

Dec. 19, 1922.

1,438,989.

L. ESPENSCHIED ET AL.
HIGH FREQUENCY TRANSLATING CIRCUITS.
ORIGINAL FILED SEPT. 30, 1919.

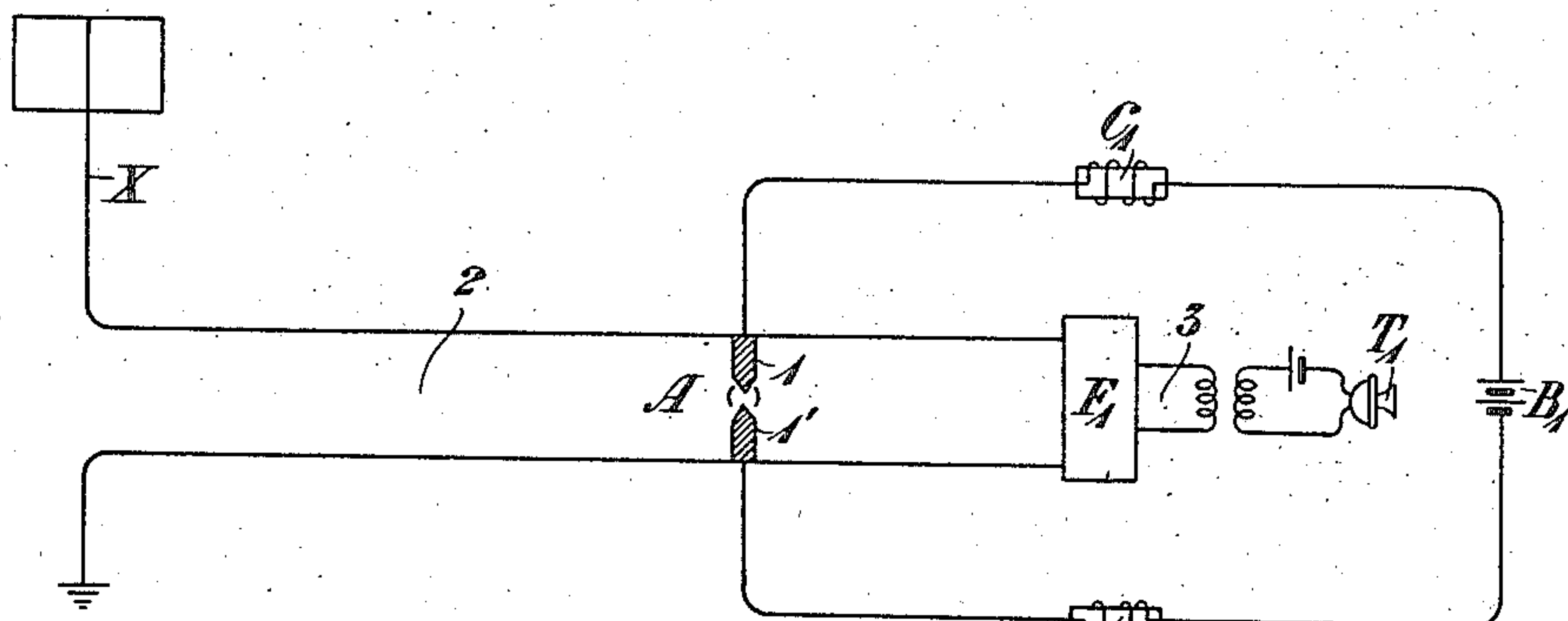


Fig. 1

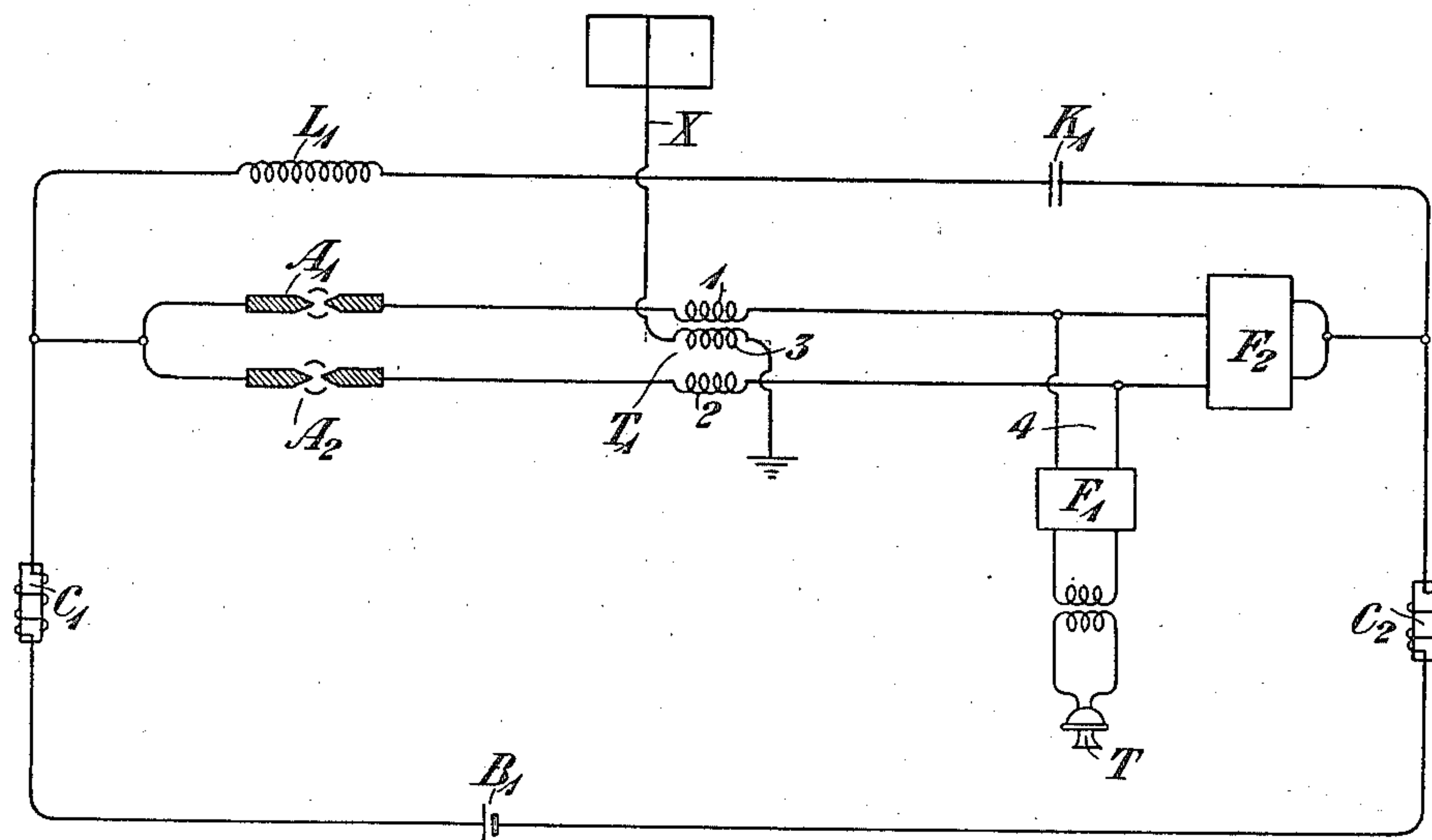


Fig. 2

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UNITED STATES PATENT OFFICE.

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HIGH-FREQUENCY TRANSLATING CIRCUITS.

Original application filed September 30, 1919, Serial No. 327,399. Divided and this application filed May 18, 1921. Serial No. 470,585.

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 co-pending 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 noninterfering, 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 disclosed in this applica-

tion comprises an arrangement for the modulation of a plurality of frequencies by means of an arc or a plurality of arcs, in which arrangement the input circuits are rendered mutually non-interfering either by means of the principle of selectivity alone or by the combination of the principles of selectivity and of balance.

This invention will be better understood from the following description read in connection with the attached drawing of which Figure 1 shows the application of the principle of selectivity and Figure 2 shows the combination of the principles of selectivity and of balance to prevent interference.

Figure 1 shows the application of this invention to a circuit in which an arc constitutes the modulator element. A represents an arc between the electrodes 1 and 1', across which a direct current from the battery B_1 is applied through the reactance coils C_1 and C_2 . Oscillations are set up in the output circuit 2 which embraces the antenna X. Low frequency signalling current in the transmitter T_1 may be impressed upon the circuit 3 which is bridged across the electrodes 1 and 1'. A filter F_1 is inserted in the low frequency circuit 3 adapted to transmit the low frequency signals of, for example, 10 to 2500 cycles, and will prevent the transmission therethrough of frequencies below 10 and above 2500 cycles. High frequency oscillations will be set up in the circuit 2 in a manner that is well known, and these high frequency oscillations may be modulated by the low frequency current impressed upon the circuit 3 by the transmitter T_1 . These low frequency signals will pass through the filter to the modulator device, namely the arc, but high frequency oscillations of the circuit 2 may not be transmitted through the filter F_1 into the low frequency signaling circuit. This circuit arrangement shows the means whereby the low frequency input circuit may be protected from interference by the high frequency oscillations of the oscillating circuit, which the low frequencies are adapted to modulate.

Figure 2 shows an arrangement for a balanced arc modulating system, in which the method of frequency selection is also applied in order to assure a higher degree of

protection of the frequencies in one input circuit from interference by currents in the other input circuits of the modulating device. In the circuit arrangement A_1 and A_2 represent two arcs, which may be of any well-known type, connected with a common source of direct current B_1 , and having reactance coils C_1 and C_2 associated in the direct current circuit. The output circuit is represented by the antenna X , which has connected therein one of the windings 3 of the triple-winding transformer T_1 . The other two windings of the said transformer are connected in series with the arcs, each winding being individual to an arc circuit. These windings of the transformer are so arranged and designed that equal currents in the same direction in each arc conductor will cause no resultant action in the winding 3 which is connected with the antenna X . Under these conditions, the action of the two arcs in parallel is equivalent to that of a single arc connected across the source of direct current B_1 and its frequency of oscillation will be determined by the inductance L_1 and the capacity K_1 . Bridged across the arc conductors is a low frequency circuit 4 upon which signaling currents from the transmitter T may be impressed. Inserted in the low frequency circuit is a filter F_1 or its equivalent, which is adapted to transmit frequencies within the range of 10 to 2500 cycles. Inserted in the two arc conductors, between the point where the low frequency signaling circuit is connected across the two arc conductors and the point of connection of the two arc conductors with one side of the battery and the oscillation circuit, is a suppression filter F_2 which is adapted to suppress oscillations having a frequency between 10 and 2500 cycles and to transmit frequencies below 10 and above 2500 cycles.

Having in mind the foregoing description, the invention will be made clear from the following description of its mode of operation:

Direct current will flow from the battery B_1 through each of the arcs A_1 and A_2 and through the windings 1 and 2, which are respectively connected with the arcs A_1 and A_2 . High frequency oscillations resulting in a manner that is well known will be set up in the high frequency oscillating circuit which embraces the inductance L_1 , the capacity K_1 and the parallel conducting paths containing the arc A_1 , the coil 1 and the arc A_2 and the coil 2 respectively. These oscillations will pass through the filter F_2 , since it is designed to transmit high frequency oscillations. Since these currents are in the same direction in each of the coils 1 and 2, and of the same magnitude, no oscillations will be set up in the output circuit X . If, however, low fre-

quency signaling currents are impressed across the arc conductors by means of the circuit 4, the high frequency oscillations in the coils 1 and 2 will be varied accordingly, and the modulated oscillations will be set up in the transmitting circuit X , since the transformer T_1 is no longer balanced. In view of the presence of the filter F_2 which suppresses frequencies between 10 and 2500 cycles, the low frequency current applied across the arc conductors will not be short circuited through the junction of the two arc conductors with one side of the direct current circuit and the oscillating circuit. Furthermore, it will be seen that the filter F_1 which is the type adapted to transmit frequencies between 10 and 2500 cycles will prevent high frequency oscillations from being impressed upon the low frequency transmitting circuit. This circuit shows means whereby each input circuit of a balanced arc modulator may be protected from interference by frequencies which are foreign to that circuit.

Although this invention has been shown as embodied in particular forms and organizations of parts, it is to be understood that it is not limited to such forms and organizations, but may be embodied in other and different forms within the scope of the appended claims.

What is claimed is:

1. In a signaling system, the combination of an oscillating arc circuit, an input circuit adapted to modulate the oscillations of the said arc circuit, and frequency selecting means associated with said input circuit to exclude therefrom oscillations of frequencies foreign to it.

2. In a signaling system, the combination of a balanced arc circuit comprising two arcs in parallel, and having a common oscillating circuit, an output circuit connected with each of said arc circuits by balanced inductive means, whereby equal currents in the same direction in each of said arc circuits will produce no effect in said output circuit, a source of low frequency signals bridged across said arc circuits for modulating the high frequency oscillations, and frequency selecting means connected with the arc circuits and with the low frequency signaling circuit, whereby each of said circuits is rendered free from interference by frequencies foreign to it.

3. In a high frequency signaling system, the combination of an antenna of an oscillatory arc circuit, a low frequency input circuit characterized by a source of low frequency variations and a filter adapted to transmit the said variations, but not the oscillations set up by the said arc.

4. In a high frequency signaling system, the combination of an antenna of an arc oscillation circuit so connected as to normally

suppress the radiation of oscillations and a low frequency input circuit connected with the said oscillation circuit and having a filter associated therewith so arranged as to prevent high frequency oscillations from entering the said low frequency circuit.

5. In a high frequency signaling system, the combination of an antenna of a source of high frequency oscillations so connected with the said antenna that radiation is normally suppressed, a low frequency input circuit connected with the said source of high frequency oscillations and high frequency and low frequency filters connected into the said oscillation circuit and the said low frequency circuit respectively to prevent interference between the respective circuits.

6. In a high frequency signaling system, the combination of a plurality of arcs in multiple having a common source of energy and a common resonant circuit of an antenna coupled with the said resonant circuit in such a manner that radiation is normally sup-

pressed, a source of low frequency variations connected across the said multiple connection of the said arcs and having frequency selecting means to transmit the low frequency variations and suppress the high frequency oscillations.

7. In a high frequency signaling system, the combination of a plurality of arcs, a high pass filter connected with the multiple conductors of the said arcs to prevent the short-circuiting of the low frequency variations by the multiple connection of the said arcs, and a low pass filter in the low frequency input circuit to suppress high frequency oscillations therein.

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.