

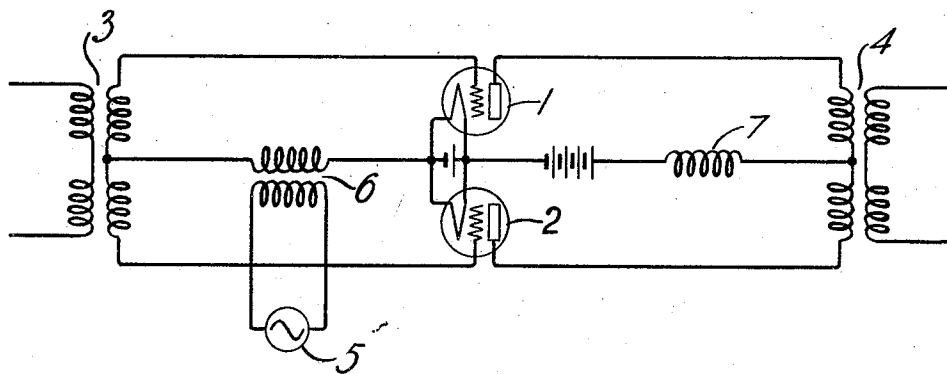
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FREQUENCY TRANSLATING CIRCUIT

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FREQUENCY-TRANSLATING CIRCUIT

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This invention relates to frequency translating circuits and particularly to such circuits employing electric discharge devices in the input circuit of which the frequency translation takes place; for example, grid current modulation in the grid circuit of a three-electrode vacuum tube.

An object of this invention is to improve the efficiency of frequency translating circuits.

A further object of the invention is to prevent output current modulation or detection in frequency translating circuits of the input current modulation or detection type.

Frequency translating circuits, which are defined for the purpose of this specification as including both modulators and demodulators or detectors, may employ electric discharge devices for performing the frequency translation function in which case they may be divided into two main types: The input circuit frequency translation, or, as more commonly known, the grid current modulation, type, in which the combination is produced in the grid or input current circuit and is due to the curvature of the grid current characteristic; and the output current frequency translation, or, as more commonly known, the plate current modulation, type, in which the combination is produced in the plate or output circuit and is due to the curvature of the plate current characteristic.

The products resulting from these two types of modulation or detection may be of opposite phase so that it is often desirable to prevent one type of modulation when the other is being used to produce a useful output product.

When input current modulation or detection is used for producing the useful output products, the discharge device acts as an amplifier for the modulation products produced in the input circuit. However, the discharge device may operate to also transmit the uncombined waves to the output circuit where they may be combined to produce output modulation or detection products which, as stated above, may be of opposite phase to the modulation products produced by the input current.

In a preferred embodiment this invention comprises a balanced frequency translating circuit of the conjugate type, in which one input wave is impressed on the individual input branches and the other on the common input branch, arranged to produce input current modulation or detection products and having an inductance coil connected in the common output branch for giving the output circuit a high impedance to the wave impressed on the common input branch thus preventing output current modulation or detection.

This invention can be more readily understood by reference to the following detailed description in connection with the drawing which shows one embodiment of the invention.

Two electric discharge devices 1 and 2 are connected in push-pull arrangement between an input transformer 3 and an output transformer 4. Signal waves are impressed on the input circuit through the primary winding of the transformer 3. Carrier waves from the source 5 are impressed on the input circuit through the transformer 6 connected in the common input branch. An inductance coil 7 is connected in the common output branch for preventing plate current modulation as hereinafter described.

The signal and carrier waves are combined in the input circuit of the devices 1 and 2 to produce grid current modulation or detection products in the manner described in the application of E. Peterson, Serial No. 696,766, filed March 4, 1924, Patent No. 1,699,711, January 22, 1929, by including in the input circuit an impedance of such value that, when the control electrodes are positive, the greater part of the potential drop takes place across this impedance while during the negative portion of the cycle the potential drop divides between the devices and the impedance. In the circuit shown herein, the input transformer 3 is so designed that its secondary winding serves as this impedance. These modulation products are amplified by the devices 1 and 2 and transmitted to the load circuit through the output transformer 4. The inductance coil

7 is given such a value as to offer a high impedance to the carrier wave amplified by the devices 1 and 2. This prevents plate current modulation which is inversely proportional to the impedance of the output circuit to the component waves. Since the amplified grid current modulation products appear only in the individual output circuit branches, the use of this coil does not affect their efficient transmission.

What is claimed is:

1. A frequency translating circuit comprising a pair of electric discharge devices each having an anode, a cathode and a control electrode, a divided input circuit therefor having an individual portion connected to each of said control electrodes respectively and a common portion connected to said cathodes, means for supplying waves of different characteristics to said individual and common portions respectively, a divided output circuit having an individual portion connected to each of said anodes and a common portion connected to said cathodes, and means for giving said common output portion a high impedance to the frequency of one of said waves.

2. A frequency translating circuit comprising a pair of electric discharge devices each having a cathode, an anode and a control electrode, a divided input circuit therefor having an individual portion connected to each of said control electrodes respectively and a common portion connected to said cathodes, means for supplying waves of different characteristics to said individual and common portions respectively to produce input current frequency translation, a divided output circuit having an individual portion connected to each of said anodes and a common portion connected to said cathodes, and inductive means in said common portion for giving said output circuit a high impedance to one of said waves to prevent output current frequency translation.

3. A frequency translating circuit according to claim 2 is which said inductive means comprises an inductance element.

4. A frequency translating circuit comprising a pair of electric discharge devices each having a cathode, an anode and a control electrode, a divided input circuit therefor having an individual portion connected to each of said control electrodes respectively and a common portion connected to said cathode, means for supplying waves of different characteristics to said individual and common portions respectively to produce input current frequency translation products, a divided output circuit for said devices having an individual portion connected to each of said anodes and a common portion connected to said cathodes, and inductive means in the common portion of said output circuit having a high impedance

to at least one of said input waves to prevent output current frequency translation.

5. A frequency translating circuit comprising a pair of electric discharge devices, each having a cathode, an anode and a control electrode, a divided input circuit having an individual portion connected to each of said control electrodes, and a common portion connected to said cathodes, means for supplying waves of different characteristics to said individual portions and to said common portion, respectively, a divided output circuit having individual portions connected to said anodes and a common portion connected to said cathodes, and means for effectively introducing inductance into said common output portion to prevent output current frequency translation.

6. A frequency translating circuit comprising a pair of three-electrode electric discharge devices, each having a cathode, an anode and a control electrode, a divided input circuit having an individual portion connected to each of said control electrodes, respectively, and a common portion connected to said cathodes, means for supplying waves of different characteristics to said individual portions and to said common portion, respectively, a divided output circuit having individual portions connected to said anodes and a common portion connected to said cathodes, and an inductance element in said common output portion for preventing output current frequency translation.

7. A frequency translating circuit comprising a pair of electric discharge devices, each having a cathode, an anode and a control electrode, a divided input circuit having an individual portion connected to each of said control electrodes, respectively, and a common portion connected to said cathodes, means for impressing signaling waves upon said individual portions, means for impressing carrier waves upon said common portion, a divided output circuit having an individual portion connected to each of said anodes, respectively, and a common portion connected to said cathodes, and means for giving said common output portion a high impedance to carrier waves to prevent output current frequency translation.

8. A frequency translating circuit comprising a pair of electric discharge devices, each having a cathode, an anode and a control electrode, a divided input circuit having an individual portion connected to each of said control electrodes and a common portion connected to said cathode, means for impressing signaling waves upon said individual portions and carrier waves upon said common portion to produce input current frequency translation, a divided output circuit having an individual portion connected to each of said anodes and a common

portion connected to said cathodes, and an inductance element connected in said common output portion to prevent output current frequency translation.

5 In witness whereof, I hereunto subscribe my name this 27th day of January, A. D., 1927.

HAROLD S. BLACK.

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