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SUPERHETERODYNE RECEIVER

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Fig. 1

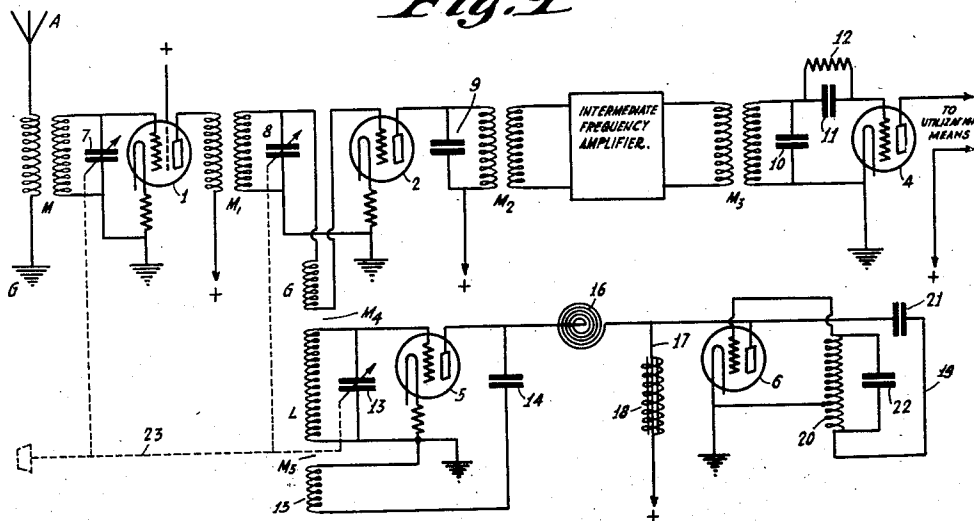
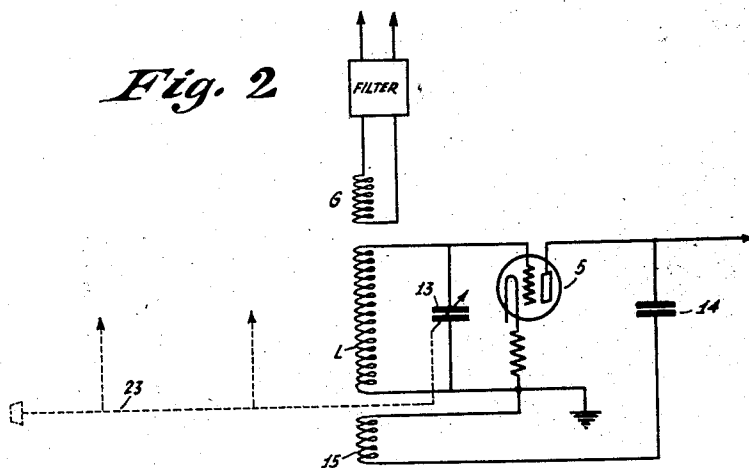


Fig. 2



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SUPERHETERODYNE RECEIVER

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1 Claim. (Cl. 250—20)

My present invention relates to heterodyne receivers, and more particularly to novel, and improved, methods of operating a superheterodyne receiver.

trolled even though utilizing identically similar tuning condensers.

Superheterodyne receivers of the prior art employ one, or more, circuits tuned to a desired signal frequency in order to exclude interfering frequencies, and a local oscillator circuit tuned to a frequency different from the desired signal frequency by a constant amount, the difference frequency being equal to the frequency to which the intermediate frequency amplifier is fixedly tuned. It has been necessary to adopt various devices, some more or less mechanically and electrically complicated, to maintain such difference frequency constant throughout a desired range of signal frequencies, and simultaneously secure uni-control.

Another important object of the present invention resides in the provision of a superheterodyne receiver which will be free of the disadvantages enumerated heretofore, and which receiver comprises a local oscillator circuit tuned to substantially the same natural period as the signal circuit, both circuits including tuning condensers and means for simultaneously and similarly varying the condensers, and additional means for modulating the local oscillations with oscillations having a frequency substantially similar to a desired intermediate frequency.

For example, the plates of the condensers utilized in the signal and oscillator circuits have been differentially cut in order to vary the various condensers simultaneously, and, according to some predetermined law, provide a constant difference frequency. Again, other arrangements, electrical in nature, have been employed for automatically regulating the tuning of the signal or oscillator circuits, in accordance with variations in tuning of either of the latter, to maintain the aforementioned difference frequency constant when uni-controlling the signal and oscillator circuits. Still other arrangements have been utilized to obtain uni-control in a superheterodyne receiver, but these, also, involve drawbacks from the point of view of simplicity of construction.

Another object of the invention is to provide a receiver adapted to receive code, music, or voice modulated signals, the receiver employing the superheterodyne principle of operation, but being free of certain constructional disadvantages present in receivers of the prior art, and embodying signal and oscillator circuits, both tuned to substantially the same natural period, and an additional oscillator circuit for modulating the output of the first oscillator with a frequency equal to the desired intermediate frequency.

Still other objects of the invention are to improve generally the simplicity of superheterodyne receivers, and to particularly provide a receiver of this type which is not only manufactured economically, but operated with greater ease and reliability than superheterodyne receivers of the prior art.

Now, I have discovered a novel method of operating a superheterodyne receiver which will be free of the aforementioned difficulties attendant upon present superheterodyne receivers. Additionally, I have devised arrangements embodying the novel method, such arrangements, briefly, consisting in maintaining the natural period of the tuned circuit of the local oscillator substantially similar to the natural period of the tuned signal circuit, or circuits, and modulating the output of the oscillator with oscillations whose frequency is substantially similar to the intermediate frequency being utilized.

The novel features which I believe to be characteristic of my invention are set forth in particularity in the appended claim, the invention itself, however, as to both its organization and method of operation will best be understood by reference to the following description taken in connection with the drawing in which I have indicated one arrangement whereby my invention may be carried into effect.

In the drawing,

Fig. 1 diagrammatically shows a receiver embodying the invention,

Fig. 2 is a detail of a modified form of the invention.

Accordingly, it may be stated that one of the main objects of the present invention is to provide a method of, and means for, superheterodyne operation wherein the natural periods of the signal and oscillator circuits are maintained similar throughout a desired frequency range, thereby permitting these circuits to be uni-con-

Referring to the accompanying drawing wherein like reference characters represent the same elements in the different figures, there is shown in Fig. 1 a receiver comprising a grounded circuit A, G coupled, at M, to the input circuit of a screen grid tube 1. As is well known in the prior art, the tube 1 may be replaced by any other type of tube, and the input circuit is tuned by a variable condenser 7. The output circuit of tube 1 is

coupled at M₁, to the input circuit of a triode 2.

The input circuit of tube 2 is tuned by a variable condenser 8, and it is to be understood that triode 2 can be replaced by any other type of tube.

5 The output circuit of tube 2 includes the fixed capacity 9 for maintaining such circuit fixedly tuned to a desired intermediate frequency. An intermediate frequency amplifier is coupled, at M₂, to the output circuit of tube 2. The amplifier is
10 conveniently represented, as it is well known in the prior art.

The input circuit of a triode 4 is coupled, at M₃, to the output of the intermediate frequency amplifier. The input circuit of tube 4 is fixedly
15 tuned, by a capacity 10, to the intermediate frequency, the grid circuit of the tube including a series capacity 11 shunted by a grid leak 12 to render the tube 4 a detector. Any type of utilization means, as head phones, speaker and
20 the like, may be connected to the output of the detector.

The local oscillator circuit includes a triode 5, having an input circuit comprising an inductance coil L shunted by a tuning condenser 13. The
25 coil L is coupled, at M₄, to a coil G arranged in series in the grid circuit of tube 2, for a reason to be later described in detail. The anode of tube 5 is coupled back to the input circuit of the tube by a capacity 14 and coil 15 in series be-
30 tween the anode and cathode, the coils 15 and L being coupled, at M₅.

A modulating oscillator tube 6 has its anode connected in parallel with the anode of tube 5, through a radio frequency choke coil 16. The
35 source of potential supply (not shown) is connected, by a lead 17 including a choke coil 18, to a point between the anode of tube 6 and the choke 16. To produce oscillations, the grid of tube 6 is connected by a lead 19 to the anode of the tube, a
40 coil 20 and capacity 21 being connected in series in the lead. A capacity 22 is shunted across the coil 20, and maintains the input circuit of tube 6 tuned to the modulating frequency, the latter being the same as the intermediate frequency.
45 The cathode of tube 6 is connected to an intermediate point of coil 20.

The tuning condensers 7, 8 and 13 are arranged, in any manner well known to those skilled in the art, for common mechanical control, the latter
50 being generally designated by the dotted lines 23. The tuning condensers 7, 8 and 13 are similar in construction. That is to say, it is not necessary, as is the case in the prior art, to provide differently shaped plates in the signal and local
55 oscillator circuit condensers.

In the operation of the present invention, the natural period of the tuned input circuit of the oscillator tube 5 is maintained the same as the natural period of the tuned input circuits of tubes
60 1 and 2 thereby allowing all the circuits to be uncontrolled, although tuned by identically similar condensers. In order to produce radio frequency voltages differing in frequency from the signal by a constant amount, the output circuit of the
65 oscillator tube 5 is modulated by the output of oscillator tube 6, whose frequency is the same as the frequency to which the intermediate frequency amplifier is tuned. The radio frequency oscillations impressed by coil L upon coil G may
70 be analyzed into three frequencies, as is well known. These three frequencies are the natural frequency of the input circuit of oscillator tube 5, the frequency higher by the modulating frequency, and a frequency lower by the same modulating frequency. These two latter frequencies,

when impressed upon the frequency changing tube 2 of the receiver, produce beats with the signal frequency and these beats are of the desired intermediate frequency. It is, of course, necessary to insure by means of suitable shielding that the
80 output of the modulating oscillator tube 6 shall not reach the intermediate frequency system of the receiver.

As the local oscillator frequency is varied, a whistle will be heard which passes through the
85 well known zero beat condition when the oscillator frequency is exactly equal to the signal frequency. This is due to the fact that, in effect, two separate oscillator voltages are applied to the frequency changing tube 2 which produce two
90 beat frequencies, these beat frequencies, if not exactly alike, form audible beats in the final detector. Thus, in receiving continuous wave telegraph signals with this system, it is not necessary to have a second heterodyne applied to render
95 the intermediate frequency current audible. The total number of tubes required in this system is not increased, and we have the advantage of being able to use similar condensers throughout, and uni-control the latter.

The present system can be used for reception of signals modulated by voice, or music, if the oscillator frequency is maintained exactly synchronous with the carrier frequency of the signals.
100 In case it is not feasible to maintain this adjustment so accurately, the difficulty may be overcome by suppressing one of the two side frequencies generated by the modulation of the oscillations generated by tube 5. For example, if the intermediate frequency employed is 1600 kilo-
105 cycles, then the upper side frequency will vary from 2100 to 3100 kilocycles when the oscillator tuning is varied from 500 to 1500 kilocycles. During this variation neither the oscillator frequency nor the lower side frequency ever has a
110 value anywhere between 2100 to 3100 kilocycles.

Therefore, in Fig. 2, a fixed filter indicated by the word "Filter" may be utilized to select the upper side frequency, and reject all other components of the oscillator output. This selected upper side frequency may, then, be used as the heterodyne voltage for the superheterodyne in exactly the same fashion as if a simple heterodyne oscillator generating frequencies from 2100 to 3100 kilocycles had been used.
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The filter circuit may be constructed in accordance with well known principles so as to pass only frequencies of say 2000 kilocycles in the instance given above. Thus, any frequency below 2000 kilocycles would be cut off.
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While I have indicated and described several systems 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 organizations shown and described, but
135 that many modifications may be made without departing from the scope of my invention as set forth in the appended claim.

What I claim is:

An improvement in a receiver of the superheterodyne type said receiver being adapted for the reception of signal modulated carrier waves and comprising a radio frequency amplifier having a tunable input circuit including a variable condenser, a local oscillator having a variable con-
140 denser in its frequency determining circuit to control the frequency of oscillations generated thereby, a first detector circuit having a tunable input circuit including a variable condenser and an intermediate frequency amplifier, said vari-
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able condensers being of similar construction and arranged for mechanical uni-control adjustment to tune simultaneously their respective circuits to the frequency of a desired carrier wave all of said tunable circuits being tuned to the same frequency at all times and an additional oscillator adapted to generate oscillations of said fixed intermediate frequency the output of said additional oscillator being connected to said local oscillator and arranged so as to modulate the oscillations of said carrier wave frequency generated by the local oscillator, the production of said modulation including the oscillations generated by the local oscillator and the sum and difference frequencies generated by the local oscillator and the additional oscillator, said improvement comprising means for coupling the local oscillator output to the first detector input, said coupling means including a filter circuit for transmitting only the upper side frequency of the modulated local oscillator output and rejecting all other components of the output of said local oscillator including oscillations generated by the local oscillator to thereby allow reasonable deviations between the frequency generated by the local oscillator and the frequency of the incoming signal oscillations without causing undesired beat energy to traverse the receiving circuit.

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