No. 785,804. PATENTED MAR. 28, 1905.

C. D. EHRET.

# SYSTEM OF TRANSMITTING INTELLIGENCE.

APPLICATION FILED JULY 8, 1902.

Fig 1.

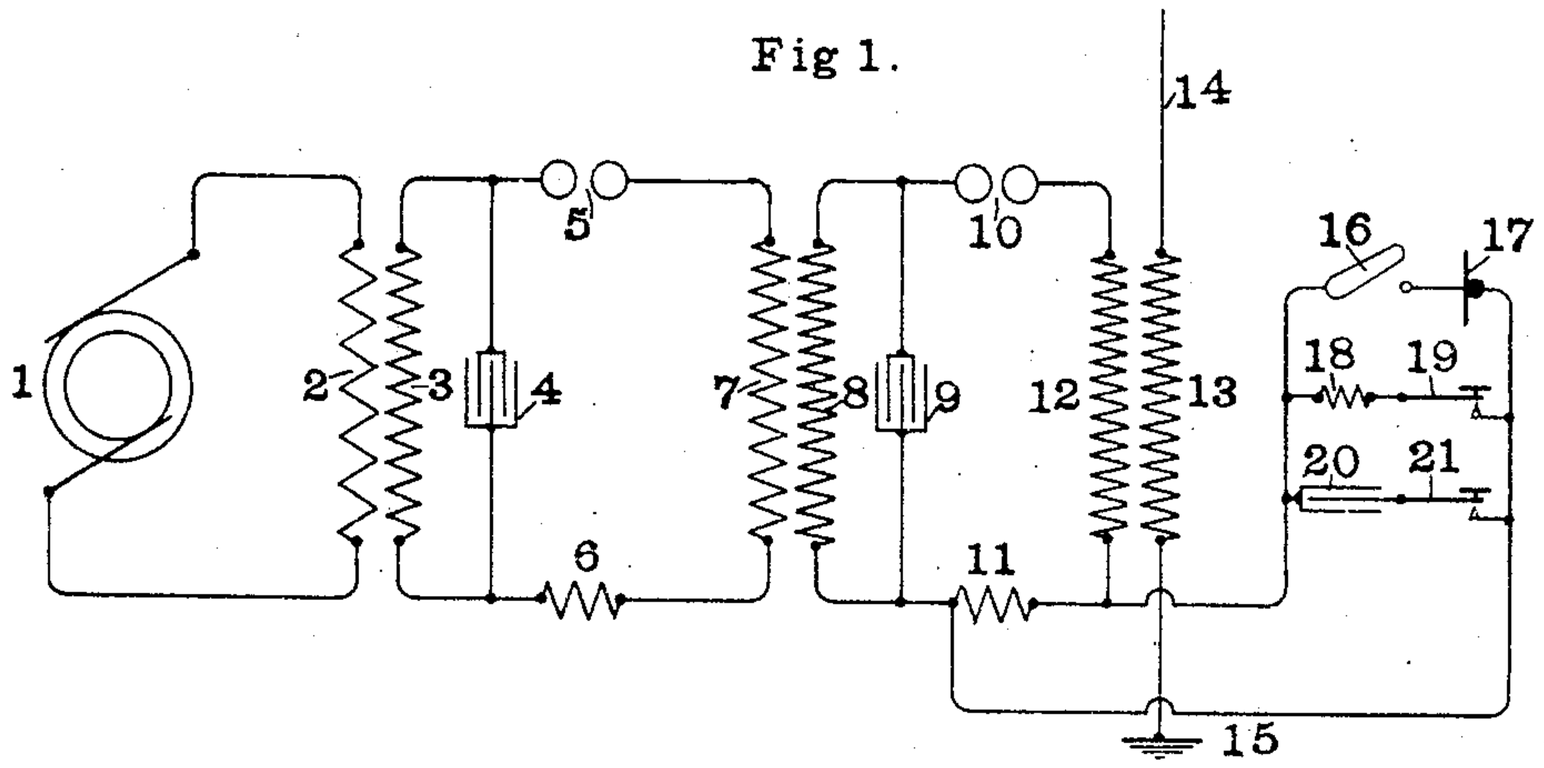



Fig 2.

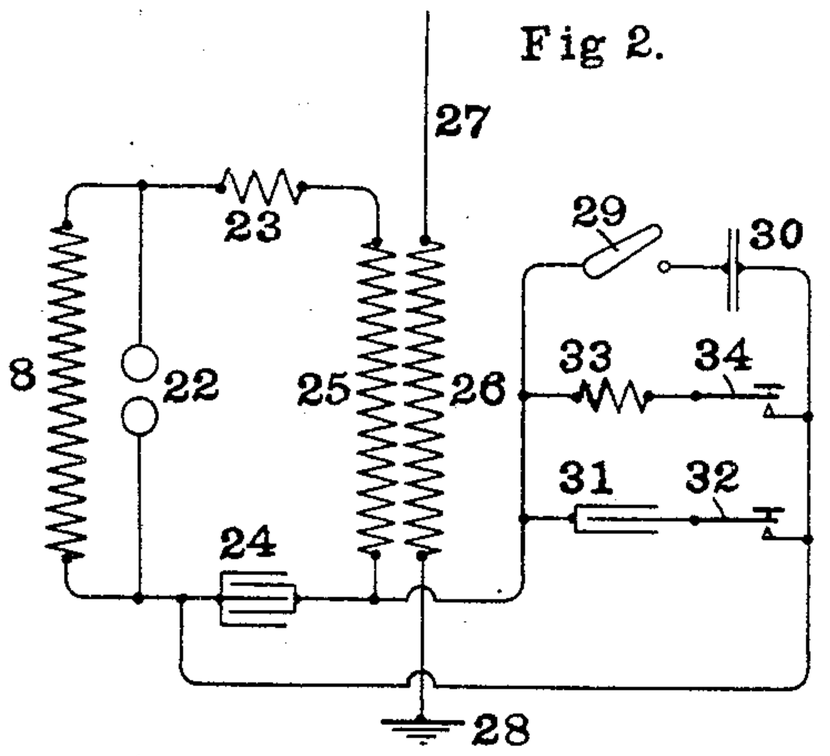



Fig 3.

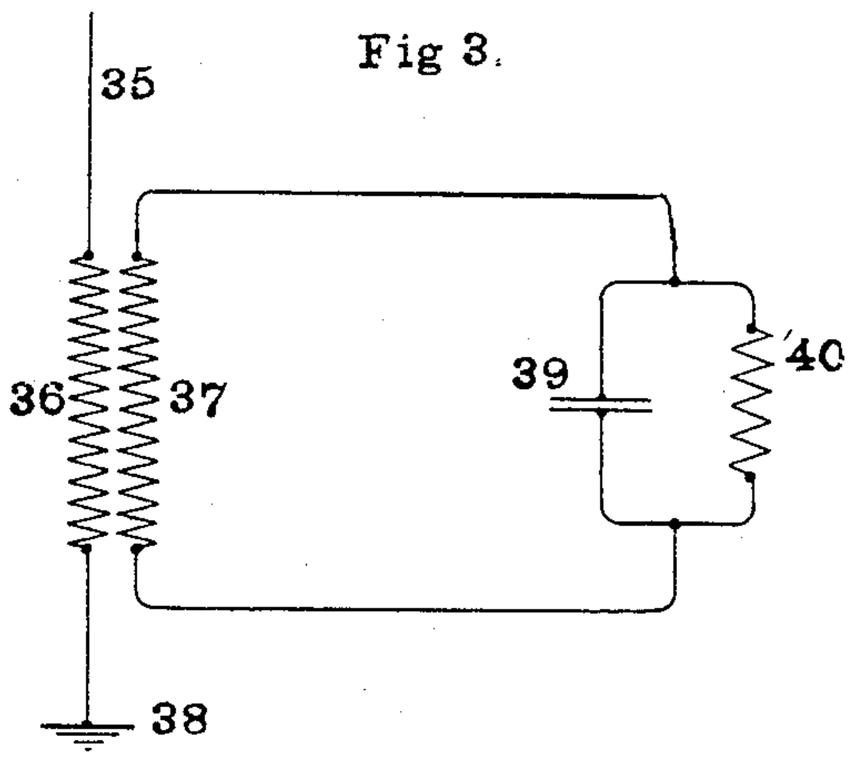



Fig 4.

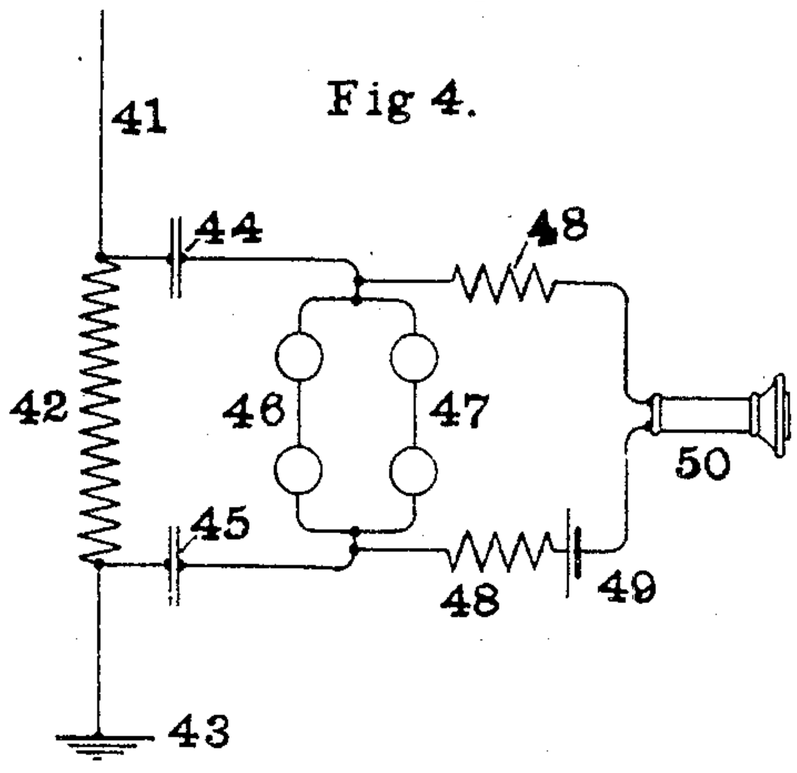
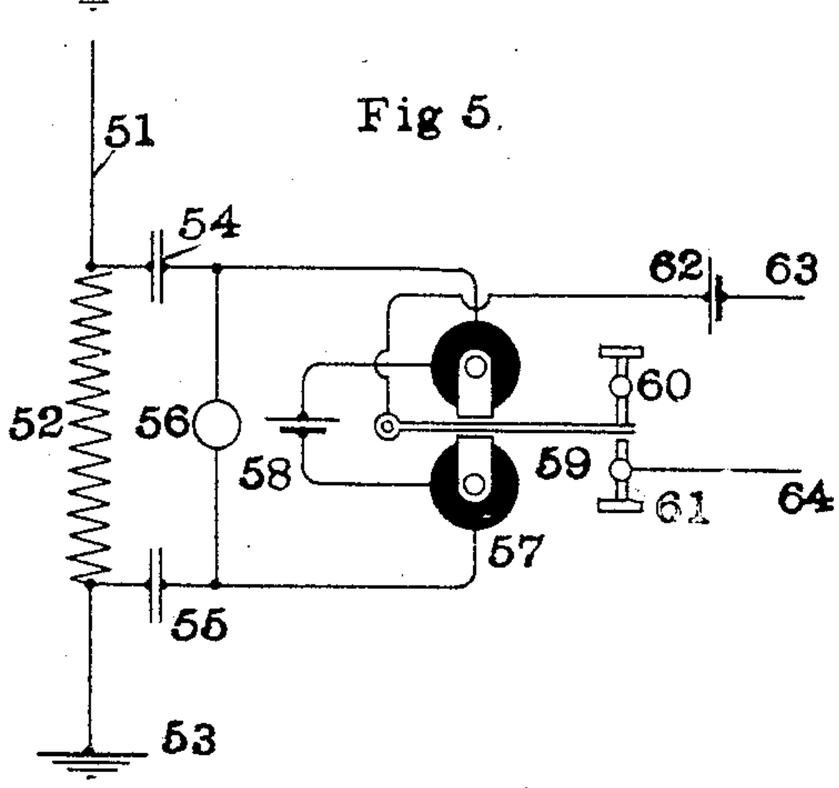



Fig 5.




Witnesses
James M. Sawyer.
Alice F. Burrough.

Inventor
Cornelius D. Ehret.

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# UNITED STATES PATENT OFFICE.

CORNELIUS D. EHRET, OF ROSEMONT, PENNSYLVANIA.

## SYSTEM OF TRANSMITTING INTELLIGENCE.

SPECIFICATION forming part of Letters Patent No. 785,804, dated March 28, 1905.

Original application filed February 10, 1902, Serial No. 93,298. Divided and this application filed July 8, 1902. Serial No. 114,753.

*To all whom it may concern:*

Be it known that I, CORNELIUS D. EHRET, a citizen of the United States, residing at Rosemont, in the county of Montgomery and State of Pennsylvania, have invented a new and useful System of Transmitting Intelligence, of which the following is a specification.

My invention comprises apparatus for transmitting intelligence through the natural media through the agency of electroradiant energy.

It comprises apparatus for generating the energy to be transmitted and modifying the properties of such energy in accordance with the signal to be transmitted.

It comprises, further, apparatus for modifying and varying the frequency of the radiant electric energy in a manner corresponding and in accordance with the signal to be transmitted.

It resides also in additional apparatus for modifying the energy to be transmitted and received by and in accordance with sound-waves, such as speech.

It comprises, further, apparatus for receiving the modified transmitted energy and causing the reproduction of speech and other signals through the agency of means responsive to changes or variations in the frequency of the received energy.

The signals to be sent by the hereinafter-described system may be either audible or visible, being either speech or simple telegraphic signals transmitted by code characters.

The energy generated, transmitted, and received in this system is of the electroradiant kind comprising electrostatic or electromagnetic energy-waves, or a combination of both, in which either the electrostatic or the electromagnetic may predominate or in which they are equal.

A charged electric circuit or conductor will, under certain conditions, oscillate electrically for a period of time, the oscillations dying out more or less rapidly, according to conditions and obeying a logarithmic law. The periodicity or frequency of such oscillations is dependent upon the electrical constants of the circuit—namely, resistance, capacity, and inductance. With the resistance less than a certain amount with relation to the inductance and capacity the circuit is oscillatory, and for best effects it is desirable that the resistance be a minimum. Changing the amount of inductance, amount of capacity, or amount of resistance, or of the amount of any combination of them, will change the natural period of oscillation of the circuit. It is upon this principle that the hereinafter-described system is based and in its essential feature comprises a system in which energy representing the message to be sent has its frequency varied or changed in accordance with such message. For the transmission through the natural media the frequency of the electrostatic and electromagnetic energies is very high, ranging from one hundred thousand periods per second to several millions. To obtain circuits which will vibrate at such high frequencies, the amounts of capacity, resistance, and inductance need be quite small, and therefore the variation of any one of these factors to even a moderate degree will greatly affect the periodicity of the circuit.

My invention comprises apparatus for varying the capacity, the resistance, or the inductance, or any combination of them, in such an oscillating circuit for procuring a substantial variation in the frequency of the transmitted energy.

Reference is to be had to the accompanying drawings, in which—

Figure 1 is a diagram representing the circuit arrangements at a transmitting-station. Fig. 2 is a modified arrangement of the circuits at a transmitting-station. Fig. 3 is a diagrammatic view of a receiving-circuit responsive to changes in frequency of the transmitted energy and adapted to reproduce a signal due to such variation. Fig. 4 is a diagrammatic view of a modified form of a receiving-circuit also responsive to variations in the frequency of the received energy and adapted to produce audible signals. Fig. 5 is a diagrammatic view of a further modification in the receiving-circuit responsive to variation in the frequency of the received energy and adapted to record signals telegraphically.

At 1 is shown a source of alternating current—such as an alternating generator, transformer, or equivalent—furnishing current at

commercial frequency and voltage—for example, one hundred and thirty-three periods per second at one hundred and ten volts. In the preferred arrangement, however, the periodicity of the current supplied by the source 1 is much higher than employed on commercial circuits in order that the trains of electromagnetic energy-waves emitted from a radiating-conductor 14 shall succeed each other at a rate which is high with respect to the more essential frequencies of the sound-waves found in human speech. For example, for telephony by the hereinafter-described system it is preferred that the frequency of the current delivered from the source 1 shall be about fifteen hundred cycles per second, though the frequency may with advantage be made much higher, and the higher the better. For telegraphy, however, the lower frequency previously mentioned is satisfactory. The energy derived from such source 1 is passed through the primary 2 of a transformer whose secondary 3 delivers current at a higher voltage to the terminals of condenser 4. When such condenser is charged to a sufficiently high potential, it discharges across the spark-gap 5 through the inductance 6 and primary 7 of a second transformer. The condenser, air-gap, transformer-primary, and inductance form a circuit which oscillates at its own frequency, and the resistance, capacity, and inductance of such circuit is so chosen that the frequency will be very high as compared with the frequency of the source 1. Such frequency may be in the neighborhood of ten thousand per second. The secondary 8 delivers then a high frequency and still higher potential current to condenser 9, which stands in the same relation to spark-gap 10, inductance 11, and primary 12 that condenser 4 bears to the oscillating-circuit just described. The capacity, resistance, and inductance of the circuit 9 10 12 11 is so chosen as to procure a natural vibration of such circuit still higher than that in the previous circuit and may be taken in the neighborhood of two hundred and fifty thousand or five hundred thousand per second, or higher, if desired. As previously stated, the variation of the effect of any of the frequency-determining factors will change the frequency of the radiated energy which is developed, as shown in this figure, in the aerial radiating-conductor 14, supplied from secondary 13, whose lower terminal connects to earth-plate 15.

The inductance 11 is shown as shunted by a telephone-transmitter 17, which may be brought into circuit by the closure of switch 16. Any variation of the resistance or other electrical property of such telephone-transmitter varies the effect of the inductance 11 in the circuit 9 10 12 11 and correspondingly changes the frequency of the energy impressed by the secondary 13 upon the radiating-circuit. The variation of frequency will follow closely and obey all slight variations occurring in the electrical properties of the combination of the inductance 11 and the telephone-transmitter 17.

At 18 is shown an inductance controlled by key 19, in parallel also to inductance 11. Upon the closure of key 19 the total inductance of the circuit 9 10 12 11 is changed, resulting in the change of the frequency of the radiated energy, as above described. Furthermore, 11 and 18 may represent resistances simply, the circuit 9 10 12 11 depending upon the property of primary 12 for its inductance.

At 20 is shown a condenser controlled by key 21 in shunt to the device 11, which, as previously stated, may be either an inductance or a resistance; but, as stated above, it is preferable to keep the resistance of the oscillating-circuit as low as possible. The closure of the key 21 throws condenser 20 in parallel with inductance or resistance 11, and thereby changes the combined effect of all the factors in the oscillating-circuit, which results in a change of the frequency of the radiated energy. It is to be noted also in connection with this figure that condenser 4 and spark-gap 5 may be interchanged in their positions, as also condenser 9 and spark-gap 10.

In Fig. 2 the circuit of the source 1 and of the secondary 3 has been omitted and simply the secondary-coil 8 is shown as furnishing high-frequency high-potential current to the oscillating-circuit 22 23 25 24, in which 22 is a spark-gap, 23 an inductance, 24 a condenser, and 25 a primary of a transformer whose secondary 26 furnishes the high-frequency high-potential charge to the aerial radiating-conductor 27, whose lower terminal connects to earth-plate 28.

At 29 is shown a switch which when closed throws the condenser telephone-transmitter 30 in shunt with the condenser 24. By speaking into the transmitter 30 the capacity of the condenser 30 is changed or varied in virtue of the relative motion of the plates of the condenser, and there results a consequent change in the total capacity of the oscillating-circuit 22 23 25 24, producing a variation in the frequency of the transmitted energy corresponding closely to the modulations of the voice speaking into transmitter 30. In other words, the frequency of the transmitted energy is changed or varied by and in accordance with sound-waves uttered by the speaker. At 31 is shown a condenser which upon the closure of the key 32 is likewise thrown into parallel with condenser 24 and has a like effect as condenser-transmitter 30, except that upon closure of key 32 a perfectly-definite and single change in the frequency of the transmitted energy is obtained. At 33 is shown an inductance or resistance which upon closure of key 34 is likewise thrown into parallel relation with the condenser 24. This results also in a change of the constants of the oscillation-

circuit 22 23 25 24, with a corresponding change in the frequency of the transmitted energy. Operating any one of the keys 19, 21, 32, and 34 according to any telegraph-code will therefore modify the frequency of the transmitted energy in like manner, and speaking into transmitters 17 or 30 varies the frequency of the transmitted energy by and in accordance with the sound-waves uttered by the speaker.

At Fig. 3 is shown a receiving-circuit in which 35 is the aerial receiving-conductor, connected, through primary 36, to ground-plate 38. The electrical constants of the conductor 35 and primary 36 may be such as to be in tune, syntony, or resonance with the normally transmitted energy—that is, the energy transmitted from the stations described when no keys are depressed and no transmitter spoken into. In the circuit of the secondary 37 are the condenser 39 and inductance 40, in parallel with each other and forming a closed resonant circuit. Normally, therefore, there exists across the terminals of 39 and 40 a maximum potential, and upon any variation from the normal frequency of the arriving energy this potential is varied from the maximum by and in accordance with such frequency change. This results in a corresponding fluctuation of the large current-flow in the local circuit embracing the condensers 39 and the inductance 40 only, or the electrical constants of 35 and 36 may be so chosen as not to be in tune, syntony, or resonance with the normally received or the normally transmitted energy nor with any frequency that may result from speaking into the transmitters 17 or 30 or depressing any of the keys 19, 21, 32, and 34. The arriving energy when representing a signal or message therefore simply causes a fluctuation of the potential at the terminals of 39 and 40, which in this case need not be adjusted as in the case above, and upon the fluctuations of such potential at the terminals of 39 and 40 there results a corresponding fluctuation in the current flowing in the local circuit embracing condenser 39 and inductance 40 only. The device 39 may be arranged as an electrostatic telephone-receiver in which the fluctuation of the charges upon its plates causes a fluctuation or change in the positions of the plates with respect to each other, and thereby reproduce speech.

In Fig. 4 is shown a receiving-conductor 41 in conjunction with the inductance 42, joined at its lower terminal to earth-plate 43. In shunt to the inductance 42 is the local circuit embracing condenser 44, wave-responsive devices 46 and 47, in series-parallel arrangement, and the condenser 45. In shunt to the wave-responsive devices is a local circuit embracing the choke-coils 48, source of energy 49, and telephone-receiver 50. Upon the arrival of energy at conductor 41, the frequency of such energy varying from instant to instant, the potential at the terminals of inductance 42 fluctuates correspondingly, and there is in consequence a fluctuating potential difference exerted at the terminals of the self-restoring detector or similar devices 46 and 47. This results in a fluctuation of the current in the local circuit including the devices 46 and 47 and source of energy 49 and telephone-receiver 50, reproducing in consequence sound-waves or speech at the receiver 50. The condensers 44 and 45 are of very small capacity and are so chosen as to have but slight or no effect upon the constants of the circuit 41 42 43. The object of these condensers is to prevent a flow of current from battery 49 through inductance 42 and telephone-receiver 50. These condensers, however, do not exclude the variations in potential existing across the terminals of inductance 42. The devices 46 and 47 may be the electrolytic wave-responsive devices or those in which metallic trees are formed and broken down or the carbon or the combined carbon and metal wave-responsive devices. These wave-responsive devices have the property of restoring themselves to their normal condition immediately upon the cessation of the energy causing a change in their condition or resistance, requiring no tapping, as in the case of the ordinary coherers. This property of self-restoration renders these devices capable of responding to the energy varying as hereinbefore described, so that, in effect, their condition or resistance varies in a manner according to the fluctuations found in speech. Those enumerated and many more, known as "self-restoring wave-responsive" devices, have in general the property of varying their resistance in proportion to the energy or potential impressed upon their terminals, provided, however, they be properly chosen in their dimensions and arrangement with respect to the energy which fluctuates in amount or pressure. It is for this reason several in series and in parallel groups are chosen, so that the impressed potential will not operate, as might be the case, to cause a sudden and great change in resistance which would not be proportional to the potential impressed upon the terminals. Upon the arrival of energy at the station shown in Fig. 4, such energy fluctuating in frequency according to sound-waves uttered against the transmitters 17 or 30, there is a fluctuation of potential at the devices 46 and 47, which results in a corresponding fluctuation of current in the circuit of the telephone-receiver 50, which in turn results in the reproduction of the speech uttered against the transmitters 17 or 30.

In Fig. 5 is shown an arrangement of circuits corresponding to Fig. 4, except that a single wave-responsive device 56 is shown, which may be either of the coherer or anti-coherer type and which controls a local circuit embracing the relay 57 and battery 58, such battery being connected between the

coils of the relay, which then operate as the usual choke-coils. The tongue 59 rests normally against back-stop 60 and upon energization of the relay contacts with post 61, thereby permitting a flow of current from battery 62, whose local circuit is shown at 63 and 64. The device 56, if a coherer, is tapped in the usual way by a device controlled by the relay. In circuit 63 and 64 is included the usual telegraph recording mechanism.

From the foregoing description it is apparent that I have disclosed circuit arrangements for transmitting speech electrically without the employment of conductors joining the transmitting and receiving stations; that speech is transmitted by these arrangements by the agency of electroradiant energy, such as Hertzian waves, as employed heretofore for telegraphy only; that the transmission of speech by these arrangements results from the control of the frequency of the transmitted electroradiant energy by and in accordance with the speech-waves uttered at the transmitter; that the result does not depend upon increasing or diminishing the amount of energy transmitted with the frequency of such energy remaining constant, and that my system depends for its operation upon the variation by and in accordance with speech-waves of the frequency of the transmitted electroradiant energy-waves, which is the only characteristic of electroradiant energy which may be varied, inasmuch as mere quantity or magnitude of energy is not a property or characteristic.

While I have shown a specific embodiment of my invention, I do not wish to be limited to the precise arrangement of circuits or apparatus used, inasmuch as many equivalents are found in the art to which my invention appertains, and it is within the scope of my invention to make such changes as are readily made by one skilled in such art, who can easily adopt the system herein shown and described to systems previously known, in which several aerial conductors are used or where the transmitting-circuit connects to several ground-plates, &c.

This application is a division of my prior application filed February 10, 1902, and bearing Serial No. 93,298.

What I claim is—

1. The combination of a generator of electroradiant energy, means for varying the frequency of said energy in accordance with the signal to be sent, and a receiver responsive to changes in the frequency of the transmitted energy.

2. The combination of a generator of electroradiant energy, means for modifying the frequency of said energy by and in accordance with sound-waves, and a receiver responsive to variations in the frequency of the transmitted energy.

3. The combination of a generator of electroradiant energy, means for varying the frequency of said energy by and in accordance with sound-waves, and a receiver responsive to variations in the frequency of the transmitted energy to reproduce sound-waves.

4. The combination of a source of fluctuating electric currents, means for increasing the potential and frequency of said currents, means for varying the frequency of the transformed energy in accordance with the signal to be sent, and a receiver responsive to variations in the frequency of the transmitted energy.

5. In a signaling system, the combination of a generator, means for varying the frequency of energy derived from said generator in accordance with a signal to be sent, and a receiver responsive to changes in the frequency of the received energy.

6. In a signaling system, a source of electric energy, means for impressing said energy upon a circuit, means for varying the natural period of said circuit in accordance with a signal to be sent, and means at the receiver responsive to the resulting variations in the frequency of the transmitted energy to reproduce a signal.

7. In a signaling system, a circuit, means for supplying energy thereto, means for varying the natural period of said circuit in accordance with a signal to be sent, and means at the receiver responsive to the resulting changes in the frequency of the received energy for reproducing a signal.

8. In a signaling system, a radiating-circuit, means for supplying energy thereto, means for changing the frequency of the energy radiated from said circuit in accordance with a signal to be sent, and means at the receiver, responsive to changes in the frequency of the transmitted energy for reproducing a signal.

9. In a signaling system, a radiating-circuit, an oscillating circuit in inductive relation therewith, means for supplying energy to said oscillating circuit, means for changing the natural period of said oscillating circuit in accordance with a signal to be sent, and means at the receiver responsive to the resulting changes in the frequency of the transmitted energy for reproducing a signal.

10. In a signaling system, means for generating electroradiant energy, means for changing the frequency of said energy in accordance with a signal to be sent, means at the receiver subjected to the changing effects of the received energy, and a signal-producing means controlled thereby.

11. In a signaling system, means for generating electroradiant energy, means for varying the frequency of said electroradiant energy in accordance with a signal, a receiving-circuit including an inductance, and a wave-responsive device subjected to the varying potential differences obtaining at the terminals of said inductance.

12. In a signaling system, a circuit, means

for supplying energy thereto, a capacity included in said circuit as a frequency-determining element thereof, means for varying the magnitude of said capacity in accordance with a signal to be sent, and means at the receiver responsive to the resulting changes in the frequency of the received energy for reproducing a signal.

13. In a signaling system, a circuit, means for supplying energy thereto, a capacity in said circuit, a variable capacity in parallel with said capacity, and means at the receiver responsive to changes in the frequency of the received energy for reproducing a signal.

14. In a signaling system, an oscillating circuit, means for supplying energy thereto, means for varying the effect of a frequency-determining element of said circuit in accordance with a signal to be sent, and means at the receiver responsive to the resulting changes in the frequency of the received energy for reproducing a signal.

15. In a telephone system, means for generating electroradiant energy, means for varying the frequency of said energy by and in accordance with speech, and means at the receiver responsive to variations in the frequency of the transmitted energy to reproduce speech.

16. In a telephone system, means for generating electroradiant energy of normally practically uniform frequency, means for varying the frequency of said energy by and in accordance with speech, and means at the receiver responsive to variations in the frequency of the transmitted energy to reproduce speech.

17. In a telephone system, a circuit, means for supplying energy thereto, means for varying the natural period of said circuit by and in accordance with speech, and means at the receiver responsive to the resulting changes in the frequency of the received energy for reproducing speech.

18. In a telephone system, an oscillating circuit, means for supplying energy thereto, a telephone-transmitter as means for varying the natural period of said circuit, and means at the receiver responsive to the resulting changes in the frequency of the received energy for reproducing speech.

19. In a telephone system, an oscillating circuit, means for supplying energy thereto, a capacity in said circuit, and means for varying the capacity of said circuit by and in accordance with speech, and means at the receiver responsive to the resulting changes in the frequency of the received energy for reproducing a signal.

20. In a telephone system, a radiating-conductor, an oscillating circuit in inductive relation therewith, means for supplying energy to said oscillating circuit, means for varying the natural period of said circuit by and in accordance with speech, and means at the receiver responsive to variations in the frequency of the transmitted energy to reproduce speech.

21. In a telephone system, a transmitting-station comprising means for generating electroradiant energy and means for modifying the frequency of said energy in accordance with speech, and a receiving-station, the latter comprising a receiving-conductor, and means responsive to variations in the frequency of the received electroradiant energy for reproducing speech.

22. In a telephone system, a transmitter of electroradiant energy, means for modifying the frequency of said energy in accordance with speech, a receiving-conductor, an inductance associated therewith, and means responsive to the varying potentials at the terminals of said inductance for reproducing speech.

23. In a signaling system, means for generating electroradiant energy, means for modifying the frequency of said energy in accordance with a signal, a receiving apparatus comprising a receiving-conductor, and means responsive to variations in the frequency of the received energy for reproducing a signal.

24. In a telephone system, means for generating electroradiant energy of practically uniform frequency, means for varying the frequency of said energy by and in accordance with speech, a receiving-conductor, a self-restoring wave-responsive device subjected to the effects of the varying frequency of the received energy and a telephone-receiver controlled by said wave-responsive device.

25. In a telephone system, means for generating electroradiant energy, means for modifying the frequency of said energy by and in accordance with speech, a receiver comprising a conductor, an inductance associated therewith, a self-restoring wave-responsive device subjected to the effects of varying potential differences at the terminals of said inductance, and a local telephone-circuit controlled by said wave-responsive device.

26. In a telephone system, means for generating electroradiant energy, means for modifying the frequency of said energy by and in accordance with speech, a receiver comprising a conductor, an inductance associated therewith, a plurality of self-restoring wave-responsive devices arranged in parallel series and connected across the terminals of said inductance, and a local telephone-circuit controlled by said wave-responsive devices.

27. In a telephone system, means for generating electroradiant energy, means for modifying the frequency of said energy by and in accordance with speech, a receiver comprising a plurality of wave-responsive devices arranged in series and in parallel, means for applying to the terminals of said wave-responsive devices the varying potentials due to

the varying frequency of the received electroradiant energy, and a local telephone-circuit including said wave-responsive devices.

28. In a telephone system, means for generating electroradiant energy, means for varying the frequency of said energy by and in accordance with speech, and means at the receiver responsive to variations in the frequency of the received energy for reproducing speech comprising a self-restoring wave-responsive device, and a telephone-circuit controlled by said wave-responsive device.

29. In a wireless signaling system, means for generating electrical energy, means for impressing said energy upon an oscillating circuit, means for varying the effect of a frequency-determining element of such circuit in accordance with a signal to be sent, means for impressing the energy upon the natural media, and means at the receiver responsive to variations in frequency for reproducing a signal.

30. In a wireless signaling system, means for generating electroradiant energy, means for modifying the frequency of said energy in accordance with a signal, a receiver responsive to variations in the frequency of the received energy, comprising an inductance, and a wave-responsive device subjected to the varying potentials existing at the terminals of said inductance.

31. In a wireless signaling system, means for generating electroradiant energy, means for modifying the frequency of said energy in accordance with a signal, a receiver responsive to variations in the frequency of the received energy, comprising an inductance, and a plurality of wave-responsive devices in series-parallel grouping, subjected to the varying potentials existing at the terminals of said inductance.

32. In wireless telephony, means for generating electroradiant energy, means for modifying the frequency of said energy in accordance with speech, a receiver responsive to variations in frequency of the received energy, comprising a receiving-conductor, a self-restoring wave-responsive device associated therewith and subjected to the effects of the varying frequency of the received energy, and a telephone-receiver included in a circuit controlled by said wave-responsive device.

33. In wireless telephony, means for generating electroradiant energy, means for modifying the frequency of said energy in accordance with speech, a receiver responsive to the varying effects of the received energy comprising a self-restoring wave-responsive device, a circuit controlled thereby, and a telephone-receiver included in said circuit.

34. In a signaling system, means for generating electroradiant energy, and means for varying the frequency of said energy in accordance with a signal to be sent.

35. In a signaling system, means for generating electroradiant energy, and means for varying the frequency of said energy by and in accordance with speech.

36. In a signaling system, means for generating trains of electroradiant energy-waves, the rate of succession of said wave-trains being high as compared with the frequency found in speech, and means for varying the frequency of said waves by and in accordance with speech.

37. In a signaling system, transmitting apparatus comprising an oscillating circuit for impressing electroradiant energy upon the natural media, and a telephone-transmitter for varying the effect of a frequency-determining element of said oscillating circuit, whereby the frequency of the electroradiant energy varies in accordance with speech.

38. In a signaling system, a source of primary electrical energy, means for converting said energy into electroradiant energy, and means for varying the frequency of said electroradiant energy in accordance with the signal to be sent, said frequency variation being effected without interrupting or breaking the continuity of said primary energy.

39. In a signaling system, a radiating-conductor, an oscillating circuit associated therewith, means for supplying energy to said oscillating circuit, and means for changing the frequency of the radiated energy in accordance with a signal to be sent.

40. In a signaling system, a radiating-conductor, an oscillating circuit inductively connected therewith, means for supplying energy to said oscillating circuit, and means for changing the frequency of the radiated energy in accordance with a signal to be sent.

41. In a telephone system, a radiating-conductor, an oscillating circuit associated therewith, means for supplying energy to said oscillating circuit, and means for varying the frequency of the radiated energy by and in accordance with speech.

42. In a telephone system, a radiating-conductor, an oscillating circuit associated therewith, means for supplying energy to said oscillating circuit, and a telephone-transmitter for controlling the frequency of the radiated energy by and in accordance with speech.

43. In a telephone system, a radiating-conductor, an oscillating circuit associated therewith, and means for supplying electrical energy to said oscillating circuit, all in combination with a telephone-transmitter which controls the frequency of the electrical energy existing in said oscillating circuit.

44. In a telephone system, a radiating-conductor, an oscillating circuit inductively connected therewith, means for supplying electrical energy to said oscillating circuit, all in combination with a telephone-transmitter for controlling the frequency of the electrical energy existing in said oscillating circuit.

45. In a telephone system, a radiating-con-

ductor, an oscillating circuit associated therewith, means for supplying electrical energy to said oscillating circuit, a telephone-transmitter for controlling the frequency of the radiated energy, a receiving-conductor, a self-restoring wave-responsive device associated therewith, and a telephone-receiver included in a circuit with said wave-responsive device.

46. In a telephone system, a radiating-conductor, an oscillating circuit in inductive relation therewith, means for supplying electrical energy to said oscillating circuit, a telephone-transmitter for controlling the frequency of the radiated energy, a receiving-conductor, a self-restoring wave-responsive device associated therewith, and a telephone-receiver included in a circuit with said wave-responsive device.

CORNELIUS D. EHRET.

Witnesses:

ALICE T. BURROUGH,

MAE HOFMANN.