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HIGH FREQUENCY AMPLIFIER

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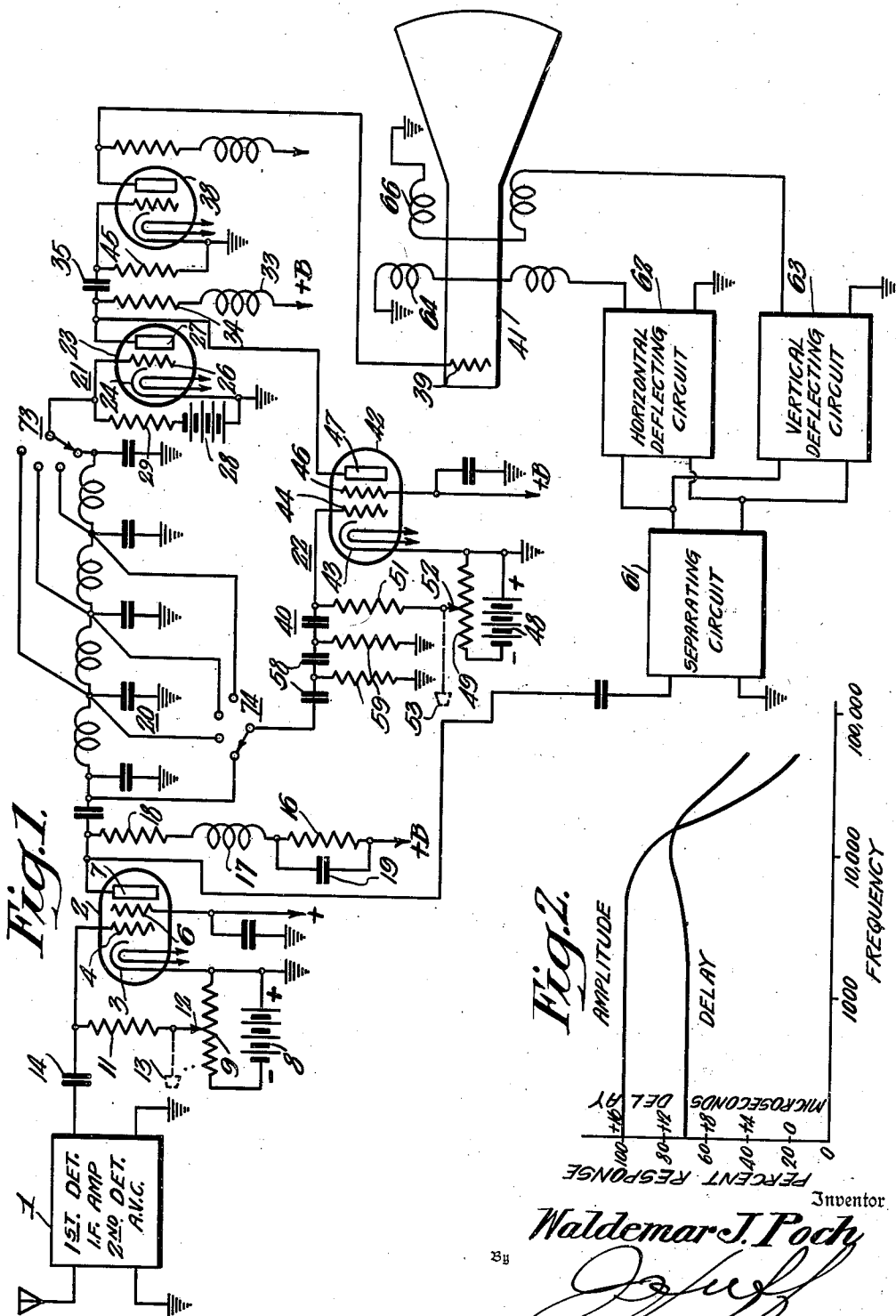
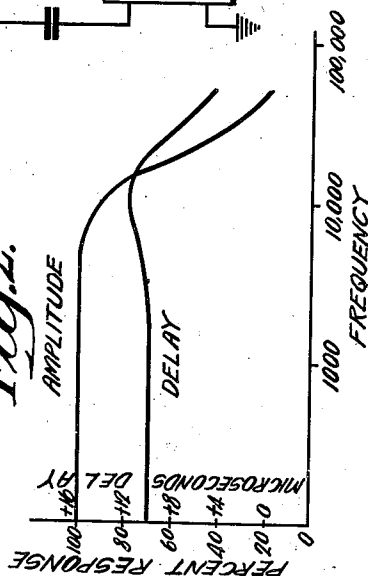


Fig. 1.

Fig. 2.



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UNITED STATES PATENT OFFICE

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HIGH FREQUENCY AMPLIFIER

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to Radio Corporation of America, a corpora-
tion of Delaware

Application June 6, 1939, Serial No. 277,615

3 Claims. (Cl. 179—171)

My invention relates to high frequency amplifiers and particularly to television receiver amplifiers.

It is often desirable to vary or adjust the frequency response characteristic of an amplifier. In television receiver amplifiers, especially, it is desirable that they be adjustable for the purpose of varying the relative amplification of the high frequency components of an incoming picture signal. It is also desirable in certain types of amplifiers to adjust the relative phase of different frequency components of a signal.

The present application is a continuation in part of application Serial No. 71,364, filed March 28, 1936, entitled High frequency amplifiers, and assigned to the Radio Corporation of America, which issued December 12, 1939, as United States Patent No. 2,183,203. It relates, in particular, to apparatus in which it is found desirable to vary or correct the phase relation of the high frequency components of a signal as compared with the remaining components.

In my United States Patent No. 2,122,990, issued July 5, 1938, which is assigned to the Radio Corporation of America, I describe and claim a television receiver having adjustable means for varying its frequency response characteristic. In that patent I point out that if a television receiver is tuned away from one transmitter station to a second transmitter station which transmits more high frequency components of a picture signal than the first transmitter, the picture at the receiver will have a "bas-relief" appearance. To overcome this, the receiver must be adjusted to amplify the higher frequency components to a less degree.

On the other hand, if the receiver is tuned back to the first transmitter station, it is desirable to increase the high frequency response of the receiver so that the picture will contain a maximum of detail. There are various other reasons for making the high frequency response of a television receiver adjustable. For example, if there is considerable interference, a picture may be improved by lowering the high frequency response whereby "noise" in the picture is reduced. As interference or "noise" is generally at the higher frequencies, the loss of detail in a picture is often less objectionable than the "noise" included at these frequencies.

Furthermore, in amplifiers of the type employing inductance coils such as the so-called "peaking coils" for holding up the high frequency response it has been found that when the amplitude response curve is made flat, the high fre-

quency components of the signal are delayed more than the lower frequency components whereby the quality of a reproduced picture is impaired.

It is an object of my invention to provide an improved method of and means for varying the frequency response characteristic of an amplifier.

A further object of my invention is to provide an improved method of and means for controlling the degree of amplification of the high frequency components of a signal as compared with the amplification of its low frequency components.

A further object of my invention is to provide an improved method of and means for controlling the amplification and/or phase of the high frequency components of a signal as compared with the amplification and/or phase of its low frequency components.

More specifically, one object of my invention is to provide in an amplifier of the type wherein a "peaking coil" or the like is employed means for eliminating or reducing an undesired delay of the high frequency components of the signal as compared with the remaining frequency components.

In a preferred embodiment of my invention the picture signal is supplied from an amplifier tube to the input circuits of two amplifier channels, one channel being designed to amplify all components of the picture signal a fixed amount, and the other channel being designed to amplify the high frequency components substantially to the exclusion of the lower frequency components. The two amplifier channels have a common output circuit whereby their outputs add to give the desired resultant picture signal. The second channel includes adjustable means for determining the amount the high frequency components are amplified whereby the high frequency content of the resultant signal may be controlled. The first amplifier channel includes a delay network whereby, in effect, the phase of the signal output of the second channel may be advanced with respect to the output of the first channel.

Other objects, features, and advantages of my invention will appear from the following description taken in connection with the accompanying drawing in which

Figure 1 is a circuit diagram of a television receiver amplifier embodying my invention, and

Figure 2 is a pair of curves which are referred to in explaining my invention.

Referring to Fig. 1, my invention is shown applied to a television receiver which may include a heterodyne receiver portion indicated at 1.

This portion of the receiver preferably includes an automatic volume control circuit for supplying a signal of constant amplitude to the first video amplifier tube 2. The amplifier tube 2 may be of the screen grid type having a cathode 3, a control grid 4, a screen grid 6 and a plate 7. A grid biasing battery 8 or other suitable voltage source shunted by a potentiometer 9 is provided, the control grid 4 being connected through a grid resistor 11 and a variable tap 12 to a point on the potentiometer 9. The variable tap 12 may be moved along the potentiometer by rotating a knob, indicated at 13, on the front of the television receiver for the purpose of controlling the contrast of the picture. The picture signals are supplied through a coupling condenser 14 to the control grid 4.

A suitable positive potential is supplied through a filter resistor 15, a peaking coil 17 and a plate resistor 18 to the plate 7 of the amplifier tube 2. The filter resistor 16 is shunted by the usual filter condenser 19.

The picture signal appearing in the output circuit of the amplifier tube 2 is supplied to two amplifier channels 21 and 22. The first channel 21 includes an amplifier tube 23 which may be of the three-element type having a cathode 24, a control grid 26 and a plate 27. The control grid 26 is maintained at a suitable negative bias by suitable biasing means such as a biasing battery 28, the grid 26 being connected through a grid resistor 29 and the biasing battery 23 to the cathode 24. Picture signal is supplied to the control grid 26 through a delay network 20.

A suitable positive potential is supplied to the plate 27 of the amplifier tube 23 through a peaking coil 33 and a plate resistor 34.

The picture signal appearing across the plate resistor 34 and peaking coil 33 is supplied to an output tube 38 which, in turn, supplies the picture signal to the control grid 39 of the cathode ray receiver tube 41. The grid condenser 35 and grid resistor 45 are given suitable values to provide automatic background control as described and claimed in my application Serial No. 718,192, filed March 30, 1934, and assigned to the Radio Corporation of America.

The second channel 22 includes a high-pass filter 40 and an amplifier tube 42 which may be of the screen grid type, having a cathode 43, a control grid 44, a screen grid 46, and a plate 47. Suitable variable bias means is provided, this being a biasing battery 48 which is shunted by a potentiometer 49 in the particular circuit illustrated. The control grid 44 is connected through a grid resistor 51 and a variable tap 52 to a point on the potentiometer 49. As in the case of the first described amplifier tube 2, the variable tap 52 may be moved along the potentiometer 49 by rotating a knob indicated at 53 which is located on the receiver panel.

The high-pass filter 40 consists of a plurality of sections, each including a series condenser 58 and a shunt resistor 59.

The television receiver is provided with a suitable separating circuit indicated at 61 which separates picture signals from synchronizing signals. The horizontal synchronizing signals and the vertical synchronizing signals are supplied from the circuit 61 to deflecting circuits 62 and 63, respectively. Deflecting coils 64 and 66 are supplied with saw-tooth deflecting currents from the deflecting circuits 62 and 63, re-

spectively, for scanning a fluorescent screen at the end of the cathode ray tube 41.

It has been found that in amplifiers employing one or more inductance coils such as a peaking coil 17 for holding up the high frequency response of the amplifier, the high frequency components of the signal are delayed too much when the amplifier is adjusted to have a flat amplitude response. This is illustrated in Fig. 2 where the amplitude response curve and the delay curve of an amplifier of the above-mentioned type are shown. It will be apparent that a suitable delay correction can be obtained by employing the delay network 20 located between the amplifier 2 and the amplifier 23 of the first channel 21 whereby all frequency components of a picture signal are delayed substantially the same amount. The high frequency components which appear in the output circuit of the amplifier 42 of the second channel 22 are not delayed and, therefore, in effect are advanced in phase with respect to the signal supplied by the first amplifier channel. It will be apparent that when the outputs of the two amplifier channels are combined, the resultant signal includes high frequency components which have been advanced in phase with respect to the low frequency components.

It will be understood that the two amplifier tubes 23 and 42 in the two channels may be included in a single envelope, this being the preferred embodiment. In one amplifier embodying my invention, a 6F7 tube was employed, the triode part of this tube acting as the amplifier 23 and the pentode part acting as the other amplifier 42.

As indicated by the switches 73 and 74, the amount the signal is delayed in the channel 21 may be changed by switching the input circuit of the tube 23 to different sections of the delay network. Likewise the signal input to the high-pass filter 40 may be delayed a certain amount if found desirable in order to obtain the desired combination of a flat amplitude response curve and a flat delay curve.

I claim as my invention:

1. In combination, an amplifier channel having an output circuit and adapted to amplify signals comprising components covering a wide frequency range, said channel including amplitude correcting means for holding up the high frequency response, two amplifier channels each having an input circuit coupled to said output circuit, one of said channels including a delay network for delaying all of said frequency components in said one channel, means for causing only the higher frequency components of said signal to be amplified in the other of said channels, said higher frequency components being passed through said other channel substantially without delay, and means for adding the outputs of said channels, the delay which is introduced by said delay network being such as to compensate for delay introduced by said amplitude correcting means.

2. In combination, an amplifier channel adapted to pass signals comprising components covering a wide frequency range, means included in said channel for correcting for amplitude distortion of certain frequency components passed by said channel, an output channel, a plurality of channels each having an input circuit coupled to said first channel and each having an output circuit coupled to said output channel, the combined pass bands of said plurality of channels

being such as to pass substantially all the components in said wide frequency range, a delay circuit in at least one of said plurality of channels, and means in at least one of said plurality of channels for passing only the signal components occurring in a portion of said wide frequency range, said delay circuit and said last means being so adjusted as to correct for the phase distortion introduced by said amplitude correcting means.

3. In combination, an amplifier channel adapted to pass signals comprising components covering a wide frequency range, said channel including amplitude correcting means for holding

up the high frequency response of the amplifier, a plurality of signal channels connected in parallel relation, one of said channels including a delay network, another of said channels being designed to pass high frequency signal components better than the lower frequency components, and means for supplying the outputs of said plurality of channels to a common output circuit, the amount of delay provided by said delay network being such as to correct for the delay or phase distortion introduced by said amplitude correcting means.

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