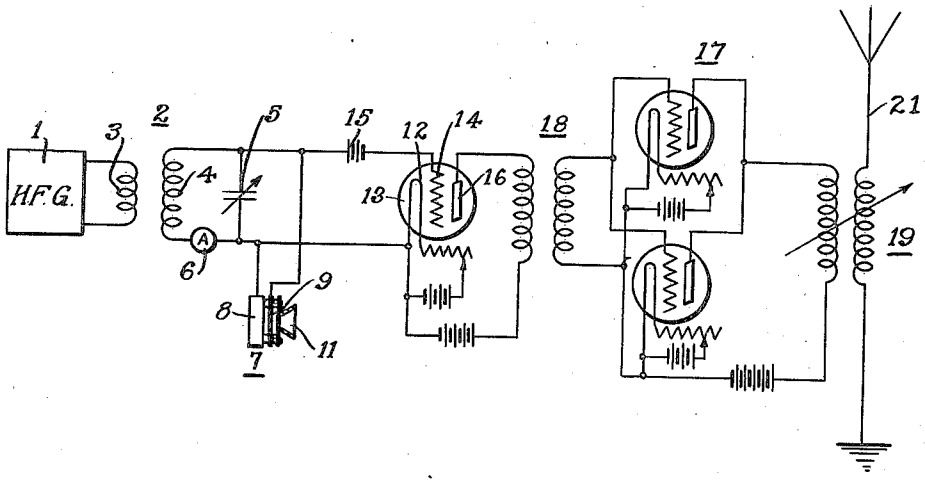
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SYSTEM OF MODULATION

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SYSTEM OF MODULATION.

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This invention relates to systems for sending radio signals and it has particular relation to modulating means therefor.

It is an object of this invention to provide means for modulating the signaling energy without making use of electrical oscillations of other than radio frequency.

It is another object of this invention to produce the modulation of the energy used in sending signals by means which will not introduce distortions.

It is a further object of this invention to make use of the characteristics of the current-capacity curve of a tuned circuit. Such a curve has a well marked peak whose sides are nearly straight lines. The practice of this invention includes adjusting the tuned circuit, so that it normally is working about at the middle of one side of the peak of this curve, and producing the modulations by changing the constants of the circuit, so that it shall work at points distributed along the straight part of the curve forming one side of the peak.

It is a further object of this invention to so construct the circuit that a small change in capacity shall produce a maximum change in current. More specifically stated, this object is accomplished by making the coupling between the tuned circuit and the energizing circuit very loose, so that the peak of the current-capacity curve will be very narrow, and then tuning, as already described, to the middle of one slope of the peak.

It is a still further object of this invention to maintain the grid of a thermionic tube at such potential that a minimum amount of power will be required in the tuned circuit controlling the grid.

Other objects of the invention and details of construction will be apparent from the following description and the accompanying drawings, wherein,

The single figure is a diagrammatic illustration of circuits and apparatus embodying my invention.

In this figure, 1 is a generator of high frequency current, which has been indicated by the letters HFG on the drawing. No particular type of generator need be illustrated or described because the invention is equally applicable to systems supplied by generators of many types.

A loose coupling 2 includes a primary coil 3 supplied by the high frequency generator and a secondary coil 4 which is part of a circuit including an adjustable condenser 5 and a current measuring instrument 6. The coupling 2 is made loose in order that the current-capacity curve for the secondary circuit shall have a very sharp and narrow peak. This circuit also includes a variable condenser 7, in parallel with the inductor 4 and condenser 5. As illustrated, this condenser comprises a stationary plate 8 and a movable plate 9, insulated from each other. The plate 9 forms one wall of a chamber into which the mouthpiece 11 will conduct sound. The sound waves, by causing the diaphragm 9 to vibrate, will change the capacity of the condenser 7, so that the total capacity in parallel with the inductor 4 is varied.

One terminal of the circuit including this capacitance and inductance is connected to the filament 12 of a thermionic device 13 and the other terminal is connected to the grid 14 of the same vacuum tube. The connection to the grid preferably includes a C-battery 15 for maintaining the grid at a negative potential. The anode 16 is connected to the usual output circuit. Further amplification of the output is provided by a circuit 17, which, as illustrated, includes two thermionic devices arranged in parallel. The invention is, however, equally applicable to a system including any form of amplifying device. The amplifying circuit just mentioned is coupled to the output circuit of the vacuum tube 13 by means of a transformer 18. The output circuit of the amplifier 17 is coupled, as shown at 19, to the antenna 21, from which the energy is radiated.

In the operation of the device, the adjustable condenser 5 is manipulated until the reading of the current-measuring device 6 is maximum and then changed in either direction until the reading of the instrument is approximately half of the maximum reading. If a curve be plotted using values of the total capacity of the condensers 5 and 7 combined, as abscissæ and current in the circuit including inductor 4 and said condensers, as ordinates, its form will be closely similar to the familiar current-frequency curve. That is, it will have a peak with rather steep and nearly straight sides. The circuit including the inductor 4 and condenser 5 will after this adjustment be operating at a point approximately half way up one

side of the peak of the current-capacity curve.

The capacity of the variable condenser 7 is then changed. This can be done by speaking into the mouthpiece 11. It will, however, be obvious that any other method of varying this capacity would be equally effective, for example, the movable element 9 of the condenser 7 might be connected to a phonograph mechanism so that the record would cause the element 9 to vibrate.

Each change in the capacity of the condenser 7 changes the point on the current-capacity curve at which the circuit through inductor 4 is working. It thus changes the energy delivered to the grid 14. The displacement, from mid-position on one side of the peak of the curve, is not great enough to reach beyond the practically straight part of the curve, consequently the changes in amplitude of the potential vibration on the grid 14 will be strictly proportional to the changes in capacity of the condenser 7 and, therefore, strictly proportional to the sound vibrations or other disturbances displacing the movable element 9. The battery 15 has its potential so chosen that the position of the point representing the average potential of the grid 14 is in the middle of the straight part of the characteristic curve of the tube 13. The changes in the potential of this grid do not extend beyond the straight part of the curve. No distortion, therefore, is introduced by the amplifying action of the tube 13. Thus, the whole system, from the condenser 7 to the antenna 21, includes nothing that will cause a departure from this strict proportionality, consequently the energy radiated from the antenna 21 will represent, without distortion, the sound spoken into the mouthpiece 11.

Although, I have described and illustrated but a single embodiment of my invention, it will be apparent to those skilled in the art that many variations may be made without departing from the spirit thereof, and I, therefore, do not intend my invention to be limited except as is necessitated by the prior art or indicated by the claims.

I claim as my invention:

1. In a radio sending system, a circuit including a source of high frequency energy, a second circuit loosely coupled thereto and including an inductor and a tuning condenser in parallel, a sound responsive condenser in parallel to said tuning condenser, the capacity of said tuning condenser and the average capacity of said sound responsive condenser together being so related to the inductance of said inductor that the circuit is not resonant to the frequency of said source, but is so nearly resonant thereto that the variations in current resulting from the changes in capacity of the sound responsive condenser bear a linear relation to said changes.

2. In a radio transmitting system, a source of high frequency oscillations, a thermionic amplifier having an input circuit coupled to said source, means for tuning said input circuit, signal responsive means for causing the period of said circuit to approach and recede from resonance with said source, and means whereby a linear relationship is maintained between the signal and the output of the amplifier.

3. In a radio transmitting system, a source of high frequency oscillations, a thermionic amplifier having an input circuit coupled to said source, means normally maintaining the tuning of said input circuit slightly out of resonance with said source, signal responsive means associated with said input circuit for slightly altering its tuning, and means whereby the output of said amplifier is maintained directly proportional to the signal.

4. In a radio transmitting system, a source of high frequency oscillations, a thermionic amplifier having an input circuit coupled to the grid and filament thereof, signal responsive means for slightly altering the amount of current flowing in said input circuit by reason of its coupling to said source, and means for maintaining the output of said thermionic amplifier directly proportional to the signal.

In testimony whereof, I have hereunto subscribed my name this 23rd day of August, 1923.

LEWIS W. CHUBB.