June 2, 1942. J. HAANTJES ET AL 2,285,030

RECEIVING SYSTEM

Filed May 11, 1940

Fig. 1

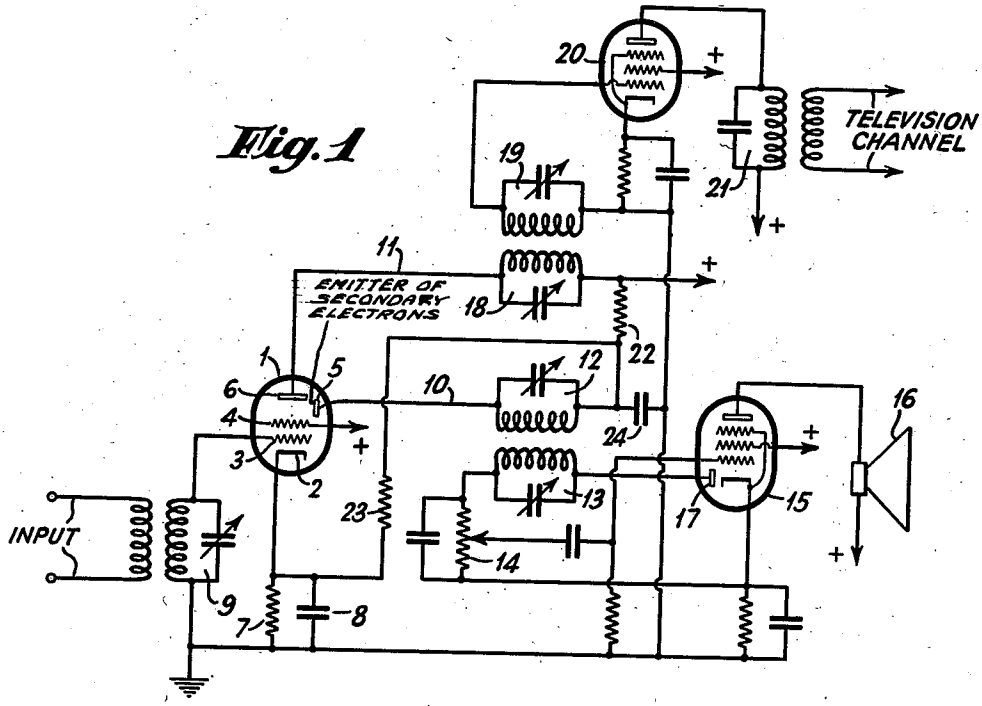
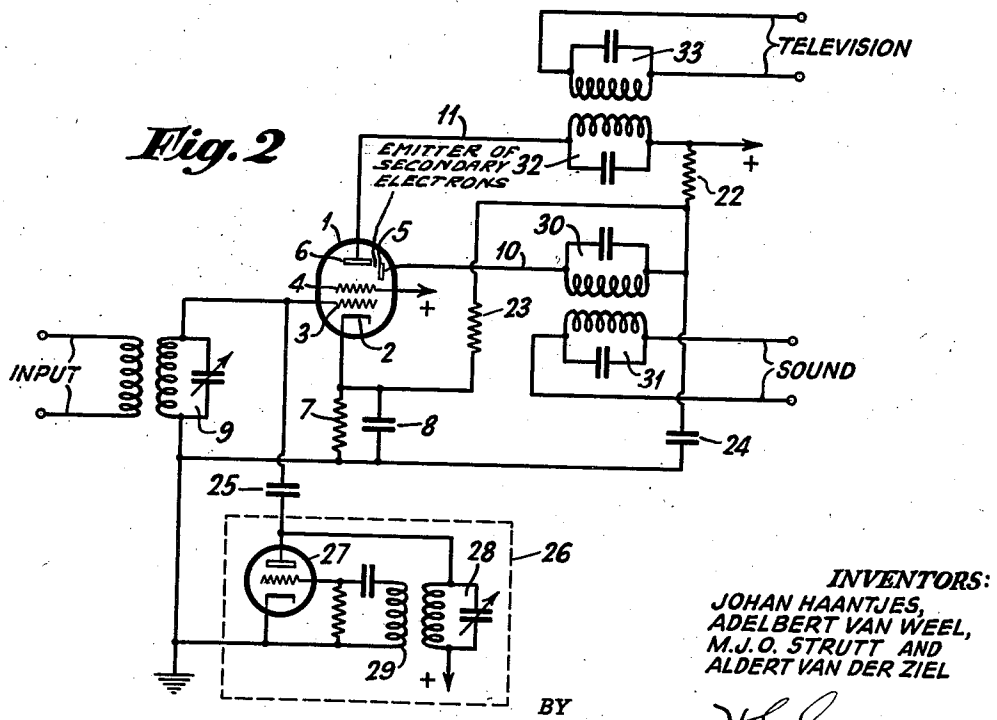


Fig. 2



INVENTORS:
JOHAN HAANTJES,
ADELBERT VAN WEEL,
M.J.O. STRUTT AND
ALDERT VAN DER ZIEL

BY H.S. Snover

ATTORNEY

Patented June 2, 1942 2,285,030

UNITED STATES PATENT OFFICE

2,285,030

RECEIVING SYSTEM

Johan Haantjes, Adelbert van Weel, Maximiliaan Julius Otto Strutt, and Aldert van der Ziel, Eindhoven, Netherlands, assignors to Radio Corporation of America, New York, N. Y.

Application May 11, 1940, Serial No. 334,502
In the Netherlands June 15, 1939

1 Claim. (Cl. 250—9)

The invention relates to a system for amplifying and, if desired after mixing with a local oscillation, separating two or more oscillations.

Such systems are utilised, for example, in television receivers which serve for the reception of a picture signal consisting of a carrier wave on which the picture currents are modulated, and a sound signal located in close proximity thereto and consisting of a carrier wave on which the corresponding sound is modulated. The frequency of the picture carrier wave is, for example, 45 megacycles per second whilst the frequency of the sound carrier wave is, for example, 41.5 megacycles per second.

For the purpose of saving receiving tubes these two carrier waves with the corresponding sidebands are usually amplified in a common high-frequency channel and, if desired after being mixed with a local oscillation, separated from one another and separately detected. The separation of the two signals may be effected in this case, for example, by utilizing two tubes which have the input circuit in common and whose anode circuits include oscillatory circuits respectively tuned to both signals.

If, in addition, in these tubes the oscillations to be separated are mixed with a local oscillation, oscillatory circuits tuned respectively to the intermediate frequency signals formed are incorporated in the anode circuits.

The invention permits further economy in tubes whilst with the system according to the invention the additional advantage of greater amplification or of a greater conversion slope is obtained.

According to the invention, the system comprises a tube which has inter alia a control grid, at least one auxiliary cathode adapted to emit secondary electrons and an anode whilst to the control grid of this tube are supplied, if desired, jointly with a local oscillation, the oscillations to be amplified and separated and the auxiliary-cathode circuit or circuits and the anode circuit of this tube have each included impedances which possess respectively a high value for each of the oscillations to be separated or for each of the intermediate-frequency oscillations corresponding to the oscillations to be separated.

The impedances included in the auxiliary-cathode circuit or circuits and the anode circuit are preferably oscillatory circuits which are tuned respectively to the frequencies to be separated.

If the oscillations to be separated are mixed beforehand with a local oscillation it is advisable to supply this local oscillation via a weak coupling to the control grid.

When the system is utilized in a television receiver for separating the picture signal and the sound signal, an oscillatory circuit tuned to the oscillation which is most amplified in the tube, preferably the sound signal, is preferably incorporated in the circuit of the electrode which has the smallest capacity with respect to the control grid.

The invention will be more clearly understood by referring to the accompanying drawing wherein

Fig. 1 represents a system according to the invention which may be utilized in a television receiver without frequency transformation for separating the picture signal and the sound signal from one another.

In the system according to Fig. 2, which is also suitable for use in television receivers, frequency transformation is utilized for the separation of the picture signal and the sound signal.

In Fig. 1, 1 denotes a tube comprising a cathode 2, a control grid 3, a screen grid 4, an auxiliary cathode 5 adapted to emit secondary electrons and an anode 6. The cathode 2 is connected to earth through the parallel connection of a resistance 7 and a condenser 8 which serves for automatic negative grid voltage. To the control grid 3 are supplied by an oscillatory circuit 9 the oscillations to be amplified and separated which originate from a high-frequency amplifier not shown in the drawing.

These oscillations control the electron current emitted by the cathode 2, which current is accelerated by the screen grid 4, moves to the auxiliary cathode 5 and causes the latter by electron bombardment to emit a number of secondary electrons which is proportional to this current, which electrons travel to the anode 6 with the result that in the auxiliary-cathode circuit 10 as well as in the anode circuit 11 there flows an electron current which comprises the oscillations supplied to the control grid 3.

The auxiliary-cathode circuit 10 includes an oscillatory circuit 12 which is tuned to the sound signal and is coupled with an oscillatory circuit 13 to which the sound signal is transferred. The oscillations occurring at the terminals of the oscillatory circuit 13 are rectified and the low-frequency component occurring across a resistance 14 is supplied to the control grid of an amplifying tube 15 whose anode circuit includes a loudspeaker 16. A diode 17 serving for rectification is preferably provided within the tube 15.

The anode circuit 11 of the tube 1 comprises an oscillatory circuit 18 tuned to the picture signal, which circuit is coupled with an oscillatory circuit 19 which is also tuned to the picture signal.

The voltage set up across the oscillatory circuit 19 is supplied to the control grid of an amplifying tube 20. The anode circuit of this amplifying tube includes an oscillatory circuit 21 which is also tuned to the picture signal and which has coupled with it the remainder of the picture receiver, which is not shown in the drawing.

A positive voltage is supplied to the anode 6 through the oscillatory circuit 18. The auxiliary cathode 5 receives, via the oscillatory circuit 12, a positive voltage from a potentiometer formed by resistances 22 and 23. The junction point of these resistances is connected to earth through the intermediary of a condenser 24.

In the system according to Fig. 2, wherein the oscillations to be separated are mixed beforehand with a local oscillation, similar components are denoted with the same reference numerals.

The control grid 3 of the tube 1 has supplied to it not only the oscillations to be separated which originate from the oscillatory circuit 9 but also, via a condenser 25, an oscillation generated in a local oscillator 26. This oscillator comprises a tube 27 whose anode circuit includes an oscillatory circuit 28 which is coupled with a coil 29 in the grid circuit. Mixing of the oscillations supplied to the control grid 3 takes place within the tube 1. The auxiliary-cathode circuit includes an oscillatory circuit 30 which is tuned to the intermediate-frequency sound signal formed and which transfers the oscillations to an intermediate-frequency circuit 31 which is also tuned to the intermediate-frequency sound signal and supplies the oscillations to a detector and low-frequency amplifier for the sound, which are not shown in the drawing. In the anode circuit of the tube 1 is incorporated an oscillatory circuit 32 which is tuned to the intermediate-frequency picture signal formed and is coupled with an oscillatory circuit 33. This circuit supplies the intermediate-frequency picture oscillations to the remainder of the picture receiver, which is not shown in the drawing.

Since the tube 1 has a high mutual conductance, for example 14 mA./volt, the oscillator voltage at the control grid need not exceed 0.5 volt and the condenser 25 may be small, for example a few tenths of a micromicrofarad so that a weak coupling between the oscillator 26 and the control grid of the tube 1 may be sufficient.

If only a narrow band of frequencies is to be amplified, for example the sound carrier wave with its side-bands, a high impedance of the oscillatory circuit tuned thereto may be chosen, so that the amplification becomes very intense in this case. In this case this oscillatory circuit is preferably incorporated in the circuit of the electrode which possesses the lowest capacity with respect to the control grid 3 of the tube 1.

What we claim is:

A frequency changing circuit for heterodyning and separating two signal-modulated carriers of different frequencies, comprising an electron discharge tube having at least a main cathode, a control grid, an auxiliary cathode in the form of a solid plate impervious to electrons adapted upon impact of electrons from the main cathode to emit secondary electrons, and an anode, means for simultaneously impressing both carrier frequencies upon the control grid, a local oscillator loosely coupled to the control grid for impressing a heterodyne frequency thereon, and a pair of impedances each included respectively in the circuit of the auxiliary cathode and in that of the anode and each having respectively a high value for one of the intermediate frequencies resulting from the interaction between the heterodyne frequency and each of the signal-modulated carrier frequencies.

JOHAN HAANTJES.
ADELBERT VAN WEEL.
MAXIMILIAAN JULIUS OTTO STRUTT.
ALDERT VAN DER ZIEL.