

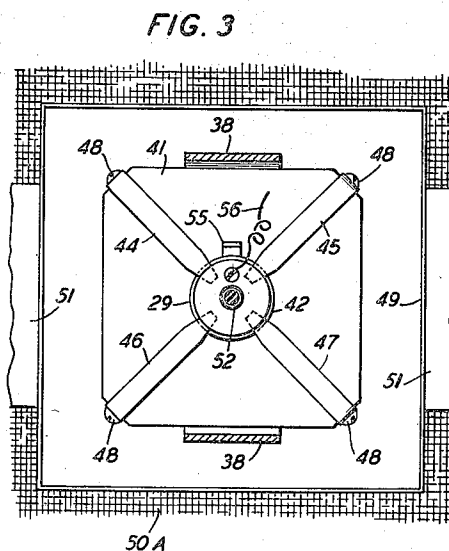
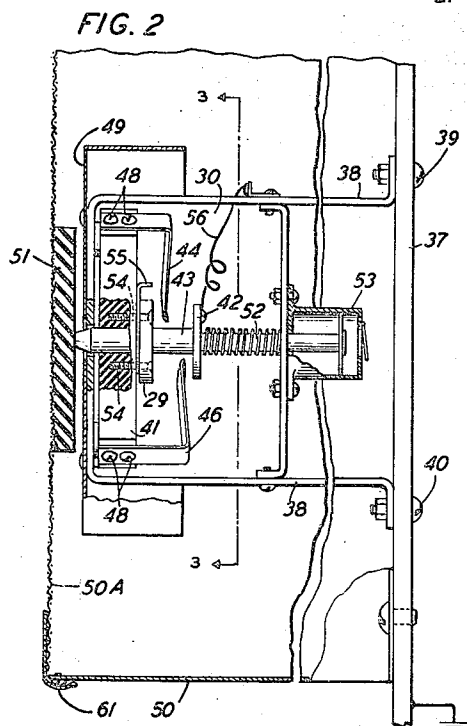
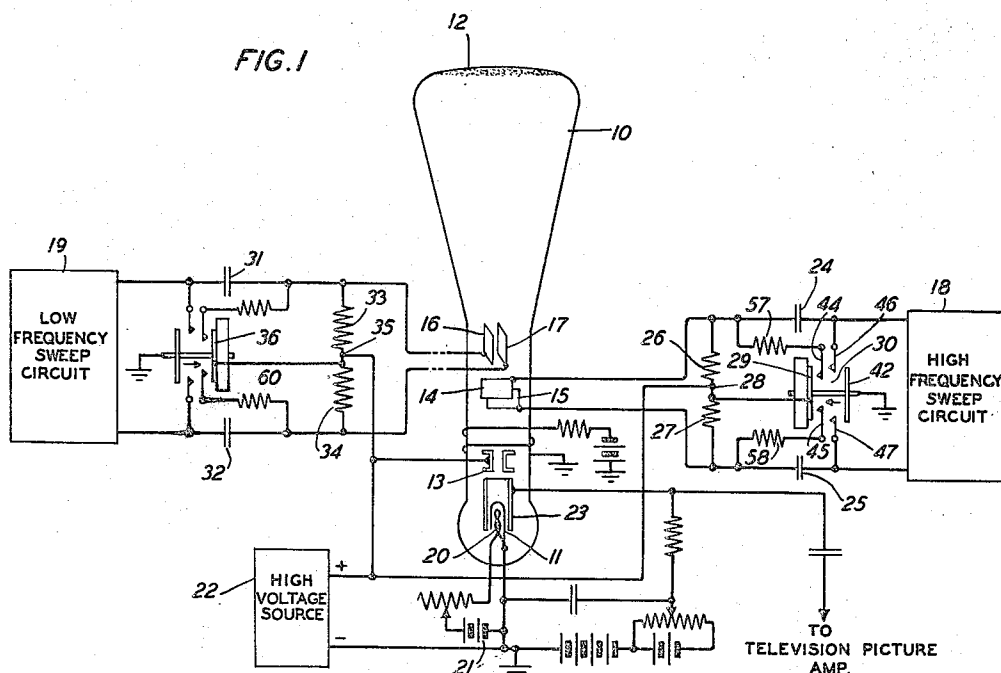
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SAFETY CIRCUITS FOR CATHODE RAY TUBES

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SAFETY CIRCUITS FOR CATHODE RAY  
TUBES

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11 Claims. (Cl. 250—27)

This case relates to safety circuits for cathode ray tubes and more specifically to automatically operated means for preventing accidental shock from high voltages in the tube circuits.

In the operation of cathode ray tubes such as, for example, those used in television, very high voltages are frequently present. For example, high voltages are generally applied to one or more anode members to accelerate to high velocity the cathode ray beam generated therein. Furthermore, high voltages, varying in intensity with respect to time, are frequently applied to the sweep plates of the cathode ray tube to cause the beam to be deflected so that it scans a screen. The sweep circuits for generating these scanning voltages in some arrangements are connected to the deflecting plates through coupling condensers and the voltages across these condensers often reach high values because of the high charges built up across the dielectric members of the condensers. These high charges are frequently a menace to operating personnel because of the danger from high voltages. The trend in cathode ray tube development seems to be, at present, towards even higher anode and sweep circuit voltages than those now used.

It is an object of this invention to provide for the use of high voltages in cathode ray tube circuits without the danger of accidental shock therefrom.

Carrying this object into effect, there is provided in the preferred embodiment of this invention which is herein described by way of example, a contact mechanism which is operated upon the opening of an enclosing container for sequentially applying a ground connection to the sweep circuit terminal of a pair of coupling condensers, discharging these condensers, if necessary through high resistances, and then applying a ground connection to the high potential anode of the cathode ray device. This contact mechanism preferably comprises a stationary disc at anode potential, a grounded movable disc mounted on an insulated rod, and two sets of contacts between the discs which are closed in sequence by the spring-operated movement of the movable disc toward the stationary disc when the cover of the container which normally exerts a force against the switch rod is removed. The first set of contacts is connected to the sweep circuit sides of a pair of coupling condensers and the second set of contacts is connected preferably through high resistances, to the deflecting plate terminals of these condensers. If desired, suitable delay means, such as

a dashpot, may be used to introduce the desired time delay between the closing of the contacts.

The invention will be more readily understood from the following description taken in connection with the accompanying drawing forming a part thereof in which:

Fig. 1 shows an embodiment of this invention applied to a cathode ray tube and its associated circuits;

Fig. 2 is a side view partly in section of the safety device of this invention; and

Fig. 3 is a cross-section view taken along the line 3—3 of Fig. 2.

Referring more particularly to the drawing, Fig. 1 shows a cathode ray device 10, suitable for television purposes, and its associated apparatus and circuits. The cathode ray device 10 comprises a means such as a cathode 11 for generating an electron beam, proper focussing means (not shown) for giving this beam the proper diameter and for accelerating it toward a fluorescent screen 12, an accelerating anode 13, and two sets of deflecting plates 14, 15 and 16, 17 adapted to have sweep potentials of appropriate frequency applied thereto for causing the beam to scan in turn every elemental area of the screen 12. Across the deflecting plates 14 and 15 through appropriate coupling means is connected a sweep circuit 18 which may be of any well-known form, but which preferably is a balanced sweep circuit of the type disclosed in an application of M. W. Baldwin, Jr., Serial No. 98,165, filed August 27, 1936. While this invention will be described for use with balanced sweep circuits, it should be understood that in certain aspects it may be used with unbalanced sweep circuits as well. Across the other set of plates 16 and 17 through appropriate coupling means is connected a sweep circuit 19 which is similar to the sweep circuit 18 except that the frequency of its generated oscillations is different. The frequency of the sweep circuit 18 is that at which the elemental lines of the screen 12 are scanned while the frequency of the circuit 19 is that at which the number of complete frames is scanned. The cathode 11 of the cathode ray device 10 is heated by any suitable means such as a heater 20 receiving current from a suitable source such as the battery 21. The cathode 11 may be placed at ground potential and the high voltage source 22, which preferably is a high voltage rectifier, is connected between the cathode 11 and the accelerating anode 13. Any suitable means, such as the modulating electrode 23, may be used to change the intensity of

the cathode ray beam in accordance with the varying intensity of the image currents transmitted from the transmitting station.

The balanced sweep circuit 18 is preferably connected to the plates 14 and 15 through equal coupling condensers 24 and 25 and equal high resistances 26 and 27 which are connected in series across the plates 14 and 15. The common terminal 28 of the resistances 26 and 27 is connected to the accelerating anode 13 and also to disc 29 of a contact mechanism 30. By means of the balanced sweep circuits 18 and 19 the average of the voltages applied to the plates 14 and 15 will always equal the voltage of the anode 13, thus producing on the screen 12 a pattern which is free from distortion.

The low frequency sweep circuit 19 is connected across the plates 16 and 17 by means of equal coupling condensers 31 and 32 and equal coupling resistances 33 and 34, the common terminal 35 of which is connected to the anode 13 of the cathode ray device 10 and to the disc 36 of a contact mechanism 60 similar to the mechanism 30.

For a more complete description of the similar contact mechanisms 30 and 60 reference will now be made to Figs. 2 and 3. The mechanisms 30 and 60 may be, and preferably are, mounted on a vertical panel 37 which may also act as a support for coupling condensers 24, 25, 31 and 32 and for the cathode ray tube 10 which is preferably supported in a vertical position to minimize the effects of the earth's field.

The mechanism 30 (and similarly the mechanism 60) comprises a supporting strap 38 bent in the form of a square cornered U the open ends of which are connected to the supporting panel 37 by any suitable means such as, for example, screws 39 and 40, an insulating block 41 fastened by any suitable means to the strap 38, stationary disc 29 of conducting material fastened by any suitable means such as screws 54 to the block 41, a movable disc 42 also of conducting material which is mounted on a rod 43 of insulating material, and spring contacts 44, 45, 46 and 47. The contact portions of contacts 44 and 45 are mounted substantially in one vertical plane and the contact portions of contacts 46 and 47 are mounted substantially in a different vertical plane which latter plane is separated from the first plane by a small distance so that the disc 42 as it moves towards the stationary disc 29 does not contact all of these contact members at the same time. The contact members 44, 45, 46 and 47 are supported from the insulating block 41 by any suitable means such as the screws 48. A front cover plate 49, the ends of which may bend inward, is screwed on the insulating block 41.

Enclosing the contact mechanisms 30 and 60 is a container 50 (part only of which is shown) which also may be and preferably is the container for at least a portion of the cathode ray tube and its associated circuits. Container 50, the cover or removable wall 50A of which is in part at least of screen-like material, carries an inner brace member 51 which is adapted when the cover is in place to press against the movable plunger 43 and hold the disc 42 away from contact members 44, 45, 46 and 47 and the disc 29 against the action of a spring 52. A dashpot 53 may be provided so as to retard the return stroke of the plunger 43 by a predetermined amount.

The disc 29 is connected to the lug 55 which

is connected by any suitable means to the common terminal 28 of the high resistances 26 and 27 and also to the accelerating anode 13 of the cathode ray tube 10. Connection is made from the movable disc 42, by means of the pigtail conductor 56, to the frame of the contact mechanism represented by the strap 38, this frame being grounded. Contacts 44 and 45 may be connected by suitable means to the cathode ray tube side of the coupling condensers 24 and 25 through suitable resistances 57 and 58 which may be, if desired, mounted on the strap 38 or on the panel 37. The contacts 46 and 47 may be connected by any suitable means to the sweep circuit side of the coupling condensers 24 and 25. It will be understood that the resistances and capacitances shown associated with the mechanism 30 in Fig. 1 differ from those shown associated with the mechanism 60 in that figure only in the value of their constants. In some cases in the high frequency sweep circuit 18 the resistances 57 and 58 may be unnecessary due to the fact that the condensers 24 and 25 are of relatively low capacity compared to that of the condensers 31 and 32 in the low frequency sweep circuit.

The contact mechanism 30 (and similarly the mechanism 60) operates as follows:

When the cover 50A is moved away from the panel 37, as by unsnapping the snap catch 61, the member 51 is released from the plunger 43 and allows the spring 52 to force the disc 42 towards the disc 29 contacting first the contacts 46 and 47, then the contacts 44 and 45, and finally the disc 29. The dash-pot 53 introduces a desired time delay between these various steps. As the disc 42 is at ground potential it first short-circuits contacts 46 and 47 and places the sweep circuit sides of the coupling condensers 24 and 25 at ground potential. It then contacts the spring contacts 44 and 45 placing them at ground potential and allowing the coupling condensers 24 and 25 to be discharged, the rate of this discharge being determined by the value of the resistances 57 and 58 and the impedance of the high voltage source 22. The disc 42 finally contacts the disc 29 and places the anode 13 of the cathode ray tube 10 at ground potential. As the other side of the high voltage source 22 is also at ground potential, this places a short-circuit across the rectifier. For this reason a rectifier having a high internal resistance should be used to provide the high voltage required.

By means of this contact mechanism the high charges accumulated on the high capacity coupling condensers may be safely dissipated without harm to the attending personnel. The high voltages applied to the sweep plates and to the accelerating anode are also reduced to ground potential when the container enclosing at least a portion of the apparatus is removed. It should be understood that the container 50 is merely shown diagrammatically and may represent any other form of contact mechanism or even a door of a container or room. The apparatus may be so arranged that the moving or removal of the cover 50A operates the contact mechanisms 30 and 60 together or the movement of certain parts of the cover or container operates one or the other of these contact mechanisms. As a further modification, different portions of the cathode ray circuits may be enclosed within different containers.

Other changes may be made without depart-

ing from the spirit of the invention, the scope of which is indicated in the appended claims.

What is claimed is:

1. In combination, a cathode ray device comprising means for generating a beam of electrons, an anode for accelerating said beam, and means for deflecting said beam, coupling condensers connected to said deflecting means, means for enclosing said condensers, and means operable upon the movement of at least a portion of said enclosing means for discharging said condensers and at a predetermined time thereafter for connecting said anode to ground, said last-mentioned means including delayed-action means for delaying the time for connecting said anode to ground.

2. In combination, a cathode ray device comprising means for generating a beam of electrons, an anode for accelerating said beam, and means for deflecting said beam, coupling condensers connected to said deflecting means, a resistance for each condenser, means for enclosing said condensers, and means operable upon the movement of at least a portion of said enclosing means for discharging said condensers through said resistances and at a predetermined time thereafter for connecting said anode to ground.

3. In combination, a cathode ray device comprising a cathode, an anode, and a pair of electrostatic deflecting plates, a sweep circuit for generating a voltage varying with time, means including coupling condensers for connecting said sweep circuit to said deflecting plates, and disabling means for sequentially applying a ground to the sweep circuit terminals of the coupling condensers, discharging the condensers through resistances, and then applying a ground connection to the anode of the cathode ray device.

4. In combination, a cathode ray device comprising a cathode, an anode, and a pair of electrostatic deflecting plates, a sweep circuit for generating a voltage varying with time, means including coupling condensers for connecting said sweep circuit to said deflecting plates, a container for said coupling condensers, and means operable upon the movement of at least a portion of said container for sequentially applying a ground to the sweep circuit terminals of the coupling condensers, discharging the condensers through resistances and then applying a ground connection to the anode of the cathode ray device.

5. In combination, a cathode ray device comprising a cathode, an anode, and a pair of electrostatic deflecting plates, a sweep circuit for generating a voltage varying with time, means including coupling condensers for connecting said sweep circuit to said deflecting plates, and a contact device comprising a stationary conductive element, a movable conductive element, a pair of contacts between said elements, a second pair of contacts between said elements but nearer said stationary element than said first pair of contacts, a container for said coupling condensers for normally holding said elements apart against the action of a spring, means for connecting the movable element to ground, means for connecting the stationary element to the anode of said cathode ray device, means for connecting said first set of contacts to the sweep circuit sides of said coupling condensers, means for connecting said second set of contacts through resistances to the deflecting plate sides of said coupling condensers, means comprising said spring for causing said

movable element to sequentially contact said first pair of contacts, said second pair of contacts, and said stationary element, upon the movement of at least a portion of said container, to thereby sequentially apply a ground to the sweep circuit terminals of the coupling condensers, discharge the condensers through resistances and then apply a ground connection to the anode of the cathode ray device, and a dash-pot for producing time intervals between these sequentially performed operations.

6. In combination, a circuit including a high potential electron discharge device having electrically associated therewith a condenser, a resistance having one terminal connected to one side of said condenser, and a source of voltage having one terminal grounded and the other at a high potential with respect to ground, and means for automatically and sequentially connecting to ground one of the terminals of said condenser, the terminal of said resistance remote from said condenser, and the high potential terminal of said source of voltage.

7. In combination, a cathode ray device comprising means for generating a beam of electrons, an anode for accelerating said beam, and means for deflecting said beam, a coupling condenser connected to said deflecting means, means for enclosing said condenser, and means operable upon the movement of at least a portion of said enclosing means for discharging said condenser and at a predetermined time thereafter for connecting said anode to ground.

8. In combination, a cathode ray device comprising means for generating a beam of electrons, an anode for accelerating said beam, and means for deflecting said beam, coupling condensers connected to said deflecting means, a resistance for each condenser, means for enclosing said condensers, and means operable upon the movement of at least a portion of said enclosing means for discharging said condensers through said resistances and at a predetermined time thereafter for connecting said anode to ground, said last-mentioned means including delayed-action means for delaying the time for connecting said anode to ground.

9. In combination, a cathode ray device comprising a cathode, an anode, and a pair of electrostatic deflecting plates, a sweep circuit for generating a voltage varying with time, means including coupling condensers for connecting said sweep circuit to said deflecting plates, a container for said coupling condensers, means operable upon the movement of at least a portion of said container for sequentially applying a ground to the sweep circuit terminal of the coupling condensers, discharging the condensers through resistances and then applying a ground connection to the anode of a cathode ray device, and means for producing time intervals between these sequentially performed operations.

10. In combination, a cathode ray device comprising a cathode, an anode, and a pair of electrostatic deflecting plates, a sweep circuit for generating a voltage varying with time, means including coupling condensers for connecting said sweep circuit to said deflecting plates, and a contact device comprising a stationary conductive element, a movable conductive element, a pair of contacts between said elements, a second pair of contacts between said elements, a resistance connected to each contact of the second pair of contacts, a container for said coupling condensers, means for connecting the movable element to ground, means for connecting the

stationary element to the anode of said cathode ray device, means for connecting said first set of contacts to the sweep circuit sides of said coupling condensers, means for connecting said second set of contacts through said resistances to the deflecting plate sides of said coupling condensers, means for causing said movable element to sequentially contact said first pair of contacts, said second pair of contacts, and said stationary element, upon the movement of at least a portion of said container, to thereby sequentially apply a ground to the sweep circuit terminals of the coupling condensers, discharge the condensers through resistances and then apply a ground connection to the anode of the cathode ray device.

11. In combination, a circuit including a condenser, a resistance having one of its two terminals connected to one of the two terminals of said condenser, and means for applying to both terminals of said condenser potentials which are

free to vary with respect to a point of fixed potential and which are of such magnitudes that the average potential of the terminal of said condenser to which the resistance is connected is farther removed from said fixed potential than is the average potential of the other terminal of said condenser and so that there is ordinarily a relatively high difference of potential between the terminals of said condenser, and means for sequentially connecting to a point of said fixed potential first the terminal of said condenser not connected to said resistance and then the terminal of said resistance remote from said condenser, whereby said condenser is discharged through said resistance with out allowing the relatively high average potential of the terminal of said condenser to which the resistance is connected to affect the potential of the other terminal of said condenser.

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