Nov. 8, 1927. H. H. SCHOTANUS À. STÉRINGA IDZERDA 1,648,402

METHOD AND ARRANGEMENT FOR HIGH FREQUENCY TELEPHONY

Filed May 7, 1921

Fig. 1.

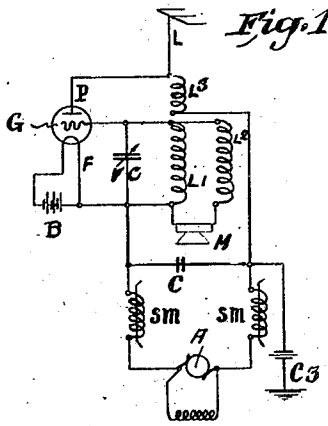


Fig. 2.

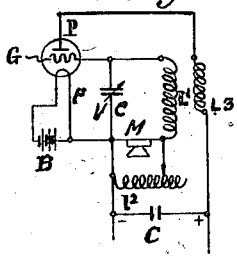


Fig. 3.

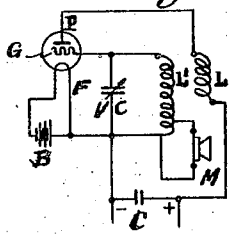


Fig. 4.

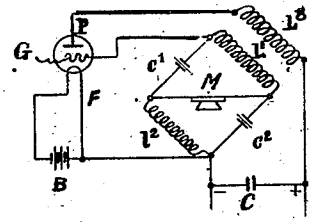


Fig. 5.

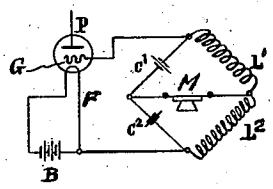


Fig. 6.

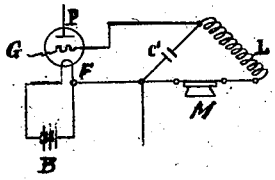


Fig. 7.

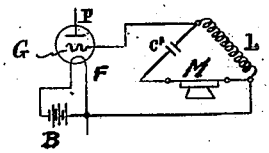


Fig. 8.

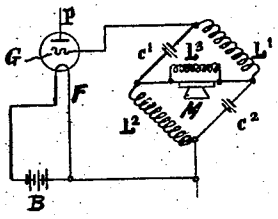


Fig. 9.

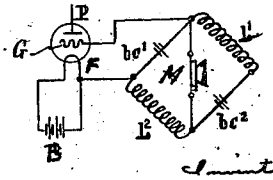
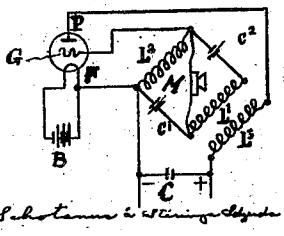


Fig. 10.



Inventor

Hanco Henricus Schotanus à Stéringa Idzerda

By his Attorneys

Pennie, Davis, Marvin & Edmonds

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UNITED STATES PATENT OFFICE.

HANSO HENRICUS SCHOTANUS À STÉRINGA IDZERDA, OF THE HAGUE, NETHERLANDS.

METHOD AND ARRANGEMENT FOR HIGH-FREQUENCY TELEPHONY.

Application filed May 7, 1921, Serial No. 467,586, and in the Netherlands January 14, 1920.

(GRANTED UNDER THE PROVISIONS OF THE ACT OF MARCH 3, 1921, 41 STAT. L., 1313.)

This invention relates to a method and arrangement for modulating high-frequency-waves and makes use of the principle that resistance-variations in highfrequency oscillatory circuits cause frequency-variations. For this a microphone is arranged in an oscillatory circuit in such a manner that the resistance-variations caused by the sound-waves in the microphone give rise to frequency-variations. The microphone is not used to cause current-variations by means of resistance-variations, as it is always the case both for wire-telephony and for wireless telephony.

A vacuum tube is advantageously used for generating undamped waves.

If two generating systems are brought near each other of which one system comprises a microphone, then the beat note, heard in a telephone connected in the usual way in the second (receiving) system will vary when the resistance of the microphone of the first system is varied for instance by a knock.

In order to use this principle a microphone is arranged in the gridcircuit of a triode-generator and this can be done advantageously in this case as the oscillating energy in this circuit is very small with respect to the energy in the anode-circuit or the antenna and therefore it is possible to use a normal microphone for a large amount of energy in the antenna. As the microphone can be shunted by pure inductance the application is nearly unlimited as regards the oscillating energy. For large values of energy a suitable way of connecting can be used; the currents passing through the microphone are a fraction of the total current in the circuit comprising the microphone, whereas the energy in this circuit is again very small with respect to that in the antenna or other energy receiving circuit.

I have illustrated the preferred embodiment of my invention in the accompanying drawings, in which

Fig. 1 is a diagrammatic view illustrating a telephone transmitting system embodying my invention, while Figs. 2–10, inclusive, are diagrammatic views showing systems embodying my invention, the particular connections in the various figures being somewhat different.

In Fig. 1, M indicates the microphone here shown connected between the two fixed inductances L_1 and L_2, and is in fact, shunted in series with the inductances L_2 across the grid circuit formed of the grid G, the inductance L_1 and the filament F, the variable condenser VC being also shunted across the grid circuit. The filament battery is indicated by B and the plate by P. The current in the plate circuit is generated by the direct current generator A through shunt coils SM shunted by the condenser C and grounded through condenser C_3. The inductance L_3 is also inserted in series between one pole of the direct current generator and the plate.

Fig. 2 shows a modification in which the microphone is connected between the variable condenser VC and the inductance L_1. The microphone is shunted by a variable inductance L_2.

In Fig. 3 the microphone is variably shunted across the inductance L_1, which forms part of the tuned grid circuit.

Figs. 4 and 5 show modifications in which the microphone is connected across a bridge arrangement and is shunted by condensers and inductances in series. In Fig. 4 the condensers C—1 and C—2 and inductances L_1 and L_2 are in parallel, whereas, in Fig. 5 the two condensers and the two inductances are in series.

Figs. 6 and 7 show simplified circuits in which the microphone is shunted across a condenser, in Fig. 6, and an inductance in Fig. 7.

Fig. 8 shows a modification in which a microphone is shunted with condensers and inductances in series in a bridge arrangement, and in addition, is directly shunted by the inductance L_3.

Figs. 9 and 10 show further modifications of the bridge arrangement.

As long as the membrane of the microphone is at rest no resistance-variations will appear and therefore the frequency or wavelength will be constant. As soon as soundwaves reach the microphone the resistance varies in accordance with the frequency of the soundwaves.

As a consequence of these frequency-variations, when used for wireless telephony, the antenna will, as long as sounds strike the microphone radiate the energy in different, varying frequencies and the energy picked up by the receiving system will vary with the frequency of the soundwaves.

Numerous variations in the above indicated arrangements are possible. The invention is not limited to wireless telephony, but can equally be applied for highfrequency-telephony or -telegraphy on wires.

The principal advantages of the invention are:

1. A common microphone can be used, even for relatively high values of the energy.

2. Modulation in sound-frequency, the emitted energy remaining constant.

3. The transmitted sounds are not distorted as is the case if a transformer is used.

4. Economical working because one triode can be used, whereas almost all other systems need two triodes.

5. For the same amount of radiated energy the range is much larger than for any other system.

6. The connections and operating are very simple.

7. Losses are reduced considerably because the microphone absorbs practically no energy and causes no damping.

As a result from a large series of tests can be stated that with sending apparatus according to the invention 30 watts in an antenna of an approximative height of 60 feet and a length of approximately 120 feet are sufficient to cover about 250 miles. Speech and music are transmitted very clearly.

For the same distance in other systems about 600 watts are necessary, whereas, by the use of two and more vacuum tubes, the primary energy often amounts to 2000 watts.

The same way of connecting can be used for telephony, or for telegraphy with undamped waves; the microphones can be shortcircuited.

Instead of an open antenna or a loop antenna, an ordinary telephone line can be used for the transmission of the highfrequency waves and the invention can then be used for highfrequency wire telephony or -telegraphy.

Having fully described my invention, what I claim is:

1. A high frequency valve telephone transmitter, having a grid circuit tuned to the energy transmitting circuit, said grid circuit comprising a microphone shunted by an impedance, consisting of a capacity and an inductance.

2. A high frequency valve telephone transmitter having a grid circuit tuned to the energy-transmitting circuit, said grid circuit comprising a microphone and a shunt for said microphone constituted by an inductance.

3. A high frequency valve telephone transmitter having a grid circuit tuned to the energy-transmitting circuit, said grid circuit comprising a microphone and a shunt for said microphone constituted by a capacity.

4. A high frequency valve telephone transmitter having a grid circuit tuned to the energy-transmitting circuit, said grid circuit comprising a condenser and two inductances, one of said inductances being connected in series with the microphone.

5. A high frequency valve telephone transmitter having a grid circuit tuned to the energy transmitting circuit, said grid circuit comprising a microphone connected intermediately between suitable inductances and capacities whereby the current reaching the microphone, must first traverse said inductances and capacities.

6. A high frequency valve telephone transmitter having a grid circuit tuned to the energy transmitting circuit, said grid circuit comprising a microphone connected intermediately between suitable inductances and capacities whereby the current reaching said microphone must first traverse said inductances and capacities and an additional impedance shunting said microphone.

In testimony whereof I have affixed my signature.

HANSO HENRICUS SCHOTANUS à STÉRINGA IDZERDA.