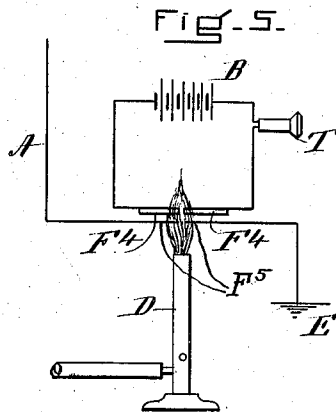
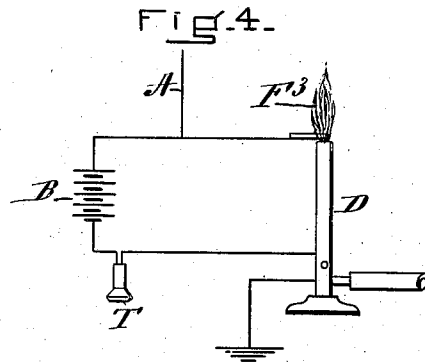
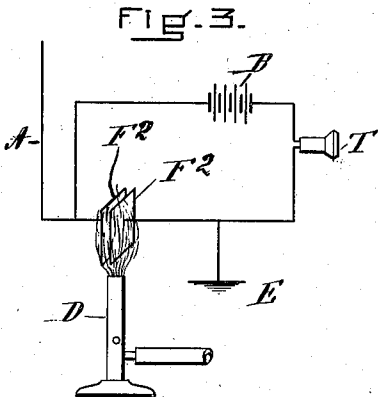
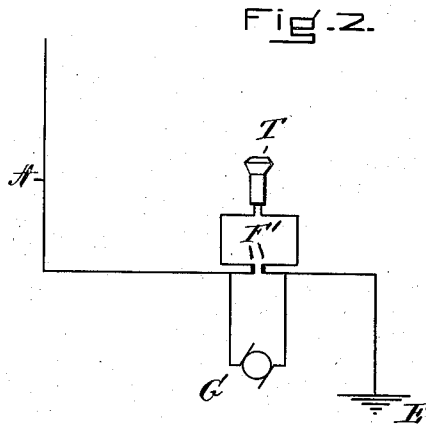
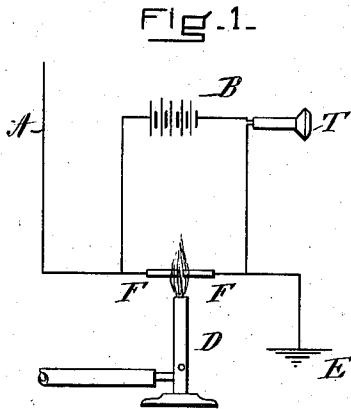


L. DE FOREST.
ART OF DETECTING OSCILLATIONS.
APPLICATION FILED JUNE 12, 1907.



WITNESSES:
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UNITED STATES PATENT OFFICE.

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ART OF DETECTING OSCILLATIONS.

No. 867,877.

Specification of Letters Patent.

Patented Oct. 8, 1907.

Original application filed February 2, 1905, Serial No. 243,913. Divided and this application filed June 12, 1907, Serial No. 378,503.

To all whom it may concern:

Be it known that I, LEE DE FOREST, a citizen of the United States, and a resident of New York, in the county of New York and State of New York, have invented a new and useful Improvement in the Art of Detecting Oscillations, of which the following is a specification.

My invention relates to an improvement in the art of receiving wireless telegraph signals transmitted from a distant station by means of electrical waves.

In the drawings which accompany and form a part of the present specification I have shown several forms of apparatus and circuit arrangements whereby my method may be carried into effect; but it will be understood that my invention is broader than mere apparatus and that my method may be carried into effect by a great variety of apparatus.

In the drawings, Figures 1, 2, 3, 4 and 5 represent space telegraph receiving systems.

In the figures, A represents an antenna or receiving conductor, or wave-intercepting means; E is the earth connection; F, F¹, F², F³, F⁴, F⁵ are the electrodes in their various forms; B is the local battery; and T is the receiving or indicating instrument which is herein shown as a telephone receiver, the same being shown only as typical of any form of indicating apparatus capable of being employed for such purposes.

I have discovered that if two bodies adapted for use as electrodes or conductive members be electrically separated partially or wholly, after the manner common in analogous devices, the separation between them may be neutralized sufficiently to enable them to act as a detector of electrical oscillations, if the intervening or surrounding gaseous medium be put into a condition of molecular and ionic activity, such for instance as would be caused by heating it in any manner, as by radiation, conduction, or by the combustion of gases in the space which surrounds the electrodes. Such condition of molecular and ionic activity causes what would otherwise be a non-sensitive device to become sensitive to the reception of electrical influences. I am thus enabled to employ as such sensitive member, devices which would otherwise be of no value and which comprise electrodes separated by a gaseous medium. This principle is embodied in the apparatus illustrated in the various figures shown.

In Fig. 1 the two electrodes F, F are slightly separated and are within the flame of an ordinary Bunsen burner D. Under these conditions the electrodes may be adjusted so that there is normally no indication of a passing current given by the receiving instrument, such as the telephone T. The electrical separation of the electrodes is, however, insufficient to prevent elec-

trical oscillations from passing across the gap. The influence of these oscillations upon the heated gas seems to vary the insulating quality of the gap, so that, while the influence of the oscillations lasts the current of the local circuit may pass between the electrodes, thus affecting the indicating instrument therein to produce a signal. This may be due to ionization of the gases surrounding the electrodes which greatly increases their conductivity, said ionization being more or less accomplished or greatly facilitated in the present instance by their previous heating which has already put them in a condition of intense molecular activity.

In Fig. 2, the electrodes F¹ F¹ are of sufficiently great resistance to be heated by a current from a dynamo G, and by their radiation heat the gas between them. This gas may be air or the electrodes may be inclosed and surrounded by any suitable gas.

In Fig. 3 the electrodes assume the form of two parallel plates F² F², which are heated by a Bunsen burner. Although I have shown a Bunsen burner for this purpose, this particular heating device is not essential, as any means of heating may be employed.

In Fig. 4, the burner itself is made one of the electrodes, the other of which is shown at F³.

In Fig. 5 the local circuit is provided with electrodes F⁴ F⁴, and the oscillation-receiving circuit with separate electrodes F⁵ F⁵, both being heated by the flame of the Bunsen burner. The effect in this case is the same as before stated, that is, the passage of the oscillations enables the current of the local circuit to jump the gap between the electrodes F⁴ F⁴ and thus to operate the receiving instrument. The oscillations apparently ionize the gas and thus temporarily reduce its insulating power, or, in other words, increase its conductivity and enable the current of the local circuit to overcome the resistance between its poles.

The action described may be effected by controlling the composition of the gases between and surrounding the electrodes or poles of the sensitive member. As an instance of this, the addition of sodium or salts of the halogen class in the flame increases the ionization and conductivity of the gases and increases the sensitivity of the device.

While I have shown and described various means for realizing my method in practice, I am aware that not all the possible means have been shown and described. Sufficient information, however, has been herein set forth to enable any one skilled in this art to carry out my method, which broadly stated consists in receiving wireless telegraph signals by causing the electrical oscillations developed in a wireless telegraph receiving system to vary the conductivity of a gas maintained in a condition of intense molecular and

ionic activity and having dissociated and conducting ions.

I make no claim herein to the apparatus and circuit arrangements whereby my method may be carried into effect, inasmuch as such apparatus and circuit arrangements constitute the subject matter of my application Serial No. 243,913, filed Feb. 2, 1905, of which the present application is a division.

I claim:

- 10 1. As an improvement in the art of receiving electromagnetic signal waves, the method herein described which consists in establishing in a circuit a gaseous medium maintained in a condition of molecular and ionic activity, impressing the electrical oscillations resulting from the waves to be received upon said gaseous medium and thereby altering the electrical condition of the circuit of which said gaseous medium forms a part, and translating the resulting current variations into signal indications.
- 20 2. As an improvement in the art of receiving electromagnetic signal waves, the method herein described which consists in establishing in a circuit a gas having dissociated and conducting ions, altering by the energy of the electrical oscillations resulting from the waves to be received, the conductive properties of said gas, and trans-

lating the resulting current variations into signal indications.

3. As an improvement in the art of receiving electromagnetic signal waves, the method herein described which consists in causing the electrical oscillations developed by electromagnetic waves in a wireless telegraph receiving system to vary the electrical conductivity of a gas maintained in a condition of intense molecular and ionic activity and having dissociated and conducting ions, and translating the resulting current variations into signal indications. 30 35

4. As an improvement in the art of receiving electromagnetic signal waves, the method herein described which consists in absorbing the energy of said waves, impressing the resulting electrical oscillations upon a gas maintained in a condition of molecular and ionic activity, thereby creating current variations in the circuit of a source of electromotive force associated with said gas, and translating said current variations into signal indications. 40 45

In testimony whereof, I have hereunto subscribed my name this 11th day of May 1907.

LEE DE FOREST.

Witnesses:

H. W. GOETZE,
THOMAS I. GALLAGHER.