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ELECTRICAL PROTECTION OF CATHODE-RAY TUBE SCREENS

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FIG. 1

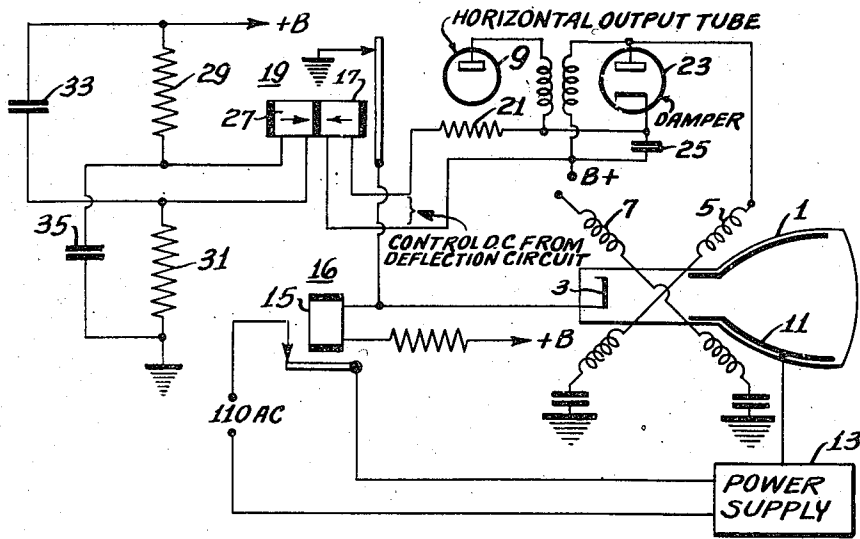
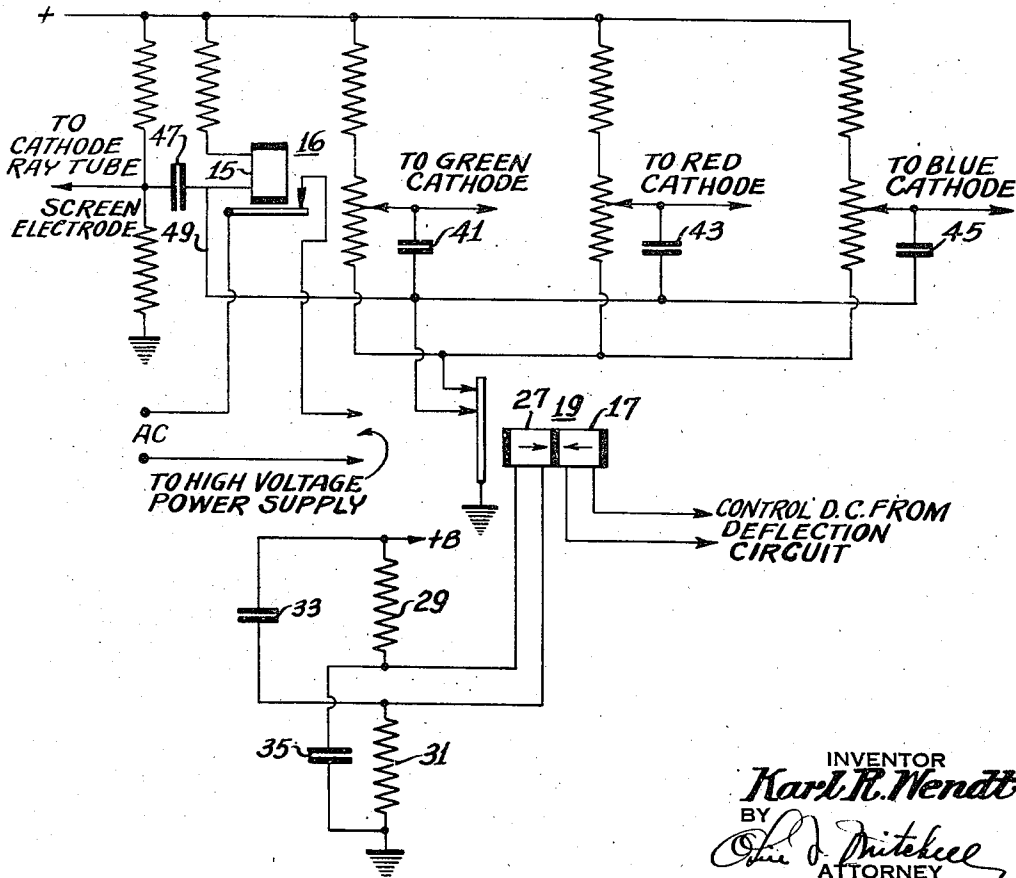


FIG. 2



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ELECTRICAL PROTECTION OF CATHODE-
RAY TUBE SCREENSKarl R. Wendt, Hightstown, N. J., assignor to
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10 Claims. (Cl. 315—20)

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This invention relates to electrical circuit protection and more particularly to the protection of cathode ray tube screens.

It is quite well appreciated in the television art that the electron beam of a cathode ray tube normally has enough energy to cause damage to the tube screen if it is allowed to remain at rest on the tube screen if, for example, the beam deflection system fails.

Electrical circuits for protecting kinescope screens from burning by failure of deflection have long been used. However, they have not been electrically fast enough to protect the screen in all cases.

According to this invention, there is disclosed a novel circuit arrangement which is exceptionally fast and which relies for its power upon stored charges, thus insuring positive extinction of the beam regardless of the condition of any of the normal power supplies.

A primary object of the invention is to provide a means for protecting kinescope screens from burns resulting from loss of deflection due to accident, deflection power loss or normal shutdown in cases where the second anode voltage may decay more slowly than the deflection, and to provide circuits especially adapted to protect three tubes as used in simultaneous color receivers.

Other and incidental objects of the invention will be apparent to those skilled in the art from a reading of the following specification and an inspection of the accompanying drawing in which:

Figure 1 illustrates by circuit and block diagram one form of this invention; and

Figure 2 shows by circuit diagram another form of this invention.

In Figure 1, there is shown a cathode ray tube or image producing device 1 equipped with a cathode ray gun structure including a cathode 3 for developing a beam of electrons. A horizontal or line deflecting coil 5 and a vertical or field deflecting coil 7 are provided in the conventional manner. Coils 5 and 7 are provided with deflection signal energy by a deflection signal generator of the usual type employing a horizontal output tube 9. Although not shown in detail here, the deflection and control circuits may be of the type shown and described in a U. S. patent to Tolson et al., No. 2,101,520, granted December 17, 1937, or in the U. S. patent to Vance, No. 2,137,039, granted November 15, 1938.

Synchronization may be maintained in accordance with any of the well known procedures.

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Circuit arrangements for producing images by controlling the intensity of the electron beam in accordance with a video signal are well shown and described in the art. For example, signals obtained from a television receiver arranged generally in the manner shown and described in the U. S. reissue patent to Carlson, No. Re. 20,700, granted April 19, 1938, may be employed. It is not intended, however, that the practice of this invention should be limited to its employment therewith.

The generation of the cathode ray beam requires that a relatively high potential be applied to second anode 11. This high voltage is supplied by power supply 13 which obtains its energy from a source of commercial power through contacts of relay 16.

In addition to supplying deflection energy for deflection coils 5 and 7, the deflection signal generator also supplies operating current to winding 17 of a polarized relay 19 through a resistance element 21 and the diode damper tube 23. A condenser 25 is included in the circuit. It will be seen that if deflection coil 5 does not receive energy, winding 17 will not be energized.

Another winding 27 of relay 19 obtains its energizing current from a B+ source. The B+ source may, for example, be an auxiliary source or be that employed in the associated circuit.

Winding 27 of relay 19 is connected to the B+ source through and between two resistors 29 and 31. There is also connected in the circuit of winding 27 a condenser 33 which is connected across the series circuit of resistor 29 and winding 27. Condenser 35 is connected across the series circuit including winding 27 and resistor 31.

As applied to the horizontal deflection, for example, this invention consists of a circuit which utilizes the balanced or polarized relay 19, such as a micro-positioner, wherein the one coil 27 is connected to the B+ supply in the direction to maintain the relay open, as indicated by the arrow. The coil 17 receives current from a source which is present only when the horizontal deflection circuit is operating, such as, for example, the power feedback voltage, or the damper tube rectified voltage. The coil 17 is connected so as to maintain the relay closed, as indicated by the arrow, the current being set to such a value that the effect of the coil 27 is completely overcome during proper operation of the circuit and the relay under normal conditions is closed. Should the current obtained from the deflection system be reduced beyond a critical value due to inadequate deflection, the coil 27 will open the relay.

In the case of the power feedback circuit, the current through the coil 17 will actually reverse with low or no deflection, thus further insuring that the relay will open. In the case of B+ failure, such operation is neither positive nor fast enough. Therefore, in addition to the resistors mentioned in series with the first coil, two capacitors 33 and 35 are provided, connected as shown in Figure 1.

The voltage drop across coil 27 due to current flow through resistances 29 and 31 will be as shown. It will be seen that any drop in the value of B+ will be transmitted to the negative end of coil 27 through condenser 33, and the negative end of the coil 27 will be driven further negative. The positive end of the coil 27, however, will be maintained at its former value by capacitor 35. Thus a decrease in B+ will cause an increase in current through coil 27, the power being supplied by the charge stored in condensers 33 and 35. The relay 19 is therefore quickly opened, and maintained open long enough for other circuits to disconnect the second anode 11 and allow its voltage to fall to a safe value.

This invention also includes novel ways of utilizing such a fast operating relay. In the past, the relay has been used to open the kinescope cathode circuit. An improvement over such a circuit is shown in Figure 1, in which the kinescope cathode 3 is grounded by the relay 19 during normal operation. The kinescope cathode 3 is also connected through relay 16 to B+. When the relay 19 contacts are closed, the kinescope cathode 3 is not only grounded, but relay 16 is also operated. Relay 16 may be used to operate the second anode power supply, as shown. When relay 19 opens, relay 16 also opens, and the kinescope cathode 3 rises to B+ potential through its connection through relay 16, thus extinguishing the kinescope beam.

When three kinescopes are operated together, as in the simultaneous color system, the cathodes may be tied together and operated as described for Figure 1. However, it is usually convenient to apply bias to the separate kinescopes by varying their cathode potentials. This is shown in Figure 2.

In order to avoid the use of three pairs of relay contacts, it is necessary to include the relay in the common ground circuit, as shown in Figure 2. In order to avoid a condition where there will be little or no bias on the kinescope, when the charge on condensers 41, 43 and 45 has disappeared, a high impedance divider supplies the screen voltage for the three tubes as shown. The screen bypass condenser 47 is connected to lead 49, which is connected to the arm of relay 19 through a set of contacts. When relay 19 opens, lead 49 goes to approximately B+ by virtue of the connection through winding 15 of relay 16 and the cathodes are elevated above B+ by the stored charges on condensers 41, 43 and 45. Condenser 47 also has a stored charge, which, during the transient after relay 19 opens, elevates the screen voltage above B+. This is immaterial since condensers 41, 43 and 45 thoroughly cut off the kinescopes. After equilibrium is reached, lead 49 is at B+ and the screen potential returns to its normal value. When normal deflection is restored and relay 19 closes, the kinescope cathodes will go to ground potential, due to the lack of charge on condensers 41, 43 and 45, and the kinescopes will be at or near zero bias. The charge on condenser 47, however, will drive the screen voltage negative, thus cutting off the kinescopes until normal bias

returns. Contacts of relay 27 may be used to remove the main discharge path for condensers 41, 43 and 45, thus lengthening the time that these capacitors bias the kinescopes off, without making them of unduly large capacity.

It will thus be seen that by practicing this invention, a dependable and fast acting protection for the cathode ray tube screens will be provided.

Having thus described the invention, what is claimed is:

1. A cathode ray tube screen protective arrangement for a system employing high voltage energy and deflection energy for control of a cathode ray, a source of B+ potential, said cathode ray tube screen having a cathode associated therewith, said cathode ray tube screen protective arrangement comprising in combination a first and a second relay, each having switching contacts, the first of said relays being of the polarized type having a pair of energizing windings polarized to neutralize the effect of each other upon the application of current to both of the said pair of windings, the second of said relays having an energizing winding, the energizing winding of said second relay connected between said cathode and said source of B+ potential, the switching contacts of said second relay being connected to interrupt said high voltage energy upon a sizeable reduction in said B+ potential, one of the windings of said first relay being connected to receive a portion of said deflection energy, the other of the windings of said first relay being connected to said source of B+ potential, and said cathode connected to a reference potential through the switching contacts of said first relay.

2. A cathode ray tube screen protective arrangement for a television system employing high voltage energy and deflection energy for control of a cathode ray of a cathode ray tube and wherein said cathode ray tube has a cathode, said cathode ray tube screen protective arrangement comprising in combination a first and a second relay, each having switching contacts, the first of said relays being of the polarized type having a pair of energizing windings to neutralize the effect of each other upon the application of current to both of the said pair of windings, the second of said relays having an energizing winding, the energizing winding of said second relay connected between said cathode and said source of B+ potential through a resistor, the switching contacts of said second relay being connected to interrupt said high voltage energy upon a sizeable reduction in said B+ potential, one of the windings of said first relay being connected to receive a direct current portion of said deflection energy, the other of the windings of said first relay being connected to said source of B+ potential through a resistor, and said cathode connected to a reference potential through the switching contacts of said first relay.

3. A cathode ray tube screen protective arrangement for a television system employing a high voltage energy and deflection energy for control of a cathode ray of a cathode ray tube and wherein said cathode ray tube has a cathode, said cathode ray tube screen protective arrangement comprising in combination a first and a second relay, each having switching contacts normally closed during proper operation of the system, the first of said relays being of the polarized type having a pair of energizing windings to neutralize the effect of each other upon the application of current to both of the said pair of windings, the second of said relays having an

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energizing winding, the energizing winding of said second relay connected between said cathode and said source of B+ potential through a resistor, the switching contacts of said second relay being connected to interrupt said high voltage energy upon a sizeable reduction in said B+ potential, one of the windings of said first relay being connected to receive a portion of said deflection energy through an electrical rectifier, the other of the windings of said first relay being connected to said source of B+ potential through a resistor, and said cathode connected to a reference potential through the switching contacts of said first relay.

4. A cathode ray tube screen protective arrangement of the type suitable for a television system employing high voltage energy and deflection energy for control of a cathode ray of a cathode ray tube and wherein said cathode ray tube has a cathode, said cathode ray tube screen protective arrangement comprising in combination a first and a second relay, each having switching contacts normally closed during proper operation of the system, the first of said relays being of the polarized type having a pair of energizing windings wound to neutralize the effect of each other upon the application of current to both of the said pair of windings, the second of said relays having an energizing winding, the energizing winding of said second relay connected between said cathode and said source of B+ potential through a resistor, the switching contacts of said second relay being connected to interrupt said high voltage energy upon a failure of said B+ potential, one of the windings of said first relay being connected to receive a portion of said deflection energy, the other of the windings of said first relay being connected to said source of B+ potential through and between a pair of resistance elements, a first capacity connected across the series circuit involving one of said resistance elements and said other winding, and a second capacity connected across the series circuit involving the other of said resistance elements and said other winding, and said cathode connected to a reference potential through the switching contacts of said first relay.

5. A cathode ray tube screen protective arrangement for a television system employing high voltage energy and deflection energy for control of a cathode ray tube cathode ray and wherein said cathode ray tube has a cathode, said cathode ray tube screen protective arrangement comprising in combination a first and a second relay, each having switching contacts normally closed during proper operation of the system, the first of said relays being of the polarized type having a first and a second energizing winding which are wound to neutralize the effect of each other upon the application of current to both of the said windings, the second of said relays having an energizing winding, the energizing winding of said second relay connected between said cathode and said source of B+ potential through a resistor, the switching contacts of said second relay being connected to interrupt said high voltage energy upon a reduction in said B+ potential, the first of the windings of said first relay connected to receive a portion of said deflection energy, the second of the windings of said first relay being connected to said source of B+ potential through and between a pair of resistance elements, a first capacity connected across the series circuit involving one of said resistance elements and said second winding, and a second capacity connected

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across the series circuit involving the other of said resistance elements and said second winding, and said cathode connected to a reference potential through the switching contacts of said first relay.

6. A cathode ray tube screen protective arrangement for a color television system employing high voltage energy and deflection energy for control of a cathode ray, a source of B+ potential, and having a plurality of cathode ray tubes, each having a cathode, said cathode ray tube screen protective arrangement comprising in combination a first and a second relay, each having switching contacts, the first of said relays being of the polarized type having a first and a second energizing winding polarized to neutralize the effect of each other upon the application of current to both of the said windings, the second of said relays having an energizing winding, the energizing winding of said second relay connected between said cathodes and said source of B+ potential through a resistor, the switching contacts of said second relay being connected to interrupt said high voltage energy upon a sizeable reduction in said B+ potential, the first winding of said first relay being connected to receive a portion of said deflection energy, the second winding of said first relay being connected to said source of B+ potential through and between a pair of resistance elements, a first capacity connected across the series circuit involving one of said resistance elements and said second winding, and a second capacity connected across the series circuit involving the other of said resistance elements and said second winding, and said cathode connected to a reference potential through the switching contacts of said first relay.

7. A cathode ray tube image screen protective arrangement for a television system employing high voltage energy and deflection energy for control of a cathode ray, a source of B+ potential, said cathode ray tube having a cathode, said cathode ray tube image screen protective arrangement comprising in combination a first and a second relay, each having switching contacts, the first of said relays being of the type having a pair of energizing windings polarized to neutralize the effect of each other upon the application of current to both of the said pair of windings, the second of said relays having an energizing winding, the energizing winding of said second relay connected serially with switching contacts of said first relay, and said source of B+ potential through a resistor, the switching contacts of said second relay being connected to interrupt said high voltage energy upon a sizeable reduction in said B+ potential, a damper tube connected to receive a portion of said deflection energy, one of the windings of said first relay connected to said damper tube to receive a rectified portion of said deflection energy, the other of the windings of said first relay being connected to said source of B+ potential through and between a pair of resistance elements, a first capacity connected across the series circuit involving one of said resistance elements and said other winding, and a second capacity connected across the series circuit involving the other of said resistance elements and said other windings, and said cathode connected to a reference potential through the switching contacts of said first relay.

8. A cathode ray tube image screen protective arrangement for a television system employing high voltage energy and deflection energy for control of a cathode ray, a source of B+ poten-

tial, said cathode ray tube screen having a cathode, said cathode ray tube image screen protective arrangement comprising in combination a first and a second relay, each having switching contacts, the first of said relays being of the type having a pair of energizing windings polarized to neutralize the effect of each other upon the application of current to both of the said pair of windings, the second of said relays having an energizing winding, the energizing winding of said second relay connected serially with switching contacts of said first relay, and said source of B+ potential through a resistor, the switching contacts of said second relay being connected to interrupt said high voltage energy upon a sizeable reduction in said B+ potential, a damper tube connected to receive a portion of said deflection energy, a resistor, a condenser and an electrical load for said source of B+ potential, a series circuit including one of the windings of said first relay and said resistor, said series circuit connected between said source of B+ potential and said electrical load, said condenser connected in parallel with said series circuit, the other of the windings of said first relay being connected to said source of B+ potential through and between a pair of resistance elements, a first capacity connected across the series circuit involving one of said resistance elements and said other winding, and a second capacity connected across the series circuit involving the other of said resistance elements and said other winding, and said cathode connected to a reference potential through the switching contacts of said first relay.

9. A cathode ray tube image screen protective arrangement for a television system employing high voltage energy and deflection energy for control of a cathode ray, a source of B+ potential, said cathode ray tube screen having a cathode and a screen electrode, said cathode ray tube image screen protective arrangement comprising in combination a first and a second relay, each having switching contacts, the first of said relays being of the type having a pair of energizing windings polarized to neutralize the effect of each other upon the application of current to both of the said pair of windings, the second of said relays having an energizing winding, the energizing winding of said second relay connected serially with switching contacts of said first

relay and said source of B+ potential, a condenser, said condenser connected between said screen electrode and the point of connection between said energizing winding of said second relay and switching contacts of said first relay, the switching contacts of said second relay being connected to interrupt said high voltage energy upon a sizeable reduction in said B+ potential, one of the windings of said first relay being connected to receive a portion of said deflection energy, the other of the windings of said first relay being connected to said source of B+ potential, and said cathode connected to a reference potential through the switching contacts of said first relay.

10. A cathode ray tube image screen protective arrangement for a television system employing high voltage energy and deflection energy for control of a cathode ray, a source of B+ potential, said cathode ray tube screen having a cathode and a screen electrode, said cathode ray tube image screen protective arrangement comprising in combination a first and a second relay, each having switching contacts, the first of said relays being of the type having a pair of energizing windings polarized to neutralize the effect of each other upon the application of current to both of the said pair of windings, the second of said relays having an energizing winding, the energizing winding of said second relay connected serially with switching contacts of said first relay and said source of B+ potential, a condenser, said condenser connected between said screen electrode and the point of connection between said energizing winding of said second relay and switching contacts of said first relay, the switching contacts of said second relay being connected to interrupt said high voltage energy upon a sizeable reduction in said B+ potential, one of the windings of said first relay being connected to receive a portion of said deflection energy, the other of the windings of said first relay being connected to said source of B+ potential, said cathode connected to a reference potential through the switching contacts of said first relay, and said screen electrode connected to said source of B+ potential through a resistive voltage divider.

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No references cited.