

J. S. STONE.
SPACE TELEGRAPHY.
APPLICATION FILED APR. 20, 1905.

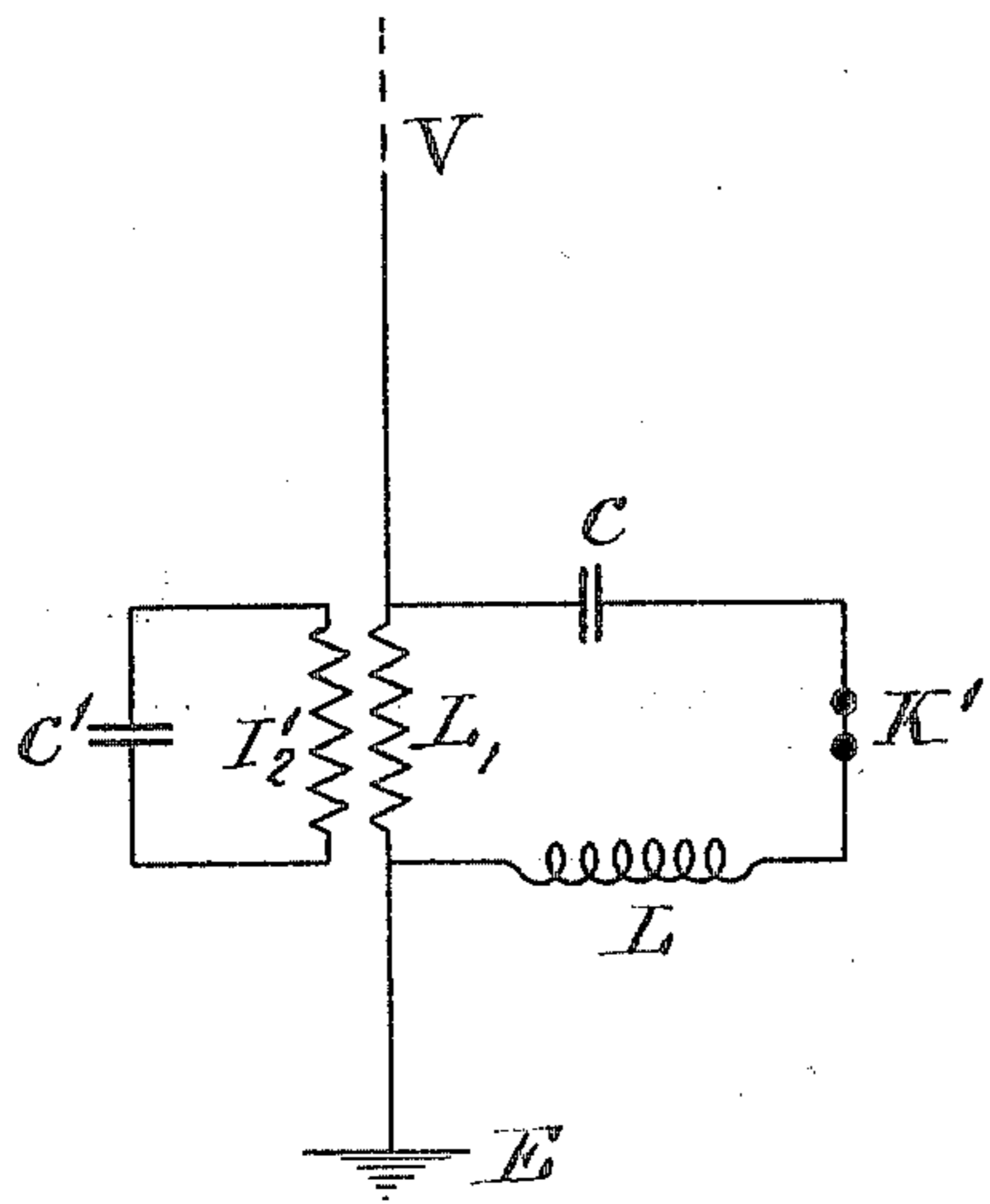


Fig. 1.

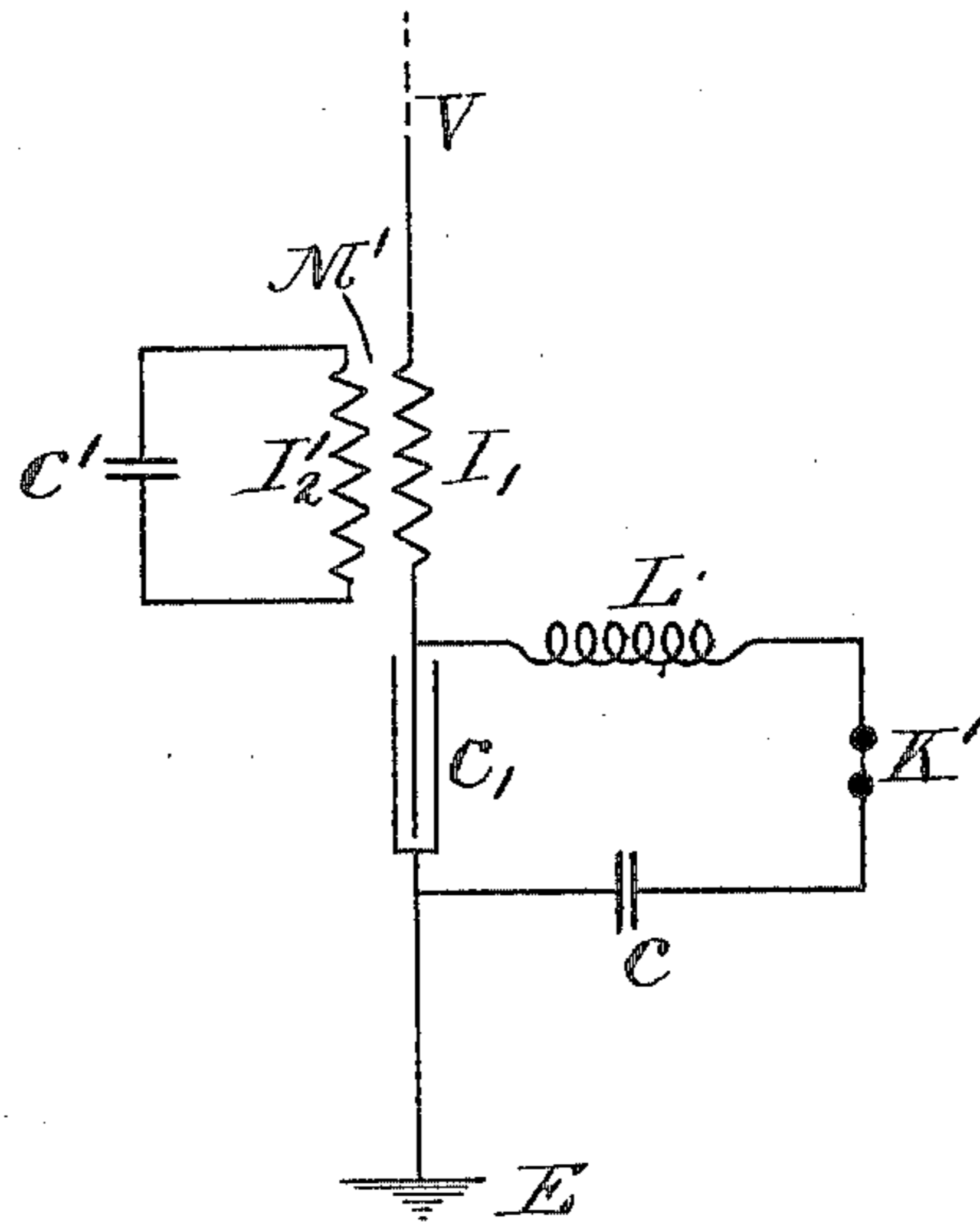


Fig. 2.

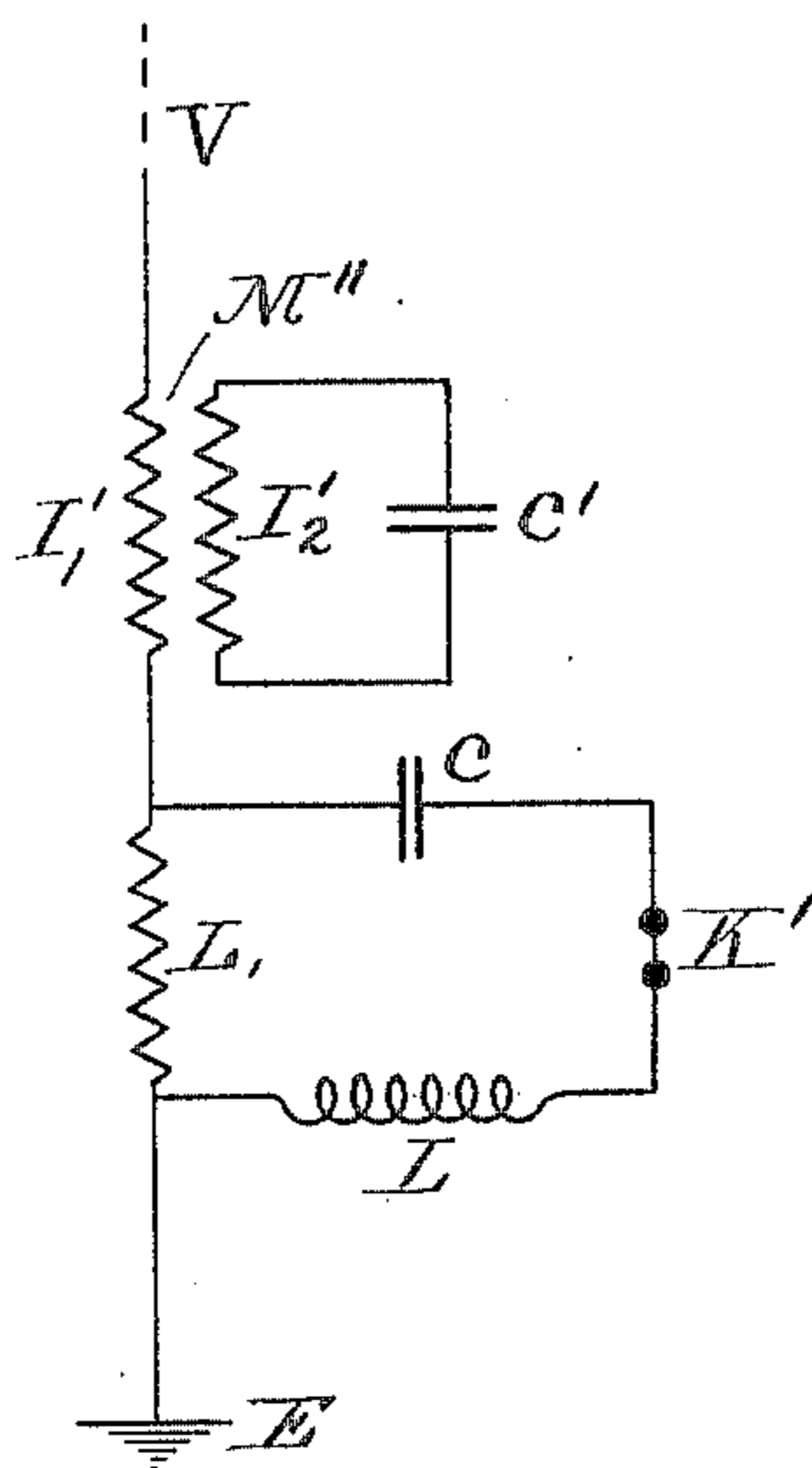


Fig. 3.

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SPACE TELEGRAPHY.

No. 802,422.

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. 258,039.

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 drawings which accompany and form a part of this specification and which illustrate diagrammatically arrangements of apparatus and circuits whereby the present invention may conveniently be carried into effect.

Figs. 1, 2, and 3, illustrate space telegraph receiving systems embodying the present invention.

In the figures,

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 .

M'' is a transformer whose primary and secondary windings are I'_1 and I'_2 .

C C' C₁ are condensers.

L is an auxiliary inductance coil.

L₁ is an inductance coil. K' is a bolometer or other suitable wave detector.

This application is a division of my application Serial No. 194,649 filed Feb. 23, 1904, in which I have broadly claimed the invention disclosed herein 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. Therefore, in the present application, I confine my

claims to those embodiments of the broad invention which are illustrated in Figs. 3, 4, and 7 of the parent application, or the electrical equivalents thereof, 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.

In Figs. 1, 2, and 3 of the present case, which figures are reproductions of the aforesaid figures 3, 4, and 7, respectively, of the 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 said elevated conductor system by means of the inductance coil L_1 in Fig. 1, the primary winding I_1 of the transformer M' in Fig. 2, or the primary winding I'_1 of the transformer M'' in Fig. 3.

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 coils L_1 , I_1 , or 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 ele-

ated 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 circuits $C L_1 L K'$ of Figs. 1 and 3, and the circuit $C_1 C K' L$ of Fig. 2, are resonant receiving circuits, each attuned to the frequency of the waves the energy of which is to be received. These resonant receiving circuits are preferably constructed according to the specifications of my Letters Patent Nos. 767,989 and 767,990, August 16, 1904, and each is preferably conductively connected to its elevated receiving conductor in such manner that the self energy of each of the conductively connected circuits of a system is great as compared to the mutual energy of each circuit with respect to the other circuits of such system. This is accomplished in Figs. 1 and 3 by making the inductance of the coil L large compared to the inductance of the coil L_1 , and in Fig. 2, by making the capacity of the condenser C small compared to the capacity of the condenser C_1 .

It is obvious that in Figs. 2 and 3 the primary coil I_1 or I'_1 may be situated below the condenser C_1 or the coil L_1 , respectively, as well as in the positions shown in the drawings, 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. As a means for preventing a resonant receiving circuit of a space telegraph receiving system from responding to extraneous electrical forces of a frequency to which said resonant receiving circuit is not attuned or

to abrupt or impulsive electrical forces, a resonant receiving circuit attuned to the frequency of the waves the energy of which is to be received, an elevated receiving conductor system conductively connected with said resonant receiving circuit, and a circuit, containing a condenser, inductively associated with said elevated receiving conductor system and so proportioned as to give the elevated receiving conductor system natural rates of vibration different from that of the associated resonant receiving circuit.

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, a receiving conductor conductively connected with said resonant receiving circuit, 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, a receiving conductor conductively connected with said resonant receiving circuit, and a circuit, containing capacity and inductance, inductively associated with said receiving conductor.

4. In a space telegraph receiving system, a receiving circuit attuned by capacity and inductance to the frequency of the waves the energy of which is to be received, a receiving conductor conductively connected with said receiving circuit, and a circuit, containing capacity and inductance, inductively associated with said receiving conductor.

5. In a space telegraph receiving system, a receiving circuit attuned by capacity and inductance to the frequency of the waves the energy of which is to be received, a receiving conductor conductively connected with said receiving circuit, the primary winding of a transformer serially connected in said receiving conductor, and a circuit, containing capacity and inductance, inductively associated with said primary winding.

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

7. 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 an inductance coil, an elevated receiving conductor conductively connected to said coil, a second coil in said resonant circuit of inductance great compared to the inductance of the first men-

tioned coil, and a circuit, containing a condenser, inductively associated with said receiving conductor.

8. 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 an inductance coil, an elevated receiving conductor conductively connected to said coil, a second coil in said resonant circuit of inductance great compared to the inductance of the first mentioned coil, and a circuit, containing capacity and inductance, inductively associated with said receiving conductor.

9. In a space telegraph receiving system, a receiving circuit attuned to the frequency of the waves the energy of which is to be received and including an inductance coil, an elevated receiving conductor conductively connected to said coil, the primary winding of the transformer serially connected in said receiving conductor, and a circuit, containing capacity and inductance, inductively associated with said primary winding.

10. 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; a receiving conductor conductively connected thereto and adapted to present for impressed forces of said frequency an inductance reactance; and a circuit, containing capacity and inductance, inductively associated with the receiving conductor system and so designed as to present, by its reaction on said receiving conductor system for impressed forces of said frequency, a capacity reactance equivalent to that which would be presented by a loading condenser adapted to make the fundamental of said receiving conductor system of a frequency equal to that of the waves to be received and thereby to balance the inductance reactance of the receiving conductor *per se* for impressed forces of said frequency.

11. 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; a receiving conductor conductively connected thereto and adapted to present for impressed forces of said frequency a definite reactance; and a circuit, containing capacity and inductance, inductively associated with the receiving conductor system and so designed as to present, by its reaction on said receiving conductor system for impressed forces of said frequency, a reactance equal and opposite to the reactance of the receiving conductor *per se* and thereby to balance the reactance of said receiving conductor *per se* for impressed forces of said frequency.

12. 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 an inductance

coil, an elevated receiving conductor conductively connected with said coil, 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.

15 13. As a means for preventing a resonant receiving circuit of a space telegraph receiving system from responding to extraneous electrical forces of a frequency to which said resonant receiving circuit is not attuned, or
20 to abrupt or impulsive electric forces, and for assisting said resonant circuit to respond to persistent forces of the frequency to which said circuit is attuned, the combina-

tion of a resonant receiving circuit attuned to the frequency of the waves the energy of which is to be received, an elevated receiving conductor system conductively connected with said resonant receiving circuit, and a circuit containing a condenser inductively associated with said elevated receiving conductor system and so proportioned that it shall by its reaction on the elevated conductor system cause the elevated conductor system to have zero reactance for electrical oscillations developed therein by a persistent force acting thereon and 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.