United States Patent [19]

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[11] **3,728,713**

[45] **Apr. 17, 1973**

[54] TRANSISTORIZED FLASHER CIRCUIT

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[22] Filed: **July 28, 1970**

[21] Appl. No.: **58,919**

[52] **U.S. Cl.** .....**340/331**, 307/252 F, 315/200 A, 315/217, 317/148.5 B, 331/111, 340/81 R

[51] **Int. Cl.** **B60q 1/38**, H05b 39/09

[58] **Field of Search**.....340/72, 81, 82, 83, 340/331; 307/132 E; 315/209 R, 210, 217; 317/141 S

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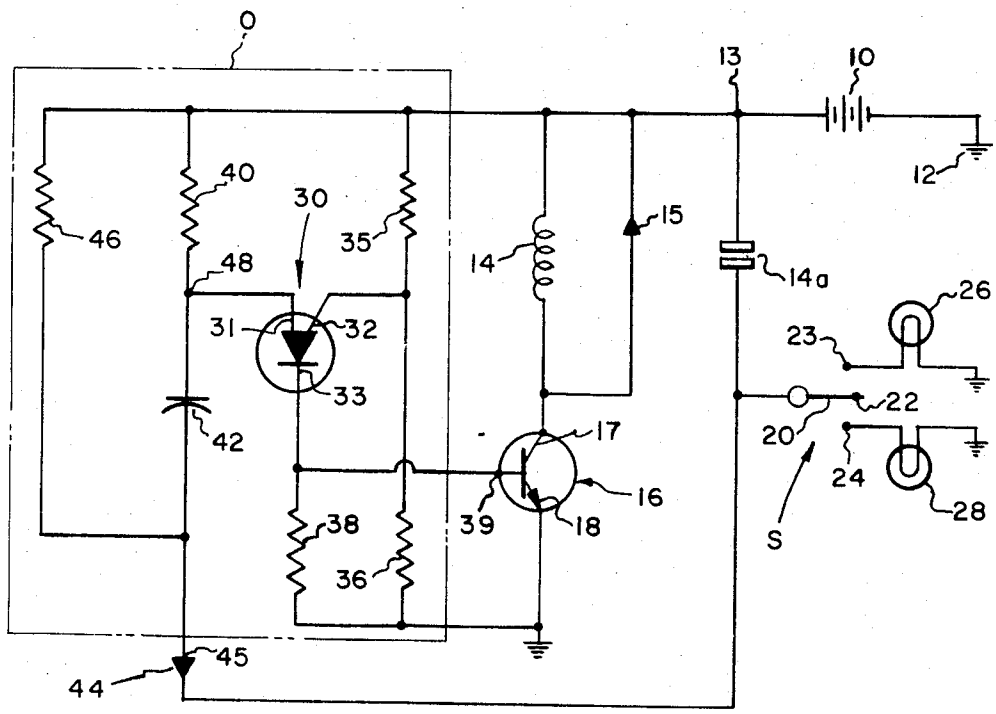
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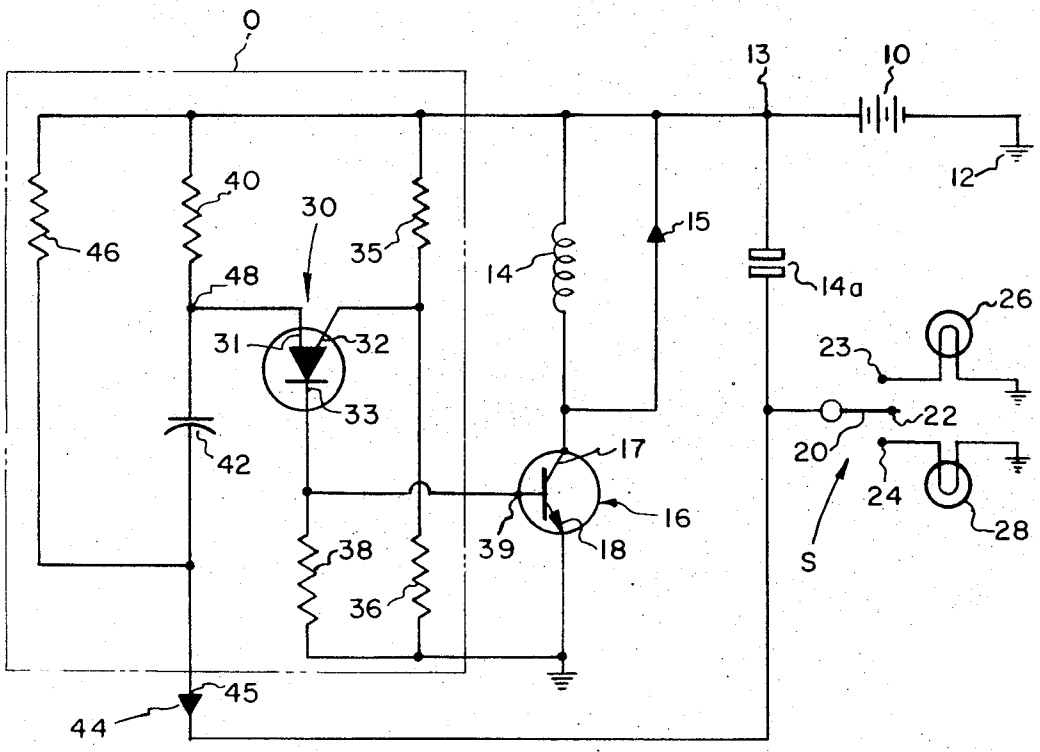
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[57] **ABSTRACT**

A transistorized flasher circuit for vehicle signal lamps comprising a free running multivibrator, incorporating a capacitor and a programmable unijunction transistor, for cyclically and intermittently driving an output transistor into a conductive state as the capacitor is alternately charged and discharged. A relay is provided and includes a coil connected in series with the output circuit of the output transistor and a set of normally open contacts which are connected in series with a lamp load and a start switch and which are closed in response to the energization of the coil. A charging circuit including the capacitor and a diode connected in series therewith is connected in parallel with the set of relay contacts for charging the capacitor along a first path when the set of relays contacts open. A discharging circuit is provided for discharging the capacitor along a second path, which does not include the diode, when the relay contacts close.

2 Claims, 1 Drawing Figure





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TRANSISTORIZED FLASHER CIRCUIT

FIELD OF THE INVENTION

This invention relates to automotive signal lamp circuits and more particularly to a transistorized signal lamp flasher circuit employing a relay and being operable in a manner which is substantially independent of the relay characteristics.

DESCRIPTION OF THE PRIOR ART

Prior art flasher circuits incorporating relays have been proposed heretofore, but their operation in most instances has been dependent upon the load and the voltage values at which the relay coil is operable to close and open the relay contacts. In such circuits, should the output of the operating voltage source fall below the "pull in" voltage of the relay, the circuit will not function properly. Moreover, the frequency at which the signal lamps flash is dependent upon the strength of the voltage source and, as the output of the source decreases, the frequency also decreases.

The prior art flasher circuits also are rather large and unwieldy and incorporate a substantial number of parts which prevents their being assembled compactly with the relays controlled thereby.

An object of this invention is to provide a flasher circuit, incorporating a relay, for intermittently energizing a lamp load and which operates at a frequency which is not load sensitive and is substantially independent of the relay operating characteristics.

Another object of the invention is to provide an intermittently energized flasher circuit composed of substantially fewer parts than previously have been required.

Other objects and advantages of the invention will be pointed out specifically or will become apparent from the following description.

A transistorized flasher circuit constructed according to the invention and adapted for use in conjunction with vehicle signal lamps comprises a relay having an operating coil connected in the output circuit of a transistor and a set of relay contacts connected with a series circuit including a manually operable switch and a lamp load. A free-running multivibrator, including a programmable unijunction transistor, is provided for cyclically and intermittently triggering the transistor between its conductive and non-conductive states and includes a resistance-capacitance charging circuit serially connected with a diode across the relay contacts for periodically rendering the programmable unijunction transistor conductive. The charging circuit automatically is isolated from its charging source and the load when the relay contacts close.

The invention more readily may be understood by reference to the accompanying drawing wherein the single FIGURE is a schematic diagram of a circuit embodying the invention.

A transistorized flasher circuit constructed according to the preferred embodiment of the invention is adapted to be connected to a source **10** of direct current which may be a conventional vehicle storage battery having its negative terminal connected to a common ground **12** and its positive terminal connected to a junction **13**. A relay operating coil **14** is connected to the junction **13** and controls a set of normally open contacts **14*a*** which also are connected to the junction

13. The contacts **14*a*** are closed when the relay operating coil **14** is energized. An NPN junction transistor **16** includes a collector electrode **17** connected to the operating coil **14** and an emitter electrode **18** at ground potential. A "free-wheeling" diode **15** of known construction is connected in parallel with the relay coil **14** to suppress the inductive voltage transient which otherwise would occur across the coil when the transistor **16** is rendered non-conductive.

The set of relay contacts **14*a*** is connected in series circuit with the manually movable armature **20** of a turn signal selector switch S having neutral, left, and right output contacts **22**, **23**, and **24**, respectively, which are selectively engageable by the armature **20**. The contacts **23** and **24** are connected with left-hand and right-hand signal lamps **26** and **28**, respectively, which are at ground potential.

To render the transistor **16** conductive and non-conductive, a free-running multivibrator oscillator circuit, generally shown in chain lines at O, is provided and includes a four-layer programmable unijunction transistor **30** having an anode electrode **31**, a gate anode electrode **32**, and a cathode electrode **33**. A programmable unijunction transistor such as that made by General Electric Company and designated Model D13T1 is suitable.

The gate electrode **32** is connected to the junction of the resistors **35** and **36** which are connected in series across the source **10** between the junction **13** and ground **12**. The resistors **35** and **36** function as a voltage divider and control the voltage at which the anode to gate junction of the programmable unijunction transistor **30** becomes forward biased. The cathode **33** of the unijunction transistor **30** is connected to the base electrode **39** of the transistor **16** and also is connected to a load resistor **38** which is connected to ground potential. The potential drop across the resistor **38** controls the conduction of transistor **16** which functions as an electronic switch.

The oscillator circuit O includes a capacitor **42** serially connected to a resistor **40** which is connected to the junction **13**. The anode **45** of a diode **44** is connected to the capacitor **42** and the cathode of the diode **44** is connected to the movable armature **20** of the turn signal selector switch. The resistor **40**, the capacitor **42**, and the diode **44** thus provide a capacitor charging circuit connected in parallel with the relay contacts **14*a*** for charging the capacitor **42** only when the relay contacts **14*a*** are open. A resistor **46** is connected in parallel with the resistor **40** and the capacitor and provides a discharge path for the capacitor **42**. The emitter **31** of the programmable unijunction transistor **30** is connected to the junction **48** between the resistor **40** and the capacitor **42**.

In an operating embodiment of the invention, the following circuit constants were found suitable for obtaining a flash rate of 90 per minute:

Source **10**	12 volts
Relay coil **14**	66 ohms
Resistor **35**	1 Kohm
Resistor **36**	3.3 Kohm
Resistor **38**	22 Kohm
Resistor **40**	220 Kohm
Resistor **46**	680 Kohm
Transistor **16**	2N341
Transistor **30**	D13T1
Capacitor **42**	1.0 Microfd.

THE OPERATION

When the switch **20** is in the neutral position shown in the drawing, the relay coil **14** will not be energized and the contacts **14a** will be opened. When the operator moves the turn signal switch armature **20** from the neutral position to engage the contact **24**, for example, for the purpose of operating the lamp **28**, a circuit will be completed from the source **10** through the resistor **40**, the capacitor **42**, the diode **44**, the armature **20**, and the lamp **28** to initiate charging of the capacitor **42**. Because of the relatively high resistance of the resistor **40**, the charging current is insufficient to illuminate the lamp **28**. When the capacitor **42** has been charged so that the voltage at the junction **48** is sufficient to forward bias the anode to gate junction of the programmable unijunction transistor **30**, the regeneration inherent in the four-layer programmable unijunction transistor causes the transistor **30** to become conductive and cause a current flow through the resistor **38** to ground. The voltage drop across the resistor **38** will be such as to forward bias the emitter to base junction of the transistor **16** so as to render the transistor **16** conductive. Current thus will flow from the source **10** through the relay coil **14** and the collector **17** and the emitter **18** of the transistor **16**. When the relay coil **14** is energized, the contacts **14*a*** will close to provide a circuit for lamp illuminating current to flow from the source **10**, through the contacts **14*a***, the switch **20**, and the lamp load **28**.

When the contacts **14*a*** close it is important to note that the charging circuit including resistor **40**, capacitor, **42**, and diode **44** will be automatically isolated from the source **10** in that the potential of the switch armature **20** will approach the potential of junction **13**. The capacitor **42** then discharges through the resistor **40** and the resistor **46** so as to reduce the voltage of the junction **48** by an amount sufficient to reverse bias the anode to gate junction of the programmable unijunction transistor **30** and thus render it non-conductive. The potential at the switch **20** reverse biases the diode **44** and permits the capacitor **42** to discharge through the resistor **46**. The capacitor **42** is also automatically isolated from the load **28** and the discharge rate of capacitor **42** is, therefore, not load sensitive. Thus the length of time that the transistors **30** and **16** remain conductive is independent of the load and the length of time that the lamp **28** is lighted and remains substantially constant. When the current flow through the resistor **38** ceases, the transistor **16** is rendered non-conductive, thus deenergizing the winding **14** whereby the contacts **14*a*** will open to darken the lamp **28**. The capacitor **42** thereupon again charges through the diode **44** and the cycle is repeated. The circuit is independent of load and is unaffected by the relay characteristics since the wave form of the voltage in the output circuit of the transistor **16** is substantially square.

When the capacitor **42** is being charged, the diode **44** is forward biased and the charging time is determined primarily by the resistance of the resistor **40**. However, when the capacitor **42** is discharging, the diode **44** is reverse-biased because the emitter end **45** of the diode **44** is then negative. As long as the capacitor **42** is charged, the discharge current must flow through the resistor **46**. Thus, the discharging time is determined by the resistance of both of the resistors **40** and the resistors **46**. Consequently, the "on" and "off" times of the unijunction transistor **30** and the lamps **26** and **28** are controlled by the values of the resistors **40** and **46**. If the resistor **46** is approximately twice the resistance of resistor **40**, the "on" and "off" times are approximately equal.

The disclosure is intended to be illustrative rather than definitive of the invention. The invention is defined in the claims.

I claim:

1. A flasher circuit comprising:

a source of unidirectional electric potential;

a junction transistor having emitter, collector and base electrodes;

a relay having an operating coil and normally disengaged contacts which are movable into engagement in response to energization of said coil, said operating coil being serially connected with said source and the emitter and collector electrodes of said junction transistor, said contacts being connected to said source and a series circuit comprising a manually operable switch and a lamp load;

a diode connected to the junction of said contacts and said series circuit; and

circuit means connected to said source and including:

a capacitor charging circuit connected to said relay contacts and including a first resistor and a capacitor connected in series with said diode to provide a charging path for capacitor charging current when said contacts are disengaged,

a discharging circuit including a second resistor connected in parallel with said first resistor and said capacitor to provide a discharging path for capacitor discharging current when said contacts are engaged,

a programmable unijunction transistor including anode, gate, and cathode electrodes, said anode electrode being connected to the junction of said first resistor and said capacitor,

a voltage divider connected to said source, and

a third resistor connected to said source,

said gate electrode being connected to said voltage divider,

said cathode electrode being connected to said third resistor and to the base electrode of said junction transistor.

2. A flasher circuit, adapted to be connected to a source of unidirectional electric potential, for intermittently energizing a signal lamp, comprising:

a relay including an electrically energizable operating coil, and a pair of contacts adapted to be connected to said source and movable between disengaged and engaged positions in response to energization and deenergization of said operating coil;

a lamp load;

switch means connected in circuit with said pair of contacts and said lamp load and being movable between a closed position and an open position for respectively connecting and disconnecting said lamp load to and from said source through said pair of contacts in the engaged position;

a transistor having base, emitter and collector electrodes, said emitter and collector electrodes being connected in series with said operating coil for establishing current flow from said source to said

operating coil when said transistor is conductive so that said pair of contacts is moved to said engaged positions to energize the lamp load; and

circuit means connected in circuit with said transistor and said switch means and operable upon application of said electric potential thereto, when said switch means moves to said closed position, to cyclically and intermittently trigger said transistor between conductive and non-conductive states and cyclically establish current flow from said source through said emitter and collector electrodes and said operating coil so that said pair of contacts move between said disengaged and said engaged positions and energize the lamp load;

said circuit means comprising a series charging circuit, connected in parallel circuit with said pair of contacts, including a first resistor, a chargeable and dischargeable capacitor, and a diode connected to said switch means permitting the flow of current in a first direction to said switch means and said load when said contacts are in said disengaged positions and for blocking a reverse flow of current isolating said first resistor and capacitor from said lamp load when said contacts are in said engaged positions;

a discharging circuit including a second resistor connected in parallel with said first resistor and said capacitor providing a discharge path for said capacitor when said contacts are in said engaged positions; and

a programmable unijunction transistor having anode, gate, and cathode electrodes, said anode electrode being connected to the junction of said capacitor and said first resistor, said gate electrode being adapted to be connected in circuit with said source, said cathode electrode being connected to said base electrode.

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