# United States Patent [19]

**Matsui et al.**

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[54] **ELECTRIC CIRCUIT FOR ENERGIZING AND DEENERGIZING AN EXCITER LAMP OF A TALKIE PROJECTOR**


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[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.** ..... **315/307**; 315/135; 315/205; 315/208; 315/291; 315/311; 323/4

[51] **Int. Cl.**[2] ..... **G05F 1/56**; H05B 39/04

[58] **Field of Search** ..... 315/94, 101, 107, 135, 315/136, 200 R, 205, 208, 291, 302, 307, 311; 323/4



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[57] **ABSTRACT**

The electric circuit for energizing and deenergizing an exciter lamp of a talkie projector having an optical sound reproducing head in accordance with the present invention comprises a constant current circuit selectively energized by an electric source. The constant current circuit includes a current control output transistor and an error current detecting amplifier. The exciter lamp is connected to the output of the constant current circuit as a load thereof so that the exciter lamp is permitted to be energized or deenergized by the constant current circuit upon energization or deenergization thereof.


**5 Claims, 4 Drawing Figures**

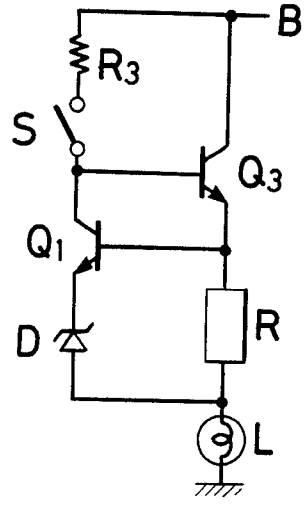


Fig . 1

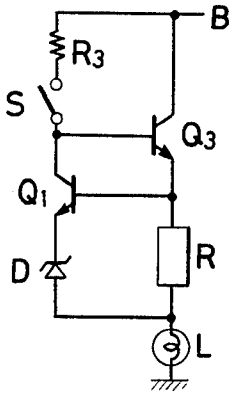



Fig . 2

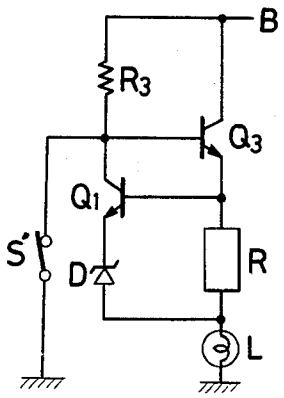



Fig . 3

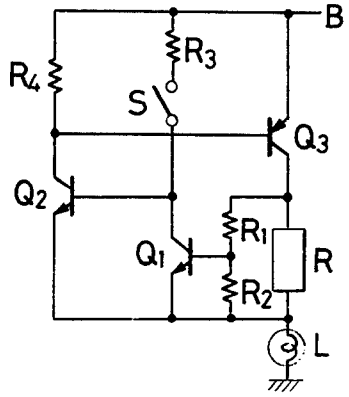
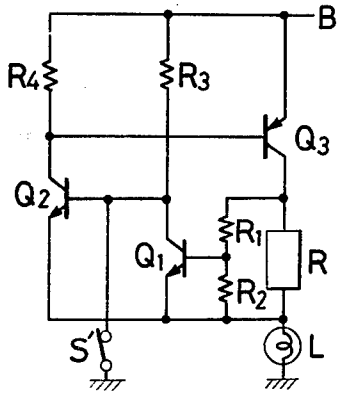



Fig . 4



# ELECTRIC CIRCUIT FOR ENERGIZING AND DEENERGIZING AN EXCITER LAMP OF A TALKIE PROJECTOR

## BACKGROUND OF THE INVENTION

The present invention relates to an electric circuit for energizing and deenergizing an exciter lamp of a talkie projector having an optical sound reproducing head.

In general, the life of a projector lamp for projecting the image born on a film and an exciter lamp for the optical sound reproducing head used in a talkie projector is several tens hours at the longest. In order to prolong the life of a projector lamp, preliminary lighting process has been applied. However, no such process has been applied to prolong the life of an exciter lamp thereby suffering from the short life of the exciter lamp. Although the price of an exciter lamp is relatively low in comparison with a projector lamp, it has often been difficult to obtain the exciter lamp in the market. Further, since the exciter lamp is generally used in a D.C. turn-on system, an excess initial rush current is flow through the exciter lamp if the lamp is inserted into the circuit of the electric source under the condition the circuit is held in the closed state, thereby tending the exciter lamp to be broken. Further, in order to reduce the hum components caused by the exciter lamp when a conventional electric source having resistors, capacitors and ripple filters is used, electrolytic capacitors of fairly large size and capacity are required thereby causing problems of the space and the cost therefor. A system has also been developed in which the exciter lamp is turned on by high frequency electric current, but such a system also suffers from the problems described above.

The present invention aims at avoiding the above described shortages of the prior art electric circuit of the exciter lamp of the talkie projector.

## SUMMARY OF THE INVENTION

It is an object of the present invention to provide a novel and useful electric circuit for energizing and deenergizing an exciter lamp of a talkie projector having an optical sound reproducing head which avoids the above described shortages of the prior art electric circuit of an exciter lamp of a talkie projector.

Another object is to provide a novel and useful electric circuit of the type described above which is simple in construction and which positively prevents the initial rush current from flowing through the exciter lamp when inserted into circuit of the electric source in the closed state thereby insuring long life of the exciter lamp while the ripple is extremely reduced so as to avoid the hum components in the sound reproduction.

The above objects are achieved in accordance with the characteristic feature of the present invention by the provision of an electric circuit for energizing and deenergizing an exciter lamp of a talkie projector having an optical sound reproducing head, comprising a constant current circuit selectively energized by an electric source and including a current control output transistor and error current detecting amplifier having an error current detecting transistor and a constant current detecting resistor, said exciter lamp being connected to said constant current circuit as a load thereof, thereby permitting said exciter lamp to be energized or deenergized by said constant current circuit



by connecting or disconnecting said error current detecting amplifier to or from said electric source.

By such a construction, the exciter lamp is supplied with a constant current without suffering from the initial excess rush current each time the exciter lamp is energized by the constant current circuit thereby insuring the long life of the exciter lamp while the ripple is reduced so as to avoid the hum components in the sound reproduction.

Since the current required for actuating the error current detecting amplifier is very low, the switch and other parts used can be made simple, compact and of a low capacity, while the life of the switch is extremely prolonged.

Further, since the voltage at the constant current detecting terminal of the constant current circuit may be used as an electric source of a constant voltage, a relay or solenoid may be energized thereby in place of the constant current detecting resistor together with the exciter lamp.

## BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a diagram showing the first embodiment of the electric circuit constructed in accordance with the present invention;

FIG. 2 is a diagram similar to FIG. 1 but showing a modification thereof;

FIG. 3 is a diagram showing a second embodiment of the electric circuit of the present invention; and

FIG. 4 is a diagram similar to FIG. 3 but showing a modification thereof.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 1 showing the first embodiment of the present invention, the constant current circuit comprises a current control output transistor $Q_3$ with its collector connected to one terminal B of an electric source, a constant current detecting resistor R connected at its one end to the emitter of the output transistor $Q_3$, an error current detecting transistor $Q_1$ with its collector connected to the terminal B through a collector resistor $R_3$, a constant voltage diode D connected between the emitter of the transistor $Q_1$ and the other end of the constant current detecting resistor R, and a switch S connected between the collector resistor $R_3$ and the collector of the transistor $Q_1$, the base of the output transistor $Q_3$being connected to the collector of the transistor $Q_1$ while the base of the transistor $Q_1$ is connected to a junction between the emitter of the output transistor $Q_3$ and the one end of the constant current detecting resistor R. The transistor $Q_1$ serves as an error current detecting amplifier, and the terminal voltage of the constant current detecting resistor R is compared with a reference voltage obtained by the sum of the base-emitter voltage of the transistor $Q_1$ and the terminal voltage of the constant voltage diode D so that the current flowing through the resistor R is detected so as to render the same to be constant.

In accordance with the characteristic feature of the present invention, the exciter lamp L is connected at its one end to the other end of the constant current detecting resistor R while the other end of the lamp L is connected to the other terminal of the electric source, i.e., to the earth. Thus, the exciter lamp L is connected to the constant current circuit as a load thereof.

In operation, when the switch S is opened, no current is supplied to the transistor $Q_1$ and, hence, the output transistor $Q_3$ is held in non-conductive state so that the constant current circuit is held in opened state thereby extinguishing the exciter lamp L. When the switch S is closed, a current is supplied to the base of the output transistor $Q_3$ and the collector of the transistor $Q_1$ through the collector resistor $R_3$ so as to render the same to be conductive so that current is supplied to the base of the error current detecting transistor $Q_1$ thereby rendering also the transistor $Q_1$ to be conductive so that a constant current is supplied to the exciter lamp L through the constant current detecting resistor R to turn the exciter lamp L on, wherein the terminal voltage of the resistor R is compared with the sum of the base-emitter voltage of the error current detecting transistor $Q_1$ and the terminal voltage of the constant voltage diode D so as to insure the constant current to be supplied to the exciter lamp L.

FIG. 2 shows a modification of FIG. 1, wherein a switch S' is provided in place of the switch S of FIG. 1 which is connected at its one contact to the junction of the base of the output transistor $Q_3$ and the collector of the transistor $Q_1$ to which the resistor $R_3$ is also connected, the other contact being connected to the other terminal of the electric source, i.e., to the earth.

The operation of the circuit of FIG. 2 is similar to that of FIG. 1, except that the lamp L is energized when the switch S' is opened so as to supply current to the transistors $Q_1$ and $Q_3$, while, when the switch S' is closed, the lamp is deenergized.

FIG. 3 shows the second embodiment of the present invention. The circuit of FIG. 3 is substantially similar to that of FIG. 1, except that the error current detecting amplifier is constructed by the transistor $Q_1$ and a further transistor $Q_2$ provided in place of the diode D of FIG. 1, the collector of the transistor $Q_2$ being connected to the terminal B of the electric source through collector resistor $R_4$ as well as to the base of the output transistor $Q_3$ while the base of the transistor $Q_2$ is connected to the collector of the transistor $Q_1$ and the emitter of the transistor $Q_2$ is connected to the emitter of the transistor $Q_1$. In the embodiment of FIG. 3, the base of the transistor $Q_1$ is connected to a junction between a first voltage dividing resistor $R_1$ and a second voltage dividing resistor $R_2$ connected in series to each other, the opposite end of the resistor $R_1$ being connected to the junction between the collector of the output transistor $Q_3$ and the one end of the resistor R while the opposite end of the resistor $R_2$ is connected to the other end of the resistor R. Thus, the divided voltage of the terminal voltage of the resistor R obtained by the resistors $R_1$, $R_2$ is compared with the reference voltage obtained by the base-emitter voltage of the transistor $Q_1$ so as to insure the constant current supplied by the resistor R to the lamp L.

In operation, in like manner as in the case of FIG. 1, when the switch S is closed, the constant current circuit is energized to turn the lamp L on, while, when the switch S is opened, the constant current circuit is opened to extinguish the lamp L.

FIG. 4 shows a modification of FIG. 3. The embodiment of FIG. 4 is similar to FIG. 3 except that the switch S' is provided in place of the switch S of FIG. 3 like manner as in the case of FIG. 2 in which the switch S' is provided in place of the switch S of FIG. 1.

The operation of the embodiment of FIG. 4 is similar to that of FIG. 3, but, when the switch S' is opened, the constant current circuit is energized so that the lamp L is energized while, when the switch S' is closed, the lamp L is extinguished.

We claim:

1. Electric circuit for energizing and deenergizing an exciter lamp of a talkie projector having an optical sound reproducing head, comprising a constant circuit connected between one terminal of an electric source and one end of said exciter lamp the other end of which is connected to the other terminal of said electric source, said constant current circuit comprising a current control output transistor with its emitter and collector connected between said one terminal of said electric source and said exciter lamp for energizing said exciter lamp when rendered to be conductive, a constant current detecting resistor connected between said current control output transistor and said exciter lamp, an error current detecting transistor with a collector resistor thereof connected to said one terminal of said electric source and its base connected to a junction between said current control output transistor and said constant current detecting resistor, the base of said current control output transistor being connected to a junction between said collector resistor of said error current detecting transistor and the collector of said error current detecting transistor the emitter of which is connected to a junction between said constant current detecting resistor and said exciter lamp, and a switch connected to the collector circuit of said error current detecting transistor for opening and closing the collector current flowing therethrough thereby permitting said current control output transistor to be rendered conductive by the operation of said switch so as to turn on said exciter lamp.

2. Electric circuit according to claim 1, wherein a constant voltage diode is connected between the emitter of said error current detecting transistor and said junction between said constant current detecting resistor and said exciter lamp, and said switch is connected between said collector resistor of said error current detecting transistor and the collector of said error current detecting transistor.

3. Electric current according to claim 1, wherein a constant voltage diode is connected between the emitter of said error current detecting transistor and said junction between said constant current detecting resistor and said exciter lamp, and said switch is connected between the collector of said error current detecting transistor and said other terminal of said electric source.

4. Electric circuit according to claim 1, wherein the base of said current control output transistor is connected through the collector-base path of a further transistor to the collector of said error current detecting transistor, said collector of said further transistor being connected to said one terminal of said electric source through a collector resistor thereof while the emitter thereof is connected to the emitter of said error current detecting transistor, and the base of said error current detecting transistor is connected through a first voltage dividing resistor to said junction between said current control output transistor and said constant current detecting resistor while said base is connected to said junction between said constant current detecting resistor and said exciter lamp through a second voltage

dividing resistor, said switch being connected between the collector of said error current detecting transistor and said collector resistor of said error current detecting transistor.

**5.** Electric circuit according to claim **1**, wherein the base of said current control output transistor is connected through the collector and the base of a further transistor to the collector of said error current detecting transistor, said collector of said further transistor being connected through a further collector resistor to said one terminal of said electric source while the emitter thereof is connected to the emitter of said error current detecting transistor, and the base of said error current detecting transistor is connected through a first voltage dividing resistor to said junction between said current control output transistor and said constant current detecting resistor while said base is connected to said junction between said constant current detecting resistor and said exciter lamp through a second voltage dividing resistor, said switch being connected between said other terminal of said electric source and the collector of said error current detecting transistor.

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