LOW-VOLTAGE TRANSISTORIZED ELECTRIC LIGHT FLASHER CIRCUIT FOR BARRICADE LIGHTS ETC.

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Fig. 2

Fig. 1

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LOW-VOLTAGE TRANSISTORIZED ELECTRIC LIGHT FLASHER CIRCUIT FOR BARRICADE LIGHTS, ETC.

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This invention relates to electric light flasher circuits of the type utilizing coupled NPN and PNP transistors for developing an intermittent or fluctuating electric current such as to intermittently energize a lamp with a flashing action. The invention is applicable to barricade lights, such as are used for warning motorists to avoid barricaded areas where road repairs are in progress, or of dangerous roadway conditions or obstructions; and it is also applicable to indicator lights such as are used on instrument panels of complex mechanism, as in airplanes, for providing a warning indication of any fault or other condition occurring in any of the several components of such mechanism, requiring the attention of an operator or attendant.

The general object of the invention is to provide a flasher circuit of this general type, which is particularly adapted for operation on a low voltage such as is conveniently utilized in a portable barricade light flasher unit.

A more specific object is to provide a transistorized flasher circuit in a portable barricade light unit. Another object is to provide an improved, simplified transistorized flasher circuit.

Other objects and advantages will become apparent in the ensuing specification and appended drawing in which:

FIG. 1 is a perspective view of a barricade light embodying the invention;

FIG. 2 is a schematic diagram of my improved circuit.

Referring now to the drawings in detail, and in particular to FIG. 1, I have shown therein, as an example of one form in which the invention may be embodied, a barricade light unit which, physically, embodies a lamp bulb 10 mounted in a rectangular casing 11 adapted to be seated upon a street barricade, and a lens 12 mounted in the casing 11 in front of the lamp bulb 10. Lens 12 may be of transparent or translucent glass or plastic material, which may in some cases be of a red color to impart warning red glow to the light flashes. Lamp bulb 10 may be a small filament lamp adapted to operate on 3 volts. A flasher control unit, mounted within the casing 11, is connected to the lamp 10 as will be more fully described hereinafter.

The flasher control circuit includes a pair of transistors PNP and NPN, resistors 40K and 270, and a capacitor C. As indicated by their reference characters, the transistors are of the NPN and PNP types, respectively.

A source of three volt direct current is indicated at 3v. It may be a small dry battery such as is used in a flashlight (e.g. two flashlight dry cells). Lamp 10 is connected in series with the collector 15 and emitter 16 of transistor PNP across current source 3v by conductors 17, 19, 19 and 20, so that when transistor PNP becomes conductive, its load current will energize lamp 10. Base 21 of transistor PNP is connected to resistor 40K by a conductor 22.

Transistor NPN functions to apply a fluctuating bias to the emitter 16 of transistor PNP. Transistor NPN in turn is biased by a fluctuating voltage applied across its emitter 23 and base 24, the latter being joined to a connection 25 between resistor 40K and the positive side of capacitor C. Where it has previously been considered necessary, however, to utilize a separate voltage source to apply the bias for developing an emitter current in the NPN transistor, or to interpose the load and an additional resistance in series between the emitter and the current source, the present invention achieves more dependable operation and simplicity through a direct connection 26 from the negative side of source 3v to emitter 23.

The negative side of capacitor C is joined by a connection 27 to the conductor 17 of the lamp circuit, and thus is directly connected to the collector 15 of transistor PNP.

Collector 28 of transistor NPN is connected by a conductor 29 and conductor 22 to the base 21 of transistor PNP, in parallel with resistor 40K. To this parallel connection is also joined one side of resistor 270, the other side thereof being connected by a conductor 30 and the conductor 19 to the positive side of current source 3v.

The invention is particularly characterized by the direct connection between condenser C and lamp 10, with substantially no voltage drop between them, and the parallel connection of the other side of condenser C to the bases of both transistors, with a relatively high resistance 40K interposed in the connection to base 21 of transistor PNP.

The invention is further characterized by the direct connection of collector 28 of transistor NPN to the base 21 of transistor PNP, without any interposed resistance.

Resistor 40K is of high resistance value (e.g. 40,000 ohms) whereas resistor 270 is of relatively low resistance value (e.g. 20 ohms). Capacitor C has a capacity of about 20 microfarads.

In operation, when the capacitor C is discharged, the transistors will be in a non-conducting state and the potential on NPN transistor base 24 will be low (negative). A small charging current will flow in the circuit including conductors 29 and 27, capacitor C, resistor 40K, conductor 22, resistor 270 and conductors 30 and 19, gradually charging capacitor C and causing the base of transistor NPN to gradually become more positive with respect to its emitter 23, which remains negative, at the same potential as the negative side of current source 3v.

As the base 24 becomes more positive, the resulting control current flow between emitter 23 and base 24 will render transistor NPN conducting, and collector current will flow in its collector circuit including conductors 28 and 29 and resistor 270. The resistance value of the latter is just sufficient to restrain this current to a relatively weak intensity, which is adequate, however, to maintain the potential on emitter 16 of transistor PNP at a high level while dropping the potential on plate 21 of transistor PNP to a more negative value than that which existed when no collector current was flowing in transistor NPN.

During the transition from non-conduction to conduction in transistor NPN which results in a drop in the potential of collector 28 from a previous value just slightly less than that at terminal 7 of source 3v (the resistor 270 being of relatively low value) to a much more negative value because of the flow across transistor NPN, the potential of plate 21 of transistor PNP will drop exactly in step with the drop in collector 28. The action of transistor PNP therefore follows closely the action of transistor NPN, and as a positive bias thus is established on the emitter 16 of transistor PNP, the latter will become conducting to a sufficient extent to light the lamp 10 and to simultaneously discharge the capacitor C.

As capacitor C loses its charge, the potential on its positive side will drop, and plate 24 of transistor NPN will correspondingly become more negative, until the bias across this transistor in its emitter circuit will have been reduced to the point where the transistor becomes non-conducting. With the collector current of the transistor NPN thus cut off, the plate 21 of transistor PNP
by leakage current through the relatively low resistance
of resistor 270, will gradually be restored to a potential
only slightly below that of terminal 7 at the positive side
of current source 3V, thus cutting off the forward bias in
the emitter circuit of transistor PNP and causing this
transistor to become non-conducting and the lamp 10 to
be extinguished. This restoration of positive potential
on plate 21 proceeds relatively rapidly, while the positive
side of capacitor C is held at substantially zero potential
(i.e. the capacitor remains in a substantially discharged
state) due to the high resistance value of resistor 40K.
This completes a cycle of operation, with both transistors
non-conducting and with capacitor C discharged. A new
cycle of operation will immediately commence with the
charging of capacitor C by the relatively weak current
passing through lamp 10 and resistors 40K and 270 in
series.

The circuit of this invention is particularly adapted for
flashing a low voltage lamp such as may be used for a
barricade warning light, the red glow of the ruby lens 12
being quite visible although of low intensity. Such a
barricade light can be energized for long periods by a
low voltage battery.

The direct, low resistance connection 26 between the
PNP emitter 23 and source 3V makes it possible to oper-
ate the circuit satisfactorily on the three volt current
source.

I claim:
1. In a low voltage electric light flasher apparatus, in
combination: a lamp; positive and negative terminals for
connection to a low voltage source; a PNP transistor
arranged with its emitter and collector connected in series
with and connected respectively to said lamp and posi-
tive terminal; an NPN transistor having a direct connec-
tion, without substantial resistance, between its emitter
and the negative terminal; means including a low voltage
resistor in series connecting the collector of said NPN
transistor to the PNP emitter and to said positive termi-
nal; a direct connection, without substantial resistance,
between said NPN collector and the base of the PNP
transistor; a capacitor having a negative side connected
to said lamp by a direct connection without substantial
resistance, with the lamp in series between said capaci-
tor and the negative terminal; a direct connection, with-
out substantial resistance, between the positive side of
said capacitor and the base of said NPN transistor; and
means including a high resistance value resistor provid-
ing a connection between said last mentioned direct con-
nection and said low value resistor and providing a parallel
connection between said last mentioned direct connec-
tion and said PNP base, providing a weak current path
from said source through said lamp, said capacitor, and
said high and low value resistors, for charging said ca-
pacitor while positive potential is built up on the PNP
base for rendering the PNP transistor non-conducting.
2. In a low voltage electric light flasher apparatus, in
combination: a lamp; positive and negative terminals for
connection to a low voltage source; a direct shunt connec-
tion between one side of said lamps and said negative
terminal a PNP transistor arranged with its emitter and
collector having respective shunt connections to said lamp
and positive terminal and thereby connected in series
with the other side of said lamp and source when said
transistor is conducting; an NPN transistor having a di-
rect shunt connection between its emitter and the nega-
tive terminal; means including a low value resistor in
series connecting the collector of said NPN transistor to
the PNP emitter and to said positive terminal; a direct
shunt connection between said NPN collector and the
base of the PNP transistor, said resistor providing a mini-
mum voltage drop between said PNP emitter and base
for establishing emitter bias in said PNP transistor; a
capacitor and a high value resistor in series with one an-
other, connected in parallel to said other side of said
lamp and the PNP collector on one side and in parallel
to said low value resistor and the PNP emitter and posi-
tive terminal on the other side, the base of said NPN
transistor being connected between said capacitor and
said high value resistor; said lamp, capacitor, and resis-
tors in series providing a weak current path for gradually
charging said capacitor while simultaneously raising the
base potential of said NPN transistor to back-bias the
same until it becomes conductive, the direct connection
between said NPN collector and said PNP base utilizing
the load current of said NPN transistor to drop the poten-
tial on the base of said PNP transistor until the latter
becomes conducting and provides a collector current
which is effective to illuminate said lamp and to simulta-
eously discharge said condenser for the beginning of
another cycle of operation.
3. A light flasher apparatus as defined in claim 2,
wherein said low voltage source is a dry battery, and
including a casing in which said battery, transistors, res-
sistors and connections are encased.

References Cited in the file of this patent

UNITED STATES PATENTS
2,788,449 Bright ---------------- Apr. 9, 1957
2,829,257 Root ---------------- Apr. 1, 1958
2,831,113 Weller ------------- Apr. 15, 1958

OTHER REFERENCES
75-76 reld on).