Jan. 25, 1949. B. F. TYSON 2,460,202

RADIO RECEIVER GAIN-CONTROL ARRANGEMENT

Filed April 19, 1944

FIG. 1.

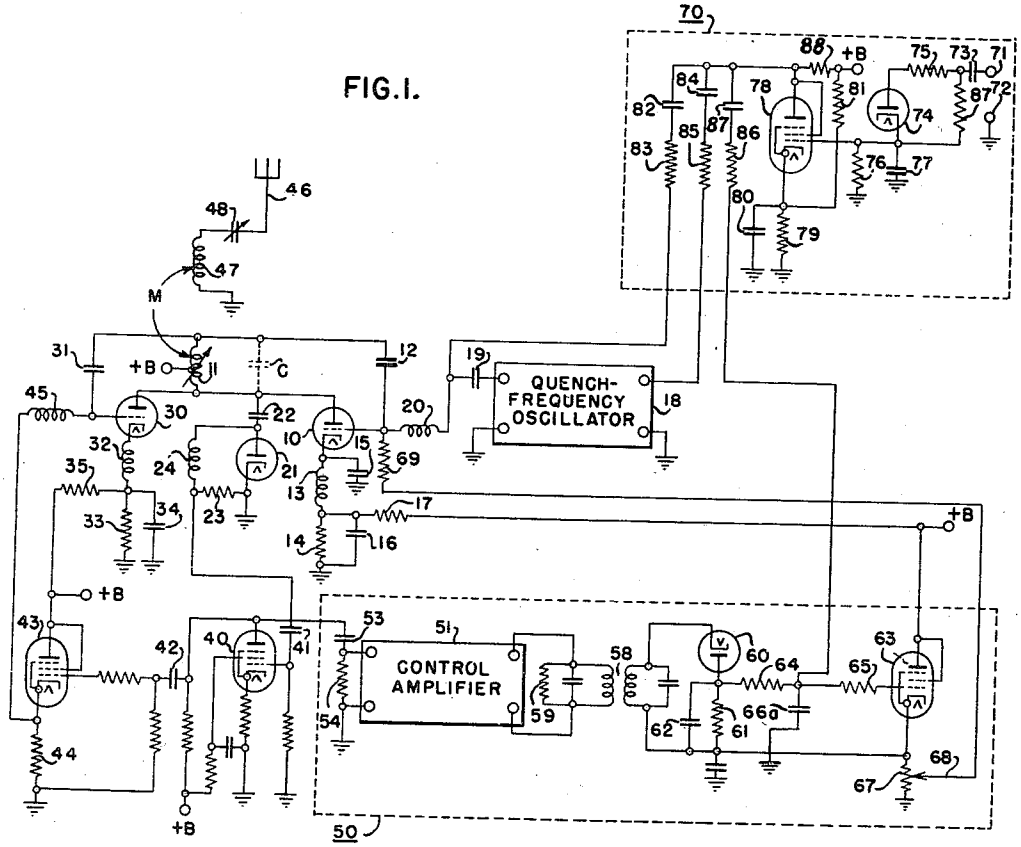
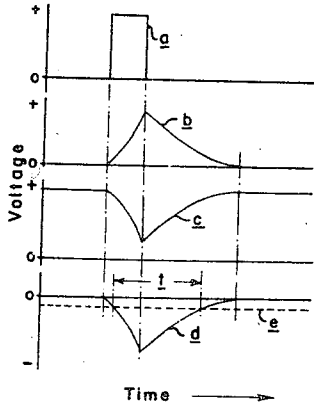


FIG. 2.



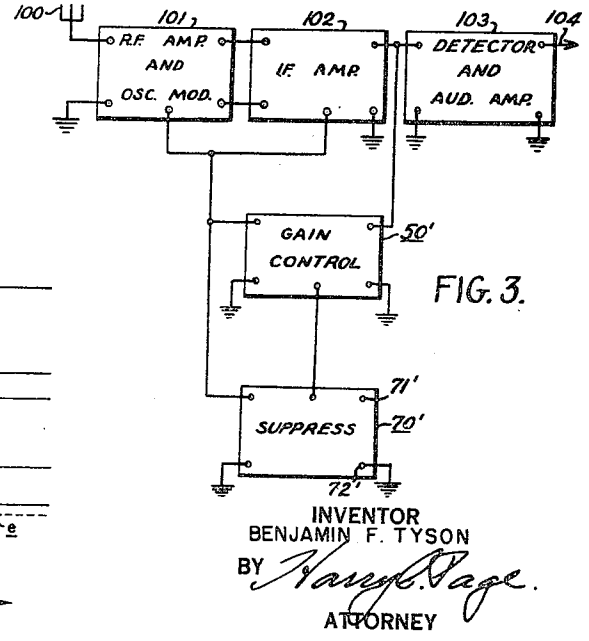


FIG. 3.

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RADIO RECEIVER GAIN-CONTROL ARRANGEMENT

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10 Claims. (Cl. 250—20)

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This invention relates, in general, to arrangements for controlling the gain characteristic of a receiver and is particularly directed to control arrangements for a receiver the operation of which may be suppressed or interrupted for a predetermined interval. While the invention is subject to a variety of applications, it is especially suited for use in a wave-signal transpondor system and will be described in that connection.

As used throughout this specification, the term "wave-signal transpondor system" is intended to designate a wave-signal translating system including a receiver and a transmitter arranged to transmit a reply signal in response to a received interrogating signal, each such signal preferably comprising a pulse-modulated radiant-energy signal.

In one prior transpondor arrangement, the receiver is of the superregenerative type having a linear mode of operation and the transmitter is triggered, or set into operation, under the control of the receiver through an amplitude-selective circuit. Optimum sensitivity of such an arrangement is obtained by adjusting the receiver gain to a compromise value between that corresponding to maximum receiver sensitivity and that which is necessary to assure freedom from triggering the transmitter on the quiescent signal output of the receiver. This quiescent signal output comprises the noise-signal output of the receiver which is obtained during intervals when no desired signal is being received. In general, the quiescent signal output has a relatively low amplitude as determined by the noise signals present in the receiver circuit, but its amplitude varies with variations of the operating potentials, tube characteristics and similar factors. In order to maintain freedom from triggering the transmitter on the quiescent signal output, it is customary to embody a gain-control arrangement in the receiver for controlling the gain thereof to maintain the amplitude level of the quiescent signal output at that value required for optimum sensitivity. One such control arrangement forms the subject matter of copending application Serial No. 521,926, filed February 11, 1944, in the name of John A. Hansen et al. and assigned to the same assignee as the present invention, now Patent No. 2,429,513, granted October 21, 1947. That arrangement includes a system which rectifies a selected portion of the quiescent signal output of the receiver to derive a gain-control voltage. The control voltage varies inversely with variations in the gain characteristic of the receiver and is utilized to stabilize the receiver gain

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so as to maintain the amplitude of the quiescent signal output at the desired optimum value. While such a control arrangement is generally satisfactory, there are certain operating conditions which require an unusual response of a gain-control arrangement of the general type under consideration.

Consider, for example, an installation which includes not only a transpondor system but also other equipment having an operating frequency which is the same as or close to that of the transpondor system. In such a case, an undesirable interference problem is encountered when both the transpondor system and the other equipment are operated simultaneously. To obviate this interference problem, a suppressor circuit may be included in the transpondor for disabling the receiver thereof during intervals when it is desired to operate the other equipment. During such intervals and under such conditions, the quiescent signal output of the receiver is interrupted or substantially decreased. If the transpondor includes a control arrangement of the type described above, the gain-control voltage increases greatly during the suppression interval in a sense to increase greatly the receiver gain. As a consequence, when the receiver is energized at the end of the suppression interval, the gain is so high that the amplitude of the quiescent signal output is sufficient to trigger the transmitter. This phenomenon is termed "false firing" of the transmitter and is an undesired condition which may be attributed to an operating limitation of the described control arrangement in installations of the type under consideration.

It is an object of the invention, therefore, to provide an improved gain-control arrangement for controlling the gain characteristic of a receiver and which avoids the aforementioned limitation of prior art arrangements.

It is another object of the invention to provide an improved arrangement for controlling the gain characteristics of a receiver the operation of which may be suppressed or interrupted for a predetermined interval.

In accordance with the invention, a gain-control arrangement comprises a wave-signal receiver having a gain characteristic, means for deriving from the receiver an output signal having a characteristic which varies with an operating condition of the receiver, means having a predetermined time constant for deriving from the output signal a control effect, and means for utilizing the control effect to control the gain characteristic of the receiver. The arrangement

includes means for substantially decreasing the output signal of the receiver for a predetermined interval which is long with reference to the aforementioned time constant and means responsive to the last-named means for effectively maintaining the magnitude of the aforesaid control effect within a predetermined range of values during the interval when the output signal of the receiver is decreased.

For a better understanding of the present 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 the drawing, Fig. 1 is a schematic circuit diagram of a wave-signal transpondor system, embodying the present invention in a preferred form, Fig. 2 comprises graphs utilized in explaining the operation of a portion of the Fig. 1 arrangement, and Fig. 3 is a block diagram of a superheterodyne receiver including the present invention.

Referring now more particularly to Fig. 1, there is represented a wave-signal tanspondor system for translating pulse-modulated signals and including an improved control arrangement in accordance with the present invention. For convenience of explanation, the system is illustrated as a radio beacon adapted to transmit direction-finding information to inquiring aircraft. The beacon is generally similar to that disclosed in the above-mentioned patent of John A. Hansen et al., and corresponding components are identified by like reference numerals.

The beacon includes a receiver of the super-regenerative type having a linear mode of operation. This receiver comprises an oscillator including a vacuum tube **10** having anode, cathode and control electrodes and a frequency-determining circuit provided by an inductor **11** and a condenser C. This condenser is represented in broken-line construction since it may be comprised in whole or in part of the distributed capacitance of the inductor, the inter-electrode capacitance of the anode and control electrodes of tube **10**, and other stray capacitance effects associated with inductor **11**. The frequency-determining circuit is directly coupled to the anode electrode of tube **10** and is coupled to the control electrode thereof through a blocking condenser **12**. The cathode circuit of the tube **10** includes a signal-frequency choke **13** and a cathode-bias resistor **15** by-passed, respectively, by condensers **15** and **16**. A bias voltage of sufficient magnitude normally to prevent oscillations is applied to the tube through a biasing circuit including resistor **14**, a resistor **17** and a source of unidirectional potential, indicated +B. A source of space current is applied to a tap of inductor **11**, as indicated, and a quench voltage to provide super-regenerative operation is applied to the control electrode-cathode circuit of tube **10** from a quench-frequency oscillator **18** by way of a coupling condenser **19** and a choke **20**. Choke **20** is designed to isolate the oscillations generated in the receiver from oscillator **18**. The quench voltage delivered by oscillator **18** preferably has a sinusoidal wave form and a frequency which is low with reference to the oscillating frequency of tube **10**. Also, the quench frequency is high with reference to the pulse-repetition frequencies of interrogating signals to be received by the beacon and, preferably, such that the period corresponding to the quench frequency is equal to or less than the pulse duration of a received interrogating signal.

A detector system is coupled to the described frequency-determining circuit through a condenser **22** and constitutes means for deriving from the receiver an output signal having a characteristic which varies with an operating condition of the receiver. This detector system includes a diode detector **21** having a load circuit which consists of a resistor **23** and a signal-frequency choke **24**.

A pulse amplifier, including a vacuum tube **40** and having an input circuit coupled to the load circuit of detector **21** through a coupling condenser **41**, applies the detected signal output of the receiver to means, comprising a unit **50**, having a predetermined time constant for deriving from the receiver output signal a first control effect. Unit **50** includes a control amplifier **51**, represented in block diagram, coupled to the output circuit of pulse amplifier **40** by means of a condenser **53** and a resistor **54**. Control amplifier **51** preferably comprises a two-stage amplifier arranged as fully disclosed in the aforementioned patent of John A. Hansen et al. where such amplifier stages are designated by reference numerals **51** and **55**. The output circuit of control amplifier **51** includes the primary circuit of a double-tuned transformer **58** damped by a resistor **59**. Transformer **58** is tuned to the quench frequency of the receiver so as to select the quench-frequency component of the detected signal output of the receiver for rectification in a rectifying system provided by diode rectifier **60** and its load circuit. The load circuit of rectifier **60** includes the secondary winding of transformer **58**, a resistor **61** and a by-pass condenser **62**. The rectifying system has a predetermined time constant, determined by resistor **61** and condenser **62**, which is long with reference to the period of the quench frequency. The rectified signal voltage produced across resistor **61** is applied with negative polarity to the input circuit of a direct current amplifier **63** through a low-pass filter including series resistors **64** and **65** and a shunt capacitance provided by condenser **66***a*. Amplifier **63** is a conventional amplifier except that its load impedance **67** is located in the cathode circuit. A first control effect or voltage of adjustable magnitude is obtained from a voltage tap **68** of impedance **67** and is applied by way of a resistor **69** to the control electrode of receiver tube **10**, constituting means for utilizing the first control effect to control the gain characteristic of the receiver.

The beacon also includes a unit **70** which comprises means for substantially decreasing the output signal of the receiver for a predetermined interval long with reference to the time constant of unit **50** and means responsive to the last-named means for effectively maintaining the magnitude of the first-mentioned control effect within a predetermined range of values during this interval. More specifically, unit **70** comprises a suppressor circuit for applying a pulse-modulated suppressor signal to receiver tube **10** for the purpose of substantially decreasing or interrupting the output signal of the receiver for a desired predetermined interval. The suppressor circuit includes a pair of input terminals **71**, **72** to which a suppressor signal, such as a positive pulse of unidirectional potential, is applied from any suitable source (not shown). A rectifying system is coupled to these

input terminals through a coupling condenser 73 and a radio-frequency filter provided by resistors 75 and 87. This rectifying system includes a diode rectifier 74 having as a load circuit resistor 75 and a parallel combination of a resistor 76 and a condenser 77. Resistor 76 and condenser 77 are selected of such such values that their combination in the rectifying system provides an integrating circuit having a fast-charging time constant by virtue of diode 74 and a slow-discharge time constant. The suppressor circuit also includes an amplifier preferably having a sharp cutoff characteristic. This amplifier consists of a vacuum tube 78 having an input circuit coupled to integrating circuit 76, 77 and having a self-bias resistor 79 by-passed by a condenser 80. Amplifier 78 has an anode load resistor 88 and is normally biased just to cutoff through a biasing circuit provided by resistor 79, a resistor 81 and a source of unidirectional potential, indicated +B. The output circuit of amplifier 78 is coupled to the input circuit of receiver tube 10 through a coupling condenser 82, a resistor 83 and signal-frequency choke 20. The output circuit of this amplifier is likewise coupled to a control circuit of quench-frequency oscillator 18 by means of a condenser 84 and resistor 85. Additionally, the output circuit of amplifier 78 is coupled through a condenser 87 and a resistor 86 to the input circuit of direct current amplifier 63, this last-named circuit arrangement providing means responsive to the suppressor signal for maintaining the magnitude of the gain-control voltage derived from voltage tap 68 within a predetermined range of values during the effective interval of the suppressor signal, as will be described more particularly hereinafter.

The transmitter of the radio beacon comprises a regenerative oscillatory circuit which is generally similar to that of the receiver, differing therefrom principally in that no quench voltage is applied to the transmitter tube. The transmitter includes a vacuum tube 30 having anode, cathode and control electrodes, the anode being directly coupled to the above-described frequency-determining circuit which is common to the receiver and transmitter tubes. The control electrode of tube 30 is coupled to the frequency-determining circuit through a blocking condenser 31. The cathode circuit of tube 30 includes a signal-frequency choke 32 and a time-constant circuit comprising a parallel arrangement of a resistor 33 and a condenser 34 for determining the duration of the transmitted pulses and the transmitter recovery time. Resistor 33 is also connected in circuit with a resistor 35 and a source of unidirectional potential, indicated +B, to provide a biasing circuit which normally holds the transmitter in a nonoscillating condition.

The transmitter is coupled to the receiver through an amplitude-selective circuit including pulse amplifier 40 and a cathode follower 43 having an input circuit coupled to the output circuit of pulse amplifier 40 through a condenser 42. Cathode follower 43 has a cathode load impedance 44 and a transmitter-control voltage developed thereacross is applied to the control electrode of tube 30 through a radio-frequency choke 45.

A single antenna-ground system 46, utilized for both receiving and transmitting, is magnetically coupled to the frequency-determining circuit of the beacon through an inductor 47. The antenna system is tunable by means of an adjustable tuning condenser 48.

The operation of the radio beacon, except for the function of unit 70, is completely described in the aforementioned copending application of John A. Hansen et al. Briefly, during quiescent operating conditions when no signal is intercepted by antenna 46, oscillations are periodically produced in the receiver circuit under the influence of the quench voltage supplied by oscillator 18. These oscillations are initiated by the low-amplitude noise signals present in the receiver circuit and have a correspondingly small amplitude value. The generated oscillations are detected by detector 21, producing across resistor 23 a low-amplitude quiescent output signal having an amplitude characteristic which varies in accordance with the gain characteristic of the receiver and the amplitude of the receiver noise signals. This quiescent signal output is amplified in pulse amplifier 40 and applied to control unit 50 where the quench-frequency component is selected and applied to rectifier 60 for rectification. The resulting rectified voltage developed across resistor 61 is applied with negative polarity to the input circuit of direct current amplifier 63, determining the conductivity thereof and producing across its load impedance 67 a gain-control voltage having a magnitude which varies with the amplitude of the quiescent signal output of the receiver. The circuit parameters and operating potentials of unit 50 are so selected that under normal conditions of operation this control voltage is applied to the input circuit of receiver tube 10 with such magnitude as to establish optimum sensitivity of the receiver circuit. Any variation in the gain of the receiver manifests itself in an amplitude variation of the quiescent signal output which, in turn, produces inverse variations of the gain-control voltage derived in unit 50 so that the gain of the receiver is maintained at that value required for optimum sensitivity.

The quiescent signal output of the receiver is also applied from pulse amplifier 40 to cathode follower 43, producing across its cathode impedance 44 a transmitter-control voltage. However, the transmitter-control voltage developed in response to the quiescent signal output has insufficient magnitude to overcome the bias voltage applied to tube 30 by bias resistor 33. Consequently, during quiescent operating intevals, the transmitter remains blocked.

Let it be assumed now that an aircraft desiring direction-finding information from the beacon transmits thereto a pulse-modulated interrogating signal. In general, this signal has a high intensity with reference to the noise signals in the receiver circuit so that the oscillations generated in the receiver circuit in any quench cycle occurring within the duration of a received pulse have a relatively high amplitude. During the intervals which intervene between pulses of the received signal, the output signal of detector 21 comprises the low-amplitude quiescent signal mentioned above. The resulting output signal of the receiver, including both the high-amplitude and low-amplitude signal components, is supplied to unit 50 which in response to the quench-frequency component thereof derives a gain-control voltage for maintaining the desired gain of the receiver, as indicated above. This output signal is also applied through pulse amplifier 40 to cathode follower 43. The transmitter-control voltage developed across cathode impedance 44 in response to the

high-amplitude signal components derived from each received pulse of the interrogating signal has sufficient magnitude to overcome the blocking potential normally applied to tube 30 and initiate oscillations in the transmitter. Oscillations are thereupon continuously generated in the transmitter until condenser 34 included in the cathode circuit of tube 30 becomes charged to such value as to block the tube and terminate the transmitted pulse. Therefore, in response to a received interrogating signal, the beacon transmits a pulse-modulated reply signal having the same pulse-repetition frequency as the received signal and having a pulse duration largely determined by the selected value of condenser 34. The inquiring aircraft is able to obtain bearing indications or other direction-finding information from the transmitted reply signal of the beacon.

In considering the operation of unit 70 and its effect on the described operation of the beacon, it will be assumed that a pulse-modulated suppressor signal, having a wave form as represented by curve *a* of Fig. 2, is applied to input terminals 71, 72 for the purpose of suppressing the operation of the beacon for a given interval of time. The suppressor signal comprises a pulse of unidirectional potential having a substantially rectangular wave form and positive polarity. This signal is rectified by rectifier 74, establishing across integrating circuit 76, 77 a signal voltage of saw-tooth wave form and positive polarity, as represented by curve *b* of Fig. 2. The signal voltage developed across integrating circuit 76, 77 is applied to the input circuit of amplifier 78 and is translated to the output circuit thereof where it appears as represented by curve *c*. The signal thus derived in the output circuit of amplifier 78 is applied to receiver tube 10 and quench-frequency oscillator 18 with negative polarity, as indicated by curve *d*. Assuming these components of the beacon to have cutoff levels represented by broken-line curve *e*, the applied suppressor signal is effective to block the receiver tube and quench-frequency oscillator for a predetermined interval *t*. The duration of the blocking interval *t* is determined by the magnitude of the suppressor signal as applied to the receiver tube and quench-frequency oscillator and the time constant of integrating circuit 76, 77 which is long with reference to the time constant of the rectifier system included in unit 50. During this blocking interval, the output signal of the receiver is interrupted and the signal voltage across resistor 61 of unit 50 falls quickly to zero at a rate determined by the time-constant circuit 61, 62. As a consequence, there is a tendency for direct current amplifier 63 to become fully conductive, causing the gain-control voltage obtained at voltage tap 68 greatly to increase in a direction to increase the gain of the receiver. However, during the blocking interval, the suppressor signal is also utilized as a second control effect or voltage and is applied through resistor 86 to the input circuit of direct current amplifier 63 with negative polarity, as represented by curve *d*. This is equivalent to applying the suppressor signal to the circuit of rectifier 60 since it maintains a negative-polarity control voltage on the input circuit of direct current amplifier 63 during the suppression interval to maintain the magnitude of the gain-control voltage derived at voltage tap 68 within a predetermined range of values during that interval. This range of values is determined by the above-mentioned second control voltage which is applied through resistor 86 to the input circuit of amplifier 63 during the suppression interval. The value of resistor 86 is so proportioned with reference to resistors 83 and 85 that the gain-control voltage obtained at voltage tap 68 falls within a range of values having the following limits: (1) a value such that the gain of the receiver at the end of a suppression interval is sufficiently high to produce a sensitivity level as required to receive an interrogating signal, and (2) on the other hand, a value which causes the receiver gain at the end of the suppression interval to be sufficiently low that the quiescent signal output of the receiver has an insufficient magnitude to trigger transmitter tube 30. At the end of the suppression interval, the function of unit 70 is complete and the beacon is restored to its normal operating condition.

The gain-control arrangement of the present invention, which in the illustrated embodiment of Fig. 1 comprises units 50 and 70, may be applied to a superheterodyne, as distinguished from a superregenerative, receiver. The block diagram of Fig. 3 represents such an arrangement. The receiver of this figure comprises an antenna system 100 for supplying received wave signals to a radio-frequency amplifier and oscillator modulator 101, including as many stages of radio-frequency amplification as desired. Coupled in cascade to unit 101, in conventional manner, are an intermediate-frequency amplifier 102 and a detector and audio-frequency amplifier 103. As many stages of amplification as desired may be included in each of units 102 and 103. The signal output of the receiver may be supplied to any utilizing circuit, as indicated by the arrow 104. A gain-control system 50', which may be similar to unit 50 of Fig. 1, has an input circuit connected to the output circuit of intermediate-frequency amplifier 102. An output circuit of gain-control system 50' is coupled to units 101 and 102 for applying to one or more of the tubes included in such units a control voltage. The voltage is used to control the amplification of the signal-translating stages of the receiver and thereby maintain the signal input to the detector 103 within a relatively narrow amplitude range for a wide range of received signal intensities. A suppressor unit 70', which may be generally similar to unit 70 of Fig. 1, has input terminals 71' and 72' for receiving a suppressor signal. Suitable output circuits of unit 70' are coupled with units 101 and 102 for selectively suppressing the operation of the superheterodyne receiver for a given interval of time. An additional output circuit of the suppressor arrangement is coupled to gain-control system 50' for maintaining the magnitude of the gain-control voltage derived in unit 50' within a predetermined range of values during the effective interval of the suppressor signal. The operation of the Fig. 3 receiver, in translating received wave signals, is well understood in the art and need not be recited. The gain-control system of unit 50' is effective to derive a control voltage from the noise-signal output of the receiver to be utilized in maintaining the receiver gain or noise signal at a desired predetermined level in a manner similar to that described in connection with the arrangement of Fig. 1. Likewise, unit 70' operates to control the output voltage of unit 50' during suppression intervals, this operation also being as described in connection with the Fig. 1 arrangement.

While there has been described what is at pres-

ent considered to be the preferred embodiment of this 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.

What is claimed is:

1. A gain-control arrangement comprising, a wave-signal receiver having a gain characteristic, means for deriving from said receiver an output signal having a characteristic which varies with an operating condition of said receiver, means having a predetermined time constant for deriving from said output signal a control effect, means for utilizing said control effect to control said gain characteristic of said receiver, means for substantially decreasing said output signal for a predetermined interval long with reference to said time constant, and means responsive to said last-named means for effectively maintaining the magnitude of said control effect within a predetermined range of values during said interval.

2. A gain-control arrangement comprising, a wave-signal receiver having a gain characteristic, means for deriving from said receiver an output signal having an amplitude characteristic which varies with an operating condition of said receiver, means having a predetermined time constant for deriving from said output signal a control effect, means for utilizing said control effect to control said gain characteristic of said receiver, means for substantially decreasing said output signal for a predetermined interval long with reference to said time constant, and means responsive to said last-named means for effectively maintaining the magnitude of said control effect within a predetermined range of values during said interval.

3. A gain-control arrangement comprising, a wave-signal receiver having a gain characteristic, means for deriving from said receiver an output signal having a characteristic which varies with said gain characteristic, means having a predetermined time constant for deriving from said output signal a control effect, means for utilizing said control effect to control said gain characteristic of said receiver, means for substantially decreasing the gain of said receiver for a predetermined interval long with reference to said time constant, and means responsive to said last-named means for effectively maintaining the magnitude of said control effect within a predetermined range of values during said interval.

4. A gain-control arrangement comprising, a wave-signal receiver having a gain characteristic, means for deriving from said receiver an output signal having a characteristic which varies in accordance with the amplitude of the receiver noise signal, means having a predetermined time constant for deriving from said output signal a control effect, means for utilizing said control effect to control said gain characteristic of said receiver, means for substantially decreasing said output signal for a predetermined interval long with reference to said time constant, and means responsive to said last-named means for effectively maintaining the magnitude of said control effect within a predetermined range of values during said interval.

5. A gain-control arrangement comprising, a wave-signal receiver having a gain characteristic, means for deriving from said receiver an output signal having a characteristic which varies with an operating condition of said receiver, means having a predetermined time constant for deriving from said output signal a control effect, means for utilizing said control effect to control said gain characteristic of said receiver, means for interrupting said output signal for a predetermined interval long with reference to said time constant, and means responsive to said last-named means for effectively maintaining the magnitude of said control effect within a predetermined range of values during said interval.

6. A gain-control arrangement comprising, a wave-signal receiver having a gain characteristic, means for deriving from said receiver an output signal having a characteristic which varies with an operating condition of said receiver, means having a predetermined time constant for deriving from said output signal a control effect, means for utilizing said control effect to control said gain characteristic of said receiver, means for supplying to said receiver a suppressor signal for substantially decreasing said output signal for a predetermined interval long with reference to said time constant, and means responsive to said suppressor signal for effectively maintaining the magnitude of said control effect within a predetermined range of values during said interval.

7. A gain-control arrangement comprising, a wave-signal receiver having a gain characteristic, means for deriving from said receiver an output signal having a characteristic which varies with an operating condition of said receiver, means having a predetermined time constant for deriving from said output signal a control effect, means for utilizing said control effect to control said gain characteristic of said receiver, means for supplying to said receiver a pulse-modulated suppressor signal for substantially decreasing said output signal for a predetermined interval long with reference to said time constant, and means responsive to said suppressor signal for effectively maintaining the magnitude of said control effect within a predetermined range of values during said interval.

8. A gain-control arrangement comprising, a wave-signal receiver having a gain characteristic, means for deriving from said receiver an output signal having a characteristic which varies with an operating condition of said receiver, means having a predetermined time constant for deriving from said output signal a first control effect, means for utilizing said first control effect to control said gain characteristic of said receiver, means for substantially decreasing said output signal for a predetermined interval long with reference to said time constant, means responsive to said last-named means for deriving a second control effect, and means for utilizing said second control effect to maintain the magnitude of said first control effect within a predetermined range of values during said interval.

9. A gain-control arrangement comprising, a wave-signal receiver having a gain characteristic, means for deriving from said receiver an output signal having a characteristic which varies with an operating condition of said receiver, means including a rectifying system having a predetermined time constant for deriving from said output signal a control effect, means for utilizing said control effect to control said gain characteristic of said receiver, means for substantially decreasing said output signal for a predetermined interval long with reference to said time constant, and means responsive to said last-

named means for effectively applying to said rectifying means during said interval a signal such that the magnitude of said control effect is maintained within a predetermined range of values during said interval.

10. A gain-control arrangement comprising, a wave-signal receiver having a gain characteristic, means for deriving from said receiver an output signal having a characteristic which varies with an operating condition of said receiver, means including a rectifying system having a predetermined time constant for deriving from said output signal a control effect, means for utilizing said control effect to control said gain characteristic of said receiver, means for supplying to said receiver a suppressor signal for substantially decreasing said output signal for a predetermined interval long with reference to said

time constant, and means for effectively applying said suppressor signal to said rectifying means to maintain the magnitude of said control effect within a predetermined range of values during said interval.

BENJAMIN F. TYSON.

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