Feb. 9, 1937. O. H. SCHADE 2,069,854

AUTOMATIC NOISE SUPPRESSOR CIRCUIT

Filed Aug. 10, 1935

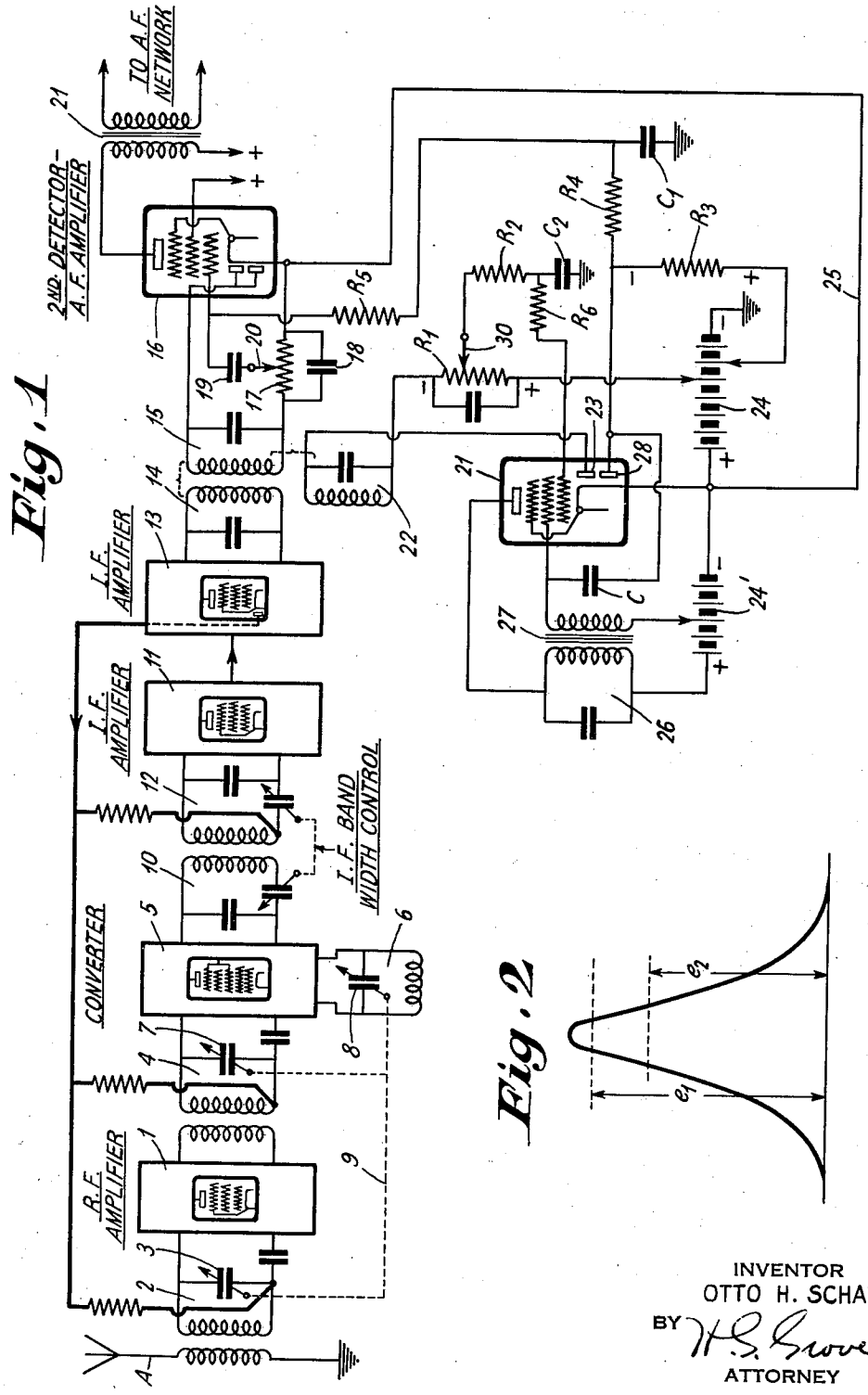


Fig. 1

Fig. 2

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Patented Feb. 9, 1937 2,069,854

UNITED STATES PATENT OFFICE

2,069,854

AUTOMATIC NOISE SUPPRESSOR CIRCUIT

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Application August 10, 1935, Serial No. 35,602

8 Claims. (Cl. 250—20)

My present invention relates to automatic control circuits for radio receivers, and more particularly to a novel and improved type of background noise suppressor for a radio receiver which utilizes automatic gain control.

One of the principal operating defects of most background noise suppressor circuits of radio receivers equipped with automatic gain control networks is the existence of a range of transition from cut-off bias to normal bias on the noise-controlled tube. This transition range causes, when the control is applied to the audio system, high distortion of the audio frequency signal. It has been found that where the background noise suppressor circuit possesses a trigger action then the transition range effect is eliminated. The trigger action usually involves a network which is capable of shifting the bias value of the controlled tube from cut-off to normal without any other possible stable value.

One of the main objects of my present invention may be said to reside in the provision of a background noise suppressor circuit for a radio receiver of the AVC type, which suppressor circuit possesses a trigger action characteristic in that it is capable of applying a cut-off bias to an audio amplifier without the necessity of adjusting the bias through any transitional bias value, and the suppressor circuit essentially comprising an oscillator under the control of the incoming signal, and whose oscillations are employed to produce the control bias for the audio amplifier to be controlled.

Another important object of the invention is to provide in a radio receiver equipped with an automatic volume control arrangement, a noise suppressor system which functions to regulate the operating bias of at least one audio amplifier of the receiver, and the suppressor circuit including an electron discharge tube which comprises an oscillator section and a pair of rectifier sections, one of the rectifier sections functioning to control the operation of the oscillator section, and the other rectifier section functioning to rectify the oscillatory output of the oscillator section for the purpose of producing the control bias for the audio tube which is to be controlled.

Another object of the present invention is to provide a superheterodyne receiver of the type including an automatic volume control system whose function it is to maintain the signal amplitude at the demodulator substantially uniform over a wide range of signal amplitude variation at the signal collector, the receiver being particularly characterized by its inclusion of a background noise suppressor arrangement, whose operation is dependent upon the decrease of the received signal amplitude below a predetermined amplitude, the suppressor arrangement comprising an oscillator, whose oscillations are rectified, and the direct current voltage component of the rectified oscillations being used to render the reproduction of the demodulated signals inefficient.

Still other objects of the invention are to improve generally the operating efficiency of superheterodyne receivers equipped with noise suppressor arrangements, and more especially to provide background noise suppressor circuits for radio receivers equipped with automatic volume control, which noise suppressor circuits are not only reliable and efficient in operation but economically manufactured and assembled in radio receivers.

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.

In the drawing:

Fig. 1 shows a circuit diagram of a superheterodyne receiver embodying the invention,

Fig. 2 graphically illustrates the operation of the noise suppressor network in the circuit of Fig. 1.

Referring now to the circuit diagram in Fig. 1, it is pointed out that this circuit is that of a superheterodyne receiver; the receiver comprising the usual signal collector A which may be of the grounded antenna type. The collector may, if desired, be the usual automobile radio signal collector, a loop antenna, and even a radio frequency distribution line of a hotel or apartment house. Regardless of the nature of the signal collector, the collected signals are impressed upon a tunable radio frequency amplifier 1 which may be of the pentode type, and utilize a tube of the 6D6 type. The input circuit of the amplifier is shown as comprising a single tunable circuit 2 which is provided with a variable tuning condenser 3. Of course, those skilled in the art are fully aware of the fact that the selector network preceding amplifier 1 may be of the band pass type wherein the band pass network comprises a pair of tunable circuits having over-optimum

coupling sufficient to give a band pass characteristic.

It is to be understood that the variable condenser 3 is chosen to vary the tuning of the selector network preceding amplifier 1 over the broadcast range which varies from 550 to 1500 k. c. The amplified output of amplifier 1 is impressed upon the tunable input circuit 4 of the converter network 5. This converter network is of a well known type and may employ a tube known as a "pentagrid" converter tube, commercially designated by the symbol 6A7. Since this tube and its circuits are well known to those skilled in the art at the present time, it is believed sufficient to point out that the input signal for the converter circuit is impressed upon the tunable input circuit 4, while the circuit 6 functions as the local oscillator circuit. The variable tuning condenser 7 in the signal input circuit 4 is arranged to have its rotors mechanically uni-controlled with the rotors of condenser 3. The variable tuning condenser 8 of the oscillator circuit 6 also has its rotors uni-controlled with the rotors of condensers 3 and 7, and the dotted lines 9 represent the mechanical uni-control mechanism employed to vary these tuning condensers in unison.

Assuming that the operating intermediate frequency of the system is chosen to be 456 k. c., although it is to be understood that any other value from 175 k. c. to a value of the order of 500 k. c. may be selected, then it will be clear that the range of the local oscillator circuit 6 will be from 1006 k. c. to 1956 k. c. The intermediate frequency energy is taken out of the converter network by means of the resonant circuit 10 which is tuned by the fixed condenser included therein to the 456 k. c. I. F. The I. F. energy in circuit 10 may be amplified in one or more stages of I. F. amplification.

The I. F. amplifier 11 may be a tube of the 6D6 type, which is a pentode, and the resonant input circuit 12 thereof is fixedly tuned to the operating I. F. of 456 k. c. Circuits 10 and 12 are coupled to normally provide a sharp tuning single peaked characteristic. This is obtained by coupling the coils of the two circuits with slightly less than optimum coupling. In order to provide a means for manually adjusting the width of the I. F. band transmitted to the demodulator of the receiver, there is provided an auxiliary adjustable capacity in each of circuits 10 and 12. Each of these auxiliary capacities is adjustable over a small range of frequencies, and the condensers are designed to vary the I. F. frequency in opposite senses.

Thus, when it is desired to widen the I. F. band width, the auxiliary capacities are adjusted so that the frequency of circuit 10, for example, will vary a predetermined frequency value below the I. F., and the frequency of circuit 12 will be varied to the same frequency value above the I. F. This band width control is provided in order to accommodate the receiver to local or weak station reception; when receiving local stations high quality is desired and all the side band frequencies of the carrier are thus included. Since the auxiliary capacities are large in size, the adjustment thereof is made by a step switch.

It is to be clearly understood that the band width control mechanism shown associated with circuits 10 and 12 may be replaced by any other type of band width control. In superheterodyne receivers of the so-called high fidelity type such a band width control is usually included because it is desired to have the operator select at his convenience the type of selectivity he wishes to employ, and which selectivity is dependent upon the range of side band frequencies he desires to have reproduced. The network 11 is followed by a network 13 which includes a tube of the 6B7 type. This type of tube comprises a pentode section and a diode section, the pentode being used for intermediate frequency amplification as in the case of network 11.

It is to be clearly understood that there may be employed between the output of tube 11 and the input of the pentode section of the following 6B7 tube a network exactly corresponding to that shown between networks 5 and 11. The diode section of network 13 is employed in this case for AVC rectification. That is the I. F. energy may be impressed upon the diode section and rectified, and the direct current component of rectified signals is then employed as AVC bias in the well known manner.

The pentode section of network 13 will, therefore, function as an I. F. amplifier, and, if desired, it may also function as an I. F. amplifier for the energy prior to impression on the diode section of network 13. Reference is made to my application Serial No. 673,389, filed May 29, 1933, Patent No. 2,039,666, granted May 5, 1936 which shows such an arrangement wherein the AVC diode rectifier derives its I. F. energy in amplified form from the output of the pentode section of a 6B7 I. F. amplifier tube. It is to be clearly understood that the specific construction of the AVC network is not an important element of the present invention.

What is essential is that there be provided in the receiver an AVC arrangement which functions in the well known manner to decrease the gain of each control tube as the received signal amplitude rises above a predetermined carrier amplitude. In this way the signal amplitude at the demodulator input is maintained substantially uniform in spite of fading and other allied undesirable effects. The resonant circuit 14 in the output circuit of amplifier 13 is fixedly tuned to the operating I. F., and is magnetically coupled to the resonant input circuit 15 of the demodulator.

The tube 16 is a 6B7 type tube, and the code section thereof has its strapped anodes connected to the high alternating potential side of input circuit 15, whereas the cathode of the tube is connected to the low alternating potential side through the load resistor 17 which is properly by-passed for I. F. currents by condenser 18. The input circuit 15 which feeds the demodulator, or second detector, is tuned to the operating I. F., and the audio component of demodulated signal energy is impressed upon the signal grid of the pentode section of tube 16 through a path which includes the variable tap 20 and the condenser 19.

The amplified audio component of demodulated signal energy is then transmitted through the audio frequency transformer 21 to the following audio network. This subsequent audio network may comprise any of the well known types of audio networks well known to those skilled in the art. For example, this following network may comprise a system of the type disclosed by me in Fig. 8 of my application Serial No. 698,407, filed November 17, 1933; it being pointed out that the arrangement in the last named application discloses an audio system including a desirable type of manual tone control arrangement.

Thus far there has been described a superhet-

erodyne receiver wherein the signal amplitude at the second detector input circuit 15 is maintained substantially uniform regardless of fading effects. As is well known to those skilled in the art background noise reproduction increases in a most annoying fashion when tuning a receiver, as shown in Fig. 1, between signal channels. Such noise reproduction also increases to a great extent whenever the signal amplitude received decreases below the operating minimum level. Background noise suppressor arrangements have been utilized in the past to automatically quiet, or mute, the receiver whenever the AVC system is not functioning to reduce the gain of the controlled stages, and the received signal amplitude drops below a predetermined intensity level. The principal defect of most of these noise suppression circuits has been in the existence of a range of transition from cut-off bias to normal bias on the controlled tube.

Where the noise control bias is applied to the audio stage such a transition range causes high distortion of the audio signal. The most desirable type of noise suppressor network is one which possesses a trigger action so that any stable value intermediate the normal and cut-off bias values is eliminated. A noise suppressor arrangement possessing such a trigger action is shown in Fig. 1. This noise suppressor circuit generally comprises an oscillator whose operation is under the control of the incoming signals, and whose oscillatory output is rectified and utilized for the muting action on the audio amplifier of the receiver. The suppressor arrangement is constructed so as to involve a minimum of circuit elements, and comprises tube 21 of the 6B7 type whose pentode section and two diode sections are arranged as shown in the figure.

I. F. energy is impressed upon one of the diode sections through a circuit which includes the resonant network 22; the latter is tuned to the operating I. F.; and is magnetically coupled to the tuned circuit 15. The high alternating potential side of circuit 22 is connected to the diode anode 23, while the low alternating potential side of the circuit is connected to a point on voltage source 24 through a path which includes the resistor R_1. The voltage source 24 may be part of the general B voltage supply of the tube 21, and for this reason the voltage source 24' is to be understood as comprising another portion of this voltage supply. The cathode of tube 21 is connected to the positive side of the voltage supply portion 24, while the negative terminal of this voltage supply section is grounded. The point on source 24 to which resistor R_1 is connected is negative with respect to the point to which the cathode of tube 21 is connected.

The cathodes of tubes 21 and 16 are at a common direct current potential, and are connected by a lead 25. The plate of tube 21 is connected to the positive terminal of the voltage supply section 24' through a resonant network 26, the negative terminal of the voltage supply section 24' being connected to the cathode of tube 21. The resonant network 26 is reactively coupled to the screen grid of the pentode section of tube 21 through an audio frequency transformer 27. There is thus provided a local oscillator for producing local oscillations which are to be rectified, and the direct current component of the rectified oscillations is used to control the audio transmission efficiency of the receiver.

The oscillations produced by the oscillator just described are impressed upon a rectifier which comprises the diode anode 28. The load resistor R_3 is connected to a point on the voltage supply section 24 which is negative with respect to the point thereon to which the cathode of tube 16 is connected. The condenser C reactively couples the screen grid of the pentode section of tube 21 to the diode anode 28, and comprises the path through which local oscillations are impressed upon the diode rectifier including diode anode 28. The direct current voltage developed across resistor R_3 is impressed upon the signal input grid of the pentode section of tube 16 through a path which includes the resistor R_4 and the resistor R_5.

The grid side of resistor R_4 is grounded through a condenser C_1, and the anode side of resistor R_3 is connected to the opposite side of the resistor R_4. The direct current voltage developed across resistor R_1, by rectification of the I. F. voltage from circuit 22 by the diode including anode 23, is impressed upon the first grid of tube 21. The impression path includes the adjustable tap 30, the resistor R_2 and the resistor R_6, the junction of resistors R_2 and R_6 being connected to ground through condenser C_2.

The operation of the receiving system will now be described, attention being directed to Fig. 2 which shows in a graphic manner such operation. Fig. 2 shows the overall selectivity including the combined selectivity of all tuned circuits inclusive of circuit 22. The I. F. voltage of circuit 14 is applied to the diode section of tube 16 for demodulation, and the resulting audio frequency signal developed across the load resistor 17 is fed to the signal input grid of tube 16, and thereafter amplified and transmitted through the subsequent audio frequency network. The pentode section of tube 16 functions as an audio amplifier, and the requisite signal grid bias is provided for the signal input grid of tube 16 through the path which includes resistor R_5, the resistor R_4 and the resistor R_3. The cathode of tube 16 is connected through lead 25 to a point on voltage source 24 which is positive with respect to the point on this source to which resistor R_3 is connected. As long as signals above a desired carrier amplitude are being received, the operating grid bias for the pentode section of tube 16 is the potential difference between the points on voltage source 24 to which lead 25 and resistor R_3 are connected.

When the received signal carrier amplitude decreases below a predetermined intensity level, and the level is such that the AVC network is not functioning to reduce the gain of each controlled tube, background noises will be greatly amplified because the controlled tubes are operating at maximum efficiency. In such a case the background suppressor arrangement functions to produce an auxiliary, or additional, negative grid bias for the pentode section of tube 16. This is accomplished by permitting the oscillator section of tube 21 to produce oscillations, and the resulting oscillations are rectified for the purpose of producing the auxiliary negative grid bias for tube 16. The oscillator section of tube 21 comprises the plate circuit 26 which is reactively coupled through transformer 27 to the screen grid electrode of the tube.

The transformer 27 is a small iron cored transformer having a low natural frequency between 10 and 20 k. c., or a suitable high frequency as 1600 k. c. Such a high frequency, which is outside the limits of the operating signal frequency range of a receiver, avoids undue time delay when starting or stopping the oscillations. As soon as

the amplitude of the signal carrier energy impressed on circuit 22 falls below a predetermined intensity level, the production of local oscillations between the screen grid and plate of the pentode section of tube 21 commences. The 10 k. c. voltage of the oscillator grid coil is transmitted to the diode anode 28 through the coupling capacity C, and there is produced a direct current voltage across resistor R_3 by virtue of rectification of the locally produced oscillations. Since the signal input grid of the pentode section of tube 16 is connected to the anode side of resistor R_3, whenever local oscillations are produced there will be impressed upon the signal grid of tube 16 the auxiliary negative bias referred to heretofore.

This auxiliary bias is sufficient in magnitude to substantially prevent the amplification of audio signals in the pentode section of tube 16. The circuit elements R_4 and C_1 function as a filter network to suppress the fluctuating component of the rectified current flowing through resistor R_3 from reaching the signal grid of tube 16. When the received carrier amplitude rises above the predetermined intensity level the I. F. voltage on the loosely coupled, sharply tuned circuit 22 rises near resonance. This voltage is rectified in the diode rectifier circuit which includes the diode anode 23 and resistor R_1, and there is produced a direct current voltage across the load resistor R_1. The grid nearest the cathode of tube 21 is connected to a desired negative point on resistor R_1 through the path which includes resistors R_6 and R_2 and the adjustable tap 30. Therefore, it will be seen that a part of the direct current voltage developed across resistor R_1 is applied through resistor R_6 to the first grid of tube 21, and the magnitude of this applied voltage is sufficient to cut off the plate current flow through the pentode section of tube 21. This results in a cessation of local oscillations; and as a consequence the rectified voltage across resistor R_3 disappears. This removes the auxiliary cut-off bias from the audio amplifier pentode section of tube 16, and thus permits the normal transmission of audio signals from the demodulator to the reproducer of the system.

The primary or energizing circuit 14 is coupled at optimum coupling to the secondary circuit 15 which is used to feed the demodulator diode. This secondary circuit is also loosely coupled to the tertiary circuit 22 which is not coupled directly to 14. This arrangement is important as then the AVC (which is derived from 13) is actuated by a circuit passing a wider frequency band than is passed by the additional selectivity of circuit 22 which energizes the squelch diode 23. This is important for the following reasons: If tuned to a carrier frequency, the circuit 22 will build up an I. F. and diode load voltage of a certain magnitude of certain ratio to the voltage in 15. With this ratio the squelch diode operates and unlocks the audio system. If the circuits are, however, not tuned to a carrier, the wider noise spectrum of circuit 13 produces an AVC voltage which in relation to the squelch diode voltage produced by noise in the more selective circuit 22 is now considerably greater, and as the ratio is greater, the squelch circuit will not unlock the audio system; provided that the AVC has adjusted the voltage in 15 to a magnitude comparable with the carrier magnitude assumed before, which is the case for sets with good AVC. This arrangement thus discriminates between relatively large noise levels and fairly weak carrier signals. The point being: extra selectivity on the squelch diode circuit. A second point is that the time constant of the AVC must be shorter than for the squelch, so that the AVC has decreased the noise voltage in 15 before diode 23 had time to produce sufficient bias on R_1 to stop the oscillator 21.

The resistor R_6 is an alternating current load resistance on the control grid of tube 21 at 10 k. c. Its function is to increase the difference of the values e_1 and e_2, see Fig. 2, as the oscillating elements are both positive, and thus does not produce any self bias for the oscillator system. As the control grid of tube 21 is loaded at oscillator frequency by resistor R_6, an alternating current voltage is generated on resistor R_6 due to coupling in the tube 21. The positive peaks of this alternating current voltage cause grid current to flow through the control grid of tube 21, and this grid current in turn causes a self bias on the control grid due to resistors R_2, R_1 and condenser C_2. There is secured in this fashion for the oscillator circuit an overlapping start and stop characteristic. The required direct current control voltage on the control grid of tube 21 is very small as in practice the second grid, or oscillator grid, is only about 10 volts positive. This makes the circuit sensitive to small changes in carrier voltage which is essential for receivers with satisfactory AVC action.

The oscillator including tube 21 may be easily adjusted to start at a certain negative grid bias value, i. e., a definite transconductance for small amplitudes, but to continue oscillating if once started, with considerably higher bias values (self bias on resistors R_2 and the portion of R_1 below slider 30) as the transconductance for larger amplitudes remains higher as the starting value for small amplitudes at the same grid bias voltage. This action causes the oscillator associated with the plate and screen grid of tube 21 to stop oscillating if the rectified I. F. signal voltage developed across resistor R_1 increases to a predetermined value, e_1, (see Fig. 2) but the voltage across resistor R_1 must be decreased to a considerably lower value e_2 before oscillations will be produced again. The voltage e_1 may be adjusted by means of slider 30 so as to be reached near, or at, resonance when the I. F. amplitude rises due to tuning in a signal.

However, if the signal is tuned in, a slight detuning or fading of the signal will not start the oscillator action because the value e_2 is considerably lower. This is clearly shown in Fig. 2 wherein the relationships between the voltages e_1 and e_2 and the resonance voltage of circuit 22 are depicted. An improper bias value on the signal grid of tube 16 is not possible as a stable value, because the minimum oscillator voltage amplitude to which oscillations build up is greater than the additional bias voltage needed to cut off the plate current flow through the pentode section of tube 16.

The tap on R_1 determines the amount of bias voltage fed to the control grid of tube 21. As tube 21 stops to oscillate with a definite value of bias voltage on its control grid, the movable contact on R_1 thus determines the peak voltage level in circuit 22 which has to be produced in order to operate the squelch circuit. It thus determines the magnitude of e_1 in Fig. 2, or in other words is a control for the signal level at which the squelch action takes place. Moved up (in Fig. 1) a small carrier will unlock the audio; moved down, a local station only will operate the set.

While the suppressor arrangement in Fig. 1 is shown of a highly compact type, it is to be clearly

understood that the diode demodulator may be used to control the production of local oscillations in the suppressor arrangement, and in that case the oscillator may comprise a triode wherein the plate and grid are reactively coupled, and the oscillator may be of the self-bias type. Any common triode oscillator with grid leak and condenser operates Class C. The grid bias voltage is highly negative and cuts off the plate current, but the tuned circuit voltage exceeds the grid bias voltage due to flywheel action of the circuit, thus making the grid positive at the peak swing (just like a diode) thus allowing plate current to flow which in turn energizes the tuned circuit. The negative bias is a self bias (diode action) produced by the oscillation voltage, the amplitudes of which are relatively large. The operating conditions of the oscillator can be so adjusted that the transconductance at large swings is larger than at very small amplitudes. Thus, the oscillator can not start by itself at this bias value, but once oscillating, will maintain oscillations. In such a case the grid of the triode would be controlled in bias from the demodulator load resistor, and the voltage values e_1 and e_2 when impressed on the oscillator grid would control the production of oscillations.

Furthermore, the locally produced oscillations in such a case can be impressed for rectification, for the purpose of producing the oscillator cut-off bias for the audio tube, upon a diode which is independent of the oscillator tube. Furthermore, the frequency of the locally produced oscillations in the noise suppressor arrangement may vary over a range of values, the essential requisite being that this frequency be outside the operating signal frequency range, but be high enough so as to avoid undue time delay when starting or stopping the noise control oscillations.

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 combination with a radio receiver of the automatic gain control type, a background noise suppressor network comprising an oscillator responsive to variations in received signal carrier amplitude, means for rectifying the oscillations to produce a cut-off bias for an audio amplifier of the receiver, and additional means electrically associated with the oscillator for imparting a characteristic to the oscillator such that said cut-off bias is produced or removed without any transitional bias values.

2. In a superheterodyne receiver of the type including an automatic volume control system adapted to maintain the signal amplitude at the demodulator substantially uniform over a wide range of signal amplitude variation at the signal collector, the receiver being characterized by its inclusion of a background noise suppressor arrangement which comprises an oscillator adapted to produce local oscillations of a frequency outside the operating signal frequency range of the receiver, means responsive to received signal carrier amplitude variations for controlling the amplitude of said oscillations, and additional means for rectifying the oscillations and impressing the direct current voltage component of the rectifier oscillations upon a stage subsequent to the receiver demodulator to render the reproduction of the demodulated signals inefficient.

3. In a receiving system provided with a demodulator, a signal transmission network feeding said demodulator, and means for automatically varying the transmission efficiency through said network in a sense to maintain the signal carrier amplitude at the demodulator input substantially uniform, the receiver being characterized by the inclusion of a suppressor system which comprises an oscillator arranged to produce local oscillations of a frequency outside the operating signal frequency range of the receiver, means responsive to an increase in carrier amplitude at the demodulator input above a predetermined intensity level for automatically stopping the production of said oscillations, and means responsive to said oscillations for automatically regulating the sound output from said receiver when said carrier amplitude decreases below said intensity level.

4. In a receiving system provided with a demodulator, a signal transmission network feeding said demodulator, and means for automatically varying the transmission efficiency through said network in a sense to maintain the signal carrier amplitude at the demodulator input substantially uniform, the receiver being characterized by the inclusion of a suppressor system which comprises an oscillator arranged to produce local oscillations of a frequency outside the operating signal frequency range of the receiver, means responsive to an increase in carrier amplitude at the demodulator input above a predetermined intensity level for automatically stopping the production of said oscillations, and means responsive to said oscillations for automatically regulating the sound output from said receiver when said carrier amplitude decreases below said intensity level, said first means including a device for stopping said oscillations only when said carrier amplitude at the demodulator input decreases to said intensity level.

5. In a receiving system provided with a demodulator, a signal transmission network feeding said demodulator, and means for automatically varying the transmission efficiency through said network in a sense to maintain the signal carrier amplitude at the demodulator input substantially uniform, the receiver being characterized by the inclusion of a suppressor system which comprises an oscillator arranged to produce local oscillations of a frequency outside the operating signal frequency range of the receiver, means responsive to an increase in carrier amplitude at the demodulator input above a predetermined intensity level for automatically stopping the production of said oscillations, and means responsive to said oscillations for automatically regulating the sound output from said receiver when said carrier amplitude decreases below said intensity level, said first means comprising a rectifier having a signal input circuit coupled to the demodulator input.

6. In the receiving system provided with a demodulator, a signal transmission network feeding said demodulator, and means for automatically varying the transmission efficiency through said network in a sense to maintain the signal carrier amplitude at the demodulator input substantially uniform, the receiver being characterized by the inclusion of a suppressor system which comprises an oscillator arranged to produce local oscillations of a frequency outside the operating signal frequency range of the receiver, means responsive

to an increase in carrier amplitude at the demodulator input above a predetermined intensity level for automatically stopping the production of said oscillations, and means responsive to said oscillations for automatically regulating the sound output from said receiver when said carrier amplitude decreases below said intensity level, said last means comprising a rectifier reactively coupled to said oscillator for the impression of oscillations on said rectifier, and the output of said rectifier being impressed upon an audio amplifier of the receiver.

7. In a receiving system provided with a demodulator, a signal transmission network feeding said demodulator, and means for automatically varying the transmission efficiency through said network in a sense to maintain the signal carrier amplitude at the demodulator input substantially uniform, the receiver being characterized by the inclusion of a suppressor system which comprises an oscillator arranged to produce local oscillations of a frequency outside the operating signal frequency range of the receiver, means responsive to an increase in carrier amplitude at the demodulator input above a predetermined intensity level for automatically stopping the production of said oscillations, and means responsive to said oscillations for automatically regulating the sound output from said receiver when said carrier amplitude decreases below said intensity level, each of said first and second means including a rectifier, and the electrodes of said oscillator and two rectifiers being disposed within a common tube envelope.

8. In a receiving system provided with a demodulator, a signal transmission network feeding said demodulator, and means for automatically varying the transmission efficiency through said network in a sense to maintain the signal carrier amplitude at the demodulator input substantially uniform, the receiver being characterized by the inclusion of a suppressor system which comprises an oscillator arranged to produce local oscillations of a frequency outside the operating signal frequency range of the receiver, means responsive to an increase in carrier amplitude at the demodulator input above a predetermined intensity level for automatically stopping the production of said oscillations, and means responsive to said oscillations for automatically regulating the sound output from said receiver when said carrier amplitude decreases below said intensity level, said oscillator including an electron discharge tube provided with a pentode section and a pair of diode sections, the plate and screen grid of said pentode section being reactively coupled for the production of said oscillations, one of said diode sections being included in said first means, and the other diode section being included in said second means and having said oscillations impressed thereon through a reactive coupling from said screen grid.

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