

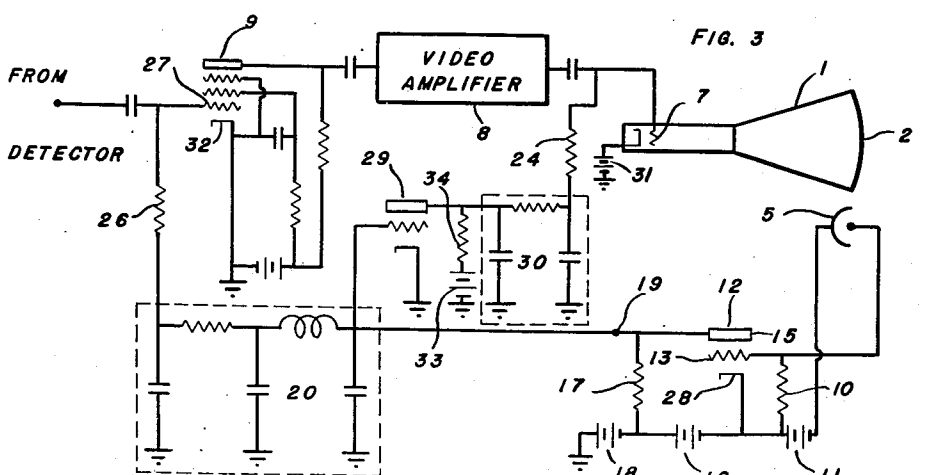
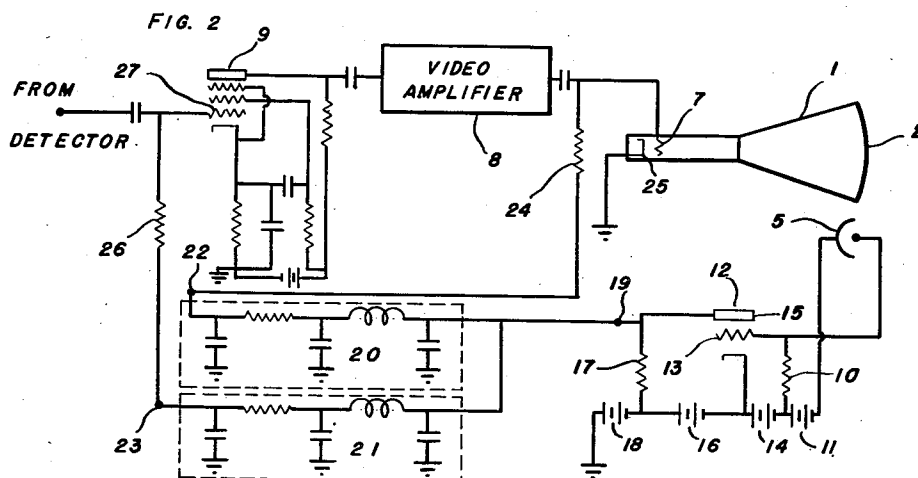
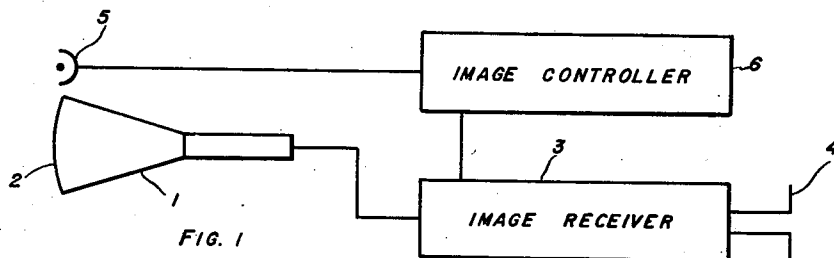
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TELEVISION RECEIVER

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TELEVISION RECEIVER

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My invention relates to television receivers, and particularly to a receiver which is capable of giving relatively uniform performance under varying conditions of extraneous light.

In the art of television reproduction, it is frequently necessary to operate an image receiver in a location where the amount of extraneous light falling upon the image screen of the receiver varies from time to time. It has often been found desirable when the amount of such extraneous light does change, to readjust certain operating parameters of the receiver to maintain the best possible quality of image reproduction. Generally speaking, the two parameters which require adjustment most frequently are the mean brightness of the image screen and the maximum deviation from this mean brightness, or the contrast of the image.

It will be recognized that the amount of extraneous light in the room occupied by the receiver and falling upon the surface of the reproducer on which the image is produced has a definite bearing upon the contrast values in the reproducing image. Thus, an image produced with an absolute contrast ratio of 1 to 100 may have a contrast ratio of 11 to 110 when 10 units of extraneous light fall upon the image screen.

In view of this fact that the best adjustments of, for example, the mean brightness and contrast of the image are functions of the amount of extraneous light falling on the image screen, it is an object of my invention to provide automatic means for controlling the operating characteristics of a receiver in accordance with the amount of extraneous light present at any time.

In accordance with my invention, I have provided an image reproducer adapted to reproduce television images with various controllable operating characteristics, light sensitive means proportionally responsive to the amount of light falling upon the image screen of the reproducer, and automatic control means for varying at least one of said controllable operating characteristics in accordance with the amount of light received by the light sensitive means.

In one embodiment of my invention, I have provided on the face of the image receiver and located at a point where it receives illumination proportional to the illumination received by the image screen from room illumination, a photoelectrically sensitive device whose output is appropriately amplified to produce, or may yield directly, control signals which will modify the background level of light produced by a cathode ray tube or other image reproducing device in

an inverse relation to the extraneous light received by the screen, with the result that a substantially constant average background level of illumination may be maintained upon the image screen. Thus, I have introduced a measure of uniformity of image aspect which has not previously been possible.

In another embodiment, I have found that advantageous results are obtained when my apparatus is extended to control not only the background level of the image reproducer, but also the intensity of the image signal applied to the image reproducer. Thus, my photoelectric extraneous light detector may be used advantageously to control the background level as a function of extraneous light or the image level as a function of extraneous light, or both.

It will be seen that my principle of image control in accordance with extraneous light may thus be applied to control automatically any desired image receiver operating characteristic.

In order to describe my invention more fully, attention is directed to the accompanying drawing in which Figure 1 represents a block diagram of a television receiver employing my invention; Figure 2 is a schematic diagram of a typical control circuit adapted for use in my invention, and Figure 3 is a modified control circuit of my invention.

Referring to Figure 1, an image reproducer 1 is provided, which may be of any desired type but is here indicated as being a cathode ray tube, on whose image screen 2, an image may be reproduced in accordance with the signals provided by the image receiver 3 under the influence of radiation intercepted by the antenna 4.

A light sensitive device 5 is provided at a point at which it may receive light proportional to the extraneous light falling upon the image screen 2, and a signal is generated which is proportional to that extraneous light. The signal so produced is carried to an image controller 6 which generates appropriate control signals in proportion to the amount of light received by the light sensitive device 5. These signals are in turn carried to the image receiver 3 where they are utilized to control any desired operating characteristic of the image receiver 3 or the image reproducer 1.

For example, it may be desirable in certain instances to control the average brightness of the image reproduced on the image screen 2; these control signals may be employed for that purpose. It may at the same time, or in other in-

stances, be desirable to control the contrast of the image reproduced on the image reproducer 1; this may also be accomplished by the proper introduction of the control signals into the image receiver 3.

In order to describe my invention more fully, certain specific embodiments have been shown in Figures 2 and 3, but it will be understood that these circuits are shown merely as being typical applications of my invention, and they do not imply any limitation upon the application of my principle of extraneous light control of image reproduction.

Figure 3 is a circuit of apparatus adapted to increase both the average brightness and contrast of the image when the amount of extraneous light falling upon the image screen 2 is increased. An image reproducer 1 having an image screen 2 is provided with a control element 7 adapted to impress the required image intensity variations upon the image screen 2. For the sake of simplicity, deflecting circuits have been omitted, but it will be understood that such circuits of any of the types known in the art may be used in connection with the image reproducer which has been shown as having a cathode ray tube. Mechanical image reproducers may, of course, be used in which event the control element 7 would be the appropriate control device such as a grid in a gaseous discharge tube, a Kerr cell, or any desired type of control.

The control element 7 is energized by the output of the main video amplifier 8. The amplifier 8 in turn receives signals from the controlled video amplifier 9 which is energized by signals from the detector of the image receiver 3 (not shown in its entirety in Figure 2). It will be understood that the amplifiers 8 and 9 will generally be elements of the image receiver 3 shown in Figure 1.

A light sensitive device 5, which may for example be a caesium photoelectric cell, is provided at a point either directly adjacent the image screen 2 or at some other point where it may receive extraneous light in an amount proportional to the amount impinging the image screen 2. The output voltage which appears across the photocell resistor 10 caused by current from the photocell battery 11 under the control of the light sensitive device 5 is impressed upon the grid 13 of the control tube 12 which may be a triode amplifier, as shown, or any other amplifying device. The bias battery 14 may be provided if desired to maintain a predetermined reference voltage upon the grid 13. The plate 15 of the control tube 12 is energized by the battery 16 through the load resistor 17 to produce therein a current varying in inverse proportion to the current in the photocell resistor 10. Thus, a voltage is available across the resistor 17 which is inversely proportional to the amount of light falling upon the light sensitive device 5.

When desired, an image bias battery 18 may be provided which, in the embodiment shown, is connected between ground and the resistor 17. Because the current in the plate resistor 17 decreases as the voltage on the grid 13 becomes more negative, a voltage with respect to ground will exist on the terminal 19 having a constant negative potential with respect to ground increased by the potential across the resistor 17, under the influence of the control circuit. The voltage with respect to ground on the terminal 19, may, if desired, be filtered by the filters 20 and 21

to provide filtered control voltages to the control terminals 22 and 23. The terminal 22 is used in the present instance to apply a bias voltage through the grid resistor 24 to the control element 7 of the image reproducer 1. As the voltage on the terminal 22 increases in a negative direction with respect to the cathode 25, which is grounded, the average brightness of the image reproduced on the image screen 2 will be reduced.

The second control terminal 23 has a varying negative potential with respect to ground similar to that of the terminal 22, and when the potential of the former is impressed through the grid resistor 26 upon the grid 27 of the controlled video amplifier 9, the amplification of the latter is reduced by virtue of the fact that the controlled amplifier 9 is chosen of a type having an amplification which decreases as the negative bias upon its control element is increased. The amplifier 9 is located at a point in the receiver where the signal level is sufficiently low that no appreciable distortion occurs because of the non-linear control characteristic. It will be evident that the amplifier 9 may be of the type in which amplification is controlled without materially affecting the wide-range linearity by applying the amplification-controlling voltage to more than one grid element in the tube, or otherwise. Such amplifiers are known in the art and will not be described here. When the voltage on the terminal 23 is applied to the amplifier 9 in such a way as to reduce the amplification as the control voltage increases negatively, the signal impressed upon the control element 7 will be increased in direct proportion to the amount of light falling upon the light sensitive device 5.

Thus, the embodiment of Figure 2 will be seen to be so arranged and constructed that both the average brightness and the contrast of the image reproduced on the image screen 2 will be controlled in accordance with the amount of light falling upon the light sensitive device 5.

It may be seen that either of these characteristics may be controlled without the other by omitting either of the filters 20 or 21 and the associated load circuits as required. For example, it may sometimes be desirable to omit my automatic control of the background level when the direct current component of a transmitted signal is re-inserted at the receiver in a manner well known in the art. In this instance, my automatic control would be applied only to the gain of the controlled video amplifier 9, and an automatically controlled D. C. background component could be inserted from the control video signal. Frequently, however, independent control of the contrast and background will be desirable even when direct current component re-insertion is employed, and any desired combination of my invention and D. C. re-insertion apparatus may be employed.

Moreover, the polarity of the controlled voltages may readily be changed by simple circuit modifications which will be evident to those skilled in the art, if for any reason it is desirable to have control characteristics which are the inverse of either or both of those produced by the embodiment of Figure 2.

In Figure 3, I have shown one such modification by which the contrast of the image on the screen 2 is controlled exactly as in Figure 2, but the inverse characteristic is applied to the average brightness. To accomplish this, the image reproducer 1, the video amplifier 8 and the controlled video amplifier 9 are associated exactly as they were in the embodiment of Figure 2. A

light sensitive device 5 and its circuit including the resistor 10 and the battery 11 are similarly provided to control the voltage on the grid 13 of the control tube 12. The output current of the tube 12 supplied by the battery 16 flows through the load resistor 17 to impress a voltage on the terminal 19 which is equal to the voltage of the battery 18 plus the voltage drop caused by the current of the tube 12 flowing in the resistor 17, and the polarity of the terminal 19 with respect to ground will be negative. The filter 20 is provided for smoothing the voltage on the terminal 19 and the smoothed potential is impressed through the grid resistor 26 upon the control element 27. Thus, the voltage between the cathode 32 and the grid 27 of the amplifier 9 will be that of the battery 18 plus the voltage drop in the plate resistor 17 of the control tube 12 and as the voltage at the terminal 19 becomes more negative, the grid 27 of the amplifier 9 also becomes more negative to decrease the gain of the amplifier. In this way, the contrast of the image screen 2 is decreased, and the contrast of the image is controlled just as it was by the embodiment in Figure 2.

The voltage upon the terminal 19 is further amplified, or at least repeated, by the second control tube 29 and the output voltage of the control tube 29 may be further filtered by the filter 30 whereupon it is impressed upon the control element 7 through the grid resistor 24. In this embodiment, a bias battery 31 is connected between the control element 7 of the image reproducer 1 and ground, so that the voltage on the control element 7 will be that of the battery 31 plus that of the plate battery 33 plus the voltage drop in the plate resistor 34 of the tube 29, all added algebraically. As the terminal 19 becomes more negative, less current will flow through the plate resistor 34 of the tube 29. This will cause the voltage drop across the resistor 34 to decrease and the control element 7 will become less negative. Thus, the variation of the voltage of the grid 7 is inverse to that of the terminal 19, so that the background level of the image screen 2 will decrease in inverse proportion to the light falling upon the device 5.

It will be understood that vacuum tube amplifiers or repeaters are not essential to my invention when a light responsive means of sufficient sensitivity is used; thus, the voltages appearing directly across the photocell resistor 10 may be applied directly with the proper polarity to accomplish the required control function or functions. It will be further understood that by extraneous light in the foregoing specification and in the claims, I mean light which falls upon an image reproducing screen from a source extraneous to and uncoordinated with the image reproducing system.

It may be seen that my new image control principle may be applied in any television receiver to control any image characteristic in any desired sense as a function of extraneous light intensity and although only two specific circuits have been shown, my invention, in its broadest aspect, contemplates the principle of extraneous light responsive image control as exemplified in Figure 1.

I claim as my invention:

1. A television receiver comprising means for receiving television signals, an image reproducer for reproducing images corresponding to said signals, means for controlling an operating characteristic of said receiver to modify the signals

produced thereby, a light sensitive device positioned and constructed to detect illumination impinging on the receiver from a source exterior thereto and arranged to generate control signals substantially independent of said television signals but corresponding to the level of said exterior illumination, and control means responsive to said control signals for modifying said operating characteristic of said image reproducer in accordance with changes in the intensity of said exterior illumination to modify said television signals in accordance therewith.

2. A television receiver adapted for use in a room where the general room illumination varies comprising means for receiving television signals, an image screen associated therewith, means for energizing said screen to reproduce an image thereon, said energizing means being so arranged and constructed as to permit the modification of an aspect of said reproduced image, light sensitive means associated with said receiver and disposed to receive light at a level corresponding to the general illumination falling upon said image screen for producing signals corresponding to said general illumination level, and means for causing said signals to modify said reproduced image aspect independently of said received television signals.

3. A television image receiver for use in a location of varying illumination comprising means for receiving television signals, an image reproducer adapted to reproduce images corresponding to said signals, adjustable means for controlling the background level of said reproduced images, a light sensitive device positioned and constructed to detect illumination impinging on said reproducer from a source exterior thereto to the substantial exclusion of light produced by said image reproducer and arranged to generate control signals corresponding to the level of said exterior illumination, and means for adjusting said adjustable means in response to said control signals for modifying said background level.

4. A television image receiver adapted for use in a room where the general room illumination varies comprising an image reproducer adapted to reproduce television images, adjustable means for controlling the contrast with which said images are reproduced, light sensitive means responsive to the general room illumination level and arranged to generate control signals varying in accordance with said illumination level, and means for adjusting said adjustable means in response to said control signals for modifying said contrast.

5. A television image receiver for use in a location of varying illumination comprising an image reproducer adapted to reproduce television images, adjustable means for controlling the background level and the contrast of said reproduced images, a light sensitive device positioned and constructed to detect illumination impinging on said reproducer from a source exterior thereto to the substantial exclusion of light produced by said image reproducer and arranged to generate control signals corresponding to the level of said exterior illumination, and means for adjusting said adjustable means in response to said control signals for modifying the background level and contrast of said reproduced image.

6. A television image receiver for use in a location of varying illumination comprising an image reproducer adapted to reproduce television images, a first adjustable means responsive to con-

control signals for controlling the background level of said reproduced images, second adjustable means responsive to control signals for controlling the contrast of said reproduced images, a light sensitive device positioned and constructed to detect illumination impinging on said reproducer from a source exterior thereto and arranged to generate control signals corresponding to the level of said exterior illumination, means for impressing said control signals upon said first adjustable means for modifying said background level, and means for impressing said control signals upon said second adjustable means for modifying said contrast.

7. A television image receiver for use in a room where the general room illumination varies comprising an image reproducer adapted to reproduce television images, a first adjustable means responsive to control signals for controlling the background level of said reproduced images, second adjustable means responsive to control signals for controlling the contrast of said reproduced images, a light sensitive device responsive to the room illumination level and arranged to generate control signals corresponding to the level of said room illumination, means for impressing said control signals upon one of said adjustable means, means for reversing the polarity of said control signals to produce second control signals, and means for impressing said second control signals upon the other of said adjustable means, whereby said background level and contrast are controlled in opposite senses.

8. A television image receiver adapted for use in a room where the general room illumination varies comprising a cathode ray tube having an image screen, means for receiving television signals, an amplifier for amplifying said signals, adjustable means for controlling the amplification of said amplifier, light sensitive means responsive to the room illumination level and arranged to generate control signals varying in accordance with said illumination level, and means for adjusting said adjustable means in response to said control signals for modifying the amplification of said amplifier.

9. A television image reproducer adapted for use in a room where the general room illumination varies comprising a cathode ray tube, a beam intensity control element therein, light sensitive means responsive to the general room illumination level and arranged to generate a potential varying in accordance with said illumination level, and means for impressing said generated potential upon said control element to supply biasing voltage therefor in accordance with said room illumination level.

10. Image producing apparatus adapted to compensate for varying general illumination in the location in which the apparatus is operated comprising an image screen, means for energizing said screen to reproduce an image thereon,

said energizing means being so arranged and constructed as to permit the modification of an aspect of said reproduced image, light sensitive means disposed to receive light at a level corresponding to the general illumination level and arranged to generate control signals varying in accordance with said illumination level, and means for causing said signals to modify said reproduced image aspect.

11. Visual signal producing apparatus for use in a room where the general room illumination varies comprising a cathode ray tube having a light producing screen, adjustable means for energizing said screen to reproduce visual signals thereon, said energizing means being so arranged and constructed as to permit the modification of an aspect of said reproduced visual signals, light sensitive means responsive to the room illumination level and arranged to generate control signals varying in accordance with said illumination level, and means for adjusting said adjustable means in response to said control signals for modifying said aspect of said reproduced visual signals.

12. The method of reproducing television images in accordance with received signals in a location of varying general illumination which comprises generating electrical control signals responsive to the varying general illumination, producing television images under the control of received television signals, and combining the actions of said generated control signals and said received television signals to produce television images of substantially uniform apparent contrast independently of the intensity of the varying general illumination.

13. The method of reproducing television images in accordance with received signals in a location of varying general illumination which comprises producing television images under the control of received television signals, measuring the intensity of extraneous light being added to said television images independently of the light of said images themselves, and continuously adjusting the characteristics of said television signals to make allowance for said extraneous light whereby images are produced having uniform contrast independently of the intensity of said varying extraneous light.

14. A television receiver comprising, a signal-reproducing unit for developing in response to a received signal a visual image which is subjected also to extraneous light detrimental to said image, a photosensitive device disposed to receive light excitation varying substantially in accordance with said extraneous light for developing a control effect, and means responsive to said control effect to control an illumination characteristic of said signal-reproducing unit to maintain a substantially optimum visual image with respect to said extraneous light.

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