

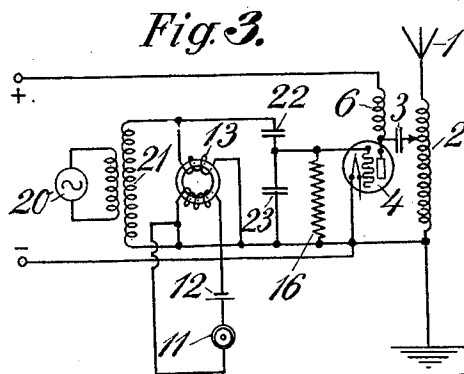
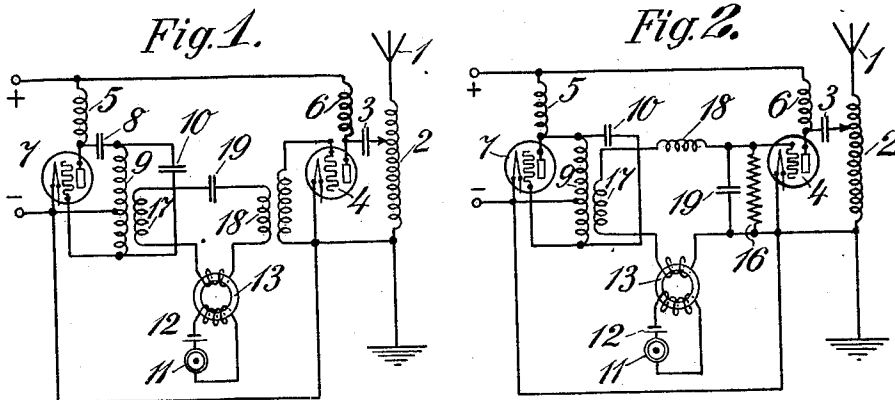
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HIGH FREQUENCY MODULATING SYSTEM

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HIGH FREQUENCY MODULATING SYSTEM

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This invention has reference to the modulation of high-frequency currents used for transmitting signals, sound waves, or the like, and relates more particularly to such high frequency generating systems in which a master oscillator controls the grid of one or more power amplifier tubes, and wherein iron-cored choke modulators with auxiliary magnetization are employed.

It has been found that iron-cored modulating devices present certain drawbacks when inserted in oscillating circuits, especially vacuum tube circuits, inasmuch as the iron-core devices are liable by virtue of their comparatively large inductance and ohmic resistance and the variations thereof, to disturb the stability of such circuits.

It has hitherto been known that the grid circuit of a self-oscillating vacuum tube having the usual cathode, grid, and anode electrode, could have inserted therein an iron-core choke device with an auxiliary control winding carrying the modulation currents for the purpose of modulating the high-frequency oscillations. However, such an arrangement possesses certain drawbacks, especially if a stabilizing resistance (grid leak resistance) is arranged in the grid circuit or placed parallel to the cathode and grid electrodes, which may result in an up-setting of the stability of the system by the operation of the choke modulator in a manner to produce irregular conditions in the working of the transmitter which may only be eliminated by a close and steady supervision of all the various adjustments, couplings, and so forth.

According to my invention, these drawbacks are obviated by inserting the iron-core choke modulator in a special control circuit arranged intermediate the master oscillator and power amplifier. Thus, the controlling oscillations already modulated are applied to the grid of the power amplifier and the above mentioned drawbacks of the choke device, when inserted in the grid circuit of the power amplifier, are avoided. The grid leak resistance of the power oscillator, if employed for stabilizing purposes, remains unaffected and accordingly, the operation of the power amplifier is undisturbed. Further-

more, reaction on the master oscillator and its operating stability is readily prevented.

Thus, the invention combines on the one hand the advantages of separately controlled transmitters (master oscillator and power amplifier), well known in the art, and on the other hand, the advantages of a high degree of stability and the possibility of modulating the oscillating current in a comparatively easy way and by using small modulating energies. The master oscillator may be of any known type, such as a self-oscillating vacuum tube, a high frequency alternator, or a piezo-electric crystal oscillator.

The novel features of my invention are more fully set forth by the following examples of practical embodiments thereof, and illustrated by the figures of the accompanying drawings.

Figure 1 shows a simple circuit of a master oscillator power amplifier system with an intermediate control circuit in accordance with the invention.

Figure 2 shows a similar circuit to Figure 1 with a capacitive coupling of the control circuit with the power amplifier in place of an inductive coupling, as shown by Figure 1.

Figure 3 is a similar circuit to Figures 1 and 2, illustrating schematically a master oscillator of any type in place of the vacuum tube oscillator shown in Figures 1 and 2.

Similar reference numbers in all the drawings refer to similar elements.

Referring to the drawings: 1, represents an aerial; 2, an aerial loading coil; 3, a blocking condenser to prevent the direct current of the anode current supply from entering the oscillating (antenna) circuit; 4, represents a power amplifying tube; 5, and 6, represent choke-coils for preventing the high-frequency oscillations from entering the anode current source; 7, indicates the master oscillator consisting of a self-oscillating vacuum tube; 8, represents a blocking condenser serving a purpose similar to that of the condenser 3; 9, represents a self-inductance coil forming in combination with a capacity; 10, represents the oscillatory circuit of the master oscillator tube 7; 11, illustrates a

microphone; and 12, a current source for supplying the microphone current.

Referring to the special feature of Figures 1 and 2, the control circuit is arranged intermediate the oscillating circuit of the master oscillator and the input circuit of the power amplifier and consists of the coupling coils 17 and 18 and a capacity 19 and the iron-core choke modulator 13.

Figure 3 illustrates an arrangement, according to my invention, in which any other type of master oscillator 20, such as a high-frequency alternator, crystal controlled oscillator, and the like, is employed coupled to the control circuit comprised of coupling coil 21, tuning capacity 22, and a coupling means (capacity 23) for effecting the coupling with the grid input circuit of the power amplifier. According to this example, the iron-core modulator is placed parallel to the coil 21 instead of in series with the circuit as shown by the circuit according to Figures 1-2.

The intermediate or control circuit 17, 18, 19 and 21, 22, 23, according to Figures 1 and 2, and Figure 3, respectively, is tuned to the frequency of the master or control oscillator 7 or 20, respectively. By properly coupling the intermediate or control circuit with the master oscillator, appreciable reaction on the operation of the master oscillator, especially the frequency stability of the same, may be readily prevented. This can easily be obtained by choosing a sufficiently loose coupling which, although it will decrease the power transmitted to the power amplifier, will not seriously affect the all-over efficiency of the system, as it is the object of the master oscillator to merely supply a control potential for operating the power amplifier which latter serves to generate the power required in the output or antenna circuit. In the case of Figures 1 and 2 where the choke modulator is inserted in series with the intermediate or control circuit, the amplitude of the carrier frequency modulations will be varied in accordance with the variations of magnetizing current produced by the microphone, provided the iron-core of the modulator is properly magnetically saturated.

As is well known, a saturated iron-core varies its ohmic or loss resistance approximately in proportion to the amount of magnetizing current, so that the amplitude of the high frequency carrier oscillations will be subjected to corresponding variations and a modulated high frequency control potential is applied to the input of the power amplifier 4. A highly saturated modulator of the type described, varies its self-induction only slightly with variation of the magnetizing biasing current so that in a system in accordance with the present invention in which the modulator is arranged sufficiently remote from the master oscillator to mini-

mize as much as possible reaction effects, substantially an amplitude modulated carrier frequency, is produced. In the circuit arrangement, according to Figure 4, where the choke modulator 13 is arranged in shunt relationship with the intermediate or control circuit 21, 22, and 23, the former absorbs more or less high frequency energy corresponding to the variations of the microphone currents, and thus indirectly produces an amplitude variation of the carrier frequency currents applied to the input of the power amplifier 4.

What I claim to be secured by Letters Patent in the United States is:

1. In a radio communication transmitting system, a master carrier frequency generator, a power amplifier, an intermediate circuit the input side of which is connected to the output circuit of said generator and the output side of which is connected to the input circuit of the power amplifier and an iron core choke modulating device for modulating the carrier frequency generated by said generator in accordance with signalling currents, said modulating device being connected in said intermediate circuit.

2. In a radio communication transmitting system, a master carrier frequency generator, a power amplifier, an intermediate circuit the input side of which is connected to the output circuit of said generator and the output side of which is connected to the input circuit of the power amplifier and an iron core choke modulating device for modulating the carrier frequency generated by said generator in accordance with signalling currents in said iron core choke modulating device having a winding connected in said intermediate winding and an auxiliary winding connected in a circuit carrying the currents in accordance with which said carrier currents are to be modulated.

3. In a radio communication transmitter system, a transmitting means, a power oscillator electron discharge device connected to said transmitting means, a master oscillating device for producing high frequency electric oscillations, an intermediate circuit coupled to the output of said master oscillator and to the input of said power oscillator for transmitting oscillating currents from said master to said power oscillator and an iron core choke modulator device having an auxiliary winding controlled in accordance with signalling currents and having a further winding connected in the intermediate circuit for modulating the carrier currents transmitted thereby in accordance with the signalling currents.

4. In a radio communication system, a transmitting means, an electron discharge device connected to said transmitting means, a master oscillator for generating radio frequency currents, an intermediate circuit connected to said master oscillator and to the

grid electrode of said electron discharge device whereby said grid electrode is influenced by the oscillating currents of said master oscillator and an iron core choke modulating device connected in said intermediate circuit
5 and modulating the carrier currents from said master oscillator in accordance with signaling currents.

In testimony whereof I have affixed my
10 signature.

FELIX GERTH.

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