

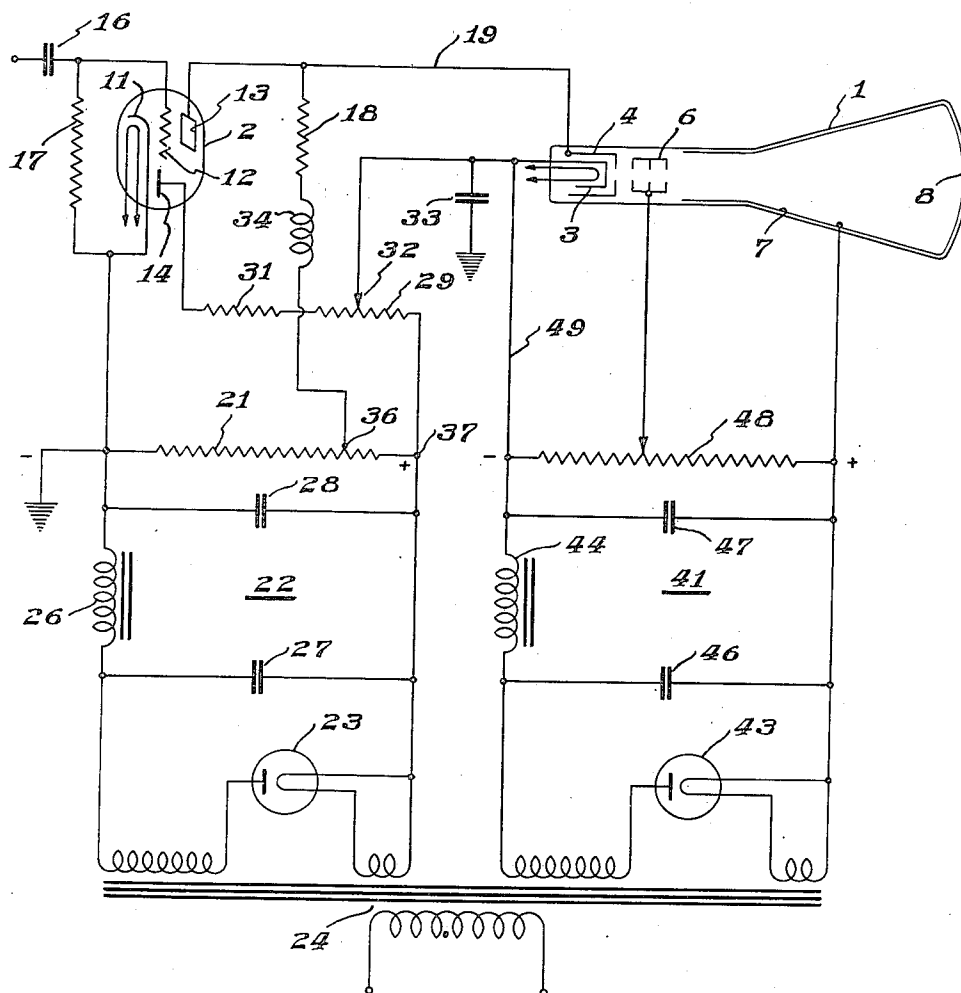
Sept. 19, 1939.

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2,173,221

CATHODE RAY TUBE CIRCUITS

Filed July 22, 1936



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CATHODE RAY TUBE CIRCUITS

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Application July 22, 1936, Serial No. 91,827

4 Claims. (Cl. 250—27)

My invention relates to cathode ray tube circuits and particularly to television receivers of the type employing cathode ray tubes.

In television receivers of the above mentioned type, means are provided for varying or controlling the "background" of a received picture. Such background control means prevents a subject in bright sunlight at the transmitter from having the same brightness at the receiver as a subject in the shade. Usually both automatic and manual background controls are provided at the receiver, the manual control being provided to permit adjustments made desirable at times because of the imperfect action of the automatic control or because of imperfect transmission of the pictures.

For reasons which will be apparent later, prior to my invention the operation of the background controls caused the cathode ray to become defocused a certain amount. As a result the quality of the picture was impaired.

It is, accordingly, an object of my invention to provide an improved television receiver in which the focusing of the cathode ray is substantially independent of background control.

A further object of my invention is to provide an improved cathode ray tube circuit in which the focusing of the cathode ray is substantially independent of biasing adjustments of the cathode ray tube grid.

Other objects, features, and advantages of my invention will appear from the following description, taken in connection with the accompanying drawing, in which the single figure is a circuit diagram of a portion of a television receiver embodying my invention.

Referring to the drawing, my invention is shown applied to a television receiver including a cathode ray tube 1 and an amplifier tube 2. The cathode ray tube 1 is of conventional design comprising an indirectly heated cathode 3, a control grid 4, a first anode 6, a second anode 7, and a fluorescent screen 8. The amplifier tube 2 is of a well known type including an indirectly heated cathode 11, a control grid 12, a plate 13, and a diode plate 14 which has for its cathode a portion of the main cathode 11.

The input circuit of the amplifier tube 2 includes a grid condenser 16 and a grid resistor 17, which are so adjusted that incoming synchronizing impulses produce a biasing potential across the grid resistor. Condenser 16 and resistor 17 may have values of the order of .1 microfarad and 2 megohms, respectively, these values being given merely by way of example. The magni-

tude of this negative bias varies in accordance with the varying height of incoming synchronizing impulses whereby the flow of direct current through the plate circuit of the amplifier tube 2 is a measure of the picture background. The varying voltage drop caused by this change in direct current flow appears across the plate resistor 18 and is applied to the control grid 4 of the cathode ray tube by a direct current connection 19. An automatic background control circuit operating in this way is described and claimed in application Serial No. 718,192, filed March 30, 1934, in the name of Waldemar J. Poch and assigned to the Radio Corporation of America.

Voltage for the plate of the amplifier tube 2 is supplied from any suitable direct current source, such as the voltage divider 21 which is connected at one end to ground and to the negative terminal of a comparatively low voltage rectifier-filter unit 22, and is connected at the other end to the positive terminal of this rectifier-filter unit. The power supply unit 22 includes a rectifier 23 which is connected to the plate and filament windings of a transformer 24, and filter elements 26, 27, and 28.

A shunt circuit is connected across the voltage divider 21, this shunt circuit including a potentiometer resistor 29 connected at one end to the positive end of the voltage divider 21 and connected at the other end, through a resistor 31, to the diode plate 14. The shunt circuit is completed through the diode 11—14 to the negative end of the voltage divider 21. It will be apparent that this shunt circuit functions as a portion of a voltage divider connected across the power supply unit 22.

The cathode 3 of the cathode ray tube is connected through a variable tap 32 to a point on the shunt resistor 29. The cathode 3 is also provided with an alternating current connection to ground, through a by-pass condenser 33.

The plate 13 of the amplifier tube is connected through the plate resistor 18 and the usual peaking coil 34 to a point 36 on the voltage divider 21 which is negative with respect to the point 37 on the voltage divider to which the potentiometer resistor 29 is connected. It will be seen that, with this connection, immediately after power has been applied to the receiver, and before the cathode 11 of the amplifier tube has become heated, the only voltage applied to the control grid 4 of the cathode ray tube is the voltage drop across the voltage divider between the points 36 and 37, this voltage drop biasing the control

grid 4 negatively. During the "warm up" period, therefore, the intensity of the cathode ray is held below a value which would cause injury to the fluorescent screen or to other parts of the cathode ray tube.

As soon as the amplifier tube 2 warms up, plate current flows through the plate resistor 18 and peaking coil 34 to apply a further negative bias to the control grid 4 of the cathode ray tube, and current flows through the shunt resistor 29 and diode 11-14 tending to impress a positive voltage upon the control grid 4; thus by adjusting the variable tap 32 on the resistor 29 the negative bias on the control grid 4 may be adjusted to the desired value.

The resistor 31 is included between the potentiometer 29 and the diode plate 14 in order that the slider 32 cannot be moved to a position where a positive voltage is applied to the grid 4. In the circuit illustrated, the grid 4 is about 10 volts negative even though the slider 32 is in position to apply the least negative potential to the grid. The protective circuit described above is described and claimed in application Serial No. 81,809, filed May 26, 1936, in the name of Walde-
mar J. Poch, and assigned to the Radio Corpora-
tion of America.

The high voltages for the first anode 6 and second anode 7 of the cathode ray tube are supplied from a second power supply unit 41. The high voltage unit 41 includes a rectifier 43 connected in series with a high voltage winding of the transformer 24, a filter consisting of a choke coil 44 and condensers 46 and 47, and a voltage divider 48.

In accordance with my invention, the negative end of the voltage divider 48 is connected directly to the cathode 3 of the cathode ray tube through a conductor 49, instead of to ground or to the negative end of the voltage divider 21 in the low voltage power supply unit. The first anode 6 and second anode 7 are connected to suitable points on the voltage divider 48. If the cathode ray tube includes a screen grid, it is connected to the proper point on the voltage divider 48.

Prior to my invention, the negative end of the voltage divider 48 in the high voltage supply unit was connected to ground the same as the negative end of the voltage divider 21 in the low voltage supply unit, this connection to ground replacing the conductor 49 illustrated. It will be evident that with such a circuit connection the voltage drop between cathode 3 and ground in the low voltage supply unit 22 was in opposition to the voltage drop along the voltage divider 48 in the high voltage supply unit 41. This objectionable feature is avoided by employing the connections illustrated in the drawing.

As previously pointed out, a further objection to the circuit connections formerly employed was that the voltage drop between the cathode 3 and ground changed in value each time the bias on the control grid 4 was changed for the purpose of controlling the background of the picture. For example, if a manual adjustment were made for changing the background of the picture by changing the position of the slider 32 on the resistor 29, the value of the voltage between the cathode 3 and ground would be changed to cause a change in voltage between the cathode 3 and the anodes 6 and 7, with resulting defocusing of the cathode ray.

Also operation of the automatic background control circuit would cause a certain amount

of defocusing, since such automatic control causes both a change in the flow of plate current through the output tube 2 and a change in beam current of the cathode ray tube, the change in beam current resulting from a change in bias on the cathode ray tube grid. Such changes in the flow of current through the voltage divider obviously would cause a change in voltage drop between the cathode 3 and ground, with resulting defocusing of the cathode ray.

It will be evident that, by operating the negative end of the voltage divider of the high voltage supply unit at the potential of the cathode ray tube cathode instead of at ground potential, the voltages applied to the first and second anodes with respect to the cathode are not changed by variations of the bias applied to the control grid.

It will be apparent from the foregoing description that I have provided an improved cathode ray tube circuit which permits adjustment of the control grid potential of the cathode ray tube either automatically or manually without changing the focusing of the cathode ray.

I claim as my invention:

1. In combination, an amplifier tube having a cathode and a plate, a uni-directional voltage supply unit including a voltage divider having a negative terminal and a point thereon which is positive with respect to said terminal, said cathode being connected to said negative terminal, a plate resistor, said plate being connected to said positive point through said plate resistor, a cathode ray tube having a control electrode, a cathode and a focusing electrode, a cathode and cathode and a focusing electrode, a second uni-directional voltage supply unit including a second voltage divider having an ungrounded negative terminal and a positive terminal, the cathode and focusing electrode of said cathode ray tube being conductively connected across at least a portion of said second voltage divider to apply positive voltage to said focusing electrode, a conductive connection from said control electrode to said plate resistor, and a conductive connection from the cathode of said cathode ray tube to a certain point on said first voltage divider which certain point is less positive than said positive point, whereby said second voltage supply unit is above ground potential by the same amount as said certain point.

2. The invention according to claim 1, characterized in that said last mentioned conductive connection includes an adjustable tap on said first voltage divider whereby the bias on said control electrode may be adjusted.

3. In a television receiver, an amplifier tube having a grid, a cathode and a plate, a plate resistor, a power supply unit including a voltage divider connected at a negative point to said cathode and connected at a positive point to said plate through said plate resistor, said amplifier tube input circuit including a grid condenser and grid resistor having such relative values that the grid is properly biased by incoming synchronizing impulses to make said tube function as an undistorting amplifier for picture signals, a cathode ray tube having a cathode, a control electrode, and a focusing electrode, a conductive connection from said control electrode to said plate resistor, a conductive connection from said cathode ray tube cathode to a certain point on said voltage divider, a second power supply unit including a second voltage divider having an ungrounded negative terminal, a conductive connection from said cathode ray tube cathode to

said negative terminal of said second voltage divider, whereby said second power supply unit is above ground potential by the same amount as said certain point, and a conductive connection from said focusing electrode to a positive point on said second voltage divider.

4. In combination, an amplifier tube having a plate circuit, a cathode ray tube having a cathode, a control electrode and at least one focusing electrode, a comparatively low voltage supply unit including a voltage divider section, said voltage divider section being included in said plate circuit, a second voltage divider section comprising a resistor and a rectifier connected in series with each other and in shunt to said first voltage divider section, said rectifier being

connected between said resistor and the negative terminal of said first section, means for conductively connecting said cathode and control electrode to said plate circuit, said means including a connection from said cathode to a certain point on the resistor in said second voltage divider section, and a comparatively high voltage supply unit having an ungrounded negative terminal connected directly to said cathode and having a positive terminal connected to said focusing electrode, said high voltage unit being electrically insulated from ground, whereby said high voltage unit is above ground potential by the same amount as said certain point.

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