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Gilbreath et al.

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[54] **MULTIPLE SCENE LIGHTING CONTROLLER**

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[52] **U.S. Cl.** **315/293,** 315/291, 315/294, 315/299, 315/307, 315/315, 315/320
[51] **Int. Cl.** **H05b 37/02,** H05b 39/04
[58] **Field of Search** .... 307/252 M; 315/292–295, 297, 299, 307, 312–321

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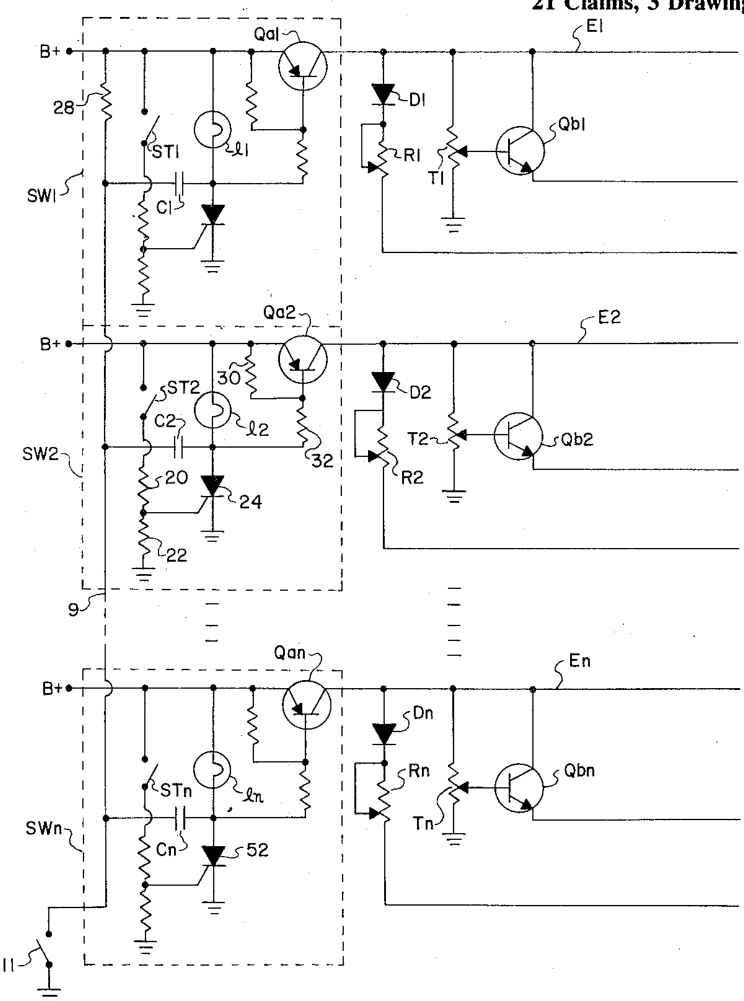
[57] **ABSTRACT**

A multiple scene lighting controller for controlling *m* dimmer units (where *m* is greater than 1) includes *m* circuits, each for controlling the magnitude and rate of change of magnitude of a voltage signal applied to a corresponding dimmer unit. The magnitude of the voltage signal generated by each such circuit is determined by a first signal applied thereto, while the rate of changing the magnitude is determined either by a second or third signal. A second signal applied to one such circuit causes the circuit to change the magnitude of the voltage signal at a controlled rate while a third signal applied to such circuit causes the circuit to rapidly change the magnitude of the voltage signal. A first *n* adjustable devices are connected to a first one of such circuits for independently applying the first signal thereto, a second *n* adjustable devices are connected to a second one of such circuits for independently applying the first signal thereto, etc. Connected to each such circuit are *n* other adjustable devices for independently applying the second signal to the circuits. By appropriately setting the adjustable devices and by controlling the application of current to selected ones of the adjustable devices, different lighting levels and different rates of achieving such lighting levels can be provided through the control of the dimmer units by the circuits.

21 Claims, 3 Drawing Figures



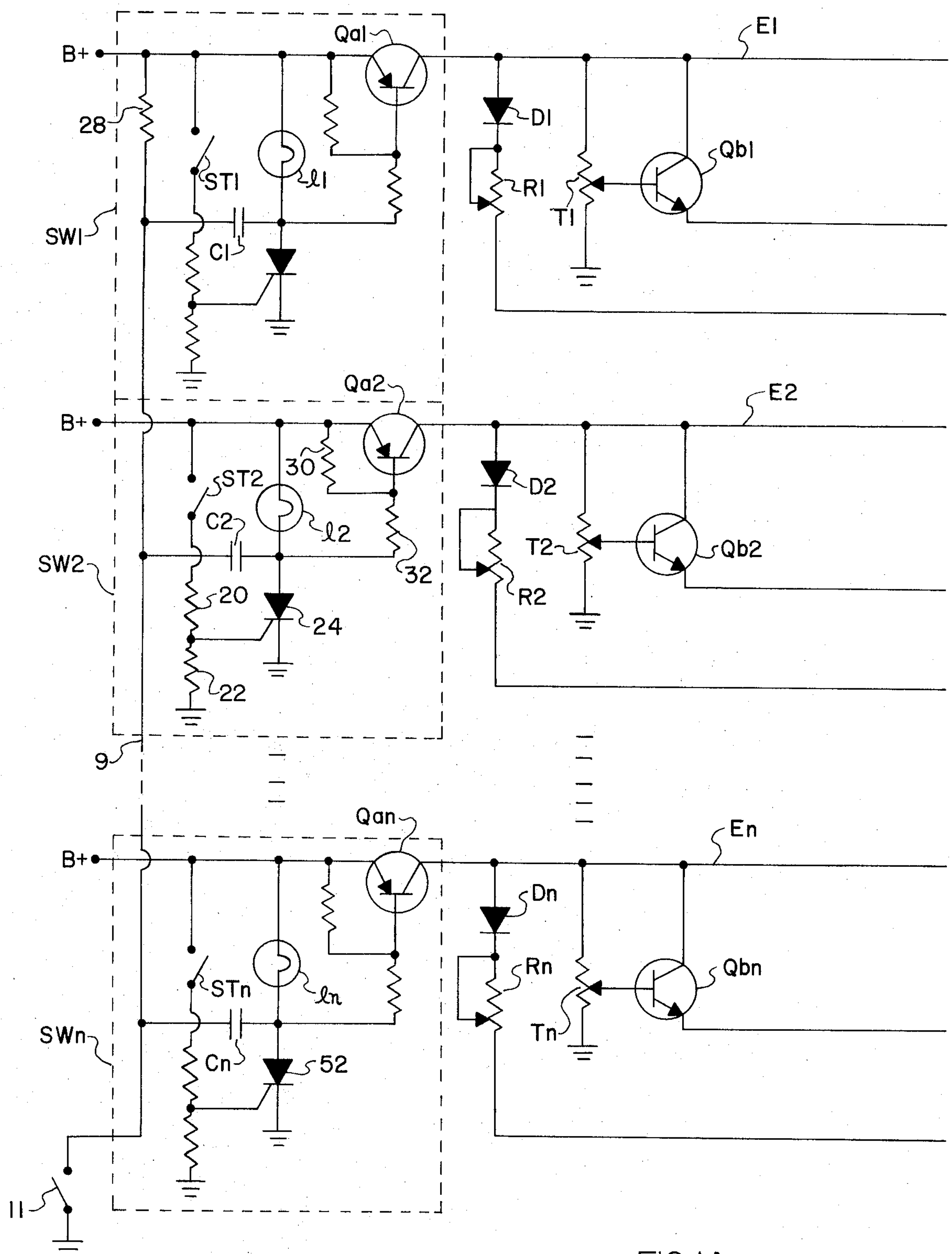

B+
28
SW1
ST1
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FIG. 1A

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SHEET 2 OF 3

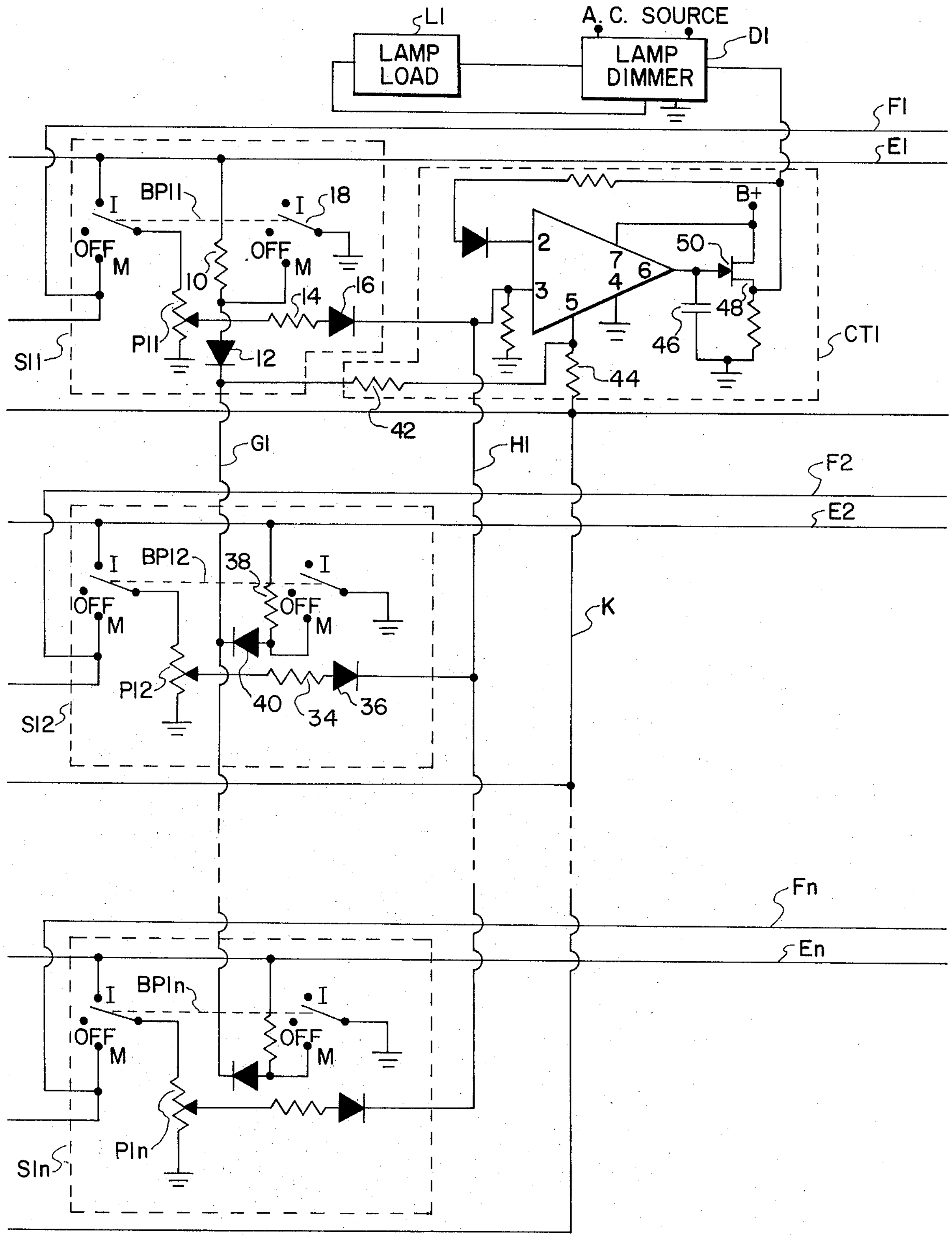

FIG. 1B

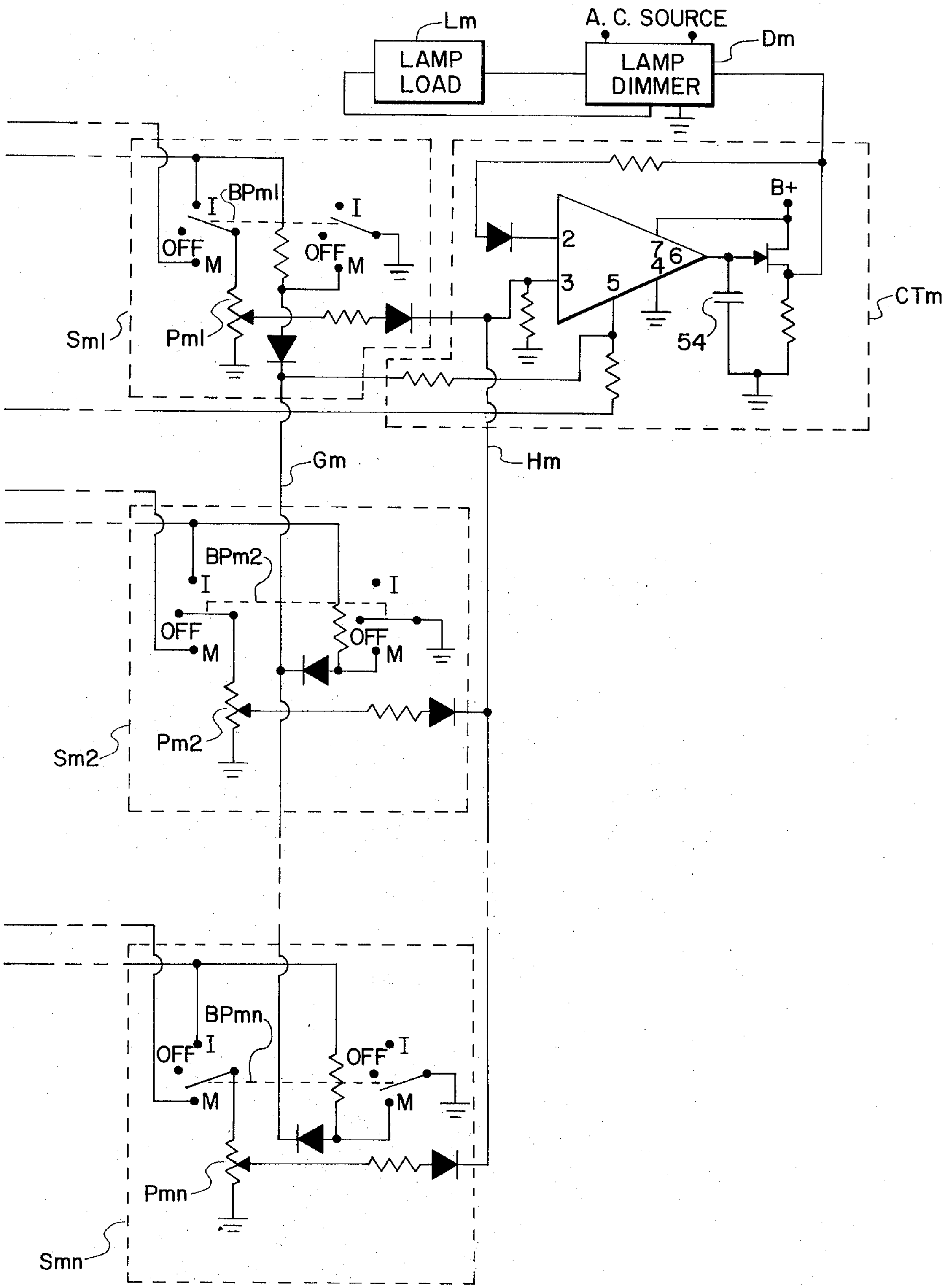
Lm
LAMP LOAD
A. C. SOURCE
LAMP DIMMER
Dm
B+
CTm
54
BPm1
OFF
M
I
Sm1
Pm1
Gm
Hm
BPm2
Sm2
Pm2
BPmn
Pmn
Smn

FIG. IC

MULTIPLE SCENE LIGHTING CONTROLLER

BACKGROUND OF THE INVENTION

This invention relates to light dimming systems and more particularly to a multiple scene lighting controller.

In theater lighting systems, it is oftentimes desirable to provide different lighting levels for different scenes being staged. In providing the different lighting levels or scenes, it may be desirable to vary the intensity of selected lights or banks of lights while leaving the intensity of other lights or banks of lights unchanged. It may also be desirable to abruptly change the brightness of certain selected lights but to change the brightness of other lights more slowly and at different rates.

Currently-used lighting control systems capable of accomplishing the above purposes have typically been complex, cumbersome, expensive and inefficient. For example, conventional systems for controlling the rate of change of brightness of lights have oftentimes included either a manually-operated potentiometer or a motor-driven potentiometer. With manually-operated potentiometers, it is difficult to obtain smooth and even transitions between brightness levels because of the dependency upon the steadiness of the human operator. With light dimming systems utilizing motor-driven potentiometers, this problem is overcome, but such systems are rather bulky and costly.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a compact and inexpensive lighting controller for controlling lighting levels and rates of changing the lighting levels for a plurality of scenes.

It is another object of the present invention to provide such a system having a relatively long and useful life.

It is still another object of the present invention to provide such a system whereby the user can manually select different lighting combinations to be produced and the rate at which the brightness levels are changed from one combination to another.

These and other objects of the present invention are realized in a specific illustrative embodiment which includes a multiple scene lighting controller for controlling a dimmer unit which, in turn, is responsive to a voltage signal for controlling the flow of current through a lamp load. Circuitry is included for controlling the magnitude of the voltage signal in accordance with the magnitude of a first signal and for controlling the rate at which the magnitude of the voltage signal is varied in accordance with a second or third signal. The circuitry is responsive to the second signal for varying the magnitude of the voltage signal at a controlled rate determined by the magnitude of the second signal and responsive to the third signal for rapidly varying the magnitude of the voltage signal regardless of the magnitude of the second signal. A plurality of first and second adjustable devices selectively control the magnitude of the first and second signals respectively in response to current signals. Application of such current signals to selected ones of said first and second adjustable means is controlled by a plurality of manually operable switch means.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects and advantages of the

present invention will become more apparent from the following detailed description presented in connection with the accompanying drawing in which FIGS. 1A, 1B and 1C, with FIG. 1A positioned to the left of FIG. 1B and FIG. 1C positioned to the right of FIG. 1B, show a multiple scene lighting controller made in accordance with the present invention.

DETAILED DESCRIPTION

The system shown in the drawings provides for controlling the brightness level of a lamp or lamps included in m lamp loads **L1**, ..., Lm. Each lamp load is connected to and controlled by a corresponding one of lamp dimmer units **D1**, ..., Dm. The number of such lamp loads and lamp dimmer units would be determined by the needs of the user. Each of the dimmer units **D1**, ..., Dm controls the root-mean-square (R.M.S.) value of current flow through a corresponding lamp or lamps to which it is connected in response to voltage signals from circuits **CT1**, ..., CTm respectively. An illustrative lamp dimmer unit is disclosed in copending application, Ser. No. 168,317, filed Aug. 2, 1971, now U.S. Pat. No. 3,733,528, granted May 15, 1973.

Each of the circuits **CT1**, ..., CTm is coupled to a corresponding plurality of switch circuits **S11, S12**, ... S1n; ...; **Sm1, Sm2**, ..., Smn respectively. The switch circuits **S11**, ... Smn are coupled together into an $m \times n$ matrix-like array as shown in FIGS. **1B** and **1C**. Each vertical column of switch circuits **S11** through S1n, ..., Sm1 through Smn is coupled together by common conductors **G1** and **H1**, ..., Gm and Hm respectively. Each horizontal row of switch circuits **S11** through **Sm1**, **S12** through **Sm2**, etc. is coupled together by common conductors **E1** and **F1**, **E2** and **F2**, etc. respectively. Each row of the switch circuits is also coupled by a corresponding one of the common conductors **E1, E2**, ..., En to a corresponding one of switch circuits **SW1, SW2**, ..., SWn. Common conductors **E1** and **F1** are coupled together via a transistor **Qb1**; common conductors **E2** and **F2** are coupled together via a transistor **Qb2**; etc. Each of the switch circuits **SW1, SW2**, ..., SWn are connected to a direct current voltage source B+. A common conductor **9** couples each of the switches **SW1, SW2**, ..., SWn to a resetting switch **11**.

Each of the circuits CTi (where $i = 1, ..., m$) produces a voltage signal for controlling a corresponding lamp dimmer unit Di. The magnitude of this voltage signal is determined by the magnitude of a signal applied to conductor Hi from one of the switch circuits **Si1, Si2**, ..., Sin, i.e., from one of the switch circuits in the ith column of the array. The rate of changing the magnitude of the voltage signal is determined either by a signal applied to conductor Gi or a signal applied to conductor K. A signal applied to conductor Gi enables the switch circuit CTi to abruptly or rapidly change the magnitude of the voltage signal from its previous level to the level determined by the signal applied to conductor Hi. This is so regardless of the signal applied to conductor K. If no signal is applied to conductor Gi, then a signal applied to conductor K causes the switch circuit CTi to change the magnitude of the voltage signal more slowly at a rate determined by the magnitude of the signal on conductor K.

Whether or not a signal is applied to the conductor K is determined by the condition of the switch circuits **SW1, SW2**, ..., SWn, i.e., whether or not one of such switch circuits has been activated or enabled. If one such switch circuit has been enabled, then a signal is applied via that switch circuit and via a corresponding diode and variable resistor, (for example, diode D2 and variable resistor R2), to the conductor K. This operation will be explained in greater detail later.

Whether or not signals are applied by one of the switch circuits Sij (where $i = 1, ..., m$ and $j = 1, ..., n$) to a corresponding one of the conductors Gi or a corresponding one of the conductors Hi is determined not only by the condition of the corresponding switch circuit SWj, but also by the condition of the switch circuit Sij. Each such switch circuit Sij includes a bi-polar switch having three positions—"Individual" or I, "Off," and "Master" or M. Considering switch circuit S11 of FIG. 1B, for example, there is shown a bi-polar switch BP11 having two wipers mechanically coupled together. When the switch BP11 is positioned in the "Off" position, no signal may be applied to conductor H1 via the switch circuit S11, but a signal would be applied from the conductor E1 via a resistor **10** and a diode **12** of the switch circuit S11 to the conductor G1, provided the switch circuit SW1 has been activated. If the switch BP11 is in the I position, then a signal would be applied from conductor E1 via a potentiometer P11 of the switch circuit S11 and a resistor **14** and diode **16** to conductor H1. The magnitude of the signal applied to the conductor H1 would be determined by the setting of the wiper terminal of the potentiometer P11. A signal would also be applied from conductor E1 via the resistor **10** and diode **12** to the lead G1, as before. Finally, if the switch BP11 were set in position M, a signal would be applied from conductor F1 via the potentiometer P11 and the resistor **14** and diode **16** to the conductor H1 (again providing the switch circuit SW1 were activated). The magnitude of the signal applied to conductor H1 would not only be determined by the setting of the potentiometer P11 but also by the setting of a potentiometer T1 which controls the conductance of the transistor Qb1 and thus the magnitude of the signal applied from the conductor E1 to the conductor F1. Also, with the switch BP11 in the M position, any signal on conductor E1 would be applied via the resistor **10** and the wiper terminal **18** of the switch BP11 to ground thereby preventing the signal from reaching the conductor G1. The significance of the three switch settings of the bi-polar switches of the switch circuits Sij will be discussed more fully later.

Each of the circuits CTi includes an operational transconductance amplifier (OTA) coupled to a field effect transistor. An OTA is similar to a conventional operational amplifier in that it includes the usual two differential input terminals (**2** and **3**), but differs therefrom in that it includes a control terminal **5**. The differential input terminal **2** of each of the OTA is connected via a diode and a resistor to the source electrode of the corresponding field effect transistor. The other differential input **3** is connected to a corresponding one of the conductors H1, ..., Hm. The control terminal **5** of each OTA is connected via a resistor to a corresponding one of the conductors G1, ..., Gm and also via another resistor to the conductor K. The output terminal **6** of each OTA is connected to the gate electrode of the corresponding field effect transistor and also to a capacitor.

An OTA operates to generate an output current which is proportional to the transconductance of the OTA and the voltage difference at the OTA's two differential input terminals. The transconductance of an OTA, in turn, is determined by the current supplied to its control terminal. The voltage difference at the two differential input terminals of an OTA also determine the polarity of the output current thereof. When the voltages at the two differential input terminals are equal, then the output current is zero. The OTA's utilized in the circuits CT1, ..., CTm might illustratively comprise one of the OTA's described in RCA publication "RCA Solid State Data Book Series," Application Notes, SSD-**202**, 1972, pp. 223 et seq.

The output current from an OTA such as the OTA of circuit CT1 either charges or discharges a corresponding capacitor, such as capacitor **46**, depending upon the polarity of the output current. The rate of charging and discharging the capacitor can thus be controlled by controlling the application of current to the control terminal **5** of the OTA. As long as there is a voltage difference at the input terminals **2** and **3** of the OTA and current is being supplied to the control terminal **5**, the capacitor **46** will continue to charge or discharge, depending upon the polarity of the output current of the OTA. If the polarity is positive, the capacitor **46** will continue to charge, causing the voltage thereacross to increase and the voltage at a source electrode **48** of a field effect transistor **50**, and thus at the differential input terminal **2** of the OTA, to increase until the voltage at terminal **2** is equal to the voltage at differential input terminal **3**. The voltage at terminal **3** is, of course, established by the voltage on the conductor H1. If the polarity of the output current of the OTA is negative, then the converse operation occurs. Thus, the voltage on the conductor H1 determines the voltage across the capacitor **46** and the current on conductors G1 and K determines the rate of change of the voltage across the capacitor. As already indicated, the voltage across the capacitor **46** controls the voltage at the source electrode **48** of the field effect transistor **50** to thereby control the voltage supplied to the lamp dimmer D1.

The employment of the OTA in the lighting controller of FIGS. 1A–1C provides advantages over other types of circuitry because of the OTA's ability to generate currents of low magnitude. Because of this, the charge or discharge time of the corresponding capacitor connected to the output of the OTA can be made longer than would otherwise be possible so that the elapse of time of changing the brightness of a corresponding lamp load can similarly be made longer. This is desirable in light dimming systems.

The field effect transistors connected to the outputs of the OTA's are provided for purposes of isolation. Some current is required for the differential input terminals **2** of the OTA's and if these inputs were coupled directly to corresponding capacitors, such as capacitors **46**, the rate of charge or discharge of the capacitors would be adversely affected. Because the gate electrode of a field effect transistor does not draw current, by coupling the gate electrode to a corresponding capacitor no charge is drained from the capacitor by the corresponding differential input **2** of the OTA in the course of charging or discharging the capacitor. The current needed by the differential inputs **2** is obtained via a corresponding field effect transistor from a direct current source B+. The operation of the controller shown in the drawings will now be described.

The lighting controller of FIGS. 1A–1C enables a user to preselect up to *n* different scenes or scene lightings, manually preset the circuitry accordingly, and then operate the appropriate one of switch circuits SW1, SW2, ..., SWn, as the scene controlled by that switch circuit is to be presented. The lighting for a particular scene is determined by presetting the circuitry in one of the horizontal rows of switch circuits and associated circuitry of the controller of FIG. 1, such as for example the second row which includes the switch circuit SW2, a diode D2 and variable resistor R2, a potentiometer T2, a transistor Qb2 and the switch circuits S12, ..., Sm2. The lighting for another scene would be determined by then selecting another horizontal row of switch circuits and associated circuitry such as that including the switch circuit SWn, etc. When it is time for a particular scene to be presented, the appropriate one of switch circuits SW1, SW2, ..., SWn, is then enabled to thereby energize the corresponding row of switch circuits and associated circuitry.

As already described, each of the switch circuits S11, ..., Smn includes a bi-polar switch having three settings or positions. The setting of this switch determines whether the lighting level of the associated lamp load will be changed and, if it will, whether the change is to occur rapidly or at a slower, controlled rate. When such switch is in the "Off" position, the lighting level of the associated lamp load will not be changed upon activation of the switch circuit in which the bi-polar switch is included. When such bi-polar switch is in the I or "Individual" position, the associated lamp load lighting level will be abruptly or rapidly changed to the level determined by the setting of the associated potentiometer Pij. That is, the rate at which the lighting level is changed will not be controlled. When a bi-polar switch is set in the M or "Master" position, the ultimate lighting level of the associated lamp load will be determined not only by an associated potentiometer Pij but also by an associated potentiometer Tj and the rate at which the lighting level is changed will be controlled in accordance with the setting of an associated potentiometer Rj.

Assume now that the lighting for a particular scene is to be determined by the second row circuitry of FIG. 1 and that the lighting level of lamp load L1 is to be increased abruptly over its previous level and that the brightness level of the lamp load Lm is to remain unchanged. To provide for this scene, the bi-polar switch BP12 of the switch circuit S12 would be set to the I position, and the bi-polar switch BPm2 of the switch circuit Sm2 would be set in the "Off" position (as shown in FIGS. 1B and 1C respectively). Also, the tap of potentiometer P12 would be adjusted to provide the desired brightness level for lamp load L1.

Activation of the controller of FIG. 1 to achieve the above-described scene would be initiated by momentarily closing a spring-loaded normally-open switch ST2 of switch circuit SW2. When the switch ST2 is momentarily closed, current flows from the direct current source B+ via the switch ST2 and resistors 20 and 22 to ground. Current is also supplied to the gate electrode of a unilateral semiconductor triode switch 24 (of the type known as a siliconcontrolled rectifier [SCR]) and this turns on or renders the SCR conductive. When the SCR 24 is conductive, its internal anode-to-cathode impedance is very small. When turned on, the SCR 24 remains conductive until the voltage between its anode and cathode is reduced to practically zero or is reversed in polarity. With the SCR 24 conductive and the switch ST2 opened following its momentary closure, a commutating capacitor C2 charges to a direct current voltage level corresponding to the direct current voltage difference between the bottom terminal of a resistor 28 (which is B+) and the junction between a lamp *l*2 and the SCR 24 (which is near ground potential because of the low resistance of the SCR 24).

Turning on the SCR 24 causes direct current to flow from the voltage source B+ via the lamp *l*2 (which is energized to provide a visual indication that the switch circuit SW2 has been energized) and the SCR 24 to ground. Current also flows via a resistor 30, a resistor 32, and the SCR 24 to ground. A voltage drop is thus developed across the resistor 30 causing a PNP-type transistor Qa2 to be biased on so that current is applied to conductor E2 via the transistor Qa2. The current applied to conductor E2 is, in turn, applied to a number of different circuits including (1) the conductor K via the diode D2 and variable resistor R2, (2) the conductor H1 via the leftmost wiper of bi-polar switch BP12 [since the switch is in the "I" position], the potentiometer P12, a resistor 34 and diode 36, and (3) the conductor G1 via a resistor 38 and diode 40. The flow of current through the resistor of the potentiometer P12 establishes a voltage at the tap of the potentiometer which ultimately determines the brightness level of lamp load L1.

Recall that a signal applied to conductor K determines the rate of change of brightness of a corresponding lamp load if no signal is applied to conductor Gi. In the case just described, however, current signals were applied to both conductors K and G1. Thus, the current signal on conductor G1 "overrides" the current signal on conductor K because the series connection of resistors 38 and 42 has a lower resistance than the series connection of variable resister R2 and resistor 44. The signal applied to conductor Gi therefore causes the OTA of circuit CT1 to abruptly change its output current.

Recall that under the assumptions made for the particular scene under discussion here, the brightness level of lamp load L1 was to be increased abruptly. In accordance with this assumption, the tap of the potentiometer P12 would have been set so that the abrupt increase in output current from the OTA of circuit CT1 would be of positive polarity causing the capacitor 46 to rapidly charge. The capacitor 46 charges to a level determined by the setting of the tap of the potentiometer P12 which, in turn, increases the voltage at the source electrode 48 of the field effect transistor 50 causing the lamp dimmer unit D1 to increase the brightness level of the lamp load L1 as required.

Since the bi-polar switch BPm2 of the switch circuit Sm2 was set in the "Off" position, no current from the conductor E2 may be applied to a potentiometer Pm2 of the switch circuit. Thus, the voltage at the input terminal 3 of the OTA of the circuit CTm remains the same and thus the lamp load Lm remains unchanged as also required under the conditions assumed.

Now assume that a second scene is desired in which the brightness level of the lamp load Lm is to be gradually decreased from a presently high level and that the brightness of all other lamp loads L1 to Lm-1 are to be gradually increased from a presently low level. To achieve this scene, all bi-polar switches BP1n through

BPmn of the switch circuits S1n through Smn respectively would be set to the master of M position. Further, the tap of potentiometer Pmn would be set so that when current were applied thereto a lower voltage than had previously been applied to conductor Hm would be applied thereto. Also, the tap of potentiometer Tn (FIG. 1A) would be set to cause a transistor Qbn to increase its level of conduction. (The individual potentiometers P1n through P[m-1]n need not be adjusted.)

To initiate presentation of this scene, as before, a switch STn of switch circuit SWn is momentarily closed. Upon closure, any of the other switch circuits SW1 through SWn-1 which may have been in an activated state are disabled or turned off. This occurs as follows. Prior to closing switch STn, the voltage on each plate of the capacitor Cn is at a B+ voltage. The capacitor Ci of any switch circuit SWi which in "on" (i.e., its SCR is conducting) will be charged to a B+ voltage. When the switch STn is momentarily closed, SCR **52** is triggered into a conductive condition bringing the right-hand plate of the capacitor Cn to ground potential. This causes the left-hand plate of the capacitor Cn, and thus also lead **9**, to go to ground potential momentarily. Thus, the right-hand plate of any capacitor Ci which was charged to a B+ voltage will be momentarily brought to a −(B+) voltage thereby placing a −(B+) voltage on the anode of a corresponding SCR. This negative voltage causes the SCR's to which it is applied to assume a non-conductive state thus turning off the corresponding switch circuit SW. In this manner, activating any one of the switch circuits SWi by closing the switch STi will cause all other switch circuits SW to be turned off.

Momentarily closing the switch STn turns on an SCR **52** causing an indicator lamp *I*n to light indicating that the switch circuit SWn has been activated. A transistor Qan is also turned on so that current is applied to the conductor En. This current is applied to a diode Dn and variable resistor Rn to conductor K and thus to the control terminal of each of the OTA's. Since all of the bipolar switches BP1n through BPmn are in the M position, no current is applied from conductor En to any of the conductors Gi since the right-hand wiper of each of the bi-polar switches conducts such current to ground. Therefore, no current on any of the conductors Gi overrides the current on conductor K. The current on conductor K thus controls the rate at which the brightness level of the lamp loads L1 through Lm will be changed.

Current applied to conductor En is also applied to the potentiometer Tn and thereby to the base of a transistor Qbn turning on the transistor. Current thus flows from the conductor En to the conductor Fn and thus via the bi-polar switches BP1n through BPmn to corresponding potentiometers P1n through Pmn (since the bi-polar switches are set in the M position). Under the conditions assumed, the potentiometer Tn would have been set so that a fairly substantial current would be applied from the conductor En via the transistor Qbn to the conductor Fn and thereby to potentiometers P1n, ..., P[m-1]n to generate certain voltage levels on conductors H-1. through H1. Because of the substantial current applied to these potentiometers, the voltage levels on conductors H1 through Hm-1 would generally increase over the voltage levels of the previous scene (for which it was assumed that the brightness levels of the lamp loads L1 through Lm-1 were low). The OTA's of circuits CT1 through CTm-**1**, in response to the voltages on conductors H1 through Hm-1 and current on conductor K, cause corresponding lamp loads L1 through Lm-1 to increase their brightness at a rate determined by the current on conductor K to a level established by the voltage on conductors H1 through Hm-**1**. Of course, since the settings of the potentiometers P1n through P[m-1]n were not changed from their previous settings, which could have been different for each potentiometer, the voltages on the conductors H1 through Hm-1 would not necessarily be the same. The operation just described illustrates how the potentiometer Tn, which is common to each of the switch circuits S1n through Smn, can be used as a master control to control the brightness level of a plurality of lamp loads.

The current applied to the conductor Fn is also applied to the potentiometer Pmn which, as indicated earlier, was set at a position to cause the lamp load Lm to decrease in brightness. This would occur even though the current on conductor Fn were fairly substantial provided the tap of the potentiometer Pmn were set near the ground side of the potentiometer. A fairly low voltage is thus applied to the conductor Hm which, under the assumptions made, would cause the OTA of the circuit CTm to discharge the corresponding capacitor **54** at a rate determined by the current applied to the conductor K and this, in turn, would cause the brightness level of the lamp load Lm to be reduced. So, while the brightness levels of lamp loads L1 through Lm-1 were being increased under control of the potentiometer Tn, the brightness of lamp load Lm was being individually controlled to decrease its level.

If it is desired to disable all of the switch circuits SW1 through Swn without at the same time enabling any particular switch circuit, a switch **11** can be operated. By momentarily closing the switch **11**, the left-hand plates of all of the capacitors C1 through Cn are brought to ground level causing the right-hand plate of any capacitor which has been charged to be brought to a negative potential below the potential of the left-hand plate. The voltage at the cathode of the corresponding SCR would thus be made more positive than the voltage at the anode thereof thereby disabling or rendering the SCR non-conductive.

In the manner shown and described above, a plurality of different scenes can be provided by pre-setting rows of circuitry in FIG. **1**, each scene being controlled by the circuitry of a different row. Presentation of that scene is commenced by operating or enabling the corresponding one of switch circuits SW1 through SWn causing current to be applied via a corresponding one of the transistors Qa1 through Qan to a respective one of conductors E1 through En. The rate of changing the brightness levels of the lamp loads is controlled by potentiometers R1 through Rn and the ultimate brightness levels achieved are controlled by potentiometers P11 through Pmn and also by potentiometers T1 through Tn, the former of which serve to control individual ones of the lamp loads and the latter of which serve to control or affect in some degree all of the lamp loads (providing, of course, that the appropriate bipolar switches of the switch circuits S11 through Smn are set in the appropriate positions—either position I or M).

It is to be understood that the above-described arrangement is only illustrative of the principles of the present invention. Other arrangements may be devised by those skilled in the art without departing from the spirit and scope of the invention and it is intended that the appended claims cover such arrangements.

We claim:

1. A lighting controller for controlling *m* dimmer units in a light dimming system, where *m* is greater than **1,** each of said dimmer units being responsive to a voltage level for controlling the flow of current through a corresponding lamp load, which comprises:

m circuit means, each responsive to a first signal for controlling the magnitude of a corresponding one of said voltage levels, each responsive to a second signal for controlling the rate of varying the magnitude of said corresponding voltage level, and each responsive to a third signal for rapidly changing the magnitude of said corresponding voltage level independently of the rate control determined by said second signal to achieve the magnitude determined by said first signal;

means for connecting to a power supply;

a first conductor;

first switch means for selectively connecting said first conductor to said power supply connecting means;

m first adjustable means, each of which is connected to one of said circuit means and each being responsive to a current applied thereto for applying said first signal to said corresponding circuit means;

second adjustable means coupling said first conductor to all of said circuit means for applying said second signal to each of said circuit means;

a second conductor;

third adjustable means coupling said first conductor to said second conductor for applying a portion of the current through said first conductor to said second conductor;

m second switch means, each for selectively coupling one of said first adjustable means to said first conductor for selectively controlling said first signal to said corresponding circuit means through said first adjustable means when said corresponding second switch means is in a first condition and for selectively coupling one of said first adjustable means to said second conductor for selectively controlling said first signal to said corresponding circuit means through said third adjustable means when said corresponding second switch means is in a second condition; and

means associated with each of said second switch means for applying said third signal to a corresponding circuit means when said associated second switch means is in said first condition and for preventing application of said third signal to said corresponding circuit means when said associated second switch means is in said second condition.

2. The controller of claim **1** wherein said third adjustable means comprises a potentiometer one of whose terminals is connected to said first conductor and the other of whose terminals is connected to ground potential, and a transistor whose base is connected to the tap of said potentiometer, whose collector is connected to said first conductor, and whose emitter is connected to said second conductor.

3. The controller of claim **1** wherein each of said second switch means further includes means for preventing application of current to a corresponding first adjustable means when said second switch means is in a third position.

4. The controller of claim **1** wherein said circuit means comprises an operational transconductance amplifier having first and second differential input terminals and a control terminal, said second differential input terminal being coupled to a corresponding first adjustable means and said control terminal being coupled to said second adjustable means.

5. The controller of claim **4** wherein each of said first adjustable means comprises a potentiometer one of whose terminals is connected to a corresponding second switch means and whose tap is connected to said second differential input terminal of a corresponding operational transconductance amplifier.

6. The controller of claim **4** wherein said second adjustable means comprises a variable resistor coupled between said control terminal of said operational transconductance amplifier and said first switch means.

7. A multiple scene lighting controller for controlling *m* dimmer units in a light dimming system, where *m* is greater than **1,** each of said dimmer units being responsive to a voltage signal for controlling the flow of current through a corresponding lamp load, including

m circuit means each responsive to a first signal for controlling the magnitude of a corresponding one of said voltage signals, each responsive to a second signal for controlling the rate of varying the magnitude of said corresponding voltage signal, and each responsive to a third signal for rapidly changing the magnitude of said corresponding voltage signal independently of the rate control determined by said second signal to achieve the magnitude determined by said first signal,

a power supply means,

$m \times n$ first adjustable means, where *n* is greater than **1,** a first *n* of which are connected to a first of said circuit means, a second *n* of which are connected to a second of said circuit means, etc., each of said first adjustable means being responsive to current from said power supply means for applying a first signal to the circuit means to which it is connected,

n second adjustable means, each connected to each of said circuit means and each responsive to current from said power supply means for applying a second signal to each of said circuit means,

n first conductors each connected to a different one of said second adjustable means,

n first switch means each coupled to a different one of said first conductors for applying current thereto from said power supply means,

$m \times n$ second switch means, a first *m* of which are coupled to a first of said *n* first conductors, a second *m* of which are coupled to a second of said *n* first conductors, etc., each of said second switch means including means for applying a third signal to one of said circuit means when the respective second switch means is in a first condition and current is applied to the first conductor to which the respective second switch means is coupled, and means for preventing application of a third signal to said one of said circuit means when the respective second switch means is in a second condition.

8. A multiple scene lighting controller as in claim **7** wherein each of said second switch means further includes means for applying current from said first conductor to which said second switch means is connected to a different one of said first adjustable means when said second switch means is in said first condition.

9. A multiple scene lighting controller as in claim 7 wherein each of said first switch means includes manually operable means, and means responsive to the operation of said manually operable means for applying current to a corresponding first conductor, and for causing the remaining first switch means to inhibit application of current to the remaining first conductors.

10. A multiple scene lighting controller as in claim 7 wherein each of said second adjustable means comprises a variable resistor.

11. A multiple scene lighting controller as in claim 10 further comprising manually operable means coupled to each of said first switch means for causing said first switch means to inhibit application of current to said first conductors.

12. A multiple scene lighting controller as in claim 7 further including n second conductors, a first of which is connected to a first m of said second switch means, a second of which is connected to a second m of said second switch means, etc., and n third adjustable means, each for applying a portion of the current from a different one of said first conductors to a different one of said second conductors.

13. A multiple scene lighting controller as in claim 12 wherein each of said second switch means further includes means for applying current from the second conductor to which the second switch means is connected to a different one of said first adjustable means when the second switch means is in the second condition.

14. A multiple scene lighting controller as in claim 12 wherein each of said third adjustable means comprises a potentiometer one of whose terminals is connected to a corresponding first conductor and the other of whose terminals is connected to ground potential, and a transistor whose base is connected to the tap of the potentiometer, whose collector is connected to the corresponding first conductor, and whose emitter is connected to a corresponding second conductor.

15. A multiple scene lighting controller as in claim 12 wherein each of said second switch means further includes means for enabling the second switch means to assume a third condition in which a third signal is applied via the second switch means to one of said circuit means and in which the second switch means inhibits application of current from either the first or second conductors to which the second switch means is connected to a corresponding one of said first adjustable means.

16. A multiple scene lighting controller as in claim 15 wherein each of said second switch means comprises first and second wiper terminals and first and second sets of first, second and third contacts, said first wiper terminal contacting said first, second and third contacts of said first set when the second switch means is in the first, second and third conditions respectively, said second wiper terminal contacting said first, second and third contacts of said second set when the second switch means is in the first, second and third conditions respectively, said first wiper terminal being connected to ground potential, and said second wiper terminal being connected to a corresponding first adjustable means.

17. A multiple scene lighting controller as in claim 16 wherein each of said first adjustable means comprises a potentiometer one of whose terminals is connected to a corresponding one of said second wiper terminals and the other of whose terminals is connected to ground potential and whose tap is connected to one of said circuit means.

18. A multiple scene lighting controller as in claim 7 wherein each of said circuit means comprises an operational transconductance amplifier having first and second differential input terminals and a control terminal, said second differential input terminal being coupled to a corresponding first adjustable means and said control terminal being coupled to a corresponding second adjustable means and to a corresponding second switch means.

19. A multiple scene lighting controller as in claim 18 wherein each of said first adjustable means comprises a potentiometer one of whose terminals is connected to a different one of said second switch means, the taps of a first n of said potentiometers being connected to the second differential input terminal of a first one of said operational transconductance amplifiers, the taps of a second n of said potentiometers being connected to the second differential input terminal of a second one of said operational transconductance amplifiers, etc.

20. A multiple scene lighting controller as in claim 19 wherein each of said second adjustable means comprises a variable resistor connected to the control terminal of each of said operational transconductance amplifiers.

21. A multiple scene lighting controller as in claim 20 wherein a first n of said second switch means are connected to the control terminal of a first operational transconductance amplifier, a second n of said second switch means are connected to the control terminal of a second operational transconductance amplifier, etc.

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