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CARRIER AMPLITUDE CONTROL IN RADIO SYSTEMS

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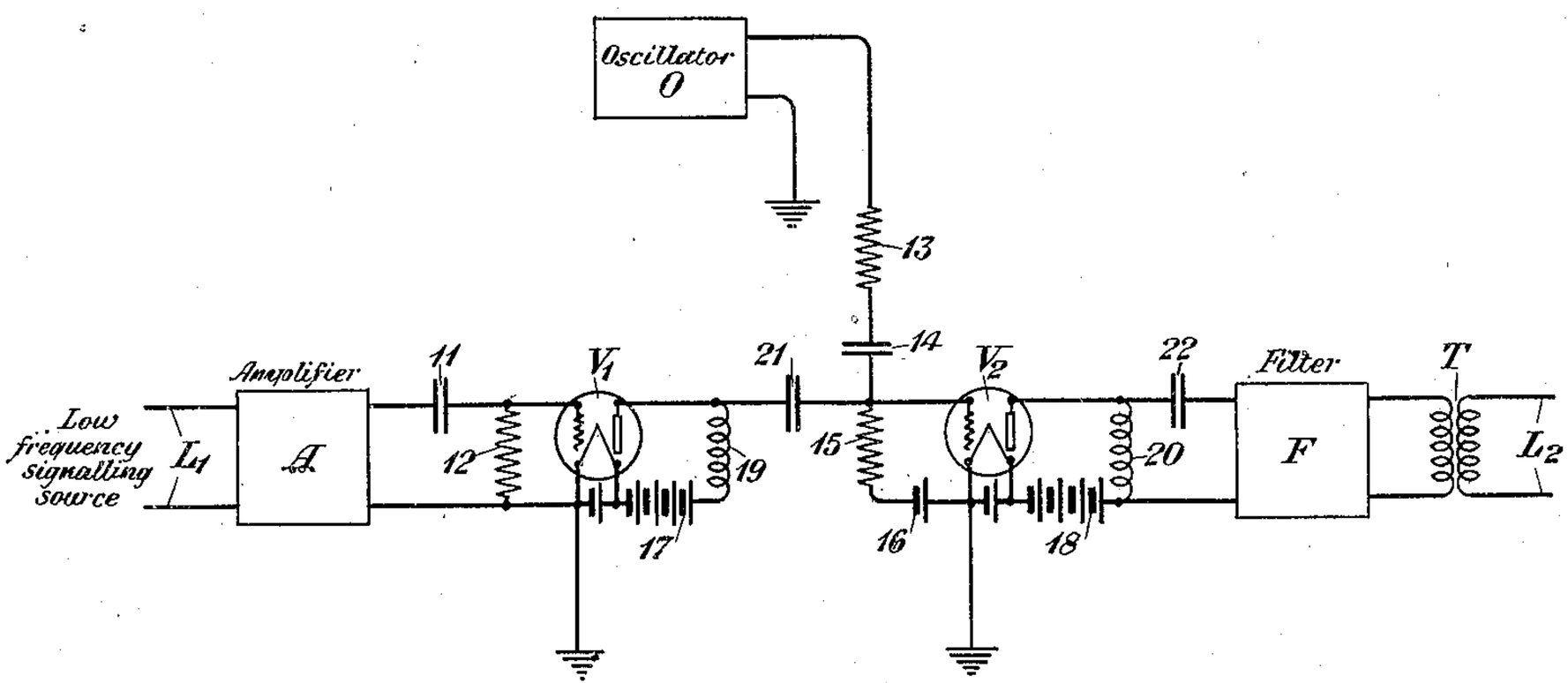

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CARRIER-AMPLITUDE CONTROL IN RADIO SYSTEMS.

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This invention relates to wave control systems, and more particularly to arrangements for controlling the amplitude of a carrier wave in accordance with the amplitude of low frequency signals.

In radio systems for the transmission of carrier frequencies modulated by low frequency signals, especially in high power transmission systems where a high field strength is ordinarily employed, the carrier frequency seems to be a source of considerable noise in a radio receiver when such carrier frequency is detected by the radio receiver modulated by low frequency signaling oscillations of low or of negligible amplitude. During the transmission of a carrier frequency modulated by low frequency signals, when the amplitude of the low frequency signals decreases the noise is clearly heard in the loud speaker at the radio receiver. The noise is objectionable and should be minimized. Furthermore, when the low frequency signals have a high level, the ratio between the modulation of these low frequency signals and the noise is not sufficient to be noticeable at the radio receiver.

In this invention there is disclosed a wave control system in which the amount of carrier radiated depends upon the level of the low frequency signals supplied to the system to a considerably greater extent than is ordinarily the case.

It is the object of the invention to vary the amplitude of a carrier wave in accordance with variations in the amplitude of low frequency signals. In other words, it is an object of the invention to increase the amplitude of a carrier wave as the level of low frequency signals increases, and vice versa.

Other objects and features of the invention will be better understood from the detailed description hereinafter following when read in connection with the accompanying drawing showing one embodiment of the invention suitable for controlling a carrier wave in accordance with low frequency signals.

Referring to the drawing, the reference character L_1 represents leads connected to a low frequency signaling source which may be, for example, a voice frequency signaling source. The leads L_1 are also connected to an amplifier A for amplifying these signals. This amplifier may be of any type well known in the art, preferably a vacuum tube amplifier. An oscillator is represented by the reference character O, which oscillator supplies the carrier frequency to be employed in the system. This oscillator may be of any well-known type, preferably a vacuum tube oscillator suitable for setting up oscillations of constant frequency and amplitude. Two three-electrode vacuum tubes V_1 and V_2, each having an anode, a cathode, and a grid are employed for controlling the amplitude of the carrier in accordance with the amplitude of the low frequency signals, as will be explained more fully in the description hereinafter following.

The output of the amplifier A is connected to the grid and cathode of the vacuum tube V_1 through a condenser 11 and resistance 12. The output of the oscillator O is connected to the input circuit of the vacuum tube V_2, current flowing in the circuit including the resistance 13, the condenser 14, the resistance 15, battery 16, and ground, the resistance 15 and battery 16 being directly connected between the grid and cathode of the vacuum tube V_2. The anodes of the vacuum tubes V_1 and V_2 are supplied with direct current potential from batteries 17 and 18 through the choke coils 19 and 20, respectively. The anode of the vacuum tube V_1 is directly connected to the grid of the vacuum tube V_2 through a condenser 21 which prevents the potential of the battery 17 from being applied to the grid of the vacuum tube V_2. The output of the vacuum tube V_2 is connected through a condenser 22 with a filter F which may be of any well-known type, preferably of the type disclosed in the patent to G. A. Campbell, dated May 22, 1917, No. 1,227,113, freely transmitting the carrier frequency and substantially suppressing all other frequencies. The output of the filter F is connected with the output circuit L_2 through a transformer T.

The condenser 11 and the resistance 12 are so related to the amplified low frequency signaling oscillations that the potential existing between the grid and cathode of the vacuum tube V_1 varies in accordance with the variations in the amplitude of the low frequency signals. The anode and cathode of the vacuum tube V_1 are in parallel relationship with the resistance 15, so that any variation in the plate-filament impedance

of the vacuum tube V_1 causes a corresponding variation in the magnitude of the high frequency potential drop across the resistance 15. When the level of the low frequency signals applied to the vacuum tube V_1 is low, the potential between the grid and cathode of the vacuum tube V_1 will also be low. The plate-filament impedance of the vacuum tube V_1 will be low, and therefore, the drop in potential across the resistance 15 will also be low. Consequently, the amplitude of the carrier wave will be considerably reduced.

When the level of the low frequency signals applied to the grid and filament of the vacuum tube V_1 increases, a negative charge will be built up on the grid of the vacuum tube V_1, thereby increasing the plate-filament impedance of the vacuum tube V_1 and effecting a corresponding increase in the potential drop across the resistance 15. Therefore, the amplitude of the carrier wave will be considerably increased. Thus it will be noted that the vacuum tubes V_1 and V_2 together form an arrangement which is employed for controlling the amplitude of the carrier wave in accordance with the level of the low frequency signals.

The anode and cathode of the vacuum tube V_2 are connected to the input of the filter F through a condenser 22 which prevents the potential of the battery 18 from being applied to the filter F. The filter F freely transmits the carrier frequency of the oscillator O and substantially suppresses all other frequencies, which other frequencies may include the harmonics of the low frequency signals and the carrier frequency. The output of the filter F is connected to the output circuit L_2 through a transformer T.

While the arrangements of the invention have been shown with particular reference to a system for the control of a carrier frequency, it is to be understood that the invention may be embodied in other systems and in other and widely varied organizations without departing from the spirit of the invention and the scope of the appended claims.

What is claimed is:

1. In combination, a source of low frequency signals of varying amplitude, a carrier frequency oscillator, means for controlling the amplitude of the carrier frequency of the oscillator in accordance with the amplitude of the low frequency signals, said means comprising two three-electrode vacuum tubes each having an input circuit and an output circuit, the source of low frequency signals being connected to the input circuit of one of the vacuum tubes and the carrier frequency oscillator being connected to the input circuit of the other of the vacuum tubes, the output circuit of the vacuum tube to which the source of low frequency signals is connected being in parallel relationship with the input circuit of the vacuum tube to which the carrier frequency oscillator is connected, the output circuit of the latter vacuum tube receiving a carrier frequency varied in amplitude in accordance with the amplitude variations of the low frequency signals.

2. A system for controlling the amplitude of a carrier frequency in accordance with the amplitude of low frequency signals, which comprises a source of low frequency signals of varying amplitude, a carrier frequency oscilator, and a pair of three-elec trode vacuum tubes placed in tandem with respect to the source of low frequency signals so that the plate-filament circuit of the first vacuum tube is in parallel relationship with the grid-filament circuit of the second vacuum tube, the low frequency signals being impressed on the grid and filament of the first vacuum tube and the carrier frequency being impressed on the grid and filament of the second vacuum tube, variations in the amplitude of the low frequency signals causing corresponding variations in the amplitude of the carrier frequency.

3. A system for controlling the amplitude of a carrier frequency in accordance with low frequency signals of varying amplitude, comprising a source of low frequency signals of varying amplitude, a carrier frequency oscillator, and two three-electrode vacuum tubes placed in tandem with respect to the source of low frequency signals so that the plate and filament of the first vacuum tube are in parallel relationship with the grid and filament of the second vacuum tube, the source of low frequency signals being connected to the grid and filament of the first vacuum tube and the carrier frequency oscillator being connected to the grid and filament of the second vacuum tube, and a filter connected to the plate and filament of the second vacuum tube freely transmitting the carrier frequency controlled as to its amplitude and substantially suppressing all other frequencies.

4. In a system for controlling the amplitude of a carrier frequency wave in accordance with variations in the amplitude of low frequency signals, in combination, a source of low frequency signals, a carrier frequency generator, two three-electrode vacuum tubes each having an input circuit and an output circuit, the source of low frequency signals being connected to the input circuit of one of the three-electrode vacuum tubes and the carrier frequency generator being connected to the input circuit of the other of the three-electrode vacuum tubes, said three-electrode vacuum tubes being so related that variations in the potential in the input circuit of the three-electrode vacuum tube to which the source of low frequency signals is con-

nected cause corresponding variations in the current in the output circuit of the three-electrode tube to which the source of low frequency signals is connected and corresponding variations in the current in the output circuit of the three-electrode tube to which the carrier frequency generator is connected.

5. In a system for controlling the amplitude of a carrier frequency wave in accordance with low frequency signals of varying amplitude, in combination, a source of low frequency signals of varying amplitude, a carrier frequency generator, two three-electrode vacuum tubes each having an anode, a cathode and a grid, the source of low frequency signals being connected to the grid and cathode of one of the three-electrode vacuum tubes, and the carrier frequency generator being connected to the grid and cathode of the other of the three-electrode vacuum tubes, said three-electrode vacuum tubes being so related that variations in the potential between the grid and cathode of the three-electrode vacuum tube to which the source of low frequency signals is connected cause corresponding variations in the amplitude of the current flowing between the anode and cathode of the three-electrode vacuum tube to which the carrier frequency generator is connected.

6. In combination, a source of low frequency signals of varying amplitude, a high frequency oscillator, two three-element vacuum tubes each having a plate, a filament and a grid, the source of low frequency signals being connected to the grid and filament of one of the three-electrode vacuum tubes so as to effect changes in the potential of the grid with respect to the filament of that tube at a rate corresponding to the variations in the amplitude of the low frequency signals, the high frequency generator being connected to the grid and filament of the other of the three-electrode vacuum tubes, said three-element vacuum tubes being so connected that changes in the plate-filament impedance of the three-electrode vacuum tube to which the source of low frequency signals is connected effect corresponding changes in the potential of the grid with respect to the filament of the three-electrode vacuum tube to which the high frequency generator is connected.

7. In combination, a source of low frequency signals of varying amplitude, two three-element vacuum tubes each having a plate, a filament and a grid, the source of low frequency signals being connected to the grid and filament of the first of the three-element vacuum tubes, said three-element vacuum tubes being so related to the source of low frequency signals that variations in the amplitude of the low frequency signals cause corresponding variations in the potential between the grid and filament of the second of the three-element vacuum tubes, and an oscillator of constant frequency connected to the grid and filament of the second of the three-element vacuum tubes, the amplitude of the wave produced by said oscillator varying with variations in the amplitude of the low frequency signals.

8. In a system for controlling the amplitude of a carrier wave in accordance with voice frequencies of varying amplitude, in combination, an oscillator setting up a current constant in amplitude and frequency, a three-element vacuum tube having a plate, a filament and a grid, said oscillator being connected to the grid and filament of said three-electrode vacuum tube, a source of voice frequencies of varying amplitude, and means for varying the amplitude of the current set up by said oscillator in accordance with the amplitude of the voice frequencies, said means comprising another three-element vacuum tube having a plate, a filament and a grid, the grid and filament of said latter three-electrode vacuum tube being connected to the source of voice frequencies, the plate and filament of said latter three-element vacuum tube being in parallel relationship with the grid and filament of the vacuum tube to which the oscillator is connected.

In testimony whereof, I have signed my name to this specification this 16th day of February, 1926.

WILLIAM H. T. HOLDEN.