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L. C. YOUNG

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RADIO TELEGRAPH KEYING SYSTEM

Filed Dec. 15, 1926

FIG. 1

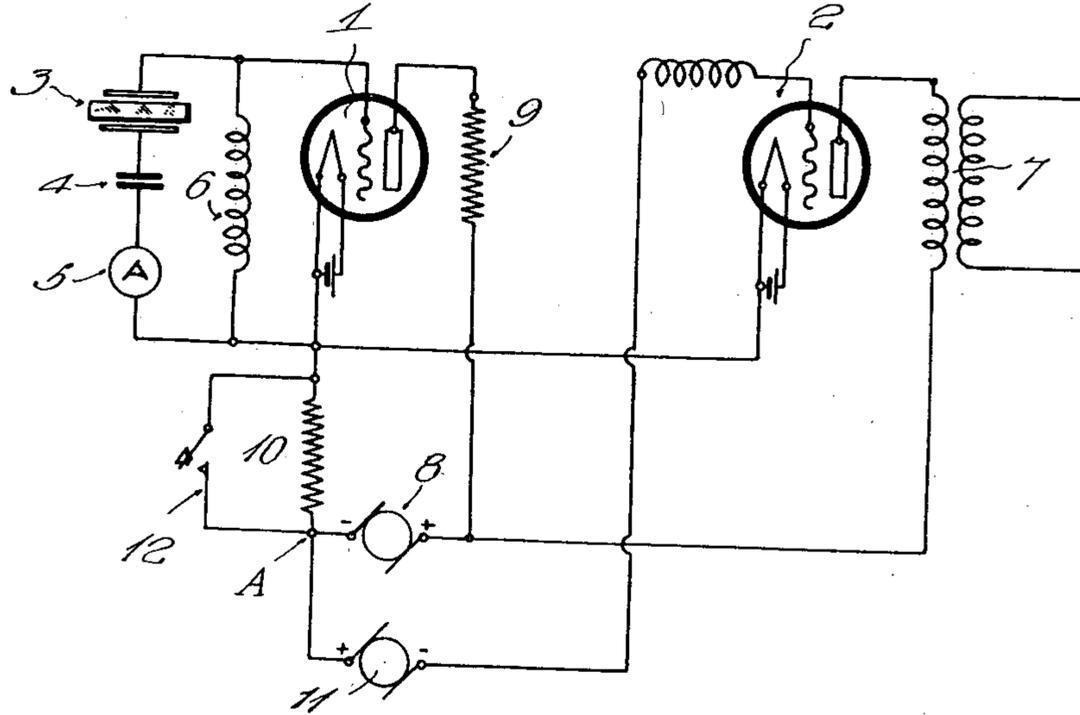
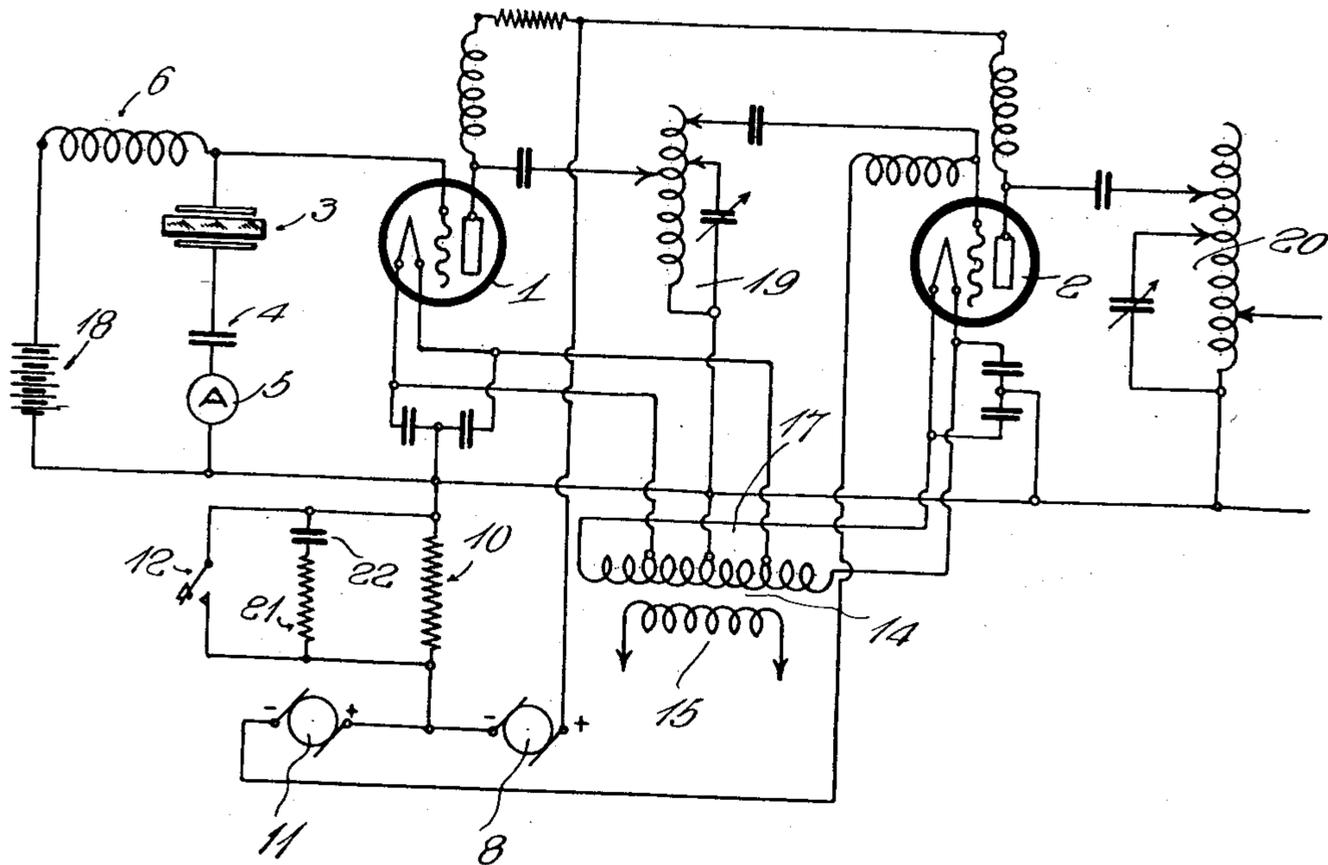


FIG. 2



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# UNITED STATES PATENT OFFICE.

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## RADIO TELEGRAPH KEYING SYSTEM.

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My invention relates broadly to high frequency signaling circuits and more particularly to a circuit arrangement for telegraphically keying an electron tube transmitter.

5 One of the objects of my invention is to provide a circuit arrangement for a high frequency crystal controlled transmitter wherein the operation of an electron tube oscillator is arranged to be sustained by the  
10 constant frequency oscillations of a piezo electric crystal element both during and intermediate the signaling intervals, while the effect of the oscillations upon a power amplifier system may be interrupted for the  
15 production of signals.

Another object of my invention is to provide an electron tube transmitter including a piezo electric crystal controlled oscillator and power amplifier system in which the operation of the power amplifier system is  
20 blocked for the making of signals, while the crystal controlled oscillator is maintained in continuous operation although at different degrees of amplitude.

25 Another object of my invention is to provide a circuit arrangement for a piezo electric crystal controlled oscillator and power amplifier system having connections interposed between the grid circuit of the power  
30 amplifier system and the input circuit of the oscillator for subjecting the power amplifier circuit to alternate conditions of blocking while the oscillator circuit is maintained in varying degrees of oscillation during and  
35 intermediate the signal intervals.

My invention will be more clearly understood from the specification hereinafter following by reference to the accompanying drawings, in which:

40 Figure 1 is an elemental circuit diagram illustrating the principle of my invention; and Fig. 2 illustrates a piezo electric crystal controlled oscillator system operating in conjunction with a power amplifier system and shows diagrammatically the arrangement of the keying circuit of my invention.

45 Referring to the drawing in detail, reference character 1 designates an electron tube having its circuits arranged for the generation of high frequency oscillations. Reference character 2 designates a power amplifier tube having circuits connected thereto upon which the high frequency oscillations generated within the circuits of tube 1 are  
50 impressed. The piezo electric crystal 3 is

connected in series with condenser 4 and ammeter 5 with the input circuit of tube 1. A choke coil 6 is illustrated in shunt with the piezo electric crystal circuit and the input circuit of tube 1. The output circuit of tube  
60 1 is connected with the input circuit of tube 2 by means of which and its associated circuits the amplitude of the high frequency oscillations are increased for delivery to any circuit that may be coupled with inductance  
65 7. The high potential for the plate circuits of tubes 1 and 2 is supplied from generator 8. A resistance 9 may be provided for controlling the potential supplied to the plate  
70 of tube 1. Resistance 10 is inserted between the filament electrodes of the tubes and the common connection of the plate potential source 8 and the grid potential source represented by 11. A keying circuit 12 is connected in shunt with the resistance 10.  
75

It will be noted that any current flowing from the plate supply source 8 through resistance 10 will result in a voltage drop across it which is negative at point A with respect to the potential 9 of the filaments.  
80 As the positive terminal of the generator 11 is connected to the filament electrodes through the same resistance 10 any potential developed along resistance 10 will add to that of the source 11 thereby increasing the  
85 negative potential applied to the grid of the amplifier tube 2. As this resistance is in the common plate return and as the master oscillator is left free to oscillate, any plate current flowing from tube 1 must pass through  
90 the resistance and the current although reduced, gives enough additional negative bias potential to block the grid of the amplifier. When this resistance is adjusted to the  
95 proper value, the master oscillator will continue to oscillate at reduced power and the amplifier tube will be blocked. When the key 12 is closed the resistance 10 is shorted out and the negative biasing potential 11 and filaments are connected directly  
100 together in a normal working position.

In Fig. 2 I have illustrated the application of my invention to a radio transmission system in which the tubes 1 and 2 hold the same relation of oscillator and amplifier with  
105 respect to each other. The cathodes of the tubes are heated from an alternating current supply source by current supplied by transformer 14 made up of primary winding 15 and secondary winding 17. The in-  
110

put circuit of the oscillator tube 1 includes the piezo electric crystal 3, condenser 4 and ammeter 5 in shunt with choke coil 6 and battery 18. This arrangement provides for the operation of the piezo electric crystal 3 under conditions of no load. The output circuit of the oscillator tube 1 is coupled to the input circuit of the power amplifier tube 2 through the link circuit 19. The output circuit of the power amplifier tube 2 includes the tuned circuit 20, from which energy may be transferred to a succeeding stage of amplification or to a transmission circuit. The high potential source 8 supplies current to the plate circuits of both tubes 1 and 2. The generator 11 supplies a biasing voltage to the grid circuit of the power amplifier tube 2. The resistance 10 in the common lead between generators 8 and 11 is illustrated as shunted by a resistance 21 and capacity 22 and by key 12. The circuit 21—22 operates to prevent sparking at the contacts of the key 12 or relay contact points that may be substituted for the key.

As the generator or source of potential 11 is required to supply only the working grid voltage of the amplifier 2, there is no loss in resistance in obtaining the required voltage. There is also no loss in plate power in producing the negative bias across a resistance in the common plate return. When the key 12 is open, the voltage on the master oscillator plate is reduced which results in the oscillator operating at a much reduced power intermediate the signaling periods. This arrangement tends to reduce local interference at receivers near the transmitter and also tends to reduce considerably the power otherwise needlessly expended by the apparatus.

It will be understood that modifications in the circuit arrangement of my invention may be made without departing from the spirit of my invention, and no limitations upon my invention are intended other than are imposed by the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is as follows:

1. A high frequency signal transmission system comprising a plurality of electron tubes each having grid, filament and plate electrodes, input and output circuits interconnecting said electrodes, including a circuit to interlink the output circuits of one of said tubes with the input circuit of a succeeding tube, the circuits of one of said tubes being arranged to sustain high frequency oscillations at a selected frequency, and another of said tubes being arranged to amplify the oscillations produced by the first mentioned tube, a source of high potential for supplying power to the output

circuits of each of said tubes, a source of potential for impressing a high negative charge on the grid electrode of the last mentioned tube, and a resistance device connected between said sources of potential and a point common to the input and output circuits of the first mentioned electron tube, and means for abruptly changing the condition of said resistance element for controlling the operation of the electron tubes in accordance with telegraphic signals.

2. A high frequency signal transmission system comprising a plurality of electron tubes each having grid, filament and plate electrodes, input and output circuits interconnecting said electrodes, a piezo electric crystal element connected in the input circuit of one of said electron tubes, connections between the output circuit of said electron tube and the input circuit of a succeeding electron tube for impressing high frequency oscillations corresponding to the frequency of the piezo electric crystal element upon the circuits of the last mentioned electron tube, a high potential source for supplying power to the output circuits of each of said electron tubes, a high potential source for impressing a negative charge upon the grid electrode of the last mentioned electron tube, a common connection between said sources, and means disposed between said common connection and a point common to the input and output circuits of each of said electron tubes for controlling the condition of operation of each of said electron tube circuits in accordance with telegraphic signals.

3. A high frequency signal transmission system comprising a plurality of electron tubes each having grid, filament and plate electrodes, input and output circuits interconnecting said electrodes, a piezo electric crystal element connected in the input circuit of one of said electron tubes, connections between the output circuit of said electron tube and the input circuit of a succeeding electron tube for impressing high frequency oscillations corresponding to the frequency of said piezo electric crystal element upon the circuits of said last mentioned electron tube, a high potential source for supplying power to the output circuits of each of said electron tubes, a high potential source for impressing a negative charge upon the grid electrode of said last mentioned electron tube, a common connection between said sources, a high resistance element disposed between said common connection and a point common to the input and output circuits of each of said electron tubes, and means connected in shunt with said resistance element for abruptly changing the value thereof for controlling the operation of said electron tube circuits in accordance with telegraphic signals.

4. A high frequency signal transmission system comprising a plurality of electron tubes each having grid, filament and plate electrodes, input and output circuits interconnecting said electrodes, a piezo electric crystal element connected in the input circuit of one of said electron tubes, a connection between the output circuit of said electron tube and the input circuit of a succeeding electron tube for impressing on said last mentioned electron tube sustained oscillations corresponding to the frequency of said piezo electric crystal element, a high potential source for supplying power to the output circuits of each of said electron tubes, a high potential source for impressing a negative charge on the grid electrode of said last mentioned electron tube, a common connection between said sources, a resistance element interposed between said common connection and a point common to the input and output circuits of said first mentioned electron tube, a keying circuit connected in shunt with said resistance element, said resistance element being proportioned in such manner that when said keying circuit is opened oscillations from said piezo electric crystal element are feebly sustained in the circuits of said first mentioned electron tube while the operation of said last mentioned electron tube is substantially blocked, the closing of said keying circuit operating to place said first mentioned electron tube in a condition for strongly sustaining the oscillations of said piezo electric crystal element while said second mentioned electron tube is placed in a condition for increasing the amplitude of the oscillations thus sustained.
5. In a piezo electric crystal controlled transmission circuit the combination of a plurality of electron tubes each having grid, filament and plate electrodes, input and output circuits interconnecting said electrodes, a piezo electric crystal element connected in the input circuit of one of said electron tubes, the output circuit of said electron tube being coupled with the input circuit of a succeeding electron tube for impressing oscillations at the frequency of said piezo electric crystal element upon said second mentioned electron tube, a high potential source for supplying power to the output circuits of each of said electron tubes, a high potential source for normally impressing a negative potential upon the grid of said second mentioned electron tube, a common connection between said sources, a resistance element disposed between said common connection and the circuits of said first mentioned electron tube, a keying circuit connected in shunt with said resistance, the closing of said keying circuit operating to place the circuits of said first mentioned electron tube in a condition for sustaining the oscillations of said piezo electric crystal element, said resistance when effectively included in the circuits of said electron tubes operating to block the operation of said second mentioned electron tubes and reducing the tendency of the circuits of said first mentioned electron tubes to sustain the oscillations of said piezo electric crystal element.

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