July 22, 1924.

1,502,063

W. SCHOTTKY

ELECTRIC WAVE RECEIVER

Filed Nov. 6, 1920

Fig. 1

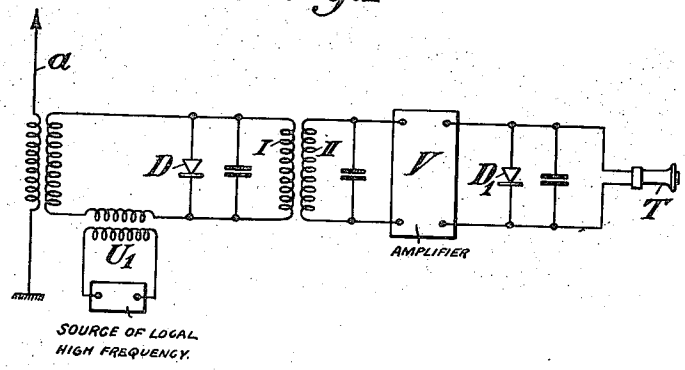


Fig. 2

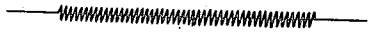


Fig. 3

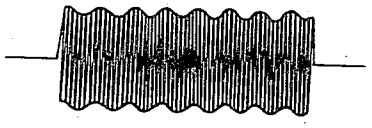


Fig. 4



Fig. 5

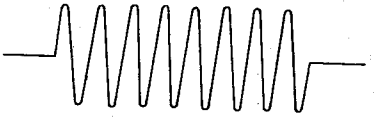
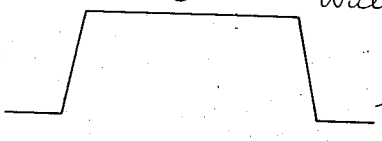


Fig. 6



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UNITED STATES PATENT OFFICE.

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ELECTRIC-WAVE RECEIVER.

Application filed November 6, 1920. Serial No. 422,339.

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

To all whom it may concern:

Be it known that I, WALTER SCHOTTKY, a citizen of the German Empire, residing at Wurzburg, Germany, have invented certain new and useful Improvements in Electric-Wave Receivers, for which I have filed applications in Germany on June 18, 1918; Austria on May 30, 1919; France on August 14, 1919, Patent No. 518,890; and England, November 7, 1919, Patent No. 135,177, and of which the following is a specification.

My invention refers to the transmission of wireless signals and more especially to the receivers employed for this purpose and its particular object is a receiver system for electric waves of superior efficiency.

In wireless telegraphy it is known that by superposing a high frequency energy generated at the receiving station over oscillations to be received and having an almost identical frequency a variation of the wave-amplitude can be generated in the apparatus whose frequency corresponds to an audible signal.

This method, commonly called "beat reception" in the art, involves a number of advantages. First of all it is possible to obtain an audible signal by simple rectification from such a high frequency energy and variation of the amplitude. Furthermore the efficiency of the rectifier is improved. For it is a property peculiar to rectifiers acting as detectors that the rectifier current increases at least for small amplitudes approximately in proportion to the square of the effective pressure and that therefore their efficiency at very small high frequency alternating current amplitudes is very low. For large amplitudes such as are formed by superposition of local frequencies the sensibility is on the contrary about a linear one. Owing to this increase in efficiency of the rectifier an amplifying tube can be dispensed with in many cases. The increase of the amplitude by superposition is superior to the increase by high frequency amplification in so far as troubles caused by high frequency waves of a different frequency result in case of beat reception in a widely different and generally inaudible frequency, whereas the high frequency amplifier tube amplifies such troubles as well as the signal.

In wireless telephony it has been proposed to employ a superposition frequency of such sort that the group or beat frequency resulting from it and from the arriving high frequency lies above the telephonic frequency in order not to trouble the receiving by sound of the signals. However this method is not applicable there and then, for the direct application of the rectifier effect does not furnish any effect whatever in a telephone or a like apparatus, the positive and the negative crests of group frequency balancing each other in their total effect.

The present invention furnishes means for practically carrying out the beat reception with inaudible group frequencies. This is effected principally by the transformation of the wave current of the rectifier into an alternating current which is then rectified once more for the purpose of forming the signal. If the system would comprise merely the two detectors with a transformation of the current, which might be an inductive one, between them, the second detector (rectifier) would obtain current amplitudes which are not greater than those of the antenna current and which work in a correspondingly unfavorable manner. According to the present invention, therefore, the current is amplified between the rectifiers.

It is further possible to prevent within wide limits all troubles inherent to high and low frequency currents by tuning to the group frequency. The selective preference for a predetermined frequency may also be carried out by means of a suitable amplifier tube, those parts of said tube which are capable of resonance, being to this end tuned to the corresponding group frequency.

In the drawings affixed to this specification and forming part thereof the preferred form of a system of connection for beat reception according to my invention is illustrated,

Fig. 1 showing diagrammatically the system of connection, while

Figs. 2 to 5 show the forms of the waves at different reception stages, and

Fig. 6 shows the wave form of the signal received.

Referring to the drawings, on the high frequency received from the antenna *a* a

local high frequency of such sort is superposed from a suitable source by means of a transformer U_1, that the group frequency resulting therefrom lies either between the high frequency and the low frequency or preferably above audible frequency. This audible beat or group frequency is then rectified in the detector D and transferred by the oscillatory circuits I, II which are tuned to this group frequency, to the amplifier tube V. The amplified wave impulses coming from the amplifier tube V are rectified in the detector D_1 and can then be received as audible frequency currents in the receiver T.

Fig. 2 shows the form of the high frequency waves arriving at the station, while Fig. 3 shows the wave after the superposition of the local high frequency wave and the beat wave produced in the transformer U_1. Fig. 4 shows the wave after rectification in the detector D and after inductive transfer from oscillatory circuit I to oscillatory circuit II. The wave has not been amplified, but its amplitude is the same, as in the original wave, and is merely transformed into the lower group frequency. Fig. 5 shows the waves of the same group frequency after the passage through the amplifier tube V. Fig. 6 shows the signal resulting from the passage of waves according to Fig. 5 through the second detector D_1.

I claim:—

1. A receiving system for high frequency electric waves comprising in combination a local source for superimposing on the received frequency a local frequency different from that received and adapted to produce a beat frequency current above the limit of audibility, a rectifier adapted to rectify said beat frequency current, means tuned to said beat frequency for transforming said rectified current into alternating current, an amplifier tube for amplifying said current, and means for rectifying said amplified current to produce an audible signal.

2. A receiving system for high frequency electric waves comprising in combination a local source for superimposing on the received frequency a local frequency different from that received and adapted to produce a beat frequency current above the limit of audibility, a rectifier adapted to rectify said beat frequency current, means tuned to said beat frequency for transforming said rectified current into alternating current, an amplifier tube having its circuit connection tuned to said beat frequency and adapted to amplify said alternating current and means for rectifying said amplified current to produce an audible signal.

In testimony whereof I affix my signature.

WALTER SCHOTTKY.