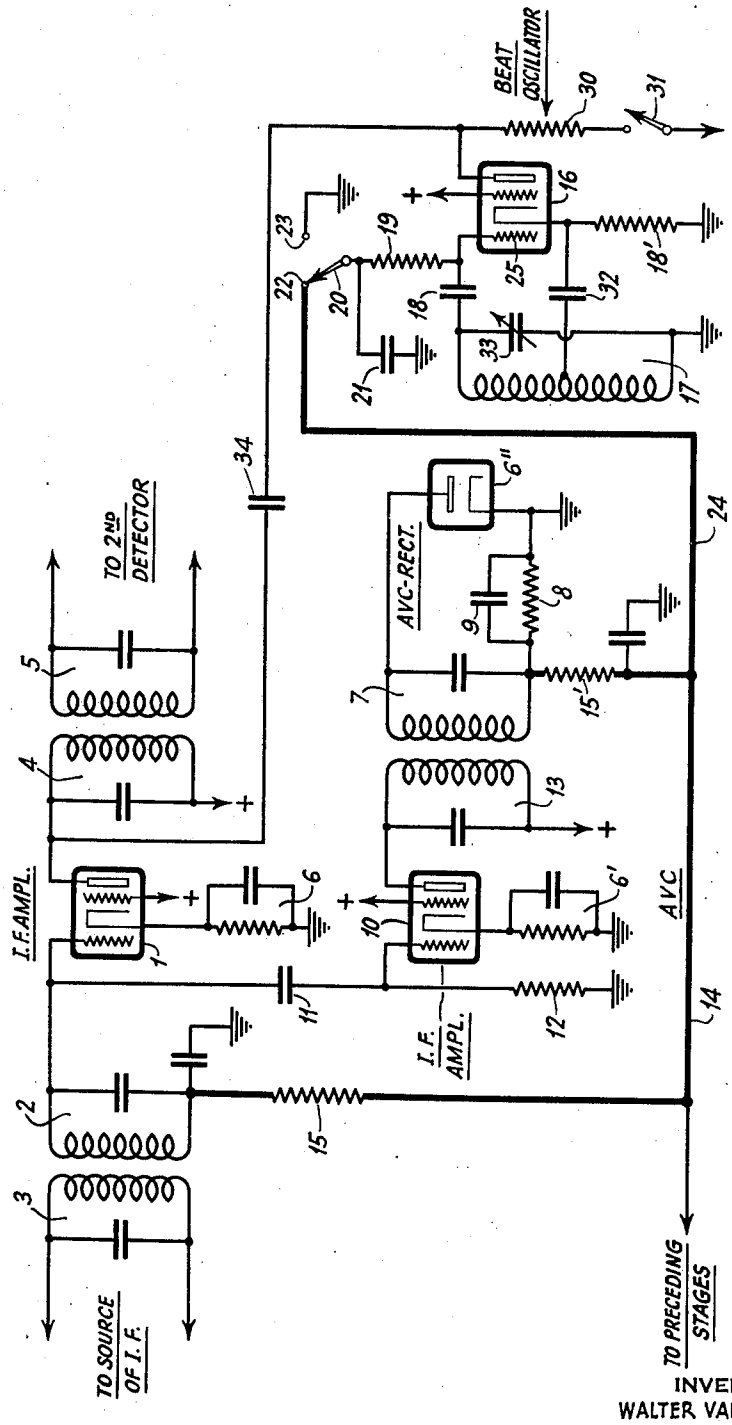
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SIGNAL CONTROLLED SIREN OSCILLATOR CIRCUIT

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SIGNAL CONTROLLED SIREN OSCILLATOR CIRCUIT

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My present invention relates to resonance indicators for superheterodyne receivers, and more particularly to an audible resonance indicator for a superheterodyne receiver wherein the indicator is of the beat oscillator type.

It may be stated that one of the important objects of this invention is to provide a beat oscillator in conjunction with the second detector of a superheterodyne receiver, and wherein the beat oscillator preferably is tuned to the operating IF during the reception of voice or music-modulated carrier waves; and means being employed for automatically squelching the oscillations due to the beat oscillator when the receiver is tuned to exact resonance.

Another important object of the invention is to provide in a superheterodyne receiver an automatic volume control arrangement which derives its signal energy from the input circuit of an IF amplifier; a beat oscillator being provided for feeding oscillations to the output circuit of the amplifier whereby an audible whistle is heard during the process of tuning to a desired resonance point; and the automatic volume control arrangement being additionally connected to the beat oscillator to render the latter inoperative when the receiver is tuned to the desired resonance point.

Still other objects of the invention are to improve generally the efficiency of beat oscillator resonance indicators for receivers of the superheterodyne type, and more especially to provide such resonance indicators in such a manner that they are not only reliable in operation but economically manufactured and assembled in the receiver.

The novel features which I believe to be characteristic of my invention are set forth in particularity in the appended claims; 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 diagrammatically a circuit organization whereby my invention may be carried into effect.

Referring now to the accompanying drawing it will be observed that there is shown in schematic manner that portion of a superheterodyne receiver circuit which is essential to an understanding of the present invention. The numeral 1 denotes an IF amplifier whose input circuit 2 may be coupled to a circuit 3 providing the IF energy. The latter may be disposed in the plate circuit of a preceding IF amplifier, or it may be connected in the plate circuit of the first detector. Again, the networks between circuit 3 and the usual signal collector may comprise one or more stages of tunable radio frequency amplification; and the converter network may be of the combined local oscillator-first detector type, or it may utilize independent oscillator and first detector tubes. Furthermore, the receiver may be of the multi-range type adapted for broadcast or code reception. Since such construction is well known to those skilled in the art, no further description is believed necessary.

The output circuit 4 of amplifier 1 is coupled to the input circuit 5 of the second detector, or demodulator. The second detector may be of the 55 type wherein a common envelope houses a diode detector and a triode, or even a pentode, audio amplifier. One or more stages of audio amplification may follow the demodulator, and the customary reproducer, such as a loud speaker or head phones, may follow the last audio amplifier. The numeral 6 denotes the conventional signal grid biasing network disposed in the cathode lead of IF amplifier 1, it is to be understood that similar biasing networks are used in preceding amplifiers. Each of circuits 3, 2, 4 and 5 is fixedly tuned to the operating IF, and the latter may be chosen from a range of 75 to 465 kc.

Automatic volume control (AVC) is provided by a diode rectifier which comprises the diode tube 6'', there being connected in series between the anode and grounded cathode of the diode a path including the IF tuned circuit 7 and the load resistor 8. The resistor 8 has developed across it direct current voltage whose amplitude is directly proportional to the amplitude of the IF carrier energy impressed on circuit 7, the condenser 9 being connected in shunt with resistor 8 to bypass IF currents. An IF amplifier 10 is employed to amplify the IF energy derived from the input circuit 2, and which IF energy in amplified form is impressed on circuit 7.

For this purpose the signal input grid of amplifier 10 is connected to the input grid of amplifier 1 through a condenser 11, the signal grid of tube 10 being connected to ground through the resistor 12. The bias network 6' is disposed in the grounded cathode lead of amplifier 10, and the IF tuned output circuit 13 of amplifier 10 is magnetically coupled to the input circuit 7. The direct current voltage developed across resistor 8 is utilized as the AVC bias, and the lead 14 is connected from the anode side of resistor 8 to the signal grid circuits of the controlled signal transmission tubes. The filter resistors 15 and 15' are disposed in the AVC line to suppress the pulsating

components in the AVC bias transmitted through lead 14.

Those skilled in the art are fully aware of the manner in which the AVC arrangement functions. As the signal carrier amplitude at circuit 7 increases, the AVC bias developed across resistor 8 increases, with the result that the negative bias impressed on the signal grid of amplifier 1 increases. Since the bias developed across the network 6 functions to provide the no-signal bias for maximum amplification, the AVC bias acts to reduce the gain of tube 1. This same action occurs in connection with the tubes of all controlled transmission networks. In this manner the carrier amplitude at input circuit 5 is maintained substantially uniform regardless of wide variations in amplitude at the signal collector.

A beat oscillator is employed to audibly indicate when the receiver has been tuned to exact resonance with a desired signal. This beat oscillator comprises a tube 16 having a resonant circuit 17 connected between its grid and cathode. The grid is connected to the high alternating potential side of circuit 17 through the condenser 18, while the low potential side of the circuit is grounded. The cathode of tube 16 is connected to ground through the bias resistor 18', the bias developed across resistor 18' being applied to the input grid through resistor 19. One side of resistor 19 is connected to an adjustable tap 20, the same side of the resistor being connected to ground through a condenser 21. The tap 20 is adapted to be adjusted into contact with either of contact points 22 or 23.

Contact point 23 is grounded whereas 22 is connected to the AVC lead 14 through the direct current potential connection 24. Thus it will be seen that in either position of tap 20 the direct current voltage developed across resistor 18' provides the normal bias for the input grid 25 of tube 16. The plate of tube 16 is connected to a proper positive potential point through a resistor 30 and a manually adjustable switch 31. The condenser 32 connects the cathode side of resistor 18' to an intermediate point on the coil of circuit 17 in order to provide the well known type of oscillator circuit. Numeral 33 denotes the condenser, which may be somewhat adjustable in nature, for tuning the circuit 17 to the desired frequency. Oscillations produced by the beat oscillator are impressed upon the demodulator input circuit through a path which includes condenser 34 and the output circuit 4 of amplifier 1.

Assuming that voice or music-modulated carrier waves are being received, the tap 20 is adjusted to the position shown in the drawing, that is in contact with contact point 22. The tap 31 is closed. In this circuit arrangement an audible whistle will be heard as the tuning instrumentality of the receiver is varied towards, or away from, the desired signal position of the tuning means. While the tuning device of the receiver has not been shown, it will be understood that it may comprise the usual uncontrolled variable condensers in the signal and local oscillator circuits of the receiver. When the tuning device has been adjusted to exact resonance position the AVC bias developed across resistor 8 will be applied through lead 24 to the input grid 25 of oscillator tube 16. This will result in a squelching of the oscillations from the beat oscillator.

For reception in the broadcast band the condenser 33 will be adjusted to tune the circuit 17 to the operating IF. In order to ensure that the beat oscillator does not itself generate an appreciable AVC voltage, the resistor 18' is designed to develop sufficient bias to prevent the drawing of grid current. In this way the beat oscillator, when the receiver has not been adjusted to exact resonance with a desired station, is able to inject oscillations into the demodulator circuit. As the tuning is incorrect, a weak signal generates little AVC voltage across resistor 8, and the beat oscillator operates producing a beat note which varies with tuning in the manner of an oscillating detector well known in the prior art.

When the receiver has been accurately tuned to a desired station, the beat note is made low in pitch due to the increasing AVC bias on grid 25, and the beat note is automatically stopped. In this manner, it will be recognized, there is a difference between the present beat oscillator circuit and that known in the prior art which produces "zero beat" reception. Due to the automatic squelching of the oscillations from the beat, or siren, oscillator at exact resonance, it is not necessary for the receiver operator to render the siren oscillator inoperative after the station has been tuned in. This facilitates search for distant stations when the arrangement is used for distant station reception.

Constant strength oscillations in the siren oscillator, as well as smooth starting and stopping, are obtained by suitable choice of resistor 19 which is grounded for radio frequencies by condenser 21 so that the load on the oscillator circuit is independent of the position of adjustable tap 20. It will be noted that the beat oscillator voltage is injected into the output circuit 4 of IF amplifier 1. This is done to prevent the beat oscillator voltage from reaching the AVC rectifier 6''. If the beat oscillator voltage were permitted to reach the AVC source, it will be readily seen that the AVC action would be detrimentally affected.

When it is desired to receive code, the tap 20 is moved into contact with contact point 23, the tap 31 being closed. Condenser 33 is adjusted for the desired beat note with a signal tuned into maximum as indicated by any desired type of plate current meter in the stages controlled by the AVC circuit.

When it is desired to eliminate the siren oscillator, the tap 31 is opened. This prevents the impression of oscillator voltage on the demodulator input circuit, and thus eliminates the possibility of a beat note when a desired carrier is tuned in. This elimination of the siren oscillator may be necessary when receiving signals so weak that the AVC bias is insufficient in intensity to stop oscillations from the beat oscillator. This may be the case in the short wave ranges; or when receiving relatively distant stations in the broadcast range.

It will now be appreciated that there has been provided in connection with a siren oscillator for a superheterodyne receiver, a means for automatically eliminating the beat whistle, which warns the operator that a signal carrier is being tuned in, when the receiver has been adjusted to resonance with the carrier. This eliminates the necessity for the operator opening or closing switches during the process of tuning and finding different stations. It may be pointed out in addition that instead of having the AVC connection 24 bias grid 25 to oscillation cut-off, the switch 31 may be automatically opened by an

electro-mechanical device responsive to the plate current flow of the AVC-controlled signal transmission tubes. In the latter case when the receiver is tuned to exact resonance, the plate currents of the control tubes drop appreciably, and a relay device of any conventional type can be used to permit the electro-mechanical mechanism to open switch 31 and thus render the beat oscillator inoperative.

While I have indicated and described a system 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, an intermediate frequency amplifier, a second detector, a beat oscillator arranged to feed oscillations of a predetermined frequency equal to the operating intermediate frequency to a point in the receiver network between the intermediate frequency amplifier and the second detector, an automatic volume control circuit having a negative biasing connection to an electrode of said beat oscillator to control the operation of the latter, and means for impressing intermediate frequency energy upon the control circuit from a point in the receiver network preceding said first point.

2. In a superheterodyne receiver of the type comprising a second detector and at least one intermediate frequency amplifier feeding the latter, an automatic volume control circuit having a signal input connection to the intermediate frequency amplifier input circuit, a siren oscillator tuned to the operating intermediate frequency and arranged to impress its oscillations upon the receiver at a point between the intermediate frequency amplifier and the second detector, and a negative biasing connection between the volume control circuit and a control electrode of the oscillator whereby the oscillator is rendered inoperative when the signal energy impressed on said intermediate frequency amplifier is of a frequency equal to the operating intermediate frequency.

3. In a receiver as defined in claim 2, said oscillator including a tube having circuits arranged to produce oscillations, and means for biasing the control electrode of the tube in such a manner that grid current flow is prevented whereby said oscillator tube is rendered inoperative only by the bias applied through said biasing connection.

4. In a receiver as defined in claim 1, said beat oscillator including a tube whose control electrode is maintained negatively biased to prevent grid current flow in the absence of negative bias impressed through said biasing connection, and means for disconnecting said connection from the beat oscillator electrode.

5. In a superheterodyne which is provided with an intermediate frequency amplifier, second detector and an audio reproduction circuit, an automatic volume control arrangement having an intermediate frequency input circuit connected to the input circuit of the intermediate frequency amplifier, an oscillator tube having circuits connected to the electrodes thereof to produce oscillations of a frequency equal to the operating intermediate frequency, means for impressing said oscillations upon the second detector input circuit whereby a beat note is produced when the signal energy fed to the second detector is substantially equal to the operating intermediate frequency, a biasing connection between said volume control circuit and the control grid of the said oscillator tube for impressing a negative bias upon the control grid which is sufficient to render the oscillator tube inoperative to produce oscillations when said signal energy is exactly equal to the operating intermediate frequency.

6. In combination with a signal amplifier tuned to an operating carrier frequency and a demodulator circuit coupled to the amplifier output circuit, a siren oscillator circuit arranged to impress oscillations of said frequency upon a point between the amplifier and the demodulator circuit, said oscillator including a tube including an oscillation control electrode, an automatic gain control circuit having a signal input connection to the amplifier input circuit and a direct current voltage output circuit, and a connection between the latter circuit and said control electrode for biasing the electrode in a sense to render the oscillator inoperative when signals of said frequency are impressed on the amplifier.

7. In combination with a signal amplifier tuned to an operating carrier frequency and a demodulator circuit coupled to the amplifier output circuit, a siren oscillator circuit arranged to impress oscillations of said frequency upon a point between the amplifier and the demodulator circuit, said oscillator including a tube including an oscillation control electrode, an automatic gain control circuit having a signal input connection to the amplifier input circuit and a direct current voltage output circuit, a connection between the latter circuit and said control electrode for biasing the electrode in a sense to render the oscillator inoperative when signals of said frequency are impressed on the amplifier, and a biasing connection between the direct current voltage circuit and said amplifier to control the gain of the latter.

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