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L. ESPENSCHIED ET AL.

HIGH FREQUENCY TRANSLATING CIRCUITS.

ORIGINAL FILED SEPT. 30, 1919.

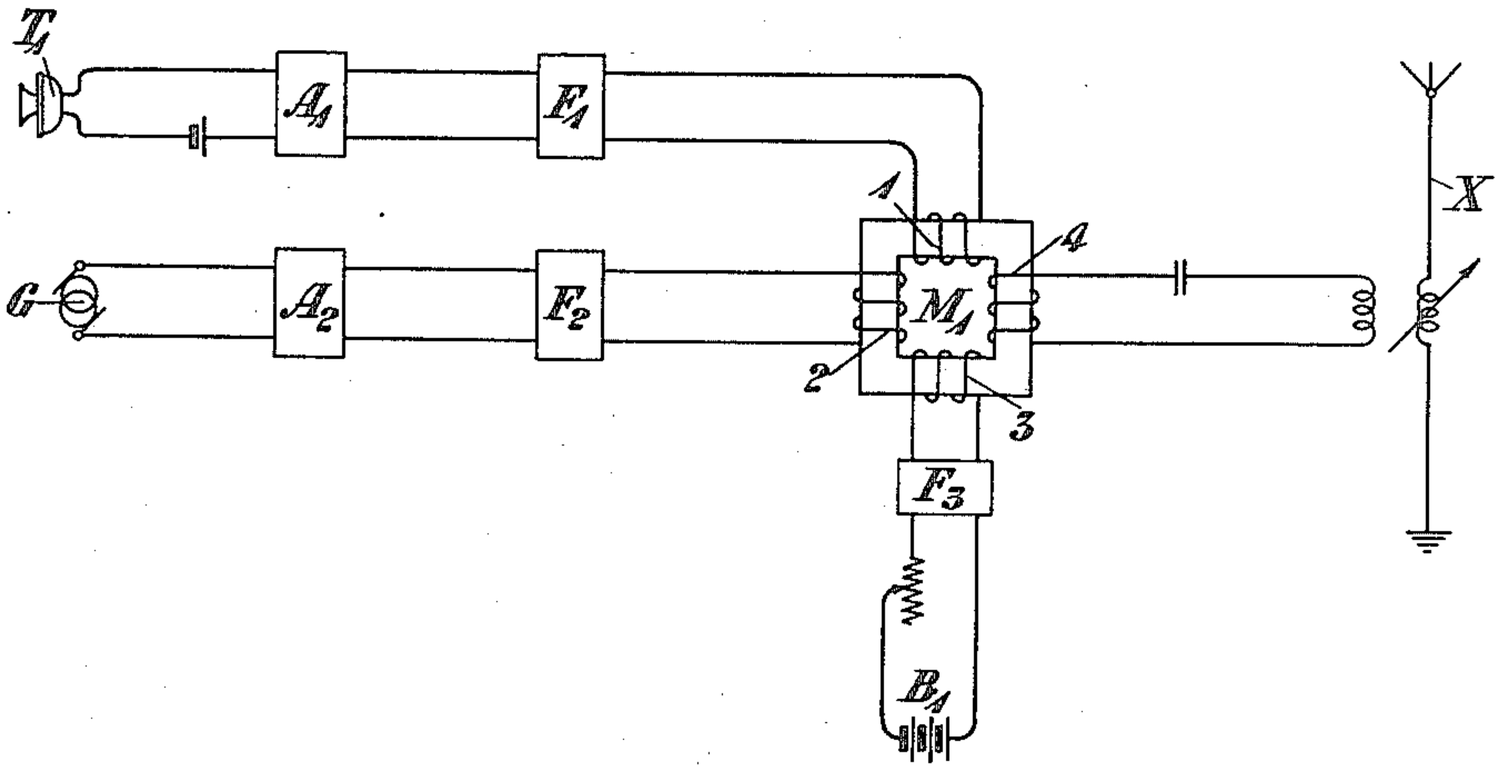

Fig. 1

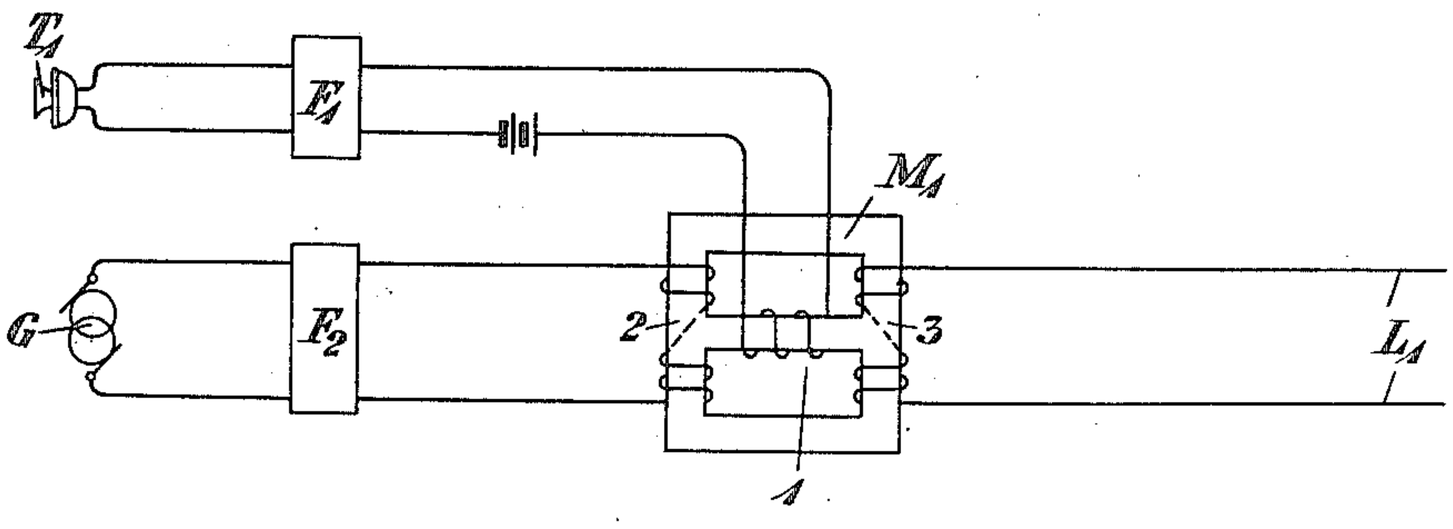

Fig. 2

Inventors
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By their Attorney
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UNITED STATES PATENT OFFICE.

LLOYD ESPENSCHIED, OF QUEENS, AND HERMAN A. AFFEL, OF BROOKLYN, NEW YORK, ASSIGNORS TO AMERICAN TELEPHONE AND TELEGRAPH COMPANY, A CORPORATION OF NEW YORK.

HIGH-FREQUENCY TRANSLATING CIRCUITS.

Original application filed September 30, 1919, Serial No. 327,399. Divided and this application filed May 18, 1921. Serial No. 470,584.

To all whom it may concern:

Be it known that we, LLOYD ESPENSCHIED, and HERMAN A. AFFEL, residing at Queens and Brooklyn, in the counties of Queens and Kings and State of New York, respectively, have invented certain Improvements in High-Frequency Translating Circuits, of which the following is a specification.

This invention relates to high frequency translating circuits, and more particularly to arrangements for modulating currents of various frequencies.

This application is a division of our copending application, Serial No. 327,399, filed September 30, 1919, entitled "High frequency translating circuits."

As is well known, modulation of a plurality of frequencies consists in the superposition of the input currents upon each other, either in the modulator element, or at some point in the input side of the said element. By the term "modulator element" is meant any portion of an electrical circuit, the electrical constants of which may be varied in accordance with signal variations; thus, it may be a vacuum tube in which the output resistance is varied in accordance with grid potential, or an electric arc, the resistance of which is a function of the impressed voltage, or, it may be a reactance element such as an inductance, the effective permeability of which is varied by a controlling circuit, or a condenser, the capacity of which may be controlled by variation in the plate separation or in the dielectric constant.

It is desirable, therefore, to provide means for superposing the two input currents so as to avoid loss of energy and diminution of modulating efficiency arising from mutual shunting effects. There are, in general, two ways whereby the input currents may be superposed so as to be rendered mutually non-interfering, one known as the method of balance and the other as the method of frequency selection. It is the object of this invention to show means for superposing the input circuits upon each other by the method of frequency selection, and also to show means which combine the method of frequency selection with the method of balance.

The invention herein disclosed shows the application of the principle of selectivity and also of the principle of selectivity and balance to prevent interference between the currents set up in different input circuits of a magnetic translating device such as a magnetic modulator.

This invention will be better understood from the following description read in connection with the attached drawing of which Figure 1 shows a form of invention embodying the principle of selectivity alone and Figure 2 shows the combination of selectivity and balance to prevent mutual interference between the respective input circuits of the common modulating device.

Figure 1 shows a way in which the method of frequency selection may be applied to a magnetic translating circuit. T_1 represents a source of low frequency signaling currents connected with an amplifier A_1 whereby the amplified currents will pass through the low pass filter F_1 and be impressed upon the iron core modulating device M_1 by means of the winding 1. High frequency oscillations from the source G, which may be of any well-known type of generating device, may be impressed upon the amplifier A_2 and the amplified currents passing through the high pass filter F_2 will be impressed upon the modulator M_1 by means of the winding 2. The third winding 3 of the modulator is connected with a source of current B_1 by means of which the proper degree of saturation of the iron core of the modulator M_1 may be maintained, and a filter F_3 is inserted between the source and the winding 3 to prevent shunting the low frequency voice currents and also the high frequency carrier current. A fourth winding 4 is connected with a tuned output circuit coupled with the antenna X. In the operation of this circuit, low frequency signaling currents set up by T_1 are amplified by the amplifier A_1 and pass through the low frequency filter F_1 to

the modulator M_1. Simultaneously high frequency carrier currents produced by G and amplified by A_2 pass through the high frequency filter F_2 and are likewise impressed upon the modulator M_1. It will be seen that high frequency oscillations cannot pass through the low pass filter F_1 to the low frequency circuit, and similarly low frequency currents cannot pass through the high pass filter F_2 to the high frequency generating circuit. In this manner interference between the input circuits is avoided, and the modulated oscillations are transmitted by the winding 4 to the antenna circuit X.

Figure 2 shows an arrangement in which the principles of selectivity and of balance are combined for preventing interference between the input circuits of a magnetic modulating device. The low frequency circuit has therein a transmitter T_1 and a low pass filter F_1. The low frequency signals set up in this circuit are impressed across the winding 1 upon the central arm of the core of the modulator M_1. High frequency oscillations from the generator G pass through the high pass filter F_2 and are impressed upon the winding 2 upon one of the side arms of the core of the modulator M_1. Symmetrically arranged upon the same core is a winding 3 which is connected with the output circuit L_1. Low frequency currents impressed upon winding 1 set up therein, a flux which divides in the arm of the core upon which the winding 2 is placed, half of the flux passing upward and half downward, which creates a neutral condition preventing induction of currents in the winding 2 upon this core. In a similar manner the flux set up by the high frequency winding 2 will not induce high frequency oscillations in the low frequency circuit. Filters F_1 and F_2 interposed in the low frequency and high frequency input circuits respectively prevent the passage of high frequency and low frequency currents through filters F_1 and F_2, respectively. If low frequency signaling currents are impressed upon the winding 1 upon the central arm of the core, the resulting flux will change the permeability of the core with respect to the winding 2. The high frequency current set up in the winding 2 by means of the source G will be modulated accordingly, and the modulated high frequency current will be impressed upon the winding 3 of the output circuit L_1. This arrangement shows means for combining frequency selective devices with a balanced iron core modulator, thereby assuring a higher degree of freedom from interference of the oscillations in one of the input circuits by those in the other input circuit.

The circuit arrangements shown in the drawing are not limited to a particular type of output circuit, such as a radio antenna or a metallic transmission line, but either arrangement is equally well adapted to be used with either type of output circuit. Although this invention has been shown as embodied in a particular form, it is to be understood that it is not so limited, but is capable of embodiment in other forms without departing from the spirit and scope of the appended claims.

What is claimed is:

1. In a high frequency signaling system, the combination of a balanced iron core modulating device, input circuits adapted to impress carrier current and signaling current upon said translating circuit and frequency selecting means associated with each input circuit to exclude from each respective circuit currents having frequencies different from that of said circuit.

2. In a high frequency signaling system, the combination of a magnetic translating device of a plurality of input circuits, each having a source of current of a definite frequency, and also a selective network adapted to transmit that frequency of the particular source with which the said network is associated.

3. In a high frequency signaling system, the combination of a magnetic translating device having a plurality of windings, an input circuit containing a source of current of one frequency connected with one winding, a second input circuit containing a source of current of a different frequency connected with another winding, each of said input circuits containing frequency selecting means adapted to transmit current of the frequency generated by the source associated with its respective circuit, a third circuit containing a source of direct current connected with a third winding and having selecting means connected between said winding and said source, and an output circuit connected with a fourth winding

4. In a high frequency signaling system, the combination of an antenna of a magnetic modulator having a plurality of input circuits, each characterized by a source of current of definite frequency, and a filter adapted to transmit readily current of that particular frequency.

5. In a high frequency signaling system, the combination of an antenna of a magnetic translating device comprising a plurality of input circuits, each characterized by a source of current of a definite frequency, and a filter adapted to transmit the said frequency.

6. In a high frequency signaling system, the combination of a transmitting circuit of a magnetic modulator having input circuits so arranged as to prevent undesired induction of current from one input circuit into another input circuit, each of the said input circuits being characterized by a source of

current of a definite frequency and by a filter adapted to transmit the frequency of its respective circuit.

7. In a high frequency signaling system, the combination of a magnetic modulator having a plurality of windings, an output circuit, a plurality of input circuits, each characterized by a source of current of definite frequency, and a filter to transmit the said frequency, the said circuits being rendered mutually non-interfering by means of their connections with the windings of the said magnetic modulator.

In testimony whereof, I have signed my name to this specification this 13th day of May, 1921.

LLOYD ESPENSCHIED.

In testimony whereof, I have signed my name to this specification this 16th day of May, 1921.

HERMAN A. AFFEL.