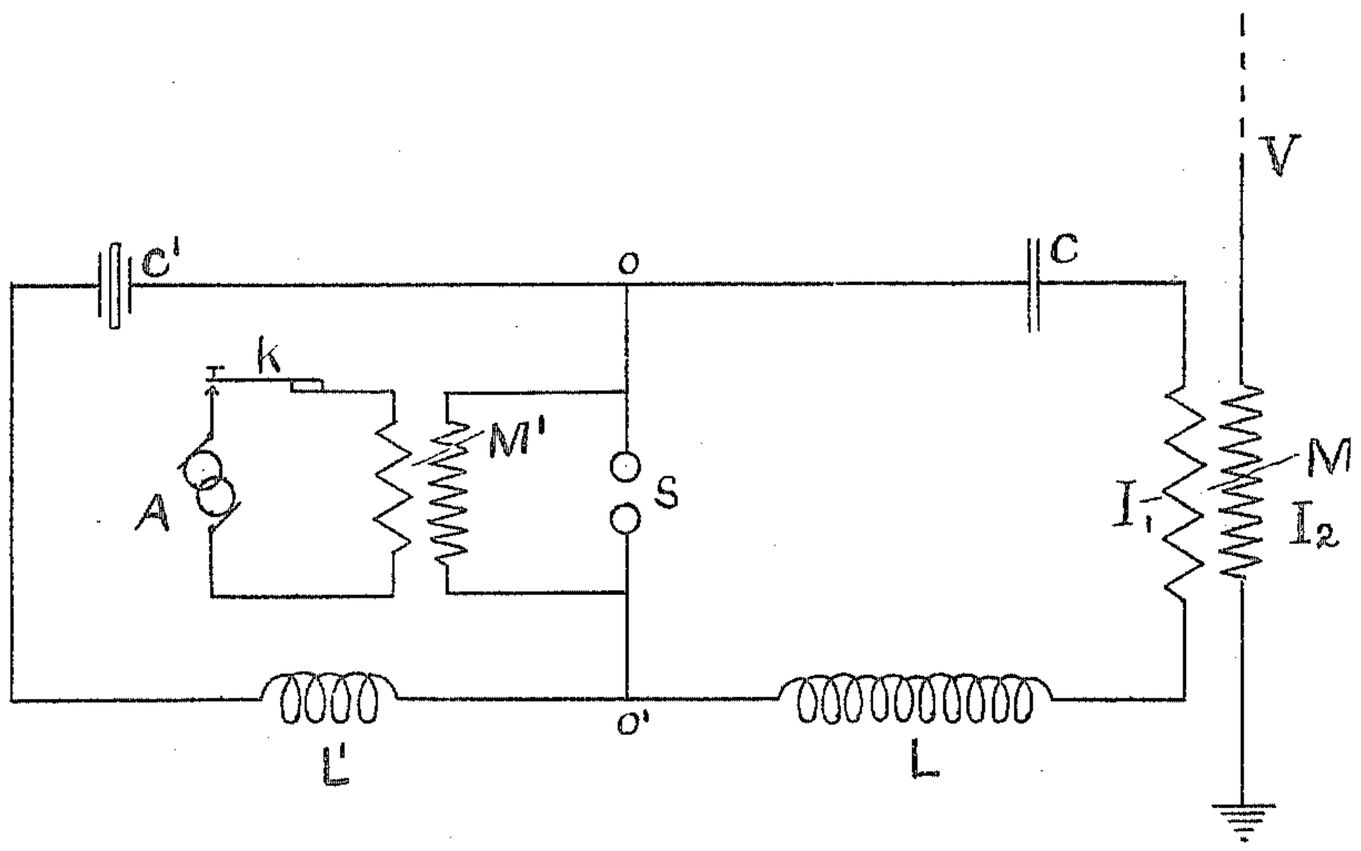
No. 802,418. PATENTED OCT. 24, 1905.

J. S. STONE.

SPACE TELEGRAPHY.

APPLICATION FILED NOV. 25, 1903. RENEWED AUG. 14, 1905.



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SPACE TELEGRAPHY.

No. 802,418. Specification of Letters Patent. Patented Oct. 24, 1905.

Application filed November 25, 1903. Renewed August 14, 1905. Serial No. 274,238.

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.

My 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 the system of such transmission in which the electromagnetic waves are developed by producing electric vibrations in an elevated conductor, preferably vertically elevated.

In my Letters Patent No. 714,756, Dec. 2, 1902, and in other Letters Patent, I have described a system of selective electric signaling in which forced simple harmonic electric vibrations of definite frequency are developed in an elevated conductor by associating the latter with a sonorous or persistently oscillating circuit capable of developing like vibrations of corresponding frequency when its electrical equilbrium is disturbed. In this system of selective space telegraphy an alternating current generator or similar source of periodically varying electro motive force is employed to charge a condenser in the sonorous circuit and this condenser discharging across a spark gap gives rise to a train of electric oscillations in said circuit which, by virtue of the inductance of the circuit, may be very persistent. The forced electric vibrations developed in the elevated conductor cause the radiation therefrom of simple harmonic electromagnetic waves of corresponding frequency which develop simple harmonic electric vibrations in the elevated conductor at a receiving station. The electric vibrations so developed are conveyed to a closed resonant circuit associated with said elevated conductor and as these oscillations persist, as above stated, for a relatively great length of time, the amplitude of the vibrations developed in the resonant circuit is greatly increased because of the ability of a resonant circuit to co-ordinate the amplitudes of the oscillations of the frequency to which it is attuned. This persistency of electric oscillation in a resonant circuit has long been recognized as prerequisite to the amplification by such circuit of the amplitude of the oscillations of the frequency to which it is attuned, and the inability to produce such persistency of electric oscillation has been one of the causes of failure of so-called selective space telegraph systems. The object of this invention is, first, to increase the amplitude of the oscillations developed by the sonorous circuit and, second, to increase the persistency of these oscillations, i. e., to increase the number of oscillations which may be developed by the sonorous circuit before the amplitude of these oscillations falls to $\frac{1}{e}$th of its initial amplitude.

In the drawings which accompany and form a part of this specification, the Fig. illustrates in diagram an arrangement of apparatus and circuits embodying one form of my invention.

In this figure,

V is an elevated conductor.

M M′ are transformers.

I_1 I_2 are respectively the primary and secondary windings of the transformer M, which may be as desired a step-up or a step-down transformer.

C C′ are condensers.

L L′ are inductances.

s is a spark gap.

A is an alternating current generator or other suitable source of electrical energy.

k is a key.

The circuit *s* C I_1 L is a sonorous circuit adapted to develop electric oscillations of a definite frequency when its electrical equilibrium is disturbed, and the circuit *s* C′ L′ is a sonorous circuit adapted to develop electric oscillations of frequency equal to those developed by the circuit *s* C I_1 L.

The function of the coil L is to render the product of the inductances of the circuit *s* C I_1 L and the elevated conductor with which said circuit is associated, large compared to the square of the mutual inductance between the two circuits, as explained in my hereinbefore mentioned Letters Patent. The condenser C is preferably a condenser having a dielectric of air, but the condenser C′ may have a solid dielectric so as to increase the capacity of said condenser per unit of cubical contents as explained in my application Serial No. 182,541, filed November 24, 1903.

The ratio of the inductance of the circuit *s* C I_1 L to the capacity of the circuit is made relatively large so as to obtain great persist-

ency of oscillation, but in the circuit *s* C′ L′ the ratio of the inductance of the coil L′ to the capacity of the condenser C′ is made relatively small by making the capacity of the condenser C′ relatively large so that although but few oscillations, say four or five, are maintained before the amplitude of these oscillations falls to $\frac{1}{e}$th of its initial value, a great amount of energy may be stored in the condenser C′ and therefore a great amount of energy may be discharged across the spark gap with the result that the spark produced by the combined discharges of condensers C and C′ is made larger, or "fatter", than if the second sonorous circuit *s* C′ L′ were not employed. In this way the impedance offered by the spark gap to the oscillations developed in the circuit *s* C I_1 L is initially greatly reduced and therefore the length of the spark may be correspondingly increased and the amplitude of the oscillations greatly increased.

When the spark at *s* ceases, the system does not cease to vibrate as would be the case if the circuit *s* C′ L′ were not employed, but on the contrary these oscillations then pass through the circuit *o* C′ L′ *o*′ in shunt to the spark gap *s* and as this circuit is resonant to the frequency of the oscillations developed by the circuit *s* C I_1 L, it offers to said oscillations no opposition other than that offered by its ohmic resistance, which should be made as small as possible. The oscillating circuit is now the circuit C′ *o* C I_1 L *o*′ L′ C′ which has the same natural period as that of the sonorous circuits *s* C′ L′ and *s* C I_1 L as will be apparent from consideration of the factors involved in the determination of the period of this circuit. The period of this circuit depends upon the factor $\frac{C_1 C_2}{C_1 + C_2}(L_1 + L_2)$ which will be seen to be equal to the products $C_1 L_1$ and $C_2 L_2$, which products respectively determine the periods of the circuits *s* C′ L′ and *s* C I_1 L, where C_1 C_2 represent the capacity, and L_1 L_2 the inductance, of these circuits.

I claim—

1. In a system of space telegraphy, an elevated conductor and means for developing electric vibrations of a definite frequency therein, said means consisting of a sonorous circuit containing a spark gap and a second sonorous circuit connected across the terminals of said spark gap, each sonorous circuit being adapted to develop electrical vibrations of said definite frequency.

2. As a means for developing electric vibrations of definite frequency, two sonorous circuits each attuned to said definite frequency and connected in parallel to a common spark gap.

3. As a means for increasing the amplitude and the persistency of electrical oscillations developed in a sonorous circuit, a circuit of low ohmic resistance connected across the terminals of the spark gap of the sonorous circuit and resonant to the frequency of the electrical oscillations developed therein.

4. In a system of space telegraphy, means for developing electrical oscillations of a definite frequency, said means consisting of a sonorous circuit containing a spark gap, and means for initially reducing the impedance offered by said spark gap to the oscillations developed in said sonorous circuit.

5. In a system of space telegraphy, means for developing electrical oscillations of a definite frequency, said means consisting of a sonorous circuit containing a spark gap, and means for automatically diverting the path of the electrical oscillations developed in said sonorous circuit from said spark gap without altering the frequency of said oscillations.

6. In a system of space telegraphy, a radiating conductor and means for developing electrical oscillations of a definite frequency therein, said means consisting of two sonorous circuits, each attuned to said definite frequency, connected in parallel to a common spark gap.

7. In a system of space telegraphy, a radiating conductor, a sonorous circuit for developing electrical oscillations therein and means for increasing the amplitude and the persistency of the electrical oscillations developed in said sonorous circuit.

8. In a system of space telegraphy, a radiating conductor. means for creating electrical oscillations therein and other means associated with the first mentioned means for increasing the amplitude and the persistency of said electrical oscillations.

9. In a system of space telegraphy, a radiating conductor, a sonorous circuit for creating electrical oscillations therein and means for increasing the amplitude and persistency of said electrical oscillations, said means consisting of a circuit of low ohmic resistance connected across the spark gap of said sonorous circuit and resonant to the frequency of the electrical oscillations developed in said sonorous circuit.

10. In a system of space telegraphy, a radiating conductor, means for creating electrical oscillations therein and other means associated with the first mentioned means for increasing the persistency of said electrical oscillations.

11. In a system of space telegraphy, a radiating conductor, means for developing electrical oscillations of a definite frequency therein, said means consisting of a sonorous circuit containing a spark gap, and means for initially reducing the impedance offered by said spark gap to the oscillations developed in said sonorous circuit.

12. In a system of space telegraphy, a radiating conductor, means for developing electrical oscillations of a definite frequency therein, said means consisting of a sonorous circuit containing a spark gap, and means for automat-

ically diverting the path of the electrical oscillations developed in said sonorous circuit from said spark gap without altering the frequency of said oscillations.

13. In a system of space telegraphy, an elevated conductor and means for developing electrical oscillations of definite frequency therein, said means consisting of a sonorous circuit containing a condenser, an inductance coil and a spark gap, and a second sonorous circuit containing a condenser, an inductance coil and the aforesaid spark gap, each sonorous circuit being adapted to develop electrical oscillations of the aforesaid definite frequency.

14. In a system of space telegraphy, means for developing electrical oscillations of a definite frequency, said means consisting of two sonorous circuits, each attuned to said definite frequency and connected in parallel to a common spark gap, a radiating conductor associated with one of said sonorous circuits and means for rendering the product of the inductance of said last mentioned sonorous circuit and the radiating conductor large compared to the square of the mutual inductance between said circuit and said radiating conductor.

15. As a means for increasing the amplitude and the persistency of electrical oscillations developed in a sonorous circuit, a circuit of low ohmic resistance, connected across the terminals of the spark gap of the sonorous circuit and resonant to the frequency of the oscillations developed by said sonorous circuit, said circuit of low resistance having the ratio of its inductance to its capacity relatively small as compared with the ratio of the inductance to the capacity of said sonorous circuit.

16. In a system of space telegraphy, a radiating conductor, a sonorous circuit associated therewith for creating electrical oscillations therein, and means for increasing the persistency of the electrical oscillations developed in said sonorous circuit.

17. In a system for developing electromagnetic signal waves of definite frequency, a plurality of sonorous circuits, each attuned to said definite frequency, means common to said sonorous circuits for simultaneously disturbing the electrical equilibrium of said sonorous circuits, and means for converting the energy of the resulting electrical oscillations into electroradiant energy.

18. In a system of space telegraphy, two sonorous circuits, each adapted to develop electrical oscillations of the same definite frequency and connected in parallel to a common spark gap, a radiating conductor inductively associated with one of said sonorous circuits, and a source of periodically varying electromotive force connected to said spark gap.

In testimony whereof I have hereunto subscribed my name this 24th day of November, 1903.

JOHN STONE STONE.

Witnesses:
G. A. HIGGINS,
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