

[54] **AUDIO RESPONSIVE LIGHT DISPLAY SYSTEM**

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[51] Int. Cl.² **G08B 5/36**

[58] Field of Search **340/384 R, 261, 148, 366 B; 179/1 VL; 84/464**

[56] **References Cited**
UNITED STATES PATENTS

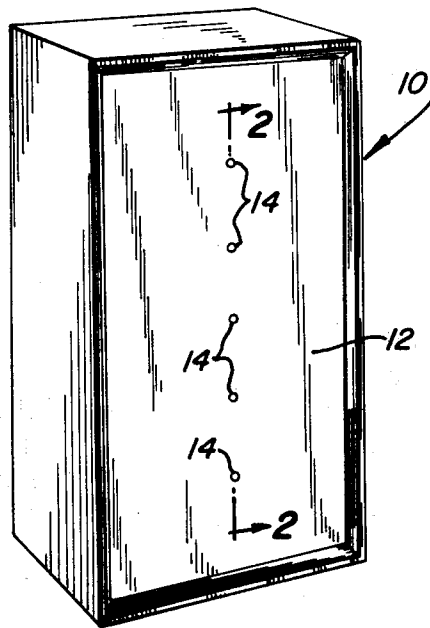
3,022,498 2/1962 Alcott 340/384 E

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[57] **ABSTRACT**

There is provided an audio responsive light display system in which one or more light emitting diodes (LED's) are actuated in response to speaker feedback impulses which modulate a low voltage direct current connected to the LED's. Speakers having such a display associated with the speaker housing or grille provides not only an esthetic combination of visual and audio effects, but enables one to determine visually the operation of any of a plurality of speakers responding to audio input.

8 Claims, 4 Drawing Figures



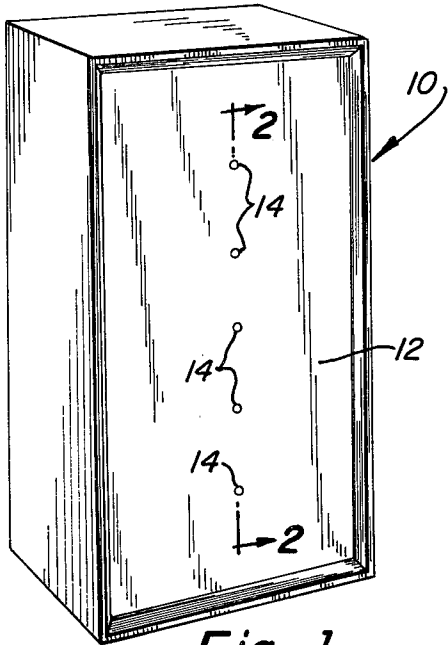


Fig. 1

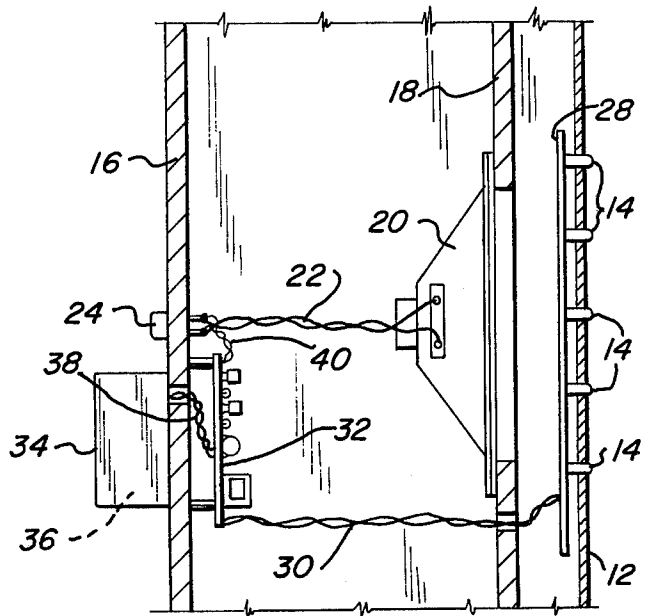


Fig. 2

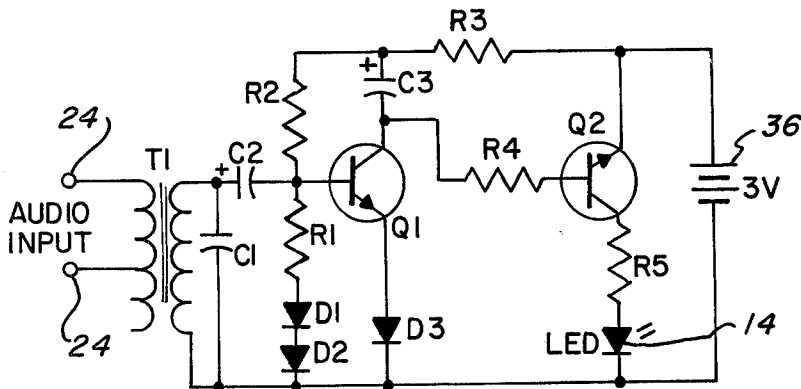


Fig. 3

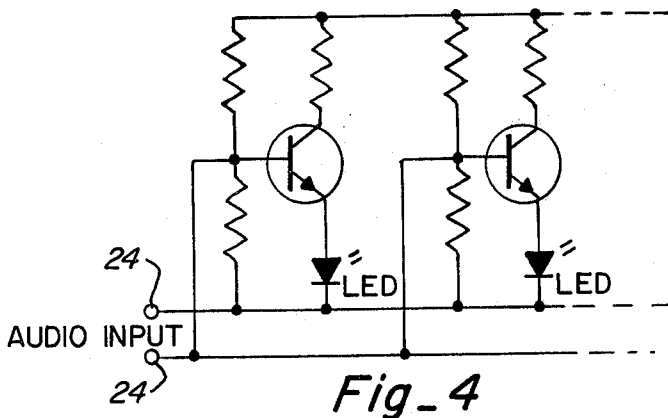


Fig. 4

AUDIO RESPONSIVE LIGHT DISPLAY SYSTEM

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an audio responsive light display system characterized by one or more light emitting diodes powered by a low voltage direct current source and modulated, for example, by speaker feedback.

2. Description of the Prior Art

Light displays which fluctuate in intensity and/or color in response to volume, range of frequency are well known. Reference may be had to U.S. Pat. No. 1,790,903 to Craig wherein there is provided in a radio speaker, colored electric lamps with numerous switches adapted to be selectively sympathetically vibrated by the sounds issuing from the speaker. Another device producing a color effect from sound is shown in U.S. Pat. No. 1,946,026 to Lewis, et al. Devices for producing projected optical effects are shown in U.S. Pat. Nos. 3,473,428 to Phillips; 3,590,681 to Cross and 3,603,195 to Williams. Still another form utilizes a stroboscopic lamp in combination with a rotary speaker as shown in U.S. Pat. No. 3,478,837 to Ross. A liquid crystal display is shown in U.S. Pat. No. 3,623,392 to Boyer. Sharp in U.S. Pat. No. 3,719,857 teaches an audio responsive intensity modulator for gas discharge lamps. Goldschmied in U.S. Pat. No. 3,798,638 teaches an audio responsive light display system using a speaker as a microphone, the output of which is amplified and provided by a separate filter networks to a plurality of lamp driver circuits and utilizes a novel alternating current/battery power supply.

SUMMARY OF THE INVENTION

The simultaneous stimulation of more than one sense by a common stimulant as a means of entertainment is enjoying new popularity particularly in the audio-visual field where sound, e.g. music, is the stimulant and both the senses of hearing and sight are acted on by channeling the signal to both sound reproducing means and to light actuating means. The present invention provides a simple, inexpensive and effective means for achieving the foregoing end.

Briefly stated, the present invention is in an audio responsive light display system comprising in combination a speaker responsive to an audio signal and productive of a feedback impulse, at least one LED, and external low voltage dc source and means for modulating the current flow from said dc source to said LED in response to the feedback impulse. The present invention is distinguished from such prior art that instead of utilizing a filament gas discharge lamp, there is employed a light emitting diode in combination with an external very low voltage direct current source, i.e., less than 10 volts, and circuitry to modulate the current flow in response to audio signals. The LED or LED's can be powered by two 1.5 volt dry cells connected in series and with very small current drain measured in microamps will last several months and are thus adapted to be continuously at ready for operation. Qualification according to certain standards, such as by Underwriters Laboratories, is not required because the voltage is so low. Moreover, since the power source is external to the receiver/amplifier system, there is no degradation of the audio signal due to noise as may be encountered in prior art devices wherein light bulbs are

operated from an ac source. Although the LED's are desirably displayed on the speaker housings, they may as well be separately displayed for other purposes, e.g., ready identification of which speaker or speakers in an array are operative.

With present day multiple track stereo systems multiple speakers are used which are located in different parts of the room. These speakers are separately controlled by console. In order to adjust the volume level of the speakers it is necessary for the operator to set the volume of one speaker from the console then walk over to the speaker and listen to it. If the volume is not at the right level he must then go back to the console, re-adjust the level and go back to the speaker again. This can occur several times before the speaker is properly adjusted. With multiple speakers the time and effort in adjusting all of the speakers to the right volume is greatly increased since the operator must walk from the console to each speaker and back again until he gets the proper adjustment. With the present invention, it is possible to visually observe the speakers from the console and determine whether or not the volume level is proper by observing the intensity of light emitted by the LED's at each speaker.

Additional advantages will become apparent from a description which follows, taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be better understood by having reference to the annexed drawings wherein;

FIG. 1 is a perspective illustration of a speaker having several LED's mounted in the front grille thereof;

FIG. 2 is a side view of a speaker in accordance with this invention with the side cover panel removed to show the mounting of the parts;

FIG. 3 is a circuit for modulating the current flow to LED from the low voltage external dc source in response to an audio signal; and

FIG. 4 is still another circuit illustrating a network for driving a plurality of LED's.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In accordance with this invention there is shown in FIGS. 1 and 2 a speaker housing 10 having a front grille 12 in which a plurality of LED's 14 are supported in a vertical array. Alternatively, the LED's may be arranged in a different array or only a single LED may be used. However, the vertical array shown has a special application as described below. With more particular reference to FIG. 2, there is here shown a side view of a speaker such as that shown in FIG. 1 with the side panel removed to expose the internal arrangement of the parts. Accordingly, there is shown a cabinet back panel 16, and a speaker mounting panel 18 having mounted thereon in a conventional manner a speaker 20. Audio input lines 22 connect the speaker 20 to an audio input jack 24.

Ahead of the speaker mounting panel 18, is grille 12 in which a plurality of LED's 14 are mounted on a printed circuit board 28 supported immediately behind the grille. An LED control line 30 electrically connects the printed circuit board 28 with a second printed circuit board 32 mounted on the cabinet back panel 16 and including a suitable circuit for controlling the LED's 14. A holder 34 mounted on the cabinet back panel 16 provides a suitable receptacle for batteries 36

supported therein. Battery lead wires 38 communicate between the batteries 36 and the printed circuit board 32. The speaker feed back or audio input is communicated to the printed circuit board 32 by the lead lines 40.

FIG. 3 is illustrative of one circuit which may be embodied in the printed circuit board 32 and utilized in carrying out the present invention. This circuit for driving an LED represents a very inexpensive and simple circuit for providing an audio responsive light display utilizing an LED powered conveniently by dry cells such as two 1½ volt dry cells which are arranged in series to provide a 3 volt output. This circuit, as illustrated, is for a speaker having a single LED but as is readily apparent to one skilled in the art can be extended for use with a multiple light arrangement as shown in FIGS. 1 and 2.

As can be seen in FIG. 3, the feedback signal is fed into transformer T1 at input jacks 24, as shown. For this particular circuit, the following values have been found to be quite satisfactory: C1 equals 0.22uf; C2 equals 1uf; C3 equals 10uf; R1 equals 10K ohms, R2 equals 2.2M ohms; R3 equals 51 ohms; R4 equals 270 ohms; R5 equals 6.8 ohms, All of these resistors are ½ watt 10 percent resistors; diodes D1, D2 and D3 are IN4004 diodes; Q1 is a 2N3904 transistor and Q2 is a 2N3906 transistor. L1, is of course a light emitting diode 14 whose response is controlled by the audio input from jacks 24 which controls through this circuitry the flow of current from battery 36 through light emitting diode 14.

In FIG. 4 a typical threshold circuit is shown wherein audio input 24 is provided to control a signal from an external dc circuit as in FIG. 3 but wherein the base of each transistor is connected to resistors of increasing value so that the number of LED's lighted is proportional to the feedback input at input jacks 24. In other words, in a vertical array of LED's, as shown in FIGS. 1 and 2, a very low resistance may be associated with the bottom LED and these resistances increase in value upwardly so that the number of LED's lighted will be proportional to the volume of input sound. Thus, when the sound is very loud all of the LED's will be lighted whereas when the sound is at a lower level only a portion of them will be lighted.

This arrangement is very convenient wherein a plurality of speakers is placed around the room and are controlled from a console. The operator can observe each speaker from the console and can tell the level of audio output by the number of LED's which are lighted in each speaker. Where speakers with a single light are provided the same can be accomplished but not to a similar degree of accuracy. In other words, by the brilliance of the light of the LED and the frequency with which it flickers the operator can by making a visual comparison between the speakers in the room tell the approximate relative audio level of all speakers.

From the foregoing, the advantages of this invention are readily apparent. A system has been provided wherein the enjoyment of the music listener can be increased by the visual sensation provided by one or more LED's on a speaker grille being lighted by feedback from the speaker. The LED's receive a signal from a low power dc circuit which is external to the internal system and therefore does not require Underwriters Laboratory approval. However, this external circuit is controlled by the audio feedback from the speaker through a transformer to control the lighting of

the LED's in response to this feedback. The result is a flickering of the LED's as music or other sounds are being played over the speaker system to enhance the enjoyment of the listener.

Furthermore, the LED's can be used to adjust the audio level of the speakers, particularly where a plurality of speakers are placed around a room and operated from a central console. By visually observing any LED's the operator can adjust the volume of the respective speakers to the desired level and adjust the sound proportionately among the speakers as desired.

The invention has been described in detail with particular reference to a preferred embodiment thereof, but it will be understood that variations and modifications can be effected within the spirit and scope of the invention.

What is claimed is:

1. An audio responsive light display system comprising in combination;
 - a speaker responsive to an audio signal for producing a feedback impulse;
 - a displayed light emitting diode;
 - an external low voltage dc source for lighting said light emitting diode and connected thereto; and
 - means for modulating the current flow from said dc source to said light emitting diode in response to said feedback impulse.
2. An audio responsive light display system in accordance with claim 1 wherein:
 - the speaker includes a housing and a light emitting diode is mounted on the housing.
3. An audio responsive light display system in accordance with claim 1 wherein:
 - the low voltage dc source is less than 10 volts.
4. An audio responsive light display system in accordance with claim 1 further including:
 - a plurality of light emitting diodes connected in separate parallel paths with said low voltage dc source.
5. An audio responsive light display system in accordance with claim 4 wherein:
 - said modulating means includes resistor means in each parallel path of different value so that different levels of feedback impulse are required to light said light emitting diode in each path.
6. In an audio responsive light display system including a speaker, a housing therefore, a source of an audio signal for driving said speaker, and a visible light emitting source, the intensity of which is proportional to at least a portion of said audio signal, the improvement which comprises:
 - a light emitting diode as the light emitting source;
 - an external low voltage dc source for lighting said light emitting diode connected thereto; and
 - means for modulating the current from said dc source to said light emitting diode in response to said audio signal.
7. A method of adjusting the level of a plurality of speakers controlled in a single console wherein each speaker has at least one light emitting diode whose illumination is controlled by a feedback impulse from the audio signal furnished to each of said speakers, said method comprising:
 - setting the sound level for each speaker at the console;
 - observing the level of the sound at each speaker from the console by viewing the response of the light emitting diode; and

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adjusting the sound level of the speakers from the console until the response of the light emitting diode at each speaker is the same as that at each other speaker which will result in an equal sound level being emitted from each speaker.

8. A method as claimed in claim 7 wherein each speaker includes a plurality of light emitting diodes which are responsive to different minimum sound lev-

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els and wherein said adjusting step further includes: adjusting the sound level of the speakers from the console until the same number of light emitting diodes on each speaker are lighted simultaneously at any one time so that an equal sound level is emitted from each speaker.

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