

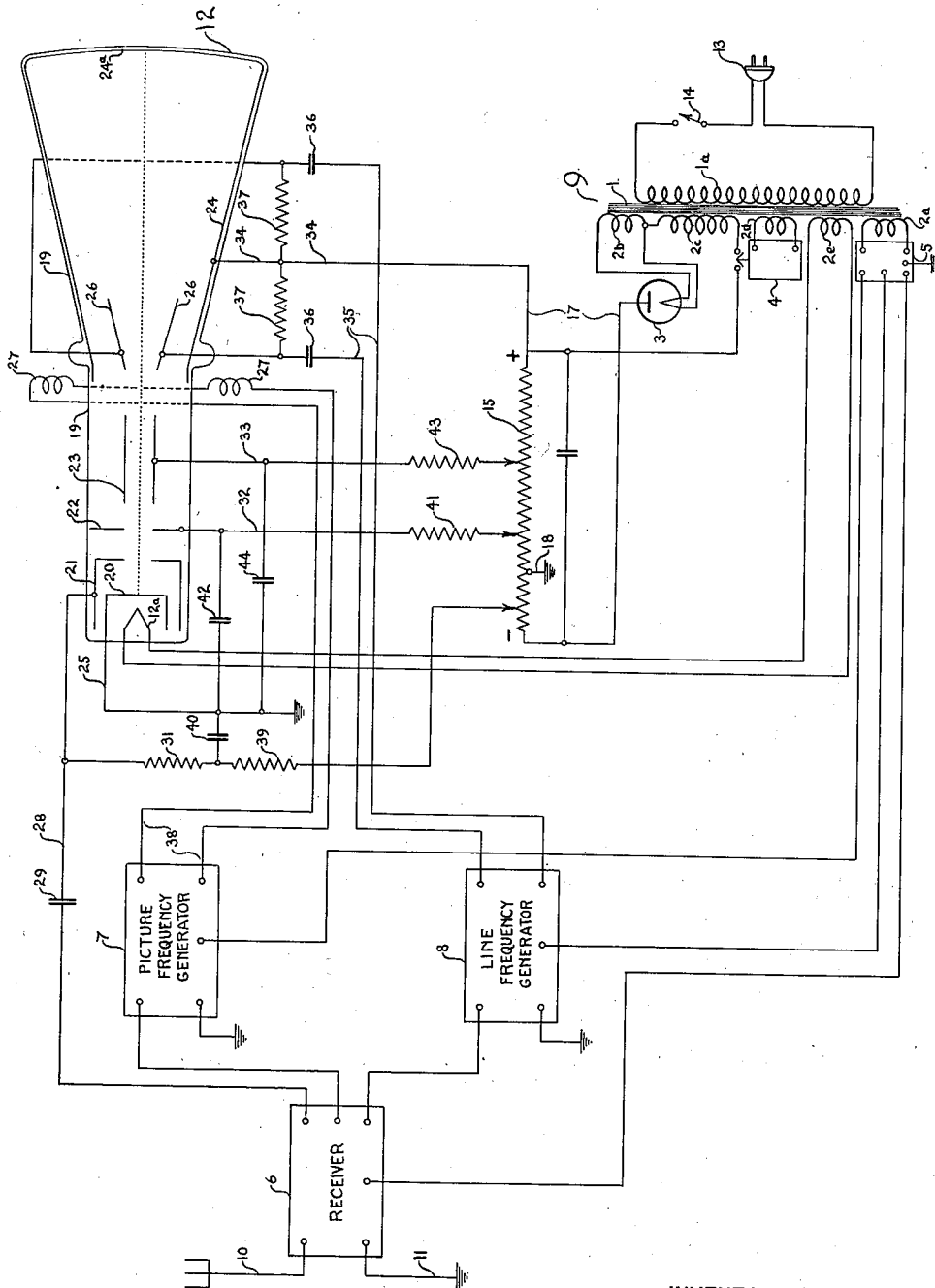
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TELEVISION RECEIVING APPARATUS

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TELEVISION RECEIVING APPARATUS

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This invention relates to control systems for cathode-ray tubes such as are generally employed in television receiving apparatus, and particularly to improved circuit arrangements for controlling the application of operating potentials to the electrodes of such tubes.

It is desirable that the application of operating potentials to the several electrodes of a cathode-ray tube be effected by a single switching operation. Such an arrangement is particularly desirable in connection with television receiving apparatus consisting of a plurality of component units which receive power from a single line, so that a minimum number of controls for the apparatus will be needed. This arrangement, however, gives rise to certain problems, due to undesirable transient effects which tend to arise subsequent to the switching operation and before all the electrodes or component parts of the apparatus have reached their normal operating potentials or conditions. More particularly, it is ordinarily necessary to employ a large time-constant filter circuit in connection with the normally negatively biased main or video control grid of the cathode-ray tube, for isolation purposes; that is, in order to prevent hum and other undesirable power supply reactions from modulating the electron beam of the tube. Such a filter circuit introduces a time delay in the application of the negative bias to the control grid after the single switching operation necessary to initiate operation of the system. Also a delay in the application of the negative bias to the control electrode may be introduced by the video frequency input circuit which is coupled thereto.

Since the application of normal operating potentials to the tube electrodes is usually delayed until the cathode reaches normal operating temperature, and since positive potentials are ordinarily applied to the normally positively charged electrodes of the tube without further delay, the additional time delay, described above, in the application of negative bias to the main control grid may permit a momentary impingement of the electron beam in full intensity upon the fluorescent screen at the end of the tube, with the possible result of permanent damage to the tube and, in any event, of a light flash which is quite objectionable to the eye.

It is, therefore, an object of the present invention to provide an arrangement for preventing the impingement of the electron beam of a cathode-ray tube upon the screen thereof with sufficient intensity to produce undesirable effects, upon initiation of the operation of the tube,

In accordance with the present invention, the aforementioned undesirable effects are prevented by the provision of a time delay circuit or circuits in operative relation with one or more of the normally positively charged electrodes of the tube. In a preferred embodiment of the invention, the delay circuits, each comprising a resistance and a condenser, are connected in the operating potential supply leads of the second grid and first anode of the tube, which electrodes exert considerable control on the intensity of the beam. The elements of the time delay circuits for these two normally positively biased electrodes are proportioned to provide time delays therefor which are of the same order as the time delay in the application of negative biasing potential on the main control grid, introduced by its isolating circuit as well as by the video coupling circuit. The electron beam intensity is thus prevented, upon initial application of the operating potentials to the control electrodes of the tube, from becoming momentarily sufficiently great to have any of the described undesirable effects.

For a better understanding of my invention, together with other and further objects thereof, reference is had to the following detailed description of a preferred embodiment of the invention, taken in connection with the accompanying drawing, and its scope will be pointed out in the appended claims.

The single figure of the drawing is a circuit diagram, partly schematic, of a complete television receiving system embodying my invention.

Referring now to the drawing, the television system illustrated comprises a receiver, indicated schematically at 6, connected to an antenna and ground system 10—11. The receiver 6 will be understood to include a sound-radio selecting, amplifying, detecting and reproducing unit, which may be of a conventional type, and a television selecting, amplifying and detecting unit, which may also be of any well-known type. The system includes also a picture frequency generator 7 and a line frequency generator 8, connected for synchronization to the television unit of the receiver in the usual manner, and a cathode-ray tube 12, or similar scanning device, which is connected to the generators 7 and 8 and to the receiver 6 in a manner presently to be described.

Power supply means, indicated generally by the numeral 9, is provided for supplying operating potentials to the various units of the system and the electrodes of the cathode-ray tube 12.

The power supply means may comprise a main power transformer 1 including a primary winding 1a and a plurality of secondary windings 2a-2e. The primary winding is preferably adapted for connection to an alternating-current power line by a plug 13 through a control switch 14. The secondary winding 2a is connected to a suitable power supply unit 5, which will be understood to include conventional rectifying and filtering apparatus, for providing operating potentials to the receiver 6 and generators 7 and 8. Secondary windings 2b and 2c are connected, in the usual manner, to the cathode heating and plate circuits, respectively, of a mercury vapor or other gaseous rectifier 3, from which direct-current potentials are applied across a voltage divider 15. In order to insure proper operation of the system, a time delay device 4, of any suitable well-known type, is preferably included in the rectifier circuit and energized from the secondary winding 2d. Operating current is supplied to the cathode heater 12a of the cathode-ray tube by means of the secondary winding 2e. The voltage divider 15 is grounded at 18 and serves to provide proper operating potentials for the several electrodes of the tube 12.

The cathode-ray tube 12 comprises the usual envelope 19 containing a cathode 20, a main or video control grid 21, a second grid 22, a first anode 23, a second anode 24 and the usual fluorescent screen 24a. Line frequency electrostatic deflecting or scanning plates 26 are disposed within the tube 12 and picture frequency electromagnetic deflecting or scanning coils 27 are disposed at opposite sides of the tube, producing a magnetic field for deflecting the beam in a direction normal to the direction of deflection of the beam by the electrostatic field of the plates 26. The cathode 20 is connected to ground through conductor 25. Video frequencies are impressed on the main control grid 21 from the receiver 6 through conductor 28 and a coupling condenser 29. A negative biasing potential is applied to the control grid 21 through resistors 31 and 39 from a suitable point on the divider 15. Positive potentials are applied to the second grid 22, the first anode 23 and the second anode 24 by conductors 32, 33 and 34, respectively, which connect these electrodes to appropriate points on the divider 15.

The line frequency scanning voltages are supplied from the generator 8 to the scanning plates 26 through conductors 35 and suitable direct-current blocking condensers 36, the same biasing potential as is applied to the second anode 24 being supplied also to these plates through conductor 34 and resistors 37. Picture frequency scanning currents are supplied from the picture frequency generator 7 to the coils 27 through conductors 38.

The general operation of the system thus far described is conventional. Briefly, when the switch 14 is closed, operating potentials are supplied to the receiver 6 and generators 7 and 8 through the medium of the unit 5; operating current for the heater 12a is supplied from the winding 2e, and operating potentials for the cathode and anodes of the tube 12 are supplied through the rectifier 3 and voltage divider 15. By virtue of the time delay action of the device 4, the application of high potentials to the anode of the rectifier 3 is delayed until after the rectifier cathode is heated sufficiently to prevent damage to the tube, as well understood in the art. As a consequence of this action the application of po-

tentials to the electrodes of the cathode-ray tube 12 is delayed until its cathode has reached its normal operating temperature. An electron beam is then emitted from the cathode and its intensity is modulated or controlled by the grid 21 in accordance with the video frequency supplied from the receiver 6. The second grid 22 serves to control the average intensity of the beam, while the first anode 23 co-operates with the second anode 24 to accelerate and focus the electron beam. The plates 26 and coils 27 serve to deflect the beam in proper synchronism, according to the frequencies supplied by the line frequency and picture frequency generators, so that the beam impinges upon and scans the fluorescent screen 24a to reproduce a received picture in the well-known manner.

Referring now to the circuit elements more directly involved in the present invention, it has been found necessary, in order to isolate the control grid 21 for the purpose of preventing modulation of the beam by hum and other undesirable power supply reactions, to provide in the biasing connection to the power supply a filtering circuit of relatively large time constant. This filtering circuit comprising an isolating resistance 39 and a by-pass condenser 40 to the cathode, which is grounded as shown. The resistance 39 and condenser 40 are proportioned to provide a time constant sufficiently great to suppress the undesirable power supply reactions above mentioned.

The presence of this filter circuit results in a certain delay in the application of the negative grid bias to the grid 21 upon closing the switch 14 and the operation of time delay device 4 to place the tube 12 in condition for picture reproduction. It will be noted also that, in the operation of the system, the condenser 29 and the resistance 31 of the video coupling circuit may delay the application of the grid bias to a certain extent.

With the arrangement so far described, it will be seen that, upon the closing of the switch 14 to initiate operation of the system, the heater 12a and the cathode 20 will be brought to operating temperature after a short interval and positive potentials will thereafter be applied simultaneously to all of the positive electrodes 22, 23 and 24. However, the application of the negative biasing potential to the grid 21 will be delayed for an appreciable interval, as described above. Under these conditions the electron beam would momentarily impinge upon the fluorescent screen of the tube in full intensity, resulting in possible permanent damage to the tube or, in any event, in creating a light flash objectionable to the eye.

In order to compensate for the delay in application of the negative bias to the control grid and to eliminate the undesirable effects mentioned, there is provided a time delay circuit in connection with one or more of the normally positively charged electrodes of the tube. Preferably, a time delay circuit is provided in connection with the second grid 22, which grid has a substantial effect upon the intensity of the beam. This time delay circuit comprises an isolating resistance 41 and a by-pass condenser 42 to the cathode. Further compensating delay circuits may be provided in connection with one or both of the other normally positively charged electrodes 23 and 24. For example, as shown, a time delay circuit for the electrode 23 comprises an isolating resistance 43 and a by-pass condenser 44 to the cathode.

The elements of each of the compensating delay circuits are so proportioned as to impart thereto a time constant which is of the same order as, and preferably greater than, the time constant of the filter circuit included in the biasing connection of the control grid 21, and also preferably sufficiently large to take care of any additional delay occasioned by the resistance 31 and the condenser 29 of the video coupling circuit. By virtue of this delay in the application of the positive potentials to one or more electrodes of the tube 12, the electron beam is prevented from reaching full or abnormal intensity during the time immediately after the switching operation and the operation of the time delay device 4 to initiate operation of the system, and before the negative potential applied to the control grid builds up to its normal value, thereby obviating the undesirable results discussed above.

While I have described what I at present consider the preferred embodiment of my invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from my invention, and I, therefore, aim in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of my invention.

What is claimed is:

1. An electric circuit arrangement for controlling an electron beam of a cathode-ray tube and for preventing said beam from becoming momentarily sufficiently intense to have undesirable effects by reason of the delayed application of a negative bias potential to a control electrode of said tube, comprising means including a single manual control means for applying a negative bias potential to said control electrode and a positive bias potential to a second control electrode, means tending to delay the application of said negative bias to said first control electrode, and means for automatically delaying the application of a positive potential to the said second control electrode for a period at least as great as the delay in said application of negative potential, to limit thereby the intensity of the beam until said negative potential reaches its normal value.

2. An electric circuit arrangement for controlling an electron beam of a cathode-ray tube and for preventing said beam from becoming momentarily sufficiently great to have undesirable effects by reason of the delayed application of a negative bias potential to a control electrode of said tube, comprising individual circuits for applying a negative bias potential to said control electrode and a positive bias potential to a second control electrode, a single manual means for controlling the energization of said circuits, means tending to delay the application of said negative bias potential to said first control electrode, and a time delay circuit connected in circuit with said positive biasing circuit for automatically delaying the application of positive potential to said second control electrode for a period at least as great as said delay of application of negative potential, to limit thereby the intensity of the beam until said negative potential reaches its normal value.

3. In a television receiving system, a cathode-ray tube having a plurality of electrodes including a normally negatively biased first electrode and a normally positively biased second electrode, a single manual control means for controlling the application of operating potentials to said electrodes, means delaying the application of negative

potential to said first electrode, and means automatically delaying the application of positive potential to said second electrode for a period at least as great as said delay of the application of negative potential.

4. In a television receiving system, a cathode-ray tube having a plurality of electrodes including a normally negatively biased first control grid and a plurality of normally positively biased electrodes, a single means for applying the operating potentials to said electrodes, means delaying the application of negative potential to said control grid, and means automatically delaying the application of normal positive potential to one or more of said normally positively biased electrodes for a period greater than the delay of the application of normal negative potential.

5. In a television receiving system, a cathode-ray tube having a plurality of electrodes including a normally negatively biased control grid and a normally positively biased electrode, a single manual means for controlling the application of operating potentials to said electrodes, a time delay circuit including a resistance and a condenser connected in circuit with said control grid, and a second time delay circuit including a resistance and a condenser connected in circuit with said normally positively biased electrode and having a time constant at least as great as the time constant of the first said delay circuit.

6. In a television system, a cathode-ray tube having a plurality of electrodes including a control grid normally negatively biased relative to said cathode and a normally positively biased electrode, a power source, means for effecting the application of operating potentials to said electrodes including a voltage divider, switching means for controlling the energization of said divider from said source and connections from said electrodes to appropriate points on said divider, means delaying application of negative potential to said control grid including an isolating resistance and a by-pass condenser in circuit therewith and means delaying the application of positive potential to said normally positively biased electrode including an isolating resistance and a by-pass condenser in circuit therewith, the electrical values of the last said delay means being proportioned to provide a time constant therefor at least as great as the time constant of the first said delay means.

7. In combination, a cathode-ray tube including a cathode, a control grid and a plurality of anodes, a power source, means including a single switching means for controlling the application of potentials from said source to said electrodes and establishing, relative to said cathode, a negative biasing potential on said control grid and positive operating potentials on said anodes, electrical means delaying the establishment of said negative bias on said grid and compensating electrical means for delaying, for a period at least as great as the period of the first said delay, the establishment of a positive operating potential on at least one of said anodes.

8. In combination, a cathode-ray tube including a cathode, a control grid and a plurality of anodes, a power source, means including a single switching means for controlling the application of potentials from said source to said electrodes and establishing, relative to said cathode, a negative biasing potential on said control grid and positive operating potentials on said anodes, electrical means delaying the establishment of said negative bias on said grid and compensating

electrical means for delaying, for a period at least as great as the period of the first said delay, the establishment of a positive operating potential on at least one of said anodes, the first said electrical means comprising a resistance and a condenser having a predetermined time constant and the second said electrical means comprising a resistance and condenser having a time constant at least as great as the first said time constant.

9. In combination, an electrical apparatus, a power source, a distributing network including a plurality of separate circuits for individually supplying a plurality of separate unidirectional potentials for operating said apparatus, means including a single manual means for simultaneously energizing said plurality of circuits from said source, each of said circuits including a resistor and a condenser having a predetermined time constant of such magnitude that said circuits and said means cooperate to develop maximum unidirectional potentials for operating said apparatus at different times in each of said circuits.

10. In combination, a cathode-ray tube having a cathode heater and a plurality of electrodes, a potential divider, means including main switching means and a source of power for supplying alternating current to said heater and unidirectional potential across said potential divider, a plurality of connections for applying positive and negative potentials from said potential divider to said electrodes, means delaying the application of unidirectional potential across said potential divider for a predetermined period after the closing of said main switching means, isolating means in the connection for applying negative potential from said potential divider to one of said electrodes providing a delay in the application of said negative potential, and means in the connection for applying positive potential to at least one other of said electrodes for automatically delaying the application of said positive potential for a period of the order of the period of said delay in the application of said negative potential.

11. The method of controlling the electron beam of a cathode-ray tube having a first control electrode and a second control electrode and including potential delaying means in circuit with said first control electrode, and preventing said beam from becoming momentarily sufficiently intense to have undesirable effects by reason of the delayed application of a negative bias to said first control electrode which consists in applying a negative bias to said first control electrode and a positive bias to said second control electrode, and delaying the application of said positive bias to said second control electrode for a period greater than the delay of application of negative potential, thereby to limit the intensity of said beam until said negative potential has reached its normal value.

12. The method of applying positive and negative potentials to electrodes of a cathode-ray tube, which comprises simultaneously initiating the application of said potentials, delaying the application of said negative potential for a predetermined period subsequent to said initiation and automatically delaying the application of said positive potential for a predetermined period at least as great as the period of the delay of application of negative potential.

13. In combination, a tube provided with a screen and with means for developing a ray of electrons and directing the ray at said screen, said means including a control electrode, means for deflecting said ray, means for supplying a biasing potential to said control electrode to substantially cut off said ray, means for supplying an operating potential to said tube to accelerate the electrons toward said screen, and means common with respect to said third-named and said fourth-named means for supplying the same with operating power, said third-named means being characterized by the fact that upon application of the operating power it has a time constant of operation substantially less than the time constant of operation of said fourth-named means.

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