Feb. 17, 1942. J. HAANTJES ET AL 2,273,640

SUPERHETERODYNE RECEIVER

Filed June 14, 1940

Fig. 1

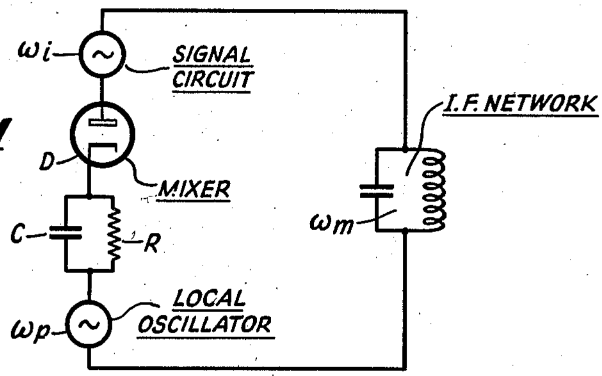


Fig. 2

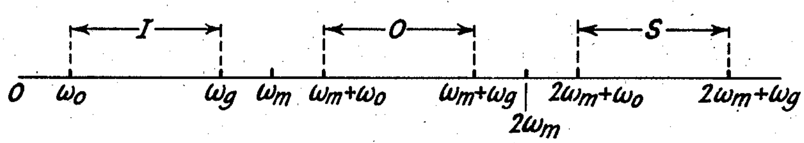
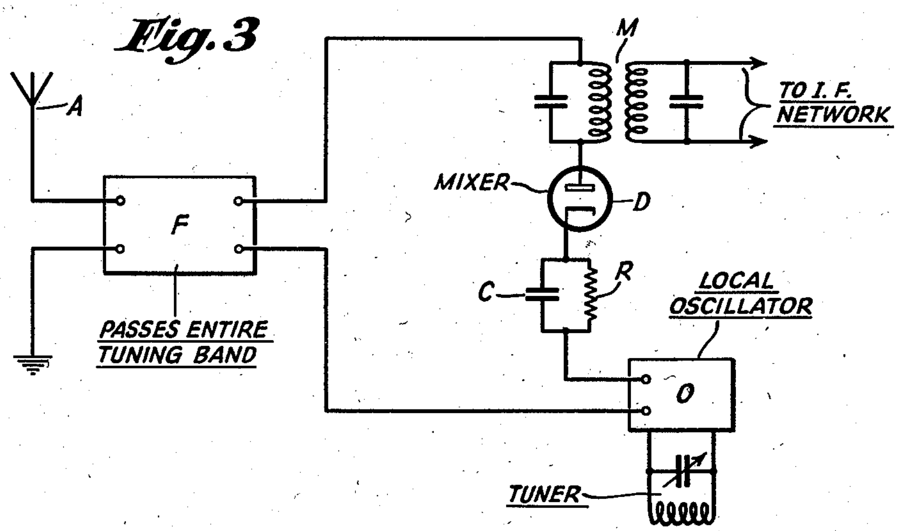


Fig. 3



INVENTORS
JOHAN HAANTJES AND
BERNARDUS D. H. TELLEGEN
BY H. S. Grover
ATTORNEY.

Patented Feb. 17, 1942 2,273,640

UNITED STATES PATENT OFFICE

2,273,640

SUPERHETERODYNE RECEIVER

Johan Haantjes and Bernardus D. H. Tellegen, Eindhoven, Netherlands, assignors to Radio Corporation of America, a corporation of Delaware

Application June 14, 1940, Serial No. 340,500
In the Netherlands September 8, 1939

7 Claims. (Cl. 250—20)

This invention relates to superheterodyne receivers, particularly to those in which at any one time the entire band of the oscillations to be received is admitted to the mixing valve, as is the case for example with so-called "infradyne" sets. Thus, with these sets it is possible to use only a single tuning circuit for the oscillator by making the intermediate frequency sufficiently high; that is to say, beyond the highest incoming frequency.

The present invention consists in that with such a receiver a diode is used as a mixing valve, and is based on recognition of the fact that the use of a diode circuit for this purpose involves the use of automatic preliminary selectivity with the result that the signals which are instantaneously undesired yield a comparatively small voltage on the diode so that cross modulation and howling noises are not troublesome.

In order that the invention may be clearly understood and readily carried into effect it will now be described more fully with reference to the accompanying drawing wherein Fig. 1 shows a schematic of the invention, Fig. 2 shows the frequency scale of the system, Fig. 3 illustrates a receiver embodying the circuit of Fig. 1.

Fig. 1 is a well known mixing circuit in which a diode D serves as the mixing valve; the latter forms a closed circuit jointly with a resistance R shunted by a condenser C, a source of local oscillations, an intermediate frequency (I. F.) circuit and a source of incoming oscillations. If ω_i is the frequency of the instantaneously desired station and ω_m the frequency to which the intermediate frequency circuit is tuned, the frequency ω_p of the oscillator must be chosen so that

$$\omega_p=\omega_i\pm\omega_m$$

and for infradyne: $\omega_p=\omega_i+\omega_m$.

Now, the impedance of such a circuit for frequencies adjacent ω_i is equal to that of the parallel combination of a resistance R and a circuit tuned to ω_i whose impedance and absolute width are equal to those of the intermediate frequency circuit. If the resistance R of Fig. 1 is shunted by the condenser C only in part, this substitution circuit is slightly altered but the tuned circuit remains.

If, therefore, in tuning the oscillator to ω_p a wide band of frequencies on either side of ω_i is impressed on the circuit, the latter will have a much greater impedance for the desired frequency ω_i than for the higher or lower frequencies so that automatic preliminary selection results. This latter fact is of considerable importance with the infradyne circuit.

Fig. 2 shows a frequency dial scale of such an infradyne set. The frequency range I comprised between ω_0 and ω_g is that of the incoming oscillations. ω_m is the intermediate frequency. The range O comprised between $\omega_m+\omega_0$ and $\omega_m+\omega_g$ is that of the oscillator. The range S comprised between $2\omega_m+\omega_0$ and $2\omega_m+\omega_g$ is that of the mirror frequencies which have to be suppressed. With the infradyne this suppression is generally effected by a low-pass filter.

Fig. 3 shows one form of construction of an infradyne circuit according to the invention. The signal oscillations in an antenna A are supplied to the input terminals of a low pass filter F. Between the output terminals of this filter are connected in series the primary of an intermediate frequency transformer M, a diode D, a resistance R shunted by a smoothing condenser C and an oscillator O. The filter F suppresses the mirror frequencies, and the automatic preliminary selective nature of the remaining part of the circuit insures that cross modulation and howling noises due to the stations undesired at that instant do not become troublesome. This latter effect may be assisted by selection of a higher oscillator voltage, and also by an improvement of the mixing characteristic of the diode, by shunting the resistance R only in part by a smoothing condenser.

What is claimed is:

1. In combination with a diode mixer tube, a filter network constructed to pass all the carrier frequencies in a desired tuning range, a local oscillator provided with means for tuning the oscillator over a range of frequencies differing from said carrier frequencies by an intermediate frequency, said intermediate frequency exceeding the highest carrier frequency of said range, and an intermediate frequency circuit, said filter, oscillator and intermediate circuit being connected in a closed series circuit with the electrodes of said mixer tube.

2. In combination with a diode mixer, a low pass wave input circuit constructed to pass without selection all modulated carrier waves comprised in a wide range, means impressing the waves passed by said input circuit upon said mixer, a local oscillator including means for tuning it to different desired frequencies comprised in a frequency range different from the carrier frequencies by a predetermined intermediate frequency, said intermediate frequency being chosen substantially higher than the highest carrier fre-

quency of said input range, means comprising a resistor shunted by a condenser applying the oscillator output upon said mixer device, and an output circuit connected to said mixer device tuned to said intermediate frequency.

3. In combination with a mixer device of the electron discharge type, a wave input circuit constructed to pass without selection all modulated carrier waves comprised in a wide range, means impressing the waves passed by said input circuit upon said mixer, a local oscillator including means for tuning it to different desired frequencies comprised in a frequency range differing from the carrier frequencies by a predetermined intermediate frequency, said intermediate frequency being chosen substantially higher than the highest carrier frequency of said input range, means applying the oscillator output upon said mixer device, and an output circuit connected to said mixer device tuned to said intermediate frequency, said mixer device being a diode, and said input circuit being a low pass filter adapted to attenuate all frequencies in excess of said highest carrier frequency.

4. In combination with a mixer device of the electron discharge type, a wave input circuit constructed to pass without selection all modulated carrier waves comprised in a wide range, means impressing the waves passed by said input circuit upon said mixer, a local oscillator including means for tuning it to different desired frequencies comprised in a frequency range differing from the carrier frequencies by a predetermined intermediate frequency, said intermediate frequency being chosen substantially higher than the highest carrier frequency of said input range, means applying the oscillator output upon said mixer device, and an output circuit connected to said mixer device tuned to said intermediate frequency, said mixer being a diode, said input circuit having a pair of output terminals, said oscillator having a pair of output terminals, and said two pairs of output terminals, said output circuit and diode space current path all being arranged in series relation.

5. In a superheterodyne receiver, an aperiodic signal input network adapted to transmit solely the signal energy comprised in a wide band of signal carrier frequencies, a diode mixer tube, means applying signal energy passed by said network to said diode, a local oscillator connected to said diode, means for tuning the oscillator over a range of frequencies substantially higher than the highest carrier of said band, and an output circuit connected to said diode which is tuned to a frequency equal to the difference between the highest carrier of said band and the frequency of said oscillator range.

6. In a superheterodyne receiver, an aperiodic signal input network adapted to transmit solely the signal energy comprised in a wide band of signal carrier frequencies, a diode mixer tube, means applying signal energy passed by said network to said diode, a local oscillator connected to said diode, means for tuning the oscillator over a range of frequencies substantially higher than the highest carrier of said band, a resistor in series with the space current path of the diode, a condenser in shunt with the resistor, and an output circuit connected to said diode which is tuned to a frequency equal to the difference between the highest carrier of said band and the frequency of said oscillator range.

7. In a superheterodyne receiver, an aperiodic signal input network adapted to transmit solely the signal energy comprised in a wide band of signal carrier frequencies, a diode mixer tube, means applying signal energy passed by said network to said diode, a local oscillator connected to said diode, means for tuning the oscillator over a range of frequencies substantially higher than the highest carrier of said band, and an output circuit connected to said diode which is tuned to a frequency equal to the difference between the highest carrier of said band and the frequency of said oscillator range, said aperiodic network, output circuit and oscillator all being in series relation with said diode.

JOHAN HAANTJES.
BERNARDUS D. H. TELLEGEN.