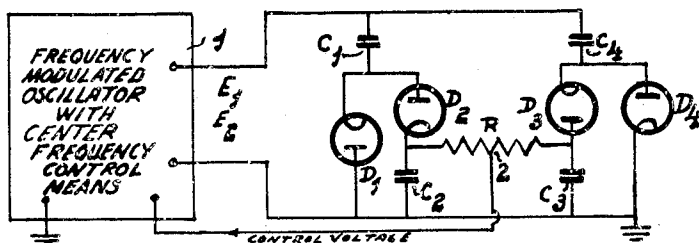


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CIRCUIT ARRANGEMENT FOR STABILIZING
A FREQUENCY-MODULATED OSCILLATOR
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CIRCUIT ARRANGEMENT FOR STABILIZING A FREQUENCY-MODULATED OSCILLATOR

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1

This invention relates to a circuit-arrangement for stabilizing a frequency-modulated oscillator according to my copending U. S. A. patent application No. 665,008 filed April 26, 1946.

The said copending application describes a circuit-arrangement in which a control voltage controlling the frequency of the oscillator, is generated across a control condenser which is inserted in the circuit of two series-connected rectifiers having the same pass direction, the junction point of these rectifiers being connected to the oscillator through a charging condenser which is small with respect to the control condenser, and the latter being connected, across a resistance, to a comparison condenser which is likewise included in the circuit of two series-connected rectifiers of which the junction point is connected to the oscillator through a condenser which is larger than the charging condenser.

In this event the problem arises that the control condenser can be charged only in one direction, since charges of opposite polarity leak away through both series-connected rectifiers. In the prior application this drawback was obviated, since a counter-voltage was generated somewhere in the circuit of the first-mentioned series-connected rectifiers and in order to eliminate the influence of the first-mentioned voltage on the zero-value of the control voltage, an equal voltage was generated in the circuit of the last-mentioned series-connected rectifiers.

The invention permits the circuit-elements, by means of which these two counter-voltages are produced, to be dispensed with. To this end, according to the invention, the control-voltage produced across the control-condenser is taken from a tapping of the resistance connected between the comparison condenser and the control condenser, at which tapping the control-voltage is zero for the central frequency-wave of the oscillation produced by the oscillator.

In order that the invention may be more clearly understood and readily carried into effect, it will now be described more fully with reference to the accompanying drawing, given by way of example.

In this drawing the reference numeral 1 designates a frequency-modulated oscillator which is to be stabilised. The oscillator is connected, through the condenser C_1 , to the junction point of the two series-connected diodes D_1 and D_2 which have the same pass direction and the circuit of which includes the control condenser C_2 . The oscillator is at the same time connected,

2

through a condenser C_4 , to the junction point of the two series-connected diodes D_3 and D_4 which have the same pass direction and the circuit of which comprises a comparison condenser C_3 , the charging condenser C_1 having a small value with respect to the control condenser C_2 and being also smaller than the condenser C_4 .

The comparison condenser C_3 is connected to the control condenser C_2 through a resistance R . In this manner the condenser C_2 is charged through the charging circuit D_1 , C_1 , D_2 and discharged through the resistance R , the voltage set up across the condenser C_2 being a measure of the frequency of the oscillations produced by the oscillator 1.

As a rule it is desirable that the control voltage should be equal to zero for the central frequency of these oscillations. In this event the difficulty arises that the condenser C_2 can be charged only in one direction, since charges of opposite polarity leak away through the two series-connected diodes D_1 and D_2 . In the principal application this disadvantage was obviated by producing a counter voltage in the circuit of the two diodes D_1 and D_2 , for instance by means of a current traversing a decoupled resistance which was included in the circuit of these diodes. To provide that voltage across the control condenser C_2 was again equal to zero for the central frequency, an equal counter voltage was produced in the circuit of the two diodes D_3 and D_4 , for instance likewise by means of an equal current traversing a decoupled equal resistance, which two currents could be supplied by the same source.

The invention is based on the recognition that this separate direct current supply can be dispensed with, since the series-circuit comprising the diodes D_1 and D_2 the resistance R and the diodes D_3 and D_4 is traversed by the same direct current so that an equal counter voltage is produced across the decoupled resistances connected, for instance, in series with the diodes D_1 and D_3 .

It proves to be possible to provide these two decoupled resistances, across which the counter voltages are produced, in series with the resistance R . Furthermore it appears that in this event these resistances are not traversed by high-frequency current, since the condensers C_2 and C_3 constitute a short-circuit for this current, so that the decoupling condensers across these resistances can be dispensed with. Consequently, the circuit-arrangement is simplified to the case in which the control voltage is taken from the

tapping point 2 of the resistance R, the circuit elements, by means of which the back electromotive forces had to be produced, being dispensed with.

The efficiency of the circuit thus obtained will be shown with reference to the following calculation:

Assuming that the source of potential i produces an asymmetric voltage with a positive amplitude E_1 and a negative amplitude E_2 .

The condenser C_1 is charged per cycle through the diode D_1 to a voltage E_2 and receives a charge $C_1 E_2$. Subsequently this condenser is discharged through the diode D_2 and acquires the voltage $(E_1 - V)$ (V being the voltage set up at the condenser C_2), since the condenser C_1 is small with respect to the condenser C_2 . Consequently the condenser C_2 receives per cycle a charge $C_1 E_2 + C_1 (E_1 - V) = C_1 (2E - V)$ where $E_1 + E_2 = 2E$.

The condenser C_4 is charged to a voltage E_1 , and the condenser C_3 to a voltage $E_2 + E_1 = 2E$, the voltage drop due to the discharge of these condensers being smaller as they have a larger value with respect to the condenser C_1 .

The condenser C_2 is discharged across the resistance R, the charge leaking away per unit time being equal to

$$\frac{2E + V}{R}$$

Consequently we have per cycle:

$$C_1(E - V) = \frac{2E + V}{fR}$$

where f represents the frequency of the oscillations produced by the oscillator, whence it follows

$$V = \frac{fRC_1 - 1}{fRC_1 + 1} 2E$$

If the control voltage is taken from the tapping point 2 of the resistance R, at which the value of the voltage taken off of the central frequency f_0 is equal to zero, we have

$$\frac{r}{R - r} = \frac{V}{2E}$$

where r represents the resistance between this tapping point and the condenser C_2 .

Inserting this expression in the preceding re-

lation we find for this central frequency f_0 the condition:

$$f_0(R - 2r)C_1 = 1$$

What I claim is:

1. A circuit arrangement for producing a control potential having variations in sign and amplitude proportional to deviations in frequency about a given value of a wave applied thereto, comprising a first capacitor, means to cyclically charge said first capacitor in a given direction comprising a second capacitor and a first rectifier element having one terminal thereof connected to one terminal of said first capacitor and having the other terminal thereof connected to one terminal of said second capacitor, a second rectifier element connected in shunt with said first capacitor and said first rectifier and having a polarity in series with said first rectifier element, means to apply said wave to the free terminal of said first and second capacitors, a third capacitor, means to cyclically charge said third capacitor in a direction opposite to the direction of charge of said first capacitor comprising a fourth capacitor and a third rectifier element having one terminal thereof connected to one terminal of said third capacitor and having the other terminal thereof connected to one terminal of said fourth capacitor, a fourth rectifier element connected in shunt with said third capacitor and said third rectifier element and having a polarity in series with said third rectifier element, means to apply said wave to the free terminal of said third and fourth capacitors, a resistance element interconnecting the junction of said first capacitor and first rectifier element and the junction of said third capacitor and said third rectifier element, said resistance element being provided with tapping, and means to derive said control potential from said tapping.

2. A circuit arrangement as claimed in claim 1 wherein said second capacitor has a smaller capacity value than said first capacitor and said fourth capacitor.

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REFERENCES CITED

The following references are of record in the file of this patent:

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Number	Name	Date
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