

March 24, 1931.

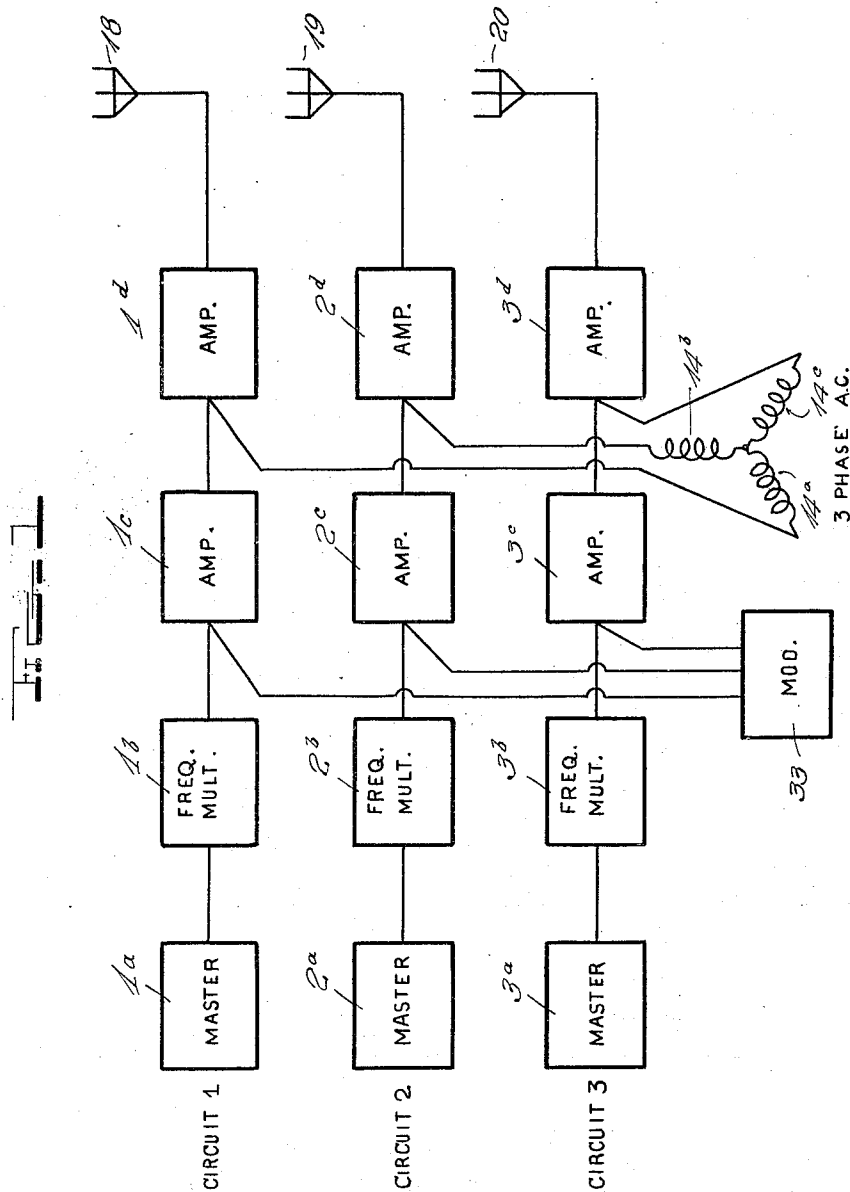
L. C. YOUNG

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MULTIPLE CHANNEL MULTIPHASE ANTIFADE SYSTEM

Filed July 20, 1928

2 Sheets-Sheet 1



INVENTOR.

Leo C. Young,
BY *Harold Todd*
ATTORNEY.

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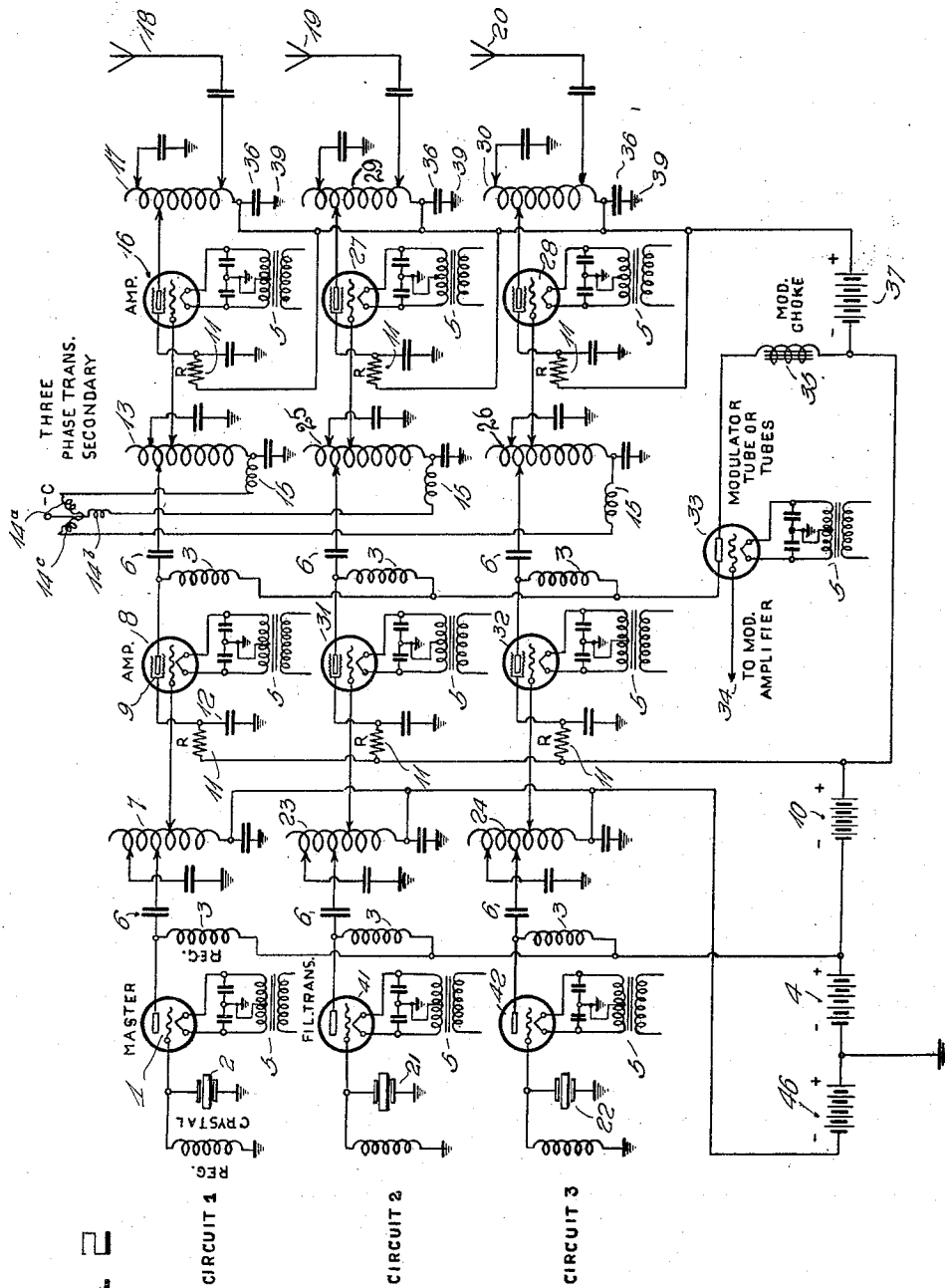
L. C. YOUNG

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2 Sheets-Sheet 2



INVENTOR.
Leo C. Young,
BY
H. J. Young,
ATTORNEY.

UNITED STATES PATENT OFFICE

LEO C. YOUNG, OF WASHINGTON, DISTRICT OF COLUMBIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO FEDERAL TELEGRAPH COMPANY, A CORPORATION OF CALIFORNIA

MULTIPLE-CHANNEL MULTIPHASE ANTIFADE SYSTEM

Application filed July 20, 1928. Serial No. 294,286.

My invention relates to transmitting systems in general and more specifically to transmitting systems employing vacuum tubes.

An object of my invention is to provide a system wherein a plurality of frequencies are transmitted at slightly different intervals.

Another object of my invention is to provide a transmitting system wherein a plurality of frequencies are transmitted in different phase relations.

A further object of my invention is to provide a transmitting system wherein sources of high frequency energy are modulated by a common means and transmitted either by space radio or wired radio at a predetermined difference in phase.

A still further object of my invention is to provide a transmitting system whereby fading of signals is largely eliminated.

It is now well known that slightly different frequencies will fade at different rates. The transmitting system of my invention provides a means to compensate for this effect which is especially noticeable on the higher frequency bands. The transmitting system of my invention consists essentially of two or more complete circuits tuned to different frequencies the energy of which is modulated or controlled by an alternating current source, in such a manner that first one circuit operates and then the other circuits operate in a predetermined order.

A better understanding can be had of the system I employ by referring to the specification which follows and to the accompanying drawings in which:

Figure 1 is a diagrammatic illustration of the transmitting system of my invention and Fig. 2 is a diagrammatic circuit arrangement showing the circuit connections in the transmitting system of my invention.

In Fig. 1 a source of high frequency energy 1a is shown connected to a frequency multiplier 1b. The frequency multiplier 1b may be dispensed with if an increased frequency above that of the source is not desired. The frequency multiplier is shown connected to an amplifier 1c. A source of modulated signaling energy 33 is shown connected to the amplifier 1c. The output of

amplifier 1c is shown connected to a power amplifier 1d where the energy is further amplified and transferred to a load circuit 18, represented as a space radio radiating system. A source of grid potential 14a is shown supplying amplifier 1d. A second complete system includes a source of high frequency energy 2a, frequency multiplier 2b, amplifier 2c, a source of modulated energy 33, power amplifier 2d, a source of grid potential 14b and a load circuit 19. A third complete system includes a source of high frequency energy 3a, frequency multiplier 3b, amplifier 3c, a source of modulated energy 33, power amplifier 3d, a source of grid potential 14c and a load circuit 20.

In Fig. 2 the circuit is shown in more detail. A thermionic vacuum tube 1 having grid, filament and plate electrodes and associated grid, filament and plate circuits is shown as a source of high frequency energy. A mechanically vibratile element 2 is shown connected in the grid circuit to stabilize the frequency of the generated energy. The filament of thermionic vacuum tube 1 is shown energized by transformer 5 which could be any source of energy depending upon the type of tube employed. A source of plate potential is supplied the plate circuit by way of radio frequency choke coil 3. A blocking condenser 6 prevents short-circuiting of the plate supply and allows the radio frequency to pass to inductance 7. Thermionic vacuum tube 9 having grid, filament, plate and shielding plate electrodes is associated with the output circuit of oscillator 1. The shielding plate electrode is not essential to operation of the system but usually increases the efficiency of the amplifier system. A positive potential is connected to the shielding plate electrode, through resistance 11 from a source of energy 10. This provides the plate with a higher positive charge in respect to the filament than the positive charge on the shielding plate, since they are both supplied from a common source 10. A radio frequency choke coil 3 is connected in the plate supply lead and serves as a high resistance to radio frequency energy but a low resist-

ance to the plate potential from source 10. A capacity 6 is shown interposed between the plate electrode of the thermionic tube 8 and the inductance 13 for preventing short circuiting of the plate supply 10. A negative potential is supplied the grid electrode of amplifier 8 from a source 46 through inductance 7. A source of energy for the plate electrode of amplifier 8 is supplied by source 10 and may be fluctuating in value because of modulator 33 and audio frequency choke coil 35. The output energy is transferred from inductance 13 to the input circuit of amplifier 16. Amplifier 16 is supplied with a negative grid potential from a source 14a of varying amplitude. The shielding plate is supplied with a positive charge of less value than that supplied to its plate, by reason of resistance 11. The output energy from amplifier 16 and output circuit 17 is transferred to load circuit 18. The latter may be a space radio radiating system, the input of a wired radio transmission circuit or additional amplifier circuits.

The second and third complete circuit arrangements are similar to the first circuit just described. The electrical constants and frequency characteristics of circuits 1, 2 and 3, however, are not the same. Each of the three circuits are tuned to a frequency different from the other. Therefore the mechanically vibratile element 21, which may be a piezoelectric crystal, will not have the same frequency characteristics as will the elements 2 or 22. Neither will the inductances 23, 25, 29 or load circuit 19 have frequency characteristics corresponding to the inductances 7, 13, 17 and load circuit 18, respectively. Amplifier 27 of circuit 2 is supplied with a negative grid potential from source 14b of varying amplitude and 120° out of phase with the varying potential supplied to the grid circuit of amplifier 27.

For continuous wave telegraphy all three circuits could be keyed by a common key and relay system in one of the first amplifier circuits. Three-phase modulation can be applied to the output amplifier as shown in Fig. 1 or to one of the intermediate stages. Any number of phases may be employed to control any number of complete circuits. However in the drawings, only a three-phase system is shown. The three-phase modulation is applied in series with the negative grid potential to the output stage. Tone or voice modulation is shown applied to the intermediate amplifier circuits, thereby modulating the three complete circuits simultaneously.

It is understood that the modulation can be applied to different parts of the circuit other than as shown in the accompanying drawings.

The filament circuits are shown as being separately energized by individual transformers. It is obvious however that all fila-

ments could be energized by a single transformer or any convenient source of energy suitable for the type of thermionic tubes employed. Series connected capacities are shown connected across the respective filament supply leads and the mid-connection connected to ground. This connection completes the grid circuits and plate circuits of the respective oscillator and amplifier circuits. Oscillators 1, 41 and 42 and amplifiers 8, 31 and 32 are shown with parallel connected plate supply. Power amplifiers 16, 27 and 28 are shown with series connected plate supply. Capacities 36 are employed to complete the respective radio frequency circuits. Batteries are shown as supplying the necessary potential to the different circuits but it is intended that any suitable source of plate potential may be employed. It is obvious that many arrangements not described in the foregoing specification or in the accompanying drawings may be employed without departing from the spirit of my invention and it is not intended to restrict the embodiments of my invention to the foregoing specification or to the accompanying drawings but only as defined in 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. In a transmitting system the combination of a plurality of individual sources of energy each source having frequency characteristics different from the other, a plurality of load circuits, and a polyphase actuating circuit for rendering said individual sources of energy successively effective upon said load circuits.

2. In a radio transmitting system the combination of a plurality of individual sources of high frequency energy, a common modulating means, a plurality of load circuits, means for causing high frequency energy from said sources to be transferred to said load circuits, a polyphase activating circuit connected to said means for effecting the transfer of high frequency energy to said load circuits in a predetermined phase relation.

3. In a transmitting system a plurality of sources of high frequency energy each having different frequency values, means common to said sources for simultaneously modulating said sources of high frequency energy, a load circuit connected to each of said sources, and a polyphase activating circuit for rendering said sources of high frequency energy successively effective upon said load circuits in a predetermined phase relation.

4. A transmitting system including a plurality of sources of high frequency energy each having different frequency values, means common to all of said sources for modulating said high frequency energy, a plurality of

load circuits, and polyphase means for causing said modulated high frequency energy to be transferred to said plurality of load circuits successively at predetermined time intervals.

5 5. A transmitting system comprising in combination a plurality of individual oscillators, amplifiers connected thereto, individual load circuits connected with said amplifiers and polyphase means for effecting the amplification of signal energy generated by said oscillators at predetermined different intervals of time.

15 6. A transmitting system comprising in combination a plurality of individual oscillators, amplifiers connected thereto, individual load circuits connected with said amplifiers and a polyphase activating circuit connected to said amplifiers for causing said load circuits to be energized by said oscillators at predetermined different intervals of time.

25 7. A transmitting system comprising in combination a plurality of individual oscillators having different frequency characteristics, a plurality of amplifiers connected with said oscillators, a plurality of load circuits connected with said amplifiers, and a polyphase activating circuit common to said amplifiers for successively rendering said amplifiers effective to transfer energy from said oscillators to said load circuits at predetermined different intervals of time.

35 8. A transmitting system comprising in combination a plurality of individual oscillators having different frequency characteristics, an amplifier connected with each of said oscillators, a plurality of load circuits connected with said amplifiers, and a polyphase activating circuit having one phase thereof connected to each of said amplifiers for causing said load circuits to be successively energized by said amplifiers at predetermined different intervals of time.

45 9. A transmitting system comprising in combination a plurality of sources of high frequency energy of different frequency values, a corresponding number of load circuits, amplifier circuits individual to each of said load circuits, and a polyphase circuit connected to said amplifier circuits for energizing said load circuits by said high frequency energy at predetermined different intervals of time through said amplifier circuits.

55 10. A transmitting system comprising in combination a plurality of sources of high frequency energy of different frequency value, a plurality of load circuits, amplifiers each having input and output circuits interposed between said sources and said load circuits, and polyphase means connected to the input circuits of said amplifier for energizing said circuits and rendering effective said sources of high frequency energy at prede-

termined different periods upon said load circuits.

11. A transmitting system comprising a plurality of thermionic vacuum tube oscillators having different frequency characteristics, a plurality of vacuum tube amplifiers connected with said oscillators, means for modulating the high frequency energy of said oscillators by a source of voice frequency energy, and polyphase means for rendering said amplifiers alternately effective for amplifying the modulated high frequency energy during successive predetermined time intervals.

12. A transmitting system comprising in combination a plurality of high frequency generating means each having different frequency characteristics, a plurality of amplifying means associated with said generating means, means for simultaneously modulating the high frequency energy of said generating and amplifying means, a plurality of amplifying means and means for causing the amplification of said energy from said oscillators in successive order.

13. A transmitting system comprising in combination a plurality of constant frequency oscillators each having different frequency characteristics, means for amplifying the energy from said oscillators, and a polyphase activating circuit connected to said means for periodically rendering said means effective to transfer energy from said oscillators in a predetermined phase relation.

14. A transmitting system comprising in combination a plurality of constant frequency oscillators each having different frequency characteristics, amplifiers individual to each of said oscillators, a load circuit connected to each of said amplifiers and means for successively impressing a source of energy on said amplifiers whereby said oscillators are rendered effective in successive order upon said load circuits.

15. A transmitting system comprising in combination a plurality of constant frequency oscillators each having different frequency characteristics, a plurality of individual amplifiers connected with said oscillators, said amplifiers each having input and output circuits with the output circuits connected to individual radiating systems, a polyphase activating circuit connected to the input circuit of each of said amplifiers for rendering said amplifiers operative at predetermined successive time intervals for exciting said radiating systems.

16. A transmitting system comprising in combination a plurality of means for producing a plurality of sources of high frequency energy each of constant frequency and having different frequency characteristics, a plurality of means for amplifying said sources of energy, means for simultaneously modulating said amplified energy, and means

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for successively energizing each of said amplifying means whereby said sources of high frequency energy are amplified according to the phase relation of said energizing means.

17. A transmitting system comprising in combination a plurality of constant frequency oscillators each having frequency characteristics differing from the other, a plurality of amplifiers associated with said oscillators, modulating means common with each of said amplifiers and means for impressing a multiphase current on said amplifying means thereby causing amplification of signaling energy from said oscillators according to the phase of said impressed current.

18. A transmitting system comprising in combination a plurality of individual high frequency oscillators each having frequency characteristics differing from the other, a plurality of amplifiers each having input and output circuits connected with said oscillators, a load circuit connected to each of said amplifiers, means for simultaneously modulating the energy of said oscillators and polyphase means for successively activating the input circuits of said amplifiers whereby said amplifiers operate in successive order to energize said load circuits from said oscillators as determined by the phase of said impressed current.

19. A transmitting system comprising in combination a plurality of sources of constant high frequency energy each source having frequency characteristics differing one from the other, a plurality of amplifiers each associated with respective sources of said high frequency energy, means common to said amplifying means for simultaneously modulating the amplified high frequency energy from said sources, a plurality of amplifiers associated with such modulated high frequency energy, a plurality of load circuits associated with said last mentioned amplifiers and means for causing a source of potential to energize said amplifiers in successive order.

20. A plurality of high frequency transmitting systems each system having frequency characteristics differing from the other, a source of high frequency energy connected to each of said systems, means for simultaneously modulating the high frequency energy of said systems, polyphase means for rendering said plurality of sources of energy successively effective to energize said transmitting systems whereby the modulated high frequency energy from each of said transmitting systems is transmitted at predetermined successive intervals of time of predetermined duration.

LEO C. YOUNG.