July 5, 1938. W. J. POCH 2,122,990

TELEVISION RECEIVER

Filed May 26, 1934 2 Sheets-Sheet 1

Fig.1.

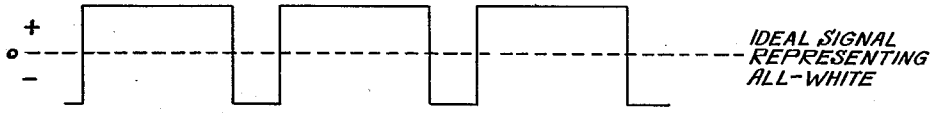


Fig.2.

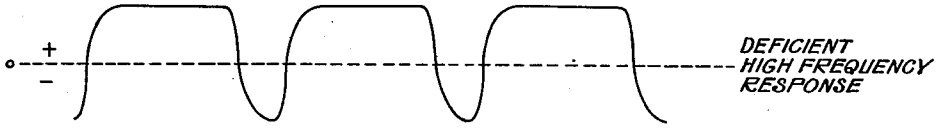


Fig.3.

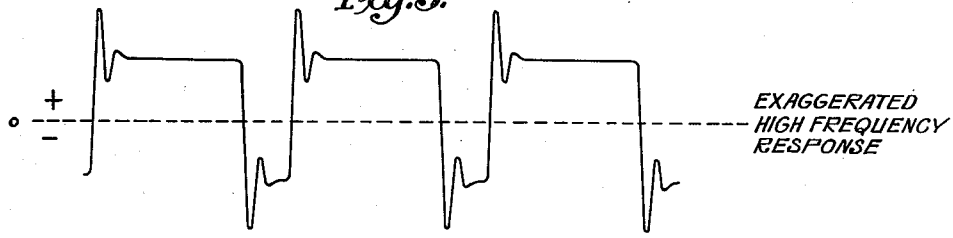


Fig.4.

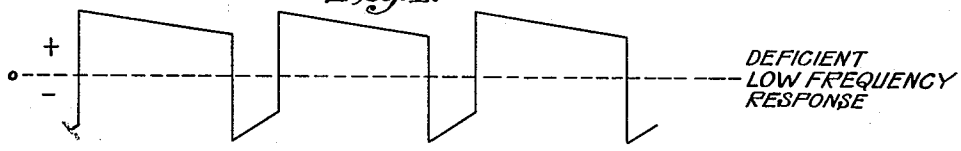
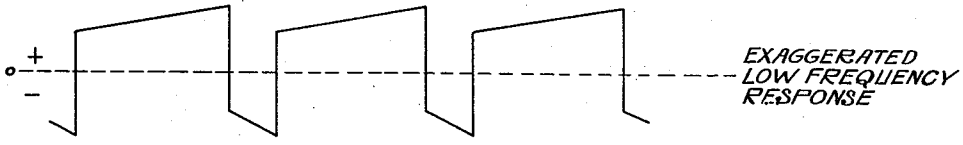


Fig.5.



INVENTOR:
Waldemar J. Poch
BY R. R. Goldsborough
ATTORNEY.

July 5, 1938. W. J. POCH 2,122,990

TELEVISION RECEIVER

Filed May 26, 1934 2 Sheets-Sheet 2

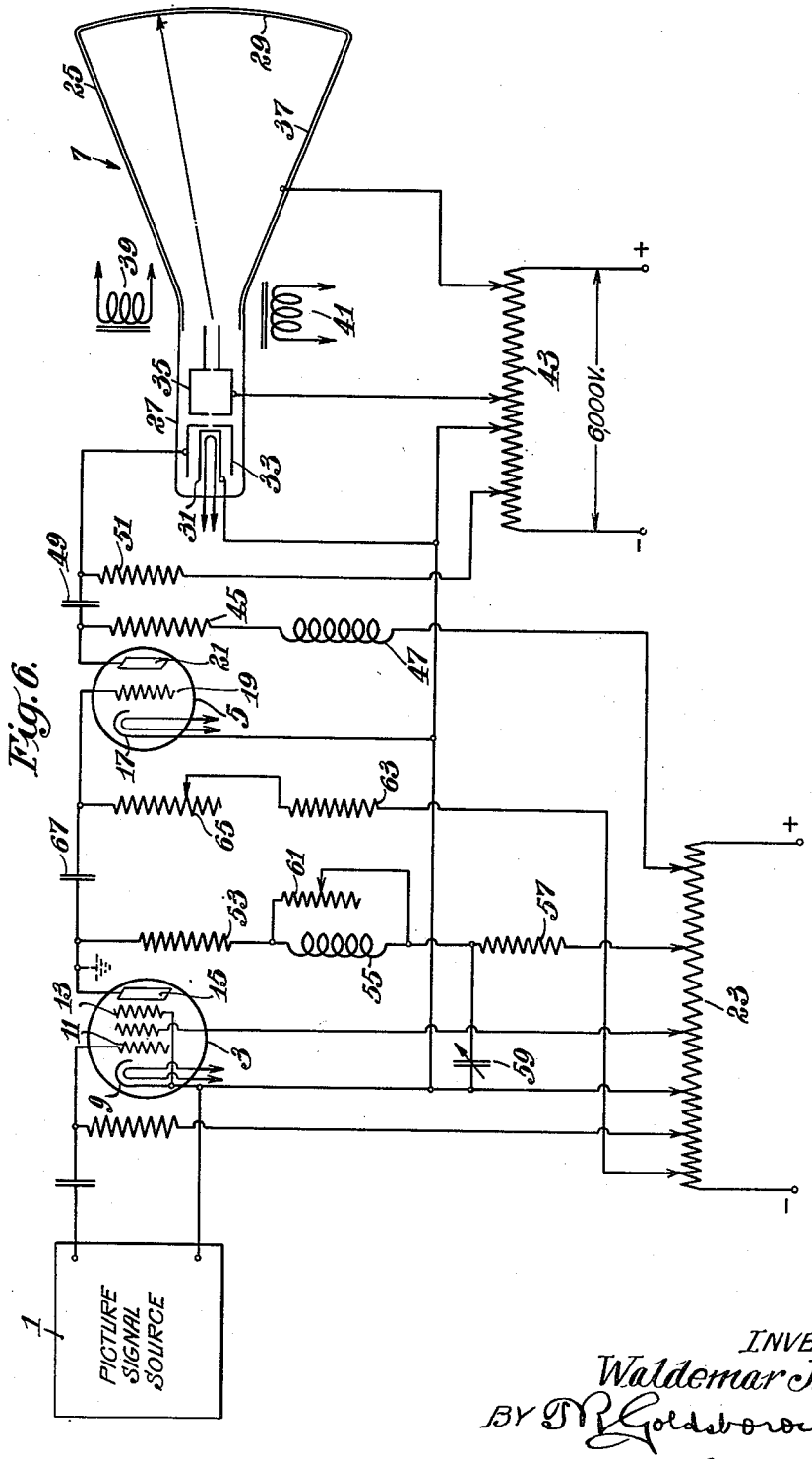


Fig. 6.

INVENTOR:
Waldemar J. Poch,
BY P. L. Goldsborough
ATTORNEY.

Patented July 5, 1938

2,122,990

UNITED STATES PATENT OFFICE

2,122,990

TELEVISION RECEIVER

Waldemar J. Poch, Collingswood, N. J., assignor to Radio Corporation of America, a corporation of Delaware

Application May 26, 1934, Serial No. 727,759

1 Claim. (Cl. 178—7.5)

My invention relates to television systems and more particularly to such systems wherein cathode-ray tubes are utilized at the receivers for the purpose of translating incoming picture signals into visual representations of the views at the transmitter.

As is well known to those skilled in the art, a cathode ray tube of the type now extensively utilized in television receivers is constituted by an evacuated container having a bulbous portion and a cylindrical portion. The inner surface of the end wall of the bulbous portion is overlain by fluorescent material over which an electron-stream, from a picture-signal-controlled source in the cylindrical portion, is repeatedly deflected horizontally at the "line" frequency and vertically at the "frame" frequency.

In my experiments with cathode-ray tubes as view translating devices I have often noticed a serious deficiency in detail and, at times, a rather curious accentuation of the outlines of objects when there is an abrupt change in illumination thereof in the direction in which the electron stream is moving, horizontally, over the screen. The latter phenomenon might appropriately be called a "bas-relief" effect. I have also noticed, occasionally, that the top of the fluorescent screen may be more brightly illuminated than the bottom or vice versa.

As the result of my investigations, I determined that the faulty reception cannot be ascribed to the receiving tube per se and I came to the conclusion that it resulted from irregularities in the over-all frequency-response of the entire channel between the transmitter and the receiving tube. This appears to be the correct conclusion and it is amply justified by the fact that the channel includes a large number of amplifiers, both at the transmitter and at the receiver, the frequency response characteristics of which may be such as to attenuate or to over-accentuate either the high or low frequencies appearing in the picture-signal.

Accordingly, the principal object of my invention is to provide means for controlling the detail of a televised picture appearing upon the fluorescent screen of a receiving tube of the cathode-ray type.

Another object of my invention is to provide means whereby the received picture is not marred by over-accentuation of the contrast between the edges of an object and the background which gives a "bas-relief" effect.

A still further object of my invention is to provide means whereby the illumination of the received picture, from top to bottom of the fluorescent screen, may be made to correspond to the illumination of the view at the transmitter.

The foregoing objects and other objects related thereto I prefer to accomplish by including a frequency-discriminating network in the receiving amplifier that supplies picture-signals to the control electrode in a cathode-ray tube. The exact position of the network in the amplifier is not especially important.

The novel features that I consider characteristic of my invention are set forth with particularity in the appended claim. The invention itself, however, both as to its organization and its method of operation, together with additional objects and advantages thereof, will best be understood from the following description of a specific embodiment, when read in connection with the accompanying drawings, in which:

Figs. 1 to 5 are graphs exemplifying television signals under differing conditions and,

Fig. 6 is a diagrammatic view of a television receiver including an embodiment of my invention.

Before explaining in detail the manner in which I prefer to accomplish the several objects of my invention, I wish first to call attention to Figs. 1 to 3 of the drawings which exemplify, in a conventionalized manner, the amplified picture-signals, corresponding to three successive lines of an all white view, as impressed upon the control grid of a receiving cathode-ray tube. Of these figures, Fig. 1 represents the ideal wave-shape, Fig. 2 the wave-shape when the system has poor over-all high frequency response, and Fig. 3 the wave-shape when the high-frequency response is excessive. Fig. 4 exemplifies the wave-shape corresponding to three successive frames of the white picture when the system is deficient in low frequency response and Fig. 5 the wave-shape when the low-frequency response is excessive. In Figures 4 and 5 it is to be understood that the relatively long, horizontal portions lying at the positive side of the zero axis, represent the integrated picture-signals corresponding to successive frames and the short, intermediate portions represent synchronizing impulses at the "frame" frequency which drive the control electrode of the cathode-ray tube negative between successive frames. The "frame" frequency, in a system to which my invention is applicable, may be of the order of sixty per second.

Obviously, if the signal impressed upon the control electrode of the cathode-ray tube is of the general type exemplified by Fig. 2 of the

drawings the change in the grid-potential will not be sufficiently rapid to make the details of the view "crisp". That is to say, if the over-all high frequency response of the system is deficient, detail will be lost. Again, referring to Fig. 3, if the signal is of the type exemplified thereby, and if the cathode ray is scanning the screen horizontally from left to right as viewed from the exterior of the tube, it will cause the left hand edges of objects in the view to be over-accentuated to give the so-called bas-relief effect.

If the low frequency response of the system is deficient, the amplifiers do not "hold up" during the time required for a single vertical deflection of the cathode ray from top to bottom of the screen, and the signal "drops off" as exemplified by Fig. 4 of the drawings. This dropping off causes the lower portion of the view to be shaded and, if the response is extremely poor, all detail may be lost in the shaded portion.

Having the foregoing in mind, it should now be apparent that if the frequency-response of the cathode-ray tube itself, or that of an amplifying stage immediately preceding the tube, could be altered at will any irregularity in the over-all response of the preceding portion of the system could be compensated. No further explanation of this fact should be necessary since it is obvious that Fig. 3 is complementary to Fig. 2 and that Fig. 5 is complementary to Fig. 4, insofar as frequency response compensation is concerned.

Referring now to Fig. 6 of the drawings, a television receiver constructed according to my invention may include a picture-signal source 1, a plurality of cascade connected picture-signal amplifying tubes 3 and 5 and a cathode-ray tube 7. The source may be understood as being any suitable device or series of devices capable of demodulating an incoming carrier-wave to provide plural-frequency picture signals or capable of amplifying the picture signals themselves, without demodulation, if no carrier wave is utilized.

Preferably, the first amplifier tube is of the screen-grid pentode type, having an equipotential cathode 9, a control-grid 11, a suppressor grid 13 and an anode 15.

The second amplifying tube may be of the same type but for purposes of simplicity it has been illustrated in the drawings as a triode having an equipotential cathode 17, a control-grid 19 and an anode 21.

A common source of unidirectional anode and biasing potentials is provided for the several amplifying tubes, which source is exemplified in the drawings by a bleeder resistor 23.

The cathode-ray tube utilized is of the well known type constituted by an evacuated container having a bulbous portion 25 and a cylindrical portion 27. The inner surface of the end wall of the bulbous portion is provided with a fluorescent screen 29 and an electron gun, comprising a cathode 31, a control electrode 33 and a first anode 35 is disposed in the end of the cylindrical portion. The entire inner surface of the bulbous portion may be provided with a thin metal coating 37 adapted to function as a focusing electrode or second anode for the cathode ray and suitable devices, exemplified by the coils 39 and 41 appearing in the drawings, may be disposed exteriorly of the tube to deflect the ray horizontally and vertically across the screen.

A separate source of unidirectional biasing and high anode potentials is provided for the cathode-ray tube, exemplified by a bleeder resistor 43 to appropriate points on which extend connections from the various tube-elements.

Amplified picture-signals are impressed upon the control-grid of the cathode-ray tube from the second amplifier tube. Preferably, the coupling network is of the resistor-condenser type including a resistor 45 and an inductor 47 in series in the output circuit of the amplifier tube, a stopping condenser 49 and a grid-leak 51.

Between the first and second amplifier tubes I interpose a coupling network constructed in accordance with my invention. This network, in its broadest aspect, is also of the resistor-condenser type but in it are included a number of important modifications. In the first place, the output circuit of the first amplifier tube includes, in series between the anode thereof and the potential source 23, a first resistor 53, an inductor 55 and a second resistor 57. A small capacitor 59 is connected between the low potential end of the inductor and the cathode of the tube for a purpose that will be explained in more detail hereinafter. The inductor is of such value that it is tuned, by the stray capacity between the anode of the tube and ground, to the highest picture-frequency expected and around it is connected a variable resistor 61. The adjustment of the variable resistor determines the "peaking" effect of the inductor upon the frequency response of the second amplifier tube. When the resistor is adjusted to substantially zero resistance the inductor has no effect; when the resistance is maximum the high-frequency response of the amplifier is also maximum. Also, the peaking effect depends upon the value of the resistor 53 connected directly to the anode of the first amplifier, being greater the lower the resistance thereof. In an actual embodiment of my invention the upper, or anode resistor 53 has a magnitude of 1500 ohms, the lower resistor 57 a magnitude of 10,000 ohms and the inductor an inductance of approximately 800 microhenries.

In order to control the low frequency response of the second amplifier tube I subdivide the grid-leak resistor thereof into a fixed portion 63 and a variable portion 65. The resistance of the fixed portion is high enough, approximately 15,000 ohms, so that when the resistance of the variable resistor is zero, the said fixed portion has no appreciable short-circuiting effect upon the resistor connected to the anode of the first amplifier tube.

The capacity of the stopping condenser 67 interposed between the anode of the first amplifier tube and the grid of the second tube, approximately .25 mfd., is such that when the variable resistor 65 is adjusted to zero the reactance of the stopping condenser and the fixed resistor 63 is low for the low frequencies with the result that the low frequency response of the amplifier is decreased. Conversely, increasing the resistance of the variable resistor improves the low frequency response.

It is also feasible, by adjusting the condenser 59 interposed between the low potential end of the inductor and the cathode of the first amplifier tube to values approximately one-tenth of its normal capacity, which is of the order of 10 mfd., to increase the low frequency response and, in fact, to obtain a rising characteristic at low frequencies. If such adjustment is made while the resistors 65 and 63 are held at their maximum resistance adjustments, it is possible thereafter by altering the variable resistor 65 to give the low frequency response either a rising characteristic or a falling characteristic, as desired.

By altering the value of the resistor 61 connected in shunt to the inductor in the anode circuit of the first amplifier tube the wave-front of the picture-impulses, applied to the control element of the cathode-ray tube, may be altered. The higher the value of the resistor, the steeper the wave front and the more pronounced the "bas-relief" effect. This resistor, therefore, affords means for effecting such compromise between picture detail and the "bas-relief" effect that will give the most pleasing appearance to the received picture.

The principal function of the low frequency response control is to adjust the vertical shading of the picture. If the incoming signals "drop off" as indicated in Fig. 4 of the drawings, adversely affecting the shading of the picture, this can be compensated by increasing the low frequency response of the second amplifier tube, and vice versa.

From a consideration of the foregoing, it will be obvious that I have provided novel means for controlling the detail and shading of a televised view when reproduced through the agency of a cathode-ray tube. My invention is also advantageous in that it disposes of the necessity for making theoretically perfect all of the amplifying devices included in the transmission channel between a television transmitter and a receiving tube of the cathode-ray type.

Although I have chosen certain specific frequency-response controlling devices for purposes of explanation, many obvious modifications will be apparent to engineers and others familiar with television receivers. My invention, therefore, is not to be restricted except insofar as is necessitated by the prior art and by the spirit of the appended claim.

I claim as my invention:

In a television receiver for the reception of a carrier wave modulated by picture signals, demodulating means for demodulating said carrier wave to produce said picture signals, a first amplifying device for amplifying said picture signals, said first amplifying device having an output circuit serially including in the order mentioned a resistor, an inductor and a second resistor, a second amplifying device having an output circuit and having an input circuit serially including a variable resistor and a fixed resistor, a coupling condenser interposed between a high potential point on the first resistor and a high potential point on the input circuit, means for controlling the effectiveness of the inductor, and a cathode ray tube for reproducing the view being transmitted, said cathode ray tube being connected to the output circuit of said second amplifying device.

WALDEMAR J. POCH.