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SIGNAL-SELECTING SYSTEM

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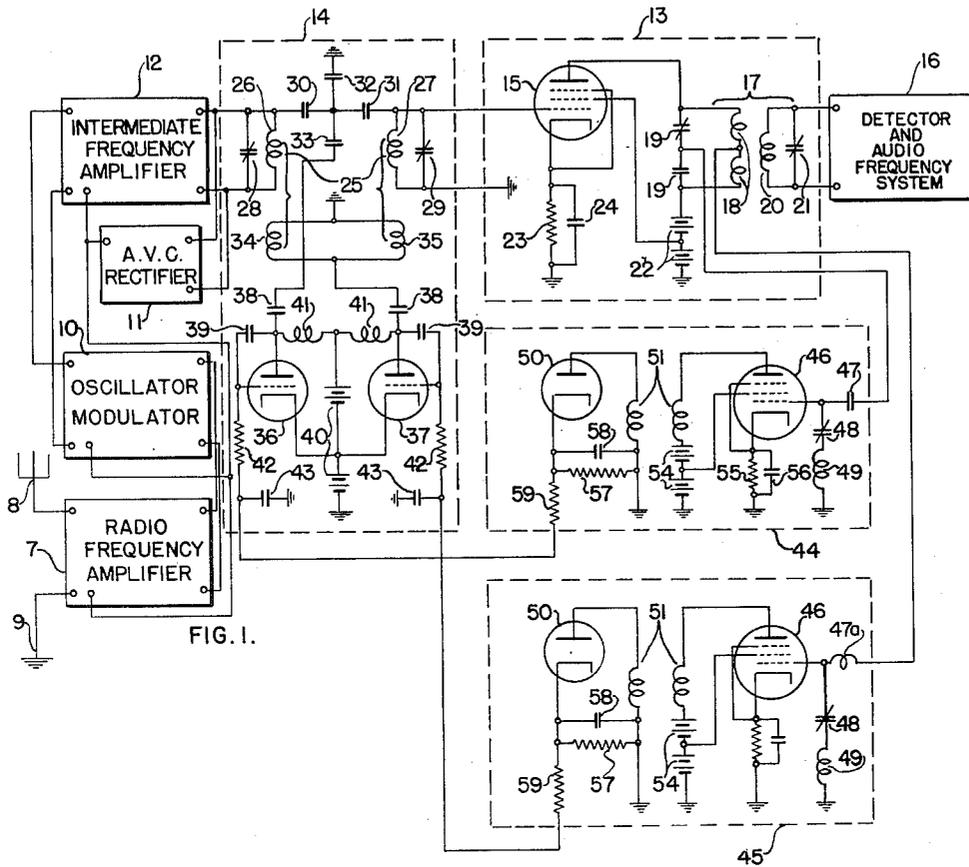
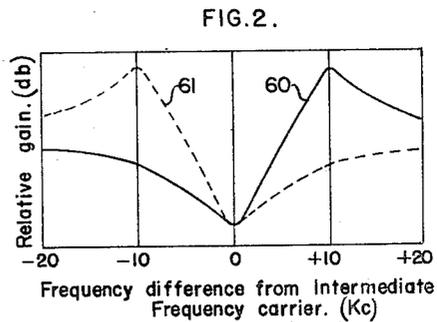
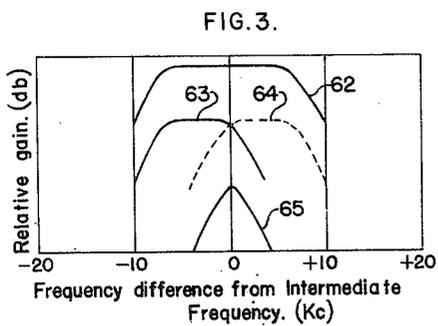


FIG. 1.



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## UNITED STATES PATENT OFFICE

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## SIGNAL-SELECTING SYSTEM

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19 Claims. (Cl. 250-20)

This invention relates to modulated-carrier signal receivers and particularly to signal-selecting systems of such receivers and to methods of, and means for, controlling the selectivity and fidelity thereof to discriminate against undesired signals.

system in accordance with received undesired signals adjacent a desired signal carrier as well as the feature of controlling the selectivity in accordance with both desired and undesired signals form the subject matter of applicant's co-pending application Serial No. 46,081, filed October 22, 1935.

According to conventional radio broadcasting practice, each program or signal is transmitted on a carrier frequency having two sidebands of modulation, usually extending 6 or more kilocycles on either side thereof. The various broadcasting stations employ different carrier frequencies, and these frequencies, in present practice, are uniformly spaced throughout the broadcast frequency range, the spacing of adjacent carrier frequencies usually being 10 kilocycles. In many instances, therefore, the sideband frequencies of one carrier overlap, or closely encroach upon, those of an adjacent carrier received at the same location. This condition frequently renders it difficult to adjust a receiver so as to receive and reproduce a desired signal without objectionable interference from undesired signals on carrier frequencies near the desired signal carrier, particularly when the strength of such undesired signals is comparable to or exceeds that of the desired signal. In addition to these undesired signals, static and other so-called background noises, which are ordinarily present at the higher frequencies of the sidebands, may interfere with quiet operation.

Ordinarily, such undesired interfering frequencies are received at only one side of the desired signal carrier at a particular time. Obviously, at such time it is only necessary that the sideband on the same side of the desired carrier as the undesired frequency be contracted in order to reduce such interference. Ideal selectivity and fidelity control, therefore, requires a system wherein an undesired signal on either side of the desired signal carrier will control the amount of expansion of the desired signal sideband on that side independently of the other sideband, so that the latter may remain at maximum width if conditions permit. In other words, the expansion, or contraction, of the transmission band is unsymmetrical with respect to the carrier frequency unless undesired signals of equal intensities happen to be received on both sides of the desired carrier at the same time.

To obtain faithful reception and reproduction of the desired signal, substantially free from undesired signal, static and noise interference, therefore, it is necessary to employ a selecting system which is effective to pass a band of desired modulation frequencies sufficiently narrow substantially to reduce the response at interfering frequencies. The fidelity of reception of the desired signal, however, tends to be impaired by such narrowing of the selected band, since the outer frequencies of the sidebands, corresponding in radio broadcasting to the higher audio frequencies of modulation, are suppressed. It is highly desirable, therefore, that the width of the selected band of frequencies be automatically controlled in accordance with the conditions of reception, the band being contracted when interference on an undesired frequency is received with sufficient amplitude appreciably to impair the reception and being expanded to maximum width in the absence of such interference, passing all of the sideband frequencies of the desired signal and providing maximum fidelity. This feature of controlling the selectivity of a

It is a primary object, therefore, of the present invention to provide a method of, and means for, controlling the selectivity and fidelity of a modulated-carrier signal receiver by automatically effecting expansion and contraction of each of the sidebands of a desired signal passed by the system, independently of each other and in accordance with the intensity of an undesired frequency near the desired signal carrier and on the same side thereof as such sideband, thereby to obtain maximum fidelity of reception consistent with the intensity of such undesired frequencies.

It is a further object of the invention to provide a method of, and means for, automatically controlling the selectivity of a receiver in the manner above described by the utilization of electronic-control circuits.

For a better understanding of the invention, together with other and further objects thereof, reference is had to the following description taken in connection with the accompanying drawing, and its scope will be pointed out in the appended claims.

In accordance with the present invention, a modulated-carrier signal receiver is provided with a band-pass selector for selecting a desired signal comprising a carrier frequency and its sidebands of modulation frequencies. The selector

is automatically controlled so that the width of one, or both, of the two sidebands of the desired signal passed thereby is independently adjusted inversely in accordance with the amplitude of undesired signals on frequencies near the desired carrier and on the same side thereof as the respective sideband.

According to a specific form of the invention, the band-pass selector embodies a double-tuned intermediate-frequency transformer, having both capacitive and inductive couplings proportioned normally to provide the maximum desired band width. Adjustable impedances are connected in circuit with these couplings. Shunting of the capacitive coupling operates to decrease the amount of coupling between the circuits and simultaneously to lower the mean resonant frequency of the selector. That is, the width of the band passed by the selector is decreased and its center frequency is shifted to a lower frequency. The two effects are inherently coordinated so that there is no substantial change of the lower frequency limit of the band.

Shunting of the inductive coupling operates to decrease the amount of the coupling between the circuits and simultaneously to raise the mean resonant frequency of the selector, thus decreasing the width of the band and shifting the center frequency to a higher frequency. These effects are likewise inherently coordinated so that there is no substantial change in the upper frequency limit of the band. When both couplings are shunted simultaneously and to the same extent, both sidebands of the signal are contracted equally, as in conventional symmetrically contracting and expanding selectors. Each of the shunting impedances is independently controlled and preferably comprises a vacuum tube which is connected across its respective coupling and is provided with an associated individual control system. Each of the control systems is designed to favor undesired frequencies near the desired signal carrier and on the same side thereof as the sideband which the particular control system, tube and coupling are intended to adjust and to be least responsive to the desired signal carrier, so that the desired signal has a negligible effect on the expansion.

In the accompanying drawing, Fig. 1 is a circuit diagram of a complete superheterodyne radio receiver, partly schematic, embodying the present invention, and Figs. 2 and 3 are graphs representing certain operating characteristics of the receiver to aid in the understanding of the invention.

Referring now more particularly to Fig. 1, there is shown schematically a superheterodyne radio receiver embodying the invention in a preferred form. In general, the receiver includes a tunable radio-frequency amplifier 7 having its input connected with an antenna 8 and ground 9 and its output connected to an oscillator-modulator 10. The output of the oscillator-modulator is connected to intermediate-frequency amplifiers 12 and 13, which are coupled by means of a band-pass selector system 14. An automatic amplification control or "A. V. C." rectifier 11 is also coupled to the output amplifier 12 and the control voltage developed thereby is applied over suitable leads to the control grids of the tubes of the amplifiers 12 and 7 and the oscillator-modulator 10 to control the amplification and maintain the output of the amplifier 12 approximately constant, all in accordance with conventional practice. The system 14 forms a part of the present invention

and is hereinafter described in detail. The amplifier 13 includes one or more amplifying stages each comprising a vacuum tube 15, preferably of the conventional pentode type, and a selective coupling network 17, the final network 17 being coupled to a detector and audio-frequency system 16. The network 17 includes an intermediate-frequency transformer having a primary winding 18, which is included in the output circuit of the tube 15 and is tuned to the intermediate frequency by condensers 19, and a secondary winding 20 which is included in the input of the system 16 and is tuned to the intermediate frequency by a condenser 21. A suitable source of operating potentials is provided for the tube 15, as indicated by the battery 22. A suitable biasing resistor 23 and by-pass condenser 24 are included in the cathode circuit of the tube. The coupling between the windings of transformer 17 is on the order of optimum, preferably somewhat greater than optimum, thereby to pass a band of frequencies including the selected intermediate frequency and its two sidebands of modulation.

It will be understood that the several parts which are illustrated in the drawing in block form may be of substantially conventional construction and operation, the details of which are well known in the art, rendering description thereof unnecessary herein.

Neglecting for the moment the particular operation of the selector system 14 and the control apparatus associated therewith, which embody features of the invention to be hereinafter described in detail, the system above described comprises a conventional superheterodyne receiver. The operation of such a receiver is well understood in the art and detailed explanation thereof is, therefore, unnecessary. In brief, however, signals intercepted by the antenna are selected and amplified in the amplifier 7 and converted to intermediate frequencies, in the conventional manner, in the oscillator-modulator 10. The intermediate frequencies are then selected and amplified in the amplifier 12, selector 14 and amplifier 13. The amplified intermediate-frequency signals are thereupon transmitted to the detector and audio-frequency system 16, wherein the audio-frequency signals are derived, amplified and supplied, in the usual manner, to a loudspeaker for reproduction. The AVC rectifier develops the control voltage from a part of the output of the amplifier 12 and this voltage is utilized, as above explained, to maintain the amplitude of the output of the amplifier 12 within a relatively narrow range for a wide range of signal amplitudes at the input of the receiver.

While, in accordance with the present invention, various selectivity control circuit arrangements may be employed, in the present embodiment the band-pass selector system 14 is provided for this purpose. The selector circuit, per se, comprises an intermediate-frequency transformer 25 having a primary winding 26 included in the output circuit of the frequency changer 10 and a secondary winding 27 included in the input of the intermediate-frequency amplifier 13. Adjustably fixed condensers 28 and 29 are connected, respectively, across the primary and secondary circuits, as illustrated, individually to tune these circuits to the intermediate frequency.

There are also associated with the two circuits separate capacitive and inductive couplings. The capacitive coupling comprises condensers 30 and

31 in series, connected between the high alternating potential ends of the windings 26 and 27. A condenser 32 is connected between the junction of the condensers 30—31 and ground and a condenser 33 is also connected between this junction and ground through a control network including a vacuum tube, which provides effectively an adjustable shunt impedance for the capacitive coupling 30—31, as hereinafter described. The preferred relationship, which can be shown mathematically, is that the self-reactance of the condenser 33 plus the self-reactance of the condensers 30, 32 and 31 in parallel is much greater than the minimum apparent resistance of the tube 36 shunting this network for contracting the upper part of the frequency band.

The inductive coupling comprises a link circuit including a winding 34 coupled to the primary winding 26 of the transformer, and a winding 35 coupled to the secondary winding 27. A control network including a vacuum tube is similarly effectively shunted across this link circuit. Coil 34 is moderately coupled to the coil 26 and coil 35 is moderately coupled to the coil 27; "moderately coupled" being intended to mean coupled on the order of 25 per cent., for example, from 10 to 40 per cent. The inductive coupling is poled to aid the capacitive coupling. The self-reactance of the coils 34 and 35 in parallel should preferably be made much greater than the minimum apparent resistance of the tube 37 shunting this coupling network.

For controlling the capacitive and inductive couplings there are provided vacuum tubes 36 and 37, respectively, which may be of any suitable type, such as triodes, as illustrated. The control tubes 36 and 37, as above mentioned, are connected effectively in shunt, respectively, with the capacitive and inductive couplings of the selector. A coupling condenser 38, having relatively a large capacitance, is interposed in the anode circuit of each of the tubes and serves to isolate its electrode circuits from its coupling circuit.

In order to control the impedances of the tubes 36 and 37, a condenser 39, having a capacitance of a higher order than the interelectrode capacitance of its respective tube, is connected between the anode and control grid of each tube and thereby provides a degenerative effect which greatly lowers the apparent plate resistance of the tube during normal operation. Stated quantitatively, the apparent plate resistance of the tube is made substantially equal to the actual plate resistance divided by  $(\mu+1)$ , where  $\mu$  is the amplification constant of the tube. In other words, the condenser 39 has the effect of multiplying the plate conductance of each of the tubes 36—37 by  $(\mu+1)$ . This does not, however, affect the minimum value of plate conductance, which is substantially zero, but greatly increases the maximum value and, therefore, the range of operation.

Suitable operating potentials are supplied for the tubes 36 and 37 by means of a source of voltage, as indicated by the batteries 40. An inductance element 41 of high impedance at the intermediate frequency is included in the anode circuit of each of the tubes 36, 37. The cathodes of the tubes are connected to an intermediate point on the source 40 to provide the desired initial bias voltages for the tubes. An isolating resistor 42 is included in the grid circuit of each of the tubes 36 and 37, and a by-pass condenser 43 is connected between the lower

ends of each resistor 42 and ground. Each of the resistors 42 preferably has a resistance of the order of 1 megohm and serves to determine the grid bias without substantially dissipating the intermediate-frequency voltage applied to the grid by the coupling condenser 38.

Looking through its coupling condenser 38, each tube constitutes substantially a pure resistance or conductance effectively shunting its respective coupling. This requires that each inductance element 41 have very high inductance and be approximately resonant with the inherent capacitance of its respective tube and circuit connections at the intermediate frequency. This requires also that the condensers 38 have, at the intermediate frequency, a much lower reactance than the inductance elements 41.

For the purpose of controlling the conductances of the tubes 36 and 37, individual control systems for producing control effects and indicated generally at 44 and 45, respectively, are provided for these tubes. These control systems are substantially similar in construction and operation and, except for their distinguishing features, therefore, only the system 44 will be described in detail. Corresponding elements in the systems 44 and 45 are indicated in the drawing by the same reference numerals. The system 44 comprises an amplifier tube 46, preferably of the pentode type, having its control grid connected to an intermediate tap in the capacitive arm of the tuned primary circuit of the coupling transformer 17 through a coupling condenser 47. Operating potentials are provided for the tube 46 from a suitable source, as indicated by the battery 54. The cathode circuit includes a suitable biasing resistor 55, by-passed by condenser 56 in conventional manner. A condenser 48 and coil 49 are connected in series to form a shunt trap between the control grid and ground. The trap is tuned to the intermediate carrier frequency and, with the condenser 47, provides a selective network proportioned and arranged to have a peak in its response characteristic at a frequency about 10 kilocycles above the intermediate frequency, as will be hereinafter described.

The output of the amplifier 46 is coupled to a rectifier 50 by an insulating transformer 51. The transformer 51 is designed to pass approximately uniformly, a frequency band in excess of about 20 kilocycles on each side of the intermediate frequency; that is, it is not intended to have a material effect on the frequency characteristic of the control system near the intermediate-frequency carrier. The load circuit of the rectifier includes a resistor 57 shunted by an intermediate-frequency by-pass condenser 58.

The tube 46 operates as the conventional intermediate-frequency amplifier, and the tube 50 as a conventional diode rectifier. The voltage developed across the resistor 57 is applied to the control grid of the tube 36 by way of a resistor 59 and the previously mentioned resistor 42. The resistor 57 is preferably on the order of 0.1 megohm, while the resistor 59 is preferably of a somewhat greater value. The time constant of operation of the control system 44 is determined principally by the resistor 59 and condenser 43. This time constant is not critical but is preferably on the order of the time constant of the usual automatic volume control, for example, of the order of 0.1 second.

The control grid of the tube 46 in the system 45 is connected to an intermediate tap in the

inductive arm of the tuned primary circuit of the transformer 17 by way of a selective network 47a-48-49, which is substantially identical with that of the system 44, just described, 5  
 10 excepting that here a coupling inductance element 47a is employed instead of the condenser 47 of system 44. The elements of the selective network of the system 45 are proportioned to cause a peak in the transmission characteristic curve at a frequency 10 kilocycles below the intermediate carrier frequency. The remaining portion of the control system 45 is like the system 44, and the bias voltage developed by its rectifier 50 is similarly applied to the control electrode of its associated control tube 37. 15

In Fig. 2, the frequency-response characteristics of the selective circuits 47-48-49 and 47a-48-49 of the control systems 44 and 45 are shown. The relative gain, in decibels, of these circuits is plotted against frequency difference, in kilocycles, from the intermediate-frequency carrier, indicated as 0. The solid line curve 60 illustrates the characteristic of the selective circuit of the control system 44, and the dotted line curve 61 illustrates the characteristic of the selective circuit of the control system 45. It will be apparent from the curves 60 and 61, respectively, that the system 44 is most responsive at a frequency about 10 kilocycles above the intermediate frequency, and that the system 45 is most responsive at a frequency about 10 kilocycles below the intermediate frequency. 20

Referring to Fig. 3, there are shown characteristic curves illustrating the operation of the selector 14, as automatically controlled in accordance with the present invention. In this figure, as in Fig. 2, relative gain in decibels is plotted against frequency difference in kilocycles, from the intermediate-carrier frequency, indicated as 0. The relative heights of the curves in Fig. 3 are not significant, all of the curves being intended to have substantially the same maximum gains but being spaced vertically in the figure for the purpose of clarity. Curve 62 25  
 30 indicates the width of the band passed by the selector with maximum expansion. This curve is intended to be fairly level within about 7 kilocycles to either side of the intermediate-carrier frequency. The tube 36 is normally, that is for maximum expansion, biased for substantially zero plate conductance by the battery 40 with no input from the control system 44, as has been previously explained. 35

When there is being received an undesired signal of appreciable intensity on a carrier frequency near the desired signal carrier and resulting in an intermediate frequency above that of the desired signal, the control system 44, by virtue of its selective action described above, develops a unidirectional voltage which is impressed positively upon the grid of the tube 36, thereby increasing the tube conductance across the capacitive coupling of the selector 14. This increase of the tube conductance effects a reduction of the coupling between the winding of the transformer 25 to contract the frequency band passed by the selector and simultaneously lower the mean resonant frequency of the selector. The effect, therefore, is a contraction of the upper sideband. This contraction is indicated by the transition from curve 62 to the curve 63 in Fig. 3. When there is being received an undesired signal of appreciable intensity on a carrier frequency near the desired signal carrier and resulting in an intermediate frequency below that 40  
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of the desired signal, the tube 37 and its control system 45 operates in substantially the same manner to effect a contraction of the lower sideband of the desired signal, that is, the increase of the conductance of the tube 37 effects a reduction in the coupling between the windings of the transformer 25 to contract the band passed by the selector and simultaneously raise the mean resonant frequency thereof. Thus, the effect in this instance is a contraction of the lower sideband, as is indicated by the transition from curve 62 to the curve 64. When undesired signals interfere on both sides of the desired carrier, both of the sidebands will be simultaneously contracted and, if such signals are substantially the same intensities, a symmetrical contraction will result, as indicated by the characteristic curve 65, which represents the minimum band width. 5  
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Obviously, all intermediate conditions between curves 62 and 65 will be obtained, with equal or unequal expansion of the two sidebands according to the conditions of reception, the only requirement for ideal selectivity being the operation of the selectivity control system to effect contraction only when and where it is needed, thereby assuring that the band width is as great as permitted for any given receiving conditions. In other words, in accordance with the present invention the width of the band of frequencies passed by the system is contracted in accordance with the amplitude of undesired signals on frequencies near the carrier frequency of the desired signal and at the opposite sides thereof. This contraction is symmetrical when the undesired signals at the opposite sides have equal interference values, that is, are of equal intensities and equally spaced on either side of the carrier frequency of the desired signal, while the contraction is unsymmetrical when the signals at the opposite sides have unequal interference values. That is, the contraction is accompanied by a shifting of the center of the selected band of frequencies in a direction away from the side on which the undesired signal has the greater interference value, or, in other words, the receiver is adjusted to vary the frequency difference between the mean resonant frequency of the selector and the desired signal-carrier frequency, thereby effectively to adjust the difference between such mean resonant frequency and the undesired signal proportionally to the amplitude of the undesired signal. 25  
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While there has been described what is at present considered the preferred embodiment of the invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention, and it is, therefore, aimed in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention. 55  
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What is claimed is:

1. An electric circuit arrangement for controlling the selectivity of a modulated-carrier signal receiver to discriminate against undesired frequencies near the desired signal carrier frequency and at one side thereof and including a band-pass selector adapted to pass the desired carrier frequency and its modulation sidebands, comprising means responsive to said undesired frequencies for deriving a control effect, means for automatically adjusting said selector to control the width of the modulation sideband passed by said selector, at the same side of said desired 65  
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signal carrier as said undesired frequencies and independently of the width of the other sideband passed thereby, and means for applying said control effect to said adjusting means to effect said adjustment inversely in accordance with the amplitude of said undesired frequencies and independently of the width of the other sideband passed thereby.

2. An electric circuit arrangement for controlling the selectivity of a modulated-carrier signal receiver to discriminate against undesired signals on carrier frequencies near the desired signal carrier frequency at either opposite side thereof and including a band-pass selector adapted to pass the desired carrier frequency and its modulation sidebands, comprising means for adjusting said selector inversely in accordance with the intensity of the undesired signals on one side of the desired signal carrier frequency to control the width primarily of only the modulation sideband at said side passed by said selector, and separate means for adjusting said selector inversely in accordance with the intensity of the undesired signals on the other side of said desired signal carrier frequency to control the width primarily of only the modulation sideband at said other side passed by said selector.

3. In a modulated-carrier signal receiver including a band-pass selector for selecting a desired signal comprising a carrier and two modulation sidebands, a selectivity control system comprising means for adjusting said selector to control the width of one of said sidebands passed thereby independently of the width of the other sideband, means responsive to the amplitude of undesired signals on frequencies near the carrier frequency of said desired signal and at the same side thereof as said one of said sidebands for developing a control effect, and means for applying said control effect to said adjusting means to effect adjustment thereof inversely in accordance with said undesired signal amplitude.

4. In a modulated-carrier signal receiver including a band-pass selector for selecting a desired signal comprising a carrier and a band of modulation frequencies, a selectivity control system comprising means for adjusting said selector to control the width of said band passed thereby and for simultaneously effectively shifting the mean resonant frequency of said selector, means responsive to the amplitude of an undesired signal on a frequency near the carrier frequency of said desired signal for developing a control effect, and means for applying said control effect to said adjusting means to effect said band width adjustment inversely in accordance with said undesired signal amplitude and effectively to shift the mean resonant frequency of said selector in a direction away from said undesired signal.

5. In a modulated-carrier signal receiver including a band-pass selector for selecting a desired signal comprising a carrier and a band of modulation frequencies, a selectivity control system comprising means for adjusting said selector to contract the width of the band passed thereby and for simultaneously shifting the mean resonant frequency of said selector, means responsive to the amplitude of an undesired signal on a frequency near the carrier frequency of said desired signal for developing a control effect, and means for applying said control effect to said adjusting means to effect contraction of said band width and effectively to shift the mean resonant frequency of said selector in a direction

away from said undesired signal by an amount substantially equal to one-half the amount of said contraction.

6. In a modulated-carrier signal receiver including a band-pass selector for selecting a desired signal comprising a carrier and modulation sidebands, a selectivity control system comprising means for adjusting said selector to control the width primarily of only one of said sidebands passed thereby inversely in accordance with the amplitude of an undesired signal on a carrier frequency near the carrier frequency of said desired signal and at the same side thereof as said sideband, and separate means for automatically and independently adjusting said selector to control the width primarily of only the other of said sidebands inversely in accordance with the amplitude of an undesired signal on a carrier frequency near the carrier frequency of said desired signal and at the same side thereof as said other sideband.

7. In a modulated-carrier signal receiver including a band-pass selector for selecting a desired signal comprising a carrier and modulation sidebands, a selectivity control system comprising means for adjusting said selector to contract the width of the band of frequencies passed thereby and simultaneously to shift the mean resonant frequency of said selector in either direction, means responsive to the amplitude of undesired signals on frequencies near the carrier frequency of said desired signal and at either side thereof for developing control effects, and means for applying said control effects to said adjusting means to effect band width contraction and to shift said mean resonant frequency in a direction away from the undesired signal having the greater interference value, whereby said band is adjusted symmetrically when said undesired signals at said opposite sides have equal interference values and unsymmetrically when said undesired signals at said opposite sides have unequal interference values.

8. In a modulated-carrier signal receiver including a band-pass selector for selecting a desired signal comprising a carrier and modulation sidebands comprising a plurality of coupled resonant circuits normally tuned to said carrier frequency, a selectivity control system comprising means for reducing the coupling between said circuits to contract the width of the band of frequencies passed by said selector and simultaneously to detune said circuits, means responsive to the amplitude of undesired signals on frequencies near the carrier frequency of said desired signal and at the side thereof for developing a control effect, and means for applying said control effect to said coupling reducing means to effect said band width contraction and said detuning of said circuits in a direction away from said undesired signal.

9. In a modulated-carrier signal receiver including a band-pass selector for selecting a desired signal comprising a carrier and modulation sidebands, said selector comprising primary and secondary circuits each tuned to the frequency of the carrier of said desired signal, a capacitive coupling between said circuits, an inductive coupling between said circuits, adjustable impedance means effectively in circuit with said capacitive coupling, adjustable impedance means effectively in circuit with said inductive coupling, means for independently controlling the one said impedance means in accordance with the amplitude of an undesired signal on a carrier fre-

quency near and above the carrier frequency of said desired signal, and means for independently controlling the other said impedance means in accordance with the amplitude of an undesired signal on a carrier frequency near and below the carrier frequency of said desired signal.

10. In a modulated-carrier signal receiver, a band-pass selector for selecting a desired signal comprising a carrier and modulation sidebands, said selector comprising primary and secondary circuits each tuned to the carrier frequency of said desired signal, a capacitive coupling between said circuits, an inductive coupling between said circuits, a vacuum tube conductance for effectively reducing said capacitive coupling, a vacuum tube conductance for effectively reducing said inductive coupling, means for adjusting the first said conductance directly in accordance with the amplitude of an undesired signal on a carrier frequency near and above the carrier frequency of said desired signal, and means for independently adjusting the second said conductance in accordance with the amplitude of an undesired signal on a carrier frequency near and below the carrier frequency of said desired signal.

11. In a modulated-carrier signal receiver including a band-pass selector for selecting a desired signal comprising a carrier and two modulation sidebands, a selectivity control system comprising means including a selective circuit most responsive at a frequency at the outer edge of one of the sidebands of frequencies passed by said selector for developing a control effect, means for adjusting said selector to control the width of said one of said sidebands independently of the width of the other of the sidebands of frequencies passed by said selector, and means for applying said control effect to said adjusting means to effect adjustment of the width of said one of said sidebands inversely in accordance with the amplitude of undesired signals on frequencies at said edge.

12. In a modulated-carrier signal receiver including a band-pass selector for selecting a desired signal comprising a carrier and two modulation sidebands, a selectivity control system comprising means including a pair of selective circuits most responsive, respectively, at frequencies at the outer edges of the sidebands of frequencies passed by said selector for developing individual control effects in accordance with the amplitude of undesired signals on frequencies at said outer edges, means for adjusting said selector to control the width of either of said sidebands independently of the width of the other of the sidebands, and means for applying said control effects to said adjusting means for effecting adjustments of the widths of said sidebands inversely in accordance with the amplitude of said undesired signals on frequencies at their respective outer edges.

13. In a modulated-carrier signal receiver including a band-pass selector for selecting a desired signal comprising a carrier and two modulation sidebands, a selectivity control system comprising a selective circuit most responsive at a frequency at the outer edge of one of the sidebands of frequencies passed by said selector, rectifying means coupled to said circuit for deriving a unidirectional voltage in accordance with the amplitude of signals on frequencies passed by said selective circuit, and means for utilizing said voltages to adjust said selector to control the width of the sideband of frequencies passed there-

by on the same side of said carrier frequency of said desired signal as said edge, independently of the width of the other sideband.

14. The method of controlling the selectivity of a modulated-carrier signal receiver to discriminate against undesired signals on carrier frequencies near the carrier frequency of a desired signal, at the opposite sides thereof, which comprises selecting the desired signal including its carrier and modulation sidebands, and independently adjusting the width of either of said selected sidebands inversely in accordance with the amplitude of the undesired signal at the same side of the carrier frequency of said desired signal as the respective sideband.

15. The method of controlling the selectivity of a modulated-carrier signal receiver to discriminate against an undesired signal on a frequency near the carrier frequency of a desired signal, at one side thereof, which comprises selecting the desired signal including its carrier and modulation sidebands and adjusting the width of the selected sideband on the same side of the carrier frequency of the desired signal as said undesired signal inversely in accordance with the amplitude of said undesired signal and independently of the width of the other sideband passed by said receiver.

16. In a modulated-carrier signal receiver including a band-pass selector for selecting a desired signal comprising a carrier and a band of modulation frequencies, a selectivity control system comprising means responsive to the amplitude of an undesired signal on a frequency near the desired-signal carrier frequency at one side thereof for developing a control effect, means for adjusting said selector to shift the mean resonant frequency thereof, and means for applying said control effect to said adjusting means effectively to shift the mean resonant frequency of said selector in a direction away from the undesired signal.

17. In a modulated-carrier signal receiver including a band-pass selector for selecting a desired signal comprising a carrier and a band of modulation frequencies, a selectivity control system comprising means for adjusting the receiver to vary the frequency difference between the mean resonant frequency of said selector and the desired-signal carrier frequency, means responsive to the amplitude of an undesired signal on a frequency near the desired-signal carrier frequency at one side thereof for developing a control effect, and means for applying said control effect to said adjusting means effectively to adjust the difference between said mean resonant frequency and said undesired-signal frequency proportionately to said undesired signal amplitude.

18. In a modulated-carrier signal receiver including a band-pass selector for selecting a desired signal comprising a carrier and a band of modulation frequencies, a selectivity control system comprising means responsive to the interference values of undesired signals on frequencies near the desired-signal carrier frequency and at either side thereof for developing a control effect, means for adjusting said selector to shift the mean resonant frequency thereof, and means for applying said control effect to said adjusting means effectively to shift the mean resonant frequency of said selector in a direction away from the frequency of that one of said undesired signals having the greater interference value by an

amount substantially proportional to the difference between the interference values of said undesired signals.

5 19. In a modulated-carrier signal receiver including a band-pass selector for selecting a desired signal comprising a carrier and a band of modulation frequencies, a selectivity control system comprising means for adjusting the receiver to vary the frequency difference between the  
10 mean resonant frequency of said selector and the desired-signal carrier frequency, means responsive to the amplitude of undesired signals

on frequencies near the desired-signal carrier frequency and at either side thereof for developing individual control effects, and means for utilizing said control effects to control said adjusting means effectively to increase the difference between said mean resonant frequency and the frequency of that one of said undesired signals having the greater interference value by an amount substantially proportional to said difference between the interference values of the undesired  
5 10 signals.

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