J. S. STONE.

SPACE TELEGRAPHY.

APPLICATION FILED DEC. 14, 1905.

916,895.

Patented Mar. 30, 1909.

3 SHEETS—SHEET 1.

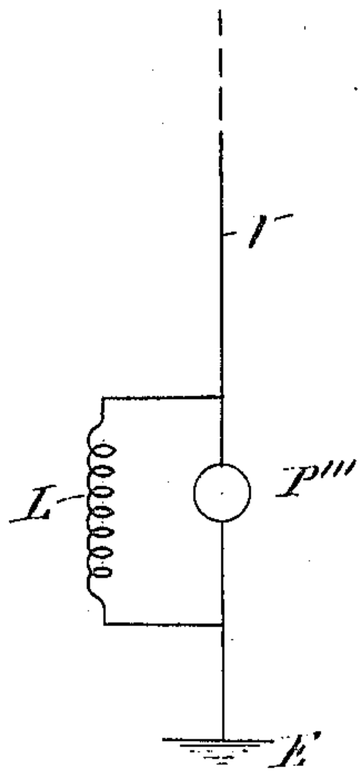

Fig. 1.

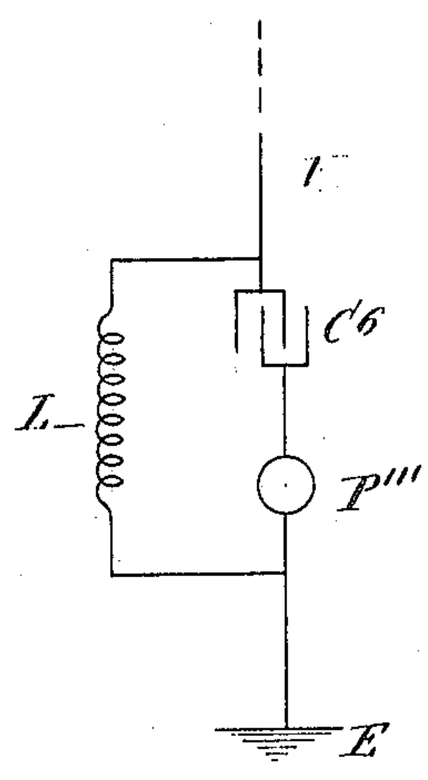

Fig. 2.

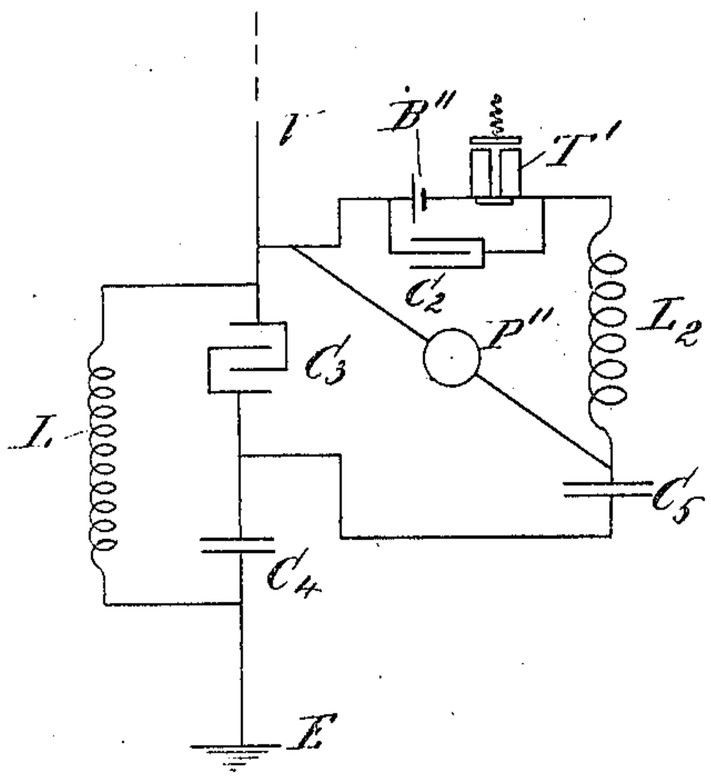

Fig. 3.

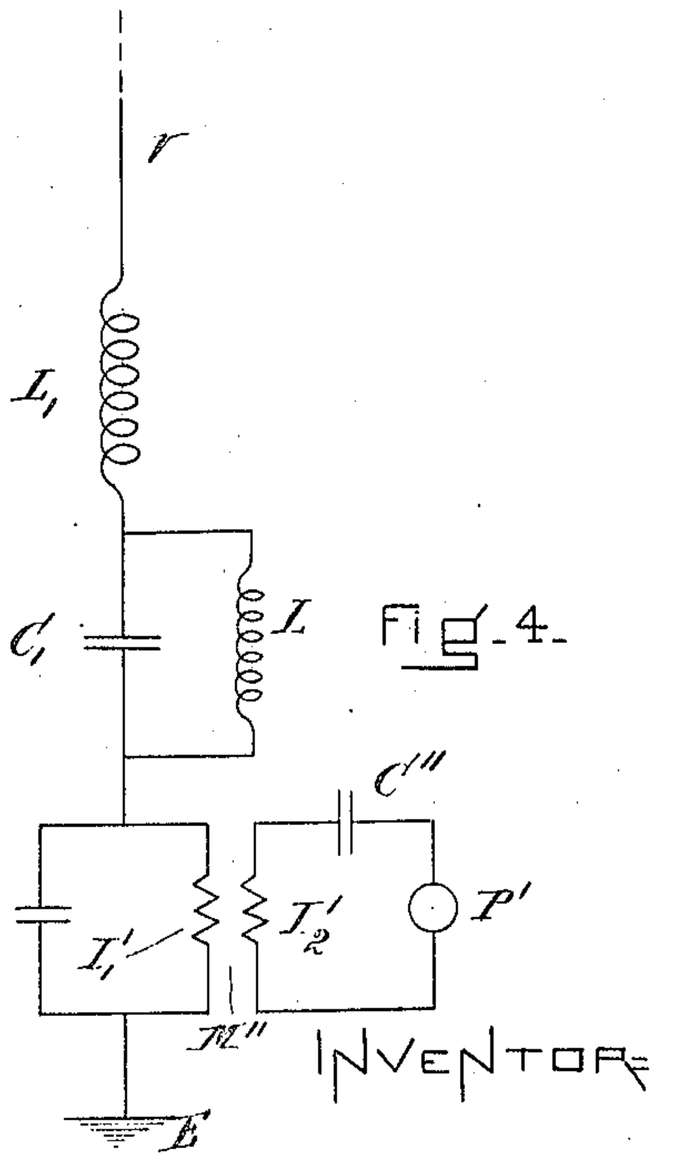

Fig. 4.

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3 SHEETS—SHEET 2

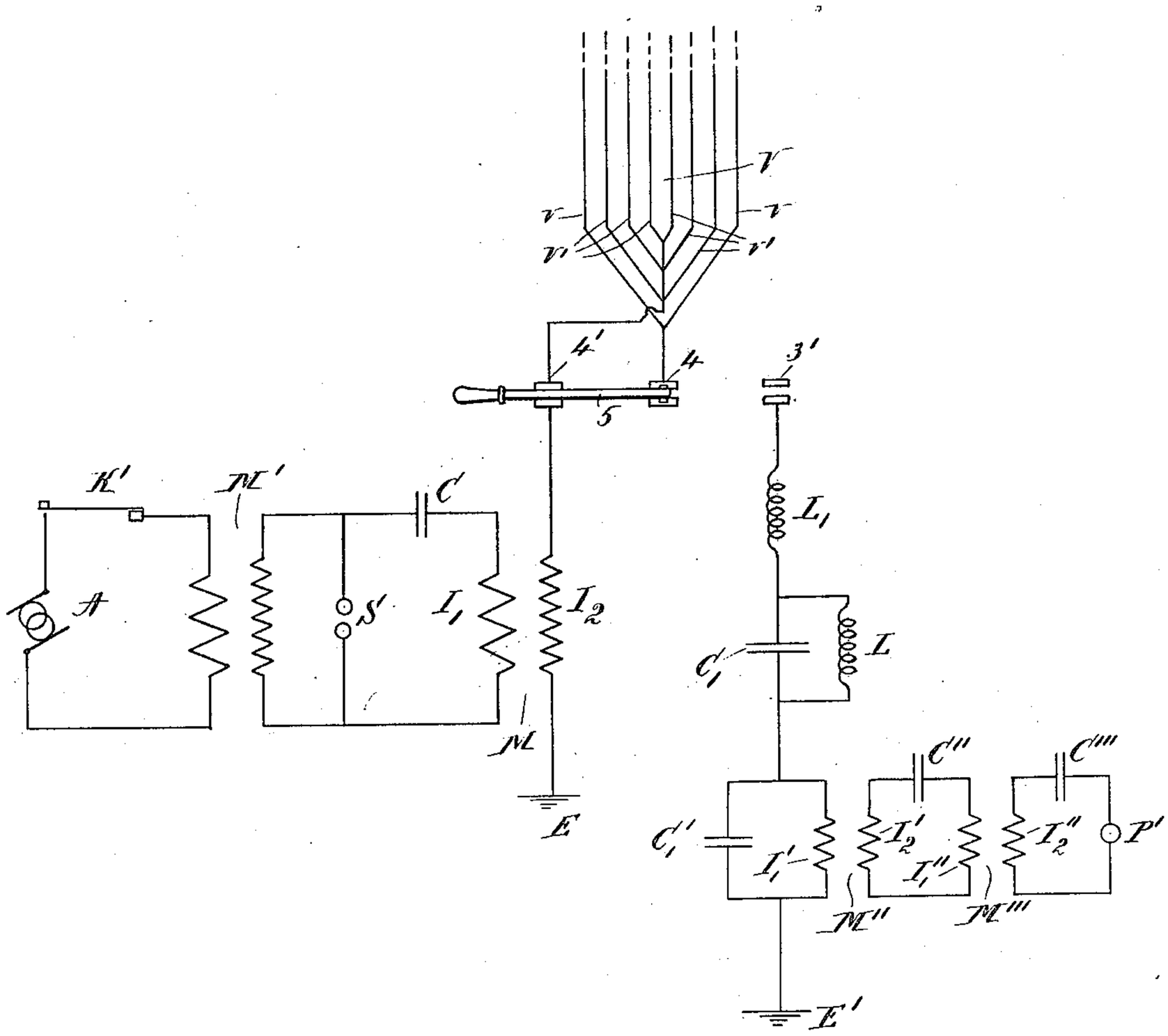

Fig. 5.

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3 SHEETS—SHEET 3.

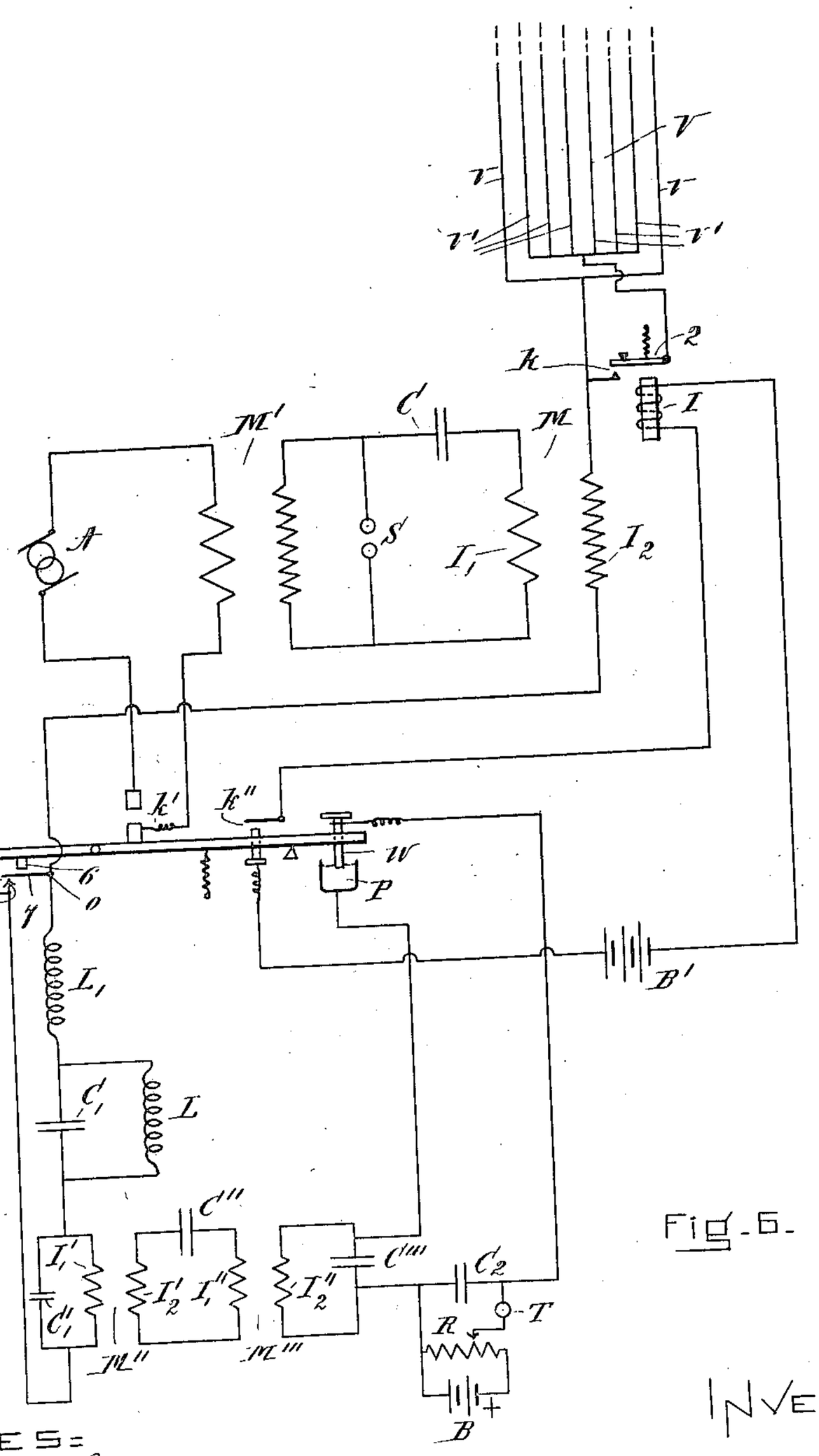

Fig. 6.

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SPACE TELEGRAPHY.

No. 916,895. Specification of Letters Patent. Patented March 30, 1909.

Application filed December 14, 1905. Serial No. 291,702.

To all whom it may concern:

Be it known that I, JOHN STONE STONE, a citizen of the United States, and resident of Cambridge, in the county of Middlesex and State of Massachusetts, have invented a 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 systems for receiving signals transmitted by such waves.

In the art of wireless telegraphy no problem is of greater importance from an industrial and commercial standpoint than that of rendering the receiving instruments of wireless telegraph stations immune from interference. There are two principal kinds of interference: First, that which arises from such stray electromagnetic waves as are produced by lightning, by magnetic storms, by sparks in neighboring circuits, such for instance as occur in trolley circuits, and also from electromagnetic waves emanating from wireless telegraph stations other than that with which communication is desired; and second, that which arises from electrical charges which accumulate upon the vertical oscillator or elevated receiving conductor under various conditions of weather, provided said elevated conductor has no adequate electrical connection to the earth.

In my prior Letters Patent Nos. 767,994, 714,756 and other Letters Patent, I have disclosed means for rendering the receiving instruments immune from interference of the first class above mentioned, namely, interference which arises from electromagnetic waves emanating from foreign stations, and which arises from abrupt or impulsive electrical forces; and the object of my present invention is to provide a wireless telegraph receiving system, the instruments of which shall be immune from interference of the second class, namely, "static" interference.

The greatest security from static interference is obtained by providing the elevated receiving conductor with an adequate conductive connection to earth and by placing the receiving device in a local circuit made resonant by a coil and a condenser to the frequency of the electrical oscillations to which the receiver is intended to respond, as shown in my above mentioned Letters Patent. However, in some instances it is advisable to include a condenser or condensers in the elevated conductor as more fully explained in connection with some of the figures of my Letters Patent No. 767,994, and in connection with my Letters Patent Nos. 767,990, 802,425 and other Letters Patent.

By the means set forth in the present application static interference is readily overcome even when a condenser is serially included in the elevated conductor, for by said means said conductor may always be given a metallic connection to the earth sufficient to maintain it clear of static charges without in any appreciable degree interfering with its operation as a receiving conductor; and it is readily overcome even if the oscillation detector is included directly in said receiving conductor.

I accomplish the hereinbefore stated objects of my invention by connecting across the terminals of a condenser serially included in the elevated conductor, or across the terminals of an oscillation responder similarly included in said conductor, or across the terminals of that portion of the conductor which includes said condenser and responder, a device having, for the frequency of the waves to be received, an impedance greater than the impedance of said condenser, said responder, or both.

My invention may best be understood by having reference to the drawings which accompany and form a part of this specification and which illustrate diagrammatically several forms of apparatus and circuit arrangements whereby the hereinbefore stated objects may be carried into effect.

In the drawings, Figure 1 represents a space telegraph receiving system in which the oscillation responder is serially included in the elevated conductor; Fig. 2 represents a space telegraph receiving system in which the oscillation responder and a condenser are serially included in the elevated conductor; Fig. 3 represents another type of space telegraph system; and Figs. 4, 5 and 6 represent space telegraph systems embodying elevated conductor systems of the type set forth in my Letters Patent No. 802,425.

In the figures, A is a source of varying

current such for example as an alternating current generator.

M M′ M″ M‴ are transformers.

I_1 I'_1 and I''_1 are transformer primaries, and I_2 I'_2 I''_2 are transformer secondaries which preferably are so related to their respective primaries as to produce transformers of large magnetic leakage.

C C_1 C'_1 C″ C‴ C_2 C_3 C_4 C_5 and C_6 are condensers.

P P′ are oscillation detectors of any suitable type.

B B′ are batteries.

L is a protective inductance.

L_1 L_2 are tuning inductances.

V is an elevated conductor consisting of a plurality of wires, of which the wires *v v* are employed for receiving.

K is a key.

R is a resistance which with the battery B constitutes a potentiometer.

T T′ are signal-indicating devices.

In Fig. 1 I have shown a simple wireless telegraph receiving system of the kind first employed in this art in which the oscillation detector P‴ is included in the elevated conductor. Connected across the terminals of the electrical device or detector P‴ is a protective coil L having for waves which have the high frequency of the waves to be received, an impedance much greater than the impedance of the device P‴, so that the coil will serve as a by-path for the currents due to the passage of the static charges in the elevated conductor V to earth. Such an inductance coil, which, as before stated, has an impedance for the high-frequency oscillations created in the elevated conductor by the waves to be received, which is very high compared to the impedance of the device P‴, operates practically as an open circuit for such oscillations, while affording a ready path to earth for the electrical charges which, in its absence, would accumulate upon the elevated conductor and produce disruptive discharges to earth, thereby operating the oscillation detector.

In Fig. 2 is shown practically the same simple system as in Fig. 1 with the addition of a condenser C_6 serially connected in the elevated conductor. The capacity of this condenser is so large as not to impede appreciably the passage of the high-frequency oscillations of wireless telegraphy while operating practically as an open circuit for the more slowly varying currents by which the elevated conductor is maintained free of static charges and which pass to earth by way of the protective inductance coil L, which as before stated, operates practically as an open circuit for said high-frequency oscillations.

In Fig. 3 I have shown a receiving system, in which the circuit C_3 C_5 L_2 C_2 is made resonant to the frequency of the waves to be received, and in which the capacity of the condenser C_5 is small compared to the capacity of the condenser C_3. The protective coil L connected across the terminals of that portion of the elevated conductor which includes the condensers C_3 and C_4 operates as a by-path around said condensers for the currents produced by the static charges, while impeding the passage to earth of the high-frequency oscillations created by the waves to be received. It will be noted that this coil L does not assist in tuning any circuit in any of the systems disclosed in the present application.

In Fig. 4 I have shown the receiving system set forth in my Letters Patent No. 802,425, in which the condenser C_1 insulates a portion of the elevated conductor from the earth and is shunted by the protective coil L which as in the figures already discussed affords a bypath to earth by way of the primary I'_1 for the currents resulting from the static charges in the elevated conductor. Were the coil not employed, said charges would accumulate until a sufficient potential difference existed between the terminals of the condenser to produce disruptive discharges to earth which would have the effect of creating false signals in the detector P′.

It is, as set forth in my Letters Patent No. 767,979, advantageous to employ an elevated conductor consisting of a plurality of wires, and I have discovered that under certain circumstances it is preferable to employ a smaller number of wires for receiving than for transmitting. In Fig. 5 I have shown a receiving system, having the serially included condenser C_1 shunted by the protective inductance coil L, and the transmitting system set forth in my Letters Patent No. 714,756 associated with a multiple wire transmitting elevated conductor. The switch 5 pivoted between the jaws 4 and connecting, in the position shown, said jaws with the jaws 4′, connects the transformer secondary I_2 with all the wires, *v* and *v′* of the multiple transmitting conductor V. When the switch 5 is thrown over so as to connect the jaws 4 with the jaw 3′, the receiving system is connected with a portion only of the wires of the multiple elevated conductor. In the system shown in Fig. 5 the two outer wires *v v* are connected to the receiving system when the switch is thrown over so as to connect the jaws 4, and 3′, but obviously any given number of said wires might be so connected to the receiving system by said switch 5 when in such position.

In Fig. 6 I have shown the same system as Fig. 5 provided with means operated by the sending device K for automatically connecting a given number of the wires of the multiple elevated conductor V with the receiving system and for connecting all said wires with the transmitting system. In this

figure the key carries at one end one member W of the electrolytic receiver P, and in the normal position of said key the member W is in contact with its coöperating member, the wires v' v' of the elevated conductor are disconnected from the rest of the system, and the wires v v are connected to the receiving system which is earthed at the point E. Upon the depression of the key, the stud 6 presses the spring 7 down upon the contact o', thereby closing the contact k''' and short-circuiting the receiving system at the point k''' between the terminals o, o' of the receiving system and connecting the secondary I_2 to earth E by way of said spring 7. At the same time, or shortly before or shortly afterward, the member W is separated from the member P, thereby rendering the receiver inoperative, and either before or after, or between said operations, and at any time prior to the closure of the contact k', the circuit of the magnet I is closed by the closure of the contact k''. The energization of the magnet I by the battery B′ effects the closure of the contact k by the attraction of the armature 2 which is connected with the conductors v' v' and thereby, before the closure of the contact k', automatically connects all the wires of the elevated conductor V with the transmitting system.

I claim,

1. In a wireless telegraph receiving system, an elevated conductor system including a condenser, and protective means connected across the terminals of said condenser and having, for the frequency of the waves to be received, an impedance so much greater than the impedance of said condenser that it operates practically as an open circuit for oscillations of said frequency.

2. In a wireless telegraph receiving system, an elevated conductor system including a condenser, and a protective inductance connected across the terminals of said condenser and having, for the frequency of the waves to be received, an impedance so much greater than the impedance of said condenser that it operates practically as an open circuit for oscillations of said frequency.

3. In a wireless telegraph system, a transmitting system, a receiving system, an elevated conductor comprising a plurality of wires, and means for connecting a small number of said wires with the receiving system and for connecting all said wires with the transmitting system.

4. In a wireless telegraph system, a transmitting system, a receiving system, a sending device, an elevated conductor comprising a plurality of wires, and means operated by said sending device for automatically connecting a small number of said wires with the receiving system and for connecting all said wires with the transmitting system.

In testimony whereof, I have hereunto subscribed my name this 8th day of Dec. 1905.

JOHN STONE STONE.

Witnesses:
GEORGIA A. HIGGINS,
GEO. O. WOODWORTH.