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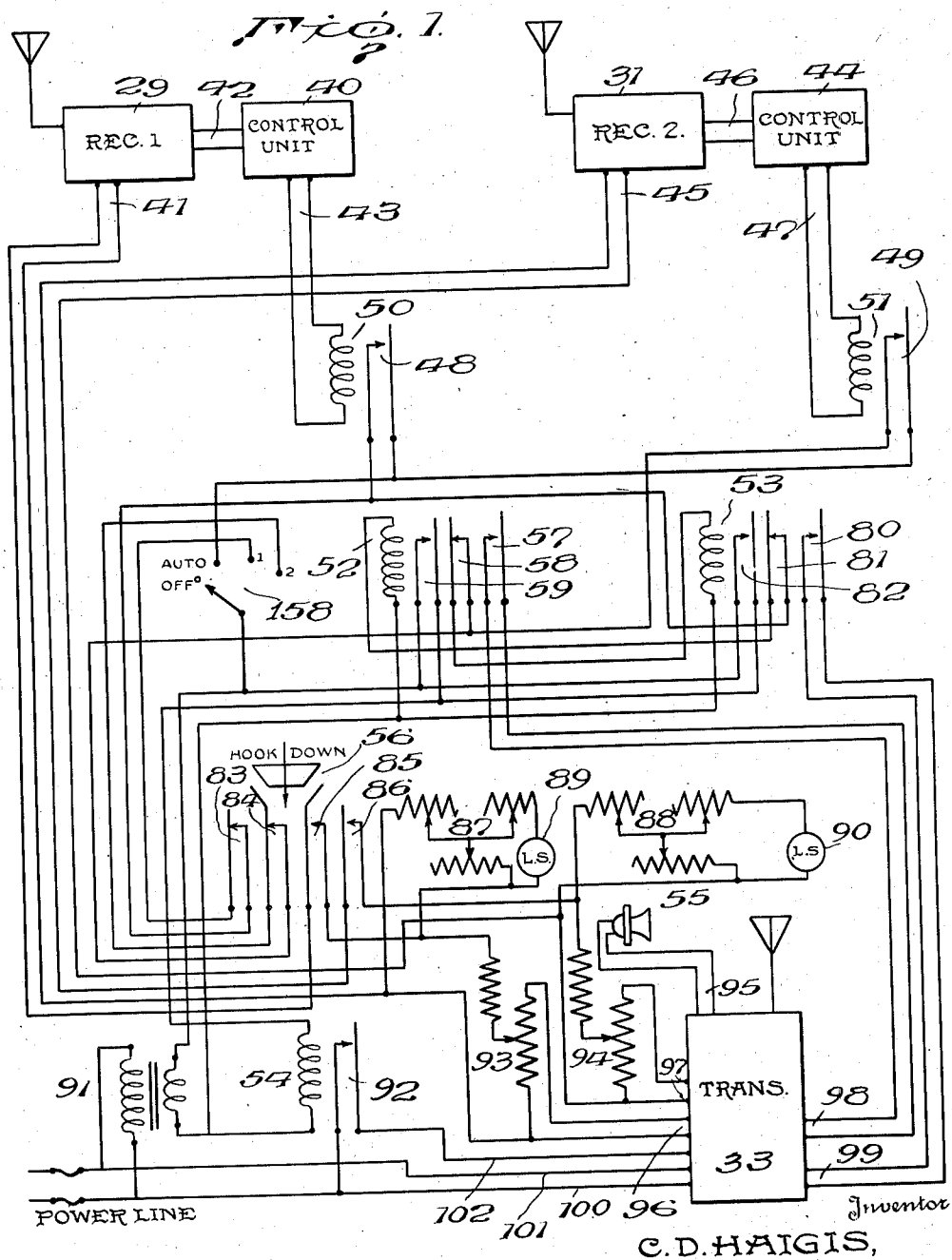
C. D. HAIGIS

2,379,799

RADIO CONTROL UNIT WITH INTERFERENCE SUPPRESSION

Original Filed Dec. 28, 1939

2 Sheets-Sheet 1



C. D. HAIGIS,

Inventor

334

Ben. J. Lehman

Attorney

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C. D. HAIGIS

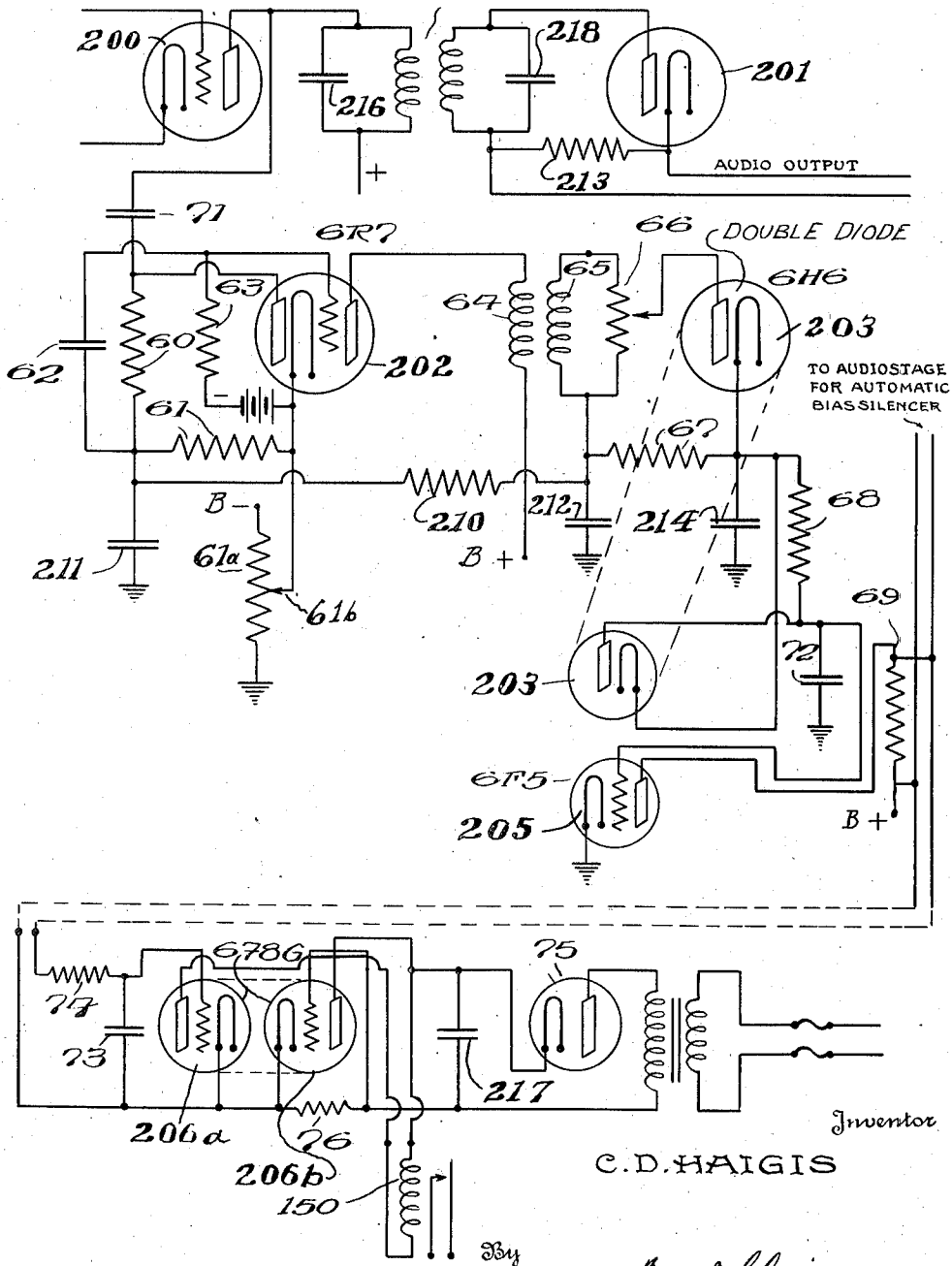
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Fig. 2.
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Inventor
C. D. HAIGIS

Ben. J. Lehman
Attorney

UNITED STATES PATENT OFFICE

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RADIO CONTROL UNIT WITH INTER-
FERENCE SUPPRESSION

Carleton D. Haigis, Martinsville, N. J.

Original application December 28, 1939, Serial No.
311,233. Divided and this application February
9, 1942, Serial No. 430,131

14 Claims. (Cl. 250—20)

This invention relates to radio signaling apparatus generally. More particularly this invention relates to a control circuit adapted for use in a radio receiver for controlling a transmitter or other apparatus in accordance with carrier waves through static and various forms of interference.

This application is a division of my application, Serial No. 311,233, filed December 28, 1939, for Two way radio communication systems, now Patent No. 2,292,222.

An object of my invention is to provide a circuit arrangement adapted to be connected to one of the last stages or to the last stage of a superheterodyne receiver for the purpose of developing a control potential that varies in amplitude a fixed amount despite wide variations in amplitude of the received carrier.

Another object of this invention is to provide a circuit network that responds to weak carrier waves having low amplitude, substantially the same in the presence of a large amount of noise as it does when only a small amount of noise is present.

This invention is particularly adapted for use in controlling the operation of a transmitter which may be a relay transmitter, at some remote point. In order that the transmitter at any station shall not be put into operation by static or by electrical disturbances of a man-made variety such as ignition, commutator noise etc. nor by periodic variations of these types of disturbances, and shall be controlled only by the first receiver at the station that responds to a continuous carrier wave, I utilize a novel circuit network to provide a control-potential that varies in amplitude a fixed amount despite wide variations in amplitude of the said carrier wave and which responds to weak carrier waves or carrier waves having low amplitude substantially the same in the presence of a large amount of interference as it does when only a small amount is present.

Furthermore, the connections are such that the rate of change of control potential is a function of the amplitude of the incoming signal, being slower for a weak signal than for a strong one.

Other and further objects and features of this invention will be apparent to those skilled in the art to which this invention relates from the following specification, claims and drawings. In the drawings, briefly, Fig. 1 illustrates a schematic diagram of an application of the positive response control unit of my invention to a relay

transmitter having two receivers which are interlocked so that the first one receiving a signal selectively causes the transmitter to radiate a desired wave length, and Fig. 2 shows a detailed circuit diagram of the receiving circuit of my invention including the control unit.

The system which I provide for separating interference from carrier for control purposes involves the balancing of its interference against interference, which balance is destroyed when the carrier is received.

Referring to the drawings in detail, and particularly to Fig. 1, when receiver 29 receives a message sent out on a channel A, to which it is tuned, it provides at leads 42 a control voltage change as hereinafter described. The voltage change applied to control unit 40, shown in detail in Fig. 2, energizes the coil of relay 50, causing contacts 48 to close. Similarly, contacts 49 of relay 51, are closed when a signal is received by receiver 31 on a second channel which will be referred to as channel C. The coil of selector relay 52, is energized by voltage from the secondary of transformer 91 when contacts 48 are closed due to a signal being received on receiver 29, only when the selector switch 158 is set in "auto" position and only if relay 53 is not energized and contacts 31 are closed. Similarly, the coil of selector relay 53 is energized when contacts 49 are closed by a signal in receiver 31, only if relay 52 has not been previously energized which would open contacts 58. Thus, it will be seen that if relay 52 is already closed by a signal in receiver 29, it will remain so as long as the signal persists, even though a signal is received on receiver 31 during this period, because even though contacts 49 close, the coil of 53 cannot be energized, since contacts 58 of relay 52 are open. At the end of the message, when receiver 29 no longer receives the signal, contacts 48 will open and relay 52 is de-energized.

Similarly, when a signal is received by receiver 31 on channel C, contacts 49 of relay 51 close and energize the coil of selector relay 53, provided relay 52 is not energized and its contacts 58 remain closed. By this means, a signal in receiver 29 is caused to energize relay 52 provided a signal in receiver 31 has not previously energized relay 53. Conversely a signal accepted by receiver 31, will energize relay 53 provided a signal from receiver 29 has not previously energized relay 52. By this means, either receiver retains control of its selector relay 52 or 53, even though a message is received on the

other receiver during the interval of reception of the first received message.

Transmitter 33 is kept in the stand-by position by power supplied it via leads 100 and 101. When contacts 59, of relay 52 are closed by a signal in receiver 29, or when contacts 82 of relay 53 are closed by a signal in receiver 31, the circuit is closed to the coil of relay 54, which in turn closes contacts 92 and thru lead 102 applies power to put transmitter 33 on the air. In the sub-station when it is desirable to cause the station transmitter 33 to radiate on a different channel B when a signal is being received on channel A to which receiver 29 is tuned, and to radiate on another channel D when a signal is received on channel C to which receiver 31 is tuned, contacts 57 of relay 52 and contacts 80 of relay 53 are made to operate frequency changing relays within the transmitter 33 thru leads 98 and 99. These frequency changes can be made by various well known means such as by the energizing of a relay whose contacts act to add capacity to the various tuned circuits and to connect a frequency control unit such as a quartz crystal. Thus thru contacts 57 of relay 52, a signal on a receiver 29 will cause transmitter 33 to radiate on a certain desired channel, and a signal from receiver 31, thru contacts 80 of relay 53, will cause it to radiate on a second selected channel.

Furthermore, because of the interlocking action explained above, control of the transmitter frequency cannot be obtained by a signal coming into one receiver as long as the other receiver is active.

In the central station where the transmitter is caused to radiate on a single channel when either receiver is active, the frequency selecting contacts 57 of relay 52 and 80 of relay 53 are eliminated and the system functions in the same manner except that the transmitter frequency remains constant.

The selector switch 158 is provided so that automatic control of the transmitter by the receivers 29 and 31 can be broken, in which case the contact of the switch is in the off position. This prevents voltage from transformer 91 from reaching coils of relays 52 and 53 via contacts 48 and 49 of relays 50 and 51. Selector switch 158 also permits manual choice of transmitter channel, so that the operator at any station can send a message via microphone 55 and transmitter 33 on either channel. By tracing the circuit from the secondary of transformer 91 thru selector switch 158 when in position 1 and thence thru contacts 83 of the hook switch 56 and thru contacts 81 of relay 53, it will be found that the coil of relay 52 is energized, thus putting transmitter 33 on the air on the same channel which would be selected by a signal in receiver 29.

Similarly, when manual selector switch 158 is in position 2, relay 53 is energized and transmitter 33 is put on the air on the same channel which a signal in receiver 31 would cause it to radiate. Contacts 83 and 84 of hook switch 56 are closed only when the microphone is removed from its cradle and since the closure of these contacts completes the circuit from positions 1 and 2 of the manual selector switch to relays 52 and 53, the motion of removing the microphone from its hook or cradle puts the transmitter on the air on the channel selected by switch 158.

The audio output from receivers 29 and 31 passes via leads 41 and 45 thru hook switch contacts 85 and 86 which are closed, when the microphone is in its cradle, to loudspeakers 89 and 90

thru volume controlling T-pads 87 and 88. The audio signal from each receiver is also applied to the transmitter thru the volume controlling pads 93 and 94 via leads 96 and 97 where they are amplified and modulate the carrier wave of the transmitter.

Since the removal of microphone 55 from its cradle on hook switch 56 opens contacts 85 and 86, the audio output from both receivers is disconnected from transmitter 33 during the time that it is being modulated by the local microphone 55. Also the loudspeakers are disconnected by the opening of contacts 85 and 86 in order to eliminate oscillation which might be set up by feedback and to eliminate annoyance to the operator when he is transmitting the message via microphone 55.

The control units 40 and 44 shown in Fig. 1 in block diagram form are illustrated in detail in Fig. 2. The anode of the diode portion of the initial combination diode-triode 6R7 tube 202 conveniently is connected to one side of the last intermediate frequency transformer 70 in the receiver 29 or 31 (Fig. 1) by way of a blocking condenser 71.

Specifically, although other types of tubes may be used, I prefer for compactness to utilize a combination diode-triode, a second diode, and a final amplifier connected in a rectifying and amplifying arrangement to supply a potential change for control purposes when a carrier is received, said connections supplying substantially no potential change from received interference. Thus I prefer to utilize in this control unit 40 a combination diode-triode 202 of the 6R7 type, a double diode 203 of the 6H6 type, and a final triode 205 of the 6F5 type connected in a rectifying and amplifying arrangement to supply a control-potential and to cancel the effect of received interference. These type designations are in current commercial general use in the industry. The anode of the diode portion of the first combination diode-triode tube 202, the 6R7, is connected conductively to the cathode thereof through two resistors 60 and 61, the junction point of which is connected through a capacitor 62 to the grid of the triode portion. A resistor 63 connected at one end to the grid of the triode portion of the tube 202 and at the other end to a suitable source of negative potential, provides the proper grid bias for amplification. The primary winding 64 of an output transformer is connected to the anode of the triode portion of tube 202. The secondary winding 65 of the output transformer is connected by means of a potentiometer slider 66 in series with a resistor 67 to a first one of the anode-cathode paths of the double diode 6H6 tube 203, the other second anode and cathode of which are interconnected through an output resistor 68 which constitutes part of the input impedance of the 6F5 triode 205 which acts as an amplifier and control tube, and is the final triode of the control unit. The latter tube is provided with an output resistor 69 across which the control potential appears when the system is in operation.

Because of the connections enumerated, intermediate frequency energy produced by the incoming carrier as well as by received interference, is impressed upon and rectified by the diode portion of the 6R7 tube 202 and unidirectional potentials representative thereof appear across the resistor 61 adjacent the cathode of the said diode portion, the remaining resistor 60 acting to complete a conductive path for the unidirectional current to the anode. Received interference, therefore,

produces a unidirectional potential across the resistor 61 connected to the cathode which potential varies with the strength of the received interference. Superimposed on this potential are the audio components of the interference. These components are impressed upon the grid of the triode portion of the tube through the capacitor 62 connected to the junction point between the two resistors 60, 61.

These components, therefore, are amplified by the triode portion and appear as potentials across the primary winding 64 of the output transformer, which has such characteristics that only interference components above a frequency which has a negligible amount of energy from audio modulation are impressed upon the next tube 203, the 6H6 double diode. This tube acting as a rectifier supplies through its first diode portion, unidirectional potential across the resistor 67 connected in series with it from the potentiometer 66 which is in turn connected across the secondary winding 65 of the transformer. By adjusting the potentiometer 66, this unidirectional potential across resistor 67 obtained by rectification of the selected interference above the cut-off frequency of the output transformer, may be made equal to that appearing across the resistor 61 directly connected to the cathode of the initial 6R7 tube 202.

It has been found by experiment that the energy distribution in interference of most types is spread over such a wide frequency spectrum that the potentials appearing across the load resistors 61 and 67 of the 6R7 tube 202 and the 6H6 double diode 203 remain nearly alike in magnitude even though the interference level varies over a wide range of amplitudes.

The potentials appearing across the said two resistors 61 and 67 are applied in series opposition to the grid of the 6F5 control tube 205 through a time delay circuit consisting of a resistor 68 connected to the grid of the 6F5 control tube 205 and a capacitor 72 connected between its grid and cathode. The second diode section of the 6H6 double diode 203 is connected across the delay resistor 68 and functions as will be further explained.

In normal operation, with interference present but no carrier, the grid of the 6F5 tube 205 is adjusted at or near zero potential by adjusting a potentiometer, 61a, the resistor element of which is included in the connection from the negative terminal of the source of plate potential to ground, and the slider 61b of which is connected to the cathode of the 6R7 tube 202 and therefore to the grid of the 6F5 tube 205 through the series resistors 61, 67, 68, of the diodes. In such event, the potentials across the output resistor 61 of the diode portion of the 6R7 tube 202 and across the output resistor 67 of the first mentioned diode portion of tube 203 which is connected to the secondary 65 of the coupling transformer, remain equal and opposite and cancel over wide variations of interference and do not materially affect the potentials of the grid of 6F5 tube 205. Under these conditions, space current flows in the 6F5 control tube 205, and unidirectional potential appears across the output resistor 69 connected to the anode. In practice the output resistor 69 has a magnitude of the order of 20,000 ohms and the potential appearing across it is of the order of 10 volts.

Changes in interference level have no effect on this output potential because of the balance of the potentials appearing across the 6R7 and 6H6 diodes or tubes 202 and 203.

When a carrier wave is received, however, the

potential across the output resistor 61 of the diode portion of the 6R7 tube 202 is increased, although the potential across the output resistor 67 connected to the secondary 65 of the transformer remains practically the same, or may even decrease somewhat if the A. V. C. action of the receiver reduces its sensitivity and, consequently, the amount of interference present at audio frequency. The constants of the circuits are so chosen that a weak signal with carrier impresses sufficient negative voltage on the grid of the 6F5 tube 205 to completely block the said tube 205, with consequent disappearance of potential across the output resistor 69 connected to the anode thereof. Because of the previously mentioned selective action of the coupling transformer 64, 65, audio modulation of the carrier, appearing across the diode load resistor 61 connected to the cathode of the 6R7 tube 202, has no effect on the potential appearing across the output or load resistor 67 of the first portion of the 6H6 double diode 203 which is connected between the secondary 65 of the transformer and the cathode of the first diode portion of the tube 203.

The terminal of the load resistor 67 in the circuit of the first diode portion of tube 203, connected to the secondary winding 65 of the transformer, is connected to the junction point between the output or load resistors 60, 61, of the diode portion of the tube 202 through an isolating resistor 210 having a resistance of the order of 500,000 ohms, said resistor being for stabilizing purposes. The circuit thus far described prevents received interference and variations of received interference either of steady or transient type from materially influencing the potential appearing across the output resistor 69 of the 6F5 tube 205 but permits changes therein in response to carrier waves only. Even weak signals, if continuous, provide a sufficient change in potential across the output resistor 69 of the 6F5 tube 205 to enable the operation of the transmitter control relays hereinafter to be referred to.

In some instances it is desirable, particularly when there are several receiver-controlled transmitters in one network which may automatically relay signals from mobile or fixed stations to one central point, that the delay in actuating the transmitter be longer, the weaker the signal. For that purpose the grid of the 6F5 tube 205 is by-passed to the cathode thereof by the large condenser 72 hereinabove referred to, which condenser receives its charge through the resistor 68 shunted by the second diode portion of the 6H6 tube 203.

The grid of the 6F5 tube 205 achieves the negative potential applied to the said resistor 68 only after the cessation of charging current to the by-pass condenser 72. The 6F5 tube 205, therefore, requires a longer time to block and the control potential across the output resistor 69 thereof is reduced to zero only after a predetermined delay.

The second diode element of tube 203 shunting the resistor 68 which is connected to the grid of the 6F5 control tube 205, offers infinite or very high resistance to applied potentials of one polarity because of its unilateral conductivity, and accordingly it does not effectively shunt the resistor 68 feeding the grid of tube 205, when potential is applied. When potential is removed because of the cessation of a carrier signal, the said second diode portion of tube 203 so rapidly conducts away the charge acquired by the by-pass condenser 72 that while time delay is provided upon the application of a signal, but little or no delay results

when the signal ceases. The primary purpose of having a double diode 203 with this second diode portion across resistor 68, instead of a single diode like the first portion thereof, is to thus facilitate this delay action.

In actual use the potential appearing across the output resistor 69 of the 6F5 tube 205, is also utilized to provide blocking grid bias for the first audio-frequency amplifier tube in the receiver itself when no carrier frequency signal is being received. A "silent standby" unaffected by interference or interference variations and which maintains substantially the full sensitivity of the receiver even with large amounts of interference present, is thus provided, and the receiver is quiet except when a carrier wave is being received. This method of providing "silent standby" and control potentials, offers great advantages in contrast to systems in common use because of the above described interference neutralizing scheme.

In silent standby systems heretofore employed, in the common types where the 6F5 tube 205 or similar tube is blocked by rectified intermediate frequency energy, interference as well as carrier block the tube and the system must be adjusted so that the maximum interference which occurs at any location will not block the 6F5 tube 205. Under these conditions, a carrier signal of greater amplitude than the maximum interference ever encountered, is necessary to provide control and put the receiver in operation. Thus in these prior systems the effective sensitivity of the receiver is greatly reduced, whereas in my system, the maximum sensitivity can be substantially maintained, a very desirable feature especially where it is used to receive mobile stations.

As hereinbefore mentioned, in my circuit, at each station except the mobile stations, there are a plurality of receivers each of which is adapted to control a single transmitter for the purpose of relaying an incoming message. To that end the potential appearing across the output resistor 69 of the 6F5 tube 205, is utilized. The said potential is applied to the grid of one section of a dual triode 206a, 206b, such as the type 6F8G, said grid being connected to the cathode of the same tube by way of a by-pass condenser 73. The constants of the resistor 74 and the by-pass condenser 73 are such that no appreciable time delay is introduced thereby and the connecting resistor 74 is made sufficiently large to prevent shunting of the output resistor 69 of the 6F5 tube 205. The capacitor 73 connected between the grid and the cathode of the above controlling section of the 6F8G tube 206a, 206b, is used merely for stabilizing purposes.

The potential on the grid of the controlling triode section of the 6F8G tube 206a, 206b, changes from its steady value of approximately 10 volts negative to approximately zero volts independently of the strength of the received signal, because even a weak signal with carrier completely blocks the grid of the 6F5 control tube 205. The action of the network therefore is of the "on and off" type, one triode of the 6F8G tube 206a, 206b, being completely blocked as in the case of no signal, or having zero grid potential when a signal with carrier is received.

A relay winding 150 is included in the output element of the controlling or blocking triode section of the 6F8G tube 206a, 206b, which is devoid of current when no signal is being received but which actuates its contacts when a carrier wave comes in and actuates a relay transmitter, corresponding to the action of relay 50 or relay 51 in the arrangement of Fig. 1.

Plate current from this controlling or blocking section of the dual triode 206a, 206b, increases from zero to 10 or 15 milliamperes when a signal is received, and reliable rugged relays can be used, thus eliminating the uncertainty attendant upon relays of the more sensitive types that are usually used in similar situations.

Because the entire network connected to the relay is above ground potential by reason of the fact that the lower terminal of the output resistor 69 of the 6F5 tube 205 is connected to the positive terminal of the plate potential source, a small separate tube rectifier 75 is utilized for supplying anode potential to the 6F8G dual triode 206a, 206b. The second section of the 6F8G dual triode 206a, 206b, is used as a regulator tube to keep the potential supplied by the rectifier substantially constant whether the controlling section is drawing current or not. To accomplish this, a resistor 76 is connected between the common cathode terminal of the 6F8G dual triode 206a, 206b, and the grid of the second triode section of this tube, through which resistor 76 the current supplied by the separate rectifier returns to the said common cathode. When the current through the controlling or blocking section of the dual triode 206a, 206b, is high, the grid of the regulating section becomes more negative, thus reducing the current through said regulating triode. Conversely, when the current in the controlling section is reduced to zero by an incoming signal, the grid of the regulating section becomes less negative, and more plate current flows in said regulating section. Thus the potential from the rectifier source, applied to the blocking or controlling section of the 6F8G dual triode 206a, 206b, can be kept substantially constant whether current flows through this section or not.

The action of the system, therefore, is to provide approximately uniform current through the relay 150, when in the "on" condition, and substantially constant voltage from the separate rectifier.

The relay 150, of course, may be provided with as many contacts as are desirable for the purpose of changing the transmitter from the "standby" condition to the active condition, as well as for the purpose of changing the transmitter frequency by actuating other relays which in turn change the tuning of the various circuits and select the desired crystal.

However, in the preferred arrangement, I use a single pair of contacts on the controlling relay 150 in the plate circuit of the 6F8G double triode 206a, 206b, to actuate other relays which perform the various tuning and selective actions as illustrated in Fig. 1.

Although I have shown merely a schematic of a portion of a police radio system constructed and arranged according to my invention and have described certain specific features thereof, it will be apparent to those skilled in the art that many modifications may be possible. My invention, therefore, is not to be limited except insofar as is necessitated by prior art and the spirit of the appended claims.

What I claim is as follows:

1. In a radio receiver, a thermionic tube having input and output circuits, the input circuit comprising a resistor and capacitor network, the output circuit being constituted by a resistor, a pair of rectifier devices for deriving two potentials each substantially proportional to received interference, connections for impressing the

said potentials in opposing balanced relation across said input circuit to provide substantially zero grid-potential independent of interference-level, and means connected to one of said rectifier devices for controlling the potential derived therefrom to impress a blocking potential across said input circuit upon reception of a carrier-wave.

2. In a radio receiver, an auxiliary thermionic system which is substantially without effect on the normal receiver characteristics in normal reception, said auxiliary system comprising a first rectifying device which is adapted to rectify any part of the energy received, means for amplifying and selecting a desired portion of said received energy of determined frequency characteristics, a second rectifying device adapted to rectify said desired portion, a thermionic amplifying tube having an input circuit and an output control circuit, and connections for impressing in opposed relationship the output of both said rectifying devices across the input circuit of said thermionic amplifying tube, said rectifying devices and connections being so adjusted that the output of said rectifying devices provides on said input circuit of said amplifying tube substantially zero potential with no carrier signal applied and without response to interference being received, and further provides a blocking potential across said input circuit of said tube upon reception of a carrier wave.

3. In a carrier-signal-responsive, interference-non-responsive, control unit for a radio receiver, means for deriving a portion of the signal traversing said receiver including carrier components and interference components, first rectifying means comprising an output impedance element for rectifying said derived portion, amplifying means for amplifying the so rectified derived portion, frequency selective means for transferring said so rectified derived portion and adapted to suppress audio frequencies, adjustable voltage divider means connected for adjustably delivering a desired portion of the voltage output of said transferring means, second rectifying means comprising an output impedance element connected for rectifying the voltage so delivered by said adjustable voltage divider means, a control tube having an input circuit and an output circuit, and a connection to the input circuit of said control tube comprising said output impedance elements of said first and second rectifying means, said output impedance elements being connected serially in said connection and being poled to oppose each other, whereby said voltage divider means may be adjusted when interference without carrier is received so that substantially no voltage is then applied to the input circuit of said control tube.

4. A control unit according to claim 3, and a connection from the output circuit of said control tube to an electronic element in the main signal path of said receiver on the output side thereof with respect to the point of deriving said derived portion, said control unit and said connection and said electronic element being arranged to render said electronic element ineffective when no carrier is being received.

5. A control unit according to claim 3, the connection from said input circuit of said control tube to said output impedance element of said second rectifying means comprising electrical time delay means adapted to delay the application of energy to the input circuit of said control tube when a carrier signal is received for an

interval whose length is an inverse function of the strength of said carrier signal.

6. A control unit according to claim 3, and an output circuit controlling arrangement connected to the output circuit of said control tube and having output terminals to which energy is selectively applied according to whether voltage is applied to the output circuit of said control tube, said circuit controlling arrangement comprising means for maintaining constant the output voltage of said circuit controlling arrangement under various conditions of operation.

7. In a radio receiver, an auxiliary thermionic amplifying tube having input and output circuits, said input circuit comprising a conducting path to the grid of said tube, said output circuit comprising an impedance element, means comprising circuit elements and frequency discriminating means and a pair of individual rectifying means connected for deriving from the main signal channel of said receiver two potentials each substantially proportional to received interference, connecting means connected for impressing said derived potentials in opposing balanced relation across said input circuit to provide thereacross substantially zero grid biasing potential due to interference independent of the interference level, output control means which blocks when a certain potential is applied thereto, and control circuit means connected to said output circuit and connected to impress a blocking potential upon said output control means when no carrier frequency signal energy is received by said receiver, and to remove said blocking potential when carrier frequency signal energy is received.

8. In a radio receiver, an auxiliary thermionic amplifying tube having input and output circuits, said input circuit comprising a conducting path to the grid of said tube, said output circuit comprising an impedance element, means comprising circuit elements and frequency discriminating means and a pair of individual rectifying means connected for deriving from the main signal channel of said receiver two potentials each substantially proportional to received interference, connecting means connected for impressing said derived potentials in opposing balanced relation across said input circuit to provide thereacross substantially zero grid biasing potential due to interference independent of the interference level, output control means which blocks when a certain potential is applied thereto, and control circuit means connected to said output circuit and connected to impress a blocking potential upon said output control means when no carrier frequency signal energy is received by said receiver, and to remove said blocking potential when carrier frequency signal energy is received, said output control means comprising time delay means for making the delay in response of said output control means the greater, the weaker the received signal.

9. In a radio receiver comprising an audio-frequency portion, an auxiliary thermionic amplifying tube having input and output circuits, said input circuit comprising a conducting path to the grid of said tube, said output circuit comprising an impedance element, means comprising circuit elements and frequency discriminating means and a pair of individual rectifying means connected for deriving from the main signal channel of said receiver two potentials each substantially proportional to received interference, connecting means connected for impressing said derived potentials in opposing balanced relation

across said input circuit to provide thereacross substantially zero grid biasing potential due to interference independent of the interference level, and control circuit means connected to said output circuit and connected to impress a blocking potential across said audio-frequency portion when no carrier frequency signal energy is received by said receiver, and to remove said blocking potential when carrier frequency signal energy is received.

10. In a radio receiver having an audio-frequency portion, an auxiliary thermionic amplifying tube having input and output circuits, said input circuit comprising a conducting path to the grid of said tube, said output circuit comprising a resistor, means including a pair of rectifying devices for deriving from the main signal channel of said receiver two potentials each substantially proportional to received interference, connecting means connected for impressing said derived potentials in opposing balanced relation across said input circuit to provide thereacross substantially zero grid potential due to interference independent of the interference level, said output circuit comprising means for maintaining a blocking potential across said resistor when no carrier frequency signal energy is being received by said receiver, and connections between said resistor and said audio-frequency portion for applying said blocking potential to said audio-frequency portion when no carrier frequency signal energy is being received.

11. In a radio receiver having an audio-frequency amplifying portion, a thermionic tube having input and output circuits, the input circuit comprising a resistor and capacitor network, the output circuit being constituted by a resistor, a pair of rectifier devices for deriving two potentials each substantially proportional to received interference, connections for impressing the said potentials in opposing balanced relation across said input circuit, means connected to one of said rectifier devices for controlling the potential derived therefrom to provide across said input circuit substantially zero potential independent of interference level to impress a blocking potential across said input circuit upon reception of a carrier wave, and connections for supplying a blocking potential from said output resistor to the audio-frequency amplifying portion of the receiver during such times as a carrier wave is not being received, whereby the condition known as silent standby is achieved irrespective of received interference without resort to fixed reduction of the sensitivity of the receiver.

12. In a carrier-signal-responsive, interference-non-responsive, control unit for a radio receiver, means for deriving a portion of the total received signal energy traversing said receiver including carrier components and interference components, first rectifying means comprising an output impedance element for rectifying said derived portion, frequency selective means for transferring said so rectified derived portion and adapted to

suppress audio frequencies, adjustable transducer means connected for adjustably selecting a desired portion of the voltage output of said transferring means, second rectifying means comprising an output impedance element connected for rectifying the voltage so selected by said adjustable transducer means, a control tube having an input circuit and an output circuit, and a connection to the input circuit of said control tube comprising means for opposing to each other rectified output voltages of said first and second rectifying means, whereby said transducer means may be adjusted when interference without carrier is received so that substantially no voltage is then applied to the input circuit of said control tube.

13. In a radio receiver, an auxiliary thermionic amplifying tube having input and output circuits, said input circuit comprising a conducting path to the grid of said tube, said output circuit comprising an impedance element, means comprising circuit elements and frequency discriminating means and a pair of individual rectifying means connected for deriving from the main signal channel of said receiver two uni-directional potentials each substantially proportional to received interference, connecting means connected for impressing said derived uni-directional potentials in opposing balanced relation across said input circuit to provide thereacross substantially zero grid biasing potential due to interference independent of the interference level, output control means which blocks when a certain potential is applied thereto, and control circuit means connected to said output circuit and connected to impress a blocking potential upon said output control means when no carrier-frequency signal energy is received by said receiver, and to remove said blocking potential when carrier-frequency signal energy is received.

14. In a radio receiver system, a first auxiliary rectifier device connected to an intermediate stage of said receiver, a first resistance device connected across said first rectifier device, an auxiliary electron amplifying device having input and output circuits, said input circuit being connected across said first resistance device, a frequency discriminating device connected to said output circuit, a second rectifying device connected to said frequency discriminating device, a second resistance device connected to said second rectifying device, said first and second resistance devices being connected in opposed relationship, said receiver comprising a controlled output unit which is connected to be controlled by the combined potential across said first and second resistance devices, whereby the combined potential across said first and second resistance devices which controls said output unit is substantially zero in the absence of a carrier wave without regard to interference level, and is not zero in the presence of a carrier wave.

CARLETON D. HAIGIS.