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WAVE SIGNALING SYSTEM

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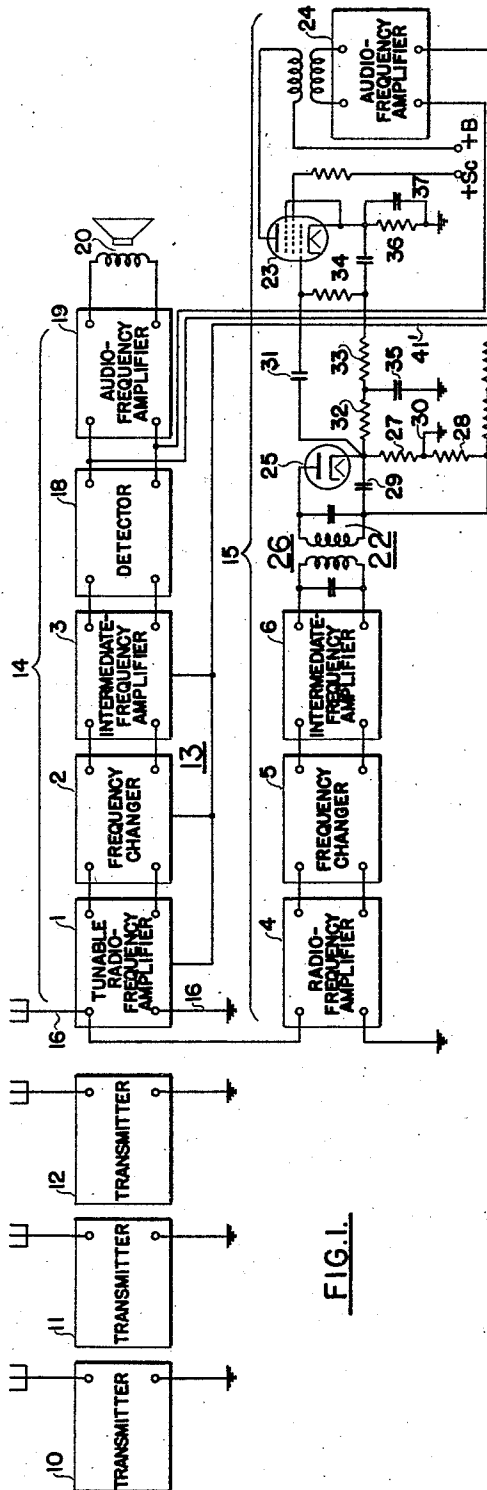


FIG. 1.

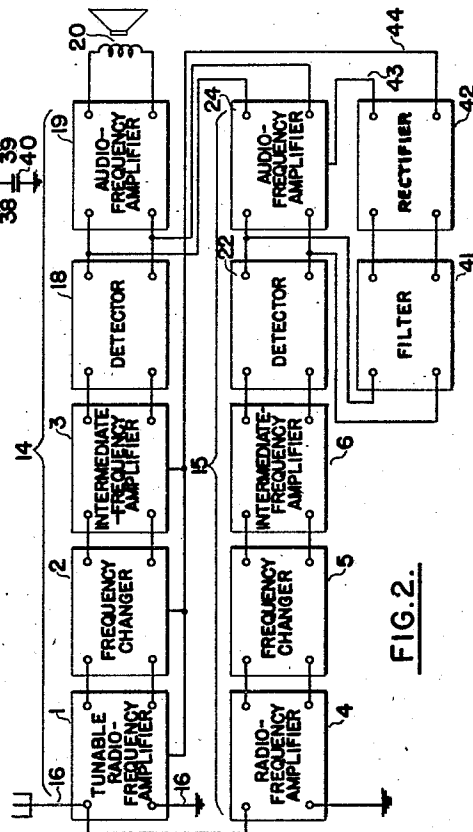


FIG. 2.

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WAVE SIGNALING SYSTEM

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15 Claims. (Cl. 250—20)

This invention relates to wave-signaling systems, and more particularly to such systems constructed and arranged to facilitate the dissemination of signals of unusual interest.

In the art of radio broadcasting it is frequently desirable to transmit to the listening public or a portion thereof special unscheduled signals or programs of unusual interest or importance and it is often equally as desirable from the listeners' point of view to receive such programs. As examples of the type of program referred to, there may be mentioned important news items, traffic instructions to traveling motorists, police bulletins, and the like.

As is well known, with the present system of radio broadcasting the various transmitters operate on different assigned carrier frequencies and the present method by which such unscheduled programs are broadcast is that of interrupting one or more of the scheduled programs and transmitting in lieu thereof the special or unscheduled program. Due to the nature of such unscheduled programs, it is impossible effectively to announce the same or to apprise all of the public thereof. Consequently, listeners or operators who may have their receivers tuned to receive signals from transmitters other than those from which such unscheduled programs are transmitted are unaware of them and fail to receive them.

It is an object of the present invention, therefore, to provide a wave-signaling system for facilitating the transmission and reception of unscheduled programs of the type referred to.

It is another object of the invention to provide a wave-signaling system in which receivers are automatically conditioned to receive signals of the type referred to from a particular transmitter irrespective of the signal frequencies to which the receivers are individually tuned at the time the signal from the particular system is transmitted.

It is a further object of the invention to provide a wave signal-receiving system which functions automatically to interrupt the reproduction of a program from any selected transmitter and to reproduce an unscheduled program of the character described from a predetermined different transmitter.

Briefly, the above objects are attained in accordance with the present invention by broadcasting the unscheduled programs or signals from one or more transmitters having predetermined individual carrier frequencies and by arranging the receiving systems to be individually responsive to one such carrier frequency in a manner

such that when programs of the character referred to are broadcast by the corresponding transmitter, the selected received signals or programs then being reproduced by the receivers are automatically interrupted and the receivers are conditioned to reproduce the unscheduled signal transmitted from the corresponding transmitter. The invention further contemplates that, upon the cessation of the transmission of the special message, the receivers will automatically be reconditioned to continue the reproduction of the interrupted programs.

The preferred embodiments of receiving systems capable of operating in the above-described manner are described in detail hereinafter. In each of the embodiments two signal channels extend from the antenna or input circuit of the receiver to the translating device, and in each instance one of the two channels is constructed in the form of a conventional broadcast receiver to include means for tuning the channel over a range of frequencies to select any desired signal-modulated carrier. The other signal channel is normally inoperative in some portion, but, when unscheduled signals of the type referred to are received by the operative portion, the inoperative portion is conditioned to transmit the same to the translating device for reproduction. Simultaneously with the conditioning of this other channel the first channel is rendered inoperative. In one of the embodiments, the required control is obtained by rectifying the carrier of the received unscheduled signal transmitted by the predetermined transmitter to obtain bias voltages for properly influencing certain of the repeater or amplifier stages included in the two channels, whereas in the other embodiment the control voltages are obtained by filtering out and rectifying a predetermined modulation-frequency component which is impressed on the carrier at the predetermined transmitter. In either embodiment the second signal channel may be either fixed tuned to the carrier frequency of only one predetermined transmitter or may be tunable, either continuously or in steps, to different predetermined frequencies corresponding to the carrier frequencies of several such transmitters.

The novel features which are believed to be characteristic of the invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and method of operation, together with further objects and advantages thereof will best be understood by reference to the following specification taken in connection with the accompanying

drawing in which Fig. 1 is a schematic diagram of a wave-signaling system embodying the invention and Fig. 2 is a diagram of a modified embodiment of the receiving system shown in Fig. 1.

Referring now more particularly to Fig. 1 of the drawing, there is shown a wave-signaling system arranged in accordance with the present invention and comprising a plurality of radio transmitters 10, 11, and 12 and a receiving system indicated generally at 13. The transmitters 10, 11, and 12 operate on different assigned carrier frequencies and may be of any conventional form used in radio broadcast transmission for transmitting carriers individually modulated in accordance with the particular signals to be transmitted. One of the transmitters, as, for example, the transmitter 10, may be used for the transmission of the unscheduled programs or signals as outlined above. This transmitter will, of course, operate on the same carrier frequency at all times and will be known to the public as the transmitting station from which are broadcast the unscheduled programs of the type referred to.

The receiver 13 comprises two signal channels, 14 and 15, each coupled between the input or antenna circuit 16 and the translating device or sound reproducer 20. The channel 14 includes a tunable radio-frequency amplifier 1, a tunable frequency changer 2, and an intermediate-frequency amplifier 3, coupled in cascade in the order named, a detector 18, an audio-frequency amplifier 19, and the translating device or sound reproducer 20. This channel of the receiver, as described, is of the conventional superheterodyne type, the operation of which is well understood in the art. Briefly, the signals transmitted by the transmitters 10, 11, 12 and by other transmitters, not shown, are intercepted by the antenna circuit of the receiver. One of these signals is selected in the radio-frequency amplifier 1, is converted into a signal-modulated intermediate-frequency carrier in the tunable frequency changer 2, is further selected and amplified in the selective intermediate-frequency amplifier 3, and is delivered to the detector 18 wherein the modulation-frequency components of the selected signal are derived. These components are amplified in the audio-frequency amplifier 19 and reproduced by the translating device 20.

The channel 14 of the receiver may, of course, be tunable over a wide range of frequencies to select any desired received signal transmitted from any desired transmitter. In this connection it will be understood that the various tuning elements of the receiver may be ganged for uncontrolled adjustment in the conventional manner. It will be seen that, if this channel of the receiver is tuned to select and reproduce the signal transmitted by the transmitter 11 and a news bulletin or other important item is broadcast from the transmitter 10, the listener will miss this particular item.

In order automatically to interrupt the reproduction of the signal selected in the channel 14 of the system at such times as the transmitter 10 is in operation and to condition the receiving system to reproduce the received signal transmitted from the station 10, there is provided the second signal channel 15 which comprises a radio frequency amplifier 4, a frequency changer 5, and an intermediate-frequency amplifier 6, coupled in cascade in the order named, a detector 22, an audio-frequency amplifier stage including the vacuum tube 23, further stages of audio-frequency

amplification indicated at 24, the audio-frequency amplifier 19, and the translating device 20. The detector 22 comprises a diode rectifier 25 coupled to the preceding intermediate-frequency amplifier by a double-tuned intermediate-frequency transformer 26 and operates into a load circuit comprising resistors 27 and 28 shunted by a by-pass condenser 29 and having their common terminals grounded at 30. The modulation-frequency voltage developed across the resistor 27 is impressed on the input electrode of the amplifier tube 23 through a coupling condenser 31 and the direct voltage developed across this resistor is applied positively to the same electrode through a filter circuit comprising series resistors 32, 33, and 34 and a shunt condenser 35.

The total bias applied to the input electrode of the tube 23 with respect to the cathode thereof is determined by the magnitude of the positive voltage across the resistor 27 and the magnitude of the negative direct voltage developed across a resistor 36 included in the output circuit of the tube and shunted by a high-frequency by-pass condenser 37. The voltage across the latter resistor normally biases the input electrode negatively and the resistance value of this element is selected so that, in the absence of a rectified carrier voltage of appreciable magnitude across the resistor 27, the tube 23 is biased considerably beyond cutoff. The direct voltage developed across the load resistor 28 is applied negatively to the control electrodes of one or more of the tubes of the repeater or amplifier stages included in the channel 14 through a filter network, comprising series resistors 38 and 39 and a shunt condenser 40, and a connection 41' to bias the tubes of the controlled stage or stages beyond cut-off upon reception of a signal from transmitter 10. Normally, and in the absence of a received carrier from the transmitter 10, the voltage across the resistor 28 is not appreciable and the controlled tubes of the signal channel 14 are fully operative to transmit the signal selected therein.

Considering now the operation of the system as a whole, assume that the channel 14 of the receiver is tuned to select and reproduce a signal being broadcast from the transmitter 12, that the channel 15 is tuned to the signal frequency of the transmitter 10, and that the transmitter 10 is not broadcasting. Under these conditions, the channel 15 of the system has no effect on the conventional operation of the channel 14 to reproduce the desired signal, since no appreciable voltage is developed across the load resistors 27 and 28, with the result that the amplifier stages under the control of the bias voltage across the resistor 28 are operative in the ordinary manner and no appreciable positive biasing voltage is applied to the input electrode of the tube 23. Hence, this tube is biased beyond cutoff and no output is supplied from the amplifier 24 to the input of the amplifier 19.

With the system in this condition when the transmitter 10 starts broadcasting, the transmitted carrier from such station intercepted by the antenna circuit 16 is selected and amplified in the radio-frequency amplifier 4, is converted into a modulated intermediate-frequency carrier in the frequency changer 5, is further selected and amplified in the intermediate-frequency amplifier 6, and is rectified by the detector 22. The bias voltage developed across the load resistor 27 causes the bias on the tube 23 to become more positive so that this tube becomes operative to

transmit the modulation-frequency components of the signal to the audio amplifier 24. Simultaneously, the voltage developed across the load resistor 28 biases the controlled tubes of the channel 14 negatively beyond cutoff so that the reproduction of the selected signal from the transmitter 12 is interrupted. Thus, the receiving system operates in such a manner that when the transmitter 10 comes on the air, the normal operation of the system to reproduce any desired signal is interrupted and the system is conditioned to reproduce the signal transmitted from the station 10 carrying the special program or signal. Upon cessation of the latter signal, the bias voltages developed across the resistors 27 and 28 assume negligible values and the system is automatically reconditioned to reproduce the signal selected in the channel 14.

The radio-frequency amplifier 4 and the frequency changer 5 may be either fixed tuned to the carrier frequency of the transmitter 10 or, if it be desired to make this portion of the receiver responsive to any one of several stations operated in the same manner as the transmitter 10, it may be tunable, either continuously or in steps by uni-controlled means, over a range of frequencies to any desired predetermined frequency.

It is evident from the foregoing description that, in the operation of the system described above, the transmitter 10 can only be active at such times as the special programs are being broadcast, for otherwise the receiving system 13 would be maintained continuously conditioned to reproduce the signal of this transmitter. This, of course, means that the station 10 is inactive for a large portion of the time.

In order to make it possible to operate the transmitter 10 in the ordinary manner at any and all times and to retain the advantage of automatically conditioning the receivers to receive unscheduled programs of unusual interest, a slightly different method may be used. This method comprises modulating the carrier of the transmitter 10 with a predetermined high modulation-frequency component in addition to the signal modulation-frequency components at such times as it is desired to render the receiving systems responsive only to the signal of this transmitter, and arranging the receiving systems so that the conditioning thereof to reproduce the signal-frequency components is dependent upon the presence of this particular modulation-frequency component in the modulation-frequency envelope of the carrier received from this transmitter.

To this end the receiving system may be constructed as illustrated in Fig. 2, which differs from that shown in Fig. 1 only in that a filter network 41 is provided having its input terminals coupled to the output of the detector 22 and its output terminals coupled to a rectifier 42. The output circuit of the rectifier 42 includes one or more load resistors across which are developed biasing voltages, one of which is applied negatively, through a connection 44, to the control electrodes of one or more of the tubes of the repeater or amplifier stages included in the channel 14, and the other of which is applied positively, through a connection 43, to the control electrodes of one or more of the tubes included in the audio-frequency amplifier 24. It will be understood that the rectifier 42, its load circuit and control connections 43, 44 may be entirely similar to the detector 25 of Fig. 1,

together with its load circuit 27, 28, 29 and its connection to the amplifier tube 23 and to the control connection 41', respectively. These voltages control the conditioning of the two signal channels 14 and 15 to determine which of the two signals individually selected in the two channels is to be reproduced. The circuit arrangement is such that, in the absence of voltages of appreciable magnitude on the connections 43 and 44, the channel 14 is in normal operating condition and the controlled tubes of the amplifier 24 are biased beyond cutoff to block signal transmission through the channel 15. The filter 41 is designed to pass to the rectifier 42 for rectification only the predetermined modulation-frequency component present on the received carrier of the transmitter 10. Hence, in the absence of this component from this carrier, the second channel of the system is inoperative and the first channel of the system is in normal operating condition. When, however, the predetermined modulation-frequency component is present on the carrier received from the transmitter 10, this component alone is passed through the filter 41 to be rectified by the rectifier 42. The voltage developed by such rectification is applied positively to the controlled tube, or tubes of the amplifier 24, to cause the bias thereof to increase positively to a value within its normal operating range thereby to render the second channel 15 operative to pass signals modulated on the carrier from the transmitter 10 to the input of the audio-frequency amplifier 19. The other bias voltage, which is applied negatively through the lead 43 to the control electrodes of one or more of the tubes of the channel 14, biases these tubes to an inoperative condition to interrupt the reproduction of the signal selected in this channel of the system.

It will, of course, be understood that in the second method described above the radio-frequency amplifier 4 and the frequency changer 5 may be either fixed tuned to the particular carrier frequency of the transmitter 10 or may be tunable over a range of frequencies to select any one of a plurality of predetermined carrier frequencies from transmitters operated in a similar manner.

When the second method described above is used, it is desirable to employ a predetermined high modulation frequency which is above the highest frequency of the normal signal-frequency range, as, for example, a frequency of 9,000 cycles. This permits the audio-frequency amplifier 24 to be designed to exclude all frequencies above a predetermined value, such as 7,000 cycles, which is above the highest frequency of the signal-frequency range and below the 9,000 cycle control frequency, thereby to prevent the latter frequency component from being transmitted to the sound reproducer 20.

Another refinement which is equally desirable for both embodiments of the receiving system described above is that of shielding the local oscillator network included in the signal channel 15 to prevent interference in the normal operation of the channel 14. This is necessary with the channel 15 because the local oscillator thereof is in operation at all times. However, it is not necessary to shield the local oscillator included in the channel 14 if the oscillator tube of this channel is used as one of the controlled tubes under the influence of the bias voltage for rendering this channel inoperative, since, under these conditions, this oscillator is inactive

during intervals when the signal channel 15 is operative.

From the foregoing description it will be seen that the system herein disclosed is particularly suited to the dissemination of traffic instructions to motorists driving automobiles equipped with radio receiving systems of the form described. To increase the effectiveness of such a system, the same carrier frequently could be assigned to all municipally operated transmitters or, if the second system described above be used, the same predetermined control modulation frequency could be used by all such stations.

While there has been described what are at present considered to be the preferred embodiments of the invention, it will, of course, be understood that further modifications may be made therein without departing from the invention and it is contemplated in the appended claims to cover all such modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. In a wave-signaling system comprising a plurality of transmitters for transmitting different signals and a receiving system including at least one receiver tunable over a range of frequencies to select and reproduce any desired one of said signals and including a first signal-translating portion normally conditioned to translate said desired signal and a second signal-translating portion normally biased to an inoperative condition, the method of operation which includes interrupting the translation of said selected signal by said first portion upon reception of a predetermined signal, conditioning said second portion of said receiving system to translate said predetermined signal only during reception thereof, and reconditioning said first portion of said receiving system to translate said selected signal upon the cessation of reception of said predetermined signal.

2. In a wave-signaling system comprising a plurality of transmitters for transmitting different signal-modulated carriers and a receiving system including at least one receiver tunable over a range of frequencies to select any desired one of said signal-modulated carriers and including a first signal-translating portion normally conditioned to translate said desired signal and a second signal-translating portion normally biased to an inoperative condition, the method of operation which includes reproducing the modulation-frequency components of said selected carrier, interrupting the translation of said desired signal by said first portion upon reception of a carrier of a predetermined frequency, conditioning said second portion of said receiving system to translate the modulation-frequency components of said second-named carrier only during reception thereof, and reconditioning said first portion of said receiving system to translate the modulation-frequency components of reception of said selected carrier upon the cessation of said second-named carrier.

3. In a wave-signaling system comprising a plurality of transmitters for transmitting different signal-modulated carriers and a receiving system including at least one receiver tunable over a range of frequencies to select a desired one of said signal-modulated carriers and including a first signal-translating portion normally conditioned to translate said desired signal and a second signal-translating portion normally biased to an inoperative condition, the method of operation which includes reproducing the modulation-frequency components of said selected carrier, interrupting the translation of said desired signal by said first portion in response to the presence of a predetermined modulation-frequency component in a predetermined one of said received signal-modulated carriers, conditioning said second portion of said receiving system to translate the modulation-frequency components of said predetermined carrier only during the reception thereof, and reconditioning said first portion of said receiving system to translate the modulation-frequency components of said selected carrier upon the removal of said predetermined modulation-frequency component from said predetermined carrier.

4. In a wave-signaling system, a plurality of transmitters for transmitting different signals, at least one receiver tunable over a frequency range to select and reproduce any desired one of said signals and including a first signal-translating portion normally conditioned to translate said desired signal and a second signal-translating portion normally biased to an inoperative condition, and means coupled to said first portion for interrupting said reproduction in response to the reception of a predetermined one of said signals and means coupled to said second portion for conditioning said receiver to reproduce said predetermined signal only during the reception thereof.

5. A wave signal receiver including means for selecting and reproducing any desired one of a plurality of different signals and including a first signal-translating portion normally conditioned to translate said desired signal and a second signal-translating portion normally biased to an inoperative condition, and means coupled to said first portion for interrupting the reproduction of said desired signal in response to the reception of a predetermined signal and means coupled to said second portion for conditioning said receiver to reproduce said predetermined signal only during the reception thereof.

6. A wave signal receiver including means for selecting and reproducing any desired one of a plurality of different signals and including a first signal-translating portion normally conditioned to translate said desired signal and a second signal-translating portion normally biased to an inoperative condition, and means coupled to said first portion for interrupting the reproduction of said desired signal in response to the reception of a predetermined signal, and means coupled to said second portion for conditioning said receiver to reproduce said predetermined signal only during the reception thereof.

7. A wave signal receiver including a first signal channel tunable over a range of frequencies to select any desired signal, a second signal channel responsive only to a predetermined signal, and means coupled to said first channel and responsive to the reception of said predetermined signal for rendering said first channel inoperative and means coupled to said second channel for conditioning said second channel to transmit said predetermined signal only during the reception thereof.

8. A wave signal receiver including a first signal channel tunable over a range of frequencies to select any desired one of a plurality of different signal-modulated carriers, a second signal

channel responsive only to a modulated carrier of a predetermined frequency, and means coupled to said first channel and responsive to the reception of said second-named carrier for rendering said first channel inoperative and means coupled to said second channel for conditioning said second channel to transmit the signal on said second-named carrier only during the reception thereof.

9. A wave signal receiver including a first signal channel tunable over a range of frequencies to select any desired one of a plurality of different signal-modulated carriers, a second signal channel responsive only to the reception of a signal having a carrier of a predetermined frequency, and means coupled to said first channel and responsive to a predetermined modulation-frequency component of said last-named signal for rendering said first channel inoperative and means coupled to said second channel for conditioning said second channel to transmit said last-named signal only during the reception thereof.

10. A wave signal receiver including a first signal channel tunable over a range of frequencies to select any desired signal from a plurality of received signals, a second signal channel responsive only to the reception of a predetermined signal, and means included in said second channel and coupled to said first channel and responsive to the reception of said predetermined signal for rendering said first channel inoperative to transmit said selected signal and means coupled to said second channel for conditioning said second channel to transmit said predetermined signal only during the reception thereof.

11. A wave signal receiver including a first signal channel tunable over a range of frequencies to select any desired signal-modulated carrier from a plurality of received signal carriers, a second channel responsive only to the reception of a different carrier of a predetermined frequency, and means included in said second channel and coupled to said first channel and responsive to a predetermined modulation-frequency component of said last-named signal for rendering said first channel inoperative and means coupled to said second channel for conditioning said second channel to transmit the signal on said second-named carrier only during the reception thereof.

12. A wave signal receiver comprising an input circuit and a translating device, a pair of signal channels each coupled between said circuit and said translating device, at least one of said channels being tunable over a range of frequencies to select any desired signal from a plurality of received signals, whereby said selected signal is normally reproduced by said translating device, the other of said channels being responsive to translate a different predetermined signal but normally inoperative, and means coupled to said first channel for interrupting said reproduction

in response to the reception of said predetermined signal and means coupled to said second channel for conditioning said other channel to transmit said predetermined signal to said translating device only during the reception thereof.

13. A wave signal receiver comprising a first signal channel including a repeater stage normally biased to an operative condition, said channel being tunable over a range of frequencies to select any desired signal from a plurality of received signals, a second channel responsive only to translate a predetermined signal and including a repeater stage normally biased to an inoperative condition, and means coupled to both said repeater stages and responsive to the reception of said predetermined signal for biasing said first-named repeater stage to suppress the transmission of said selected signal and for biasing said second-named repeater stage to transmit said predetermined signal only during the reception thereof.

14. A wave signal receiver comprising a first signal channel including a repeater stage normally biased to an operative condition, said channel being tunable over a range of frequencies to select any desired signal from a plurality of received signals, a second signal channel responsive only to translate a predetermined signal and including a repeater stage normally biased to an inoperative condition, and means coupled to both said repeater stages and responsive to the reception of said predetermined signal and comprising a signal rectifier included in said second channel for biasing said first-named repeater stage to suppress the transmission of said selected signal and for biasing said second-named repeater stage to transmit said predetermined signal only during the reception thereof.

15. A wave signal receiver comprising a first signal channel including a repeater stage normally biased to an operative condition, said channel being tunable over a range of frequencies to select any desired signal-modulated carrier from a plurality of received signal-modulated carriers, one of said carriers having a particular modulation frequency, a second signal channel responsive to translate said signal-modulated carrier of a predetermined frequency and including a repeater stage normally biased to an inoperative condition, a rectifier including an input circuit and a load circuit, means comprising a filter network coupled between said second channel and said rectifier input circuit for impressing on said input circuit a voltage derived from said signal modulation of a particular frequency, thereby to develop bias voltages in said load circuit, and means for impressing said voltages individually on said repeater stages to bias said first-named repeater stage to an inoperative condition and to render said second-named repeater stage operative to transmit the signal of said second-named carrier.

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CERTIFICATE OF CORRECTION.

Patent No. 2,129,740.

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It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 4, first column, line 14, for "has" read have; line 62, claim 2, strike out the words "of reception" and insert the same after "cessation" in line 63, same claim; same page, second column, line 63, claim 7, strike out the word "signal" first occurrence, and insert instead one of a plurality of different signals; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 27th day of December, A. D. 1938.

Henry Van Arsdale

(Seal)

Acting Commissioner of Patents.