

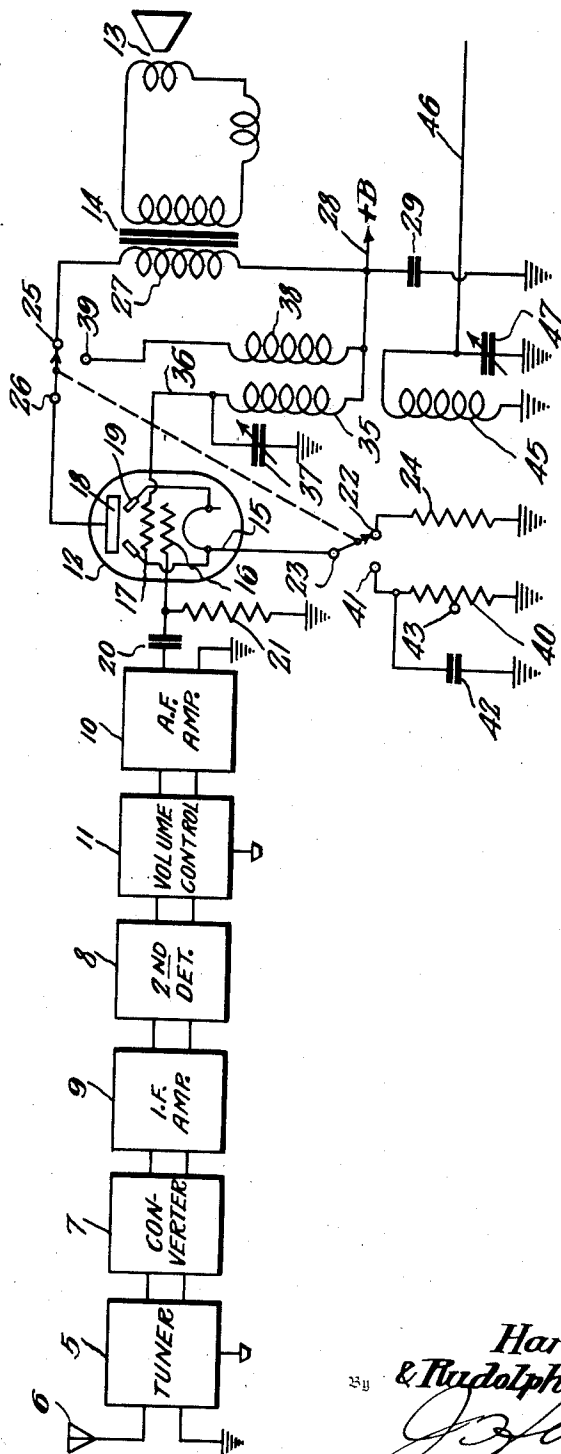
Nov. 26, 1940.

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2,222,761

RADIO RECEIVER

Filed May 31, 1939



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## UNITED STATES PATENT OFFICE

2,222,761

## RADIO RECEIVER

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Application May 31, 1939, Serial No. 276,583

6 Claims. (Cl. 250—20)

The present invention relates to radio receivers, and has for its primary object to provide a radio receiver adapted for dual operation in the reception and reproduction of radio signals and in the remote control of another radio receiver.

It is also an object of the present invention to provide a radio receiver having tuning and volume control means which may be utilized to receive, control and reproduce selected signals as a separate and independent radio signal receiving instrument and which may have the additional function of controlling tuning or signal selection, and volume of signal output, in an additional remotely located radio receiver.

It is a still further object of the present invention to provide a modulated oscillator system in a radio receiver for the transmission of modulated signals to a remotely located second receiver at a predetermined frequency and having means for modulating the transmitted oscillations in accordance with received signals, and an improved circuit wherein a single tube may function both as a modulated oscillator and as an audio frequency output tube.

It is also a still further object of the present invention to provide a radio receiver having signal selecting and volume control means wherein the audio frequency output stage is adapted to provide an oscillator modulated by signals picked up by the receiver, and means for radiating the output of the oscillator at a predetermined frequency, whereby, in connection with a remotely located second receiver, the first receiver may provide signal selection and volume control of the second remotely located receiver when the latter is adjusted to said predetermined frequency.

It is an object of the present invention to provide a radio receiver of the midget type that may be operated as a complete receiver for radio signals and which may be operated as a wireless remote control unit providing signal selection and volume control of the second radio receiver remotely located with respect to the first receiver with a minimum of circuit adjustment and without change in tube complement.

In carrying the present invention into effect, a small radio receiver, preferably of the midget or portable type, provided with suitable broadcast or signal selecting means and volume control means, is further provided with selector and circuit means for converting the audio frequency output tube into an oscillator for the radiation of signals to the second receiver at a fixed frequency. The modulation of the oscillator is pro-

vided by the audio frequency signals developed in the receiver in response to various signals as tuned in by the receiver, and the volume control is adapted to control the percentage modulation on the signal and, therefore, the volume of signals provided at the remotely controlled receiver.

The invention will, however, be better understood from the following description when considered in connection with the accompanying drawing, and its scope will be pointed out in the appended claims.

In the drawing, to which attention is now directed, the figure is a schematic circuit diagram of a radio receiver embodying the invention, and in the present example is shown as a receiver of the superheterodyne type, comprising a suitable tuning means 5 coupled to a receiving antenna 6 and adapted to supply signals to a suitable converter or detector-oscillator 7. The resulting intermediate frequency signals are supplied to the second detector 8 through an intermediate frequency amplifier 9 and the detected or audio frequency signals are applied to an audio frequency amplifier 10 through a suitable volume control means 11. The volume control means represents any suitable volume control means for a radio receiver and the receiving system schematically shown may be taken to represent any suitable radio receiving system which may be tuned for the selection of radio signals for the control of the volume of output of the received signals.

The audio frequency amplifier 10 is coupled in any suitable manner to an output amplifier stage comprising in the present example an amplifier tube 12 which normally supplies audio frequency signals to a loudspeaker or sound reproducing device 13 through an output transformer 14. The tube is preferably of the screen grid type having a cathode 15, a signal input or control grid 16, a screen grid 17 and an output anode 18. The tube in the present example is of the RCA 6L6 type having also beam deflecting electrodes 19.

The control grid is coupled to the preceding audio frequency amplifier 10 through a suitable coupling capacitor 20 and is connected to chassis for bias supply through a grid resistor 21. The cathode is also connected to ground or chassis through one contact 22 of a switch 23 and a self-bias resistor 24, which is not bypassed, in order to provide a small degree of degeneration. For the 6L6 type of tube, this resistor may be of the order of 150 ohms in value.

The output anode is connected through one contact 25 of a selector switch 26 to the primary

27 of the output transformer 14 and thence to the positive side of the anode current supply circuit indicated at 28. This is also bypassed to chassis or ground through a suitable bypass capacitor 29. In the system thus far described, the amplifier 12 operates as a normal audio frequency output or power amplifier for the loudspeaker 13 and the receiver is operable to receive signals throughout a predetermined band of frequencies, such as the broadcast band, as a complete receiving unit.

In accordance with the present invention, the output tube for the receiver is used as the oscillator for remote control, and in the circuit shown, wherein a screen grid tube is employed, the screen grid and the plate are used in the oscillator circuit. Modulation is accomplished without change from the normal receiving condition by applying the derived audio frequency signal to the control grid as in the normal amplifier operation. However, switches 23 and 26 in the cathode and anode circuits are arranged for a minimum of circuit adjustments to select the remote control operation when desired.

In this circuit, the screen grid 17 is provided with a positive potential supplied through a tuning inductance 35 located in the screen grid circuit 36. The inductance is tunable by a shunt variable capacitor 37, one side of which is connected to ground and to the low potential end of the inductance 35 through the bypass capacitor 29, the opposite side of the capacitor 37 being connected directly to the inductance 35. The inductance 35 and capacitor 37 provide a tuned oscillator circuit permanently connected in circuit with the screen grid and does not require switching for amplifier operation at audio frequencies. For generating oscillations, the winding 35 is coupled with a feedback winding, indicated at 38, to which the output circuit of the anode 18 may be connected by operation of the switch 26 to a second contact 39. This arrangement provides for disconnecting the output circuit of the tube 12 from the transformer 14 and the loudspeaker and provides feedback from the winding 38 to the tuning inductance 35 for sustaining oscillations.

The switch 26 is connected with the switch 23 to be jointly operable therewith in effecting a change in the cathode circuit to include a second and larger bias resistor 40 when the switch 23 is moved to the contact 41. This resistor is bypassed by a suitable capacitor indicated at 42. The higher bias required by the oscillator is provided by the resistor 40 which is connected in the circuit with the cathode in lieu of the resistor 24 when the feedback coil 38 is connected in circuit with the anode. The resistor 40 may have a resistance of approximately 2,000 ohms with an RCA 6L6 output-tube, for proper operation as an oscillator.

In case that the bias for the audio frequency input grid 16 must be less than the self-bias on the oscillator, the grid return for the grid resistor 21 may be made to ground through a portion of the resistor 40 in connection with a tap, indicated at 43.

Oscillations modulated at audio frequency provided by the receiver output stage may be transmitted to the second receiver or other utilization device (not shown) by any suitable means. However, it is at present preferred to provide a coupling coil, indicated at 45, inductively coupled with the winding 35 of the oscillator and connected with suitable radiating means, such as a

power lead or wire line 46, which may serve as a transmitting antenna. In order to increase the energy output at the selected transmission frequency for the modulated oscillations, the winding 45 may also be tuned as indicated by a shunt capacitor 47, to the frequency of the oscillator.

From the foregoing description, it will be seen that the receiving system may be operated in a normal manner whether receiving signals as a complete receiver or supplying modulated signals as a control unit, the modulations in one case being applied to the loudspeaker and in the other being applied to the oscillator. Since the same tube serves as the output tube and oscillator, no switching of the control grid circuit is required, and since, in the case of a screen grid tube, the tuning inductance for the oscillator function may be maintained in circuit for audio frequency amplification, the selective switching is simplified, requiring only a change in the output anode connection and in the bias, the latter being supplied by the usual self-bias resistor means.

The additional apparatus required for remote control does not add appreciably to the cost of the receiver. Therefore, this system is adapted for use in midget or low cost radio receivers greatly enhancing their usefulness and without in any way complicating or changing the normal mode of operation. In the one mode of operation, the signal selecting and volume control means function to select and control the signals reproduced by the loudspeaker, while, as a remote control unit, the signal selection and volume control means serve to control the selection of signals for a remotely located receiver and the volume control being effective to change the percentage modulation of the oscillator also controls the volume of the signal output at the remotely located receiver. An additional advantage lies in the fact that no additional tube is required for the dual operation of the receiver.

The output of the oscillator is tuned preferably to a frequency which lies within the tuning range of the receiver to be controlled, and at or adjacent to one end of the tuning range which normally is comparatively free of other signals. For example, in connection with a broadcast receiver, the output of oscillator may be tuned by means of the capacitor 37 to a frequency slightly below or slightly above 550 kcs. to bring it just below or just within the present standard broadcast band of frequencies.

It will also be appreciated that by utilizing the output tube as a conversion device for supplying signals to a remotely located utilization means, such as a second receiver, the remote control unit may include signal reception in any one of a plurality of frequency bands, including short wave reception, thereby readily adapting the utilization means for the reception of other signals than that for which originally it was designed.

We claim as our invention:

1. In a radio signal receiving system, the combination with an audio frequency amplifier tube having a plurality of control electrodes, of means for operating said tube as an audio frequency output amplifier stage for said system, and means for modifying the operation of said stage whereby said tube functions alternatively as a modulated oscillator, said last-named means including a circuit connected with one of said control electrodes and tunable to the oscillation frequency, an audio frequency input circuit coupled with another of said electrodes, and a volume control device for

determining the amplitude of audio frequency signals transmitted through said input circuit to said stage when functioning both as an amplifier and as a modulated oscillator.

5 2. In a radio receiver, the combination with an audio frequency output amplifier, of means for reproducing signals transmitted through said amplifier, and means for converting said amplifier for the generation of oscillations at a predeter-  
10 mined frequency and the modulation of said oscillations by the audio frequency signals transmitted through said amplifier, and means for selecting and controlling the volume of said signals for the remote control of radio receiving ap-  
15 paratus responsive to said predetermined frequency.

3. In a radio receiver, the combination with signal-selecting and volume-control means, of an audio frequency output amplifier stage com-  
20 prising a tube having a control grid, a cathode, an output anode and a screen grid, means providing a fixed audio frequency input circuit for said control grid for applying thereto audio frequency signals controllable in amplitude by said volume  
25 control means, means for applying biasing potentials to said control grid with respect to the cathode to cause said tube to operate as an amplifier and as an oscillator, a tunable oscillator circuit connected with the screen grid and including  
30 a tuning inductance connected in circuit with the screen grid for both amplifier and oscillator operation, a feedback winding coupled with said tuning inductance, means providing an audio frequency output circuit for said tube, means for  
35 selectively connecting said anode with said output circuit for amplifier operation and with said feedback winding for oscillator operation, and a signal output circuit coupled with said tuning inductance.

40 4. In a radio receiver, an audio frequency output stage comprising a pentode tube having an anode, a cathode, a screen grid and a control grid, means including a volume control device for applying audio frequency signals to said control  
45 grid, a tunable circuit connected with said screen grid, an audio frequency output circuit connected with said anode, means for selectively coupling said anode with said tunable circuit for generating oscillations within a predetermined fre-

quency range modulated in accordance with audio frequency signals applied to said control grid, and means coupled with said tunable circuit providing an output circuit for modulated oscillations, said last-named circuit being tunable to the frequency of the oscillations. 5

5. In a radio receiver, an audio frequency output stage comprising a pentode tube having an anode, a cathode, a screen grid and a control grid, means including a volume control device for applying audio frequency signals to said control  
10 grid, a tunable circuit connected with said screen grid, an audio frequency output circuit connected with said anode, means for selectively coupling said anode with said tunable circuit for generating  
15 oscillations within a predetermined frequency range, means conjointly operable with said selective coupling means for applying a biasing potential to said tube for operation as an oscillator to provide oscillations modulated in accordance with  
20 audio frequency signals applied to said control grid, and means coupled with said tunable circuit providing an output circuit for modulated oscillations.

6. In a radio receiver, an audio frequency output stage comprising a pentode tube having an anode, a cathode, a screen grid and a control grid, means including a volume control device for applying audio frequency signals to said control  
25 grid, a tunable circuit connected with said screen grid, an audio frequency output circuit connected with said anode, means for selectively coupling said anode with said tunable circuit for generating oscillations within a predetermined frequency  
30 range modulated in accordance with audio frequency signals applied to said control grid, means coupled with said tunable circuit providing an output circuit for modulated oscillations, said last-named circuit being tunable to the frequency  
35 of the oscillations, bias-applying means including a cathode resistor without bypass for amplifier operation of said tube, a second cathode resistor and a bypass capacitor therefor, for effecting oscillator operation of said tube, and a selector switch for connecting said resistors selectively in  
40 circuit with the cathode. 45

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