No. 802,428. PATENTED OCT. 24, 1905.

J. S. STONE.

SPACE TELEGRAPHY.

APPLICATION FILED JUNE 24, 1905.

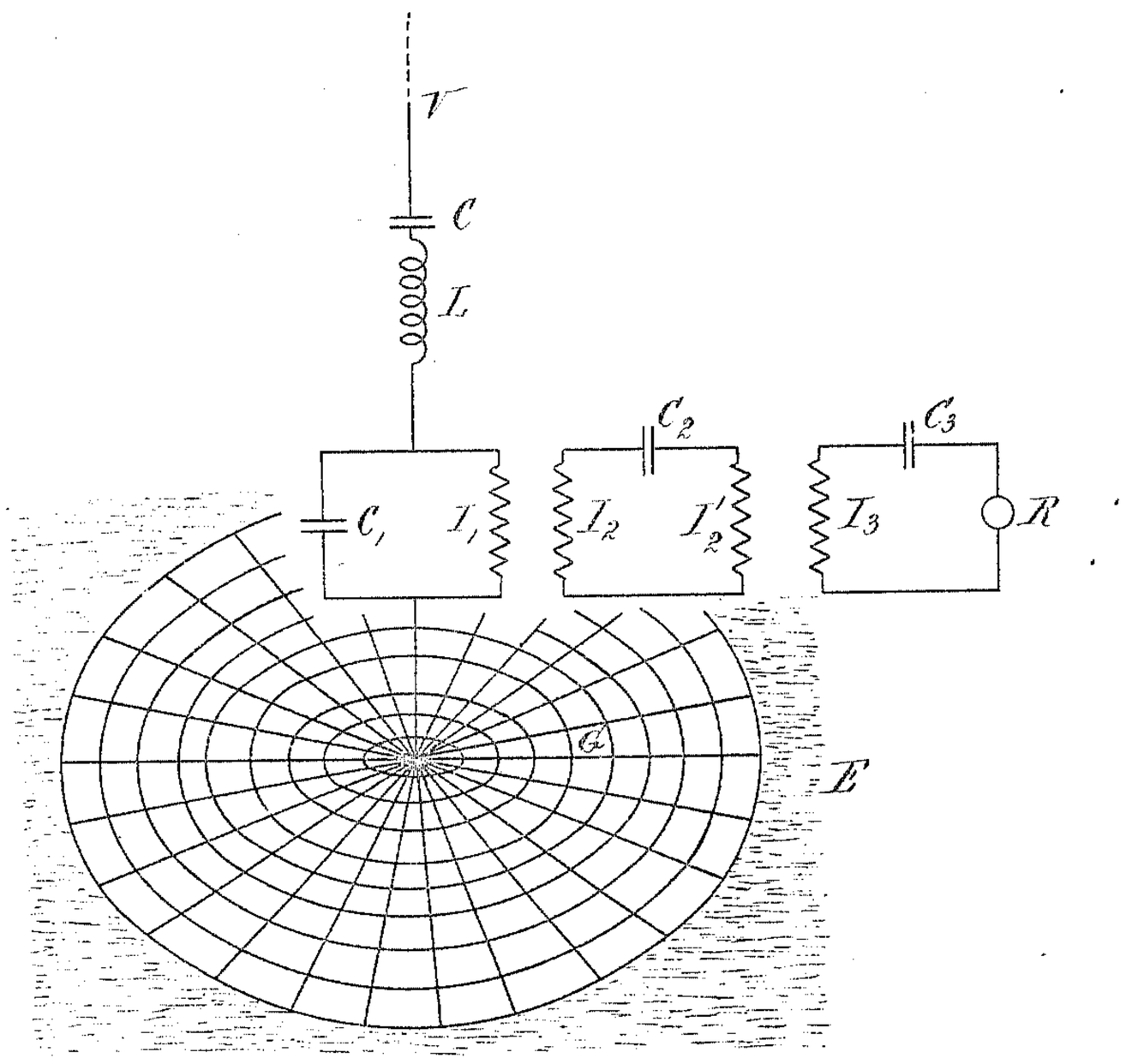

Fig. 1.

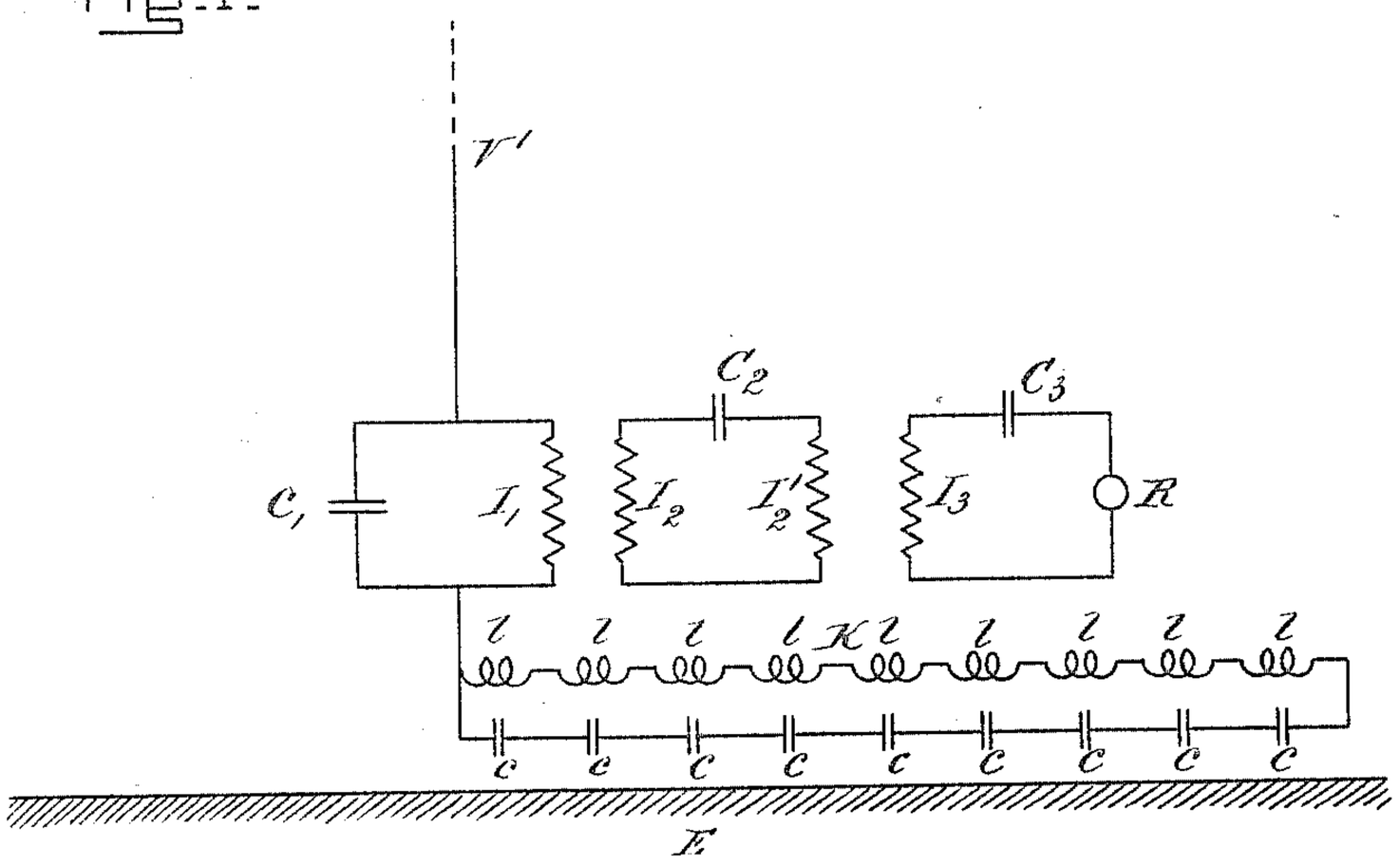

Fig. 2.

WITNESSES=
Braund T. Jenkins
Georgia L. Higgins

INVENTOR=
John Stone Stone
by Alex. P. Browne.
attorney

UNITED STATES PATENT OFFICE.

JOHN STONE STONE, OF CAMBRIDGE, MASSACHUSETTS, ASSIGNOR TO WILLIAM W. SWAN, TRUSTEE, OF BOSTON, MASSACHUSETTS.

SPACE TELEGRAPHY.

No. 802,428. Specification of Letters Patent. Patented Oct. 24, 1905.

Original application filed May 4, 1905, Serial No. 258,762. Divided and this application filed June 24 1905. Serial No. 266,857.

To all whom it may concern:

Be it known that I, JOHN STONE STONE, a citizen of the United States, and a resident of Cambridge, in the county of Middlesex and State of Massachusetts, have invented a certain new and useful Improvement in Space Telegraphy, of which the following is a specification.

This invention relates to the art of transmitting intelligence from one station to another by means of electro magnetic waves without the use of wires to guide the waves to their destination and more particularly to methods whereby the maximum reception of the energy of such waves at the receiving station may be accomplished.

In my U. S. Letters Patent Nos. 767,973 and 767,974, dated Aug. 16, 1904, I have disclosed means similar to one of those herein illustrated, and the other means herein illustrated I have disclosed broadly in a paper read by me before the Electrical Section of the Canadian Society of Civil Engineers at Montreal, Canada, March 9, 1905, and published in the Electrical Review, New York, March 25, 1905.

The object of my present invention broadly stated is to realize a method whereby the receiving or translating device of a space telegraph station may be associated with the receiving oscillator substantially at the electrical center of such oscillator considered as a whole, and may be therefore located where the current therein has its maximum amplitude.

For the purposes of this case a space telegraph receiving system considered as a whole may be regarded as consisting of an elevated conductor *per se*, or an elevated conductor, connected to the earth or to some electrical substitute therefor through the means by which the receiving device is connected therewith. In the present specification such a system considered as a whole will be spoken of as a complete oscillator, and the upper portion thereof as an elevated conductor *per se* or elevated conductor as the case may be. The distinction between the terms employed will be more clearly seen by reference to the detailed description of the drawings.

In the drawings,

Fig. 1 illustrates a means of connecting the lower extremity of an elevated conductor to the earth and thereby forming a complete oscillator.

Fig. 2 illustrates a means of connecting the lower extremity of an elevated conductor to a device having for all rates of change a resistance operator substantially equal to that of the elevated conductor, and hence the electrical substitute of the earth, whereby again a complete oscillator is formed.

In these figures,

V is an elevated conductor *per se*.

V′ and V C L are elevated conductors.

V C L C_1 I_1 G E and V′ C_1 I_1 K are complete oscillators.

C C_1 C_2 C_3 are condensers.

L is an inductance coil.

I_1 I_2 I'_2 and I_3 are coils. I_1 and I_2 are so spatially related that they form a transformer of great magnetic leakage and similarly I'_2 I_3 form a second transformer of great magnetic leakage, while otherwise there is no mutual inductance between any of the coils.

G is a superficial earth plate lying on the surface of the earth E, and shown in Fig. 1 as a wire grid or netting.

K is a device which for all rates of change presents a resistance operator substantially equal to that of the elevated conductor.

l in each case is a small inductance coil.

c in each case is a small condenser.

R is an oscillation detector.

The function of the coil L and condenser C is fully described in my application Serial No. 258,763, filed May 4, 1905, and needs no further description herein.

The functions of the several circuits C_1 I_1, C_2 I_2 I'_2 and C_3 I_3 R have been fully described in my prior Letters Patent, especially Letters Patent Nos. 714,756, 767,984 and 767,994, and therefore need not be described herein.

The reason for employing the superficial earth plate G is that the currents developed in the elevated conductor system and therefore also in the earth surrounding the earthed terminal of that system are of such high frequency that they tend to flow only upon the surface of the earth. For this reason the usual specifications for obtaining a good earth connection which involve burying a conductor of large area so deep in the ground that it shall be in permanently moist earth are not advantageous in the case of wireless or space telegraphy of the type which employs elevated conductors earthed at their lower extremities.

In a properly designed wireless telegraph station of this type, therefore, the conductiv-

ity of the surface of the earth in the immediate neighborhood of the base of the oscillator should be artificially increased by a superficial earth plate composed of sheet metal or of wire netting, extending radially from the base of the elevated conductor and covering as large an area about the said base as is available for the purpose and consistent with reasonable economy.

Instead of connecting the lower extremity of the elevated conductor to earth as illustrated in Fig. 1, I may with advantage in many instances connect it as shown in Fig. 2 to an electrical system K which has for all rates of change of the current employed a resistance operator equal to that of the elevated conductor. By either of the means above described the electrical center of the oscillator considered as a whole is definitely located. This result, so far as I am aware, has not been published prior to its publication by myself, and also, so far as I am aware, was originally observed by myself.

It will be seen that by means of the present invention, opportunity is afforded to insure definite location of the electrical center of the complete oscillator at the point where the receiving or translating device is most conveniently located, to-wit, approximately at the base of the elevated conductor, and its association therewith at such location insures its operation by the maximum current developed in the complete oscillator.

If, as in Fig. 1, a device or devices having a given resistance operator be interposed between the elevated conductor *per se* and the loop circuit C_1 I_1, then a device or devices having the same resistance operator must be similarly interposed between the loop circuit C_1 I_1 and the device K.

The device K may be constructed in a great variety of ways, as in the form shown in Fig. 2 or it may be constructed in the manner of the artificial line so completely set forth by A. Vaschy in Annales Telegraphiques, Vol. XVI, pages 517-532, Paris, 1889, and the slow speed conductor of Prof. Pupin set forth in his papers read before the American Institute of Electrical Engineers in 1899 and 1900. In this connection it is necessary to point out that there should be a large number of coils l and condensers c to a wave length in the device K for any frequency likely to be employed, in order that its reactance may for all such frequencies closely approximate the reactance of the elevated conductor, or, stated more generally, in order that its resistance operator may for all the rates of change of the currents developed in the oscillator closely approximate the resistance operator of the elevated conductor.

Furthermore it is necessary to point out that the distribution of the inductance and capacity along an elevated conductor is not in general uniform. For example, in the case of a straight, cylindrical, vertically-elevated conductor *per se* the inductance is relatively small near the earth and gradually increases toward the upper end of the wire, as a careful consideration of the writings of Mr. Oliver Heaviside will show, while the capacity is relatively large near the earth and gradu ally diminishes toward the upper end of the wire. Because of these facts it is desirable to construct the electrical system K with reference to the special type of elevated conductor to be employed, to use the adequate number of coils 1 and condensers c, and to slope the values of the inductances of the coils l and the capacities of the condensers c approximately after the manner in which they slope in the elevated conductor.

No claim is made herein to an apparatus whereby the method herein claimed may be carried into effect as such apparatus forms the subject matter of my application Serial No. 258,762, filed May 4, 1905, of which the present application is a division.

Having fully described my invention, I claim—

The method of bringing the electrical center of a complete oscillator to the point at which a receiver is to be associated therewith, which consists in balancing the resistance operator of the elevated conductor by a resistance operator equal, for all rates of change of the currents developed in the oscillator, to the resistance operator of said elevated conductor.

In testimony whereof I have hereunto subscribed my name this 16th day of June, 1905.

JOHN STONE STONE.

Witnesses:
BRAINARD T. JUDKINS,
GEORGIA A. HIGGINS.