

Feb. 3, 1942.

S. W. SEELEY

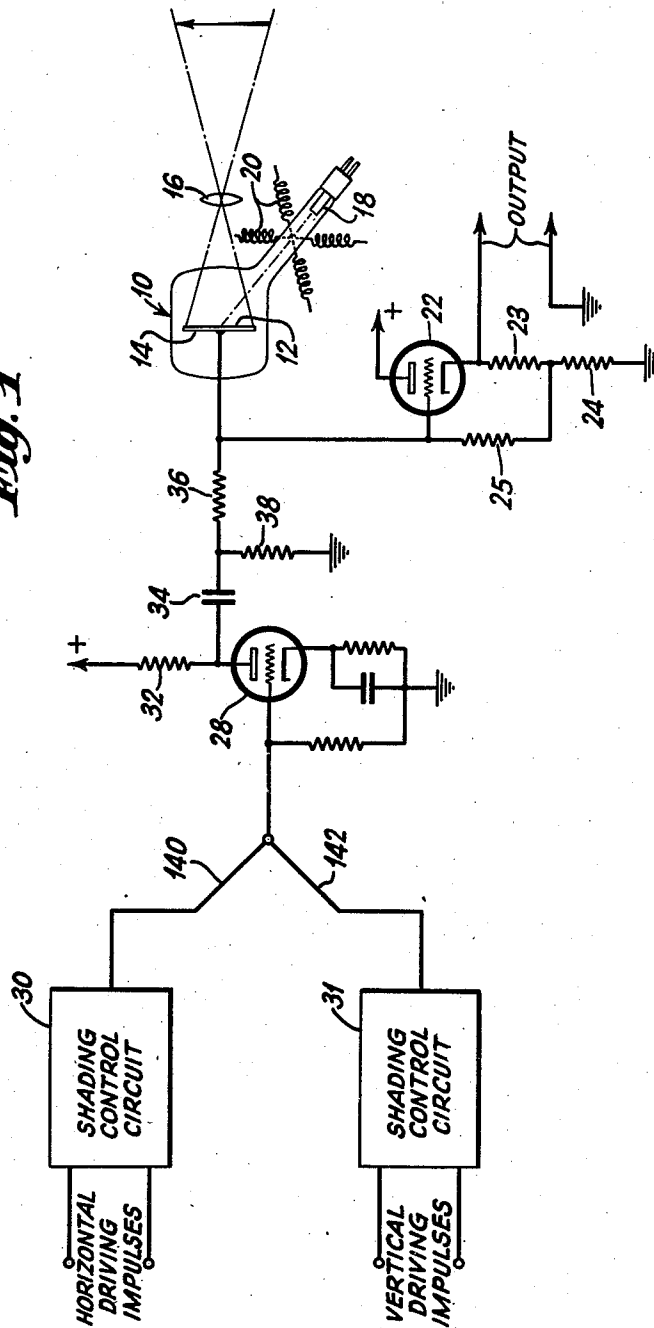
2,271,876

TELEVISION SHADING CONTROL CIRCUIT

Filed June 27, 1939

2 Sheets-Sheet 1

Fig. 1



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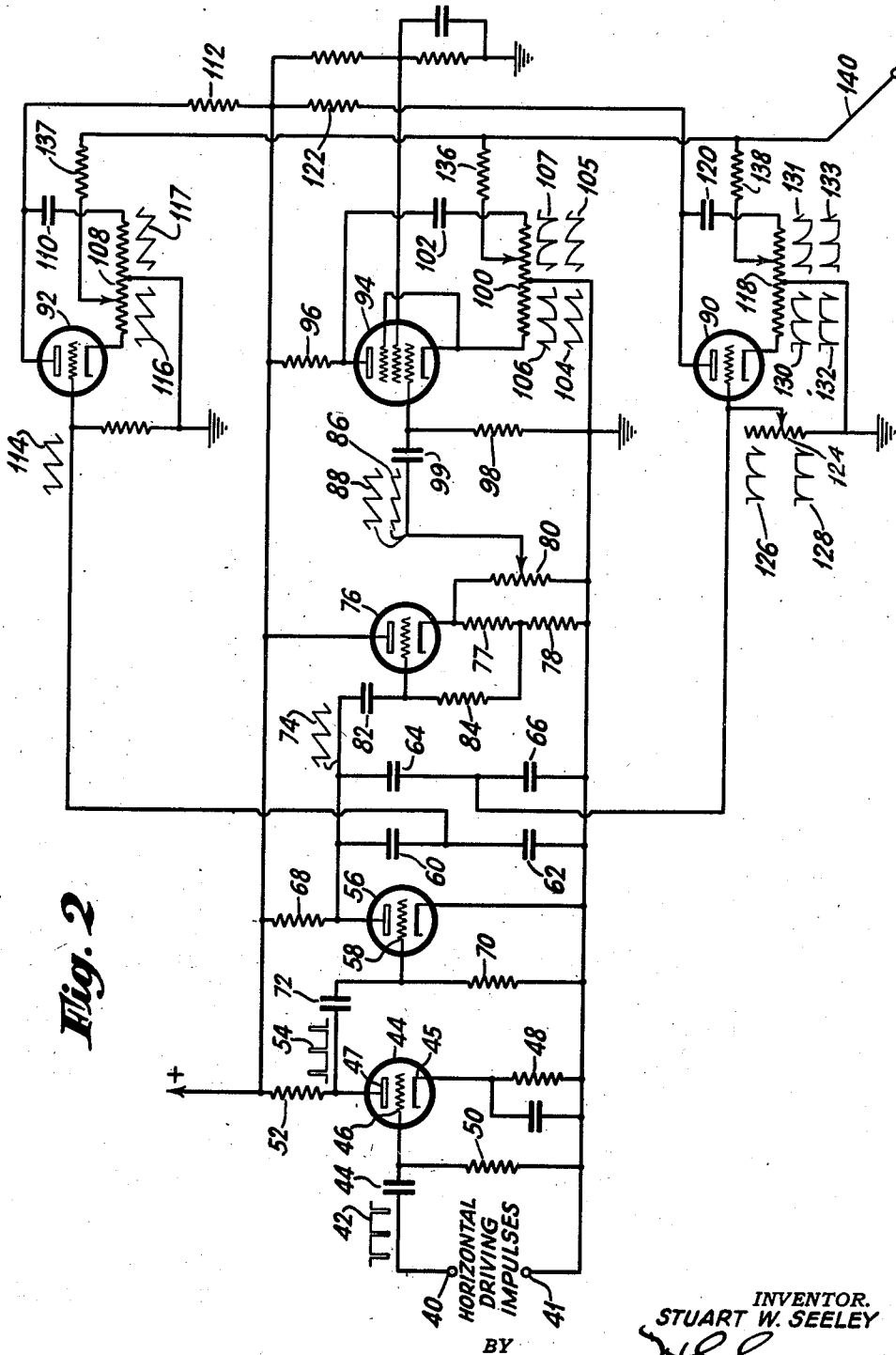
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2 Sheets-Sheet 2



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2,271,876

TELEVISION SHADING CONTROL CIRCUIT

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Application June 27, 1939, Serial No. 281,359

20 Claims. (Cl. 178-7.1)

This invention relates to shading control for television transmitting systems and more particularly to circuits whereby the background intensity or average light values of various selectable portions of the television image may be controlled in order to compensate for inherent operating characteristics of the system.

In present-day electronic television transmitting stations a television transmitting tube is used in which a light responsive electrode is provided upon which a charge image is produced in accordance with the light values of an optical image projected thereon. The light responsive or mosaic electrode is then scanned in a systematic order by a cathode ray beam which is deflected in bilateral directions in order that electric signals or potential variations may be produced which are representative of the charge values which are present on the mosaic electrode. The operation of such a transmitting tube, particularly the scanning of the mosaic and the resulting production of picture signals, depends to a considerable extent upon secondary electron emission at the mosaic electrode and the average value of the signals produced by the transmitting tube are to a certain extent controlled by the secondary electron emissive characteristics of the mosaic electrode. In the production of television picture signals due to the scanning of the mosaic electrode, a certain relatively high frequency signal series is produced which is indicative of the light values (or detail) of the optical image projected on the mosaic, but due to various reasons, the average value of the high frequency signal series may shift or change considerably during the scanning of the complete mosaic area or in fact during the scanning of each line of the area, that is, during each deflection of the cathode ray beam in a particular direction. Such changes in the average value of the signal series may actually exceed the amplitude of the signal frequency voltage variation thereof. Such variation in the average value of the picture signal series as derived from the signal plate of the television transmitting tube are represented in the received picture by an improper and undesirable background level of the picture in localized areas or portions of the entire picture image, often together with a loss of detail in such areas. This effect is known as "dark spot." One portion of the picture may appear white light and in fact so light as to be devoid of substantially all detail whereas another portion of the picture may under extreme conditions appear almost black. This change in

the average value of the picture signals as produced by the television transmitting tube may be caused by several different factors, one of which is the lack of uniformity of the secondary electron emissive effect throughout the entire light responsive electrode surface. Another cause of dark spot is the possible unequal distribution of the produced secondary electrons over the scanned side of the light responsive electrode or mosaic. Various other cause and effects may also contribute to the existence of dark spot in the presently used television transmitting system.

The dark spot voltage variation, as stated above, may be the result of several different effects, but it has been noticed that the dark spot voltage variation or wave form remains relatively constant for any particular television transmitting tube and is not altered in an excessive amount when different light images are projected on the mosaic. There is, however, a slight variation in the dark spot of a particular television transmitting tube when different light images are projected on the mosaic, but the percentage change in the dark spot voltage variation is relatively small and is of such a value as would ordinarily be noticed only when considerable change is present in the average value of the light projected on the light responsive electrode.

In order to compensate for dark spot various systems have been devised by means of which there is inserted in the picture signal series a compensating voltage of relatively low frequency as compared with the frequency of the picture signals, the wave shape of the dark spot correcting voltage being controllable both as to amplitude and shape. Such previously used dark spot correction circuits have heretofore normally employed signals of sine wave formation, or harmonics of a sine wave, as well as other related wave forms, the amplitudes and the frequencies of which have been controlled in accordance with the wave form of the particular dark spot signal variation which is to be compensated. Such systems of the prior art are rather complicated and often do not readily lend themselves to rapid manual manipulation and control. This control is desirable in order that proper and complete dark spot elimination may be exercised for all possible lighting conditions and for all light images which might be projected on the television transmitting tube. Furthermore, in previously used dark spot correction circuits different means must be employed

for producing either a positive or negative correction in the dark spot with the result that the system became somewhat complicated and the controls were somewhat numerous to provide adequate high fidelity.

The present invention, therefore, has for its purpose the provision of a dark spot correcting or shading circuit which is simple in operation and which involves a minimum of electrical apparatus and controls.

Another purpose of the present invention resides in the provision of a dark spot correction or shading control circuit in which voltage variations of saw tooth wave form are used and in which various components of such a voltage may be derived from the circuit.

Still another purpose of the present invention resides in the provision of a dark spot correction or shading control circuit in which the initial or leading portion of the picture of each line thereof as scanned, the central portion and the final or lagging portion of the picture, may be shaded in any desired manner.

Still another purpose of the present invention resides in the provision of a shading control circuit in which the shading of the image may be controlled both in a horizontal and in a vertical direction selectively and independently.

A still further purpose of the present invention resides in the provision of a dark spot correction or shading control circuit in which the wave form of the shading impulses as applied to the television system may be applied either in a positive or negative manner to increase or decrease the average value of the picture signals existing at the particular instant.

Still another purpose of the present invention resides in the provision of a dark spot correction or shading control circuit in which the system and means used for correction in a horizontal direction are substantially identical with the system and means used for correction in a vertical direction and the entire circuit is of such a nature that the individual shading signals may be combined into a composite signal series which may be superimposed upon the picture signals as developed by the transmitting tube in order that the resultant signal variation may correspond to the actual light values of the optical image which is projected on the light responsive electrode of the television transmitting tube.

A still further purpose of the present invention resides in the provision of a dark spot correction or shading control circuit for developing signals which may be applied directly to the signal plate of the television transmitting tube in order that such dark spot correction may be exercised prior to any amplification of the picture signals to thereby eliminate any attenuation or excessive amplification of portions of the picture signals as a result of the non-linear operation characteristics of various of the television signal amplifying tubes when such tubes are operated over a wide range.

Still other purposes and advantages of the present invention will become more apparent to those skilled in the art from a reading of the following specification and claims, particularly when considered with the accompanying drawings, wherein like reference characters represent like parts and wherein:

Figure 1 represents the application of the present invention to a television transmitting system and

Figure 2 represents the circuit used to produce the various shading control potentials and wave forms.

Referring now to Figure 1, a television transmitting tube 10 is shown, which includes a light responsive electrode 12 with which is associated a signal plate 14. A lens system 16 is also provided for projecting and focusing an optical image on the light responsive electrode 12, and for scanning the mosaic electrode an electron gun structure 18 is positioned at one side of the light responsive electrode and displaced from the axis of the lens system 16. For deflecting the cathode ray beam which is generated in the gun structure 18, a deflecting yoke 20 is provided, this yoke being shown as a magnetic deflecting device. It is to be understood, however, that electrostatic deflecting means or a combination of electromagnetic and deflecting means could as well be used. The specific apparatus for causing energization of the deflecting unit whereby the cathode ray beam may be deflected in mutually perpendicular directions is not shown, since such apparatus is well known in the art, and furthermore, since such apparatus does not form a part of the present invention.

When an optical image is projected upon the light responsive electrode 12 of the television transmitting tube 10, and when the electrode is scanned by a cathode ray beam, a series of picture signals are developed at the signal plate 14 and these signals are applied to the control electrode of a discharge tube 22. The discharge tube includes in addition to the control electrode at least a cathode and an anode, the anode of which is maintained positive with respect to the cathode. Included in the cathode circuit are a pair of resistances 23 and 24 and the control electrode is connected to a point between these resistances by means of a still further resistance 25. Due to the modulation of the electron stream within the discharge tube 22, varying potential drops are produced across the resistances 23 and 24 and across these resistances are connected the output terminals of the amplifier tube as indicated in the drawing. The output from these conductors may be applied to successive amplifying stages which in turn may supply energy to a modulating system in order that the picture signals may ultimately be transmitted in the usual manner.

For applying the shading control impulses to the system in order to correct for dark spot, a discharge tube 28 is provided, which includes at least a cathode, a control electrode and an anode. The shading control impulses are derived from the shading control circuits represented schematically at the 30 and 31, the signals from the two shading control circuits being combined and the composite signal being impressed on the control electrode of the discharge tube 28. A source of potential is provided for maintaining the anode of the tube 28 positive with respect to its cathode and in the anode circuit of the tube is included a load resistance 32. The anode of the tube 28 is coupled to the signal plate of the television transmitting tube by means of the condenser 34 and the resistance 36, the junction of these two elements being connected to ground by a resistance 38.

The two shading control circuits 30 and 31 are each supplied with impulses preferably of rectangular wave form, one of the circuits, for instance, the shading control circuit 30, being supplied with horizontal driving impulses of a fre-

quency equal to the line frequency of the television transmitting system whereas the other shading control circuit 31 is supplied with vertical driving impulses of a frequency equal to the field frequency of the television transmitting system.

The shading control circuits represented schematically at 30 and 31 in Figure 1 are identical except for the time constants of certain of the resistance-capacitance networks, because of the difference in the frequencies impressed on the two control circuits, and are shown in detail in Figure 2. It is to be understood that the circuit shown in Figure 2 is included in each of the rectangles 30 and 31 representing the shading control circuits of Figure 1. For the purpose of explaining the operation of Figure 2, it will be assumed that the shading control circuit shown in that figure is specifically for supplying the shading control voltages which are used to control the dark spot in a horizontal direction, and accordingly, the shading control circuit is supplied with impulses of line frequency, such impulses being generally described as, horizontal driving impulses. As previously stated, these impulses are preferably of rectangular wave form in which the negative portions of the pulses occupy a relatively small percentage of a complete cycle of the voltage variation. These impulses are applied to the terminals 40 and 41 and the wave form which is impressed upon these terminals is indicated at 42.

An electron discharge tube 44 is provided for receiving the horizontal driving impulses, which tube includes a cathode 45, a control electrode 46 and an anode 47. The cathode and the control electrode are connected to ground through appropriate resistances 48 and 50, while the anode 47 is connected to a source of positive potential through a load resistance 52. The horizontal driving impulses are, however, impressed upon the control electrode 46 of the discharge tube 44 through condenser 54, and since the discharge tube 44 operates as an amplifier tube, voltages of rectangular wave form appear in the anode circuit of the tube 44 to increase the amplitude as indicated at 54. It will also be noticed that the narrow portion of the wave form indicated at 54 is in a positive direction whereas the applied driving impulses were applied in a negative direction. In order to produce voltage variations of saw-tooth wave form, a discharge tube 56 is provided which includes a cathode, a control electrode 58 and an anode. The cathode of the discharge tube 56 is connected to ground, and between the anode and the cathode of the tube 56 are serially connected condensers 60, 62 and condensers 64, 66. The anode of the tube 56 is connected to a source of positive potential through a load resistance 68. The discharge tube 56 has a relatively low impedance during the time that the tube is rendered conductive. The control electrode 58 is connected to ground through a resistance 70, and is coupled to the anode 47 of the discharge tube 44 by means of a condenser 72. The value of the resistance 70 is such that the discharge tube 56 will normally be biased to cut-off due to rectified grid current but which will be rendered conductive upon the occurrence of each of the positive impulses which are derived from the anode 47 by discharge tube 44 through the condenser 72.

Assuming that the discharge tube 56 is in a non-conductive condition, then the condenser 60, 62 and 64, 66 will charge in substantially a

linear manner through the resistance 68 until they have acquired a predetermined charged condition, and until the control electrode 58 is supplied with a positive impulse from the anode 47 of the discharge tube 44. Such positive impulse renders the discharge tube 56 conducting, and accordingly, the condensers 60, 62, as well as the condenser 64, 66, will be discharged substantially instantaneously through the discharge tube 56. The tube will then be rendered non-conducting and the condensers will again be charged in a similar linear manner. The wave form of the voltage variation present at the anode of the discharge tube 56 will therefore be of saw-tooth wave form as indicated at 74.

Another amplifying discharge tube 76 is provided which includes a cathode, a control electrode and an anode, the anode of which is connected directly to a source of positive potential while the cathode is connected to ground through resistances 77 and 78, as well as the potentiometer 80 which is connected in parallel with the resistances 77, 78. The impulses of saw-tooth wave form as derived from the anode of the discharge tube 56 are applied to the discharge tube 76 through condenser 82, the control electrode being connected to a point between resistances 77 and 78 by means of another resistance 84. Since the load circuit of the discharge tube 76 is included in circuit with the cathode thereof, the wave form of the voltage variations appearing across the cathode resistors and the wave form of the voltage applied to the control electrode of the tube 76 will be in phase and will increase in a positive direction with time. The potentiometer 80 is provided in order that varying amplitudes of this wave form may be derived from the circuit and obviously, if the movable contact of the potentiometer 80 is placed relatively near the grounded end of the potentiometer, a voltage variation of saw-tooth wave form but of small amplitude such as indicated at 86 will be supplied whereas if the movable contact of the potentiometer is positioned at the cathode end thereof, a saw-tooth wave form of the same frequency but of a greater amplitude as indicated at 88 may be derived therefrom.

The voltage variations of saw-tooth wave form and of manually controllable amplitude as indicated at 86 and 88, are, as previously indicated, at line frequency and increase in a positive direction with time so that if such impulses were directly impressed upon the signal plate of a television transmitting tube, the average potential value of the picture signals derived therefrom would be gradually increased in a positive direction throughout the duration of each picture line. Since the dark spot correction or shading control is not uniformly variable with respect to time throughout the entire line of the picture, such a wave form is altered in order that only a portion of the picture image may be shaded or controlled in intensity, other portions of the image being controlled by other wave forms. It has been found that if individual shading control may be manually exercised over the initial or leading portion of each of the lines, the central portion thereof and the trailing or lagging portion of each of the lines, a satisfactory shading control of the picture in a horizontal direction may be accomplished. Accordingly, separate tubes and associated circuits are provided for producing voltage variations which will affect these three portions of each line of the picture.

and the tubes are indicated at 90, 92 and 94. These three tubes will produce signals which will affect respectively the initial or leading portion of each line, the central portion thereof and the final or lagging portion thereof, in a manner which will be later explained.

For controlling the lagging or trailing portion of each line of the picture, as stated above, the discharge tube 94 is provided. This tube is preferably of the screen grid type and includes a cathode, a control electrode, a screen grid, a suppressor electrode and an anode. The suppressor electrode is connected directly to the cathode of the tube, while the anode is supplied with positive potential with respect to the cathode through a load resistance 96. The control electrode is connected to ground through an appropriate resistance 98 and a condenser 99 is provided through which the saw-tooth voltage variations of manually controllable amplitude may be impressed upon the control electrode of the tube 94. The cathode of the control electrode 94 is connected to the anode thereof by means of a potentiometer 100 and a condenser 102, a mid-point along the potentiometer being connected directly to ground.

In order that the tube 94 may produce the desired results, a tube is selected which is of the remote cut-off type and in order to accentuate this operation, and to provide the desired operating characteristics of the tube, the screen electrode is supplied with a relatively low potential which may be of the order of 5 to 10 percent of the available anode potential. When such potentials are applied to a tube which inherently has a remote cut-off, the operating characteristics of the tube will be quite curved and will extend considerably in a negative direction, the anodic current increasing rapidly as the grid potential is brought nearer the potential of the cathode.

When voltage variations of saw-tooth wave form and of low amplitude such as indicated at 86, are impressed upon the control electrode of the discharge tube 94, the tube will operate over that portion of its characteristic which is less curved so that the wave form of the voltage variation appearing in the output circuit of the tube will be slightly curved but generally of saw-tooth wave form. If, however, voltage variations of saw-tooth wave form and of considerable amplitude such as indicated at 88 are applied to the discharge tube 94, then the output circuit of tube 94 will contain voltage variations which are quite peaked and whose wave form fronts increase rapidly with time. Since the potentiometer 100 is coupled between the cathode and the anode of the discharge tube 94, and since the mid-point of this potentiometer is connected to ground, the signal voltage variations as produced by the tube 94 may be derived therefrom in either positive or negative polarity. If the movable contact of the potentiometer 100 is placed on the cathode side of the grounded point, the voltage variations will be of the same polarity as the impressed voltage variations, whereas if the movable contact is placed on the anode side of the grounded point such polarity will be reversed and the wave form, if observed in an oscilloscope, will be inverted. This relationship exists irrespective of the intensity of the saw-tooth wave form which is applied to the control electrode of the tube, and furthermore, it will be noticed that the intensity of the voltage variations as produced by the tube 94 may be

controlled by the position of the movable contact of the potentiometer, the intensity of the derived signal obviously increasing as the movable contact is moved toward either extremity of the potentiometer.

As explained above, if voltage variations of saw-tooth wave form and of low amplitude are applied to the control electrode of the tube 94, the output of this tube will supply voltage variations having a slightly curved wave form such as indicated at 104 and 105. It will also be noticed that if the movable contact of the potentiometer 100 is placed on the cathode side of the grounded point thereof, a wave form such as indicated at 104 may be derived therefrom in which case the potential of the wave form increases in a positive direction with time. If, however, the movable contact of the potentiometer 100 is placed on the anode side of the ground point a voltage variation such as indicated at 105 may be derived in which case the voltage variation increases negatively with time, this voltage variation being similar in wave form to the voltage variation 104, but differing therefrom only in polarity. Furthermore, as stated above, if voltage variations of saw-tooth wave form and of considerable amplitude such as indicated at 88 are applied to the control electrode of the discharge tube 94, a voltage variation will be produced in the output circuit of the tube 94, which variation will be considerably peaked in view of the curved characteristic of the tube 94 and in view of its remote cut-off operation. Such wave-forms are indicated at 106-107, these wave forms being identical except for polarity, which polarity depends upon the position of the movable contact of the potentiometer with respect to the grounded point thereof. The wave forms such as indicated at 104-107 or various modifications thereof may be controlled in intensity by means of the potentiometer 100.

In inspecting the wave forms indicated at 104-107 it will be noticed that the change of the voltage variation of the wave forms is most pronounced at the trailing or final edge thereof. Accordingly, when such wave forms are applied to the signal plate of a television transmitting tube, or in fact to any portion of the system, dark spot elimination or shading correction is effective over the latter or trailing portion of each line thereof. The affected portion of the line may be controlled by means of the potentiometer 80 whereas the degree as well as the polarity of the effect may be controlled by means of the potentiometer 100. If the movable contact of the potentiometer 80 is positioned relatively adjacent the cathode end thereof, then the shading correction may be concentrated in the very final portion of each line, whereas if the movable contact of potentiometer 80 approaches the grounded end thereof, such shading control may be started at or even before the center of each line. As stated above, the polarity of such shading control as well as its intensity may be very conveniently controlled by means of the manually adjustable potentiometer 100.

For controlling the shading during the initial or leading portion of each line of the image, an electron tube 90 is provided. This tube includes a cathode, a control electrode and an anode, the cathode and anode of which are connected by means of a potentiometer 118 and a condenser 120. The mid-point of the potentiometer is connected to ground and the anode of the tube 90 is connected to a source of positive potential which

connection includes a load resistance 122. The control electrode of the tube 90 is connected to ground through a variable resistance 124 and voltage variations of saw-tooth wave form are impressed upon the control electrode of the tube 90. These voltage variations are derived from the junction of the condenser 64 and 66. Adjustment of the time constant of condenser 66 and resistor 124 by changing the value of resistor 124 alters the wave form of the voltages which are applied to the control electrode of the tube 90. If substantially all of the resistance 124 is included in the circuit, then the wave form of the voltages which control the tube 90 will be substantially saw-tooth in nature, with the exception that the most positive portions thereof will be slightly rounded as indicated at 126. When such signals are impressed upon the discharge tube 90 the output circuit thereof will supply voltage variations of similar wave form, the polarity of which, as well as the intensity, may be controlled by the potentiometer 118. If the movable contact of the potentiometer 118 is moved toward the cathode end thereof, a voltage variation such as 130 is available in which the leading edge of each cycle increases positively with time, whereas if the movable contact is positioned on the anode end of the potentiometer, a voltage variation of inverted wave form such as indicated at 131 is available. It will be observed that through such wave forms the shading of a substantial portion of the initial part of each line may be controlled.

If, however, the value of the resistance 124 is materially decreased, then the voltage variations which are applied to the control electrode of tube 90 will be materially altered by filter action of the short time constant of condenser 66 and the reduced value of resistance 124 and the resultant wave form is indicated at 128. When the tube 90 is subjected to such a voltage variation, a similar but amplified voltage variation will be present in the output circuit of the tube, the polarity and intensity of which may be controlled by the potentiometer 118. Such voltage variations are indicated at 132 and 133. It will be noticed from the shape of these curves that each cycle of the voltage variation changes abruptly soon after the beginning of each cycle in either a positive or negative sense, so that only the very initial or beginning of each line of the image may be properly shaded. By means of tube 90 and the circuit immediately associated therewith, the shading over the initial portion of each line may be controlled, and the degree of shading so far as the length of the line is concerned, may be controlled by varying the amount of the resistance 124. Furthermore, the polarity of the shading as well as its intensity may be controlled through a manual manipulation of the potentiometer 118.

Since the wave form of the voltage variations as supplied by tubes 90 and 94 and their associated circuits can be used to control respectively the leading and lagging portions of each line of the picture the average value of these portions of the picture signals may be so controlled as to the extensions of the slope of the dark spot signal at the center of each line in order that a final correction of the shading or dark spot signal may be exercised by changing the slope of the correction signal throughout the entire line. For controlling the slope of the shading signal along the entire line a separate tube 92 is provided. This tube includes a cathode, a control electrode and an anode. The cathode and the anode are

connected together by means of a potentiometer 108 and a condenser 110, the mid-point of the potentiometer being connected directly to ground. The cathode of the tube 92 is supplied with positive potential through a load resistance 112. Voltage variations of saw-tooth wave form such as indicated at 114 are impressed upon the control electrode of the tube 92 and are derived from a point between the condenser 60 and 62. The tube 92 operates primarily as an amplifier tube and accordingly voltage variations of substantially saw-tooth wave form will be present in the output circuit of the tube. Since the potentiometer 108 is coupled between the cathode and the anode of the tube, the polarity of the voltage variations as present in the output circuit of the tube 92 may be controlled by means of the position of the movable contact of the potentiometer 108. If the movable contact is positioned on the cathode side of the grounded point of the potentiometer, then voltage variations of saw-tooth wave form which increase positively with time may be derived from the tube 92. Such a voltage variation is indicated at 116. If, however, the movable contact of the potentiometer 108 is placed at the anode end thereof, voltage variations of saw-tooth wave form may be developed which increase negatively with time, and such a voltage variation is indicated at 117. These voltage variations are of similar wave form, but differ only in polarity. The intensity of these voltage variations may also be controlled by the position of a movable contact along the anode or cathode ends of the potentiometer 108. If the movable contact is positioned in the center of the potentiometer at the grounded point thereof then obviously no voltage variation will be derived therefrom, but if moved in either direction one polarity or the other of the voltage variation is available. This wave form is effected to correct the shading throughout the entire length of each line.

The movable contacts of the potentiometers 100, 108 and 118 are connected together by means of isolating resistances 136, 137 and 138, so that voltage variations from the three potentiometers may be present upon the conductor 140. These voltage variations are prevented from interfering with each other and from affecting other portions of the shading control circuit through the use of the isolating resistances. The conductor 140 which supplies the combined shading impulses for each line of the image, is then connected to the control electrode of the tube 28 as indicated in Figure 1.

It may be seen from the above that any degree or polarity of shading throughout any portion of each line of the image may be controlled by means of the circuit shown in Figure 2, through a manipulation of the potentiometers and resistances contained therein, and by means of such a circuit, shading in a horizontal direction of the entire television image is made possible.

Through the use of a similar circuit, which is supplied with vertical driving impulses, shading may also be exercised in a vertical direction in order that each field of the television image may also be shaded in accordance with the desired requirements. The signals from the vertical shading control circuit 31 are supplied over a conductor 142 and are also impressed upon the control electrode of the tube 28 as explained above.

When two such shading control circuits such as shown in Figure 2 are employed, one for shad-

ing in a horizontal direction and the other for shading in a vertical direction, it is possible to produce any desired shading over the entire surface of the television image, in order that proper background level of the produced image may be maintained. Such a shading control will then compensate for all dark spot which may originate within the television transmitting tube, with the result that the transmitted signals will be truly representative of the optical image projected on the light responsive electrode of the television transmitting tube.

The shading control, as explained above, incorporates various advantages, among which is the possibility of controlling any portion of the television image either as to the intensity of the shading control or the polarity of such control without the necessity of circuit closures for altering such polarity and without the necessity for employing a great number of control elements. The normal dark spot characteristics of a television transmitting tube are such that the system, as explained above, will fully and adequately compensate for any existing dark spot, and furthermore, due to the simplicity of the system, it is entirely possible for an operator or monitor to compensate for small changes in dark spot correction due to changes in the light value of the optical image being projected on the transmitting tube.

Although the present invention is described as being applied to an electronic television transmitting tube of the type wherein a single-sided mosaic electrode is used (such as an "iconoscope") it is obvious that the system may readily be applied to any type television transmitting tube where dark spot correction is necessary. A system such as shown and described above may, of course, be readily applied to the so-called image-dissector tube or the system may be applied to a transmitting tube of the image intensifying type. Furthermore, it is not necessary that the correction signal for compensating for dark spot be applied to the signal plate of the television transmitting tube since the correction signals may readily be applied at any portion of the complete television transmitting system.

Although the system shown and described herein is rather specific in nature, it is to be understood that various alterations and modifications may be made therein without departing from the spirit and scope thereof, and it is desired that any and all such modifications be considered within the purview of the present invention except as limited by the hereinafter appended claims.

What I claim is:

1. A shading control circuit for a television transmitting system including means for generating a cyclically varying voltage of substantially saw-tooth wave form and of a frequency corresponding to one of the scanning rates, means including an electronic tube for distorting the wave form to cause the voltage variations thereof to be confined to substantially the final portion of each cycle, additional means for distorting the wave form to cause the voltage variation thereof to be confined to substantially the initial portion of each cycle, and separate manually operable means for independently determining the polarity and for controlling the intensity of each distorted wave form.

2. A shading control circuit for a television transmitting system including a source of cyclically varying voltage of substantially saw-tooth

wave form and of a frequency corresponding to one of the beam deflection rates, means for distorting the wave form to cause the voltage variations thereof to be confined to substantially the final portion of each cycle, additional means for distorting the wave form to cause the voltage variation thereof to be confined to substantially the initial portion of each cycle, separate means for independently determining the polarity and for controlling the intensity of each distorted wave form, and means for combining the distorted wave forms.

3. A shading control circuit for a television transmitting system including a source of cyclically varying voltage of substantially saw-tooth wave form and of a frequency corresponding to the frequency of horizontal scansion, means including an electron discharge tube for distorting the wave form to cause the voltage variations thereof to be confined to substantially that portion of each cycle which corresponds to the concluding period of each horizontal scansion, additional means for distorting the wave form to cause the voltage variation thereof to be confined to substantially that portion of each cycle which corresponds to the beginning of each horizontal scansion, separate means for independently determining the polarity and for controlling the intensity of each distorted wave form, and means for combining the distorted wave forms.

4. A shading control circuit for a television transmitting system including means for producing a cyclically varying voltage of substantially saw-tooth wave form of a frequency corresponding to the frequency of vertical scansion cycle, means including an electron tube for distorting the wave form whereby the voltage variations thereof may be confined to substantially the final portion of each cycle, additional means for distorting the wave form to cause the voltage variations thereof to be confined to substantially the initial portion of each cycle, separate manually operable means for individually determining the polarity and for controlling the intensity of the distorted wave forms, and means for combining the controlled distorted wave forms.

5. A shading control circuit for a television transmitting system including means for producing a cyclically varying voltage of substantially saw-tooth wave form and of a frequency corresponding to the vertical scansion cycle, means for distorting the wave form whereby the voltage variations thereof may be confined to substantially the final portion of each cycle, additional means for distorting the wave form to cause the voltage variations thereof to be confined to substantially the initial portion of each cycle, each cycle being in phase with the vertical scansion cycle, separate means for individually determining the polarity and for variably controlling the intensity of the distorted wave forms, and means for combining the distorted wave forms.

6. A shading control circuit for a television transmitting system including a source of cyclically varying voltage of substantially saw-tooth wave form of a frequency corresponding to the vertical scanning frequency, means for distorting the wave form whereby the voltage variations thereof may be confined to substantially that portion of each cycle which corresponds to the conclusion of each vertical scanning cycle, additional means for distorting the wave form to cause the voltage variations thereof to be confined to substantially that portion of each cycle which corresponds to the beginning of each vertical scan-

ning cycle, separate means for determining the polarity and the intensity of the distorted wave forms, and means for combining the controlled distorted wave forms.

7. In shading control circuit for a picture transmitter comprising, a source of signals of substantially saw-tooth wave form of a frequency corresponding to the horizontal scanning frequency, means for distorting the wave form to cause the voltage variations thereof to be confined to substantially that portion of each cycle corresponding to the last portion of each horizontal deflection, and a single element for manually controlling the polarity and the intensity of the distorted wave form.

8. In a shading control circuit for a picture transmission system including a source of cyclically varying voltage of substantially saw-tooth wave form, means including a remote cut-off electron tube for distorting the wave form to cause the voltage variations thereof to be confined to the final portion of each cycle, and a single manually operable element for determining the polarity and for varying the intensity of the distorted wave form.

9. A shading control circuit for television transmitting systems comprising means for generating a cyclically varying voltage of saw-tooth wave form, means including an electron discharge tube for distorting the wave form to cause the voltage variations thereof to be confined to substantially the final portion of each cycle, and manually operable means including a single element for varying the intensity of the distorted wave and for determining the polarity of the distorted wave.

10. A shading control circuit for television transmitting systems comprising a source of cyclically varying voltage of saw-tooth wave form, means including a biased remote cut-off electron discharge tube for distorting the wave form to cause the voltage variations thereof to be confined to the final portion of each cycle, and with a single manually operable element for varying the intensity of the distorted wave and for determining the polarity of the distorted wave.

11. A shading control circuit for television transmitting systems comprising a source of cyclically varying voltage of saw-tooth wave form, means including an electron discharge device for distorting the wave form to cause the voltage variations thereof to be confined to only a predetermined portion of each cycle, and a single manually operable element for determining the polarity and for varying the intensity of the distorted wave.

12. A shading control circuit for television transmitting systems comprising means for generating a cyclically varying voltage of saw-tooth wave form, means including an electronic tube having a curved operating characteristic and a remote cut-off point for distorting the wave form to cause the voltage variations thereof to be confined to substantially the final portion of each cycle, means for varying the length of the portion of each cycle during which the voltage variation occurs, and a single manually operable element for determining the polarity and for varying the intensity of the distorted wave form.

13. A shading control circuit for television transmitting systems comprising a source of cyclically varying voltage of saw-tooth wave form, means including an electronic tube having a curved operating characteristic for distorting the wave form to cause the voltage variations thereof

to be confined to substantially the initial portion of each cycle, means for varying the length of the portion of each cycle during which the voltage variation occurs, and a single element for determining the polarity and for varying the intensity of the distorted wave form.

14. A shading control circuit for television transmitting systems comprising a source of cyclically varying voltage of saw-tooth wave form, means including an electronic tube having a non-linear operating characteristic for distorting the wave form to cause the voltage variation to be confined to only a portion of each cycle, means for varying the length of the portion of each cycle during which the voltage variation occurs, and a single operable element for determining the polarity and for varying the intensity of the distorted wave form.

15. A shading control circuit for television transmitting systems comprising a source of cyclically varying voltage of substantially saw-tooth wave form, means for distorting the wave form to cause the voltage variations thereof to be confined to substantially the initial portion of each cycle, and a single element for determining the polarity and for varying the intensity of the distorted wave form.

16. A shading control circuit for television transmitting systems for compensating for dark spot comprising a source of cyclically varying voltage of a predetermined wave form, means for distorting the wave form to cause the voltage variations thereof to be confined to substantially the final portions of each cycle, means for controlling the degree of distortion, and a single manually operable element for determining the polarity and for varying the intensity of the distorted wave form.

17. A shading control circuit for television transmitting systems comprising means for generating a cyclically varying voltage of substantially saw-tooth wave form, means including an electron discharge tube having a cathode, a control electrode and an anode, means for applying the voltage variations of saw-tooth wave form between the control electrode of said tube and a point of fixed potential, a potentiometer coupled between the cathode and the anode of said tube with a point on the potentiometer connected to a point of fixed potential and an output circuit including the movable contact of the potentiometer and the point of fixed potential whereby the polarity and the intensity of the voltage variations appearing in said output circuit may be controlled.

18. A shading control circuit for a television transmitting system comprising means for generating a cyclically varying voltage of a predetermined wave form, and electron tube including at least a cathode, a control electrode and an anode, a potentiometer having an adjustable contact associated therewith, means for connecting one end of the potentiometer to the cathode of the tube, means including a condenser for connecting the other end of the potentiometer to the anode of said tube, means for maintaining the anode positive with respect to the cathode, means for impressing the voltage variations upon the control electrode of the tube, and an output circuit connected to the mid-point of the potentiometer and to the adjustable contact thereof whereby the polarity of the output signal as well as its intensity may be determined by the position of the adjustable contact along the potentiometer.

19. A shading control circuit for a television transmitting system comprising means for generating a cyclically varying voltage of a predetermined controllable wave form, an electron discharge tube including at least a cathode, a control electrode and an anode, a resistance having a movable contact associated therewith, means for connecting one end of the resistance to the cathode of the tube, means including a condenser for connecting the other end of the resistance to the anode of said tube, means for maintaining the anode positive with respect to the mid-point of the resistance, means for impressing the voltage variations upon the control electrode of the tube, and an output circuit connected to the mid-point of the resistance and to the movable contact thereof whereby the polarity of the output signal as well as its intensity may be determined by the position of the movable contact along the resistance.

20. A shading control circuit for a television transmitting system comprising means for gen-

erating a cyclically varying voltage of a predetermined wave form, an electron tube including at least a cathode, a control electrode and an anode, a resistance, means for connecting one end of the resistance to the cathode of the tube, means including a condenser for connecting the other end of the resistance to the anode of said tube, a source of potential having positive and negative terminals, means for connecting said anode to the positive terminal of the source of potential, means for connecting the mid-point of the resistance to the negative terminal, means for impressing the voltage variations across the control electrode of the tube and the negative terminal, and an output circuit connected to the mid-point of the resistance and to a movable contact along the resistance whereby the polarity of the output signal as well as the intensity thereof may be determined by the position of the movable contact along the resistance.

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