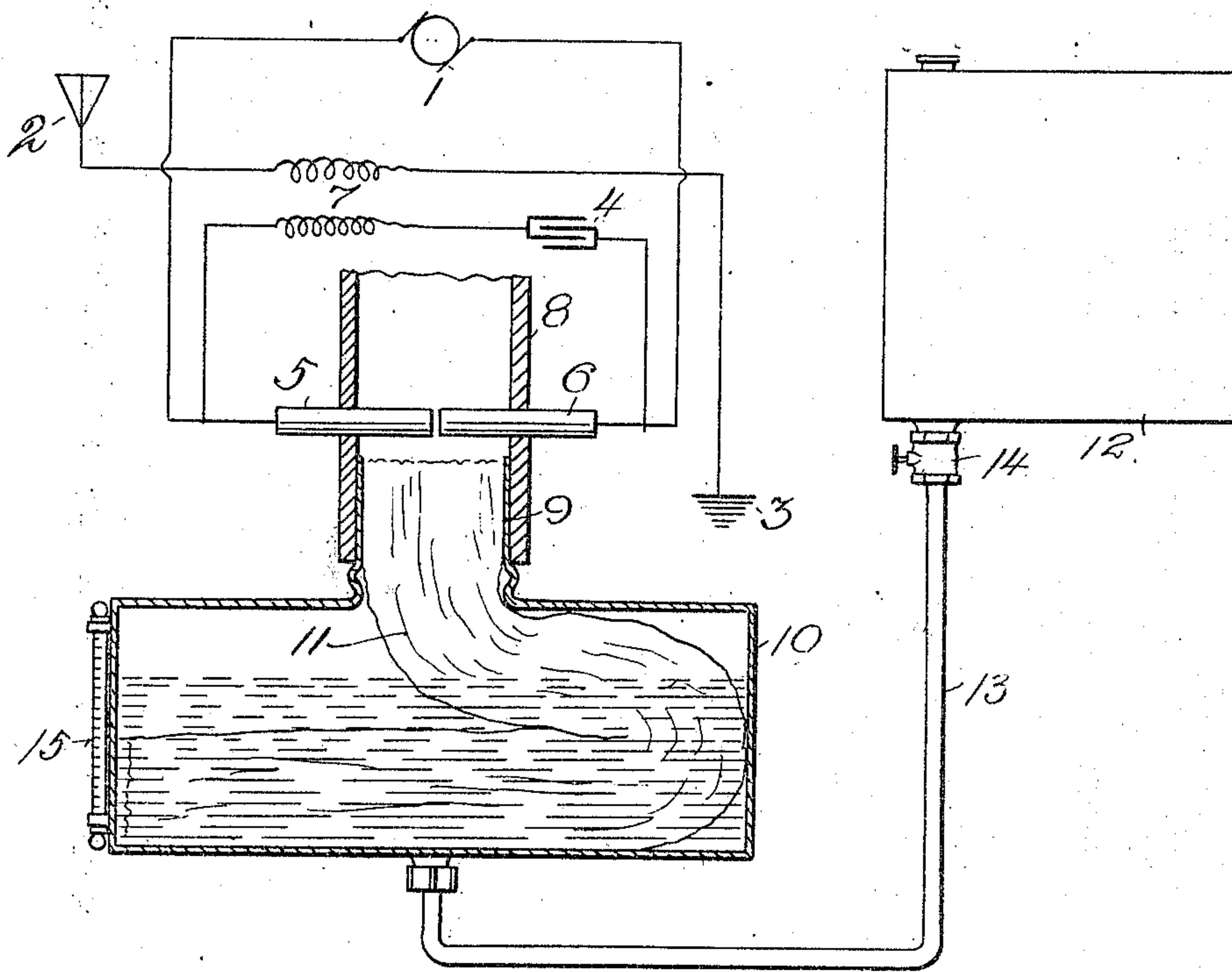


L. DE FOREST.  
TRANSMITTING APPARATUS.  
APPLICATION FILED AUG. 24, 1908.

966,539.

Patented Aug. 9, 1910.



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# UNITED STATES PATENT OFFICE.

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## TRANSMITTING APPARATUS

966,539.

Specification of Letters Patent.

Patented Aug. 9, 1910.

Application filed August 24, 1908. Serial No. 449,949.

*To all whom it may concern:*

Be it known that I, LEE DE FOREST, a citizen of the United States, residing at New York, in the county of New York and State of New York, have made a certain new and useful Invention in Transmitting Apparatus, of which the following is a specification.

This invention relates to systems for the transmission of signals or sounds through space telegraphically or telephonically, and more especially to such systems employing an electric arc to produce high frequency vibratory currents.

The object of the invention is to improve the efficiency of the arc circuit.

A further object is to maintain a uniform length of arc thereby avoiding irregularities due to variations in the arc length.

A further object is to prevent the accumulation of carbon or other deposits upon the electrodes more rapidly than such electrodes are consumed by the arc during the operation of the apparatus.

A further object is to obtain a quiet and steady arc for generating high frequency oscillations.

Other objects of the invention will appear more fully hereinafter.

The invention consists in forming the arc in a hydrocarbon or like vapor, as, for instance, in a vapor of alcohol containing a hydrocarbon or similar element.

The invention also consists in certain details of structure and arrangement for carrying it out, all substantially as will be more fully hereinafter set forth, as shown in the accompanying drawing and finally pointed out in the appended claims.

The single view of the drawing illustrates, diagrammatically, with parts in elevation and parts in section, an apparatus and arrangement for carrying out practically the objects and purposes of my invention.

In the practical operation of space telephone and telegraph systems employing, in the transmitting apparatus, an energizing circuit, commonly known as the "singing-arc" circuit, and which includes a condenser and means for producing an electric arc, I have experienced great difficulty by reason of irregularities resulting from variations

in the length of the arc, such variations causing instability and unsteadiness of the arc and a consequent derangement of the period or frequency of the oscillations. I have also found that where "atmospheres" or vapors are employed, in which the arc is formed, for the purpose of attempting to secure stability and steadiness of the arc, the tendency is to cause an accumulation of deposits upon the arc electrodes, which deposits, continuing to accumulate, build up teats or protuberances upon the electrode ends, thereby causing variations in the length of the arc, which result in grave irregularities in the energizing circuit, throwing the same out of resonance with the other circuits of the transmitting and receiving systems.

It is among the special purposes of my present invention to avoid these and other objections attendant upon the practical operation of wireless transmitting systems as heretofore carried out and in accordance with my invention I propose to provide means whereby deposits of carbon or like substance upon the carbon or other electrode is effected only in about the proportion such electrode is consumed by the arc.

I also propose, in accordance with the principles of my invention, to provide means for insuring a steady and uniform supply of the vapor or "atmosphere" to the arc.

In carrying out my invention in one form of practical application thereof, I form the arc in an "atmosphere" of alcohol or alcohol vapor employing for the purpose an alcohol containing a hydrocarbon in sufficient amount only to supply a carbon or other deposit on the carbon electrode in proportion or substantially the proportion in which the carbon electrode is consumed by the arc. I have found that denatured alcohol is efficient for my purposes, but other alcohols may be used when mixed with some suitable hydrocarbon in the proper proportions, as, for instance, alcohol containing approximately ten parts, more or less, of methyl alcohol or methylene to one hundred parts, more or less, of pure or ethyl 95% alcohol, the essential being that sufficient carbon containing element be mixed with the alcohol to produce or cause a deposit of carbon upon the carbon arc elec-



trode to substantially equal or approximate the consumption of the electrode by the arc. Unless this result is accomplished the arc is rendered unsteady and unstable, and the length of the arc is constantly decreasing or varying, thereby rendering the apparatus unsuited for use in wireless telephony, and very inefficient for use in wireless telegraphy.

My invention may be carried out practically in many specifically different ways, and with many specifically different arrangements of apparatus. While, therefore, I will now describe one form and arrangement for accomplishing the desired objects my invention, in its broadest scope is not to be limited or restricted to the specific details shown and hereinafter described.

In the drawing reference sign 1, designates a source of electromotive force, in this instance a direct current generator, 2, is an antenna or aerial, 3 an earth connection for the antenna, 4 a condenser, 5, 6, the arc electrodes, and 7, an inductance or autotransformer. These various parts may have the usual or any well known relative arrangement and relation. In the form shown the arc electrodes are included directly in circuit with the source of electromotive force, and also in circuit with the condenser and the primary of the induction coil or autotransformer, the secondary of the induction coil being included in circuit with the antenna and its earth connection.

The electrodes 5, 6, are arranged to extend into a tubular chimney 8, and from opposite directions, so that the arc is formed between the proximate ends of the electrodes within the chimney. This chimney is carried upon the neck 9, of a tank or vessel 10, designed to contain the carbon containing alcohol. A wick 11, is placed within this vessel and one end of such wick extends up into the neck 8, and into proximity with the arc electrodes. The carbon containing mixture is drawn up the wick by the heat of the arc and is vaporized in the region of the arc thereby forming the desired "atmosphere" or vapor envelop for the arc.

It is exceedingly desirable that the supply of vapor or "atmosphere" be maintained as steady and uniform as possible to the end that irregularities and variations in the arc may be avoided, and so as to attain the very best results. In order to accomplish this result I propose to feed the vessel 10, with the alcohol, or alcohol mixture, from a reservoir 12, which is placed at a higher level than the vessel 10, and connected thereto through a feed pipe 13, which, if desired, and preferably, connects to the bottom of the reservoir or vessel 10, as shown. A stop-cock 14, in the feed pipe may serve to control the flow of alcohol mixture from the reservoir or supply tank 12, to the vessel 10.

If desired, the vessel 10, may be supplied with a gage glass 15, thereby enabling the alcohol to be maintained at a constant uniform level in the vessel 10.

Having now set forth the object and nature of my invention and a construction and arrangement as an illustrative embodiment thereof, and having described such construction and arrangement, its purpose, function and mode of operation, what I claim as new and useful, and of my own invention, and desire to secure by Letters Patent is:—

1. In a transmitting apparatus, a circuit including a condenser and means for producing an electric arc, in combination with means for maintaining an atmosphere of denatured alcohol vapor about said arc.

2. In a transmitting apparatus, and in combination with a singing arc circuit, of means for maintaining the arc in an atmosphere or vapor of denatured alcohol.

3. The combination with means for developing electro-magnetic waves including arc electrodes between which an arc is formed, of means for supplying carbon to the electrodes in substantially the proportion in which the electrodes are consumed by the arc.

4. The combination with means for developing electro-magnetic waves including electrodes between which an arc is formed and a chimney inclosing the same, of means for maintaining a draft of carbon containing vapor through the chimney.

5. The combination with means for developing electro-magnetic waves including electrodes between which an arc is formed and a chimney inclosing the same, of means for maintaining a draft of vapor of carbon containing alcohol through the chimney.

6. The combination, with means for developing electro-magnetic waves including electrodes between which an arc is formed, of means for maintaining the arc in a vapor of a mixture of ethyl alcohol and methyl alcohol.

7. The combination with means for developing electro-magnetic waves including arc electrodes, a chimney into which the electrodes extend, a tank having a neck to support the chimney, a wick contained in the tank and extending into the neck and means for supplying a vapor producing material to the wick.

8. The combination with means for developing electro-magnetic waves including arc electrodes, a chimney into which the electrodes extend, a tank carrying the chimney, a wick arranged in the tank, and a reservoir supported in elevated position relative to the tank and communicating therewith.

9. The combination with means for de-



veloping electro-magnetic waves including  
arc electrodes, of means for enveloping the  
arc in an atmosphere produced from a mix-  
ture of pure or ethyl alcohol and methyl  
5 alcohol in about the proportion of ten parts  
of the methyl alcohol to one hundred parts  
of the ethyl alcohol.

In testimony whereof I have hereunto set

my hand in the presence of the subscribing  
witnesses, on this 15th day of August A. D., 10  
1908.

LEE DE FOREST.

Witnesses:

E. M. TRINES,

S. E. DARBY.