

[54] ASTABLE SWITCHING CIRCUIT

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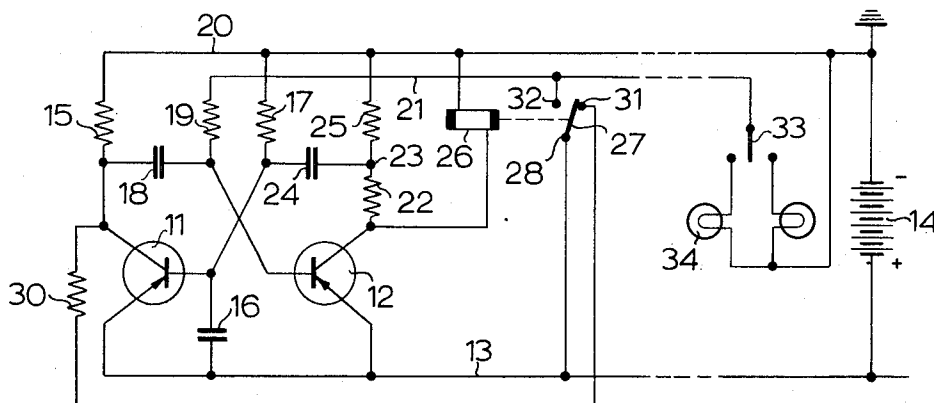
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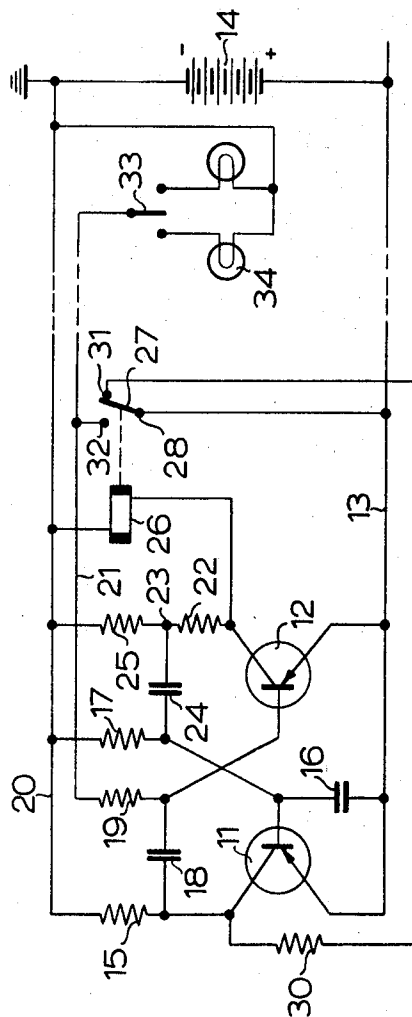
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[57] ABSTRACT

An astable circuit arrangement for providing periodically spaced pulses to a flashing directional light system in motor vehicles. Two transistors of identical conductivity type are intercoupled through capacitive and resistance networks so as to generate the required pulses for actuating the flashing light. The coil of a relay is also actuated by these pulses, and a single-pole, double-throw switching contact arrangement of the relay connects a resistor in parallel with the emitter-collector path of one of the transistors, which conducts when the relay coil is de-energized. In the other state of the switching contact arrangement, one terminal of the motor vehicle battery is directly applied to the flashing lamps.

9 Claims, 1 Drawing Figure





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ASTABLE SWITCHING CIRCUIT

BACKGROUND OF THE INVENTION

The present invention resides in an astable circuit of the multivibrator type for periodically switching on and off load circuits. The circuit of the present invention is particularly adapted to a clock or pulse generator for flashing arrangements in motor vehicles. The astable circuit therein, is comprised of two semi-conducting elements with alternating conducting paths, and are preferably constructed of transistors. The astable circuit controls a relay with at least one switching contact which is connected to the load circuit. The arrangement is such that the switching circuit is made specifically insensitive to voltage variations or voltage pulses appearing on the operating voltage lines of the circuitry.

When driving in traffic, it is common to indicate the changes in driving direction of the motor vehicle. For this purpose, flashing lamps are used which flash on the motor vehicle and which consist essentially of a flashing arrangement as well as a directional switch. The flashing arrangement controls the flashing of the lamps between 60 and 120 times per minute.

Flashing arrangements are known in the art, in which a transistorized astable multivibrator is used as a pulse generator or clock. Such astable multivibrators usually contain two transistor circuits which are feedback coupled through a timing network, so that when one of the transistor circuits is in the conducting state, the other transistor circuit is turned off. After the lapse of time interval determined by the timing network, the circuit which has been conducting is transferred to the non-conducting or turned-off state. At the same time, the circuit which had been turned off, is made conducting. By repeatedly reproducing this process, the circuit operates as an oscillator. The transistor of one of the circuits includes the coil of a relay. Such relay may be operated through the presence of an intermediary power transistor for the purpose of amplifying the current.

The oscillating frequency is, thereby, determined mainly through the time constants of the timing network. Variations in the operating voltages which arise often in all motor vehicles when loads are switched on or off, have a large influence upon the oscillating frequency. Accordingly, it is difficult to realize stable operation. When the flashing arrangement is switched off, each such voltage impulse or voltage variation can lead to initiating a switching process, whereby the relay becomes briefly actuated and a disturbing switching and noise effect is realized.

Accordingly, it is an object of the present invention to solve this problem through a circuit in which the variations in the oscillating frequency are reduced in response to the variations in the operating voltage. Voltage variations or oscillations resulting, in general, from switching off the flashing arrangement, furthermore, will not affect the switching process of the pulse generator through the present invention.

The objects of the present invention are achieved through the provision of an astable switching circuit in which the coil of the relay is connected in parallel with the conductive path of one of the semi-conductor elements. The latter is arranged to conduct during the interval in which the relay is not energized or operated.

A particularly effective arrangement is realized when, in accordance with the present invention, the relay is further connected with two circuit paths of which one is connected in parallel with the first semi-conductor element, and the second is in the load circuit.

SUMMARY OF THE INVENTION

An astable circuit of the multivibrator family for use as a pulse generator in flashing arrangements in motor vehicles. Two transistors of identical type are interconnected so that they are made alternately conductive. A relay coil is connected to the output of the astable multivibrator so that it becomes periodically energized and de-energized with the pulses emitted by the astable circuit. The relay has a single-pole,

double-throw contact arrangement so that when the coil of the relay is de-energized, the switching contact is connected in parallel with the conducting path of one of the transistors, which conducts while the relay coil is in the de-energized state. When, on the other hand, the relay is energized, the switching contact of the relay is connected to the flashing lamp arrangement. The transistors of the astable circuit are intercoupled through resistance and capacitance networks so as to constitute a feedback coupling arrangement which is fed from a DC voltage battery within the motor vehicle. A directional switch determines which set of lamps is to be flashed through the pulses emitted by the astable circuit.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

The FIGURE is an electrical circuit diagram showing the components and their interconnections for realizing a flashing circuit for bidirectional lights in motor vehicles, in accordance with the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawing, two transistors 11 and 12 are both silicon transistors of the PNP type. The emitters of both of these transistors are connected to the positive connecting line 13, leading to the positive terminal of a motor vehicle battery 14. The collector of the transistor 11 is connected to the negative voltage line 20, through a resistor 15. The negative voltage line 20 leads to the negative terminal of the battery 14. A capacitor 16 is connected between the base of first transistor 11 and the positive voltage line 13, whereas a resistor 17 is connected between the base of this transistor 11 and the negative voltage line 20. The base of the second transistor 12 is connected or coupled to the collector of the first transistor 11, through a capacitor 18. At the same time, the base of this second transistor 12 is connected to a resistor 19 which, in turn, leads to a junction or common connecting line 21. A damping resistor 22, connected to the collector of the transistor 12, leads to a junction 23. A capacitor 24 is connected between this junction 23 and the base of the first transistor 11, and a resistor 25 is, furthermore, connected between this junction 23 and the negative voltage line 20. One terminal of the coil of a relay 26, is, moreover, connected to the collector of the transistor 12, whereas the other end of this relay coil is connected to the negative voltage line 20. A switching contact 27 is operated through this relay coil 26. The common or movable contact 28 of this switch 17 is connected to the positive voltage line 13. When the coil of the relay 26 is deenergized, the relay 26 is in its normally inoperative state, and the switching contact 28 lies against the fixed contact 31 during this inoperative state of the relay. The fixed contact 31 leads, through a resistor 30, to the collector of the first transistor 11. When the relay 26 is energized, the movable or common contact 28 connects with the operating contact 32. The latter is, in turn, connected to the common connecting line 21 which leads to a driving direction switch 33. This switch 33 has a zero position and two operating positions. Connected to each of the two operating positions of this switch 33, are a plurality of directional lamps 34. One terminal of each of the lamps is connected to the negative voltage line 20.

The basic operation of an astable multivibrator is known in the art. Thus, a first amplifying circuit consisting of a first transistor 11 and a first timing network comprised of the capacitor 18 and the resistor 19, is connected to a second amplifying circuit constructed of the transistor 12 and a second timing network comprised of a capacitor 24 and the resistor

17. The arrangement is such that the two amplifying circuits are feedback coupled.

As soon as the direction switch 33 is transferred to one of its two operating positions, current flows from the negative terminal of the battery 14, and through the respective directional lamp 34. The circuit is closed through the common connecting line 21 and the resistor 19, so that the current flows to the capacitor 18 which has one of its electrodes connected to the emitter-collector path of the transistor 11. The latter is at this instant of time conductive and, thereby, this electrode of the capacitor is substantially connected to the positive line 13, whereby the capacitor becomes charged. Such charging of the capacitor takes place independent of whether the collector is connected to the fixed contact 31 of the switch 27. When the second transistor 12 becomes conductive after a time interval determined by the first timing network including the capacitor 18 and the resistor 19, current flows through the coil of the relay 26, and the armature of this relay is moved into operative position. As a result of such operation of the relay, the common or movable contact 28 is made to lie against the contact 32.

Current also now flows from the negative terminal of the battery 14, and through the directional lamp 34 which is switched into the circuit. Current flow through such respective lamp takes place also through the switching contact 33, the switch 27, and to the positive terminal of the battery. As a result of this closed circuit path through the lamp, the latter will light. As a result of this switching process, the capacitor 24 becomes discharged. The capacitor 16 serves the purpose of limiting the voltage peak or rise which appears during the change or transfer in the charged state of the capacitor 24. With the use of limited voltages applied to the transistors, the capacitor 16 can, of course, be omitted. After the lapse of some time, the potential or voltage across the capacitor 24 has risen to the extent that the first transistor 11 becomes conducting, and the second transistor 12 is returned, thereby, to its cut-off or non-conducting state. The coil of the relay 26 becomes, consequently, deenergized, and the armature becomes released, so that the switch 27 is returned to its normal inoperative state or position in which the movable contact 28 lies against the fixed contact 31. In this circuit state, the directional lamp 34 is turned off, on the one hand, but the collector of the first transistor 11 becomes again connected to the positive voltage line 13, on the other hand.

Voltage variations or voltage rises at the operating voltage lines, be it the positive line 13 or the negative line 20, have a disadvantageous effect upon the functional operation of the astable switching circuit. During the time interval in which the first transistor 11 conducts and the second transistor 12 is cut-off, negative voltage variations can, for example, reach the base of the first transistor 11 and thereby turn this transistor off briefly. Such negative voltage variations may reach the base of the transistor 11 through the negative voltage line 20, the low resistance 25, or the relay 26, and the small resistor 22, with the circuit completed through the capacitor 24. With the application of such negative voltage variations to the base of the transistor 11, the collector voltage or potential of this transistor 11 can thereby rapidly acquire negative potential and to transfer, thereby, the second transistor 12 to its conducting state, whereby a new switching process is initiated. This process takes place when the directional switch 33 is in its zero position, as well as when this switch 33 is in one of its two operating positions, and the first transistor 11 is within the switching cycle of the multivibrator and is, in particular, in the conducting state. In the first case, the undesired process leads to a brief current through the coil of the relay 26, whereby the attraction of the armature of this relay causes an undesired noise effect. In the second case, the first transistor 11 becomes prematurely again cut-off, and the transistor 12 becomes thereby prematurely again conducting, so that the relay coil 26 operates the switch 27 prematurely. As a result, the off period of the lamp is shortened within the on-off cycle of the lamp arrangement.

Since the collector of the first transistor 11 is connected to the positive voltage line 13, through the switch in contact 27, during the off interval of the lamp, the undesired sensitivity of the multivibrator in relation to voltage variations on the operating lines 13 and 20, is avoided. A positive voltage pulse which reaches the base of the first transistor 11 can, in this manner, no longer alter substantially the collector potential. The second transistor 12 becomes first conducting again when the capacitor 18 has become charged through the resistor 19 to the extent that the base-emitter voltage is sufficient for switching the second transistor 12.

It has been further found advantageous to connect the resistor 30 in series with the switching path 28-31 of the switch 27. The transistor 11 does not present a complete short-circuit, even when in its fully turned-on state, since a residual voltage of, for example, 0.5 volt prevails across its collector-emitter path. When now, the relay 26 is in the state in which the switch 27 forms a circuit closure through the fixed contact 31, the collector-emitter path of the transistor 11 becomes no longer short-circuited through low resistance.

The voltage variations of 0.5 volt which arise, can, under circumstances, initiate a new switching process through the second transistor 12. The resistor 30 prevents the aforementioned voltage variations, depending upon the magnitude of the resistor, so that the voltage variations are attenuated, for example, by a third. In this manner, no further danger prevails.

With the aid of the present invention, a simple and economical astable switching circuit is realized, which is insensitive to voltage variations in the voltage operating lines. In particular, such an astable arrangement is adaptable as a clock for a flashing arrangement in motor vehicles in which it is desired to avoid noise disturbances when the lamps are turned off, and to prevent reduction of the off-time of the lamps.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of constructions differing from the types described above.

While the invention has been illustrated and described as embodied in astable circuits, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

What is claimed as new and desired to be protected by Letters Patent is:

1. An astable circuit with two unstable states for emitting periodically spaced pulses comprising, in combination, two semi-conductor elements with interconnecting means for influencing the state of one semi-conductor element in dependency on the state of the other semi-conductor element so that when one semi-conductor element conducts the other in non-conducting and vice versa, each semi-conductor element being alternately conducting and non-conducting periodically for generating said periodically spaced pulses; relay means connected to one of said semi-conductor elements and actuated when said one semi-conductor element conducts; switching means actuated by said relay means and having two operating states, said switching means forming a conductive path in parallel with the other one of said semi-conductor elements in one of said operating states, said relay means being unactuated during said one operating state of said switching means; load means connected to said switching means when said switching means is in the other one of said operating states; and a source of voltage connected to said switching means, said switching means connecting said load means to said source of voltage when said switching means is in the other one of said operating states, whereby said load means is connected to said source of voltage during the time intervals of said pulses.

2. The astable circuit as defined in claim 1 wherein said two semi-conductor elements comprise pnp silicon transistors.

3. The astable circuit as defined in claim 2 including capacitor means connected in parallel with the base-emitter path of said other semi-conductor element in form of a PNP transistor.

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4. The astable circuit as defined in claim 1 including resistor means connected in series with said switching means when said switching means is in said one operating state.

5. The astable circuit as defined in claim 1 wherein said semi-conductor elements comprise transistors of identical type.

6. The astable circuit as defined in claim 1, said switching means comprising a movable contact switchable between two fixed contacts through actuation of said relay means, said movable contact being connected to one terminal of said volt-

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age source and one of said fixed contacts being connected to said other semi-conductor element, the other fixed contact of said switching means being connected to said load means.

7. The astable circuit as defined in claim 6 wherein said voltage source comprises a direct current source.

8. The astable circuit as defined in claim 6 wherein said load means comprises lamp means on a motor vehicle.

9. The astable circuit as defined in claim 6 wherein said voltage source comprises a motor vehicle battery.

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