

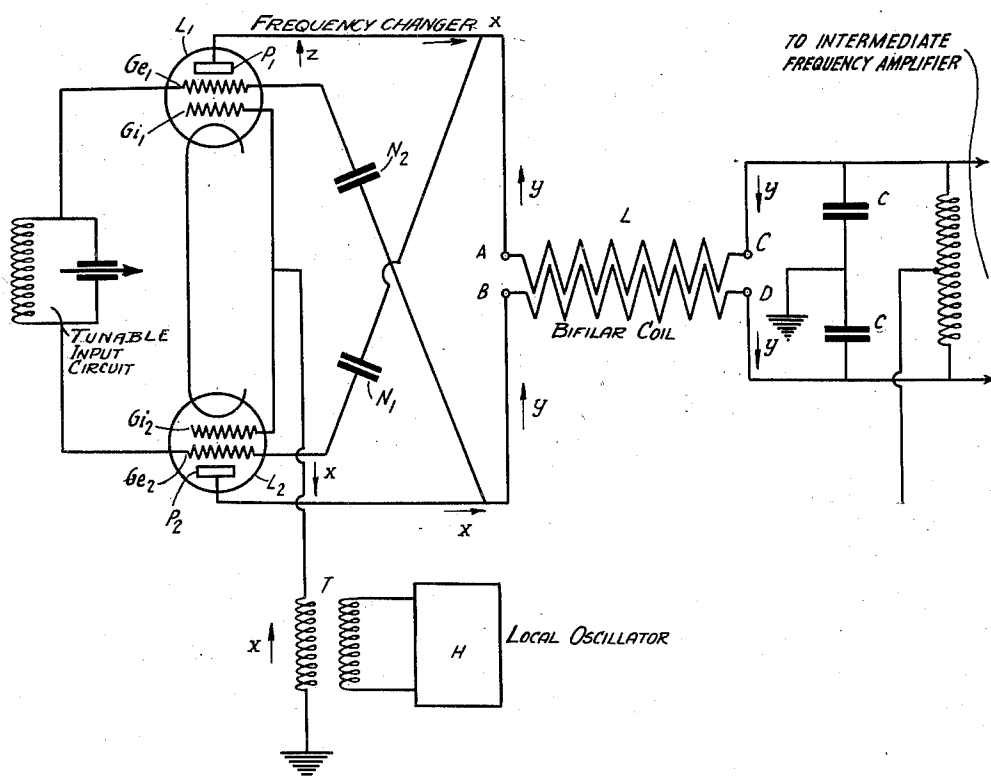
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HETERODYNE SYSTEM

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HETERODYNE SYSTEM

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The present invention relates to improvements upon superheterodyne circuit schemes disclosed heretofore by me in U. S. P. 1,907,624 with a view towards improving the effectiveness of the same.

I have heretofore disclosed arrangements in the said patent adapted to prevent reaction between the different frequencies in a heterodyne system. However, it has been found that the present improvements considerably improve the operation of the aforementioned earlier arrangements.

In the drawing is shown a superheterodyne circuit involving the present invention. The circuit consists of a stage of two double grid detector tubes L_1 and L_2 in push-pull. The outer grids are excited by the received signal and the inner grids by a local oscillator H. In this way the stage in question operates as a frequency changer, and supplies the output circuit with an intermediate frequency, amplified by a push-pull amplifier (not represented in the figure which only shows at the right connections to the input of this amplifier). At the output of this amplifier the frequency will be as usual detected and rendered audible so as to permit its indication. The flow of signal oscillations through the intermediate frequency amplifier (not shown) is prevented by the aid of neutralizing condensers N1, N2. As the heterodyne H acts in parallel upon the grids G1 and G2 of double-grid tubes L_1 and L_2 its action upon the push-pull amplifier of medium frequency is compensated.

Still, it is true that the oscillations of the heterodyne H flow directly across the various capacities of the tubes, and the coupling from the intermediate frequency amplifier as far as the detector tubes, which are then excited in parallel by the heterodyne oscillations (whereas they are excited in symmetry by the intermediate frequency oscillation).

Inasmuch as detection is associated with an integration effect, the oscillations due to the heterodyne H are detected separately by the two detector tubes, and their effects become added at the output end. This results in an unnecessary increase in the stray noise. Moreover, if the heterodyne is modulated with a musical frequency (reception of pure c. w. telegraph signals), a musical note will be constantly perceivable in the ear phones even in the absence of any signal.

Now, this is obviated according to the present invention by inserting between the plates P1 and P2 of tubes L_1 and L_2 and the input end of the intermediate frequency amplifier, a bifilar inductance coil L, the coil setting up a high imped-

ance for radio frequency currents which act in parallel, but a very small impedance for intermediate frequency currents which act in push-pull.

The undesirable action which the present invention intends to remedy arises in circuit arrangements comprising a frequency changer stage consisting of two tubes, in the case of a difference between the mode of action upon the amplifier of medium frequency by the mean frequency resulting from the beats of the heterodyne and the signal, on the one hand, and on the frequency changer by the heterodyne constituting the local source, on the other hand. Two cases have thus to be examined, to wit:

(A) The mean frequency (MF) acts upon the intermediate frequency amplifier in parallel.

The heterodyne (H) acts upon the frequency changer in a push-pull scheme.

(B) The mean frequency acts upon the intermediate frequency amplifier in push-pull. The heterodyne acts upon the frequency-changer in parallel.

To obtain each of the cases A and B, it is necessary that the signal (S) should act upon the frequency-changer push-pull fashion.

In each of the cases A and B it is possible to realize circuit arrangements with single-grid tubes and with twin-grid tubes. It is the arrangement of class B, using twin-grid tubes that appears by way of example in the drawing.

In the drawing there is indicated by arrows x currents of the heterodyne transmitted by virtue of the self-capacitance of the tubes, and by arrows y currents of mean frequency resulting from a superposition of the heterodyne and the signal. It will be seen that the mode of action on the intermediate frequency amplifier is different in regard to the x and the y currents. It is the x currents which are undesirable in the intermediate frequency circuit, and it will be seen that it is desirable to eliminate them.

According to the invention these x currents are eliminated by inserting between the plates of the frequency-changer tubes and the intermediate frequency amplifier an element setting up a high impedance for the x current and a very low impedance for the y currents. This element is constituted by a bifilar inductance coil. In the case of circuit schemes of the aforesaid class B the same will have to be connected in series ahead of (below) the intermediate frequency amplifier.

As a matter of fact, for the x currents which are unidirectional the mutual inductance M of the bifilar coil L becomes added to the self-in-

ductance of each of the wires of L so that the aggregate inductance is $2L+M$ and this may attain a considerable value. So far as the y currents are concerned which, on the contrary, are of opposite directions, the resultant inductance will be $2L-M$ and the same may become almost zero.

Hence, with input capacities c of the intermediate frequency filter whose middle point is grounded, the coil L thus forms a radio frequency filter whereby it is possible to reduce as much as may be desired the flow of radio frequency energy in the intermediate frequency amplifier. Inasmuch as the inductance of coil L is very small for the intermediate frequency wave, it will not act in any manner upon the intermediate frequency circuits.

Obviously, part, or the whole, of capacities c may be placed at AB instead of CD as shown in the drawing which is merely a non-limiting example.

While I have indicated and described one arrangement for carrying my invention into effect, it will be apparent to one skilled in the art that my invention is by no means limited to the particular organization shown and described, but that many modifications may be made without departing from the scope of my invention as set forth in the appended claims.

What I claim is:

1. In a superheterodyne receiver, a frequency-changer circuit comprising at least one stage with two tubes, a signal-collecting circuit connected with the inputs of the said tubes in a push-pull arrangement, a local source of energy associated with these tubes for heterodyning with the signals, means impressing the frequency resulting from the said heterodyne action upon an amplifier, and an impedance element disposed in the circuit connecting the output of the frequency-changer with the input end of the said impressing means, the impedance of the said element being very low for the frequency resulting from the heterodyne action and very high for the frequency of the said local source.

2. In a superheterodyne receiver, a frequency-changer circuit comprising at least one stage with two tubes, a signal-collecting circuit connected with the inputs of these tubes in a push-pull arrangement, a local energy source associated with these tubes to cause beats with the signal, means for impressing the frequency resulting from the beats upon an amplifier, and an inductance coil wound bifilar-fashion, and disposed in the circuit

connecting the output of the frequency changer with the input of the said impressing means whereby there is set up an impedance very low for the frequency resulting from the beat action and a very high impedance for the frequency of the said local source.

3. In a superheterodyne receiver, a frequency changer circuit comprising at least one stage with two tubes, a signal-collecting circuit connected with the inputs of these tubes in a push-pull arrangement, a local source of energy, exciting in parallel these tubes for heterodyning with the signal, means for impressing the frequency resulting from the heterodyning upon an amplifier, and a bifilar inductance of two wires, each wire of which is connected respectively in series in the connection between the plate of each of the said two tubes and the input of the said impressing means which sets up an impedance very low for the frequency resulting from the beat and an impedance very high for the frequency of the said local source.

4. In a superheterodyne receiver, a frequency-changer comprising at least one stage with two twin grid tubes, a signal collecting circuit connected with the grids of these tubes in a push-pull arrangement, a local energy source connected with the other grids of these tubes for beating with the signal, means for impressing the frequency resulting from the beats upon an amplifier, and a bifilar inductance coil disposed in the circuit connecting the output of the frequency changer and the input of the said impressing means which sets up an impedance very low for the frequency resulting from the beating action and a very high impedance for the frequency of the said local source.

5. In a superheterodyne receiver, a frequency changer comprising at least one stage with two twin grid tubes, a signal collecting circuit connected with the grids of the said tubes in a push-pull arrangement, a local energy source exciting in parallel the other grids of these tubes for beating with the signal, means for impressing the frequency resulting from the beating upon an amplifier, and a bifilar inductance coil of two wires, each one of which wires is connected, respectively, in series with a connection between the plate of each of the said tubes and the input of the said impressing means which sets up a very low impedance for the frequency resulting from the beating and a very high impedance for the frequency of the said local source.

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