C. R. ENGLUND.
RADIOTELEPHONY.
APPLICATION FILED MAR. 11, 1916.

1,258,548. Patented Mar. 5, 1918.

Fig. 1.

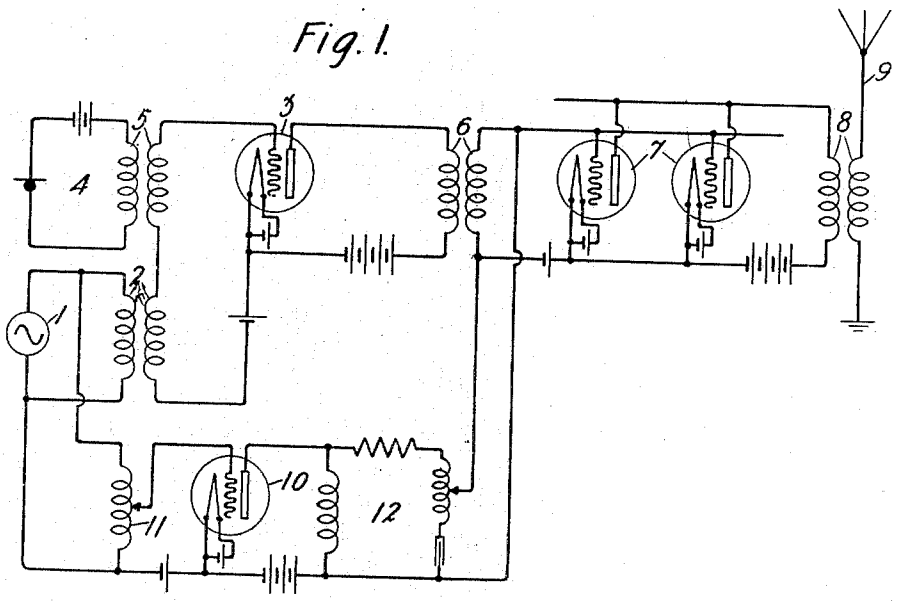
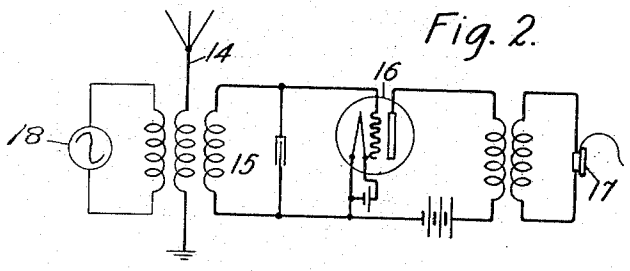


Fig. 2.



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UNITED STATES PATENT OFFICE.

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REISSUED

RADIOTELEPHONY.

1,258,548. Specification of Letters Patent. Patented Mar. 5, 1918.

Application filed March 11, 1916. Serial No. 83,504.

To all whom it may concern:

Be it known that I, CARL R. ENGLUND, a citizen of the United States, residing at East Orange, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Radiotelephony, of which the following is a full, clear, concise, and exact description.

This invention relates to radio telephony, and in particular to a system of transmission in which only the modulated portion of a high frequency wave is radiated from the antenna.

In radio telephony it has been customary to establish in a circuit a high frequency oscillation and to modulate the amplitude of this oscillation in accordance with a signal to be transmitted. Now, it is well-known that when a high frequency carrier wave of frequency C is modulated in accordance with a signal wave of frequency S, the resultant wave radiated from the antenna is made up of three parts of frequencies C—S, C and C+S, which components may be considered to be transmitted simultaneously through the ether. It has been proposed as described in British specification No. 17,170 of 1916 of which the serial number under the new British system of consecutive numbering, is 102,503, to eliminate from the antenna the unmodulated component of frequency C, and to transmit only the modulated portions represented by the other two components. When this method is adopted the radiated wave is spoken of as a pure modulated wave. The great advantage of this method is that the waste of power represented by currents of frequency C in the antenna is eliminated, and that there is some gain in the quality of received oscillation. In order to receive signals sent in this manner it is necessary to include at the receiving station, in addition to the usual apparatus, a small generator capable of delivering currents of the elminated frequency C, but since only a very small amount of power of this frequency is required at the receiving station, the auxiliary generator at that station need have but an extremely small power output.

In the specification above referred to, a certain method of eliminating the unmodulated component of the carrier wave is given, and this invention proposes still another way of accomplishing this purpose, namely, by superposing upon the modulated wave before it reaches the antenna an oscillation of carrier frequency which is equal in amplitude but opposite in phase to the oscillation of carrier frequency which represents the unmodulated portion of the wave to be transmitted. By this means the component to be eliminated from the antenna is neutralized in the apparatus between the primary modulating source and the antenna.

The invention will be more particularly described in connection with the drawing, in which Figure 1 represents a transmitting station constructed in accordance with this invention and Fig. 2 shows a form of receiving station by which the modulated waves may be received. This receiving station forms no part of this invention.

Referring to Fig. 1, 1 is a generator of oscillations of the frequency C and 2 a transformer by means of which these oscillations are impressed upon the input circuit of a thermionic modulator 3. 4 is a microphone circuit, the variations of current in which are impressed upon the same input circuit through the transformer 5. The result of this arrangement is, as is now well-known, to produce in the output circuit of the modulator 3 a high frequency current whose amplitude is modulated in accordance with the alternating currents set up in the microphone circuit. This output circuit is connected through transformer 6 to the common input circuit of a number of thermionic amplifiers 7 arranged in parallel, their common output circuit being coupled through transformer 8 to the radiating antenna 9.

The system so far described is characterized by the fact that currents of all three of the above mentioned frequencies occur in the antenna 9. By means of the apparatus next to be described the component of frequency C is prevented from reaching the antenna by being neutralized in the input circuit of the amplifier 7. To accomplish this, the input circuit of the amplifier 10 is connected through an autotransformer 11 to the terminals of the generator 1, the purpose of this autotransformer connection being to regulate the voltage impressed upon the input circuit of the amplifier 10. The output circuit of the latter is connected to a phase regulating device 12, which may be of any suitable form, and the voltage appearing across a section of this network is

then applied to the common input circuit of amplifiers 7. It will be clear that this latter voltage will have the frequency C of oscillations produced by the generator 1, and that these may be so regulated as to intensity and phase that they shall exactly neutralize the component of frequency C appearing in the input circuit of amplifiers 7 and prevents its appearance in the output circuit of the modulator. Currents of the frequency C will therefore not appear in the antenna 9. In case the amplifier 10 or the phase regulating device 12 are not so adjusted that the neutralizing current is exactly opposite in phase or equal in intensity to the component of frequency C of the modulated current, a small portion of the said component of frequency C may not be neutralized. In such a case, the system would be operative, but less efficient, as some energy would be radiated in the form of waves of frequency C. The expressions "equal in intensity" and "opposite in phase" should, therefore, be taken to mean substantially equal in intensity and substantially opposite in phase.

Referring to Fig. 2, 14 is a receiving antenna coupled to a resonant circuit 15 tuned to the frequency C of the waves to be received. 16 is a thermionic detector whose output circuit is connected through a transformer to the translating device 17. It will be clear that the waves received by this system will lack the component of frequency C, and the function of the auxiliary generator 18 is to supply small oscillations of this frequency. The circuit of this generator may be coupled in any suitable manner to the antenna 14 or to the resonant circuit 15.

Although this invention has been described as applying to radio telephony, it will be clear to those skilled in the art that a wire telephone line may be substituted for the antenna 9 without departing from the spirit of this invention. It will further be obvious that many other circuit arrangements may be devised by means of which the oscillation of frequency C may be neutralized in the input circuit of the amplifier 7.

What is claimed is:

1. The method of preventing the radiation of the unmodulated component of a signaling wave which consists in superposing upon said wave an unmodulated wave of equal value, but of phase opposite to that of the said unmodulated component.

2. The method of preventing the radiation of the unmodulated component of a signaling wave which consists in opposing said component by an equal wave.

3. A radio transmitting system comprising in combination means for generating and modulating high frequency oscillations, means for impressing upon said modulated oscillations an unmodulated oscillation of opposite phase, and means for amplifying and transmitting the resultant of said oscillations.

4. A radio transmitting system comprising in combination means for generating and modulating high frequency oscillations, means for neutralizing the unmodulated component of said modulated wave, and means for amplifying and transmitting the modulated portion of said wave.

5. In a radio transmitting system, the combination of means for generating high frequency oscillations in two circuits, means for modulating the oscillations of one of said circuits, means for changing the phase of said unmodulated oscillations in the other circuit so that it is substantially opposite to the phase of the unmodulated component of said modulated oscillations, and means for impressing said modulated and unmodulated oscillations of changed phase upon a third circuit.

In witness whereof, I hereunto subscribe my name this 9th day of March A. D., 1916.

CARL R. ENGLUND.