting systems, individual light sources are typically hung from trusses or fixed structural members mounted in front of the stage, at the sides of the stage or over the stage. The light sources are adjusted to direct the light beam to a desired location on the stage and are then secured in that position by tightening bolts or other fasteners. A large sealed beam lamp of 1,000 to 1,500 watts run from a 110 volt AC line is typically employed to create the light. In addition to generating visible light, such lamps, generally noted as par lamps, generate a significant amount of infrared heat.

In a typical stage lighting plan, the light sources are employed in either of two fashions. Certain light sources may be used as a wash or general stage illumination. The remainder of the light sources are used as spots for highlighting specific positions on the stage, such as an actor's face.

The light beams emanating from each light source may be colored by the use of a colored celluloid gel. The gel is positioned within a frame which is slid into a receiver positioned at the end of the light source so that the beam passes through the colored gel. The gel functions to absorb the incident light other than the color desired. The absorbed light is transformed into heat which warps and discolours the gel, requiring frequent replacement as often as once every show.

Shutters are typically pivoted at the end of the light source to block out selected portions of the light beam to shape the incidence of the beam on the stage. In many cases, a mechanical iris may be provided in the light source to control the beam divergence. When a light source is used as a wash, a wide beam divergence is desired. However, when used as a spot, the light beam preferably is narrowed to a very small divergence.

The intensity of the light beam emanating from each light source is individually controlled by a large power dimmer. The power dimmers, in turn, are controlled by the main lighting control panel. The typical lighting system therefore requires a massive array of electrical cables, including cables connecting the control console with a power dimmer and cables interconnecting the power dimmer with the associated light source. It

has also been found that the use of power dimmers to control the intensity of light has induced chop in the AC power line supplying the entire theater. This has been found to induce undesirable noise, such as distortion, hum etc. particularly during the performance of rock groups employing instruments relying on electrical input.

A typical performance, such as rock concert or theatrical performance, may require a hundred or more individual light cues or lighting formats during the performance. Up to 500 separate lights may be necessary to light the entire performance. Usually 25% of these lights are used as wash and the remainder are used as specials. The large number of lights are necessitated as the light position, color intensity and divergence must be preset prior to the performance.

Attempts have been made to automatically control a stage lighting system during a performance. U.S. Patent No. 3,898,643 to Ettlinger, issued August 5, 1975, discloses a system including a memory for storing the intensity level of the lights for each cue during a performance. The system may then set the intensity of the light through conventional power dimmers in an automatic sequence. However, this device merely transfers the manual operation of power dimmers to an automatic system which, while relieving an operator of substantial work during the performance, necessitates still more complex and costly equipment in the system.

US Patent Specification No. 3845351 discloses apparatus for adjusting floodlights, each floodlight having a number of separate controls for adjusting individual parameters of azimuth, elevation, brightness, focus and colour. Each of these controls is connected to a separate amplifier which is driven by an analogue voltage delivered to it by a separate analogue transmission channel. Furthermore, such an arrangement is multiplied by the number of floodlights in the lighting system. Thus, the apparatus suffers mainly from the disadvantage of requiring a multiplicity of control lines.

In a lighting system to which the present invention relates, wherein receiver means is associated with each one of a plurality of light sources for reading data representing the predetermined orientation, colour of light, or both of a selected light source in order to actuate means to vary the orientation of the light source or to actuate means to position a filter relative to the source, or both, the information transmitted to the receiver means is in the form of serial messages. Each message includes a coded address which respectively represents a particular one of said light sources and further includes the data representing the predetermined orientation, colour of light, or both of the selected light source. Only a single communication channel is provided to carry these messages to the plurality of light sources, each of the receiver means responding to only the respective coded address of its associated light source.

An advantage of the invention is that only a single communication channel is needed to carry all of the information, in serial message form, to the plurality of light sources. This avoids the need for a number of heavy and separate lines which would need to be connected to each light source. A further advantage is that if a light source becomes inoperable, it may be rapidly replaced by installing a new source having the same address as the previous source. Thus, by using a new light source which responds to the same address, its orientation and colour may be directly and immediately controlled by the system. Yet a further advantage is that the capacity of the lighting system may be varied simply by providing sufficient addresses for each source which is installed. The system is therefore flexible and versatile since it does not require a multiplicity of different cabling in order to connect different numbers of light sources to a control system. A lighting system according to the invention also eliminates or reduces undesirable noise which can be induced in electronic musical instruments and associated sound reinforcement equipment, such as mixing consoles, amplifiers, etc.

In preferred embodiments of the invention, each light source includes a frame or housing in which a lamp is mounted, at least one dichroic filter being provided which is positioned, relative to the lamp, for producing a predetermined colour. For example, such a filter is pivotally mounted within the frame or housing for pivotal motion in the light path for transmitting light of a predetermined colour, a variation of the angle of incidence of the light on the dichroic filter causing a change in the colour which is produced. According to another example, a wheel having a plurality of dichroic filters located around and adjacent its periphery is rotatably mounted so as to enable selected filters to be positioned in the light path in order to produce a predetermined colour.

The light source with colour filter per se is subject-matter of the European patent application 0 140 994.

Preferred embodiments of the invention will now be described with reference to the accompanying drawings, in which:

Figure 1 is a perspective view of a lighting system according to an embodiment of the invention;

Figure 2a is a vertical cross-sectional view of a light source according to a first embodiment of the invention;

Figure 2b is a horizontal cross-sectional view of the light source shown in Fig. 2a;

Figure 3 is a vertical cross-sectional view of a light source according to a second embodiment of the invention;

Figure 4 is a vertical cross-section of the light source shown in Fig. 3, taken along line 4—4 of Fig. 3 in the direction of the arrows;

Figure 5 is a vertical cross-section of the em-

bodiment shown in Fig. 3, taken along the line 5—5 in Fig. 3 in the direction of the arrows;

Figure 6 is an illustration of a control panel embodying the present invention;

Figure 7 is a flow diagram illustrating the major functions of a system embodying the invention;

Figure 8 is a schematic diagram of servo-drive components associated with each light source;

Figure 9 is a general schematic view of the control panel embodying the invention;

Figures 10a—f are detailed schematic views of the control panel shown in Fig. 9; and

Figure 11 illustrates the interrelationship of Figs. 10a—f.

Referring now to the drawings, wherein like reference characters designate like or corresponding parts throughout several views. Figure 1 illustrates a lighting system 10 embodying the present invention. The lighting system 10 may be used to light a stage or other forum where directable light is desired. For example, the lighting system 10 may be used to light a rock concert or a theatrical performance.

As will be explained in greater detail hereinafter, the light system 10 includes a remote control panel 12 for controlling the light sources 14 mounted on a truss 16 above, in front or to the side of the stage to be lit. Each light source 14 may be positioned and the light beam produced thereby varied in color, intensity and beam divergence from the remote control panel 12. If the performance being lit includes a number of scenes, or individual lighting changes generally termed as cues, the remote control panel 12 includes a memory for recalling the position, color, intensity and beam divergence of each light source 14 for each separate cue and the remote control panel 12 will automatically set up an entire cue by the activation of a single control on the control panel 12. Each function described above is accomplished with only a single two conductor data link or signal cable 18 interconnecting the control panel 12 and truss 16 and a power cable 20.

The first embodiment of light source 14 is illustrated in Figures 2a and 2b as light 30. The light 30 includes a rigid frame 32 having an aperture 34 formed in one end thereof for passage of the light beam 36. The frame 32 and components therein are pivotally mounted to the truss 16 by a gimbal mechanism 38.

The gimbal mechanism 38 pivotally supports the frame 32 for motion in two mutually perpendicular planes. The frame 32 may move in a horizontal plane or pan across a stage and in a vertical plane or tilt. The gimbal mechanism 38 also includes motor for independently panning and tilting the frame 32 in discrete increments in response to signals generated by the remote control panel 12. The motors permit the light beam 36 to be aimed at any desired location on the stage. In the preferred embodiment servo motors are used in gimbal mechanism 38.

A lamp 50 is positioned within frame 32 adja-

cent one end thereof. The lamp 50 produces white light, or light across substantially the entire visible spectrum. In the preferred embodiment, the lamp 50 may comprise a common projection lamp as used in movie projectors and the like having a 110 volt AC input with a power consumption of approximately 350 watts. This type of lamp has the advantage of very low infrared radiation generation, thereby avoiding the generation of excess heat within the light 30. An elliptic mirror 52 is positioned about the lamp 50 to reflect light incident thereon to converge at a focus 54 within the frame 32. After convergence at focus 54, the light diverges and enters a collimating lens 56 which collimates light incident thereon to form the light beam 36.

Dichroic filters 58 and 60 are pivotally mounted to the frame 32 on either side of focus 54. Two additional dichroic filters 62 and 64 are pivotally mounted to frame 32 on the side of collimating lens 56 opposite focus 54. Dichroic filters are available commercially, such as those sold by the Technical Products Division of Optical Coating Laboratory, Inc. of P.O. Box 1599, Santa Rosa, California. A dichroic filter is a multiple layered optical film having a glass, pyrex or quartz base. The alternate layers have low and high indexes of refraction, respectively. Dichroic filters work on an interference principle, separating two colors transmitted and the other color, the complement of that transmitted, being reflected. The transmitted color depends upon the type of material used in the layers and its refractive index, the thickness of each layer, the number of layers and the angle of incidence of the white light source striking the surface of the filter. By varying the angle of incidence of white light on a given filter, a pre-selected range of color spectrum may be produced.

The dichroic filters 58-64 are preferably formed of multiple thin layers of material and may have a circular, rectangular or other shape. The filters therefore have a thickness of a relatively small dimension and a relative large surface for incidence of light. Dichroic filter 58 is mounted for pivotal motion about an axis X-X by shaft 68. As can be seen with reference to 2b, the axis X-X extends through the center of the light path. Dichroic filters 60, 62 and 64 are similarly mounted for pivotal motion about axis Y-Y, Z-Z and V-V, respectively, about shafts 68, 70 and 72, respectively. Each dichroic filter may be pivoted about its associated shaft by means of a servo motor 74, 76, 78 or 80.

When the dichroic filters are aligned with the light path, as shown in Figure 2b, no influence on the color is created and the filters do not significantly interfere with the light path. Therefore, a white light beam is created for use as a spot or other desired use. As a given dichroic filter is pivoted so that the angle of incidence of the light, θ increases above 0, the filter moves across the light path and transmits a colored beam with the color dependent on the angle θ . The four filters

may be chosen to transmit four dominant colors. Filter 58 may transmit blue, filter 60 green, filter 62 red and filter 64 yellow. However, each individual filter will transmit a range of spectrum as θ is varied. At low values of θ , white light spills around the edges of the filters, diluting the transmitted beam to produce pastel or un-saturated shades of color as the beam is passed through an integrating lens 100 described hereinafter to homogenize the light beam. In the preferred embodiment, the blue and green filters are positioned furthest from lamp 50 to form dichroic filters 62 and 64. This permits desirable pastel or unsaturated shades of color to be produced when low values of θ are present. The permutations of color in the light beam 36 in passing light through a filter or multiple filters are theoretically infinite dependent only on the relative position of the filters. In one application of the present invention, 4,000 permutations of color are possible.

A douser unit 90 is positioned within the frame 32. The douser unit 90 acts to permit the light beam 36 to pass therethrough when open but substantially cuts off the light beam 36 when closed. It therefore acts like a shutter to block light from passing from the light 30, but permits the light beam to be almost instantaneously restored by opening the douser unit. In the preferred embodiment, the douser unit 90 is in the form of a mechanical shutter. The shutter is controlled by a solenoid 92 which may be activated to either close or open the shutter to control the light beam. The shutter is designed so that the shutter is closed upon deactivation of the solenoid. This feature prevents a light beam from emanating from a light when the light is malfunctioning, or the data transmitted to the light is in error to prevent improper lighting.

In close proximity with douser unit 90 is a dimmer unit 94. The dimmer unit 94 dims or decreases the intensity of light beam 36 to vary the mood or impact of the light on the stage. The dimmer unit 94 is controlled by a servo motor 96.

An integrating lens 100 is provided to mix the light passing through the dichroic filters to insure a uniform color. The integrating lens 100 is formed of a large number of small spherical lens 102 mounted on a flat transparent surface which acts to homogenize any light passing there-through. Finally, light beam 36 passes through a focusing lens 104 prior to exiting frame 32 through aperture 34 to light a desired location on a stage.

The light 30 may include a cooling fan 106 mounted in the lower base thereof. The cooling fan 106 forces outside air into the lower portion of the light to cool the electric components such as receiver 166 and servo drive 168. A portion of the airflow is directed through nozzles 107 at the lamp 50 to cool the lamp directly. The remainder of the air passes forward to a slot 108 adjacent the douser and dimmer units and passes to the upper portion of the light 30 to cool the lenses and dichroic filters. The air passing through slot 108 and issuing from the nozzles 107 exits the light 30

through a grating 109 at the rear of light 30 adjacent the elliptical mirror 52.

The second embodiment of the light source 14 is illustrated in Figures 3-5 and comprises light 110. Certain portions of light 110 are identical to portions of the light 30. These portions are identified by reference numerals indicating the identical portion in light 30 with a superscript '.

The frame 32' is also gimbaled on a gimbal mechanism 38'. The mechanism 38' permits the frame 32' and light beam 36' emanating therefrom to be panned and tilted across a stage.

The lamp 50' produces white light which is reflected off the elliptical mirror 52' to converge at a focus 54' within the frame 32' of the light 110. Color wheels 112 and 114 are rotatably mounted to frame 32' for rotation about axes R-R and S-S. The axes R-R and S-S are generally aligned with the path of light travel in the light 110 and are positioned so that the light falls on portions of the outer periphery of both color wheels 112 and 114, as best illustrated in Figure 4.

Each color wheel 112 and 114 has a plurality of apertures numbered from 1 to n distributed about the outer periphery of the wheel. Each aperture may be centered across the light path. The color wheels 112 and 114 are positioned sufficiently close to the focus 54' so that substantially all the light from lamp 50' passes through the aperture centered on the path of the light and the area of the apertures may be minimized.

At least one aperture in each wheel 112 and 114 is clear to permit passage of the light therethrough without interference. However, the remainder of the apertures have individual dichroic filters mounted therein, each filter permitting a single color to be transmitted therethrough. Each color wheel may include sufficient dichroic filters to individually provide a wide spectrum of color or, in combination with the other color wheel, provide a number of color permutations. In the preferred construction, each color wheel 112 and 114 will have 32 apertures, one being clear and 31 having dichroic filters mounted therein. This permits almost 1000 permutations of color to be induced in the light beam 36' issuing from light 110 by rotating the two color wheels 112 and 114 by motor means 116 and 118, respectively.

A gobo wheel 126 is rotatably mounted on frame 32' for rotation about axis T-T. The gobo wheel 126 has apertures 128a-d formed in the outer periphery thereof through which substantially all the light diverging from focus 54' may pass therethrough when an aperture is centered across the light path. Again, aperture 128a does not interfere with the light travel. The apertures 128b-d may have characters or other designs meant to project a silhouette or other background design onto the stage. A motor means such as servo motor 129 is used to rotate the gobo wheel 126 to position an aperture across the beam.

A light intensity wheel 130 is rotatably mounted to frame 32' for rotation about an axis U-U. In the preferred embodiment, the outer periphery of

intensity wheel 130 is formed of a material permitting a percentage of light incident thereon to be transmitted therethrough which varies as a linear function of the angle ϕ measured from a reference radius r . The wheel 130 may be a transparent wheel with a reflective coating around the periphery that varies in reflectance from 0% to approximately 100%. This type of wheel is referred to as a circular variable neutral density wheel. Such a wheel is sold by Melles Griot, 1770 Kettering St., Irvine, California as a Circular Linear-Wedge N-D Filter. The periphery is sized to permit the entire light beam to be incident thereon. Portion 132a does not interfere with light passage therethrough. Portions 132b-h have progressively smaller percentages of incident light being transmitted therethrough and reflecting higher percentages of the incident light diverging from focus 54' back into the light. The wheel 130 has been divided into 7 portions 132a-b merely for ease of discussion. The variation of ϕ permits the light transmitted to be varied continuously from virtually 100% to 0% of the incident light. Preferably, the wheel 130 in portion 132h permits no light to be transmitted therethrough, forming an effective means to cut off the light beam 36'. A servo motor 133 is used to rotate a desired portion across the light path.

In a first modification shown in Figure 5b, light intensity wheel 130 may include a number of apertures formed in the outer periphery thereof. Each aperture is sized to permit the entire light beam to pass therethrough. Reflective mirrors are mounted in each of the apertures. The mirrors 132'a-h distributed about the wheel 130' have progressively smaller percentages of incident light being transmitted therethrough and reflect higher percentages of the incident light diverging from focus 54' back into the light. A servo motor may be used to rotate the intensity wheel 130 to position a mirror having a desired percentage of transmission across the light beam. Preferably, one mirror transmits substantially 100% of the light incident thereon to provide a full intensity light beam.

In a second modification, a mechanical iris 135 would be mounted adjacent the lens 138 on either side thereof as illustrated in Figure 3 in phantom line. The mechanical iris 135 would be controlled by a servo motor 137 which would operate to extend or contract the iris to vary the intensity of the light beam emanating from light 110.

A three element zoom lens 134 is positioned within the frame 32' for controlling the divergence of the light beam 36' issuing from the light 110. The three element lens includes a movable center lens 136 positioned between fixed outer lens 138 and 140. In the preferred construction, the zoom lens assembly 134 will permit variation of the beam divergence from an angle of 5 degrees to an angle of 50 degrees as illustrated in Figure 3. The movement of the center element 136 is controlled by a servo motor 142.

As is readily apparent from the description above and the referenced figures, both lights 30

and 110 permit variation of the position, color, and intensity of a light beam. Light 110 also permits variation of the beam divergence. These functions may be remotely controlled in a manner described hereinafter. The lights 30 and 110 are a significant improvement over the prior art lights. The dichroic filters mounted therein for inducing color in the light beams permit a large number of permutations of shades and hues to be created, thereby amplifying the artistic scope available to the director. The dichroic filters transmit light incident thereon and reflect the complement of the color of the transmitted beam. Therefore, no light is absorbed and transformed to heat as found in the prior art use of celluloid gels. The use of a relatively low power projection lamp in lights 30 and 110 substantially reduces the generation of infrared radiation which causes high power consumption and heat buildup within prior art devices.

A flow chart of the light system 10 is shown in Figure 7. Information representing the desired position, color, intensity and beam divergence of a light source 14 is manually entered by an operator or stored in a memory in the controller 160. Each individual light source is identified by a code in address 162. This code identifies the particular light or series of lights to which a set of variable functions is assigned. The information input to controller 160 is placed in a 32 bit parallel format and transferred to a transmitter 164. While a 32 bit data format is suitable for the system 10, it will be understood that the data format would be expendable or contractable as needed to achieve a desired control resolution. The selected light source is represented in address 162 by 8 bits of parallel data which is transferred into transmitter 164. Transmitter 164 translates the parallel data into a 40 bit serial format for transmission along a two conductor twisted signal cable 18. The signal cable 18 may comprise common microphone cable. The first 8 bits of the serial data transmitted represents the address of the light source.

Signal cable 18 represents an open loop system, having receivers 166 branched therefrom associated with each of the light sources 14. Each receiver 166 translates the first 8 bits of serial data to identify the particular light source represented by the data in address 167. The address select 167 includes a number of thumb operated switches for determining the address of the particular light source. If a light source mounted on the truss is rendered inoperable, the light source may be rapidly replaced with a new light source by setting the address of the new light source to correspond with the address of the failed light source. If the associated light source corresponds to the address in the data transmitted, the remaining 32 bits of data are transferred to servo drives 168 and translated from digital information to analog information for controlling the pan and tilt, color, intensity and beam divergence of the light sources. In the embodiment illustrated in Figure 7, four dichroic filters having the dominant colors, red, blue, green and yellow are employed represented by the letter R, B, G and Y.

The manual input by an operator of the information representing the position, color, intensity and beam divergence of the light system 10 is best discussed with reference to the control panel 12 illustrated in Figure 6. The control panel 12 illustrated in Figure 6 is designed to control 32 separate light sources such as lights 30 represented by the 32 keys in the direct assign group 182. The operator may address any one of the 32 light sources by depressing its associated key or a number of the light sources by sequentially depressing the key representing each of the light sources. The position of the selected light source or sources may be adjusted in unison by rotating the pan and tilt controls 184 and 186. The pan and tilt controls activate the gimble mechanism 38 associated with a light 30. Color controls 188, 190, 192 and 194 are provided for adjusting the angle θ of each of the four dichroic filters 58, 60, 62 and 64. In a control panel adapted for use with light 110, the color controls 188—194 will be replaced by two 32 position switches or other means for rotating the desired aperture of the two color wheels 112 and 114 across the path of the light beam.

The intensity control 195 may be used to control the intensity of the light beam from light 30 if a mechanism is provided on the light to do so. When control panel 12 is adapted for use with the light 110, the intensity control 175 would rotate the intensity wheel 130 to adjust the intensity of the light beam as desired.

The zoom control 196 is inactive when control panel 12 is associated with lamp 30. When control panel 12 is adapted for use with light 110, the zoom control may be used to adjust the position of the traveling lens 136.

To avoid adjusting the color of each light manually, a color memory 198 may be provided which associates individual colors with the keys numbered 1 through 16. For example, the color controls 188, 190, 192 and 194 may be adjusted to create a blue light beam. By depressing a selected button, such as 4, in color memory 198 and subsequently the store key 204, the setting of the filters to provide a blue light beam will be stored within the memory. The setting may be recalled by merely depressing the key 4 in color memory 198. This permits the operator to preprogram common colors so that one button operation will set a light to the desired color and avoid the necessity to address four controls for each color setting.

As noted previously, a concert or performance being lit typically has a number of light cues. The independent control of the variable functions in a light source 14 within the light system 10 permits a single light source to be used in a different position, and with a different color, intensity and beam divergence for each cue. The cue control 200 is used to assign the information input regarding position, color, intensity and beam divergence to a particular cue. The cue selected is displayed on a display 202.

Having determined the position, color, intensity and beam divergence for a selected light source for a given cue, this information may be stored in a

(1A)

memory by depressing the store key S in cue control 200. The information stored may be recalled at any desired moment.

Having preset the information with respect to each of the 32 light sources for every cue in a performance, it is necessary to recall the information for each light source for the cues in sequence during the performance. This is accomplished by the use of cross fade controls 206 and 208. When the handle 210 of cross fade control 206 is moved adjacent the display 214, the light system 10 automatically recalls the information regarding each light source and activates the servo drives 168 to position the light sources, adjust the colors, intensities and beam divergences to the value set for the cue displayed in display 214.

As the handle 212 on the cross fade control 208 is moved toward the display 216, the light system 10 recalls the information regarding each light source for the cue displayed in display 216 and activates the servo drives 168 to set the light sources for the cue displayed in display 216.

At the beginning of a performance, the display 216 is typically set to zero and the display 214 is set to one. With the handles 210 and 212 in the position shown adjacent display 216, no stage lighting is provided. Both handles 210 and 212 are moved upward adjacent display 214, thereby setting the light sources for cue 1 and increasing the intensity of the lights to their full value when the handles abut display 214. The display 216 automatically resets to cue 2. At the end of the scene representing cue 1, the handles 210 and 212 are moved downward adjacent display 216 to fade out the settings of cue 1 and fade in the settings of cue 2. If a cue is desired out of numerical sequence, the cue control 220 may be activated to set a desired cue in either display 214 or display 216, the display elected being opposite the present position of the cross fade handles 210 and 212 so that the desired cue may be faded in by moving the handles toward the selected display. The cue control 220 is activated to elect a cue out of sequence by depressing the E key and depressing the keys corresponding to the desired cue. A blackout button 221 is provided for instantaneously darkening the stage by blocking the light beam from every light source. A grand master dimming control 222 is provided for reducing the lighting intensity from the value for a given cue to a total blackout.

A number of preset lighting cues may be desired. In particular, a general stage wash or other lighting setup may be commonly employed. Such a preselected cue may be stored in control panel 12 and recalled by depressing a key on either upper or lower cue controls 218 and 220. If, for example, a general wash cue has been pre-programmed into upper cue control 218 for recall by depressing key 5, the depression of key 5 will cause a letter P, representing preselected and the number 5 to appear in display 214 and the preset cue will be implemented as the cross fade handles 210 and 212 are moved adjacent display 214.

In a similar manner, a preselected cue may be recalled from lower cue control 220 by depressing the associated key, which will cause the letter P and associated key number to be displayed in display 26 and implement the cue as the cross fade handles 210 and 212 are moved adjacent display 216.

A general schematic of the control panel 12 of the present invention is disclosed in Figure 9. The manual controls 350 represent the various switches, buttons, visual displays and sliding controls such as illustrated in Figure 6. The manual controls 350 are interconnected by a bus 352 to a control interface 354. The control interface 354 continuously scans the setting of the manual controls 350 and communicates through a data bus 356 to the control processor 358.

The control panel 12 operates in two separate modes. In the program mode, information is input by the manual control 350 representing the desired position, color, divergence and intensity of the lights 14 for each cue during the show. In the operate mode, the control processor 358 is responsible for recalling the settings of the variable functions from various memories within the control panel and directing the remainder of the control panel to set each light 14 with the proper setting for each cue in sequential order when requested by the operator through the manual controls 350.

In the program mode, the control processor 358 will direct information representing the desired setting for a variable function to one of the five variable function processors. For example, the panning function includes a data bus 360 interconnecting the control processor 358 and a processor interface 362. A bus 382 interconnects the processor interface 362 with the pan function processor 384. A pan cue memory 386 is interconnected with the pan function processor 384 by a data bus 388. Information input to the control processor 358 regarding the panning function will be transmitted along the bus 360 through processor interface 362 and into pan function processor 384 through bus 382. The control processor 358 may direct the pan function processor 384 to store the information in the pan cue memory 386. Similar bus lines 364, 370, 374 and 378 interconnect the control processor 358 with processor interfaces 368, 372, 376 and 380. The processor interfaces 368, 372, 376 and 380 are interconnected through bus lines 390, 398, 406 and 412 to the tilt function processor 392, intensity function processor 400, color function processor 408 and zoom function processor 414. The tilt cue memory 394, intensity cue memory 402, color cue memory 409 and zoom cue memory 416 are interconnected with the associated function processors by data buses 396, 404, 410 and 418.

In the operation mode, where the control processor 358 is commanded to direct the remainder of the control panel 12 to set the variable functions to values retained in each cue memory, control processor 358 acts as an interface between each of the individual function processors

(15)

384, 392, 400 and 408 and 414. The control processor 358 will direct each function processor to recall from memory the setting of the variable function for a particular cue and direct this information through a bus line 420, 424, 428, 432 or 436 to an output interface 422, 426, 430, 434 or 438. Each of the output interfaces is connected by a bus line 440, 442, 444, 446 or 448 to the data link transmitter 164. The data link transmitter 164 converts the parallel data output from the output interfaces to a serial data. It also acts to order the information for each address representing a light or series of lights in a preset order so that each variable function setting is represented by a known position in the stream of data. The data link transmitter 164 then directs the information in serial form along the data link or signal cable 18 to the various receivers 166 associated with each light.

Figures 10a, b, and c illustrate in greater detail the schematic of the control panel 12 of the present invention. The components illustrated in Figure 9 or again illustrated in Figure 10 within dotted lines. The bus lines interconnecting the components of Figure 9 generally form the bus line extending across the dotted lines in Figures 10a, b and c. The manual controls 350 include the variable manual controls 500, such as rotary or linear potentiometers. These controls are fed into an analog to digital converter 502. The manual control switches 504 are sequentially scanned by a switch scanner 506. The input data is transferred to input data latches 508. A control logic 510 having a timing generator 512 connected thereto and a control bus 514 control the operations of the converter 502, scanner 506 and data latches 508 through the latch select logic 516 and latch select bus 518.

The output numerical displays 520 and indicator lamps 522 present output data for indicating to the operator the status of the lighting system 10. The output data travels through output data latches 524 controlled by control logic 510 through a latch select logic 526 and latch select bus 528. A display decoder 530 is required to decode data for display in numeric display 520. An address generator 532 is employed with an address bus 534 to control the operation of the input and output indicators.

The bus 352 illustrated in Figure 9 comprises the control bus 514, address bus 534 and data buses 536 and 538. These buses enter the control interface 354 which includes dual access memories 540 and 542. The function of dual access memory 540 is essentially to retain the status of the controls and switches on the control panel and update this status in a continuous manner. The operation of dual access memory 542 is essentially to retain the status of the displays and indicator lamps on the control panel, and also update in a continuous manner.

The control processor 358 forms the heart of the lighting system and directs each sub-function representing an individual variable function such as panning, tilting, intensity, color and beam

divergence as zoom. The control processor 358 includes a central processing unit 544, an operating program memory 546 and a scratch pad memory 548. Control bus 550 and address bus 552 interconnect the control interface, control processor and individual function processors, and act to form the bus lines 356, 360, 364, 370, 374 and 378 of Figure 9. The operating program memory 546 contains instructions necessary for the central processing unit 544 to control the lighting system. The central processing unit 544 directs input information to the individual function processors or directs the individual processors to recall from memory the setting of the variable function. The central processing unit 544 also directs information back through the dual access memory 542 for visual display to the operator of the status of the system.

The function of only one processor interface, function processor, cue memory and output interface will be described as the others are substantially identical. The dual access memory 554 acts as the processor interface 362 between the control processor 358 and pan function processor 384. The operating program memory 556 within pan function processor 384 directs the central processing unit 558 to control the panning function. A scratch pad memory 560 is provided which forms a random access memory. The cue storage memory 386 stores the entire block of data representing the panning function for each light for every cue during a show. The relative complexity of cue storage memory 386 requires a memory control 564 for proper operation with the other components in the pan function processor. The control bus 566, address bus 568 and data bus 570 interconnect the various components of the pan function processor as indicated as well as the dual access memory 554 and the dual access memory 572 forming the output interface 422 as shown in Figure 9. The intensity and color function processors 400 and 408 differ by having twin dual access memories comprising the processor interface between control processor 358 and the function processor. This is necessary as the cross fade controls and preset colors require feedback to the control processor for proper operation.

The dual access memory 572 forming the output interface of the pan function processor is connected to the address bus 574, the output data bus 576 and a control bus 578. These buses enter the data link transmitter 164 and extend to the output interfaces of the other function processors for tilt, intensity, color and zoom. The parallel to serial converter 580 within the data link transmitter translates the parallel format data from the individual function processors to a ordered serial data form for transmission over the data link or signal cable 18 connected to the transmitter through a line driver 582. The signal transmitted along data link 18 is a bipolar signal. That is, positive, negative and zero voltage level signals are employed. A negative voltage signal is provided as a synchronization pulse between the transmitter and receivers. The negative voltage

signal precedes each block of serial data representing the address of a selected light and the data representing the setting of the variable functions. The receivers sense the negative voltage signal to synchronize the processing of the serial data by each receiver to the transmitter.

In the preferred embodiments, each operating program memory such as 546 and 556 within the control panel 12 comprises a 64 kilobit memory Model 2716 sold by Mostek Corporation of Carrollton, Texas and its associated hardware. Each scratch pad memory such as 548 and 560 is preferably formed of a four kilobyte random access memory sold as Model 4118 by Mostek Corporation of Carrollton, Texas. The cue storage memory for each of the function processors is preferably an 8 kilobyte electrically alterable read only memory such as sold by General Instruments of Hicksville, N.Y. as Model ER 3400. The central processing units such as 544 and 558 within control panel 12 are preferably Model 1802 sold by the Radio Corporation of America of Somerville, New Jersey. The dual access memories such as 554 and 572 within the control panel 12 are preferably formed of a series of multiport registers Model No. 74LS170 such as sold by Texas Instruments of Dallas, Texas. While the lighting system 10 forming the present invention may be constructed with the components noted above, it would be obvious to one skilled in the art to replace or substitute the components with other components to perform substantially the same function.

The schematic of the receiver 166 and servo drive 168 and associated mechanisms within the light source 14 are illustrated in Figure 8. Information representing the desired settings for a selected light source is transmitted as serial data along the signal cable 18. The address select 167 is preprogrammed to select the address of the light source to which it is associated. If the information transmitted along the signal cable 18 does not contain the proper address, the information is rejected by the address select. If the information does contain an address corresponding to the address preprogrammed, the remainder of the serial data, containing the information for setting the light source is transmitted along a line 252 to a series of digital-to-analog converters 254 through 268. The numbers beside each convertor represents the number of bits necessary to communicate the setting of the variable function. The digital-to-analog converters translate portions of the serial data transmitted along the data line 18 to analog voltage signals. The digital-to-analog converter 254 controls the panning mechanism of the associated light source 14 and requires 8 bits of information for operation. The number of bits noted for each variable function in Figure 8 may be varied to achieve the desired resolution. For example, 8 bits of data may be used to position each dichroic filter which increases the precision in positioning the filter. A logic supply 270 connected to the 110 volt AC power input line 20 provides a power

output 272 to operate the digital-to-analog converters.

The voltage signal produced by each converter is transmitted to an amplifier 274 through 286 for amplification and further transmitted to the associated servo motor. In the case of the douser unit 90, a current amplifier 290 is interconnected with the digital-to-analog converter 260 to operate the solenoid 92. Each of the servo motors is provided with reference voltages from an analog supply 292 so that the voltage signal input from the associated amplifier causes the servo motors to move to a predetermined position. The predetermined position is determined by the relative reference voltage levels provided by analog supply 292 and the voltage input from the amplifier. This circuit therefore provides a method for positioning the light source and determining the color, intensity and beam divergence of the light beam from the light source by use of servo motors providing accurate positioning.

The lamp 50 is provided power through the 110 volt input line 20 and lamp supply 293. A fan 106 may also be provided and interconnected with the power input for cooling the light source during operation.

It can be seen from the description above and the accompanying drawings that the lighting system 10 has automatically variable positioning, color, intensity and beam divergence and utilizes movable dichroic filters for color variance and digital computers with storage for control of all the variable functions. While the embodiment disclosed permits 32 light sources to be independently controlled, any number of light sources may be operated by expanding the system. The capacity of lighting system 10 to set the variable functions of a light source from a remote position permits an individual light source to be used in different settings for different cues. Therefore, the typical requirement for 400 separate light sources all prepositioned to light an entire performance may be reduced to as few as 100 light sources 14 controlled by the lighting system 10 to thereby reduce cost. The lighting system 10 also eliminates the need for any dimmers, and associated cables. This vastly simplifies the procedure in setting up stage lighting and eliminates the need for long links of expensive cable. The chop found in AC power lines in conventional lighting systems is also eliminated by the present lighting system 10 and therefore the undesirable noise induced in electronic musical instruments and associated sound reinforcement equipment such as mixing consoles, amplifiers, etc. is reduced.

An operator at the control panel 12 of lighting system 10 may request a particular cue to be recalled from memory and each function of the light source for that cue to be set. The operator may adjust the variable functions for each of the light sources from control panel 12. The present invention therefore eliminates the slow process of positioning lights manually, setting colored gels and other steps in preparing a performance. The variable functions for every light source may be

reset at any time, even during a performance. The lighting system 10 also permits the operator to vary the functions of individual light source selected even during a performance from the control panel.

Claims

1. A lighting system (10) in which at least the orientation of a selected one of a plurality of light sources (14) and/or the color of the light therefrom is remotely controlled, the system comprising controller means (12) which provides an input of information including data representing a predetermined orientation, color of light, or both of a selected one of said light sources (14) and which transmits the information to receiver means (166) associated with each of said light sources (14), said receiver means reading the data representing the predetermined orientation, color of light, or both of the selected light source (14) in order to actuate means (38, 38') to vary the orientation of said light source (14) or to actuate means (74, 80 or 116, 118, 129, 133) to position a filter (58—64; or 112, 114) relative to said source (14), or both, characterised in that the information transmitted to said receiver means (166) is in the form of serial messages, each message including a coded address which respectively represents a particular one of said light sources (14) and further including the data representing the predetermined orientation, color of light, or both for said light source (14); and that a single communication channel (18) is provided to carry said messages to said plurality of light sources (14); each of said receiver means (166) responding to only the respective coded address of its associated light source (14).

2. A lighting system according to claim 1, characterised in that said filter is a dichroic filter (58—64; or 112, 114).

3. A lighting system according to claim 2, wherein each of said light sources (14) includes a lamp (50, 52), characterised in that means (74—80) are provided for causing a variation in the angle of incidence of the light from said lamp (50, 52) on said dichroic filter (58—64).

4. A lighting system according to claim 3, wherein each of said light sources (14) includes a lamp (50, 52) mounted in a frame or housing (32), characterised in that said dichroic filter (58—64) is pivotally mounted (66—72) in said frame or housing (32), whereby light from said lamp (50, 52) passes through and around the edges of said filter (58—64) when pivoted at an angle with respect to the incident light from said lamp (50, 52).

5. A lighting system according to claim 4, characterised in that a plurality of said dichroic filters (58—64) are pivotally mounted (66—72) one behind the other in said frame or housing (32).

6. A lighting system according to claim 4 or 5, characterised in that means (100) are provided to homogenise the light received from the lamp (50, 52) and the dichroic filter system (58—64).

7. A lighting system according to claim 2 wherein each of said light sources (14) includes a lamp (50', 52'), characterised in that a plurality of said dichroic filters ($n, n - 1, \dots$) are mounted in at least one rotatable wheel (112, 114) and means (116, 118) are provided for rotatably positioning said wheel (112, 114) relative to said lamp (50', 52') such that light from the lamp (50', 52') is transmitted through a selected one of said dichroic filters ($n, n - 1, \dots$).

8. A lighting system according to claim 7, characterised in that first and second rotatable wheels (112, 114) are provided, each having a plurality of said dichroic filters ($n, n - 1, \dots$), said first and second wheels (112, 114) being relatively and rotatably mounted such that any one of the dichroic filters ($n, n - 1, \dots$) of said first wheel (112) can be superimposed on any one of the dichroic filters ($n, n - 1, \dots$) of said second wheel (114) to enable selective permutations of the dichroic filters ($n, n - 1, \dots$) of said first and second wheels (112, 114) for the light from said lamp (50', 52').

9. A lighting system according to any one of the preceding claims, wherein each of said light sources (14) comprises means (94 or 130) for varying the intensity of the light from said source (14), and means (134—142) for controlling the divergence of the light from said source (14); said system including means (386, 394, 402, 409, 416) for storing data relating to a required orientation, color of light, intensity of light, or divergence of light from a selected one of said light sources (14), characterised in that said system includes respective data processors (384, 392, 400, 408, 414) for processing said data, and which are connected to respective interfaces (422, 426, 430, 434, 438) which are connected to a data link transmitter (164) to convert parallel data into serial data for transmission on said single communication channel (18) to said light sources (14).

Patentansprüche

1. Beleuchtungssystem (10) bei, dem zumindest die Orientierung einer ausgewählten aus einer Anzahl von Lichtquellen (14) und/oder die Farbe des Lichts von dort ferngesteuert wird, wobei das System eine Steuereinrichtung (12) umfaßt, die eine Informationseingabe einschließlich Daten liefert, die eine vorbestimmte Lichtorientierung, Lichtfarbe oder beides einer ausgewählten der Lichtquellen (14) darstellen, und die die Information zu einer jeder der Lichtquellen (14) zugeordneten Empfängereinrichtung (166) überträgt, wobei die Empfängereinrichtung die die vorbestimmte Orientierung, Lichtfarbe oder beides der ausgewählten Lichtquelle (14) darstellenden Daten liest, um eine Einrichtung (38, 38') zu betätigen, um die Orientierung der Lichtquelle (14) zu verändern oder um Einrichtungen (74, 80 oder 116, 118, 129, 133) zu betätigen, um einen Filter (58—64; oder 112, 114) bezüglich der Quelle (14) anzuordnen, oder für beides, dadurch gekennzeichnet, daß die zur Empfängereinrichtung (166)

(19)

reset at any time, even during a performance. The lighting system 10 also permits the operator to vary the functions of individual light source selected even during a performance from the control panel.

Claims

1. A lighting system (10) in which at least the orientation of a selected one of a plurality of light sources (14) and/or the color of the light therefrom is remotely controlled, the system comprising controller means (12) which provides an input of information including data representing a predetermined orientation, color of light, or both of a selected one of said light sources (14) and which transmits the information to receiver means (166) associated with each of said light sources (14), said receiver means reading the data representing the predetermined orientation, color of light, or both of the selected light source (14) in order to actuate means (38, 38') to vary the orientation of said light source (14) or to actuate means (74, 80 or 116, 118, 129, 133) to position a filter (58—64; or 112, 114) relative to said source (14), or both, characterised in that the information transmitted to said receiver means (166) is in the form of serial messages, each message including a coded address which respectively represents a particular one of said light sources (14) and further including the data representing the predetermined orientation, color of light, or both for said light source (14); and that a single communication channel (18) is provided to carry said messages to said plurality of light sources (14); each of said receiver means (166) responding to only the respective coded address of its associated light source (14).

2. A lighting system according to claim 1, characterised in that said filter is a dichroic filter (58—64; or 112, 114).

3. A lighting system according to claim 2, wherein each of said light sources (14) includes a lamp (50, 52), characterised in that means (74—80) are provided for causing a variation in the angle of incidence of the light from said lamp (50, 52) on said dichroic filter (58—64).

4. A lighting system according to claim 3, wherein each of said light sources (14) includes a lamp (50, 52) mounted in a frame or housing (32), characterised in that said dichroic filter (58—64) is pivotally mounted (66—72) in said frame or housing (32), whereby light from said lamp (50, 52) passes through and around the edges of said filter (58—64) when pivoted at an angle with respect to the incident light from said lamp (50, 52).

5. A lighting system according to claim 4, characterised in that a plurality of said dichroic filters (58—64) are pivotally mounted (66—72) one behind the other in said frame or housing (32).

6. A lighting system according to claim 4 or 5, characterised in that means (100) are provided to homogenise the light received from the lamp (50, 52) and the dichroic filter system (58—64).

7. A lighting system according to claim 2 wherein each of said light sources (14) includes a lamp (50', 52'), characterised in that a plurality of said dichroic filters ($n, n - 1, \dots$) are mounted in at least one rotatable wheel (112, 114) and means (116, 118) are provided for rotatably positioning said wheel (112, 114) relative to said lamp (50', 52') such that light from the lamp (50', 52') is transmitted through a selected one of said dichroic filters ($n, n - 1, \dots$).

8. A lighting system according to claim 7, characterised in that first and second rotatable wheels (112, 114) are provided, each having a plurality of said dichroic filters ($n, n - 1, \dots$), said first and second wheels (112, 114) being relatively and rotatably mounted such that any one of the dichroic filters ($n, n - 1, \dots$) of said first wheel (112) can be superimposed on any one of the dichroic filters ($n, n - 1, \dots$) of said second wheel (114) to enable selective permutations of the dichroic filters ($n, n - 1, \dots$) of said first and second wheels (112, 114) for the light from said lamp (50', 52').

9. A lighting system according to any one of the preceding claims, wherein each of said light sources (14) comprises means (94 or 130) for varying the intensity of the light from said source (14), and means (134—142) for controlling the divergence of the light from said source (14); said system including means (386, 394, 402, 409, 416) for storing data relating to a required orientation, color of light, intensity of light, or divergence of light from a selected one of said light sources (14), characterised in that said system includes respective data processors (384, 392, 400, 408, 414) for processing said data, and which are connected to respective interfaces (422, 426, 430, 434, 438) which are connected to a data link transmitter (164) to convert parallel data into serial data for transmission on said single communication channel (18) to said light sources (14).

Patentansprüche

1. Beleuchtungssystem (10) bei, dem zumindest die Orientierung einer ausgewählten aus einer Anzahl von Lichtquellen (14) und/oder die Farbe des Lichts von dort ferngesteuert wird, wobei das System eine Steuereinrichtung (12) umfaßt, die eine Informationseingabe einschließlich Daten liefert, die eine vorbestimmte Lichtorientierung, Lichtfarbe oder beides einer ausgewählten der Lichtquellen (14) darstellen, und die die Information zu einer jeder der Lichtquellen (14) zugeordneten Empfängereinrichtung (166) überträgt, wobei die Empfängereinrichtung die die vorbestimmte Orientierung, Lichtfarbe oder beides der ausgewählten Lichtquelle (14) darstellenden Daten liest, um eine Einrichtung (38, 38') zu betätigen, um die Orientierung der Lichtquelle (14) zu verändern oder um Einrichtungen (74, 80 oder 116, 118, 129, 133) zu betätigen, um einen Filter (58—64; oder 112, 114) bezüglich der Quelle (14) anzuordnen, oder für beides, dadurch gekennzeichnet, daß die zur Empfängereinrichtung (166)



übertragene Information in der Form serieller Nachrichten vorliegt, wobei jede Nachricht eine codierte Adresse umfaßt, die jeweils eine einzelne der Lichtquellen (14) darstellt, und weiter die Daten umfaßt, die die vorbestimmte Orientierung, Lichtfarbe oder beides für die Lichtquellen (14) darstellen; und daß ein einziger Nachrichtenkanal (18) vorgesehen ist, um die Nachrichten zu der Anzahl von Lichtquellen (14) zu befördern; wobei jede der Empfangereinrichtungen (166) nur auf die jeweilige codierte Adresse ihrer zugeordneten Lichtquelle (14) anspricht.

2. Beleuchtungssystem nach Anspruch 1, dadurch gekennzeichnet, daß der Filter ein dichroitischer Filter (58—64; oder 112, 114) ist.

3. Beleuchtungssystem nach Anspruch 2, bei dem jede der Lichtquellen (14) eine Lampe (50, 52) umfaßt, dadurch gekennzeichnet, daß Einrichtungen (74—80) vorgesehen sind, um eine Veränderung im Winkel des Einfalls des Lichts von der Lampe (50, 52) auf dem dichroitischen Filter (58—64) zu bewirken.

4. Beleuchtungssystem nach Anspruch 3, bei dem jede der Lichtquellen (14) eine in einem Rahmen oder Gehäuse (32) angebrachte Lampe (50, 52) umfaßt, dadurch gekennzeichnet, daß der dichroitische Filter (58—64) schwenkbar in dem Rahmen oder Gehäuse (32) angebracht ist (66—72), wodurch Licht von der Lampe (50, 52) durch und um die Ränder des Filters (58—64) gelangt, wenn er um einen Winkel in bezug auf das einfallende Licht von der Lampe (50, 52) geschwenkt ist.

5. Beleuchtungssystem nach Anspruch 4, dadurch gekennzeichnet, daß eine Anzahl der dichroitischen Filter (58—64) schwenkbar einer hinter dem anderen in dem Rahmen oder Gehäuse (32) angebracht sind (66—72).

6. Beleuchtungssystem nach Anspruch 4 oder 5, dadurch gekennzeichnet, daß Einrichtungen (100) vorgesehen sind, um das von der Lampe (50, 52) und dem dichroitischen Filtersystem (58—64) empfangene Licht zu homogenisieren.

7. Beleuchtungssystem nach Anspruch 2, bei dem jede der Lichtquellen (14) eine Lampe (50', 52') umfaßt, dadurch gekennzeichnet, daß eine Anzahl der dichroitischen Filter ($n, n - 1, \dots$) in zumindest einem drehbaren Rad (112, 114) angeordnet ist und Einrichtungen (116, 118) vorgesehen sind, um das Rad (112, 114) in bezug auf die Lampe (50', 52') derart drehbar zu positionieren, daß Licht von der Lampe (50', 52') durch einen ausgewählten der dichroitischen Filter ($n, n - 1, \dots$) übertragen wird.

8. Beleuchtungssystem nach Anspruch 7, dadurch gekennzeichnet, daß erste und zweite drehbare Räder (112, 114) vorgesehen sind, die jeweils eine Anzahl der dichroitischen Filter ($n, n - 1, \dots$) aufweisen, wobei die ersten und zweiten Räder (112, 114) relativ und drehbar derart angebracht sind, daß ein beliebiger der dichroitischen Filter ($n, n - 1, \dots$) des ersten Rads (112) über einen beliebigen der dichroitischen Filter ($n, n - 1, \dots$) des zweiten Rads (114) angeordnet

werden kann, um selektive Permutationen der dichroitischen Filter ($n, n - 1, \dots$) des ersten und des zweiten Rads (112, 114) für das Licht von der Lampe (50', 52') zu ermöglichen.

9. Beleuchtungssystem nach einem beliebigen der vorhergehenden Ansprüche, bei dem jede der Lichtquellen (14) Einrichtungen (94 oder 130) zur Veränderung der Intensität des Lichts von der Quelle (14) und Einrichtungen (134—142) zur Steuerung der Divergenz des Lichts von der Quelle (14) umfaßt; wobei das System Einrichtungen (386, 394, 402, 409, 416) zum Speichern von Daten enthält, die sich auf eine benötigte Orientierung, Lichtfarbe, Lichtintensität oder Lichtdivergenz von einer ausgewählten der Lichtquellen (14) beziehen, dadurch gekennzeichnet, daß das System entsprechende Datenverarbeitungseinrichtungen (384, 392, 400, 408, 414) umfaßt, die zur Verarbeitung der Daten dienen und die mit entsprechend Schnittstellen (422, 426, 430, 434, 438) verbunden sind, die mit einer Datenübertragungseinrichtung (164) verbunden sind, um parallel Daten in serielle Daten für die Übertragung auf dem einzigen Nachrichtenkanal (18) zu den Lichtquellen (14) umzuwandeln.

Revendications

1. Système d'éclairage (10) dans lequel au moins l'orientation de l'une choisie d'une pluralité de sources lumineuses (14) et/ou la couleur de la lumière en provenant est commandée à distance, ce système comprenant un moyen contrôleur (12) qui fournit une entrée d'information comprenant des données représentant une orientation prédéterminée, la couleur de la lumière ou les deux pour l'une sélectionnée des sources lumineuses (14) et qui transmet l'information à un moyen récepteur (166) associé à chacune des sources lumineuses (14), le moyen récepteur lisant les données représentant l'orientation prédéterminée, la couleur de la lumière ou les deux pour la source lumineuse choisie (14) de façon à actionner les moyens (38, 38') pour faire varier l'orientation de la source lumineuse (14) ou pour actionner des moyens (74, 80 ou 116, 118, 119, 133) pour positionner un filtre (58—64; ou 112, 114) relatif à ladite source (14), ou les deux, caractérisé en ce que l'information transmise vers le moyen récepteur (166) est sous forme de messages série, chaque message comprenant une adresse codée qui représente respectivement l'une particulière des sources lumineuses (14) et comprenant en outre les données représentant l'orientation prédéterminée, la couleur de la lumière, ou les deux pour ladite source lumineuse (14); et en ce qu'un canal de communication unique (18) est prévu pour transporter lesdits messages à ladite pluralité de sources lumineuses (14); chacun desdits moyens récepteurs (166) répondant seulement à l'adresse codée respective de sa source lumineuse associée (14).

2. Système d'éclairage selon la revendication



(19)

1, caractérisé en ce que ledit filtre est un filtre dichroïque (58—64; ou 112, 114).

3. Système d'éclairage selon la revendication 2, dans lequel chacune desdites sources lumineuses (14) comprend une lampe (50, 52), caractérisé en ce que des moyens (74—80) sont prévus pour provoquer une variation de l'angle d'incidence de la lumière en provenance de la lampe (50, 52) sur le filtre dichroïque (58—64).

4. Système d'éclairage selon la revendication 3, dans lequel chacune desdites sources lumineuses (14) comprend une lampe (50, 52) montée dans un cadre ou boîtier (32), caractérisé en ce que ledit filtre dichroïque (58—64) est monté à pivotement (66—72) dans ledit cadre ou boîtier (32), d'où il résulte que la lumière en provenance de ladite lampe (50, 52) passe par et autour des bords du filtre (58—64) quand elle est tournée d'un certain angle par rapport à la lumière incidente en provenance de la lampe (50, 52).

5. Système d'éclairage selon la revendication 4, caractérisé en ce que plusieurs desdits filtres dichroïques (58—64) sont montés à pivotement (66—72) l'un derrière l'autre dans ledit cadre ou boîtier (32).

6. Système d'éclairage selon l'une des revendications 4 ou 5, caractérisé en ce que des moyens (100) sont prévus pour homogénéiser la lumière reçue de la lampe (50, 52) et du système de filtres dichroïques (58—64).

7. Système d'éclairage selon la revendication 2, dans lequel chacune desdites sources lumineuses (14) comprend une lampe (50', 52'), caractérisé en ce qu'une pluralité de ces filtres dichroïques ($n, n - 1, \dots$) est montée dans au moins une roue susceptible de tourner (112, 114) et en ce que des moyens (116, 118) sont prévus pour positionner en rotation ladite roue (112, 114) par rapport à ladite lampe (50', 52'), de sorte que la lumière en provenance de la lampe (50', 52') est transmise

par l'intermédiaire de l'un choisi des filtres dichroïques ($n, n - 1, \dots$).

8. Système d'éclairage selon la revendication 7, caractérisé en ce que des première et seconde roues pouvant tourner (112, 114) sont prévues, chacune comprenant une pluralité desdits filtres dichroïques ($n, n - 1, \dots$), les première et seconde roues (112, 114) étant montées de façon relative et pouvant tourner de sorte que l'une quelconque des filtres dichroïques ($n, n - 1, \dots$) de ladite première roue (112) peut être superposé à l'un quelconque des filtres dichroïques ($n, n - 1, \dots$) de la seconde roue (114) pour permettre des permutations sélectives des filtres dichroïques ($n, n - 1, \dots$) des première et seconde roues (112, 114) pour la lumière en provenance de ladite lampe (50', 52').

9. Système d'éclairage selon l'une quelconque des revendications précédentes, dans lequel chacune des sources lumineuses (14) comprend des moyens (94 ou 130) pour faire varier l'intensité de la lumière en provenance de la source (14), et des moyens (134—142) pour commander la divergence de la lumière en provenance de la source (14); ce système comprenant des moyens (386, 394, 402, 409, 416) pour mémoriser des données ayant trait à une orientation requise, à la couleur de la lumière, à l'intensité de la lumière ou à la divergence de la lumière en provenance de l'une choisie des sources lumineuses (14), caractérisé en ce que ce système comprend des processeurs de données respectifs (384, 392, 400, 408, 414) pour traiter lesdites données, et qui sont connectés aux interfaces respectives (422, 426, 430, 434, 438) qui sont connectées à un émetteur de liaison de données (164) pour convertir des données parallèles en données série pour transmission sur ledit canal de communication unique (18) vers lesdites sources lumineuses (14).



* C L M S *