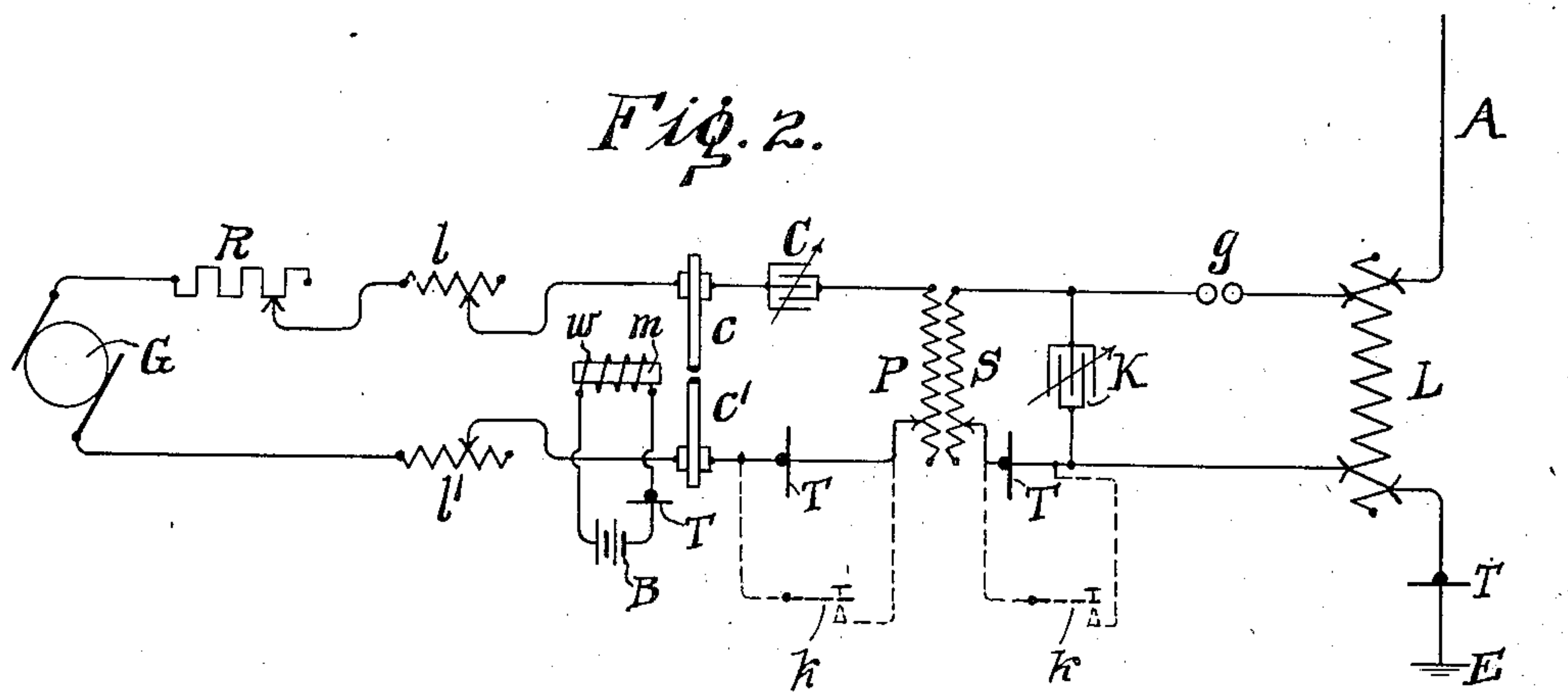
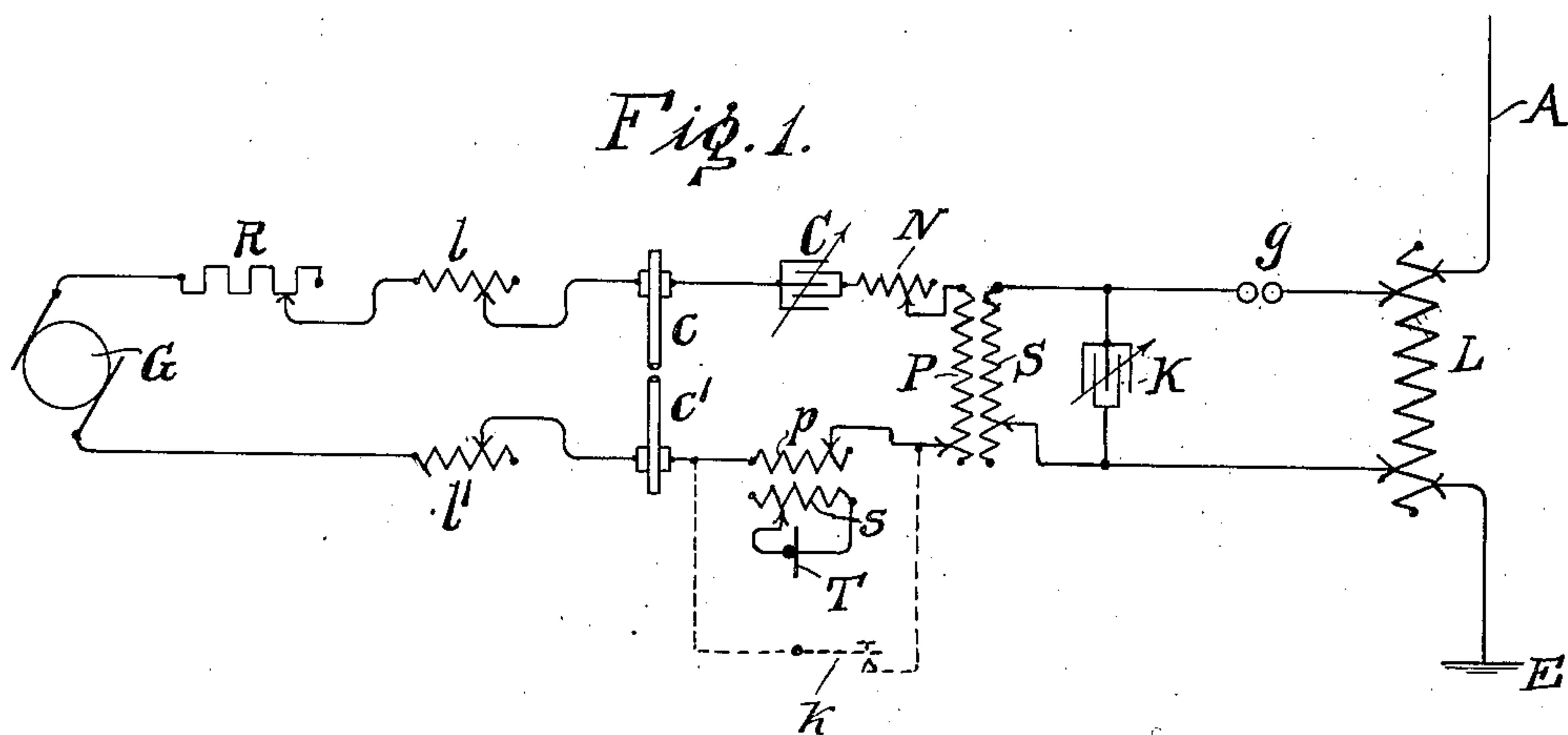


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 TELEPHONE AND TELEGRAPH TRANSMITTING APPARATUS.
 APPLICATION FILED JULY 25, 1908.

932,821.

Patented Aug. 31, 1909.



Witnesses

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UNITED STATES PATENT OFFICE.

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932,821.

Specification of Letters Patent.

Patented Aug. 31, 1909.

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To all whom it may concern:

Be it known that I, HARRY SHOEMAKER, a citizen of the United States, residing in Jersey City, county of Hudson, State of New Jersey, have invented certain new and useful Improvements in Telephone and Telegraph Transmitting Apparatus, of which the following is a specification.

My invention relates to transmitting apparatus for telephone, telegraph or other signaling systems, and particularly those wherein the message or signal is transmitted through the natural media in electro-radiant form, as by electro-magnetic waves.

It is the object of my invention to provide transmitting apparatus in which a high wave train frequency, higher than the limit of audition in the case of a telephone system, may be secured, an oscillation circuit of high natural frequency being provided to produce high frequency energy to be radiated, and it is the object of my invention, in such a system, to secure the radiation of large amounts of energy which may be easily and simply controlled either by the voice, telegraphic key, or other instrumentality.

More particularly it is the object of my invention to supply an oscillation circuit with energy fluctuating or alternating at high rate, though at a rate lower than the natural frequency of the oscillation circuit, the alternating or fluctuating energy being derived from a circuit containing inductance and capacity in shunt to an arc.

My invention resides also in other features hereinafter pointed out and claimed.

For an illustration of some of the forms my invention may take, reference is to be had to the accompanying drawing, in which:

Figure 1 is a diagram of transmitting apparatus for use in transmitting speech. Fig. 2 is a diagram of telephonic transmitting apparatus, the telephone transmitter being shown in various positions with relation to the circuits.

Referring to Fig. 1, G is a source of electrical energy, either alternating or direct current (though preferably direct current) of any suitable voltage, preferably low voltage. The current is supplied from the generator G through the adjustable non-inductive resistance R and through the two adjustable inductances l and l' to the electrodes c and c' , between which an arc is

maintained. The inductances l and l' may serve to prevent oscillations running back beyond the arc toward or to the generator G, and they, or either of them, may also serve as a source of self-induction to give electro-magnetic inertia to the circuit containing generator G and the arc. The arc electrodes c and c' may be of carbon or metal, or any other suitable material, or one electrode may be of one material while the other electrode is of another material. And furthermore, the arc may be maintained in any suitable atmosphere as of hydrogen, steam, or hydro-carbons, etc., or may be maintained in air. In shunt to the arc, between the electrodes c , c' , is connected a circuit containing the variable condenser C, the primary P of a transformer, and the primary p of a small transformer. The primary P may serve as the principal inductance source of this circuit, and may be variable in number of turns or amount, or an additional external variable inductance N may be employed. The number of turns in the primary p may also be adjusted as may also the number of turns in its secondary s , in circuit with which is connected the telephone transmitter T, which may be the ordinary carbon microphone transmitter, or of any other suitable type. The secondary S is associated with the primary P, the two constituting, preferably, a step-up transformer, so that the secondary delivers current at higher potential than the current flowing through the primary. The number of turns in the secondary S may be adjusted and the distance of the secondary S from the primary P may be varied so that the coupling may be either a close one, or a loose one, though a close coupling is preferred. Connected across the secondary S is an adjustable condenser K which is connected in circuit with the spark gap g (preferably a small gap in the case of a telephonic transmitter) and a variable portion of the inductance L is also connected in series between the radiating conductor A and the earth or other connection E. The amount of capacity and inductance in the circuit containing C and P is so chosen that the natural frequency of that circuit may be, for example, ten thousand oscillations per second, or a higher frequency may be employed if desired; in any event, a frequency is chosen especially for telephony, which is

higher than the limit of audition. The ohmic resistance of the circuit containing C and P should be maintained low and should preferably not exceed two ohms, more or less.

By speaking into the telephone transmitter, T, the resistance of the circuit of the small secondary s is varied by and in accordance with speech and, in consequence, the load upon the primary p varies also by and in accordance with speech, thus modifying the energy in the circuit C P accordingly. The high frequency current is transformed by the transformer P S and the condenser K is charged at a corresponding rate, and when charged, discharges across the gap g and through the inductance L producing high frequency oscillations as, for example, two hundred thousand per second or even a million per second, more or less. Accordingly, in the well known manner the energy is radiated from the conductor A and is modified by and in accordance with speech uttered at the transmitter T.

At the receiving station, which may be suitably attuned to the circuit containing K, g , L, a preferably self-restoring wave-responsive device is employed to control an ordinary magneto or other type of telephone receiver. Thus, for example, the Ferrié electrolytic detector, comprising a fine wire or conductor electrode in contact with a suitable liquid and having another electrode, may be employed along with a battery with potentiometer and telephone receiver. In the telephone receiver speech spoken into the transmitter T at the transmitting station will be reproduced. Or a primary cell detector may be employed suitably associated with an aerial receiving conductor, an ordinary magneto or other telephone receiver being affected by the primary cell detector to reproduce speech.

Obviously, the apparatus shown in Fig. 1 may also serve for telegraphic or other purposes. For telegraphy an ordinary operator's key k may be substituted in place of the primary p in the circuit C P. Or the key may be interposed in the oscillation circuit K, g , L or at any other suitable point.

Referring to Fig. 2, the generator G, resistance R, and inductances l , l' and the arc electrodes c , c' are the same as described in connection with Fig. 1. A carbon microphone or other telephone transmitter T may be inserted directly in series in the circuit containing C and P. As previously pointed out, the resistance of this circuit containing C and P should be low and should preferably not exceed two ohms, more or less. In such case, the telephone transmitter T forms a substantial part of the entire resistance of such circuit and, in response to speech or sound waves, changes the resistance of that circuit materially. Or the tele-

phone transmitter T may be inserted between the secondary S of the preferably step-up transformer and the condenser K of the oscillation circuit similar to that shown in Fig. 1. Or the telephone transmitter may be inserted in the aerial conductor as shown at T, at the base of the conductor as shown, or at any other suitable point in the conductor or in the inductance L. Or a magnet core m may be disposed with its pole near the arc and surrounded by a winding w included in circuit with a battery B and a telephone transmitter T. The core m is preferably laminated or composed of wires, and the resistance of the winding w should be relatively low so that the variations of resistance in the transmitter T will cause a substantial variation in the magnetic field produced in the core m . Thus, speaking into the telephone transmitter T causes fluctuations in the magnetic field in which the arc is placed, such fluctuations corresponding with speech or sound waves, the arc is influenced by and in accordance with speech, thus changing the energy in the circuit C P and the circuits supplied therefrom. It is preferred also that the winding w have as low self-induction as possible consistent with securing sufficiently powerful magnetic field. Thus, I have shown in Fig. 2, four telephone transmitters T, any one of which may be employed when the others are omitted. Or, in some instances, two or more of them may simultaneously be used.

Obviously, in place of any of the telephone transmitters shown in Fig 2, an ordinary telegraph key may be inserted so as to control the radiated energy to represent dots and dashes.

What I claim is:

1. In transmitting apparatus, an arc, means for supplying current thereto, a circuit including said arc, capacity and inductance, and having a natural frequency higher than the limit of audition, and means for deriving from the energy in said circuit high frequency oscillations, and a radiating conductor associated with said means.

2. In transmitting apparatus, an arc, means for supplying current thereto, a circuit including said arc, capacity and inductance, said circuit being adjusted for a natural frequency higher than the limit of audition, an oscillation circuit, a step-up transformer intervening between said circuit and said oscillation circuit, a radiating conductor associated with said oscillation circuit, and a telephone transmitter for controlling the radiations.

3. In transmitting apparatus, an arc, means for supplying current thereto, a circuit containing said arc, capacity and inductance, said circuit being adjusted for a natural frequency above the limit of audition, a high frequency oscillation circuit

deriving energy from said circuit, an associated radiating conductor, and a telephone transmitter included in said first mentioned circuit.

5 4. In transmitting apparatus, an arc, means for supplying current thereto, a circuit including said arc, capacity and inductance, an oscillation circuit deriving
10 energy from said circuit, the natural frequency of said oscillation circuit being higher than the frequency of said circuit containing the arc, and an associated radiating conductor.

15 5. In transmitting apparatus, a substantially continuously oscillating circuit having a relatively low natural period, a high frequency oscillation circuit associated with said first mentioned circuit and deriving energy therefrom, and an associated radiating conductor.
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6. In transmitting apparatus, a substantially continuously oscillating circuit having a relatively low natural period, a high frequency oscillation circuit deriving energy
25 from said first mentioned circuit, said second oscillation circuit including capacity inductance and a spark gap, and a radiating

conductor associated with said second oscillation circuit.

7. In transmitting apparatus, a substantially continuously oscillating circuit having a relatively low natural period above the limit of audition, a high frequency oscillation circuit including a spark gap associated with said first mentioned circuit and deriving energy therefrom, an associated radiator,
35 and means for controlling the radiated energy by sound waves.

8. In transmitting apparatus, a substantially constantly continuously oscillating circuit having a relatively low natural period above the limit of audition, a high frequency disruptive oscillation circuit deriving energy from said first mentioned circuit, a radiator, and means for controlling the
45 radiated energy to represent a signal or message.

In testimony whereof I have hereunto affixed my signature in the presence of the two subscribing witnesses.

HARRY SHOEMAKER.

Witnesses:

DANIEL WEBSTER, Jr.,

ANNA E. STEINBOCK.