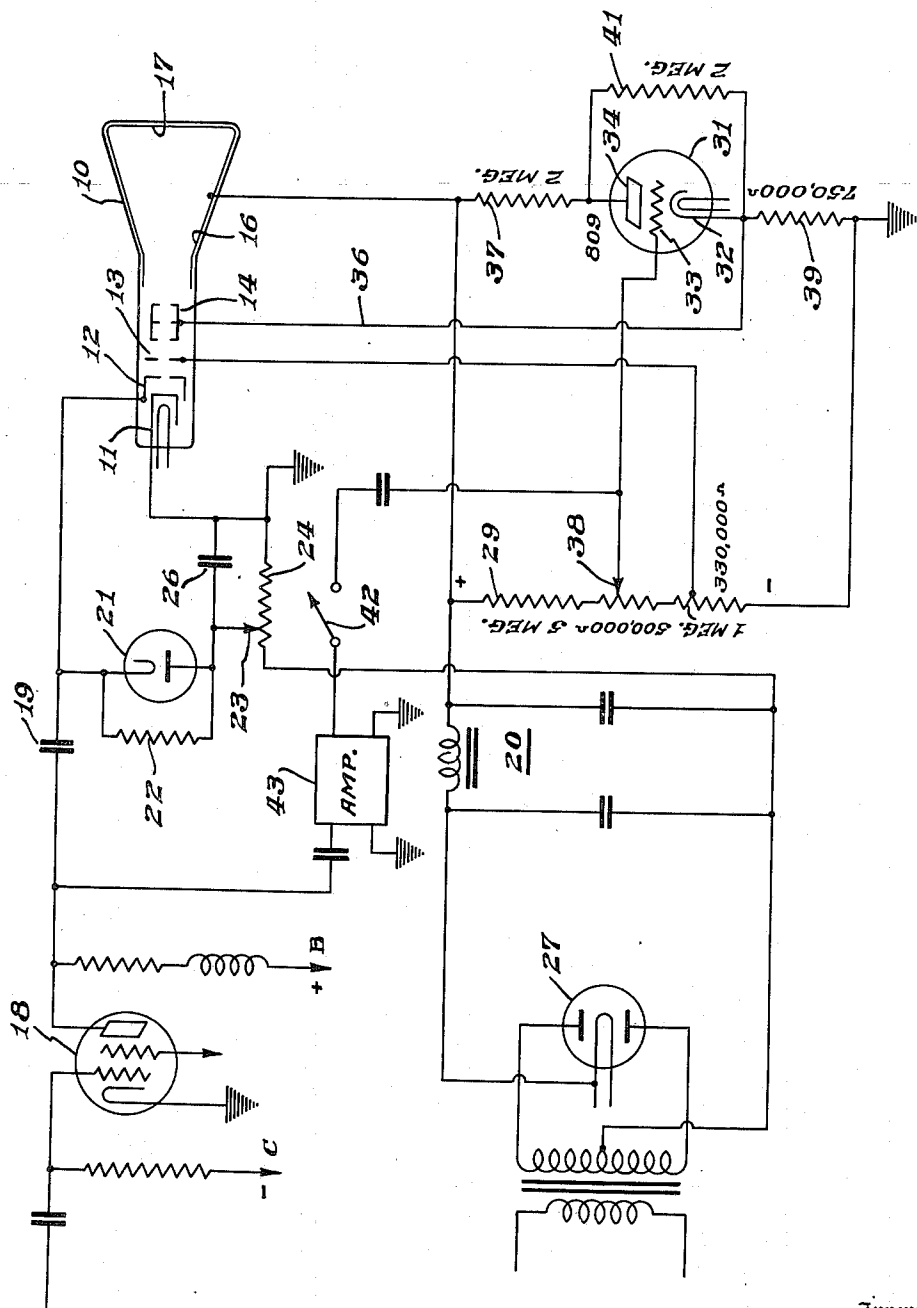


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CATHODE RAY TUBE APPARATUS

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CATHODE-RAY TUBE APPARATUS

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My invention relates to cathode ray tube apparatus and particularly to television systems or the like in which there is a tendency for a cathode ray to become defocused.

In the case of cathode ray tubes employing electrostatic focusing, there should be a certain ratio between the first anode voltage and the second anode voltage for proper focusing of the cathode ray. It frequently is difficult to maintain this voltage ratio constant because of the poor voltage regulation of an economically designed voltage supply unit. Likewise, since the anode voltage required for cathode ray tubes is usually several thousand volts, it is economically desirable to keep the current drain on the supply source as low as possible. In practice, the first anode current of a cathode ray tube varies with variations in the average potential on the control grid whereby the first anode voltage changes and there is a departure from the proper voltage ratio for good focusing.

It is, accordingly, an object of my invention to provide an improved cathode ray tube apparatus in which the cathode ray is maintained properly focused.

It is a further object of my invention to provide an improved television receiver or the like in which the electron beam of a cathode ray tube is maintained properly focused regardless of voltage variations on the control grid of the cathode ray tube.

In a preferred embodiment of my invention, it is applied to a television receiver in which the control grid potential of the cathode ray tube is varied in accordance with the background or average overall illumination of the picture being transmitted. The first anode and second anode voltages are supplied from a single voltage supply unit having the usual voltage divider. The first anode is connected to this voltage supply unit through an amplifier tube having a control grid connected to a point on the voltage divider where the voltage is substantially the correct voltage for the first anode. Any change in first anode current changes the amplifier tube impedance and holds the ratio of the two anode voltages at the desired value.

The invention will be better understood from the following description taken in connection with the accompanying drawing in which the single figure is a circuit diagram of the invention as applied to a television receiver.

Referring to the drawing, there is shown a portion of a television receiver comprising a cathode ray tube 10 having a cathode 11, a con-

trol electrode 12, a screen grid 13, a first anode 14, a second anode 16 and a fluorescent screen 17. The tube 10 is of a well-known type in which the cathode ray is electrostatically focused by properly adjusting the ratio of the first anode voltage to the second anode voltage.

It may be assumed that the usual composite signal consisting of picture signals, line synchronizing impulses and framing impulses are applied to the control grid 12 through an amplifier tube 18 and a coupling condenser 19. It will be understood that the line synchronizing and framing impulses are applied to the grid 12 with a negative polarity and that they are of greater amplitude than picture signals of like polarity. Also, it is assumed that these impulses contain background intelligence, that is, that their height varies in accordance with changes in background illumination as taught in British Patent 448,065, accepted June 2, 1936.

In order to make the voltage on the grid 12 vary in accordance with the height of the synchronizing impulses, and, therefore, in accordance with picture background, a diode 21 shunted by a resistor 22 may be connected between the grid 12 and ground. Manual adjustment of the picture brightness is accomplished by varying the bias on the grid 12 by means of a tap 23 on a resistor 24 connected between the negative terminal of a voltage supply filter 20 and ground. Preferably, there is provided a bypass condenser 26 between the tap 23 and the cathode 11 of the cathode ray tube.

The background or D.-C. inserting diode circuit is described in British Patent 422,906, accepted January 14, 1935. In operation, the synchronizing impulses cause current flow through the diode 21 which charges the condenser 19. The time constant of the circuit including condenser 19 and resistor 22 in series is such that condenser 19 discharges only slightly between successive synchronizing impulses. The bias due to this condenser discharge through resistor 22 opposes the negative bias supplied from the resistor 24.

As a result of the varying bias on the control grid 12, the current taken by the first anode 14 varies, this current increasing as the grid 12 goes more positive whereby, unless a special circuit is employed, the first anode voltage is lowered due to the first anode current being supplied through a high resistance circuit. The second anode voltage, however, stays comparatively constant with the result that there is a change in the voltage ratio which causes defocusing.

It will be evident that this undesired change in voltage ratio is produced also when the bias on control grid 12 is varied manually and that it is desirable to employ my voltage control circuit in any system in which the focusing is disturbed due to a flow of anode current.

The voltage supply unit for the first and second anodes comprises a rectifier tube 27 and the filter 20 which has a voltage divider 29 connected between its positive terminal and ground. Voltage is supplied to the second anode from the high potential end of the voltage divider 29 in the usual way. If the cathode ray tube has a screen grid, the screen grid voltage may be taken off a suitable point on the divider 29.

In accordance with my invention, the first anode 14 is not connected directly to the voltage divider 29 but, instead, is connected to the high potential end thereof through a variable impedance device such as an amplifier tube 31. In the example shown, this tube is of the 809 type having a cathode 32, a control grid 33 and a plate 34.

The voltage supply connection for the first anode 14 is through a conductor 36 to the cathode 32, through the tube plate impedance, and, preferably, through a series resistor 37 to the high voltage end of the voltage divider 29. The control grid 33 is connected through a variable tap 38 to a point on the divider 29 which is at substantially the desired first anode potential.

If it be assumed that the control grid 33 and the cathode ray tube screen grid 13 draw no current, then the ratio of the voltage between the tap 38 and ground to the voltage across the entire voltage divider remains constant regardless of the total voltage across the voltage divider.

Assuming the regulator tube 31 to be similar to the type illustrated, it is desirable to connect a resistor 39 between the cathode 32 and the negative terminal of the divider 29. Also, in order to protect the tube 31 from possible voltage breakdown, a resistor 41 in shunt to the tube may be desirable. With a tube 31 of a suitable type, any one or all of the resistors 37, 39 and 41 may be omitted.

An important feature of the invention is that in all cases, even though the second anode voltage varies, there is maintained a fixed ratio of first anode voltage to second anode voltage, this ratio being determined by the setting of the variable tap 38. This will be apparent if it is noted that the action of the circuit is such as to bring the cathode 32 always to substantially the potential of the grid 33, here being a small voltage difference, of course, between these tube electrodes for maintaining the grid 33 negatively biased with respect to the cathode 32.

That the cathode 32 is brought at all times substantially to the potential of grid 33 (and of tap 38) will be seen from the following:

Any increase in first anode current increases the voltage drop in resistor 37 and in tube 31 whereby cathode 32 goes more negative with respect to the positive terminal of divider 29 and, therefore, with respect to the tap 38. In other words, grid 33 becomes less negative with respect to cathode 32, the plate impedance of tube 31 decreases whereby the voltage drop in the tube decreases and the cathode 32 is prevented from going more negative any substantial amount.

From the foregoing, it will be seen that even though the total voltage across the divider 29 changes (thus changing the voltage applied to

both the first and second anodes 14 and 16), the first anode 14 is held substantially at the potential of the tap 38 whereby the ratio of first anode voltage to second anode voltage remains substantially constant. Thus, so long as the ratio of the voltage between the tap 38 and ground to the voltage between the positive terminal of divider 29 and ground remains constant, the ratio of the first anode voltage to the second anode voltage will likewise remain substantially constant. As previously stated, the ratio of the voltage between the tap 38 and ground to the voltage between the positive terminal of divider 29 and ground will remain constant unless the grid of tube 31 takes current, which will not occur if a suitable tube of the type described is used.

It may be noted that the desired fixed ratio of anode voltages may be maintained by connecting a resistor in series with the second anode to make the voltage regulation at the second anode the same as that at the first anode. In general, this is not entirely satisfactory because, while the cathode ray does remain in focus as desired, the voltage changes resulting from the use of this resistor are sufficient to cause a noticeable variation in the cathode ray's sensitivity to deflection and the size of the received picture will vary correspondingly. Also, it will be apparent that the use of such a second anode resistor maintains the desired fixed voltage ratio only when the current change in the first and second anode currents is in the same direction and in approximately the same ratio. Manual adjustment of the focus of the cathode ray is secured by varying the position of the tap 38 on the voltage divider 29.

The values of the several resistors in the voltage supply circuit have been indicated in ohms and megohms merely by way of example.

My invention may be utilized to reduce defocusing or "blooming" of the cathode ray caused by the application of picture or video signals of high amplitude to the control grid 12. As illustrated, by closing a switch 42, the video signals may be applied through an amplifier 43 to the control grid 33 of the regulator tube whereby the first anode voltage is caused to vary in accordance with these signals. The polarity of the output from amplifier 43 is made such that in response to the grid 12 of the cathode ray tube being made more positive, the first anode 14 is made less positive.

I claim as my invention:

1. In combination, a single voltage supply source, two variable impedance loads, means for supplying from said source to said loads potentials differing in magnitude and having a fixed voltage ratio, said means including a variable impedance device connected in series with the voltage supply source and one of said impedance loads, and means for varying the impedance of said device in accordance with variations in current taken by said one impedance load and in the correct direction to maintain said fixed voltage ratio.

2. Cathode ray tube apparatus comprising a cathode ray tube of the type employing electrostatic focusing of the cathode ray, said tube having a first focusing electrode and a second focusing electrode, means for supplying positive voltages to said electrodes with the ratio of first electrode voltage to second electrode voltage such as to properly focus the cathode ray, said means including a variable impedance device connected

in series with the voltage supply means and said first electrode, and means for varying the impedance of said device in accordance with variations in current taken by said first electrode and in the correct direction to maintain said cathode ray properly focused.

3. Apparatus comprising an electrostatically focused cathode ray tube, said tube having a first anode and a second anode, means for supplying voltages to said anodes in the correct ratio for focusing the cathode ray, said means including a voltage supply unit having a voltage divider across its output terminals, said second anode being connected to a high voltage point on said divider and said first anode being connected to a point on said voltage divider through a vacuum tube having a control grid, said control grid being connected to a lower voltage point on said divider which is at approximately the desired first anode voltage.

4. In combination, an electrostatically focused cathode ray tube, said tube having a first electrode and a second electrode, means for supplying voltages to said electrodes in the correct ratio for focusing the cathode ray, said means including a voltage supply unit having a voltage divider across its output terminals, said second electrode being connected to a high voltage point on said divider and said first electrode being connected to a point on said voltage divider through a vacuum tube having a control grid and a cathode, said control grid being connected to a lower voltage point on said divider, and a resistor connect-

ing said cathode to the negative end of said voltage divider.

5. In combination, an electrostatically focused cathode ray tube, said tube having a first focusing electrode and a second focusing electrode, means for supplying voltages to said electrodes in the correct ratio for focusing the cathode ray, said means including a voltage supply unit having a voltage divider across its output terminals, said second electrode being connected to a high voltage point on said divider, a vacuum tube having a cathode, a plate and a control grid, said plate and said cathode being connected through resistors to the positive and negative ends, respectively, of said divider, said first focusing electrode being connected to said cathode, and said control grid being connected to a point on said voltage divider intermediate said positive and negative ends.

6. Apparatus comprising an electrostatically focused cathode ray tube, said tube having a first anode and a second anode, means for supplying voltages to said anodes, said means including a variable impedance connected in series with said first anode, and means for causing said impedance to vary with variations in current to the first anode.

7. The invention according to claim 6 wherein said last means causes said impedance to decrease with an increase in current to the first anode.

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