United States Patent

Wakai

[15] **3,670,264**

[45] **June 13, 1972**

[54] ASTABLE MULTIVIBRATOR

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[22] Filed: **March 22, 1971**

[21] Appl. No.: **126,458**

[30] **Foreign Application Priority Data**

March 27, 1970 Japan.....45/26351

[52] **U.S. Cl.**.....**331/113 R**, 331/176

[51] **Int. Cl.**.....**H03k 3/282**

[58] **Field of Search**.....331/113, 176

[56] **References Cited**

OTHER PUBLICATIONS

" Temperature Dependence in Multivibrators" Electro-Technology, W. F. Miller, August 1964 Pgs. 38–41, 154.

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[57] **ABSTRACT**

A multivibrator circuit comprising a base bias-supplying circuit for a transistor which is connected with at least one diode in parallel with a resistor for obtaining stable temperature and voltage characteristics. This resistor serves to overcome the problem of the cessation of variations in bias voltage directly proportional to the supply voltage which is caused by the insertion of the diode. Thus it is possible to start and stop oscillation of the multivibrator circuit even when the supply voltage is reduced to a considerably lower voltage.

1 Claim, 4 Drawing Figures

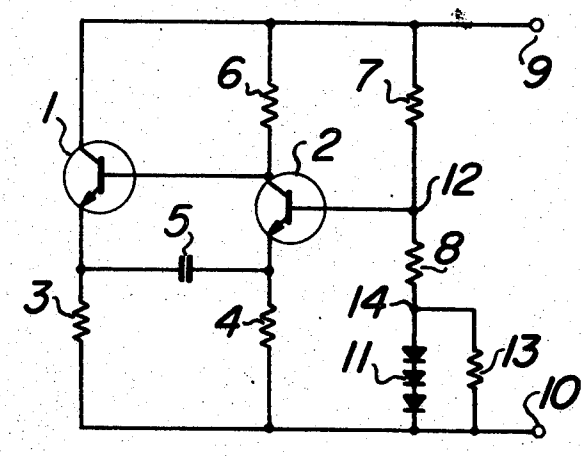


FIG. 1 PRIOR ART

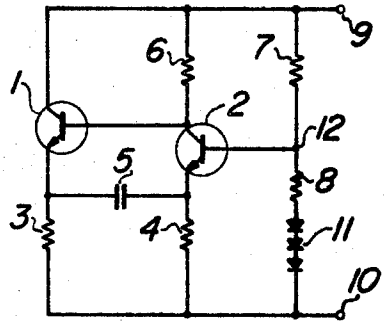


FIG. 3

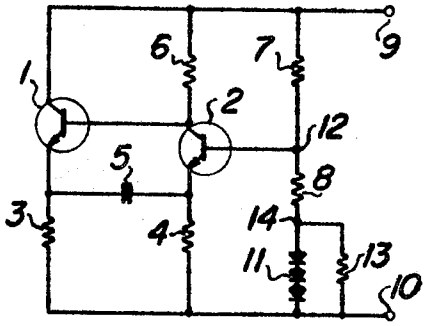


FIG. 2 PRIOR ART

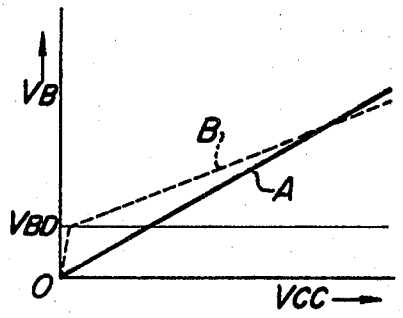
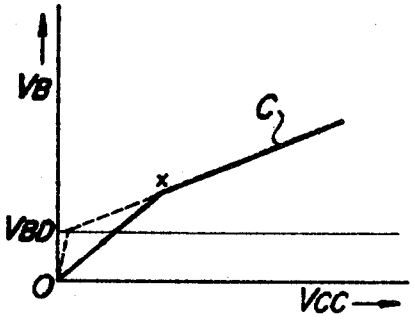


FIG. 4



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ASTABLE MULTIVIBRATOR

The present invention relates to a circuit for reducing oscillation starting and stopping-voltages for an emitter capacitor-coupled multivibrator circuit.

The emitter capacitor-coupled multivibrator circuit presents a problem of temperature and voltage characteristics in which an oscillating frequency is subject to variations of supply voltage and ambient temperature. To overcome this problem, conventional devices have one or more diodes connected in series with a resistor in a bias circuit.

Objects, features and advantages of the present invention will become apparent from the following detailed description of the preferred embodiments taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a diagram showing a conventional emitter capacitor-coupled multivibrator circuit with improved temperature and voltage characteristics of oscillation frequency;

FIG. 2 shows a diagram for explaining the relationship between the supply voltage and bias voltage of the astable multivibrator circuit of FIG. 1;

FIG. 3 is a diagram showing an emitter capacitor-coupled multivibrator circuit according to the present invention; and

FIG. 4 shows a diagram for explaining the relationship between the supply voltage and bias voltage of the multivibrator circuit of FIG. 3.

Referring to FIG. 1 of the conventional multivibrator, numerals 1 and 2 show oscillating transistors, numerals 3 and 4 resistors for determining an oscillation frequency, numeral 5 a coupling capacitor, numeral 6 a collector resistor, numerals 7 and 8 resistors for supplying a base bias, numerals 9 and 10 terminals for supplying a DC voltage, and numeral 11 diodes for improving the temperature and voltage characteristics.

The provision of the diodes in the base bias supplying circuit causes improved temperature and voltage characteristics due to the constant voltage drop across the diodes 11, but the bias voltage V_B at the junction point 12 between resistors 7 and 8 is not directly proportional to the supply voltage V_{cc}. Such a relation is shown in FIG. 2, from which it is apparent that, in the absence of the diodes, the supply voltage V_{cc} is directly proportional to the bias voltage V_B as shown by the straight line A, whereas, with the diodes 11 inserted, the voltage at the junction point 12 is raised by the amount V_{BD} which is determined by the product of the number of the diodes inserted and the forward voltage of each of the diodes, resulting in the voltage at the junction point 12 as shown by the dotted line B. Here, it is needless to say that the resistance value of the resistor 7 or 8 is different from that in the absence of the diodes since the base of the transistor 2 should be always supplied with a predetermined constant voltage corresponding to the intersecting point of both the full and dotted lines in FIG. 2, whether the diodes 11 are connected to the circuit or not. It follows that with the increase in the number of the diodes inserted, the voltage V_B at the junction point 12 is decreased at a lower rate. If the voltage V_{cc} is reduced smaller than the value at the intersecting point, the base voltage V_B of the transistor 2 becomes larger by inserting the diodes in the circuit, which results in biasing the transistor in the forward direction, detriorating the oscillation capability thereof and thereby inconveniently increasing the voltages needed for starting and stopping the oscillation.

The present invention is aimed at obviating the problem of the high oscillation starting- and stopping- voltages caused by the diodes which are inserted in the base bias-supplying circuit for compensating for the influence of the ambient temperature and supply voltage on the oscillation frequency, and is characterized by a resistor shunted with the diodes in the base bias-supplying circuit.

Explanation will be now made of the present invention with reference to FIGS. 3 and 4. FIG. 3 is a circuit diagram of an emitter capacitor-coupled multivibrator according to an embodiment of the invention, in which a resistor 13 is connected in shunt with the diodes 11. The presence of the resistor 13 eliminates the problem caused by the diodes. In other words, when the supply voltage V_{cc} is normal, the base bias voltage (the voltage at the junction point 12) of the transistor 2 is maintained at a value determined by the voltage drop in the forward direction through the diodes 11 and resistors 7, 8 and 13.

When the supply voltage is decreased, the voltage across the resistor 13 also decreases. As long as this voltage across the resistor 13 is higher than the forward voltage drop of the diodes 11, a current flows in the diodes 11 and the voltage between the junction point 14 and terminal 10 is controlled by the amount of the forward voltage drop in the diodes, thus compensating for the variations in oscillation frequency caused by variations in temperature or voltage.

However, when the supply voltage V_{cc} is further reduced to the point where the above-mentioned relation is not maintained, that is to say, the voltage across the resistor 13 is decreased more than the forward voltage drop across the diodes 11, the absence of the resistor 13 causes the voltage V_B at the junction point 12 to decrease straight along the dotted line of FIG. 4 toward the point V_{BD}, having a greater effect on the conduction of transistor 2, with the result that the loop gain is reduced and the oscillation stops at a certain higher supply voltage. The insertion of the resistor 13, however, causes the diode 11 to be cut-off at such a reduced value of the supply voltage as is insufficient to maintain the above-mentioned relation. As a result, the current path along the diodes 11 is virtvally opened, and the voltage V_B at the junction point 12 which is subsequently controlled by the resistors 7, 8 and 13 follows the full line to zero as shown in FIG. 4.

The relationship between the supply voltage V_{cc} and voltage V_b at the junction point 12 in the multivibrator circuit according to the present invention is as shown by the solid line C of FIG. 4. This multivibrator, unlike the conventional one in which V_{cc} follows the dotted line from points X to V_{BD}, maintains oscillations until a lower supply voltage is reached, since the reduction in loop gain due to the saturation of transistor 2 is less.

Not only in the stoppage of oscillation but in starting the oscillation does the multivibrator according to the present invention achieve a lower voltage than does the conventional multivibrator. In other words, the voltage at the junction point 12 increase along the solid line C even when the supply voltage V_{cc} rises from zero.

It will be understood from the above description that the multivibrator circuit according to the present invention makes it possible to start and stop oscillations at a lower voltage than the conventional multivibrator circuit. For this reason, the multivibrator circuit according to the present invention is suitable for application to a horizontal oscillator circuit of a television receiver which requires lower starting and stopping voltages than a vertical oscillator circuit.

What is claimed is:

1. A multivibrator circuit comprising an emitter capacitor-coupled multivibrator circuit including two switching transistors with emitters connected with each other through a capacitor, the base of one of said switching transistors being connected with a base-biasing means comprising a plurality of dividing resistors and at least one diode connected in series with one of said dividing resistors, said diode being connected in parallel with a resistor.

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