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J. S. STONE.

METHOD OF SIMULTANEOUSLY TRANSMITTING AND RECEIVING SPACE TELEGRAPH SIGNALS.

(Application filed Jan. 23, 1901.)

(No Model.)

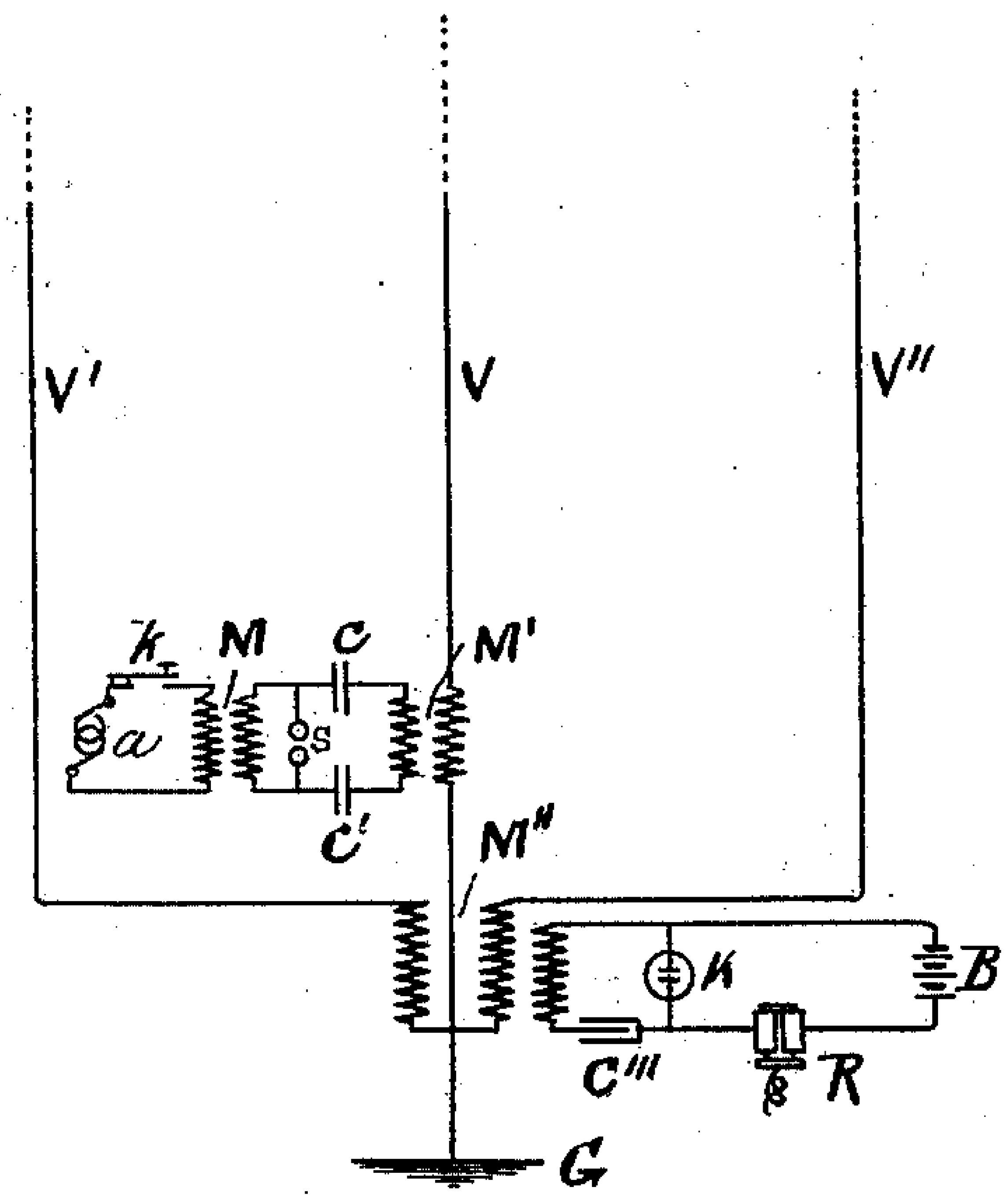

Fig.1.

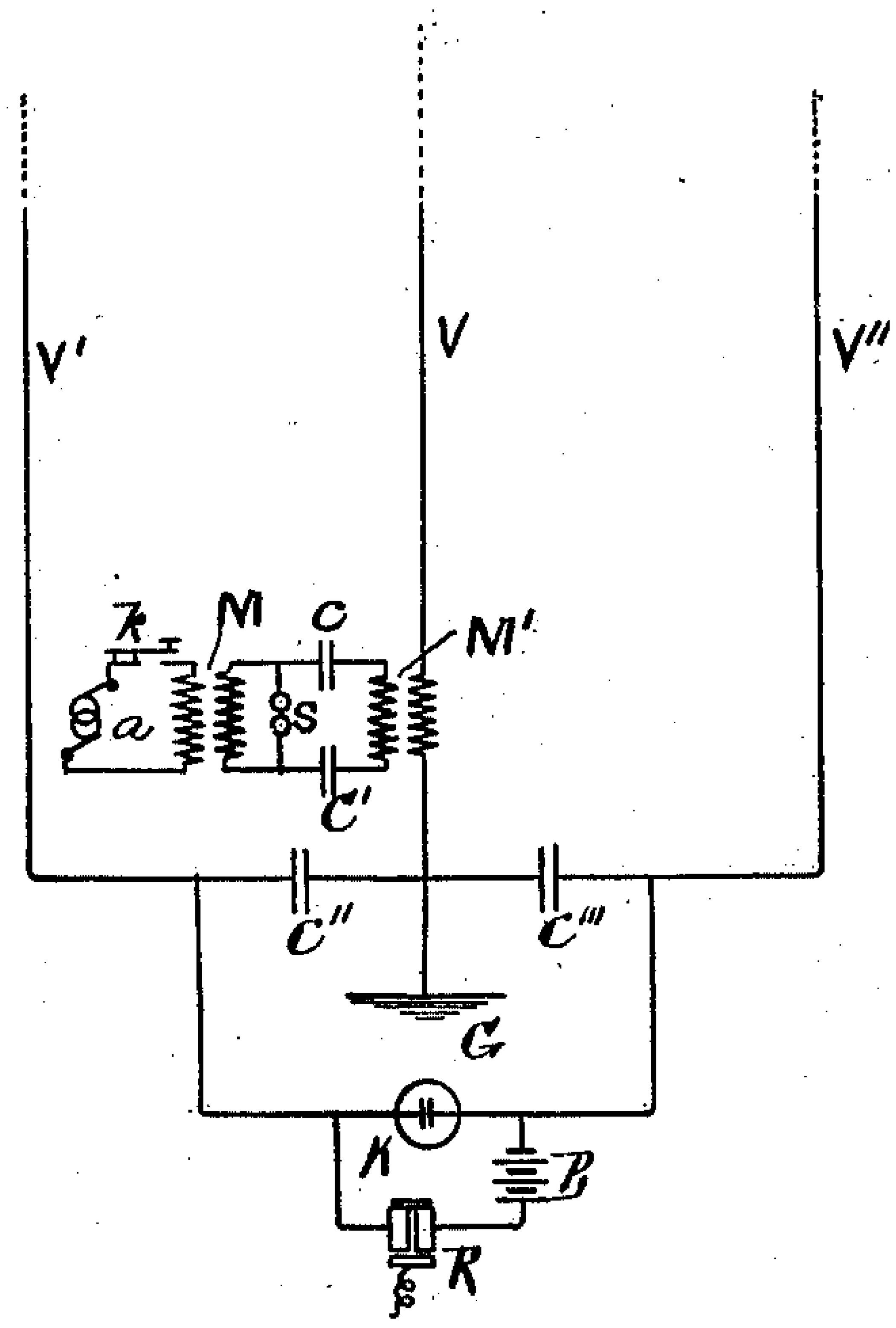

Fig.2.

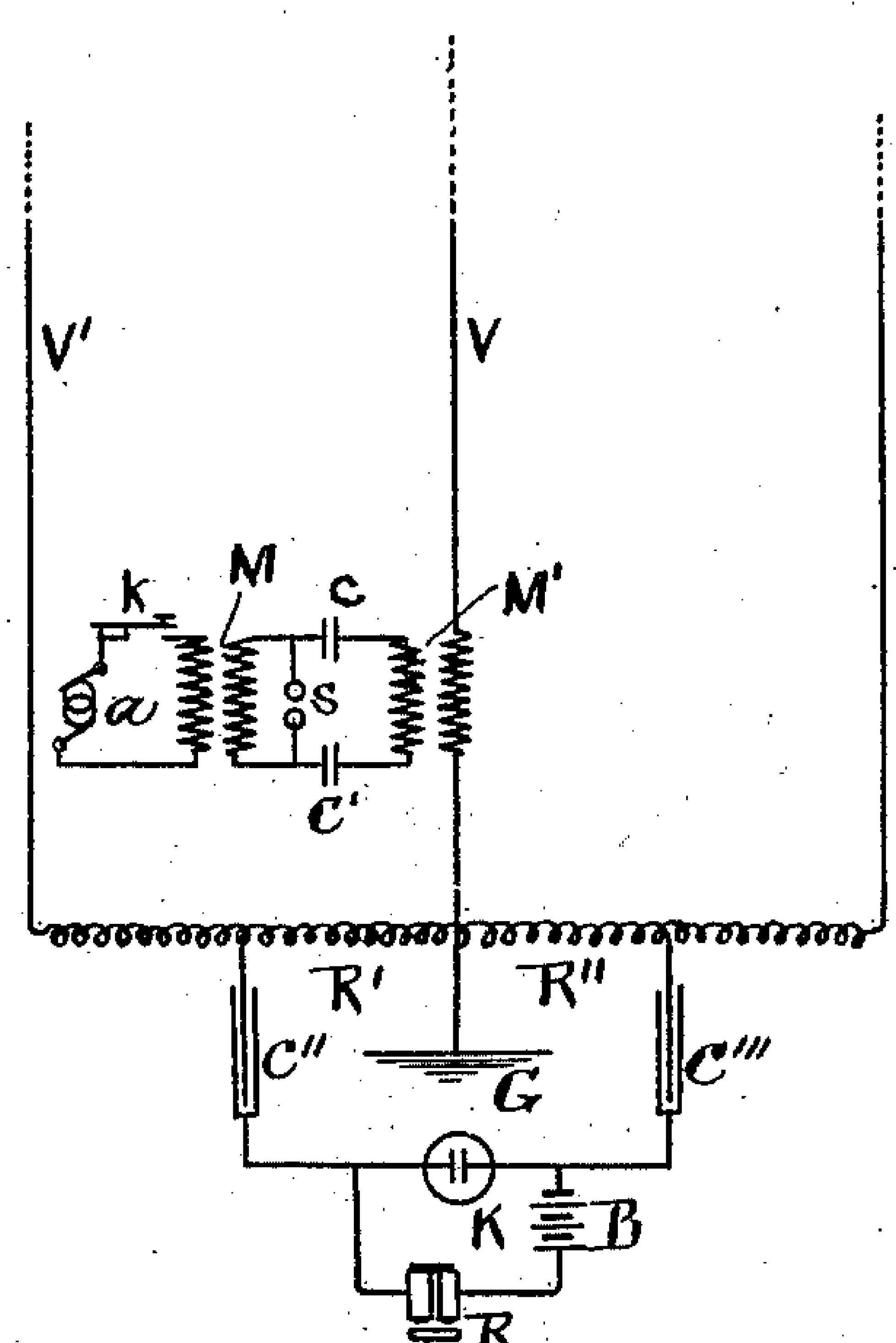

Fig.3.

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METHOD OF SIMULTANEOUSLY TRANSMITTING AND RECEIVING SPACE-TELEGRAPH SIGNALS.

SPECIFICATION forming part of Letters Patent No. 716,955, dated December 30, 1902.

Application filed January 23, 1901. Serial No. 44,397. (No model.)

To all whom it may concern:

Be it known that I, JOHN STONE STONE, a citizen of the United States, and a resident of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Methods of Simultaneously Transmitting and Receiving Space-Telegraph Signals, of which the following is a specification.

The present invention depends upon the fact that if in a vertical conductor or conductors lying in a plane equidistant at all points from two other vertical conductors there be developed electrical oscillations, then the oscillations thereby developed in the last-named conductors will be equal in amplitude and phase. Further, if the effects of these oscillations upon a receiving device be opposed to one another their resultant effect upon said receiving device will be *nil.*

By my invention I utilize as a transmitting-conductor a conductor or conductors lying in a plane equidistant at all points from two other vertical conductors which I utilize as receiving-conductors, and I cause the oscillations developed in the receiving-conductors to be opposed to one another in their effect upon a receiving or translating device associated with them. This may be done by means of a variety of apparatus of the nature of induction-balances, some forms of which will be hereinafter described. Careful consideration will show that the two vertical receiving-conductors will be incapable of receiving signals from any transmitting-station in their equatorial plane, but will in general be capable of receiving signals from stations otherwise located. In order that they may be most sensitive to the signals from distant transmitting-stations, these two conductors should be placed at a distance apart of one-half a wave length and in the vertical plane including the distant transmitting-station to be communicated with. If it be desired to receive from more than one transmitting-station, the two receiving-wires may be mounted upon a frame capable of rotation around a central vertical axis.

Figures 1, 2, and 3 show certain embodiments of the invention.

In the figures V V′ V″ are vertical conductors.

G is a ground.

M M′ M″ are induction-coils.

C C′ C″ C‴ are condensers.

B is a battery.

R is a relay.

K is a coherer.

a is a generator of vibratory currents.

k is a key.

s is a spark-gap.

R′ and R″ are equal resistances or inductances.

Electrical oscillations may be developed in the transmitting-conductor V in any suitable manner, which need not further be considered here. When such oscillations are developed, corresponding oscillations equal in amplitude and phase will be produced in the receiving-conductors V′ V″, and their effects upon the coherer K neutralize each other, owing to the fact that the latter is in effect in a branch of an induction-balance, which branch is conjugate to the vertical transmitting-conductor V.

The three forms of induction-balance shown in the several figures are common forms, the one shown in Fig. 1 being merely an inductance-coil having similar but differentially-wound primaries, the one shown in Fig. 2 being merely the equivalent of substituting two equal condensers for the two bridge-arms of a Wheatstone bridge, and Fig. 3 being in effect a Wheatstone bridge. The electrical translating device or coherer shown in the drawings is always included in the "telephone" branch of the bridge or induction-balance. The vertical transmitting-conductor may be regarded in each case as the battery branch, and the intervening dielectric between this conductor and the two receiving-conductors V′ V″ may be regarded as constituting the remaining two branches of the induction-balance.

In the operation of the organization shown at Fig. 1 the signal-waves emanating from the centrally-located vertical conductor V develop potentials in the two similar conductors V′ and V″, which are equal in amplitude, form, and phase. The two primary coils of

M'', through which V' and V'' are grounded, are equal in every respect and disposed symmetrically with respect to the remaining or secondary coil of M''. Equal electric oscillations are therefore developed in the conductors V' M'' G and V'' M'' G; but the primary coils of M'' are so disposed as to oppose each other in their action upon the secondary of M'', and the result upon this coil of the electric oscillations in the two primaries is therefore *nil*. For this reason the coherer and its associated electric translating device are not operated by the signal-waves sent out from the vertical conductor V. The signal-waves from a distant transmitting-station in the plane of the vertical wires V' V'' will, if their wave length be twice the distance which separates V' and V'', develop in V' and V'' electric potentials equal in amplitude, but opposite in phase. The electric oscillations in the two conductors V' M'' G and V'' M'' G will therefore be equal and opposite and their effect upon the secondary of M'' will be to produce electric oscillations in the local circuit containing the coherer K, which is thereby operated, and which consequently permits the battery B to operate the electric translating device R. Similarly in the operation of the organization shown in Fig. 2 the signal-waves from the conductor V produce equal electric oscillations in the similar conductors V' C'' G and V'' C''' G. The condensers C'' and C''' being equal, the potential of the branch containing the coherer K is changed as a whole, but no difference of potential is developed therein, and therefore the coherer is not operated and the associated translating device is not set in motion. As in the case of the organization shown in Fig. 1, the waves from the distant transmitter-station produce unequal electric vibrations in the conductors V' C'' G and V'' C''' G. This causes a difference of potential in the coherer branch, which operates the coherer, and thereby sets in motion the electric translating device R.

The operation of the organization shown in Fig. 3 is the same as that shown in Fig. 2, except that two equal resistances R' R' are employed instead of the two equal condensers C'' C''' of Fig. 2.

I claim—

1. The method of transmitting electromagnetic signal-waves and of simultaneously or otherwise receiving other electromagnetic signal-waves without mutual interference, which consists in generating the electromagnetic signal-waves to be transmitted by producing electric vibrations in an elevated transmitting conductor or conductors, in receiving the energy of signal-waves to be received in other elevated conductors and in conveying the energy so received to a conductor or branch that is conjugate to said transmitting conductor or conductors.

2. The method of simultaneously transmitting and receiving electromagnetic signal-waves, which consists in transmitting electromagnetic signal-waves at a transmitting-station, causing the effects of the transmitted waves in a receiver at the same station to be neutralized, and causing the electromagnetic signal-waves simultaneously received from a a distant station to coöperate to affect the receiver.

3. The method of simultaneously transmitting and receiving electromagnetic signal-waves, which consists in transmitting electromagnetic signal-waves at a transmitting-station, causing the effects of the transmitted waves in a receiver at the same station to be neutralized, receiving the energy of simultaneously-transmitted waves from a distant station and causing the energies of the resulting electric vibrations of said simultaneously-transmitted waves to coöperate to affect the receiver.

4. The method of producing a maximum effect in a receiver by electromagnetic waves of a certain predetermined length, which consists in receiving the energy of said electromagnetic waves in two elevated conductors situated a distance apart equal to one-half the length of said waves, conveying the resulting electric vibrations to a receiver associated therewith and causing the energies of said vibrations to coöperate to affect said receiver.

5. The method of transmitting and receiving electromagnetic signal-waves simultaneously or otherwise, which consists in transmitting electromagnetic signal-waves, causing the transmitted waves to effect a zero difference of potential at the terminals of the receiver, and causing the received waves to combine to effect a certain difference of potential at said terminals.

6. In the art of space telegraphy, the method herein described of preventing the radiation of electromagnetic waves of great intensity by a transmitter in proximity to a receiving system from affecting the receiver, which consists in receiving said radiated waves in a plurality of elevated conductors, and causing the effects on the receiver of the resulting electric oscillations developed in the elevated conductors to be neutralized.

JOHN STONE STONE.

In presence of—

ALEX. P. BROWNE,
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