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J. S. STONE.

SPACE TELEGRAPHY.

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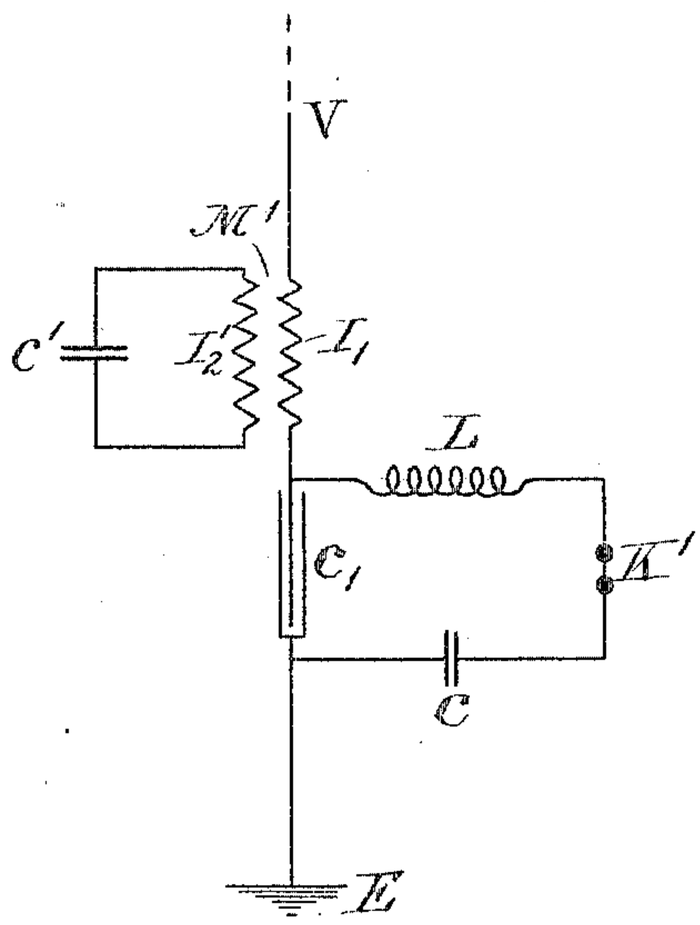

WITNESSES:
Braimard T. Jenkins
J. Adelaide Higgins

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

ANDREW. B. GRAHAM CO., PHOTO-LITHOGRAPHERS. WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

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

SPACE TELEGRAPHY.

No. 802,423. Specification of Letters Patent. Patented Oct. 24, 1905.

Original application filed February 23, 1904, Serial No. 194,649. Divided and this application filed April 29, 1905. Serial No. 258,040.

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 electromagnetic waves without the use of wires to guide the waves to their destination; and it relates more particularly to systems for receiving signals transmitted by such waves.

The object of the present invention is to so adjust the elevated conductor system of a wireless or space telegraph receiving station relative to an associated tuned or resonant receiving circuit or circuits that, first, a persistent train of electromagnetic waves of a predetermined frequency impinging upon the elevated conductor shall cause the associated circuit or circuits to respond energetically; that, second, a persistent train of electromagnetic waves of frequency other than said predetermined frequency impinging upon the elevated conductor shall cause the associated tuned or resonant circuit or circuits to respond but feebly; and that, third, abrupt or impulsive electric forces acting upon the elevated conductor shall likewise produce but feeble response in the associated tuned or resonant circuit or circuits.

The first and second objects of this invention may be attained by giving the elevated receiving conductor system a pronounced fundamental of a frequency which is the same as that to which the associated tuned or resonant receiving circuit or circuits is attuned.

The first and second objects of this invention may therefore be attained by placing a suitable inductance or capacity in the elevated conductor near its connection to earth, if it be an earthed elevated conductor, or at the center of a receiving conductor, if it be an unearthed conductor, as thereby the receiving conductor will be given a pronounced and predetermined fundamental, much as a stretched string may be given a predetermined and more pronounced fundamental by the addition of a suitable load at its center.

If, therefore, the loading inductance or capacity added be made such as to give the elevated conductor system a fundamental whose frequency is the same as that of the associated tuned or resonant receiving circuit or circuits, the first and second objects of the invention will be realized.

But this simple device is not sufficient to accomplish the third object of the present invention, and for that purpose it is necessary to give the elevated conductor natural periods of vibration whose frequencies are different from that to which the associated tuned or resonant receiving circuit or circuits is attuned, and this in turn I accomplish by giving the elevated conductor system a plurality of degrees of freedom by any one of a variety of means.

In other words, I accomplish the third object of this invention by employing an elevated conductor system having natural rates of vibration different from the frequency of the waves the energy of which is to be received, and consequently different from the frequency to which the associated tuned or resonant receiving circuit or circuits is attuned.

The invention may best be understood by having reference to the drawing which accompanies and forms a part of this specification and which illustrates diagrammatically an arrangement of apparatus and circuits whereby the present invention may conveniently be carried into effect.

The figure illustrates a space telegraph receiving system embodying the present invention.

In this figure

V is an elevated receiving conductor.

E is an earth connection.

M′ is a transformer whose primary and secondary windings are I_1 and I'_2.

C C′ C_1 are condensers.

L is an auxiliary inductance coil.

K′ is a wave detector of any suitable type, and herein illustrated as a bolometer fine wire or strip.

This application is a division of my application Serial No. 194,649 filed Feby. 23, 1904, in which I have broadly claimed the invention herein disclosed and in which I have specifically claimed those embodiments of the broad invention which are illustrated in Figs. 1, 2, 5 and 6 thereof, in which figures the resonant receiving circuit is inductively associated with the elevated receiving conductor. In an application filed simultaneously herewith I have

claimed broadly those embodiments of the invention which are illustrated in Figs. 3, 4, and 7 of the parent application, in which figures the elevated receiving conductor is conductively connected to the resonant receiving circuit across the terminals of an inductance coil or a condenser, and have claimed specifically those embodiments of the invention in which such connection is made across the terminals of an inductance coil. Therefore, in the present application I confine my claims to that particular embodiment of the broad invention which is illustrated in Fig. 4 of the parent application, or the electrical equivalents thereof, in which figure the connection of the elevated receiving conductor with the resonant receiving circuit is made across the terminals of a condenser.

In the figure of the present case, which figure is a reproduction of said Fig. 4 of the aforesaid parent application, the means whereby natural rates of vibration are given to the elevated conductor system, which natural rates are made different from that of the associated resonant receiving circuit, is the circuit C′ I'_2 inductively associated with the elevated conductor system by means of the primary winding I_1 of the transformer M′.

As more fully explained in my application Serial No. 194,649, the circuit C′ I'_2 employed for giving the elevated conductor system natural rates of vibration different from that to which the associated resonant receiving circuit is responsive will, in combination with the coil I_1 and by its reaction thereon, present a definite capacity or inductance reactance for a predetermined frequency of impressed force, and said reactance will be different for different frequencies of impressed force.

When the waves to be received are longer than those natural to the elevated conductor *per se*, the reactance of the elevated conductor *per se* is a capacity reactance and therefore for such waves the circuit C′ I'_2 may be so proportioned as to present, in combination with its associated primary winding and by its reaction thereon, an inductance reactance equivalent to that which would be given by a loading coil adapted to make the fundamental of the elevated conductor system of a frequency equal to that of the waves to be received. The reactance offered by the elevated conductor system to the electrical oscillations developed therein by a persistent train of simple harmonic waves of such frequency is therefore zero.

When the waves to be received are shorter than those natural to the elevated conductor *per se* and not less than one half the length of those natural to the elevated conductor *per se*, the reactance of the elevated conductor *per se* is an inductance reactance and therefore for such waves the circuit C′ I'_2 may be so proportioned as to present, in combination with its associated primary winding and by its reaction thereon, a capacity reactance equivalent to that which would be given by a loading condenser adapted to make the fundamental of the elevated conductor system equal to the frequency of the waves to be received. Here again the reactance offered by the elevated conductor system to the electrical oscillations developed therein by a persistent train of simple harmonic waves of such frequency is therefore zero.

I find by experience that when such proportions are given to the constants of the inductively related circuit C′ I'_2 that, in combination with its associated primary winding and by its reaction thereon, it will present for the frequency of the waves to be received and to which the resonant receiving circuit is attuned, a reactance equal and opposite to the reactance of the elevated conductor *per se*,—the elevated conductor system in responding to electrical impulses of frequencies to which said resonant receiving circuit is not attuned, or to abrupt or impulsive electrical forces, has developed in it natural oscillations of frequencies ill adapted to cause a response of the associated resonant receiving circuit, because the frequencies of said natural oscillations are different from the frequencies to which said resonant circuit is attuned.

A more complete exposition of the general principles upon which the present invention is founded has been set forth in my hereinbefore mentioned application Serial No. 194,649 and in my Letters Patent No. 767,994, dated August 16, 1904, to which reference may be had.

The circuit C_1 C K′ L is a resonant receiving circuit attuned to the frequency of the waves the energy of which is to be received. This resonant receiving circuit is preferably constructed according to the specifications of my Letters Patent No. 767,990 August 16, 1904, and is preferably conductively connected to its elevated receiving conductor in such manner that the self energy of each of the conductively connected circuits of the system is great as compared to the mutual energy of each circuit with respect to the other circuits of such system. This is accomplished by making the capacity of the condenser C small compared to the capacity of the condenser C_1.

It is obvious that the primary coil I_1 may be situated below the condenser C_1 as well as in the position shown in the drawing, and that many other changes may be made in the relative arrangement of the apparatus herein specifically described without departing from the spirit of my invention.

I claim—

1. In a space telegraph receiving system, a resonant receiving circuit attuned to the frequency of the waves the energy of which is to be received and including a condenser, an elevated receiving conductor conductively connected to the terminals of said condenser,

means whereby the mutual energy of the resonant circuit with respect to the elevated conductor is made small compared to the self energy of said resonant circuit, and a circuit, containing a condenser, inductively associated with said receiving conductor.

2. In a space telegraph receiving system, a resonant receiving circuit attuned to the frequency of the waves the energy of which is to be received and including a condenser, an elevated receiving conductor conductively connected to the terminals of said condenser, a second condenser in said resonant circuit of capacity small compared with the capacity of the first mentioned condenser, and a circuit, containing a condenser, inductively associated with said receiving conductor.

3. In a space telegraph receiving system, a resonant receiving circuit attuned to the frequency of the waves the energy of which is to be received and including a condenser, an elevated receiving conductor conductively connected to the terminals of said condenser, means whereby the mutual energy of the resonant circuit with respect to the elevated conductor is made small compared to the self energy of said resonant circuit, and a circuit, containing capacity and inductance, inductively associated with said receiving conductor.

4. In a space telegraph receiving system, a resonant receiving circuit attuned to the frequency of the waves the energy of which is to be received and including a condenser, an elevated receiving conductor conductively connected to the terminals of said condenser, a second condenser in said resonant circuit of capacity small compared with the capacity of the first mentioned condenser, and a circuit, containing capacity and inductance, inductively associated with said receiving conductor.

5. In a space telegraph receiving system, a resonant receiving circuit attuned to the frequency of the waves the energy of which is to be received and including a condenser, an elevated receiving conductor conductively connected to the terminals of said condenser, means whereby the mutual energy of the resonant circuit with respect to the elevated conductor is made small compared to the self energy of said resonant circuit, and a circuit, containing a condenser, inductively associated with said receiving conductor and so proportioned as to give the elevated conductor system zero reactance for electrical oscillations developed therein by a persistent train of simple harmonic waves of the frequency to which said resonant receiving circuit is attuned.

In testimony whereof I have hereunto subscribed my name this 28th day of April, 1905.

JOHN STONE STONE.

Witnesses:
BRAINERD T. JUDKINS,
G. ADELAIDE HIGGINS.