United States Patent

Knauff

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[54] **COLOR ORGAN AND ELECTRICAL CONTROL CIRCUIT THEREFOR**

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[51] **Int. Cl.** **A63j 17/00**

[58] **Field of Search** .... 84/464; 40/28.3; 240/2 L

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[57] **ABSTRACT**

A color organ in which a plurality of colored lights flash in response to a signal from an audio source is provided with a control circuit which includes a white room light. When a signal is not being received from the audio source, the white light is on and serves as an ordinary room lamp. When the audio source is turned on, the circuit turns off the white light and activates the colored lights, which may either flash at random with the audio source or flash with low, medium, and high frequencies of the audio source. The control circuit includes a time delay circuit to delay for a discrete period the turning on of the white light after the audio source is shut off so that the white light does not switch on during regular intervals in the audio signal caused by record changing and the like.

14 Claims, 4 Drawing Figures

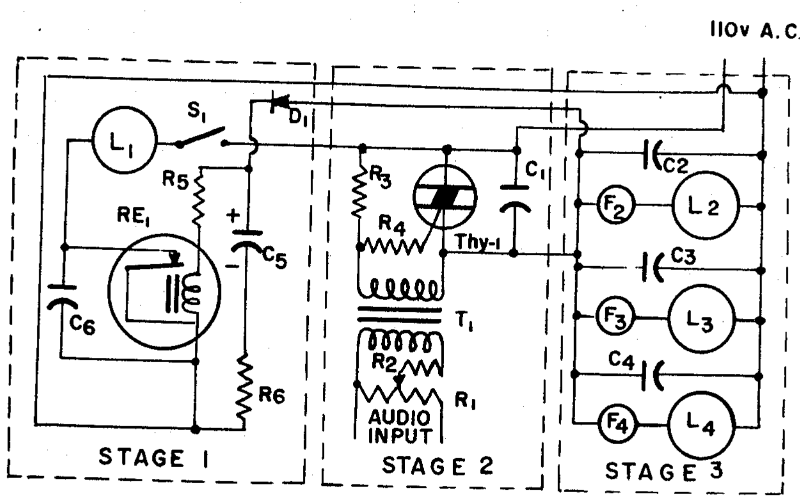

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FIG. 1

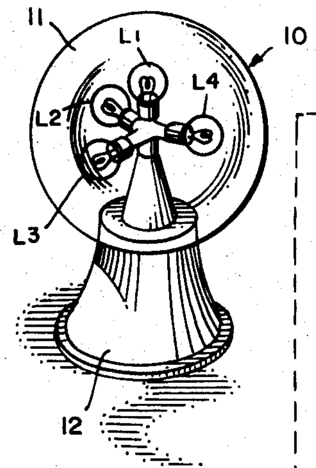


FIG. 2

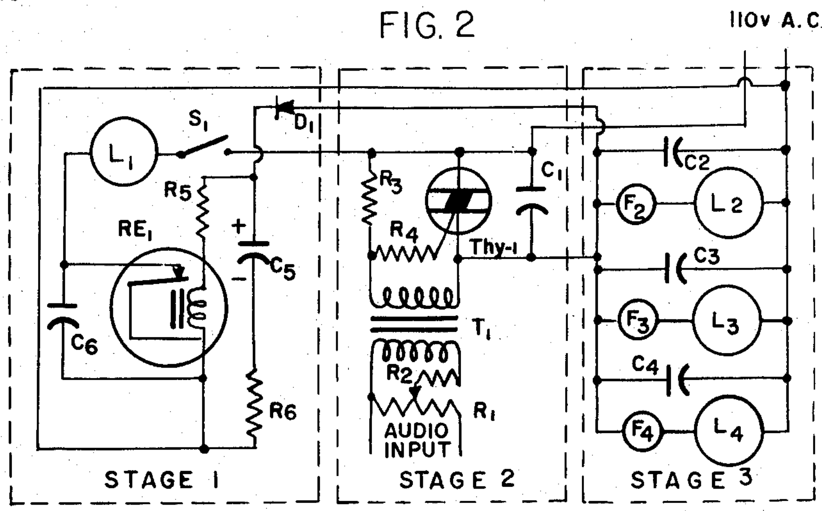


FIG. 3

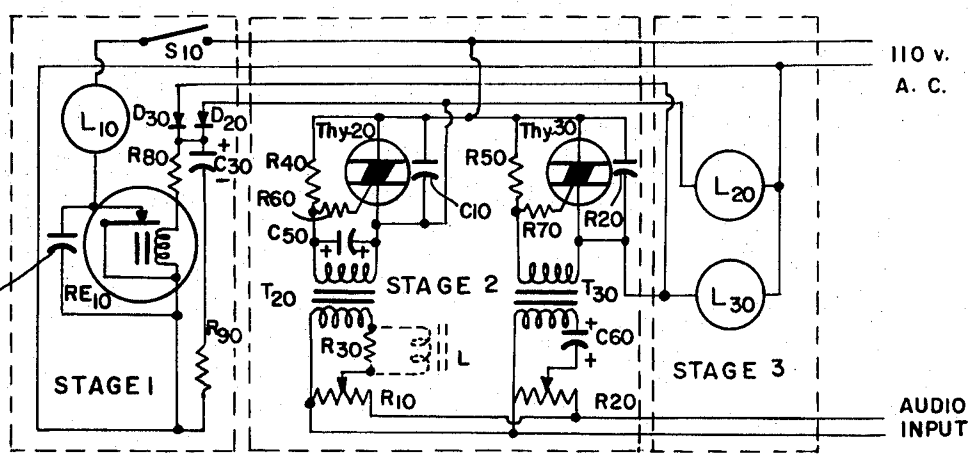
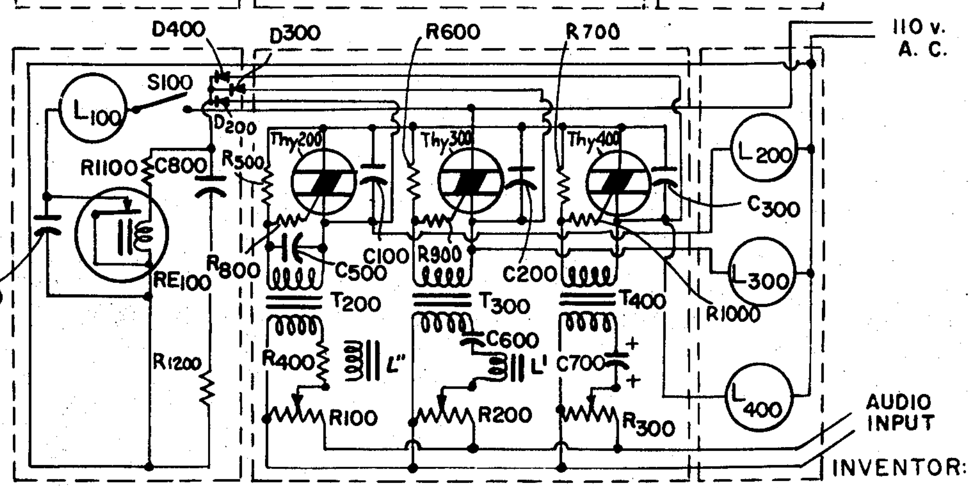


FIG. 4



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COLOR ORGAN AND ELECTRICAL CONTROL CIRCUIT THEREFOR

BACKGROUND AND SUMMARY

This invention relates to color organs, and, more particularly, to a color organ device and electrical circuit therefor which permits the device to function both as a color organ and a lamp.

Color organs generally include one or more colored lights which are actuated in response to a signal received from an audio source such as a record player, radio, and the like. Heretofore, however, color organs have generally been limited in function to producing colored light. When the color organ is activated by the audio source, the ordinary room lights must be dimmed or turned off, and when the audio source is shut off, the room lights must be turned on.

The invention provides a color organ device which functions as both a color organ and as a room light. The room light is on when the audio source is shut off, but as soon as the audio source turns on, the white light is automatically shut off and the colored lights of the color organ are energized in response to the signal received from the audio source. The color organ can either be a single-channel device in which a plurality of colored lights flash at random, a two-channel device in which the lights flash in response to the low and high frequencies of the signal from the audio source, or a three-channel device in which the lights flash in response to low, medium, and high frequencies of the audio source signal.

The control circuit includes gating means to prevent the energization of the colored lights until a signal is received from the audio source and a relay which is energized by the gating means to shut off the white light when the audio source is turned on. The gating means includes a bias resistor to increase the sensitivity of the gate and to eliminate the need for expensive driving networks for the gating means.

Time delay means delays the white light from turning on again after the audio source is shut off for a predetermined period of time, say, about 20 seconds, to insure that the white light does not turn on during short intervals in the audio signal which might be caused by record changing and the like. When the audio source has been shut off for the predetermined delay period, the white light is automatically turned on to again function as a room lamp. The unique control circuit permits the use of relatively few and relatively inexpensive components which permit the device to be manufactured for a low cost.

DESCRIPTION OF THE DRAWING

The invention will be explained in conjunction with illustrative embodiments shown in the accompanying drawing, in which:

FIG. 1 is a perspective view of a device formed in accordance with the invention;

FIG. 2 is a circuit diagram for a single-channel color organ and room lamp;

FIG. 3 is a circuit diagram for a two-channel color organ and room lamp; and

FIG. 4 is a circuit diagram for a three-channel color organ and room lamp.

DESCRIPTION OF SPECIFIC EMBODIMENTS

Referring to FIG. 1, the numeral **10** designates generally a lamp which includes a globe **11** mounted on a base **12**. The globe **11** encloses a conventional white light L_1 of from about 100 watts to about 200 watts and three inside frosted color lights L_2, L_3 and L_4. The lamp **10** is designed to be operated by standard 110 volt AC house current, and the control circuitry enclosed within the base **12** permits the white light L_1 to function as a normal room light. When an audio source is programmed into the control circuit, the white light is shut off and the colored lights L_2–L_4 are energized in response to the signal from the audio source. Each of the colored lights is advantageously about 25 watts, and if desired, the globe **11** can be frosted or otherwise rendered translucent.

A single-channel control circuit for the lamp **10** is illustrated in FIG. **2** and includes generally a timing network designated Stage **1**, a triggering network designated Stage **2**, and a light network designated Stage **3**. The light network or Stage **3** includes the three colored lights L_2–L_4 connected in parallel, and each of the colored lights is connected in series with a button flasher or switch F_2, F_3, and F_4, respectively. Discharge capacitors C_2, C_3, and C_4 are placed as close as possible between each lamp and the associated flasher to prevent radiofrequency interference from the points of the flashers.

Referring now to Stage **2** of the triggering network, the audio input is fed into a gain potentiometer R_1 and then to the primary winding of an audio output transformer T_1. A current limiter R_2 is placed in series with the primary winding. The secondary winding of the transformer T_1 steps up the incoming voltage signal from the audio source and feeds this signal to the gate and first anode of a triac which is designated $Thy._1$. The triac acts as a gating means to prevent current flow through the colored lamps L_2–L_4 until the voltage from the secondary winding of the audio output transformer reaches the designed gate trigger voltage of the triac. Thereafter, the triac conducts with the incoming audio signal to permit current flow through the colored lamps. The audio output transformer not only serves to step up the incoming voltage from the audio source but also acts as an isolator between the triac or power section of the circuit and the audio source or speakers, thereby preventing damage to the audio source.

A bias resistor R_3 is connected between the second anode of the triac and the triac gate to increase the sensitivity of the triac's gate and to maintain the trigger voltage just below that needed to switch the triac to an on state. The bias voltage is part of a voltage divider network, part of the bias voltage flowing through the secondary winding of the audio output transformer to the first anode of the triac. If the triac partially conducts when there is no audio stimulation, there may be too much gate bias voltage, and the value of the bias resistor R_3 should be increased.

A resistor R_4 is placed in series with the gate to act as a gate current limiter to protect the gate from spike voltages, and a discharge capacitor C_1 is connected between the two anodes of the triac to act as a radiofrequency interference arc suppressor to eliminate switching interference to the audio source.

The timing network or Stage **1** is characterized by economy and simplicity of operation. The white lamp L_1 is connected in series with a stop-start switch S_1 and a relay RE_1, the contacts of which are normally closed. When the stop-start switch is closed, current flows through the white lamp and the closed contacts of the relay, and the white lamp functions as an ordinary room light. An arc suppressor capacitor C_6 is placed across the contacts of the relay.

A charging rectifier D_1 is connected in series with the triac and the winding of the relay RE_1 together with a voltage limiting resistor R_5 for the relay. A timing capacitor C_5 is connected across the relay in series with a surge-limiting resistor R_6.

When the stop-start switch S_1 is turned on and no signal is being received from the audio source, the triac does not conduct, and only the white lamp L_1 is energized. When a signal is received from the audio source and the triac is triggered to an on state, the triac conducts to permit current flow through the colored lamps L_2–L_4. Current flowing through the triac also flows through the charging rectifier D_1 to the relay RE_1 to open the contacts thereof and shut off the white lamp L_1 and to charge the timing capacitor C_5.

The circuit illustrated in FIG. **2** is a single-channel circuit, and the colored lamps do not operate in response to the frequency of the audio input signal. Rather, the colored lamps are caused to flash at random by the flashers F_2–F_4, and this random flashing or pulsating of the different colored lamps causes a kaleidoscopic array of colors.

When a signal from the audio source is no longer received, the triac switches to an off state and the colored lamps are shut off. However, the white lamp L_1 is not immediately turned on because the timing capacitor C_5 will discharge through the relay to keep the contacts open for a period of time. In one specific circuit, the activating voltage of the relay and the resistor R_5 and capacitor C_5 were chosen to provide a period of about 20 seconds during which the capacitor would discharge through the relay to prevent the relay contacts from closing. This period is generally sufficient to accommodate regular interruptions of short duration in the audio signal which might be caused by record changing and the like. However, after this selected time delay, the contacts of the relay will close, and the white lamp will again turn on.

In one specific embodiment of the circuit illustrated in FIG. 2, the capacitor C_5 was a 200 mfd. 150 v. DC electrolytic timing capacitor, the voltage limiter R_5 was a 33 kΩ ohm 2 watt resistor, and the relay RE_1 activated at about 50 volts, thereby giving the timing capacitor a 100 volt discharge factor. A 120 volt relay would provide only a 30 volt discharge factor and corresponding shorter period before deactivation of the relay. Although this problem could be corrected by using a larger timing capacitor, the larger capacitor would result in higher cost.

The surge limiter R_6 was a 220 ohm 1 watt resistor and serves to prevent feedback problems due to false triggering of the triac. When the contacts of the relay close, the arc created by the high current surge through the cold filament of the white lamp sometimes causes false triggering of the triac to an on state for a few milliseconds. During even this short period of time, the timing capacitor C_5 might charge up enough to reactivate the relay, thereby causing a possible feedback problem. However, by inserting a resistor of as high as 220 ohms in series with the timing capacitor, most of the voltage created by the false triggering of the triac bleeds off through the relay, the timing capacitor does not charge up, and the relay does not activate due to insufficient voltage. A smaller resistor of, for example, 50 ohms might be insufficient to prevent activation of the relay, and if a larger resistor, for example 1,000 ohms, were used, the timing capacitor would take too long to charge up.

Other components of one specific single-channel circuit were as follows:

R_1	200 ohm 1 watt potentiometer
R_2	1.5 ohm 1 watt resistor
R_3	22 kΩ to 33 kΩ 2 watt resistor
R_4	27 ohm ½ watt resistor
R_5	33 kΩ 2 watt resistor
R_6	220 ohm 1 watt resistor
C_1	0.01–200 v. discharge capacitor
C_2, C_3, C_4	0.02–200 v. discharge capacitor
C_5 200 mfd. 150 v. DC electrolytic capacitor	
C_6	0.05–200 v. discharge capacitor
T_1	8 ohm primary 500 ohm secondary 0.1 watt transformer
D_1	500 milliampere 200 piv. charging rectifier
Thy.$_1$	RCA triac No. 40668
S_1	2 amp pushbutton stop-start switch

I have obtained good results by using a 22 kΩ resistor for R_3, but if the triac partially conducts when there is no audio stimulation, indicating excessive gate bias voltage, a higher value resistor can be used for R_3 such as 24 kΩ, 27 kΩ, or 33 kΩ.

A two-channel control circuit is illustrated in FIG. 3 and includes color lamps L_{20} and L_{30} which flash in response to low and high frequencies, respectively, of the audio input voltage. L_{20} is connected in series with a triac Thy.$_{20}$, and L_{30} is connected in series to a triac Thy.$_{30}$. An audio input voltage is fed to each of the triacs through potentiometers and audio output transformers as hereinbefore discussed with respect to the single-channel circuit of FIG. 2. Triac Thy.$_{20}$ is fed through potentiometer R_{10} and transformer T_{20}, and triac Thy.$_{30}$ is fed through potentiometer R_{20} and audio output transformer T_{30}.

The input to triac Thy.$_{20}$ is filtered by a nonpolarized capacitor C_{50} placed across the secondary winding of the transformer T_{20} which combines with the secondary winding of the transformer to act as a parallel resonant band-pass filter, allowing only low frequencies to pass to the triac Thy.$_{20}$. Only high frequencies are allowed to pass to the primary winding of transformer T_{30} by virtue of a nonpolarized capacitor C_{60} connected in series with the primary winding of the transformer, thereby creating a high band-pass filter network.

In other respects the triac networks are similar to the triggering network illustrated in FIG. 2, each of the triacs Thy.$_{20}$ and Thy.$_{30}$ being connected to gate bias resistors R_{40} and R_{50}, gate current limiters R_{60} and R_{70}, and interference suppressor capacitors C_{10} and C_{20}, respectively.

An alternate method of filtering the audio input voltage to permit only low frequencies to pass to triac Thy.$_{20}$ is to connect a choke or inductance L (illustrated in phantom in FIG. 3) in series with the primary winding of the transformer T_{10}. If the choke is used, the capacitor C_{50} must be removed. The advantage of using a choke is that a smaller control potentiometer R_{10} can be used because the choke absorbs most of the audio input energy. The advantage of using the capacitor C_{50} is that more efficient low-frequency filtering is obtained. The choke filtering method need be used only if the bass frequencies from the audio source are of unusual strength, and the capacitor filtering method is ordinarily preferred.

The timing network, designated Stage 1, of FIG. 3 similarly includes a white lamp L_{10} connected in series with a stop-start switch S_{10} and a relay RE_{10}. A charging rectifier D_{20} and D_{30} is provided for each of the triacs Thy.$_{20}$ and Thy.$_{30}$, respectively, to insure activation of the relay under all frequency conditions. Also, if only one rectifier were used to rectify the output of both of the triacs, there would be voltage feedback to the nonconducting triac by the conducting triac. Accordingly, the charging rectifiers not only serve as rectification devices, but they also serve as channel isolators.

The timing network of the circuit in FIG. 3 also includes a voltage limiter R_{80} connected in series with the charging rectifiers and a timing capacitor C_{30} connected across the relay in series with a surge limiter R_{90}. An arc suppressor capacitor C_{40} is connected in parallel with the contacts of the relay as hereinbefore discussed with respect to FIG. 2.

I have obtained particularly good results in using a red light for the low-frequency actuated light L_{20} and a yellow light for the high-frequency light L_{30}. This color combination creates a fireball effect.

For one particular two-channel circuit, the following components were used:

R_{10}, R_{20}	200 ohm 1 watt potentiometer
R_{30}	1.5 ohm 1 watt resistor
R_{40}, R_{50}	22 to 33 kΩ 2 watt resistor
R_{60}, R_{70}	27 ohm ½ watt resistor
R_{80}	33kΩ 2 watt resistor
R_{90}	220 ohm 1 watt resistor
C_{10}, C_{20}	0.01–200 v. discharge capacitor
C_{30}	200 mfd. 150 v. DC electrolytic capacitor
C_{40}	0.05–200 v. discharge capacitor
C_{50}	25 mfd. 50 wv. nonpolarized capacitor
C_{60}	10 mfd. 50 wv. nonpolarized capacitor
T_{20}, T_{30}	8 ohm primary 500 ohm secondary 0.1 watt transformer
D_{20}, D_{30}	500 milliampere 200 piv. charging rectifier
Thy.$_{20}$, Thy.$_{30}$	RCA triac No. 40668
L_{20}, L_{30}	25 watt inside frosted color lamps
L_{10}	100 to 200 watt soft light white lamp
S_{10}	2 amp pushbutton stop-start switch

For this circuit the frequency crossover between Thy.$_{20}$ and Thy.$_{30}$ was about 500 c.p.s.

A three-channel circuit is illustrated in FIG. 4 and is similar to the two-channel circuit illustrated in FIG. 3 with the addition of a filtering and triggering network for the medium frequencies, a colored light for actuation in response to the medium frequencies, and a charging rectifier to activate the relay in response to medium frequency input signals and to isolate the other two channels when the medium frequency triac is conducting. Accordingly, the circuit includes triacs

Thy.$_{200}$, Thy.$_{300}$, and Thy.$_{400}$ for the low, medium and high frequencies, respectively, which are connected in series with color lamps L_{200}, L_{300}, and L_{400}, respectively. The low frequencies are fed to triac Thy.$_{200}$ by a filtering network as described with respect to the two-channel circuit of FIG. 3 which includes a potentiometer R_{100}, transformer T_{200} and nonpolarized capacitor C_{500}. Similarly, the high frequencies are filtered to the triac Thy.$_{400}$ through potentiometer R_{300}, nonpolarized capacitor C_{700}, and transformer T_{400}.

The filtering network for the medium frequency triac Thy.$_{300}$ includes a choke L' and a nonpolarized capacitor C_{600} which are connected in series with the primary winding of the transformer T_{300}, thereby creating a series resonant filter. The signals are fed to the transformer by potentiometer R_{200}.

Charging rectifiers D_{200}, D_{300}, and D_{400} are provided for each of the triacs Thy.$_{200}$–Thy.$_{400}$, respectively, each rectifier permitting activation of the relay RE_{100} when one of the triacs is switched to an on state. In other respects, the three-channel circuit of FIG. 4 is similar to the two-channel and single-channel circuits of FIGS. 3 and 2.

I have obtained good blending of many colors by using a blue light for the low-frequency actuated light L_{200}, and a red light for the medium frequency actuated light L_{300}, and a green or yellow light for L_{400}.

In one specific embodiment of the three-channel circuit, the following components were used:

R_{100}, R_{200}, R_{300}	200 ohm 1 watt potentiometers
R_{400}	1.5 ohm 1 watt resistor
R_{500}, R_{600}, R_{700}	22 to 33 kΩ 2 watt resistor
R_{800}, R_{900}, R_{1000}	27 ohm ½ watt resistor
R_{1100}	33 kΩ 2 watt resistor
R_{1200}	220 ohm 1 watt resistor
C_{100}, C_{200}, C_{300}	0.01–200 v. discharge capacitor
C_{400}	0.05–200 v. discharge capacitor
C_{500}	25 mfd. 50 wv. nonpolarized capacitor
C_{600}	10 mfd. 50 wv. nonpolarized capacitor
C_{700}	4 mfd. 50 wv. nonpolarized capacitor
C_{800}	200 mfd. 150 v. DC electrolytic capacitor
T_{200}, T_{300}, T_{400}	8 ohm primary 500 ohm secondary 0.1 watt transformer
D_{200}, D_{300}, D_{400}	500 milliampere 200 piv. charging rectifier
Thy.$_{200}$, Thy.$_{300}$, Thy.$_{400}$	RCA triac No. 40668
L_{200}, L_{300}, L_{400}	25 watt inside frosted color lamps
L_{100}	100 to 200 watt softlight white lamp
S_{100}	2 amp pushbutton stop-start switch
L'	Medium Frequency Choke

In this circuit frequencies up to about 500 c.p.s. were fed into triac Thy.$_{200}$, frequencies between about 500 c.p.s. and about 1,000 c.p.s. were fed to triac Thy.$_{300}$, and frequencies from about 1,000 c.p.s. to about 100 kc. were fed to triac Thy.$_{400}$.

If desired the low frequencies can be filtered by placing a choke L'' across the resistor R_{400} in series with the primary winding of the transformer T_{200} as discussed previously with respect to FIG. 3. In this event the capacitor C_{500} would be removed.

Each of the foregoing circuits permits the color organ device to function both as a color organ and a lamp. The device switches automatically from a room lamp to a color organ upon the input of a signal from the audio source, and switches automatically back to a room lamp after a predetermined time lapse in the audio signal. The triggering network includes a bias resistor to increase the sensitivity of the triac's gate by keeping the trigger voltage just below the voltage needed to switch the triac to an on state, thereby eliminating the need for solid-state driving networks for the triac. Moreover, the circuit is relatively simple and provides high power at low cost.

While in the foregoing specification, a detailed description of the specific embodiments of my invention were set forth for the purpose of illustration, it is to be understood that many of the details hereingiven may be varied considerably by those skilled in the art without departing from the spirit and scope of my invention.

I claim:

1. An electrical circuit for operating a signal light in response to an input signal comprising a first light source adapted to be connected to a source of electrical power, relay means operatively associated with the first light source for disconnecting the first light source from the power source when the relay is activated, time delay means connected to the relay means for delaying the deactivation of the relay means, and gating means connected to the relay means and adapted to be connected to the power source and to the signal light, the gating means adapted to be operatively connected to the input signal whereby the input signal closes the gating means to activate the relay means and connect the power source to the signal light and cessation of the input signal opens the gating means and disconnects the power source from the signal light, the time delay means delaying the connecting of the first light source to the power source for a discrete time period after cessation of the input signal.

2. The circuit of claim 1 including a signal light connected in series to the gating means and adapted to be connected to the power source, the signal light and the relay means being connected in parallel.

3. The circuit of claim 1 in which the relay means includes contacts for connecting the light source to the power source, the relay contacts being normally closed, the time delay means including capacitor means and resistance means, rectifier means between the gating means and the relay means for permitting the capacitor means to be charged when the gating means is closed but preventing discharge of the capacitor means therethrough, the capacitor means discharging through the resistance means and the relay means when the gating means opens.

4. The circuit of claim 1 in which the gating means includes a triac having a gate and a pair of anodes, and a bias resistor connected between one of the triac anodes and the triac gate for decreasing the voltage required to switch the triac to an on stage.

5. The circuit of claim 1 including a filter network connected to the gating means for passing certain frequencies of the input signal to the gating means and screening other frequencies from the gating means.

6. The circuit of claim 5 in which the filter network includes a transformer having primary and secondary windings, the primary winding adapted to be connected to the source of the input signal, the secondary winding being connected to the gating means, and a capacitor connected across the secondary winding.

7. The circuit of claim 5 in which the filter network includes a transformer having primary and secondary windings, the primary winding adapted to be connected to the source of the input signal, the secondary winding being connected to the gating means, and an inductance connected in series with the primary winding.

8. The circuit of claim 5 in which the filter network includes a transformer having primary and secondary windings, the primary winding adapted to be connected to the source of the input signal, the secondary winding being connected to the gate, and a capacitor connected in series to the primary winding.

9. A color organ device comprising a first electrical network including gating means for opening and closing the first network, a first light connected in series with the gating means, relay means connected in series with the gating means, capacitor means connected in parallel with the relay means, the gating means adapted to be operatively connected to the electrical circuit of an audio source whereby the gating means closes in response to a signal from the audio source and opens upon cessation of the signal, a second network including contact means associated with the relay means for operation thereby and a second light connected in series with the contact means, the contact means being closed when the gating means is open, the relay means opening the contact means when the relay means is activated upon closing of the gating means, whereby the second network is closed when no signal is

received by the gating means from the audio source, the capacitor delaying the closing of the second network for a discrete period of time after cessation of the signal to the gating means.

10. The device of claim 9 in which the first signal light and the relay means are connected in parallel, and a rectifier connected in series between the gating means and the capacitor for permitting the capacitor to be charged when the gating means is closed but preventing discharge of the capacitor therethrough.

11. The device of claim 9 in which the first network includes a second gating means and a third light connected in series to each other and connected in parallel to the first gating means, the second gating means adapted to be operatively connected to the electrical circuit of the audio source whereby the second gating means closes in response to the signal from the audio source and opens upon cessation of the signal, and filter means operatively connected to the first and second gating means for passing certain frequencies of the signal from the audio source to each gating means and screening other frequencies from each gating means.

12. The device of claim 11 including first and second rectifiers, the first gating means being connected in series with the relay means through the first rectifier and the second gating means being connected in series with the relay means through the second rectifier.

13. The device of claim 11 in which the filter means includes first and second transformers, each of the transformers having primary and secondary windings, the primary winding of the first transformer adapted to be connected to the audio source and the secondary winding of the first transformer being connected to the first gating means, the primary winding of the second transformer adapted to be connected to the audio source and the secondary winding of the second transformer being connected to the second gating means, capacitor means connected across the secondary winding of the first transformer, and capacitor means connected in series with the primary winding of the second transformer.

14. The device of claim 11 in which each of the gating means includes a triac having a gate and a pair of anodes, and a bias resistor for each gating means connected between the gate and one of anodes of the triac of the gating means.

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