March 19, 1940. R. H. GEORGE 2,194,278

TELEVISION SYSTEM

Filed Sept. 30, 1935

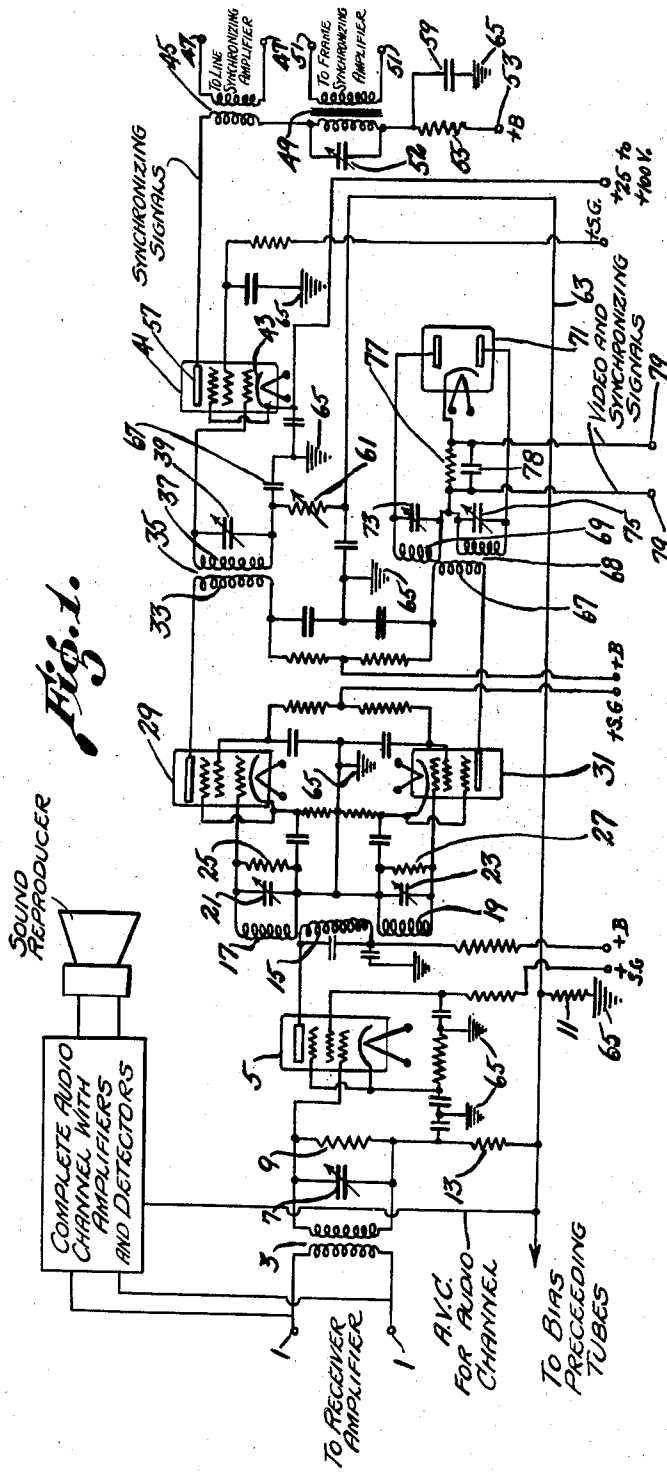


Fig. 1.

Fig. 2

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Patented Mar. 19, 1940 2,194,278

UNITED STATES PATENT OFFICE

2,194,278

TELEVISION SYSTEM

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Application September 30, 1935, Serial No. 42,822

9 Claims. (Cl. 178—7.5)

The present invention relates to television systems and is directed primarily to ways and means for controlling the background brilliance of the electro-optical representation produced at a television receiver as a result of signals transmitted from a suitable point of transmission.

As was explained in appending application of R. H. George and H. J. Heim, Serial No. 560,798 filed September 2, 1931, now Patent No. 2,100,279, granted November 23, 1937, for Television system, there is produced at a transmitter point signals representing the varying intensities of light and shadow upon the several elemental areas of a subject of which the electro-optical representation is to be produced at desired receiving points. These signals, termed the video signals since they represent the light image, are produced by scanning the subject according to any desired scanning pattern and by any appropriate means such as a scanning disk, an electronic tube, a mirror disk or the like. At the receiving points the video signals are to be reconverted into electro-optical image representations. In order that this conversion shall be in perfect synchronism with scansion at the transmitter point it is desirable to develop at the transmitter point suitable synchronizing signals serving when received at the receiving station to maintain synchronism between the receiver and the transmitter.

As was explained in the application above referred to a synchronizing signal representing the time of completing each line of scanning is caused to follow the video signals for that line, which video signals have resulted from scanning the several elemental areas of the line. Similarly, a frame synchronizing signal is caused to follow the series of video and line synchronizing signals at such a time period as when the complete series of picture lines for a single image are scanned.

Both the line and frame synchronizing signals are transmitted in like polarity and in 180° phase opposition to the video signals, or, in other words, there is polarity separation between the video and synchronizing signals. The intensity of the two types of synchronizing signals remains fixed irrespective of the character or magnitude of the video signals transmitted. In the receiver therefore, if such receiver be a cathode ray tube the synchronizing signals can serve, in addition to controlling the rate of image reproduction, as a means whereby the so-called "return line sweep" of the cathode ray is eliminated, as was also explained in the application referred to above.

It is an object of the present invention to utilize the synchronizing signals, since such signals are of fixed magnitude, to control the receiver not only as to synchronization and return-line elimination, but also in such a manner as to provide a variable bias therein or automatic volume control in order that suitable adjustments may be made in the receiver to compensate for changing average overall brilliance upon the subject at the transmitter. This compensation enables the observer of the recreated electro-optical image to sense and appreciate variances in the background brilliance of the subject located at the transmitter point.

A further object of the invention is to provide an automatic background control for a television receiver which is particularly applicable to use with the so-called D. C. type transmitter.

A further object of the invention is to provide an automatic adjustment of the amplification in a television receiver which is controllable in accordance with a received signal of constant level.

Still a further object of the invention is to provide a system for controlling television reproductions in such manner that the observer is able to sense more accurately the actual light values upon the subject of which he is viewing an electro-optical representation.

Other and ancillary objects and advantages will at once suggest themselves to those skilled in the art by reading the following specification in connection with the accompanying drawing wherein:

Figure 1 represents schematically a portion of a television receiver circuit diagram to illustrate the operation of the invention and its application in a complete receiver system; and,

Figure 2 illustrates the envelope of the rectified received signals to show the relationship between the video and synchronizing signals.

Referring now to the drawing, signals including both the video and the synchronizing portions are received from the transmitter point and suitably amplified in a radio receiver system (not shown).

The amplified signals are then impressed upon the terminal points 1, 1 and fed through a transformer 3 to the input circuit of an amplifying tube 5. The tube input circuit has its input tightly coupled by way of the transformer 3 and the tuning is broadened by means of a suitable condenser 7, preferably variable in nature. A resistor 9 is connected across the end of the band

pass filter comprising the secondary winding of the transformer 3 and the condenser 7 so as to terminate the filter chain.

The input circuit of the amplifier tube 5 is appropriately biased by means of a biasing resistor 11, to be hereinafter described in further detail, and in series with the resistor 11 and the input electrode of tube 5 is an additional filter resistor 13.

The output energy from the amplifier 5 is fed through a transformer primary 15 to a pair of transformer secondary windings 17 and 19 which are tightly coupled to the primary winding 15, as was the case with the windings of the transformer 3. Similarly, in order to broaden the tuning, condensers 21 and 23 are placed across the transformer secondary 17 and 19, respectively, so as to form band pass filters which are terminated by resistors 25 and 27. The energy transferred through the filter combinations 17, 21 and 19, 23, is supplied to the input circuits of a pair of thermionic tubes 29 and 31. This energy fed to the tubes 29 and 31 includes, like the received signal energy, both the video and synchronizing signals.

For convenience of description reference will first be made to the signals appearing in the output circuit of the tube 29. These signals although they include video signal representations are utilized for the double purpose of synchronizing the receiver system with the transmitter whereat the signal energy originated, and also for controlling the response level of the receiver to the video signals in order to produce in the receiver a more accurate electro-optical representation of the subject located at the point of transmission.

All signals appearing in the output circuit of the tube 29 are passed through the primary winding 33 of the transformer 35 whose secondary winding 37 is tightly coupled with the primary winding.

As was explained in connection with the filter combination 17, 21, for example, the response range of the filter including the transfer secondary 37 should be broadened and, therefore, the transformer secondary is shunted by a suitable variable condenser.

The signals transferred through the filter combination 37, 39 are then impressed upon the input or grid electrode of a detector tube 41. The cathode 43 of the detector tube 41 has supplied thereupon a positive bias by way of its connection at terminal point 45 to a source of positive voltage. This positive voltage source may be of a value varying between +25 and +100 volts, although under slightly changed operating conditions other biasing voltage may be used. Thus, it can be seen that with normal operating voltages supplied to the remaining electrodes of the tube 41, as shown, the tube will normally be biased well below its cut-off value.

If, now reference is made to Figure 2 of the drawing which represents the envelope of the received signals comprising the video signal components, as indicated, and the synchronizing signal components, indicated as L_1 and L_2 for the line synchronizing pulses and F_1 for the frame synchronizing impulses, it will be seen that the synchronizing impulses are always of substantially greater amplitude with reference to the abscissa video signals.

As was explained in the statement of invention and the application of this system to television systems in general, this amplitude relationship between the video and audio signals is due to the fact that the synchronizing and video signals are transmitted with "polarity separation" (that is, in 180° phase opposition) and in such manner that the synchronizing impulse is always in a direction of a black video signal but of such a value as to be blacker in effect, than the blackest video signal. Therefore, it can readily be seen that the detector tube 41 can only pass current to its output circuit during time periods when one of the synchronizing impulses such as L_1 and F_1, for example, is impressed upon the grid circuit, because the video signals are of insufficient strength or amplitude to overcome the normal tube bias below cutoff. Therefore, there can be passed through the detector tube 41 to the output circuit substantially only impulses to represent the time of completion of scansion of each individual picture line and/or frame.

These synchronizing impulses are then transferred to the high frequency transformer 45 whose secondary winding is connected at terminal points 47 so as to control the sweep frequency for each line of the produced electro-optical image representation by a cathode ray tube, as was explained in the application of R. H. George and H. J. Heim, Serial No. 560,798, previously referred to. In this way line synchronizing impulses are available at the terminal points 47 but are by-passed around the low frequency transformer 49 by means of a suitable high frequency by-pass, such as a condenser 41. The detected frame frequency synchronizing signals F_1 are, however, transferred through the audio frequency transformer 49 and are made available for synchronizing purposes at the terminal points 51, as was also explained in the said application of R. H. George and H. J. Heim.

The detector tube 41 is supplied with suitable plate voltage from a source connected at terminal point 53 which connects to a resistor 55 and the primary windings of the transformers 49 and 45 to reach the detector tube plate electrode 57. In order to by-pass any high frequency which may appear in the output circuit of the detector tube 41 from the plate supply source it is desirable to connect a condenser 59 in parallel with resistor 55, so that one terminal connects with resistor 55 at the terminal remote from the potential source and the other terminal connects to ground at 65.

From the foregoing description it can be seen that when the detector tube 41 passes current at time periods when the synchronizing impulses L_1 and L_2, F_1, for example, are received grid current flows in the detector tube 41, in which case a voltage drop takes place through resistor 61 and the bias controlling resistor 11 connected in series therewith by way of a conductor 63 so that the path of grid current flow is through the secondary winding 37 of transformer 35, the resistor 61, the conductor 63 and the resistor 11 to ground at 65, and thence back to the cathode 43 of the detector tube 41.

At the same time that grid current flows through the tube 41 the condenser 67, which should be of reasonably large size, acquires a charge in accordance with the rate of grid current flow.

Any flow of grid current through the tube 41 produces across the resistor 11 a voltage drop which, since the tube 41 is biased as above described, varies in accordance with the strength or amplitude of the synchronizing signals impressed upon the grid circuit thereof. Since the

synchronizing impulses should normally all be of the same amplitude it can be seen that by suitably adjusting the size of the resistor 11 any changing drops produced through the resistor 11 with variances in the amplitude of the synchronizing signals actually impressed upon the current of the tube 41 can be used to regulate or control the amplification factor of the various amplifier tubes in the entire system. For convenience of illustration this variable bias control for the system is shown as being effective only upon the amplifier tube 5, but it is to be understood that the same voltage drop taking place through resistor 11 during time periods when the detector tube 41 draws grid current may be utilized to control or bias any amplifying tubes in the system which are connected ahead of the tube 5, such for example as those tubes included in the radio frequency receiver amplifier portion of the receiver.

It was above suggested that the size of the condenser 67 should be of reasonably substantial size and this is due to the fact, as will be evident from what has been previously stated, that the frame and line synchronizing impulses are of different duration, that is, the line synchronizing impulse is substantially shorter than the frame synchronizing impulse, and in order that the received picture shall not "jump" when the frame synchronizing impulse is received, the provision of a large size condenser 67 serves to smooth out the operation and provide for a higher degree of regulation throughout the entire system.

It can be seen that when the tube 5, for example, has applied thereto a variable bias by way of the resistor 11 its output energy will vary in strength in accordance with the bias and consequently the amplitude of the signals passed on to the tubes 29 and 31 will be controlled in accordance with the synchronizing signal received. Therefore, it is in accordance with the received synchronizing signals that the so called background effect in the reproduced electro-optical image may be controlled and thereby the observer may be able to sense more accurately the actual all-over illumination of the subject at the transmitting point than he would be able to sense in the absence of any regulation, as herein explained.

In order to modulate the energy reproducing devices, such for example, as the cathode ray tube shown in the above mentioned application of R. H. George and H. J. Heim, the signals appearing in the output of the tube 31 which comprise both video and synchronizing components are transferred by way of the primary winding 67 of transformer 68 to the secondary windings 69 so as to be impressed upon the double diode tube 71 which gives full wave rectification of these signals.

The tuning of the input circuit of the double diode tube 71 is also broadened by suitable condensers 73, 75 shunting the transformer secondaries 69, 68. The rectified output energy from the double diode tube 71 is supplied across the resistor 77 to the terminal points 79. These terminal points 79 are intended to connect directly with the grid circuit of any suitable cathode ray tube and thus serve to apply to the cathode ray tube grid circuit rectified video signal modulation to control the intensity of the luminescent effect observed upon the end wall screen of the cathode ray tube.

In any system of television the reproduction of the image can be resolved into two components of which one is the average brightness (that is the background level) and the other of which is the contrast range. With the direct current type of transmission as herein particularly referred to and described, the rapid changes in the signal level (illustrated, for example, by the legend Video signals on Fig. 2) become effective at the terminal points 79 to produce the effects of contrast in the reproduced electro-optical image. By means of the characteristics of the circuit including the resistor 11 and its associated capacitor 67 which are associated with the grid structure of the tube 41, the average value of brightness or background of each picture may be determined in accordance with the synchronizing signal which is normally of fixed amplitude and the grid current flowing through the tube 41 will be effective, as measured by the charge on the condenser 67, to cause a voltage drop across a resistor element 11 to vary the amplifier gain and thus control the average brightness or the background level of the reproduced image.

Since it is apparent from the showing of Figure 2 that light or bright points of the picture are modulated down and dark portions of the picture are modulated up, it can be seen that the rectified synchronizing signals applied from the terminal points 79 will serve during the return line sweep of the electron ray in the cathode ray tube to cut off such ray completely. Thus, there is produced, as was also explained in the application of R. H. George and H. J. Heim, an image reproducing system wherein unilateral scanning of the screen structure of the receiver tube to all intents and purposes takes place.

While it has not been illustrated specifically in this specification, it is to be understood that the foregoing invention finds application also for controlling the amplification level of audio signals received concurrently with the video and synchronizing signals. It is customary practice to transmit video and synchronizing signals upon one carrier frequency and then to transmit the audio signals accompanying the video signals upon a carrier frequency separated from the video signals by any desired but constant amount. Such separation of the two carrier frequencies, for example, may be, where desired, of the order of 20 to 50 kilocycles beyond the maximum side band frequencies of the video carrier frequency. Since a system of the type to which reference has been made in this specification is one wherein the synchronizing signals are all intended to be transmitted at the same amplitude level, the synchronizing signal itself furnishes an excellent reference point from which it is possible to control the amplification level for all other signals appearing in the system. If now, for example, the transmission of the video signals has been monitored at the transmission point to compensate for variances in background brilliances of the subject of which the electro-optical image is to be produced at the receiving point it can be seen that the synchronizing signals should always be received as a signal of constant amplitude. Variances in the actual amplitude of the synchronizing signal, therefore, may very frequently be attributed to a fading phenomena. Thus, when the signal strength of the synchronizing impulses varies the amplitude of the related video and audio signals also usually varies. Therefore, the synchronizing impulses may be utilized in the manner above described not only as means to control the amplification level of the

receiver system for amplifying the video and the synchronizing signals, but also may serve to control simultaneously the amplification of the audio frequency signals.

It is to be understood further that when the control of the system is modified in accordance with this suggestion, the audio frequency signals are intended to be separated from the video and synchronizing signals prior to the time when the video and synchronizing signals are impressed upon the terminal points 1, 1. When so separated the audio signals may be further amplified and detected by well known means and then utilized to actuate any suitable form of sound reproducing device.

For simplicity sake all of the voltage supply sources for the various tubes of the system have not been described in detail although the drawing schematically illustrates the means of supplying the various necessary voltages throughout the system. Designations "S. G." represent the voltage supply source for energizing the screen grids of the various tubes shown. Designations "+B" indicate the voltage source for supplying plate voltages to various tubes of the system. Other portions of the system, such as the means to block D. C. from various parts of the circuit are also shown without designations, since the operation will at once be clear to those skilled in the art and while the heater element circuit is shown as incomplete it is to be understood that the various tubes illustrated may be heated from any suitable A. C. supply system or directly heated where desired.

Many and various modifications may be made to the system herein shown without departing from the spirit and scope of the present invention. It is, therefore, believed that any and all of such modifications may be made insofar as they fall fairly within the spirit and scope of the hereinafter appended claims.

I claim:

1. A receiver system comprising means for receiving video and synchronizing signals; an amplifier for amplifying both of the received signals; a first detector connected with the output of the receiver amplifier for detecting the received signals; means for biasing said detector below its cut-off point and to a value greater than the maximum amplitude of any received video signal and less than the amplitude of any received synchronizing signal, whereby signal current flows through said detector only during time periods of receipt of synchronizing impulses; a load circuit for utilizing the detected synchronizing signals; means for variably biasing the amplifier means in accordance with variances in signal current flowing into said first detector for varying the amplification level of the video and synchronizing signals and the background level of the video signals when converted into electro-optical images; and a second detector system connected with the output of said receiver amplifier for detecting all of said video and synchronizing signals, and a load circuit connected with the output of the second detector system for controlling the video signal reproduction.

2. In a television receiver wherein is provided a detecting system, an amplifier and a synchronizing circuit, the method of receiving signals and controlling the amplification level thereof which includes the steps of receiving and amplifying each of a plurality of signals including video signals of which one of the signals is transmitted at an amplitude substantially greater than the maximum amplitude of the other signal, detecting the amplified signal, biasing the detecting system to a value below its cut-off point and to a value greater than the maximum amplitude of the said other of the received signals, and controlling the synchronous operation of the synchronizing circuit and the amplification level of the amplifier for all received signals and the background reproduction level of the video signal in accordance with variances in amplitude of only the detected portion of the said one signal.

3. A television system comprising means for receiving both video and synchronizing signals, means for amplifying both of said signals, means for detecting both of said signals, independent means for detecting only synchronizing signals, synchronizing means, means for energizing the synchronizing means from the said independent detecting means, and means to control the amplification level of both of said signals and the background reproduction level of the video signals through said amplifying means in accordance with variances from average in the amplitude of only the independently detected synchronizing signal portion of said received signals.

4. A receiving system comprising means for receiving and amplifying video signals normally of varying amplitude and synchronizing signals normally of constant amplitude, means for amplifying both of said signals, means for detecting both of said signals, and a load circuit connected to receive both of said detected signals, independent means to detect the synchronizing signals only, a load circuit for utilizing the detected synchronizing signals to establish synchronous operation, and means for varying the amplification level of both of said signals and the background level of the video signals through said amplifying means in accordance with the amplitude of the detected received synchronizing signals only.

5. A signal receiving system for receiving video and synchronizing signals of which the synchronizing signal is normally of constant amplitude comprising means for receiving and amplifying all of the received signals, a detector means for detecting all of the received signals, an independent detector means for detecting only the received synchronizing signals, independent load circuits connected to each of said detector means, one of said load circuits including means to reproduce the video signals and the other of said load circuits including means to synchronize the video signal reproduction, and means operated under the control of the synchronizing signal detector means to control the amplification level of all of the signals and the background reproduction level of the video signals in accordance with the departure from normal level of the received synchronizing signals.

6. A television system comprising means for receiving both video and synchronizing signals, means for amplifying both of said signals, means for detecting both of said signals, independent means for detecting the synchronizing signals only, independent load circuits connected with each detector means, one of said load circuits including means to reproduce the video signals and the other of said load circuits including means to synchronize the video signal reproduction, and impedance means energized from the synchronizing signal detector to control the amplification level of both of said signals and the

background reproduction level of the video signals through said amplifying means in accordance with the amplitude of only the synchronizing signal portion of said received signals.

7. A television system comprising means for receiving both video and synchronizing signals, means for amplifying both of said signals, means for detecting both of said signals, independent means for detecting the synchronizing signals only, independent load circuits connected with each detector means, one of said load circuits including means to reproduce the video signals and the other of said load circuits including means to synchronize the video signal reproduction, and resistor and capacitor means energized from the synchronizing signal detector to control the amplification level of both of said signals and the background reproduction level of the video signals through said amplifying means in accordance with the amplitude of only the synchronizing signal portion of said received signals.

8. A television system comprising means for receiving both video and synchronizing signals, means for detecting both of said signals, independent means having an input circuit for receiving both of the signals, means for biasing the input circuit of the independent detector means so that only the synchronizing signals are detected to the exclusion of the video signals, an independent load circuit connected to the output of each detector means and impedance means energized from the input of the means for detecting the synchronizing signals only to control the reproduction level of both of said signals and the background reproduction level of the video signals in accordance with the amplitude of only the synchronizing signal portion of the received signals.

9. The method of controlling the amplification and background reproduction levels in television receiving systems for receiving energy transmitted from a direct current type transmitter which comprises receiving and amplifying a plurality of separate signals of which one is characteristic of the video signal and the other of which is indicative of synchronous operation and wherein each signal is of a generally different frequency range, detecting each of the received signals, independently detecting only the synchronizing signals, establishing synchronous video reproduction under the control of the independently detected synchronizing signals, and controlling the level of amplification for all the signals and the background reproduction of the video signals in accordance with variances in amplitude from a predetermined level of only the synchronizing signal portion of the detected signals.

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