

FIG. 1.

FIG. 1.a.

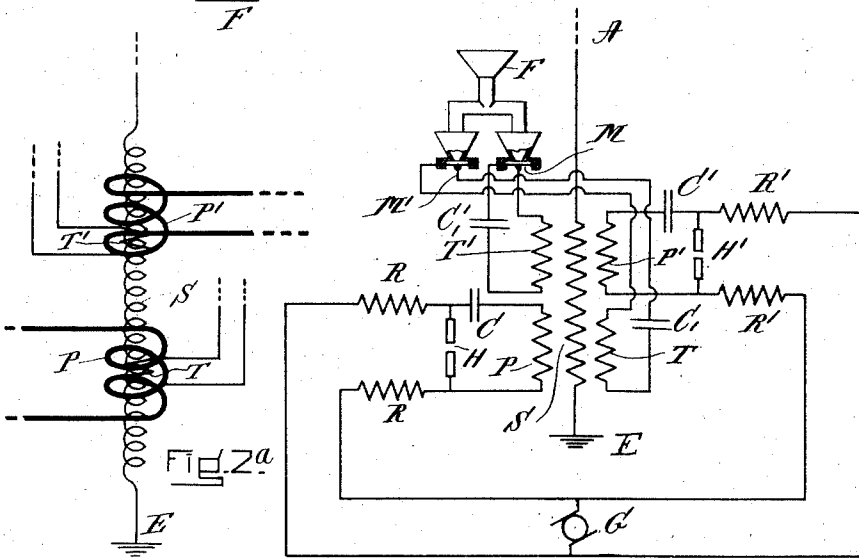


FIG. 2.

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INVENTOR:
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 by *Geo. H. Woodworth*
 Atty.

926,937.

Patented July 6, 1909.
 2 SHEETS—SHEET 2.

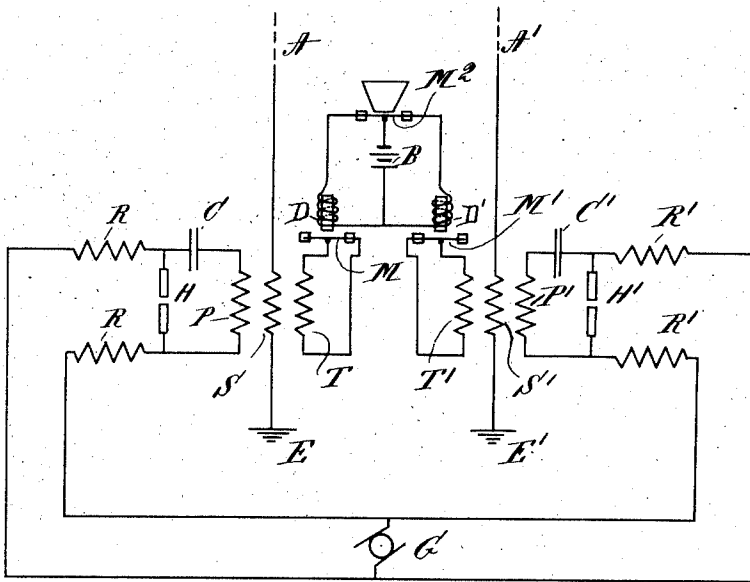


FIG. 3.

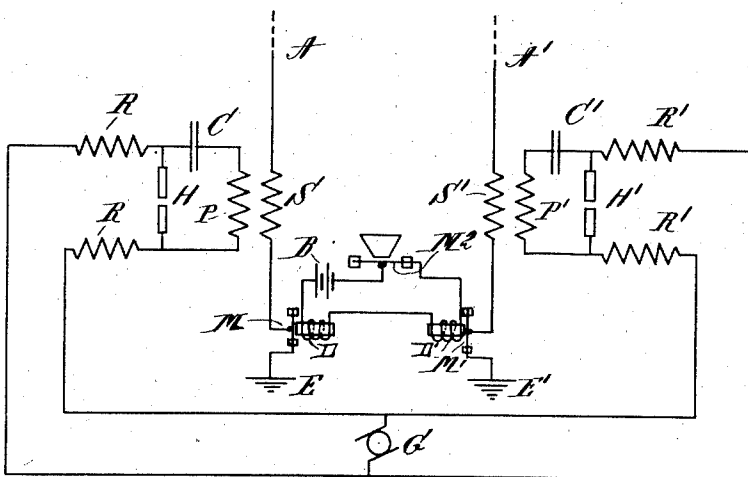


FIG. 4.

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UNITED STATES PATENT OFFICE.

LEE DE FOREST, OF NEW YORK, N. Y., ASSIGNOR TO DE FOREST RADIO TELEPHONE CO., A CORPORATION OF NEW YORK.

SPACE TELEPHONY.

No. 926,937.

Specification of Letters Patent.

Patented July 6, 1909.

Application filed June 24, 1907. Serial No. 380,653.

To all whom it may concern:

Be it known that I, LEE DE FOREST, a citizen of the United States, and a resident of New York, in the county of New York and State of New York, have invented a new and useful Improvement in Space Telephony, of which the following is a specification.

My invention relates to space telephone transmitting systems, and its objects are to increase the distance over which transmission may take place and in general to improve the efficiency of such systems.

The drawings which accompany and form a part of this specification represent in diagram several arrangements of apparatus and circuits whereby said objects may be realized; but it will be understood that I do not limit myself to the particular arrangement therein shown inasmuch as many modifications may be made in the apparatus and in the circuits without departing from the principle of my invention.

In the drawings Figures 1 and 2 represent space telephone transmitting systems employing a single antenna. Fig. 1^a shows a modification of the common controlling means shown in Fig. 1. Fig. 2^a represents a detail of construction represented conventionally in Fig. 2. Figs. 3 and 4 show modified forms of space telegraph transmitting systems in which two antennæ are employed.

In the figures G is a source of electrical energy herein shown as a direct current generator.

R R' are resistances or impedances.

C C' C₁ C₁' are condensers.

S S' are the secondary windings of oscillation transformers.

P P' are transformer primaries.

T T' are transformer tertiaries.

A A' are antennæ earthed at E E' respectively.

H H' are dischargers for the capacities C C', respectively, and in the present instance are represented as separated arc electrodes between each pair of which electric arcs may be created.

M M' M² are transmitting devices of any suitable construction and herein shown as microphones or variable resistance devices.

The circuits C H P, C' H' P' are oscillation circuits, each adapted to develop high frequency electrical oscillation having the same time period. The oscillations developed by said circuits may have a spark-frequency

higher than the more essential frequencies accompanying articulate speech, or a spark-frequency higher than the limit of audibility, or as shown, each circuit may be a continuously-oscillating circuit or a "singing-arc" circuit of any approved type. Inasmuch as there is a limit to the amount of energy that may be employed with a singing-arc circuit, about one-half kilowatt being the maximum amount of power that may be employed, I prefer to use a plurality of such circuits each associated in any suitable manner with a radiating conductor, as shown in Figs. 1 and 2, or each associated with a different one of a plurality of radiating conductors, as shown in Figs. 3 and 4. Inasmuch as there is a limit to the amount of energy that may be passed through a telephone transmitting device, I prefer to employ a plurality of such transmitting devices, one for each oscillation circuit, and to provide means common to said transmitting devices for controlling the same.

Each transmitting device may be associated with its oscillation circuit in any suitable manner.

In Figs. 1, 2 and 3, the telephone transmitting devices M M' are shown as included in the circuits of the tertiary windings T T' respectively, and in Fig. 4 they are shown as connected in the earth connectors of the antennæ A A' respectively.

In Figs. 1, 3 and 4, the common controlling means for the transmitting devices M M' consists of the master transmitter M², which may be a microphone transmitter and which by varying the resistance of the circuit of the battery B causes the electromagnets D D' to actuate the devices M M'. In Figs. 1 and 4 the coils of said electromagnets D D' are in series although, as shown in Fig. 3, they may be connected in multiple.

In Fig. 2, the controlling means for the transmitting devices consists in the megaphone arrangement F, whereby the sound-waves may be directed to both transmitters M M'. As indicated in Fig. 1^a, the controlling device F may be employed with the arrangement of circuits shown in Fig. 1, the leads a, b, c, d, of Fig. 1^a corresponding with the similarly lettered leads in Fig. 1.

The tertiary windings T T' in the circuits which, as shown in Figs. 1, 2 and 3, include the transmitting devices M M', may be associated with the primary windings P P' re-

spectively, as shown in Fig. 1, or with the secondary windings S S', as shown in Fig. 3. I prefer however to associate said tertiary windings with the secondary S or the secondaries S S' as indicated in Figs. 2 and 3 respectively.

While the separation of the primaries P P' with their secondary or secondaries may be lateral, I prefer the axial arrangement conventionally shown in Fig. 2 and illustrated in detail in Fig. 2^a. In this case the tertiaries T T' are preferably associated with the secondary S and the primaries P P' preferably surround the tertiaries T T' respectively and the common secondary S. The coefficient of coupling may be varied by relative axial movement between P and S, and P' and S.

As indicated in Figs. 1 and 2, each tertiary circuit may be attuned as by the condensers C₁ C₁' respectively, to the frequency of the oscillations developed by the oscillation-circuits C H P, C' H' P' or to any other frequency desired. In this manner the amount of energy absorbed by the tertiary circuits which include the transmitting devices can be varied and also said transmitting devices can be located at points of minimum potential and maximum current, or maximum potential and minimum current according to their construction.

I claim:

1. In a space telephone transmitting system, the combination with a plurality of oscillation circuits, of a like number of transmitting devices, each associated with a different one of said oscillation circuits, controlling means common to all of said transmitting devices for controlling the same, and means for converting the energy of said oscillation circuits into electroradiant energy.

2. In a space telephone transmitting system, the combination with a plurality of oscillation circuits, of a like number of variable resistance transmitting devices, each associated with a different one of said oscillation circuits, controlling means common to said transmitting devices and means for converting the energy of said oscillation circuits into electroradiant energy.

3. In a space telephone transmitting system, the combination with a plurality of oscillation circuits, of a like number of transmitting devices, each associated with a different one of said oscillation circuits, a controlling device common to said transmitting devices, said controlling device comprising means for directing sound waves to all of said transmitting devices, and means for converting the energy of said oscillation circuits into electroradiant energy.

4. In a space telephone transmitting system, the combination with a plurality of oscillation circuits, of a like number of transmitting devices, each inductively related to a different one of said oscillation circuits,

means common to all of said transmitting devices for controlling the same and means for converting the energy of said oscillation circuits into electroradiant energy.

5. In a space telephone transmitting system, the combination with a plurality of oscillation circuits, of a like number of tertiary circuits, each associated with a different one of said oscillation circuits, a like number of transmitting devices, each included in a different one of said tertiary circuits, controlling means common to said transmitting devices and means for converting the energy of said oscillation circuits into electroradiant energy.

6. In a space telephone transmitting system, the combination with a plurality of oscillation circuits, of a transformer having one secondary winding and a plurality of primary windings, each of said primary windings being included in a different one of said oscillation circuits, a like number of transmitting devices each associated with a different one of said oscillation circuits, controlling means common to said transmitting devices and means for converting the energy of said oscillation circuits into electroradiant energy.

7. In a space telephone transmitting system, the combination with a plurality of oscillation circuits, of a transformer having one secondary winding and a plurality of primary windings co-axially arranged therewith, each of said primary windings being included in a different one of said oscillation circuits, a like number of transmitting devices, each associated with a different one of said oscillation circuits, controlling means common to said transmitting devices and means for converting the energy of said oscillation circuits into electroradiant energy.

8. In a space telephone transmitting system, the combination with a plurality of oscillation circuits, of a transformer having one secondary winding and a plurality of primary windings, each of said primary windings being included in a different one of said oscillation circuits, a plurality of tertiary circuits, each associated with a different one of said primary windings, a like number of transmitting devices, each included in a different one of said tertiary circuits, controlling means common to said transmitting devices and means for converting the energy of said oscillation circuits into electroradiant energy.

9. In a space telephone transmitting system, the combination with a plurality of oscillation circuits, of a transformer having one secondary winding and a plurality of primary windings, each of said primary windings being included in a different one of said oscillation circuits, a plurality of tertiary windings each co-axially arranged with respect to said secondary and associated, respectively, with said primary windings, a like number of transmitting devices each associated with a

different one of said tertiary windings, controlling means common to said transmitting devices and means for converting the energy of said oscillation circuits into electroradiant energy.

10. In a space telephone transmitting system, the combination with a plurality of oscillation circuits, of a transformer having one secondary winding and a plurality of primary windings co-axially arranged therewith, each of said primary windings being included in a different one of said oscillation circuits, a plurality of tertiary windings arranged co-axially with respect to said secondary and each associated with a different one of said primary windings, a like number of transmitting devices associated respectively with said tertiary windings, controlling means common to said transmitting devices and means for converting the energy of said oscillation circuits into electroradiant energy:

11. In a space telephone transmitting sys-

tem, the combination with a plurality of oscillation circuits, of a transformer having one secondary winding and a plurality of primary windings, each of said primary windings being included in a different one of said oscillation circuits, a plurality of tertiary windings each associated with a different one of said primary windings and surrounding said secondary windings; a like manner of transmitting devices, each associated with a different one of said tertiary windings, controlling means common to said transmitting devices, and means for converting the energy of said oscillation circuits into electroradiant energy.

In testimony whereof, I have hereunto subscribed my name this 19th day of June, 1907.

LEE DE FOREST.

Witnesses:

THOMAS I. GALLAGHER,
GEO. K. WOODWORTH.