

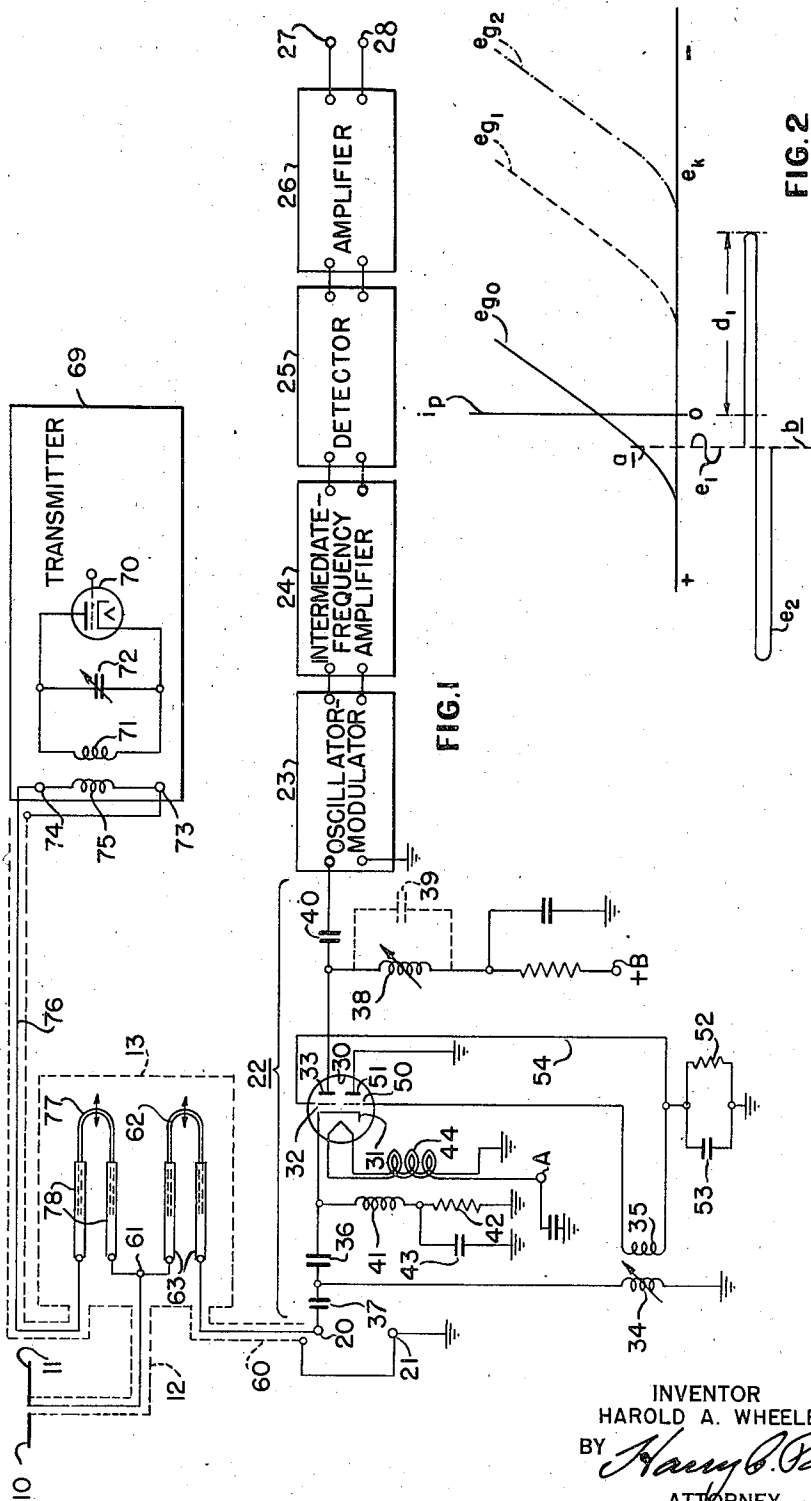
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WAVE-SIGNAL RECEIVER ARRANGEMENT

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WAVE-SIGNAL RECEIVER ARRANGEMENT

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This invention relates, in general, to a wave-signal receiver arrangement and is particularly directed to a receiver arrangement for operation at a predetermined frequency to translate received wave signals and which is adapted to share a common antenna system with an arrangement for transmitting wave signals of a frequency which corresponds substantially to the operating frequency of the receiver, as in a radio-locator or direction-finder system.

For optimum operation, a radio-locator or direction-finder system of the type under consideration should satisfy the following requirements: (a) the receiver should be characterized by a high signal-to-noise ratio; (b) during intervals of wave-signal reception, the receiver should present an input-terminal impedance approximately equal to that of the antenna system, while the transmitter should present a widely different output-terminal impedance; and (c) during intervals of wave-signal transmission, the output-terminal impedance of the transmitter should approximate the terminal impedance of the antenna system, but the input impedance of the receiver should be widely different therefrom. Preferably, during alternate intervals of reception and transmission, the transmitter and receiver should alternately exhibit the properties of a wave-signal reflector, that is, present a very high or infinite impedance at their respective junctions with the common antenna system. Where these operating conditions are fulfilled, the system exhibits its greatest sensitivity and the receiver and transmitter have a minimum interaction or loading effect on one another, permitting maximum useful energy transfer to the receiver and from the transmitter during periods of reception and transmission, respectively.

Prior art systems are known which are designed to realize the above-recited optimum conditions. In one such system the receiver arrangement has an input impedance, during normal wave-signal reception, which substantially equals that of the antenna system and is coupled to the antenna system by means of a transmission-line section which establishes proper impedance matching therebetween. The initial stage of the receiver comprises a grid-driven radio-frequency amplifier which, during intervals of wave-signal transmission, peak-rectifies the transmitted signal in its grid circuit, establishing a bias potential to bias the first stage substantially to anode current cutoff. In this manner, the input impedance of the receiver is modified to lessen the load provided by the receiver on the transmitting arrangement during intervals of transmission. While such an arrangement is generally satisfactory, it employs a screen-grid tube in the radio-frequency amplifier in order that the system may operate over a wide frequency range. As is well under-

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stood, a screen-grid tube does not provide a maximum signal-to-noise ratio and, for certain installations, may constitute an undesirable operating limitation of the described system.

In other prior art systems the initial stage of the receiver includes a cathode-driven triode amplifier which affords a desirable signal-to-noise ratio. However, in these other systems the input-terminal impedance of the receiver is not modified as required substantially to lessen the loading effect of the receiver on the transmitter during intervals of wave-signal transmission. This results from the fact that the transmitted signal is applied to the cathode of the first receiver stage so that during intervals when the transmitted signal could otherwise be peak-rectified to bias the amplifier to anode current cutoff, as in the above-mentioned prior art systems, the peak value of the signal input to the receiver exists between the anode and cathode electrodes of the first amplifier of the receiver, rendering the amplifier highly conductive. This produces an input-terminal impedance closely approaching that presented during periods of normal reception. As a consequence, the receiver constitutes a substantial load on the transmitter and undesirably decreases the power of the transmitted signal radiated by the common antenna system.

It is an object of the invention, therefore, to provide a wave-signal receiver arrangement which avoids one or more of the above-mentioned limitations of prior art arrangements.

It is another object of the invention to provide an improved wave-signal receiver arrangement for operation at a predetermined frequency to translate received wave signals and adapted to share a common antenna system with an arrangement for transmitting wave signals of a frequency which corresponds substantially to the operating frequency of the receiver.

It is a specific object of the invention to provide an improved wave-signal receiver arrangement adapted to share a common antenna system with a transmitting arrangement operating at substantially the same frequency, but which provides a minimum load on the transmitter during intervals of wave-signal transmission.

In accordance with the invention, a wave-signal receiver arrangement for operation at a predetermined frequency to translate received wave signals and adapted to share a common antenna system with an arrangement for transmitting wave signals of a frequency which corresponds substantially to the operating frequency of the receiver comprises a signal-translating channel. The signal-translating channel has an input circuit which presents a predetermined terminal impedance to the antenna system during operating intervals of normal wave-signal reception and

which tends to provide a substantial load on the transmitting arrangement during operating intervals of wave-signal transmission. The receiver arrangement also comprises means including a rectifier device exclusive of the signal-translating channel and responsive to the transmitted signals for deriving a control effect and means for utilizing the control effect so to vary the terminal impedance of the input circuit of the signal-translating channel as substantially to lessen the load provided thereby on the transmitting arrangement during operating intervals of wave-signal transmission.

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 represents a complete radio-locator system, including a wave-signal receiver arrangement in accordance with the invention; and Fig. 2 comprises graphs utilized in explaining the operation thereof.

Referring now more particularly to Fig. 1, the radio-locator system there represented includes an antenna system 10, 11 which is common to and adapted to be shared by receiver and transmitter arrangements, described more particularly hereinafter. For convenience of illustration, the antenna system is shown as a simple dipole, although other systems having more sharply directive radiation characteristics may be utilized, if desired. Also, suitable arrangements may be provided for effectively rotating the antenna directive pattern for scanning purposes. The specific properties of the antenna system are dictated by the operational requirements of the composite locator system and may vary with particular installations. A coaxial transmission line 12 connects the antenna system with a junction box 13, the transmission line being selected to have a characteristic impedance substantially equal to the terminal impedance of the antenna system.

The wave-signal receiver arrangement of the radio-locator system operates at a predetermined frequency to translate received wave signals and, as illustrated, is of the superheterodyne type. This receiver comprises a signal-translating channel for translating received signals and has a pair of input terminals 20, 21. The channel includes a radio-frequency amplifier 22, presently to be described, to which are coupled in cascade an oscillator-modulator 23, an intermediate-frequency amplifier 24 of one or more stages, a detector 25 for deriving the modulation components of received wave signals, and an amplifier 26 of one or more stages. The output circuit of amplifier 26 is coupled to output terminals 27, 28 to which a suitable utilizing circuit, not shown, may be connected.

Radio-frequency amplifier 22 is represented as consisting of a single stage, but it will be understood that as many stages of amplification may be employed as desired. This amplifier comprises a cathode-driven electron-discharge means, specifically, a cathode-driven triode amplifier provided by one section of a duo-triode 30 having a cathode element 31 common to both sections thereof. The control electrode and anode elements of the amplifier section are indicated by reference numerals 32 and 33, respectively. The input circuit of the amplifying section of tube 30 constitutes the input circuit of the described signal-translating channel. This input circuit

comprises the primary winding 34 of a transformer 34, 35 and is rendered selective through variation of the inductance of winding 34. The capacitance, which provides with winding 34 a resonant circuit, includes a condenser 35, the capacitance to ground of cathode element 31, the inherent capacitance of the winding and other associated stray capacitances. This input circuit is coupled to the input terminals of the signal-translating channel through a condenser 37. Control electrode 32 of the amplifying triode is maintained at substantially ground potential and anode electrode 33 thereof is coupled to a tuned output circuit. The output circuit is provided by a variable inductor 38 resonated by a condenser 39, shown in broken-line construction since it may be comprised in whole or in part of the inherent capacitance of inductor 38 and associated stray capacitances. The output circuit of the amplifier is coupled through a condenser 40 to the input circuit of oscillator-modulator 23. A suitable source of space current, indicated +B, is coupled to the anode electrode 33, while a self-biasing circuit is coupled to cathode element 31. The biasing circuit includes a radio-frequency choke 41 and a bias resistor 42, by-passed for radio-frequency currents by means of a condenser 43. Cathode 31 is of the indirectly heated type, having a heater circuit which consists of a bifilar winding 44 coupled to a source of heater voltage, indicated A.

The operating potentials applied to the electrode elements of the amplifying section of tube 30 are such that this section is operated substantially above anode current cutoff during operating intervals of normal wave-signal reception. Furthermore, the described input circuit thereof presents, during such operating intervals, a predetermined impedance at terminals 20, 21 which is approximately equal to the terminal impedance of the antenna system 10, 11 and which, for this reason, tends to provide a substantial load on the transmitting arrangement during operating intervals of wave-signal transmission, as will be more clear hereinafter.

The receiver arrangement under consideration also comprises means including a peak-rectifier device exclusive of the defined signal-translating channel and responsive to transmitted signals for deriving a control effect. The rectifier device is provided by the remaining section of duo-triode 30 comprising electrode elements 50 and 51. Electrode 51 is grounded and electrode 50 serves as the anode element of the rectifier. Since the cathode 31 is common to the amplifying and rectifying sections of tube 30, the self-biasing arrangement of the amplifier, including resistor 42, constitutes means for deriving from the amplifying section and for applying to the rectifier device an amplitude-delay bias. Resistor 42 is selected of such value that the rectifier device is unresponsive to signals received during normal intervals of wave-signal reception. The load circuit of the rectifier includes a time-constant circuit across which a unidirectional control potential, or control effect, is developed. The time-constant circuit comprises a parallel combination of a resistor 52 and a condenser 53 and is coupled to the anode element of the rectifier device through secondary winding 35 of transformer 34, 35. The rectifier circuit is arranged to have a fast charging time constant but a slow discharge time constant. In particular, the values of elements 52 and 53 are selected to cause the discharge time constant to be long with reference to

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the period corresponding to the carrier component of the transmitted signals in order that such signals may be peak-rectified. The described rectifier device may be considered to be exclusive of the receiver signal-translating channel in view of the fact that normal signal translation through the receiver is independent of the rectifying section of tube 30.

The receiver arrangement also has means for utilizing the control effect derived by the rectifier device so to vary the terminal impedance of the input circuit of amplifier 22 and the signal-translating channel as substantially to lessen the load provided by the channel on the transmitting arrangement during operating intervals of wave-signal transmission. To this end, a conductor 54 applies the unidirectional control potential with negative polarity to control electrode 32 of amplifier 22, biasing the amplifier in the direction of anode current cutoff.

The transmitted signals are applied to the rectifier device with such intensity that the magnitude of this control potential is such as to bias the amplifier section of tube 30 substantially to anode current cutoff, thereby to effect a maximum impedance change at input terminals 20, 21 of the receiver during intervals of transmission. This is accomplished by applying the transmitted signals to the rectifier device with greater intensity than such signals are applied to the cathode-driven amplifier. In this connection, it will be seen that signals applied to input terminals 20, 21 of the receiver are applied with a given phase and a given intensity to cathode 31 of the amplifying section of tube 30 and, since this cathode element is common to both sections of tube 30, such signals are applied with the same phase and same intensity to the cathode circuit of the rectifier. Transformer 34, 35 provides additional means for applying such signals to the anode element of the rectifier device, the secondary winding 35 being poles so that this last-named means applies received signals to the anode element of the rectifier device in phase addition with the same signals as applied directly to the cathode.

A coaxial transmission-line section 60 couples the receiver arrangement to antenna system 10, 11, having a junction with the antenna transmission line 12 as indicated at 61. This coupling arrangement is effective to apply both received and transmitted signals from the antenna feeder 12 to the input terminals of the receiver. Transmission-line section 60 is selected to have a characteristic impedance corresponding to the terminal impedance of the receiver during intervals of normal wave-signal reception so that during such intervals the receiver and antenna system are coupled with matched impedances. A portion of the inner conductor of transmission line 60 has a U-shaped configuration telescopically adjustable within a cooperating portion 63 for the purpose of adjusting the effective electrical length of the transmission line. Through this adjustment, the effective electrical length of line 60 is established to have such a value at the operating frequency of the transmitter that during intervals of wave-signal transmission when the input impedance of the receiver has its modified value, transmission-line section 60 comprises an impedance transformer which transforms the receiver input impedance to a maximum value at the junction 61.

The transmitting arrangement of the radio-locator system has substantially the same operat-

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ing frequency as the receiver portion. It is represented by the block diagram 69 and may be of any conventional design and construction, preferably including provisions for keyed operation to transmit a pulse-modulated carrier-frequency wave signal when keyed into operation. A schematic circuit representation of a portion of the transmitter arrangement is included within block 69, showing a preferred method for coupling the transmitter to antenna system 10, 11. Tube 70 of the schematic circuit diagram represents a power tube of the transmitter, such as a power amplifier or oscillator having a tuned output circuit comprising an inductor 71 and a tuning condenser 72. Tuned circuit 71, 72 is selected to be a low-loss circuit and is coupled to suitable output terminals 73, 74 through an inductor 75. Inductors 71 and 75 are arranged for optimum coupling during periods of transmission when tube 70 is conductive, but have much greater than optimum coupling during intervals of wave-signal reception when tube 70 is in a quiescent or nonconductive state. The coupling is such that this final stage of the transmitter presents, during periods of transmission, a predetermined output impedance at terminals 73, 74 which corresponds substantially to the terminal impedance of the antenna system. During periods of wave-signal reception, however, when the degree of coupling between inductors 71 and 75 is materially different, a much different terminal impedance is presented at terminals 73, 74.

Transmission-line section 76 couples the transmitter arrangement to junction 61 of the antenna transmission line 12. Transmission-line section 76 is generally similar to section 60, having a characteristic impedance corresponding to the terminal impedance of the transmitter arrangement during intervals of normal wave-signal transmission for coupling the antenna system thereto with matched impedance. This line also includes an adjustable section, comprising telescoping elements 77 and 78, for adjusting its effective electrical length. The length is so selected that at the operating frequency of the receiver line section 76 comprises an impedance transformer which transforms the modified terminal impedance of the transmitter obtained during intervals of normal wave-signal reception when tube 70 is in a quiescent condition to a maximum impedance at the antenna junction 61.

In considering the operation of the radio-locator system of Fig. 1, it will be assumed initially that the transmitter arrangement is in its quiescent condition and that the receiver arrangement is conditioned for normal wave-signal reception. For the assumed conditions, the output-terminal impedance of the transmitter is widely different from the characteristic impedance of transmission-line section 76 and the transmitter has its minimum loading effect on the receiver arrangement. The receiver, on the other hand, presents its normal input impedance which corresponds both to the characteristic impedances of transmission lines 60 and 12 and the terminal impedance of the antenna system 10, 11. Thus, the amplifying section of duo-triode 30 is substantially matched to the antenna system for maximum energy transfer therebetween. For this condition, the operating characteristic of radio-frequency amplifier 22 is represented by the full-line curve of Fig. 2, which characteristic represents the plate current-cathode voltage operating characteristic for the normal grid bias e_{c0} . It is to be noted that the abscissa axis

is drawn with positive cathode voltages indicated to the left of the ordinate axis $O-y_0$ and with negative cathode voltages indicated to the right of this ordinate axis. This unconventional abscissa scale has been chosen in order that the characteristic may resemble the more familiar plate current-grid voltage characteristic of a triode amplifier. The self-biasing circuit of the amplifier establishes an operating point indicated by the broken ordinate line $a-b$. This operating point is such that for signals applied to the receiver during normal intervals of wave-signal reception amplifier 22 does not draw grid current. Curve e_1 of Fig. 2 represents the magnitude of normal received signals and shows the amplitude-delay bias which is applied to cathode 31 to be such that the rectifier device 31, 50 is unresponsive to signals received during normal operating intervals of wave-signal reception. Thus, any such received signals are translated through the receiver arrangement, in accordance with conventional superheterodyne reception, and the modulation components thereof derived in detector 25 are amplified in amplifier 26 and applied to output terminals 27, 28 for utilization.

Assume, now, that the transmitter 69 is keyed into operation to transmit a signal. At the instant transmission is initiated, the output-terminal impedance of the transmitter is modified to a value which corresponds to the characteristic impedance of transmission lines 76 and 12, thereby coupling the transmitter to the antenna with matched impedances. However, the receiver arrangement likewise presents the same impedance to antenna junction 61 at the start of transmission and, hence, tends to provide a substantial load on the transmitting arrangement. Therefore, the transmitted signal is applied with substantial intensity to the input circuit of the receiver arrangement. The magnitude of the transmitted signal applied to input terminals 20, 21 may be as represented by curve e_2 of Fig. 2.

Neglecting for a moment the effect of secondary winding 35 of transformer 34, 35, it will be apparent that the rectifier section of tube 30 rectifies that portion of the applied transmitted signal which excess the amplitude-delay bias existing on its cathode. That is to say, the rectifier develops across time-constant circuit 52, 53 a unidirectional control potential proportional to dimension line d_1 of Fig. 2. This control potential, being applied as an operating bias to control electrode 32 of amplifier 22, effectively shifts the operating characteristic of the amplifier a corresponding amount, as indicated by broken-line curve e_{g_1} . By projecting curve e_2 upon the new characteristic e_{g_1} , it becomes evident that this bias is insufficient to bias amplifier 22 to anode current cutoff, as required to effect a maximum impedance change at the input terminals of the receiver arrangement. Consequently, transformer 34, 35 is provided to apply an additional portion of the transmitted signal to the anode element of rectifier 31, 50 in phase addition with that applied directly to its cathode element. This additional portion of the transmitted signal is selected of such value that the resulting control potential developed by time-constant circuit 52, 53 shifts the operating characteristic of the amplifier, as indicated by dash-dot curve e_{g_2} . In other words, the control potential developed is sufficient to bias amplifier 22 to anode current cutoff and effect a maximum impedance change at input terminals 20, 21 of the receiver arrangement. Since the rectifier device has a

fast charging time constant, the described change in input impedance is accomplished early in the cycle of the transmitter arrangement. Transmission line 60 transforms this new value of the receiver input impedance to a high value at antenna junction 61 so as substantially to lessen the load provided by the receiver on the transmitting arrangement during operating intervals of wave-signal transmission.

At the completion of the transmission cycle, the bias potential established by time-constant circuit 52, 53 decays to zero, reestablishing in the receiver normal conditions for wave-signal reception. At the same time, since tube 70 of the transmitter arrangement is returned to its quiescent state, the transmitter presents a maximum impedance at junction 61. Therefore, by the time the transmitted signal is reflected from the object to be located and returned to antenna system 10, 11, the first-described conditions are established in which the receiver is matched with the antenna and the transmitter has its minimum loading effect on the receiver. The reflected signal is, therefore, translated in conventional manner to output terminals 27, 28 of the receiver for utilization to obtain the required indication.

In the foregoing description it was pointed out that the receiver and transmitter arrangements have modified terminal impedances during intervals of transmission and reception, respectively. In each instance, the modified impedance was said to be transformed by the associated transmission-line section to a high impedance at the antenna junction 61 in order to lessen the loading effect of the receiver and transmitter upon one another during appropriate portions of the locator operating cycle. This phenomena may be viewed differently, in terms of signal reflection. That is, the terminal impedance of the transmitter during normal periods of reception is such as to effect a substantial impedance mismatch between the transmitter and its associated line section 76. Preferably, the impedance mismatch should cause the transmitter to appear to be a perfect reflector during periods of reception so that the entire received energy may be delivered to the receiver. Likewise, during intervals of transmission the change in impedance of the receiver should cause the receiver to appear as a perfect reflector, to minimize its loading effect on the transmitter.

In one embodiment of the invention found to have practical utility the following circuit components were utilized in the initial stage of the described receiver:

Tube 30	Type 6J6
Resistor 42	47 ohms
Resistor 52	22,000 ohms
Condensers 36 and 40	5 micromicrofarads
Condenser 37	4 micromicrofarads
Condenser 43	100 micromicrofarads
Condenser 53	50 micromicrofarads
Inductor 38	Adjusted to tune over operating-frequency range
Transformer 34, 35	Air-core transformer; 3½-turn primary and single-turn secondary
B-supply	165-195 volts
Transmission line 60	Section of 50-ohm coaxial cable
Operating frequency	157-187 megacycles

The described locator system will be seen to satisfy the aforementioned operating conditions required for optimum operation. By using a cathode-driven triode amplifier in radio-frequency amplifier 22, a high signal-to-noise ratio is obtained and the receiver may be operated over a wide range of frequencies.

While there has been described what is at present 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 to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. A wave-signal receiver arrangement for operation at a predetermined frequency to translate received wave signals and adapted to share a common antenna system with an arrangement for transmitting wave signals of a frequency which corresponds substantially to said predetermined frequency comprising, a signal-translating channel having an input circuit which presents a predetermined terminal impedance to said antenna system during operating intervals of normal wave-signal reception and which tends to provide a substantial load on said transmitting arrangement during operating intervals of wave-signal transmission, means including a rectifier device exclusive of said signal-translating channel and responsive to said transmitted signals for deriving a control effect, and means for utilizing said control effect so to vary the terminal impedance of said input circuit as substantially to lessen the load provided by said signal-translating channel on said transmitting arrangement during operating intervals of wave-signal transmission.

2. A wave-signal receiver arrangement for operation at a predetermined frequency to translate received wave signals and adapted to share a common antenna system with an arrangement for transmitting wave signals of a frequency which corresponds substantially to said predetermined frequency comprising, a signal-translating channel having an input circuit which presents a predetermined terminal impedance to said antenna system during operating intervals of normal wave-signal reception and which tends to provide a substantial load on said transmitting arrangement during operating intervals of wave-signal transmission, means including a peak-rectifier device exclusive of said signal-translating channel and responsive to said transmitted signals for deriving a control effect, and means for utilizing said control effect so to vary the terminal impedance of said input circuit as substantially to lessen the load provided by said signal-translating channel on said transmitting arrangement during operating intervals of wave-signal transmission.

3. A wave-signal receiver arrangement for operation at a predetermined frequency to translate received wave signals and adapted to share a common antenna system with an arrangement for transmitting wave signals of a frequency which corresponds substantially to said predetermined frequency comprising, a signal-translating channel having an input circuit which presents a predetermined terminal impedance to said antenna system during operating intervals of normal wave-signal reception and which tends to provide a substantial load on said transmitting arrangement during operating intervals of wave-signal transmission, means including a rectifier

device exclusive of said signal-translating channel and responsive to said transmitted signals for deriving a control effect but which is substantially unresponsive to said received signals, and means for utilizing said control effect so to vary the terminal impedance of said input circuit as substantially to lessen the load provided by said signal-translating channel on said transmitting arrangement during operating intervals of wave-signal transmission.

4. A wave-signal receiver arrangement for operation at a predetermined frequency to translate received wave signals and adapted to share a common antenna system with an arrangement for transmitting wave signals of a frequency which corresponds substantially to said predetermined frequency comprising, a signal-translating channel having an input circuit which presents a predetermined terminal impedance to said antenna system during operating intervals of normal wave-signal reception and which tends to provide a substantial load on said transmitting arrangement during operating intervals of wave-signal transmission, means including a rectifier device exclusive of said signal-translating channel and responsive to said transmitted signals for deriving a control effect, means for applying an amplitude-delay bias to said rectifier device such that said device is substantially unresponsive to said received signals, and means for utilizing said control effect so to vary the terminal impedance of said input circuit as substantially to lessen the load provided by said signal-translating channel on said transmitting arrangement during operating intervals of wave-signal transmission.

5. A wave-signal receiver arrangement for operation at a predetermined frequency to translate received wave signals and adapted to share a common antenna system with an arrangement for transmitting wave signals of a frequency which corresponds substantially to said predetermined frequency comprising, a signal-translating channel for translating said received signals, electron-discharge means included in said channel having an input circuit which presents a predetermined terminal impedance to said antenna system during operating intervals of normal wave-signal reception and which tends to cause said channel to provide a substantial load on said transmitting arrangement during operating intervals of wave-signal transmission, means including a rectifier device exclusive of said signal-translating channel and responsive to said transmitted signals for deriving a control effect, and means for utilizing said control effect so to vary the terminal impedance of said input circuit as substantially to lessen the load provided by said signal-translating channel on said transmitting arrangement during operating intervals of wave-signal transmission.

6. A wave-signal receiver arrangement for operation at a predetermined frequency to translate received wave signals and adapted to share a common antenna system with an arrangement for transmitting wave signals of a frequency which corresponds substantially to said predetermined frequency comprising, a signal-translating channel for translating said received signals, electron-discharge means included in said channel operated substantially above anode current cutoff during intervals of normal wave-signal reception and having an input circuit which presents a predetermined terminal impedance to said antenna system during such intervals but

which tends to cause said channel to provide a substantial load on said transmitting arrangement during operating intervals of wave-signal transmission, means including a rectifier device exclusive of said signal-translating channel and responsive to said transmitted signals for deriving a control effect, and means for utilizing said control effect to bias said electron-discharge means substantially to anode current cutoff to vary the terminal impedance of said input circuit and substantially lessen the load provided by said signal-translating channel on said transmitting arrangement during operating intervals of wave-signal transmission.

7. A wave-signal receiver arrangement for operation at a predetermined frequency to translate received wave signals and adapted to share a common antenna system with an arrangement for transmitting wave signals of a frequency which corresponds substantially to said predetermined frequency comprising, a signal-translating channel for translating said received signals, a cathode-driven electron-discharge amplifier included in said channel operated substantially above anode current cutoff during intervals of normal wave-signal reception and having an input circuit which presents a predetermined terminal impedance to said antenna system during such intervals but which tends to cause said channel to provide a substantial load on said transmitting arrangement during operating intervals of wave-signal transmission, means including a rectifier device exclusive of said signal-translating channel and responsive to said transmitted signals for deriving a control effect, and means for utilizing said control effect to bias said electron-discharge means substantially to anode current cutoff to vary the terminal impedance of said input circuit and substantially lessen the load provided by said signal-translating channel on said transmitting arrangement during operating intervals of wave-signal transmission.

8. A wave-signal receiver arrangement for operation at a predetermined frequency to translate received wave signals and adapted to share a common antenna system with an arrangement for transmitting wave signals of a frequency which corresponds substantially to said predetermined frequency comprising, a signal-translating channel for translating said received signals, electron-discharge means included in said channel having an input circuit which presents a predetermined terminal impedance to said antenna system during operating intervals of normal wave-signal reception and which tends to cause said channel to provide a substantial load on said transmitting arrangement during operating intervals of wave-signal transmission, means including a rectifier device exclusive of said signal-translating channel and responsive to said transmitted signals for deriving a control effect, means for deriving from said electron-discharge means and for applying to said rectifier device an amplitude-delay bias such that said device is substantially unresponsive to said received signals, and means for utilizing said control effect so to vary the terminal impedance of said input circuit as substantially to lessen the load provided by said signal-translating channel on said transmitting arrangement during operating intervals of wave-signal transmission.

9. A wave-signal receiver arrangement for operation at a predetermined frequency to translate received wave signals and adapted to share a common antenna system with an arrangement

for transmitting wave signals of a frequency which corresponds substantially to said predetermined frequency comprising, a signal-translating channel for translating said received signals, electron-discharge means included in said channel having an input circuit which presents a predetermined terminal impedance to said antenna system during operating intervals of normal wave-signal reception and which tends to cause said channel to provide a substantial load on said transmitting arrangement during operating intervals of wave-signal transmission, means including a rectifier device exclusive of said signal-translating channel and responsive to said transmitted signals for deriving a unidirectional control potential, means for utilizing said control potential to bias said electron-discharge means in the direction of anode current cutoff, means for coupling said signal-translating channel to said antenna system so that said received and transmitted signals are applied thereto, and means for applying said transmitted signals to said rectifier device with such intensity that the magnitude of said control potential is such as to bias said electron-discharge means substantially to anode current cutoff and vary the terminal impedance of said input circuit so as substantially to lessen the load provided by said signal-translating channel on said transmitting arrangement during operating intervals of wave-signal transmission.

10. A wave-signal receiver arrangement for operation at a predetermined frequency to translate received wave signals and adapted to share a common antenna system with an arrangement for transmitting wave signals of a frequency which corresponds substantially to said predetermined frequency comprising, a signal-translating channel for translating said received signals, electron-discharge means included in said channel having an input circuit which presents a predetermined terminal impedance to said antenna system during operating intervals of normal wave-signal reception and which tends to cause said channel to provide a substantial load on said transmitting arrangement during operating intervals of wave-signal transmission, means including a rectifier device exclusive of said signal-translating channel and responsive to said transmitted signals for deriving a unidirectional control potential, means for utilizing said control potential to bias said electron-discharge means in the direction of anode current cutoff, means for coupling said signal-translating channel to said antenna system so that said received and transmitted signals are applied thereto with given intensities, and means for applying said transmitted signals to said rectifier device with such a greater intensity that the magnitude of said control potential is such as to bias said electron-discharge means substantially to anode current cutoff and vary the terminal impedance of said input circuit so as substantially to lessen the load provided by said signal-translating channel on said transmitting arrangement during operating intervals of wave-signal transmission.

11. A wave-signal receiver arrangement for operation at a predetermined frequency to translate received wave signals and adapted to share a common antenna system with an arrangement for transmitting wave signals of a frequency which corresponds substantially to said predetermined frequency comprising, a signal-translating channel for translating said received signals, electron-discharge means included in said

channel having an input circuit which presents a predetermined terminal impedance to said antenna system during operating intervals of normal wave-signal reception and which tends to cause said channel to provide a substantial load on said transmitting arrangement during operating intervals of wave-signal transmission, means including a rectifier device exclusive of said signal-translating channel and responsive to said transmitted signals for deriving a unidirectional control potential, means for utilizing said control potential to bias said electron-discharge means in the direction of anode current cutoff, means for coupling said signal-translating channel to said antenna system so that said received and transmitted signals are applied thereto with a given phase and given intensities and for applying said transmitted signals to said rectifier device with substantially the same phase and intensity, and additional means for applying said transmitted signals with a predetermined intensity to said rectifier device in phase addition with said last-named means so that the magnitude of said control potential is such as to bias said electron-discharge means to anode current cutoff and vary the terminal impedance of said input circuit so as substantially to lessen the load provided by said signal-translating channel on said transmitting arrangement during operating intervals of wave-signal transmission.

12. A wave-signal receiver arrangement for operation at a predetermined frequency to translate received wave signals and adapted to share a common antenna system with an arrangement for transmitting wave signals of a frequency which corresponds substantially to said predetermined frequency comprising, a signal-translating channel for translating said received signals, a cathode-driven electron-discharge means included in said channel operated substantially above anode current cutoff during intervals of normal wave-signal reception and having an input circuit which presents a predetermined terminal impedance to said antenna system during such intervals but which tends to cause said channel to provide a substantial load on said transmitting arrangement during operating intervals of wave-signal transmission, means including a rectifier device having a cathode element in common with said electron-discharge means and effectively exclusive of said signal-translating channel for responding to said transmitted signals to derive a unidirectional control potential, means for utilizing said control potential to bias said electron-discharge device in the direction of anode current cutoff, means for coupling said channel to said antenna system and for applying said received and transmitted signals with a given phase and given intensities to said common cathode element of said electron-discharge means and said rectifier device, and additional means for applying said transmitted signals with a predetermined intensity to said rectifier device in phase addition with said last-named means so that the magnitude of said control potential is such as to bias said electron-discharge means substantially to anode current cutoff and vary the terminal impedance of said input circuit so as substantially to lessen the load provided by said signal-translating channel on said transmitting arrangement during operating intervals of wave-signal transmission.

13. A wave-signal receiver arrangement for operation at a predetermined frequency to translate received wave signals and adapted to share

a common antenna system with an arrangement for transmitting wave signals of a frequency which corresponds substantially to said predetermined frequency comprising, a signal-translating channel for translating said received signals, a cathode-driven electron-discharge means included in said channel operated substantially above anode current cutoff during intervals of normal wave-signal reception and having an input circuit which presents a predetermined terminal impedance to said antenna system during such intervals but which tends to cause said channel to provide a substantial load on said transmitting arrangement during operating intervals of wave-signal transmission, means including a rectifier device having a cathode element in common with said electron-discharge means and an anode element and being effectively exclusive of said signal-translating channel for responding to said transmitted signals to derive a unidirectional control potential, means included in said input circuit for applying an amplitude-delay bias to said rectifier device such that said device is substantially unresponsive to said received signals, means for utilizing said control potential to bias said electron-discharge means in the direction of anode current cutoff, means for coupling said channel to said antenna system and for applying said received and transmitted signals with a given phase and given intensities to said common cathode element of said electron-discharge means and said rectifier device, and additional means for applying said transmitted signals with a predetermined intensity to said anode element of said rectifier device in phase addition with said last-named means so that the magnitude of said control potential is such as to bias said electron-discharge means to anode current cutoff and vary the terminal impedance of said input circuit so as substantially to lessen the load provided by said signal-translating channel on said transmitting arrangement during operating intervals of wave-signal transmission.

14. A wave-signal receiver arrangement for operation at a predetermined frequency to translate received wave signals and adapted to share a common antenna system with an arrangement for transmitting wave signals of a frequency which corresponds substantially to said predetermined frequency comprising, a signal-translating channel for translating said received signals, electron-discharge means included in said channel having an input circuit which presents a predetermined terminal impedance to said antenna system during operating intervals of normal wave-signal reception and which tends to cause said channel to provide a substantial load on said transmitting arrangement during operating intervals of wave-signal transmission, means including a rectifier device exclusive of said signal-translating channel and responsive to said transmitted signals for deriving a unidirectional control potential, means for utilizing said control potential to bias said electron-discharge device in the direction of anode current cutoff, means for coupling said channel to said antenna system so that said received and transmitted signals are applied thereto with a given phase and given intensities and for applying said transmitted signals to said rectifier device with substantially the same phase and intensity, and additional means coupled to said channel for applying said transmitted signals with a predetermined intensity to said rectifier device in phase addition with said last-named means so that the

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magnitude of said control potential is such as to bias said electron-discharge means to anode current cutoff and vary the terminal impedance of said input circuit so as substantially to lessen the load provided by said signal-translating channel on said transmitting arrangement during operating intervals of wave-signal transmission.

15. A wave-signal receiver arrangement for operation at a predetermined frequency to translate received wave signals and adapted to share a common antenna system with an arrangement for transmitting wave signals of a frequency which corresponds substantially to said predetermined frequency comprising, a signal-translating channel having an input circuit which presents a predetermined terminal impedance to said antenna system during operating intervals of normal wave-signal reception and which tends to provide a substantial load on said transmitting arrangement during operating intervals of wave-signal transmission, means including a rectifier device exclusive of said signal-translating channel and responsive to said transmitted signals for deriving a control effect, means for utilizing said control effect to cause said input circuit to have a modified terminal impedance during operating intervals of wave-signal transmission, and an adjustable transmission-line section having a characteristic impedance corresponding to said predetermined terminal impedance for coupling said signal-translating channel to said antenna system with substantial impedance matching during intervals of wave-signal reception and having such an effective electrical length at a frequency corresponding to the operating frequency of said transmitting arrangement as to comprise an impedance transformer for substantially lessening the load provided by said signal-translating channel on said transmitting arrangement during operating intervals of wave-signal transmission.

16. A wave-signal receiver arrangement for operation at a predetermined frequency to translate received wave signals and adapted to share

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a common antenna system having a predetermined terminal impedance at said predetermined frequency with an arrangement for transmitting wave signals of a frequency which corresponds substantially to said predetermined frequency comprising, a signal-translating channel having an input circuit which presents to said antenna system during operating intervals of normal wave-signal reception a terminal impedance approximately equal to said predetermined impedance and which tends to provide a substantial load on said transmitting arrangement during operating intervals of wave-signal transmission, means including a rectifier device exclusive of said signal-translating channel and responsive to said transmitted signals for deriving a control effect, means for utilizing said control effect to cause said input circuit to have a modified terminal impedance during operating intervals of wave-signal transmission, and an adjustable transmission-line section having a characteristic impedance corresponding to said predetermined impedance for coupling said signal-translating channel to said antenna system with substantial impedance matching during intervals of wave-signal reception and having such an effective electrical length at a frequency corresponding to the operating frequency of said transmitting arrangement as to comprise an impedance transformer for substantially lessening the load provided by said signal-translating channel on said transmitting arrangement during operating intervals of wave-signal transmission.

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