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H. J. ROUND

RECEIVING SYSTEM FOR WIRELESS TELEGRAPHY AND TELEPHONY

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*Fig. 1.*

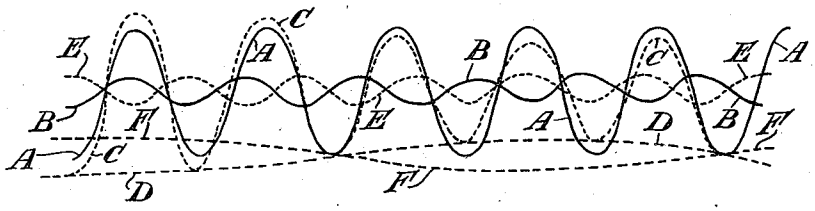
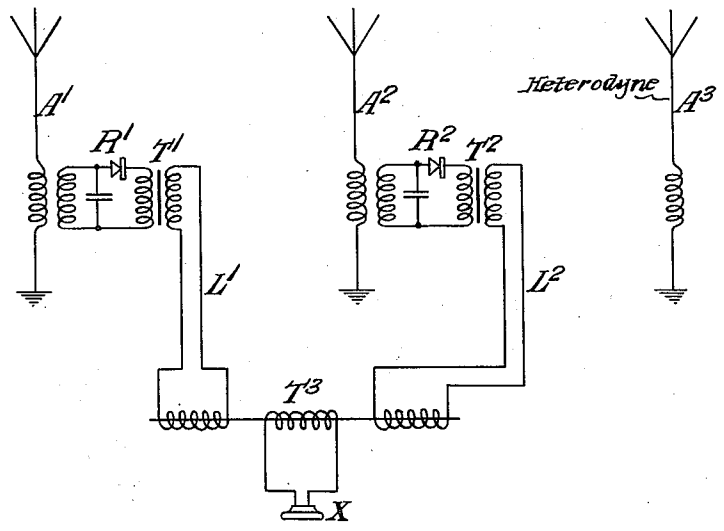



*Fig. 2.*




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# UNITED STATES PATENT OFFICE.

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## RECEIVING SYSTEM FOR WIRELESS TELEGRAPHY AND TELEPHONY.

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*To all whom it may concern:*

Be it known that I, HENRY JOSEPH ROUND, a subject of the King of Great Britain, residing at 9 Woodberry Crescent, Muswell Hill, London, England, have invented new and useful Improvements in Receiving Systems for Wireless Telegraphy and Telephony, of which the following is a specification.

This invention relates to improved methods of receiving wireless signals by which incoming signals can be affected as desired and may when it is so required be rendered ineffective.

It is well known that when two high frequency currents of different frequency are caused to act simultaneously in a circuit the result when rectified and passed through a telephone produces a beat tone. In certain cases this beat tone is beyond the frequency for audibility and a further process is necessary in order to make it audible.

It has now been discovered that the phase of the beat tone can be altered by altering the phase of either of the two original high frequency currents. Thus, if one of the high frequency currents has its phase shifted through $n$ degrees, the phase of the other current remaining constant, the beat tone shifts through $n$ degrees also.

According to this invention incoming signals are heterodyned so as to produce a beat current and on this beat current is superimposed another current of a frequency equal to that of the beat current, the phase of the heterodyne or of the signals being adjusted so as to render the phase of the beat current such that the beat current can be added algebraically to the other current in any desired manner.

Thus if it is desired to eliminate the effect of certain signals, these signals are heterodyned so that on each of two receiving aerials, which are spaced a fraction of the wave length of the signals apart, there may be the same phase difference between the signals and the heterodyne, and therefore the beat currents in the two aerials can be made to balance one another with the result that the signals are ineffective.

The invention is illustrated by the accompanying drawing in which Figure 1 is a diagram of frequencies while Figure 2 is a diagram illustrating a receiving station.

In Figure 1 the curves A, A, and B, B, represent two frequencies and the curve C, C, represents these two added. The envelope D, D, represents approximately the rectified beat tone due to these two frequencies. The curve E, E, represents the same frequency as the curve B, B, but altered in phase through 180° and the envelope F, F, represents approximately the rectified beat tone due to A, A, and E, E, and is similar to D, D, but 180° out of phase with it. In the same way a reversal of phase of A, A, leaving B, B, unaltered, will produce the same effect and any intermediate change of phase will be likewise reproduced in the envelope.

Figure 2 shows how this invention may be applied to the elimination of signals. $A^1$, $A^2$, are two receiving aerials spaced a fraction of the wave length of the signals apart. They are coupled to rectifiers $R^1$, $R^2$, connected to low frequency transformers $T^1$, $T^2$, which are connected by lines $L^1$, $L^2$, to a balancing transformer $T^3$, with a telephone X on a tertiary winding.

$A^3$ is a transmitting aerial situated in the plane of $A^1$ and $A^2$ and capable of supplying heterodyne current.

If signals arrive from a distant station in the plane of $A^1$, $A^2$, $A^3$, then, since the difference in phase between the signals and the heterodyne from $A^3$ is the same on aerial $A^1$ as on aerial $A^2$, except for a second order difference due to the slight difference of frequency between the signals and the heterodyne current the beat tones produced after rectification of the currents in aerials $A^1$ and $A^2$ will balance in transformer $T^3$ and thus the signals will not be effective in the telephone, but if signals come from any direction other than that of the plane through $A^1$, $A^2$, $A^3$, the beat tones due to the currents in aerials $A^1$ and $A^2$ will be different in phase and will not balance except in particular instances where the currents produced in the aerials by the signals are 90° or 180° apart.

As the lines $L^1$, $L^2$, only have to carry low frequency beat currents they may be ordinary telegraph lines and the telephone may be situated at practically any distance from the aerials $A^1$, $A^2$, and it is therefore possible to sum up the effects of currents in aerials at a considerable distance away, and

a number of aerials such as those used in parabolic formations may be similarly connected to a distant detector.

What I claim is:—

1. A method of receiving wireless signals which consists in combining a slightly different heterodyne frequency with the signals so as to produce a beat current, superimposing on the beat current another current of the same frequency, and adjusting the phase of the heterodyne or of the signals to adjust the phase of the beat current to a desired phase relative to the other current.

2. A method of receiving wireless signals which consists in combining slightly different heterodyne frequency with the signals so as to produce a beat current, rectifying the beat current, superimposing on the beat current another current of the same frequency and controlling the phase of the heterodyne or of the signals to bring the phase of the beat current to a desired phase relative to the other current.

3. A step in the method of eliminating certain wireless signals which consists in receiving the signals on aerials spaced apart a fraction of the signal wave length heterodyning the signals so that at any moment there may be substantially the same phase difference between the heterodyne and the signals on each of said aerials.

4. A method of eliminating certain wireless signals which consists in receiving such signals on aerials spaced apart a fraction of the signal wave length heterodyning the signals so that at any moment there may be substantially the same phase difference between the heterodyne and the signals on each of said aerials and combining the beat currents in opposition.

5. A method of eliminating wireless signals which consists in receiving such signals on aerials spaced apart a fraction of the signal wave length heterodyning the signals so that there may be substantially the same phase difference between the heterodyne and the signals on each of said aerials rectifying the beat currents thus produced and combining the rectified currents.

6. A method of eliminating wireless signals which consists in receiving the signals on aerials spaced apart a fraction of the wave length combining a slightly different heterodyne frequency with the signals so that there may be substantially the same phase difference between the heterodyne and the signals on each of said aerials, rectifying the beat currents thus produced and adding algebraically the rectified currents.

7. A method of receiving wireless signals which consists in receiving the signals in a plurality of aerials, heterodyning all of the signal currents from the same source to produce a plurality of beat frequency currents of the same frequency, combining the beat frequency currents and adjusting the phase of the heterodyne or the signals to cause said beat frequency currents to combine in a desired manner.

8. A wireless receiving system comprising a plurality of receiving aerials, means for generating a heterodyne frequency adapted to produce a beat with the received signals, means for supplying said heterodyne frequency to said receiving aerials in different phase relation to control the phase of the beat currents produced, and means for combining said beat currents.

9. A wireless receiving system comprising a plurality of receiving aerials, a heterodyne for producing a frequency adapted to beat with received signals, means for supplying said heterodyne frequency to said aerials in different phase relation and means for combining the beat currents produced.

10. In radio signaling, the method of obtaining reception directionally selective in a horizontal plane with a plurality of spaced aerials which comprises supplying the same heterodyne frequency to said aerials, and controlling the phase relation of such heterodyne frequencies with respect to each other to provide for zero indication of signals from a predetermined direction.

11. In radio signaling, the method of obtaining directional selectivity with a plurality of aerials which comprises supplying such aerials with the same heterodyne frequency and controlling the relative phase relation of said heterodyne frequency at each aerial to provide for zero response to signals from a predetermined direction.

12. In radio receiving the method of obtaining directional selectivity which comprises the step of supplying a plurality of receiving aerials with the same heterodyne frequency, and controlling the phase relations of said heterodyne frequency at said aerials with respect to each other to obtain the desired directional selectivity.

13. The method of controlling the relative phase of a plurality of currents resulting from the interaction of component currents of different frequencies which consists in controlling the phase relation of one of said component currents to produce the desired phase relation of said resultant currents.

HENRY JOSEPH ROUND.