

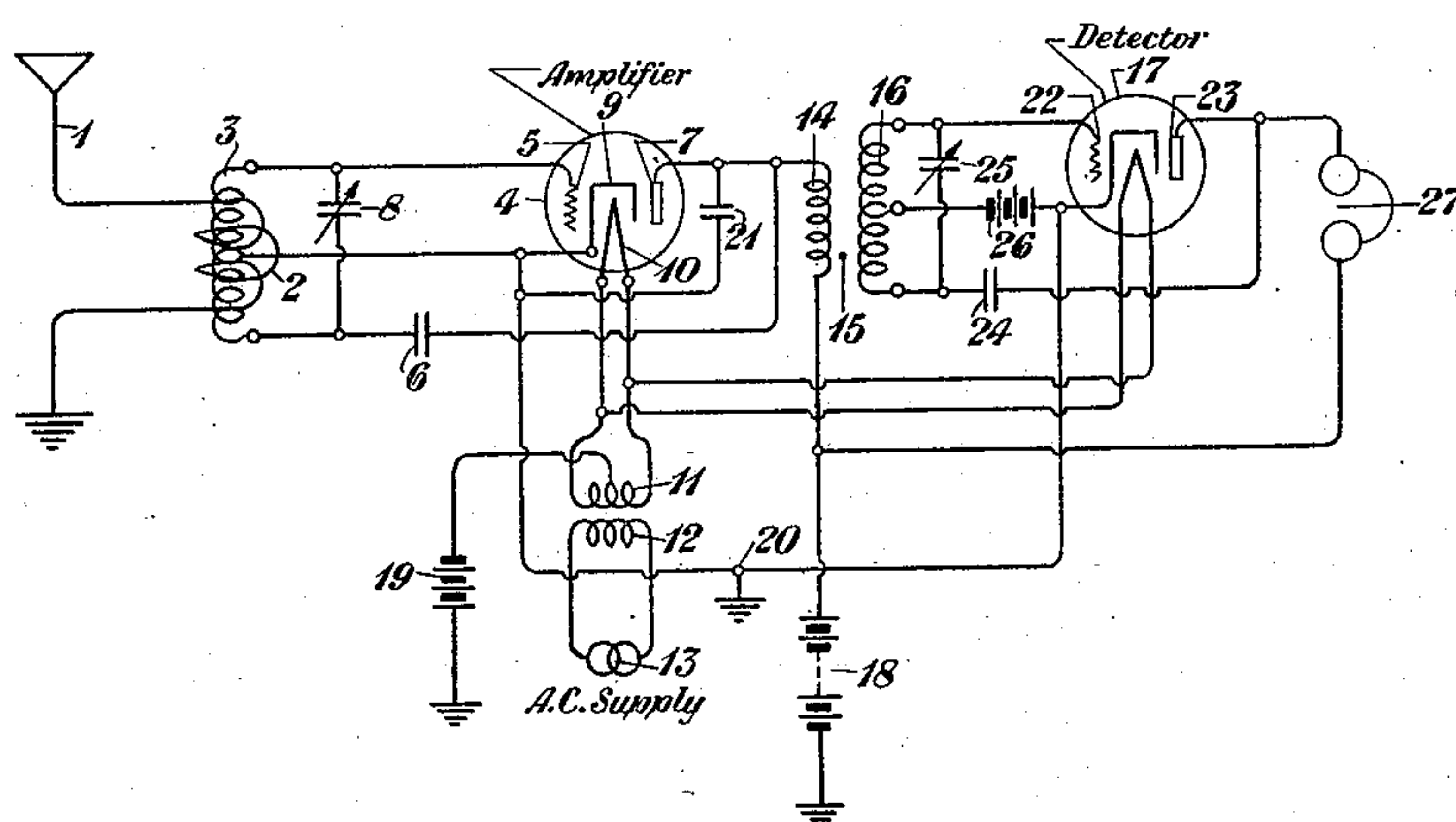
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R. S. OHL

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TUNED RADIO FREQUENCY AMPLIFIER

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INVENTOR
R. S. Ohl
BY *g r y o l a*
ATTORNEY

UNITED STATES PATENT OFFICE

RUSSELL S. OHL, OF NEW YORK, N. Y., ASSIGNOR TO AMERICAN TELEPHONE AND TELEGRAPH COMPANY, A CORPORATION OF NEW YORK

TUNED RADIO FREQUENCY AMPLIFIER

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This invention relates to radio frequency amplifiers and particularly to means for preventing the setting up of oscillations in an amplifier of that type, which oscillations are of a frequency differing from that for which the amplifier is tuned.

One of the difficulties experienced in the amplification of high frequencies arises from the tendency of the amplifier to oscillate at frequencies which are parasitic to the frequency at which the amplifier is intended to operate. These oscillations are set up by the capacity between the grid and the plate of the tube and by the inductance of the conductors forming part of the input and output circuit of the tube, which capacity and inductance become important when the frequency involved is of a high order of periodicity. These oscillations block the detector and thus prevent the detection of desired signals.

The object of this invention is to provide means for preventing a feeding back from the output to the input circuit of a high frequency amplifier of frequencies that are parasitic to the said high frequency, thereby suppressing any tendency on the part of the amplifier to oscillate at the parasitic frequency.

Other objects of this invention will be apparent from the following description when read in connection with the attached drawing showing schematically a form of embodiment of the invention.

In the drawing the antenna 1 is connected with the primary winding 2 of a coupling transformer, of which the secondary winding 3 is connected with the input circuit of the vacuum tube amplifier 4. One terminal of winding 3 is connected with the grid 5. The midpoint of the same winding is connected with the unipotential cathode 9. The other terminal of winding 3 is connected through the condenser 6 with the plate 7. A variable condenser 8 is connected across the terminals of winding 3 to tune the input circuit of the amplifier to the high frequency at which the amplifier is intended to operate. The unipotential cathode 9 is rendered active by means of a filament 10, which is connected through the windings 11—12 of a

transformer with a source 13 of alternating current. The tube 4 may be of the general type disclosed in the patent to A. M. Nicolson, No. 1,459,412, which issued on June 19, 1923. The plate 7 is connected through the primary winding 14 of transformer 15 with the positive pole of a source 18 of direct current potential which has its negative pole grounded. The secondary winding 16 of the transformer 15 is connected with a vacuum tube detector 17. One of the terminals of the winding 16 is connected with the grid 22 of the detector, and the other terminal is connected through the condenser 24 with the plate 23. The midpoint of winding 16 is connected with the cathode 28, the connection including the C battery 26. The cathode 28 is rendered active by a filament 29 which is energized by the source 13. The cathodes of each of the tubes 4 and 17 are grounded at point 20. The plate 23 of tube 17 is connected with the source 18 of plate potential, the connection including a signal indicating device represented symbolically as a telephone receiver 27. The midpoint of the winding 11 is connected with the negative pole of the source 19 of direct current potential, which, for example, may be of the order of magnitude of from 12 to 22½ volts, which potential serves to prevent the radiation of electrons from the heating filament 10, and thereby prevents distortion of the space currents within the amplifier 4. A condenser 21 is connected between the plate 7 and the conductor, which is grounded at 20. It will be seen that the winding 14 is also connected to ground through the battery 18, so that the winding 14 and the condenser 21 are in parallel.

The manner in which this circuit operates to amplify the high frequencies upon which it is designed to operate and to suppress the tendency to oscillate at parasitic frequencies, is as follows: High frequencies intended to be received will be impressed by the antenna 1 upon the tuned circuit 3—8, which is resonant to the frequency intended to be amplified. This frequency will be impressed upon the grid-cathode circuit of the amplifier 4 and will produce corresponding variations

in the space current between the plate 7 and the cathode 9, which space current is derived from the source 18 and flows through the winding 14 of the transformer 15. The high frequency will thus be amplified and impressed upon the resonant input circuit 16—25 of the detector 17. By the proper adjustment of the C battery 26, the signal will be detected and will be manifested by the signal indicating device 27. If, however, there are present certain parasitic frequencies which, by virtue of the capacity between the grid 5 and the plate 7, and also by virtue of the inductance between the conductors of the output and input circuits of the tube 4, would tend to cause the tube to oscillate at the said parasitic frequencies, such tendency will be suppressed by the condenser 21, which is connected to ground in parallel with the winding 14. In order to effect this suppression without affecting the amplification of the tube at the frequency upon which it is intended to operate, the magnitude of the condenser 21 must have a definite relation to the magnitude of the inductance 14. Briefly stated, if the inductive reactance of the winding 14 is less than the capacitive reactance of the condenser 21, for the high frequency intended to be amplified and detected, the input impedance of the transformer 15 will be increased, which condition is, of course, desirable for such amplification and detection. However, if the inductive reactance of the winding 14 is appreciably greater than the capacitive reactance of the condenser 21 for the parasitic frequencies, the impedance of these elements combined becomes less than the impedance due to the inductive reactance alone, and thus no oscillations can take place at frequencies considerably below the said high frequencies for which the amplifier is intended to function, viz., at the parasitic frequencies. Briefly stated, the magnitude of the capacity of the condenser 21 is such as to readily pass the parasitic frequencies and to oppose the passage of the high frequency intended to be amplified. It therefore shunts the parasitic frequencies and prevents any tendency of the circuit to oscillate at those frequencies.

The invention has been disclosed in a balanced type of input circuit, which circuit is characterized by the condensers 6 and 24 connected between the input winding and the plate of the tubes 4 and 17 respectively. This type of circuit has been chosen to illustrate the invention because it represents a desirable form of circuit for the reception of high frequency signals. It is not to be understood, however, that the invention is limited to such a circuit, because, to the contrary, it is capable of embodiment in other and different forms of circuits without departing from the spirit and scope of the appended claims.

What is claimed is:

1. In a high frequency signaling system, the combination with an amplifier having a vacuum tube of an input circuit and an output circuit, a detector circuit, a transformer having its primary winding connected with the said amplifier output circuit and its secondary winding connected with the detector circuit, and a condenser connected in parallel with the said primary winding, the magnitude of the capacitance and inductance of the said condenser and the said primary winding respectively being such that the impedance of the combination is high for the frequencies to be amplified and low for parasitic frequencies whereby oscillations of the said amplifier at parasitic frequencies is prevented.

2. In a high frequency amplifying system, the combination with a multi-electrode vacuum tube of an input circuit and an output circuit, a transformer having its primary winding connected with the said output circuit and its secondary connected with a work circuit, a condenser connected between the said input circuit and output circuit to apply to the input circuit oscillations equal in magnitude and opposite in phase to the oscillations fed back by the inter-electrode capacity of the tube, and a condenser connected in parallel with the said primary winding, the magnitudes of the capacitance and inductance of the said latter condenser and the said primary winding, respectively, being such that the impedance of the combination is high for frequencies to be amplified and low for parasitic frequencies whereby oscillation of the amplifier at the said parasitic frequencies is prevented.

In testimony whereof, I have signed my name to this specification this 30th day of December, 1924.

RUSSELL S. OHL.