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Belliveau

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(54) **SELECTABLE AUDIO CONTROLLED PARAMETERS FOR MULTIPARAMETER LIGHTS**

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(58) **Field of Search** 315/149, 154, 315/292, 295, 312, 316, 362; 362/85, 233, 239; 340/825.22, 825.24

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(57) **ABSTRACT**

Individual variable parameters of a multiparameter lighting device may be varied in response to a processed audio signal. The multiparameter lighting device is equipped with an audio transducer to receive sound waves in the vicinity of the device. The audio signal generated by the transducer in response to the sound waves is sent to a signal processor where the audio signal is processed and converted to a control signal for varying selected parameters of the multiparameter lighting device. The multiparameter lighting device is operated remotely from a control device using a digital communication scheme. An operator of the control device may remotely select which parameter of the multiparameter lighting device may be varied in response to the processed audio signal. One or several parameters may be varied in response to the processed audio signal. The intensity of the light source may also be varied in response to the processed audio signal.

29 Claims, 5 Drawing Sheets

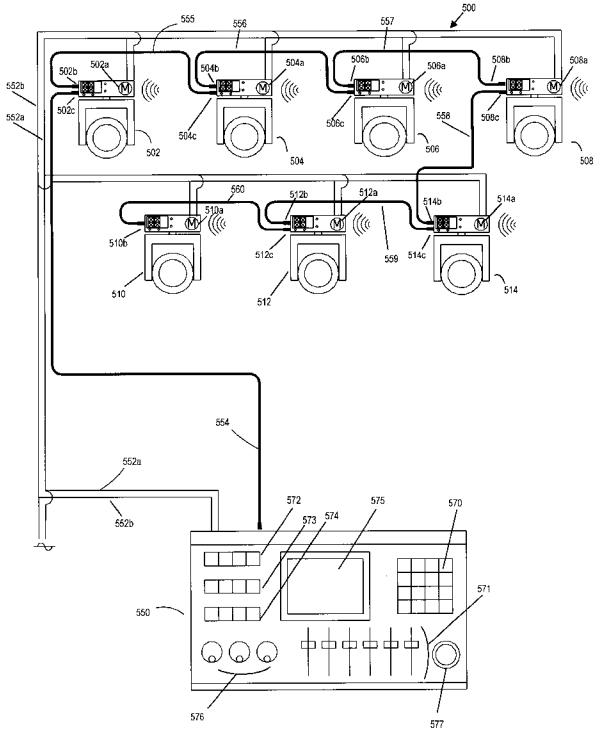


Fig. 1
(Prior Art)

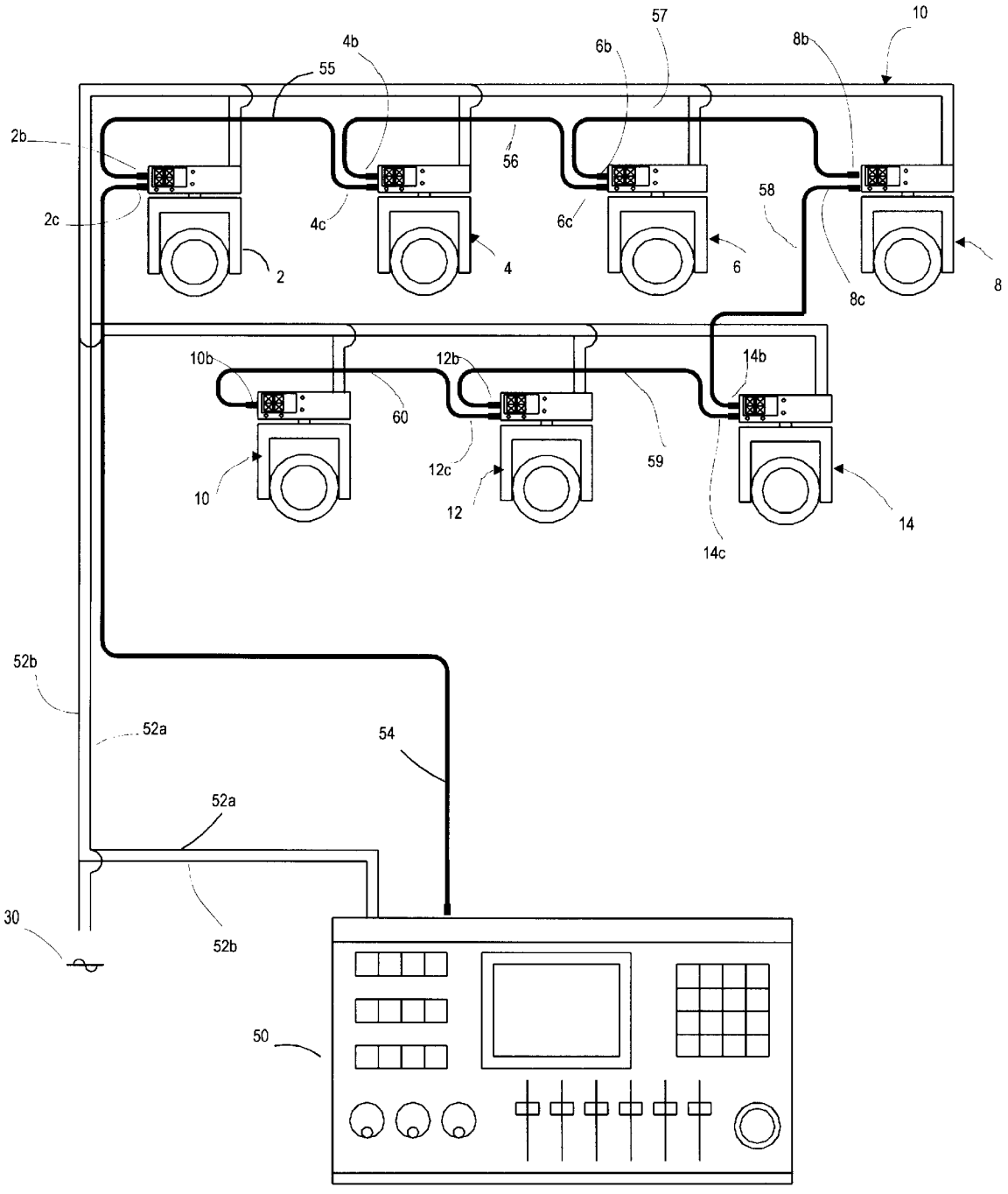


Fig. 2A
(Prior Art)

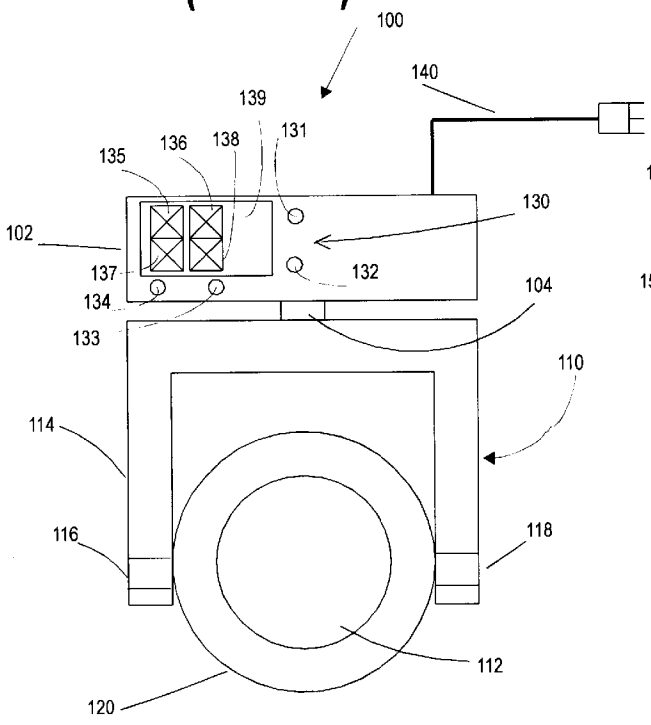


Fig. 2B
(Prior Art)

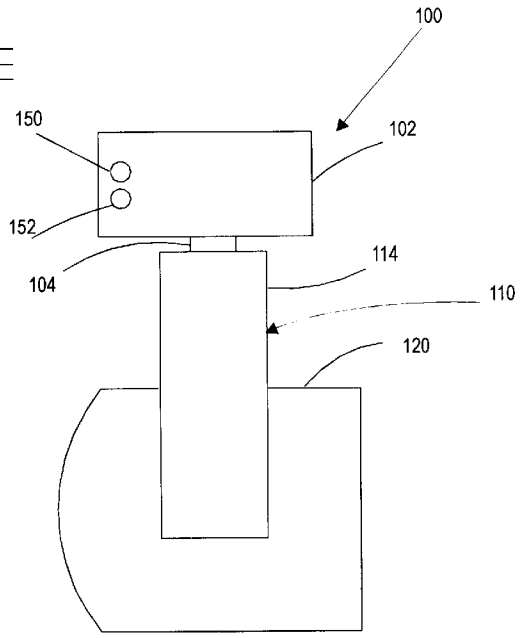


Fig. 3A

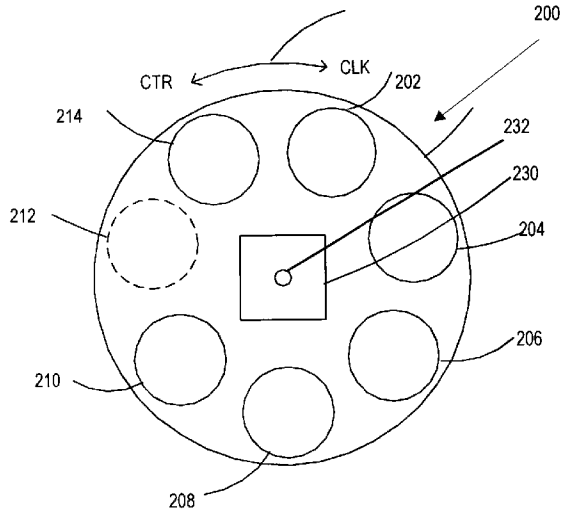


Fig. 3B

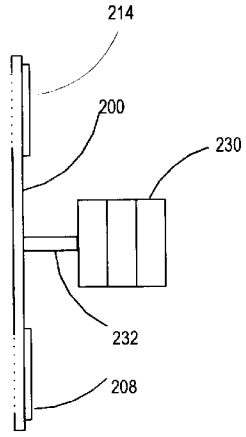


Fig. 3C

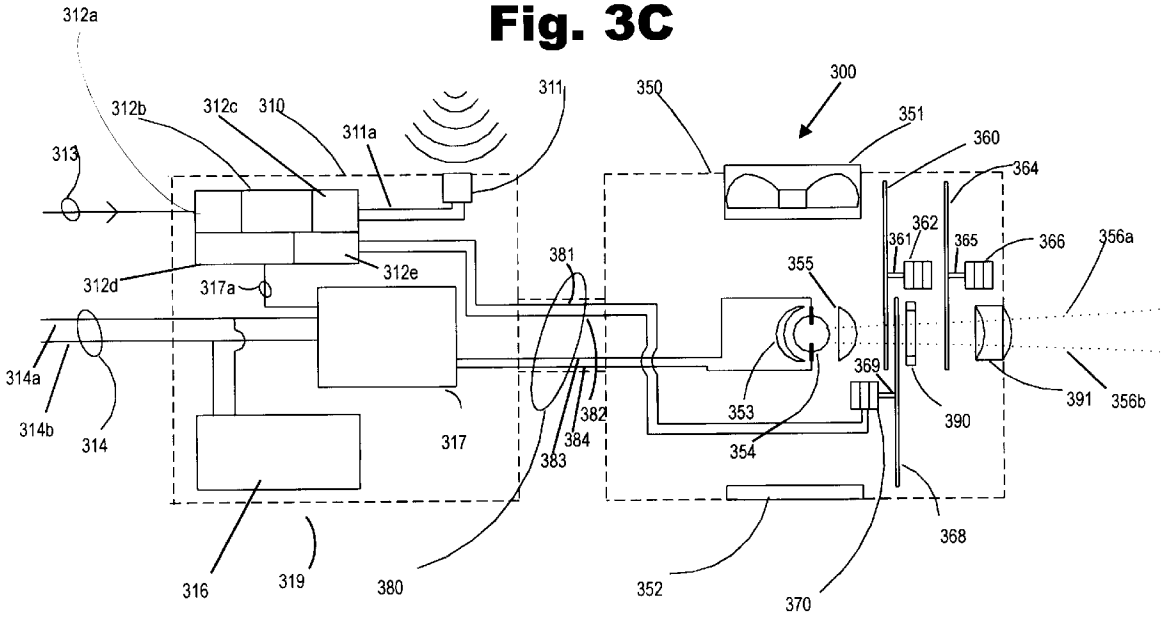


Fig. 4

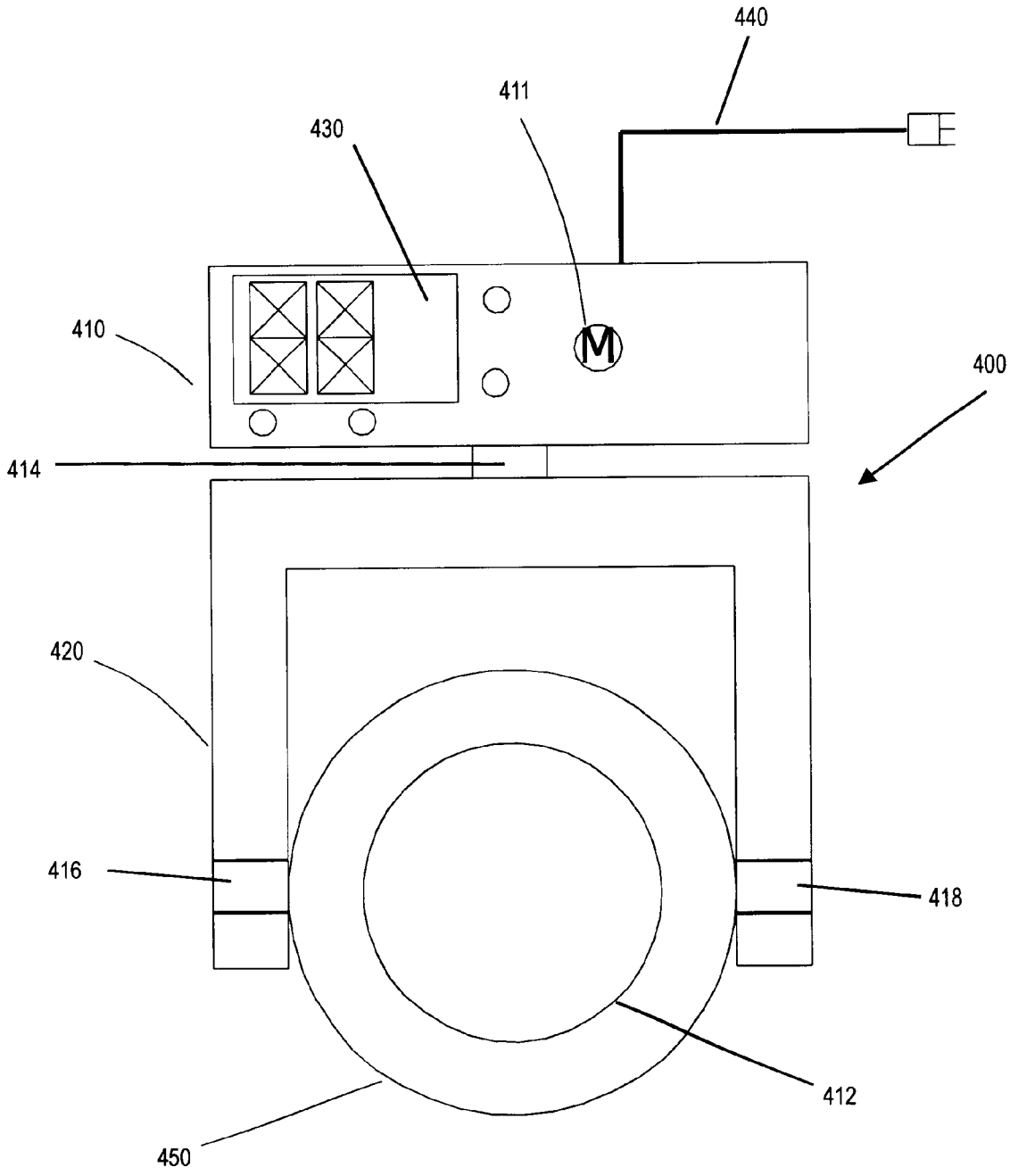
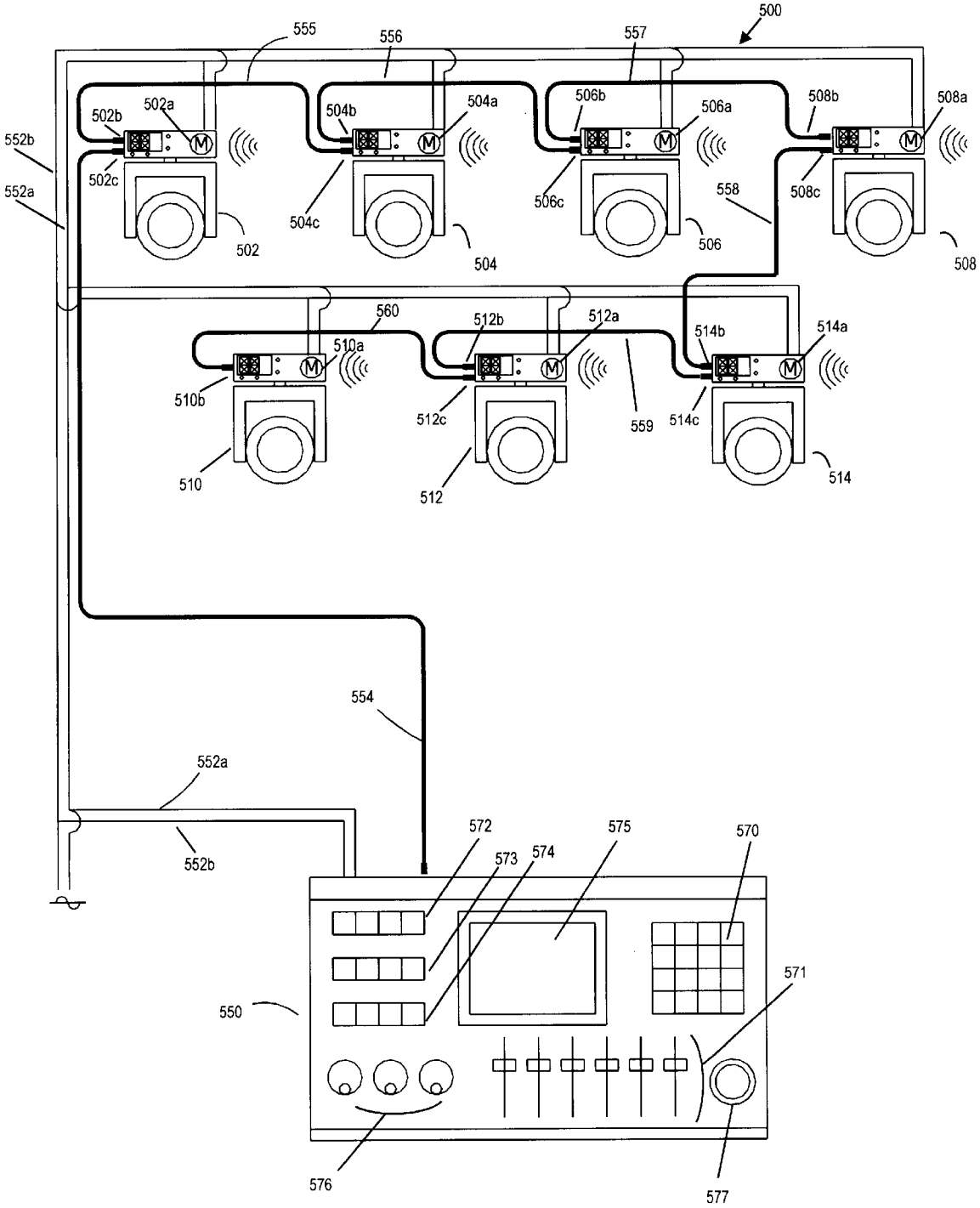


Fig. 5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SELECTABLE AUDIO CONTROLLED PARAMETERS FOR MULTIPARAMETER LIGHTS

FIELD OF THE INVENTION

The invention relates to stage lighting and more particularly multiparameter lights with remote controlled parameters.

BACKGROUND OF THE INVENTION

Stage lighting instruments may be used in theatre, rock concerts, restaurants, nightclubs, or special events. Multiparameter stage lighting instruments or devices are typically comprised of a light source and one or more parameters that may be controlled by an operator through a control device. U.S. Pat. No. 4,392,187 to Bohnhorst, which is incorporated by reference and which is titled: "Computer controlled lighting system having automatically variable position, color, intensity and beam divergence," describes multiparameter lighting devices and a central control device. Multiparameter lighting devices may offer several variable parameters such as pan, tilt, color, pattern, iris and focus. Multiparameter lighting devices are often controlled by a remote control device under the direction of an operator. The remote control device is typically hardwired to the multiparameter lighting devices through communication lines and there is "remote" control in the sense that the multiparameter lighting devices may be at distant locations. An operator may program the control device to produce a show with the multiparameter lighting devices.

The shows programmed by the operator may consist of twenty or more multiparameter lighting devices. Each multiparameter lighting device may have as many as eight to twelve parameters that may be varied to produce a desired lighting effect. The parameters to be varied are selected by an operator of the remote control device. The operator may program the multiparameter lighting devices from the control device to produce a "scene". A scene is produced by varying the parameters for each of the multiparameter lighting devices as to produce a desired effect. In the prior art within a scene a particular multiparameter lighting device will have its parameters set in a particular manner, for example the color may be set to "red", the tilt may be set to ninety degrees, the pattern may be set to a circular pattern, etc.

Each scene for the total of the twenty or more multiparameter lighting devices may take the operator of the control device considerable time to program. For each scene the average of twenty multiparameter lighting devices often comprised of eight to twelve parameters each, results in a large amount of options for the operator. The final result of the show that utilizes twenty or more multiparameter lighting devices may have fifty to one hundred scenes where each scene contains hundreds of parameters of many multiparameter lighting devices that are varied.

The operator of the control device may spend considerable time programming the show using the control device. Sometimes the show rehearsal times do not allow enough time for the operator to be as creative as they would like. With so many parameters available from each multiparameter lighting device, it can be very time consuming for the operator to address each one. ("Addressing" typically requires an operator of the control device to identify by operator inputs the"address" or unique identification for a particular multiparameter lighting device, and then after the address signal has been sent, allows the operator through additional operator inputs to specify each parameter of the multiparameter lighting device).

For instance, to set the color parameter of a multiparameter light may require setting a color wheel to a particular rotational position (a color wheel may typically have eight apertures one for each color) which is located on the multiparameter lighting device. The color wheel of a multiparameter lighting device may index from one color (one rotational position) to another when a color change command is received from the control device. If the operator wants to sequence several colors from the wheel to be placed in the light path he normally must program a separate scene for each color to be presented into the light path. Next, the scenes of selected colors are sequenced at the control device by the operator. The operator may "play back" the programmed scenes (that he programmed) sequentially by inputting a command to the control device or by a signal from the control device. The prior art multiparameter lighting devices do not typically store the "scenes" or if they are stored they are pre-stored as in the prior art TRACKSPOT (registered trademark) device at a factory. The TRACKSPOT (registered trademark) device is disclosed in TRACKSPOT (registered trademark) User Manual, copyright High End Systems, Inc. 1997, P/N 60600034, Version 4.1 which is incorporated by reference. The control device, which is located remotely, sends control signals which cause the scenes to sequence. The programming of the show, with its corresponding scenes, can be very time consuming for the operator, as each multiparameter lighting device might be individually addressed and its many parameters varied.

In order to reduce the programming time that the operator requires to be creative, manufactures of multiparameter lighting devices have included various additional commands for many of the parameters. These various additional commands might be considered as macros. A color wheel utilized by the multiparameter lighting device may most often respond to indexing commands that are sent to the light from the control device. An indexing command allows the operator to choose which color is to be placed in the light path of the multiparameter lighting device. The various additional commands or macros may include random color at a fast change speed, random color at a slow change speed, color spin at a fast change speed (the color wheel rotates continuously), color spin at a slow change speed. By selecting one of the color parameter macros, the operator can save the programming time necessary to create something similar that might be accomplished using multiple scenes with the corresponding required indexing commands.

As another example, a mechanical shutter parameter used to blackout the light emitted by the multiparameter lighting device, may not only be programmable "on or off" but different actions of the shutter may also be chosen. This means for a stroboscopic effect where the shutter may open and close several hundred times, the operator need not program the shutter to open and close several hundred times by programming several hundred scenes that sequence. Instead the operator may communicate from the control device to the multiparameter lighting device a macro command that operates from the operating memory of the multiparameter lighting device. This macro command may provide the repetitive opening and closing of the shutter necessary to create the stroboscopic effect.

The operator of the control system may implement several macros in to each scene during the programming of the show. Many multiparameter lighting devices may have several macros available per parameter. The macro commands available affect the parameters of the multiparameter lighting device, save the operator time and allow for greater creativity.

After programming the show on the control device, the show containing all the scenes and corresponding parameters for each of the multiparameter lighting devices is recalled from the control device's memory. The scenes can be called up during the actual show by the operator who may be present at the control device during the show or they might be synchronized to a timer, so that they are automatically called up during the show. If the scenes are called up by the operator during the show, it is important that the correct scene be called up at the correct moment during the show. During a musical or a rock concert, the operator may call up scenes precisely in time with a climactic musical score. This offers the audience of the show a sense that the lighting is tracking or responding to the show.

Various methods of controlling a show to audio without the operator precisely keeping time with a musical score have been tried in the prior art. Control systems such as the High End Systems INTELLABEAM (trademarked) controller as illustrated in the High End Systems All Product Brochure have included an audio input to the control device. An audio signal is provided to the audio input of the control device. This audio input is converted to a control signal that is used to advance a scene that has already been programmed by an operator. Several scenes may be advanced as an audio signal is received at the input of the control device. Unfortunately this prior art method of advancing the scenes to audio only advances the preprogrammed scenes and whatever parameters have changed due to the programming of the scenes.

At least one manufacture has included a transducer or microphone within the multiparameter lighting device housing to detect an audio signal. The TRACKSPOT (trademarked) multiparameter lighting device as illustrated in the High End Systems All Product Brochure is equipped with a microphone for advancing scenes when one of the multiparameter lighting devices is selected as a "master unit". The master unit converts the audio signal received by the microphone and utilizes the converted signal to advance the preprogrammed scenes contained within the master's memory. The master in turn advances the scenes of the rest of the multiparameter lighting devices that are on the same communication system visually simultaneously with the audio advance signal received by the master. This prior art audio advance system is limited as it only advances the preprogrammed scenes to a processed audio signal. An operator cannot program a scene at the control system and select a parameter of an individual TRACKSPOT (trademarked) multiparameter light to be audio responsive. The Trackspot system only advances the factory programmed scenes to the audio. When a scene is advanced the parameters of the lights in that scene are not audio responsive.

SUMMARY OF THE INVENTION

The present invention in one embodiment provides an apparatus comprising a first multiparameter lighting device, wherein the first multiparameter lighting device is comprised of a first transducer, and a first node for receiving a first digital communications signal, and a first processor.

The first transducer may change sound waves into a first audio electrical signal. The first processor may receive a digital communications signal and in response cause a first parameter of the first multiparameter lighting device to be modified in response to the first audio electrical signal. The first digital communications signal may specify the first parameter. The first digital communications signal may specify additional parameters. The parameters of the multiparameter lighting device may be the color emitted by the device, tilt of the device, a pattern of light emitted by the device, or the intensity of the light emitted by the device.

In one embodiment a control device is provided which provides the first digital communications signal. The control device may be electrically connected to the first multiparameter lighting device through one or more communication lines.

A plurality of further multiparameter lighting devices may also be provided whose parameters can be controlled by the control device. Each further multiparameter lighting device may have a sound transducer for receiving sound waves, a node for receiving a digital communications signal from the control device; and a processor for causing an individual parameter of any of the plurality of multiparameter lighting devices to be modified in response to a particular audio electrical signal. The control device may provide various digital communications signals to control the multiparameter lighting devices. The communication signals may be provided in response to operator inputs supplied at the control device.

The present invention in various a embodiment provides the ability to "remotely" select audio controlled parameters for multiparameter lighting devices. "Remotely" is used to mean where a control device is located at a different location from a multiparameter lighting device but the control device may still be hardwired to the multiparameter lighting device through communication lines. For the most part, the hard wired system is used. From time to time the wires can not be run and the hard wired communications node at the control device is plugged into a transmitter. In a wireless form, a transmitter would typically send the communications signal or signals to a receiver that outputs again to hard wire. The present invention in one embodiment allows the operator of a control device for a group of multiparameter lighting devices the ability to select audio macros for certain equipped parameters of the multiparameter lighting devices. For example, a color parameter of a multiparameter lighting device may respond to the prior art commands received from operator inputs of a control device such as color index or macros such as color spin or random color yet also respond to certain audio controlled macros. The present invention in one embodiment allows several parameters of a multiparameter light to be selected to respond to an audio signal while several others may be selected not to respond to the audio signal.

With embodiments of the present invention, a much greater dimension of control options are made available for multiparameter lighting devices. During the programming of shows that have limited programming time available, the audio controlled parameters allow the operator of the control device more creativity and as such greater productivity. Embodiments of the present invention allow an operator of the multiparameter lighting devices to select, during programming, which parameter of which light is to be responsive to audio signals.

The multiparameter lighting device of the invention can be equipped with a sound transducer such as a microphone for receiving external sound waves and converting the sound waves into one or more audio electrical signals. The audio electrical signal derived from the microphone may be amplified and the amplified audio electrical signal may be fed to an analog to digital converter as part of a signal processor. The amplifier and analog to digital converter, and other signal processing, may be integrated into a microprocessor

on the multiparameter lighting device. The microprocessor processes the digital audio signal in various ways that are derived from operating software programmed in the microprocessor. For instance, the digital audio signal may be processed to remove all frequency components except the low frequencies.

The microprocessor may process the audio signal to remove all frequency components except the midrange audio frequencies. The processed midrange information may be used by the microprocessor to effect changes to the parameters of the multiparameter lighting device controlled by the processor. The microprocessor may omit all frequency components except the low frequency components. The low frequency information might be processed by the microprocessor to effect changes to the selected parameters of the multiparameter lighting device controlled by the microprocessor.

The operator of the control device may start by programming a scene. The creation of the scene may involve the programming of several multiparameter lighting devices and their parameters. One of the multiparameter lighting devices is addressed by the control device under the guidance of an operator as it has been in the prior art. The operator may select from the addressed multiparameter lighting device a parameter to control. For instance, the operator may select to control the color parameter. With the multiparameter lighting device of embodiments of the present invention, the color command set for the color parameter of a particular multiparameter lighting device might include one or several audio macros that affect the color parameter. The control device would tell a multiparameter lighting device which audio macro is to be executed in response to which audio signal inputs.

BRIEF DESCRIPTION OF THE INVENTION

FIG. **1** illustrates a typical multiparameter light system of the prior art;

FIG. **2**A illustrates the general appearance of a prior art type of multiparameter lighting device;

FIG. **2**B illustrates a side view of the prior art multiparameter lighting device described in FIG. **2**A;

FIG. **3**A illustrates a color wheel of the prior art. Shown are several color apertures, a motor and the color wheel;

FIG. **3**B is a side view of the color wheel described in FIG. **3**A;

FIG. **3**C illustrates a multiparameter lighting device of an embodiment of the present invention;

FIG. **4** illustrates a multiparameter lighting device of an embodiment of the present invention; and

FIG. **5** illustrates a multiparameter lighting system in accordance with an embodiment of the present invention.

DETAILED DESCRIPTION OF THE DRAWINGS

FIG. **1** illustrates a typical multiparameter light system **10** of the prior art. A control device **50** is shown that is used to program the parameters of a plurality of multiparameter lighting devices **2**, **4**, **6**, **8**, **10**, **12**, and **14**. The control device **50** and the multiparameter lighting devices **2** through **14** are connected to the power source **30** (which may be an alternating current "AC" power source) through power lines **52***a* and **52***b*. Although seven multiparameter lighting devices **2–14** are shown, typical systems may consist of twenty or more of such multiparameter lighting devices.

A digital communication line comprised of a plurality of communication lines is illustrated. Digital communication line **54** (which may be a communications bus comprised of two or more wires) is connected to control device **50** and to the communications input **2***c*. Digital communication line **55** is electrically connected to communications output **2***b* and to communications output **4***c*. Digital communication lines **56**, **57**, **58**, **59**, and **60** are electrically connected to communications output **4***b* and communications input **6***c*, communications output **6***b* and communications input **8***b*, communications output **8***c* and communications input **14***b*, communications output **14***c* and communications input **12***b*, and communications output **12***c* and communications input **10***b* respectively. The digital communication lines **54–60** transmit control information from the control device **50** to the multiparameter lighting devices **2–14**, such as control information for controlling all available parameters of each of the multiparameter lighting devices **2–14** such as for example, but not limited to pan, tilt, color, shutter, pattern and focus.

FIG. **2**A illustrates a prior art multiparameter lighting device **100**. The multiparameter lighting device **100** includes a base **102**, a bearing **104**, a yoke **114**, bearings **116** and **118**, and lamp housing **120**.

The lamp housing **120** is connected to the yoke **114** by bearings **116** and **118** which are shown in simplified form. The yoke **104** is connected to the base **102** by bearings **104** shown in simplified form.

The lamp housing **120** includes an aperture **112** for light to be emitted from the lamp housing **120**. The lamp housing **120** houses various electronic, mechanical and optical parts. The external parts shown in FIG. **2**A are known in the prior art. The present invention will introduce new internal parts or new operation of internal parts such as will be shown and described with reference to FIG. **3**C into the prior art structure of FIG. **2**A.

The base **102** typically houses electronic circuitry for controlling positioning of the lamp housing **120**. The lamp housing **120** may be "positioned" by remote control ("positioning" means control of "tilt" and "panning"). "Tilting" the lamp housing **120** refers to tilting the lamp housing **120** about bearings **116** and **118** with respect to the yoke **114**; "panning" the lamp housing **120** refers to panning the yoke **114**, and thus the lamp housing **120**, about the bearings **104** with respect to the base **102**. The "positioning" of the lamp housing **120** can thus be controlled with at least these two parameters. The base **102** includes a display and keypad device **130**. The display and keypad device **130** includes buttons **131–134** and Light Emitting Diode Displays **135–138**. The buttons **131–134** are input devices to allow on board control of the various parameters for such things as setting the address of a multiparameter lighting device (such as device **100**) and for performing tests on the parameters (such as pan, tilt, etc). The LED displays **135–138** (or a lesser number of such LEDs) are shown in simplified form and are typically used to display the address information as well as service information for the multiparameter lighting device **100**. The base **102** includes input (**152**) and output (**150**) communications connections (which are shown in FIG. **2**B) for connecting to in and out electronic communications lines.

The display and keypad device **130** is used to select a communications address for the multi-parameter lighting device **100**. By using the display system and keypad **130** the multi-parameter lighting device **100** (and any similar multiparameter lighting device) may be given a unique address so that the multiparameter lighting device **100** may respond separately to commands from a control device (not shown

but may be control device **50** as in FIG. **1**) over a communication system (not shown but may include for example communications lines **54** through **60** in FIG. **1**) for the unique address, is recognized by the multiparameter lighting device **100**. The unique address is set for each multiparameter lighting device such as device **100**, by using the input buttons on the display and keypad device, such as **130**. The unique address is set to be different from the other multiparameter lighting devices used in a show and possibly referenced by the location as seen by the operator. For instance the first multiparameter lighting device such as device **2** in FIG. **1**, closest to the operator in the show may be set as address one.

A power cable with plug **140** is also shown in FIG. **2**A for plugging into a standard electrical power outlet.

The display and keypad device **130** may also be used to control the parameters of the multiparameter lighting device **100** directly without the need for a control device. The localized control of the multi-parameter lighting device **100** by utilizing the display and keypad device **130** may be used for small shows or events where a control device may not be cost effective.

FIG. **2**B shows a side view of the multiparameter lighting device **100**.

FIG. **3**A shows a back view of a color wheel **200** of the prior art. The color wheel **200** includes apertures **202**, **204**, **206**, **208**, **210**, **212**, and **214**. The aperture **212** is shown in dashed lines because aperture **212** has no color and freely passes the white light from a lamp, such as lamp **354** in FIG. **3**C. The other apertures **202**–**210** and **214** may contain color filters. The color wheel **200** can be made to rotate in a clockwise CLK direction or in a counterclockwise CTR direction as shown in FIG. **3**A through the use of a motor **230** which has a shaft **232** connected to the color wheel **200**.

FIG. **3**B is a side view of the color wheel **200** and the motor **230** and shaft **232** described in FIG. **3**A.

FIG. **3**C illustrates a multiparameter lighting device **300** of an embodiment of the present invention. (FIG. **3**C shows the internal components, FIG. **4** shows the external structure into which components of FIG. **3**C can be incorporated). The multiparameter lighting device **300** includes a base **310** (which may include electronics housing and corresponds to base **410** in FIG. **4**) and a lamp housing **350** (which may correspond to lamp housing **450** of FIG. **4**). The base **310** is connected to the lamp housing **350** by a yoke (not shown, which may correspond to yoke **420** in FIG. **4**), which includes an internal bearing assembly **380** which has wires **381**, **382**, **383**, and **384** running through the bearing assembly. The yoke (not shown) may also be similar to the yoke **114** of the prior art in FIG. **2**A. Not all wires running through the bearing assembly **380** are shown for simplification.

The base **310** includes microphone **311**, logic card **312**, a logic power supply **316**, and a lamp power supply **317**.The logic card **312** includes a communications interface **312***a*, a microprocessor **312***b*, a signal processor **312***c*, a lamp power supply output driver **312***d*, and a motor driver section **312***e*.

The logic card **312** of the base **310** is connected to communications line **313** through communications node **312***a*. The lamp power supply **317**, and the logic power supply **316** of the base **310** is connected to external power cable **314**, which includes wires **314***a* and **314***b* which is connected to an external power source. The external power cable **314** provides power to the multiparameter lighting device **300**.

The lamp housing **350** includes a fan **351**, a fan inlet port **352**, a reflector **353**, a lamp **354**, a condensing lens **355**, a light beam shown in dotted lines **356***a* and **356***b*, and optical wheels **360**, **364**, and **368**. Optical wheel **360** is fixed to the shaft **361** which is connected to the motor **362**. Optical wheel **364** is fixed to the shaft **365**, which is connected to the motor **366**. Optical wheel **368** is fixed to the shaft **369**, which is connected to the motor **370**. Optical wheels **360**, **364**, and **368** can be made to rotate by their respective motor. The optical parameter wheels **360**, **364**, and **368** can be rotated to a different position (i.e. a different aperture like one of apertures **202**–**214**) to provide a particular color parameter or a particular pattern parameter.

The lamp housing **350** also includes an iris **390** and a focusing lens **391**, each of which would be connected to its own motor not shown.

Sound waves **315** are shown going into the microphone **311**.

In operation, the multiparameter lighting device **300** functions as follows. The multiparameter lighting device **300** first receives an electronic signal command from a control device (not shown but may be similar to control device **50** in FIG. **1**) through communication line **313** (an electronic signal command received over communication line **313** would be a digital communications signal in accordance an embodiment of the present invention) or by receiving an input by an operator via a display and keypad device (not shown but may be similar to display and keypad device **130** shown part of base **102** in FIG. **2**A) of the multiparameter lighting device **300**. The microphone **311** picks up various audio signals. The microphone **311** is preferably fixed to and contained within the housing **319** (shown by dashed lines) of the base **310**. The microphone **311** may of course be separate from the housing **319** and connected to the signal processor **312***c* within the housing **319** of the base **310** by wire, radio frequency or other transmission means. The audio signal is sent from the microphone **311** to the signal processor **312***c* via the signal line **311***a*. The signal processor **312***c* may contain an amplifier to amplify the audio signal. The signal processor **312***c* may contain an analog to digital converter. Various types of signal processor systems may be used to extract the desired audio information as well known in the art.

The signal processor **312***c* provides the first modified signal to the microprocessor **312***b*. The microprocessor **312***b* converts the first modified signal to create a second modified signal, which is provided to the motor driver section **312***e*. The motor drive section **312***e* then provides motor drive signals via control line lines **381** and **382** which drive the motors **362**, **366**, and **370** to turn the shafts **361**, **365**, and **369**, respectively, to rotate the wheels **360**, **364**, and **368**, respectively, in relation to the original audio signal received at microphone **311**. The modifications for transforming the first modified signal into the second modified signal are stored in operational software code of the microprocessor **312***b* from which the microprocessor **312***b*, operates from.

The microprocessor **312***b* may also provide a lamp intensity modification signal to the lamp power supply output driver **312***d*. The lamp power supply output driver **312***d* may then provide a lamp driver signal via communications line **317***a*, based on the lamp intensity modification signal, to the lamp power supply **317**. The lamp power supply **317** then would provide a corresponding output signal to change the intensity of the lamp **354** through lamp power lines **383** and **384**.

Although FIG. **3** illustrates a multiparameter lighting device **300** with a base **310** separate from the lamp housing **350**, other types of housings can be utilized such as a single housing for both the base **310** and the lamp housing **350** without the bearing assemblies.

FIG. **4** illustrates a multiparameter lighting device **400** in accordance with an embodiment of the present invention, comprised of a base **410**, bearings **414**, a yoke **420**, and a

lamp housing **450**, a light aperture **412**, a power cord **440**, and tilt bearings **416** and **418**. The multiparameter lighting device **400** may include internal components similar to the embodiment of FIG. **3**C. The multiparameter lighting device **400** may include a display and keypad device **430** similar to the display and keypad device **130** shown in the prior art for FIG. **2**A. A microphone **411** is shown mounted in the electronic housing.

FIG. **5** illustrates a plurality of multiparameter lighting devices, including multiparameter lighting devices **502**, **504**, **506**, **508**, **510**, **512**, and **514** arranged in a multiparameter lighting system **500** that employs an embodiment of the present invention. Each of the multiparameter lighting devices may be similar to multiparameter lighting device **400** of FIG. **4** which includes internal components shown in FIG. **3**C. Each of the multiparameter lighting devices may have a microphone. Multiparameter lighting device **502**, **504**, **506**, **508**, **510**, **512**, and **514** may have microphones **502***a*, **504***a*, **506***a*, **508***a*, **510***a*, **512***a*, and **514***a*, each of which may have the function of microphones **411** of FIG. **4** or **311** of FIG. **3**C. The system **500** can be capable of selecting by remote control which of the multiparameter lighting devices (of **502** through **514**) will have what particular parameter (such as color, pattern, pan, tilt etc. as mentioned previously) selected to respond to an incoming audio signal as received by the appropriate transducer microphone (such as **502***a* through **514***a*).

The multiparameter lighting system **500** includes a control device **550**. The control device **550** and the multiparameter lighting devices **502–514** are each connected to power lines **552***a* and **552***b*, which may be part of an AC (alternating current) power source. The power lines **552***a* and **552***b* may be the same as the power lines **314***a* and **314***b* shown in FIG. **3**C.

The control device **550** includes input devices **570–577** which are shown simplified and may be comprised of rotary encoder wheels, slider potentiometers, touch screen input devices and input switches that are well known in the prior art.

The control device **550** may be electrically connected by digital communications line **554** to communications input **502***c* of multiparameter lighting device **502**. Communications input **502***c* may correspond to communications input **152** shown in FIG. **2**B. A similar digital communications line **555** may electrically connect communications output **502***b* to communications input **504***c* of device **504**. Similar digital communications lines **556**, **557**, **558**, **559**, and **560** may electrically connect communications output **504***b* with communications input **506***c*, communications output **506***b* with communications input **508***b*, communications output **508***c* with communications input **514***b*, communications output **514***c* with communications input **512***b*, and communications output **512***c* with communications input **510***b*.

The multiparameter lighting devices **502–514** may be electrically connected to the same power source, electrically connected to the same hardwired digital communications source (i.e. control device **550** through digital communications lines **54** through **60**), and are capable in an embodiment of the present invention of receiving and responding to particular wireless audio signals.

The digital communications line **554** (and other digital communications lines **555–560**) may be the same as line **313** in FIG. **3**C and may connect to an input connection like connection **152** in FIG. **2**B of a multiparameter lighting device such as **502**.

The operation of an embodiment in accordance with FIGS. **3**A, **3**B, **3**C, **4**, and **5** will now be described. An operator of the control device **550** can first select one of the multiparameter lighting devices available, such as for example multiparameter lighting device **502** shown in FIG. **5**, by selecting the appropriate input devices of **570** through **577** in a known manner to uniquely select the address of the multiparameter lighting device **502** as known in the art. The control device **550** may employ a numerical keypad as one or more of the input devices **570** through **577**. Other input devices could be used such as voice, Light emitting diodes, mouse, or any other that would be known to those skilled in the art. The operator may first press a select button (which may be one of input devices **570** through **577** on control device **550**) to allow the input of an address; next the operator may input the address of the multiparameter lighting device (for example **502**) to be addressed by pressing the correct address number on the keypad (such as for example address **32**). Next the operator may use the select button to select a parameter to be adjusted. In accordance with an embodiment of the present invention, during the adjustment of the parameter, the operator may select the parameter to function as audio responsive.

The operator would adjust the individual parameter selected, by entering an amount of adjustment on the keypad (one of devices **570–577**). Next he may hit "record" (which may be one of the input devices of **570–577** on control device **550**) or just select another multiparameter lighting device to be addressed.

The operator of the control system continues to address all of multiparameter lights and in turn adjusts all of their parameters to produce the desired effect. When the operator has produced the desired effect, the operator may then choose to record what they have programmed as a scene. The operator may input a designated number to record and reference the first scene to, by inputting to one of the input devices **570–577** on control device **550** as known in the art.

Next the operator may produce further scenes in the same manner as described above. In accordance with embodiments of the present invention one or more parameters of one or more multiparameter lighting devices (such as **502** through **514**) may be selected as audio responsive during the scene programming process.

When the operator has produced the desired amount of scenes to create the desired effect the operator has created a show.

The programming of the scenes and overall creation of the show is usually done during a rehearsal time for the event (while the spectators are not present). When the actual event takes place, the operator may set the control system (by inputting to input devices **570–577** on control device **550** as known in the art) to sequentially step through the scenes in the order that the show was produced. The operator may choose to step through the previously produced scenes by inputting to a "next" button (by inputting to input devices **570–577** on control device **500**) as known in the art.

In the prior art, a previously varied parameter of a multiparameter light may be recalled in a previously programmed scene. The varied parameter in the prior art may for example be a color wheel indexed to the red color. In the prior art the varied parameter may also be a color wheel rotation at a slow speed.

In one embodiment of the present invention the varied parameter may or may not be for example an audio responsive color wheel. With embodiments of the present invention several parameters may or may not be responsive to the received audio information in a previously programmed scene. Embodiments of the present invention provide the operator the ability to recall scenes that have previously selected parameters responding to audio. The invention can provide a single scene that may contain several multiparameter lights with several selected parameters responsive to audio. With the invention, creative, audio responsive visual

changes can be viewed by the spectators of the event, yet all happen within a single scene.

Many types of actuators may be controlled by the audio electrical signal supplied by the microphone transducer (such as microphone **311** in FIG. **3**C) of a particular multiparameter lighting device, such as device **300** in FIG. **3**C. The audio electrical signal from the transducer microphone **311** is sent to the signal processor **312***c* where the desired audio content is sent to the microprocessor **312***b* of the multiparameter lighting device **300**. Computer software routines set up in the operational code of the microprocessor **312***b* are acted upon by the microprocessor **312***b* based on the modified audio signal received from the signal processor **312***c*. The microprocessor **312***b* in turn controls the actuator also by routines set up in operational code of the microprocessor **312***b* by interfacing with the drive circuit **312***e* for the actuators. The actuators in the FIG. **3**C embodiment are the three motors **362**, **366**, and **370** for the three corresponding shafts **361**, **365**, and **369**, which turn the three corresponding color wheels **360**, **364**, and **368**.

Using embodiments of the present invention the lamp intensity of a lamp, such as lamp **354** of one of the multiparameter lighting devices, such as device **300** in FIG. **3**C, or a plurality of lamps may also be controlled in much the same manner. The signal processor **312***c* receives the audio signal from the sound waves picked up by the transducer microphone **311**. In turn the desired audio content as formed by the signal processor **312***c* is sent to the microprocessor **312***b* of the multiparameter lighting device **300**. Routines set up in the operational code of the microprocessor **312***b* are acted upon based on the audio signal received by the signal processor **312***c*. Multiparameter lighting devices **502**–**514** in FIG. **5** may be similar in operation and structure to multiparameter lighting device **300** in FIG. **3**C.

With the invention the operator may save time during programming as the audio function assigned to a parameter acts on the parameter as a macro. Many different looks can be created as the parameter of a multiparameter lighting device, such as **502** in FIG. **5**, responds to audio. During playback the operator need not precisely control the changing of individual scenes to track the audio as it is accomplished in the multiparameter lighting device **502** itself by having the audio signal vary the selected parameters within the scene that is called.

The microphone may be located in the base, or within any of the housing components. The microphone may be located external to the multiparameter light and the light may receive the signal via wires, or radio frequency.

I claim:

1. An apparatus comprising:

a first multiparameter lighting device;

the first multiparameter lighting device comprised of

a first sound transducer for changing sound waves into a first audio electrical signal;

a first node for receiving a first digital communications signal;

a first processor which in response to the first digital communications signal causes a first parameter of the first multiparameter lighting device to be selected from a plurality of parameters for the multiparameter lighting device and causes the first parameter to be modified in response to the first audio electrical signal.

2. The apparatus of claim **1** wherein

the first digital communications signal specifies the first parameter and causes the first parameter to be modified in response to the first audio signal.

3. The apparatus of claim **1** wherein

the first digital communications signal specifies the first parameter and a second parameter and causes the first and the second parameter to be modified in response to the first audio signal.

4. The apparatus of claim **1** wherein

the first parameter is the color of light emitted from the first multiparameter lighting device.

5. The apparatus of claim **1** wherein

the first parameter is the intensity of light emitted from the first multiparameter lighting device.

6. The apparatus of claim **1** wherein

the first parameter is a direction of light emitted from the first multiparameter lighting device.

7. The apparatus of claim **1** wherein

the first parameter is a pattern of light emitted from the first multiparameter lighting device.

8. The apparatus of claim **1** further comprised of:

a second multiparameter lighting device;

the second multiparameter lighting device comprised of

a second sound transducer for changing sound waves into a second audio electrical signal;

a second node for receiving a second digital communications signal;

a second processor which in response to the second digital communications signal causes a first parameter of the second multiparameter lighting device to be modified in response to the second audio electrical signal.

9. The apparatus of claim **8** wherein

the first and second digital communications signals specify the corresponding first parameters of the respective first and second multiparameter lighting devices and cause the corresponding first parameters to be modified in response to the corresponding first and second audio electrical signals.

10. The apparatus of claim **8** wherein

the first and second digital communications signals specify the first parameter and a second parameter of the respective first and second multiparameter lighting device and cause the corresponding first and the second parameters to be modified in response to the corresponding first and second audio electrical signals.

11. The apparatus of claim **8** wherein

first parameter of each of the first and second multiparameter lighting devices is the color of light emitted from the corresponding first and second multiparameter lighting devices.

12. The apparatus of claim **8** wherein

the first parameter of each of the first and second multiparameter lighting devices is the intensity light emitted from the corresponding first and second multiparameter lighting devices.

13. The apparatus of claim **8** wherein

the first parameter of each of the first and second multiparameter lighting devices is a direction of light emitted from the corresponding first and second multiparameter lighting devices.

14. The apparatus of claim **8** wherein

the first parameter of each of the first and second multiparameter lighting devices is a pattern of light emitted from the corresponding first and second multiparameter lighting devices.

15. The apparatus of claim **1** further comprised of:

a control device which provides the first digital communications signal.

16. The apparatus of claim **15** wherein

the control device provides the first digital communications signal in response to an operator input supplied at the control device.

17. The apparatus of claim 8 further comprised of:

a control device which provides the first and second digital communications signals.

18. The apparatus of claim 17 wherein

the control device provides the first and the second digital communications signals in response to respective first and second operator inputs supplied at the control device.

19. The apparatus of claim 15 further comprised of

a communications line which electrically connects the control device with the first multiparameter lighting device.

20. The apparatus of claim 17 further comprised of:

one or more communication lines which electrically connect the control device with the first and the second multiparameter lighting devices.

21. The apparatus of claim 1 wherein

the first sound transducer is a microphone.

22. The apparatus of claim 1 wherein

the plurality of parameters of the first multiparameter lighting device include color, pan, tilt, pattern, and intensity.

23. A method comprising the steps of:

receiving a digital communications signal;

receiving sound waves;

converting the sound waves to a first audio electrical signal;

setting a parameter of a multiparameter lighting device based on the digital communications signal and the first audio electrical signal.

24. The method of claim 23 wherein

the digital communications signal is received from a control device which is electrically

connected; to the multiparameter lighting device.

25. The method of claim 23 wherein

the digital communications signal provides information which uniquely identifies the multiparameter lighting device.

26. An apparatus comprising:

a first multiparameter lighting device;

the first multiparameter lighting device comprised of

a first sound transducer for changing sound waves into a first audio electrical signal;

a first node for receiving a first digital communications signal;

a first processor which in response to the first digital communications signal causes a first parameter of the first multiparameter lighting device to be selected from a first set of a plurality of parameters for the first multiparameter lighting device and causes the first parameter to be modified in response to the first audio electrical signal;

and wherein the first multiparameter lighting device has a second set of a plurality of parameters which includes color, pan, tilt, pattern, and intensity.

27. The apparatus of claim 26 wherein

the first set of a plurality of parameters for the first multiparameter lighting device is a subset of the second set of a plurality of parameters for the first multiparameter lighting device.

28. The apparatus of claim 26 wherein

the first set of a plurality of parameters for the first multiparameter lighting device is the same as the second set of a plurality of parameters for the first multiparameter lighting device.

29. An apparatus comprising:

a first multiparameter lighting device which includes a first set of a plurality of parameters which include pan, tilt, color, pattern, and intensity, wherein a subset of the first set of a plurality of parameters can be selected by a first audio signal;

a second multiparameter lighting device which includes a second set of a plurality of parameters which include pan, tilt, color, pattern, and intensity, wherein a subset of the second set of a plurality of parameters can be selected by a second audio signal; and

a control device which controls the first set of a plurality of parameters of the first multiparameter lighting device and the second set of a plurality of parameters of the second multiparameter lighting device.

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