

Power Supply

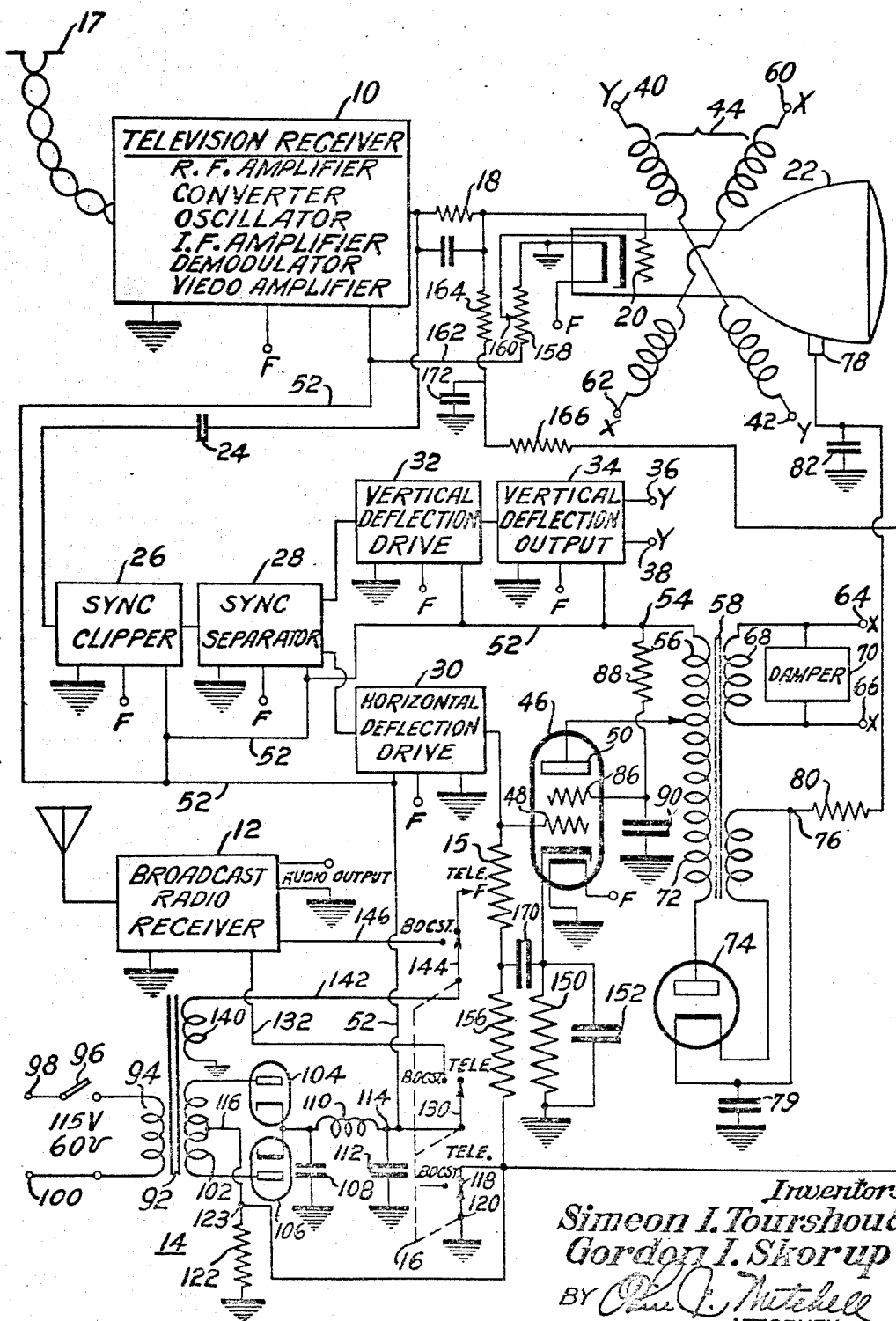
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TELEVISION-TO-RADIO VOLTAGE CHANGING SYSTEM

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TELEVISION-TO-RADIO VOLTAGE
CHANGING SYSTEM

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The present invention relates to power supply distribution systems and pertains more directly to a combined controlled power distribution system and disabling system for electrical equipment.

In more particularity, although not necessarily limited thereto, the present invention provides a power supply switching system eminently suited for application in combination television receivers wherein one or more electrical wave communicating circuits in addition to the television receiving system are separately and selectively operated from a common power supply system.

As is well known to those familiar with the art forming the background of the present invention, combination television receivers of the type, for example, providing television image reproduction as well as AM and FM reception and reproduction are becoming more and more prevalent as the art progresses. In such combination receivers for purpose of economy, it is often desirable to employ a single power supply unit which will supply operating energy for the respective television, AM and FM broadcast receiver circuits, which are in turn selectively activated by a selector switch connected with the power supply. It has been found desirable in the case of certain television deflection circuits requiring considerable plate and screen operating potential and current, to conditionally actuate such circuits by means of controlling the filament potential applied to the related thermoemissive tubes instead of controlling the application of anode and screen polarizing potentials thereto. Such arrangements permit certain economies in the construction and characteristics of the electrical switches used in distributing the power supply filamentary energy, inasmuch as switching of low voltage circuits is generally more easily accomplished in such arrangements than switching of the high voltage circuits.

In the case where only filamentary switching is used for conditionally disabling television circuits as, for example, when it is desired to operate only the AM or FM broadcast receiver portion of the combination receiver, it is commonly observed that since the plate and screen supply potentials to such circuits maintain subsequent to the discontinuance of filamentary current supply, operation of the electronic circuits also maintains to a certain extent during the period required for the filaments to cool sufficiently to destroy electron emission from the respective electron tube cathodes. Accordingly, electronic circuits providing accelerating electrode poten-

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tials for cathode ray tubes may, during a brief period following the removal of filament power to the electron tubes in the high voltage generating circuits, continue to apply to the cathode ray image reproducing tube sufficient potential to create a visible fluorescent action on the reproducing screen.

Therefore, in such combination television circuits, switching from television to AM or FM does not normally result in immediate discontinuance of visible traces on the face of the image reproducing tube but for several seconds after having energized the AM or FM circuits, a fluorescent action and annoying flashing with gradually decreased illumination on the face of the image reproducing tube may be evidenced while the filaments in the associated television circuits cool. It, therefore, is desirable in such arrangements to provide some way of disabling the image reproducing device immediately upon removal of filament power to the television circuits.

Furthermore, in such combination television receivers, the power supply circuit is normally designed to supply relatively high potentials at relatively high currents for the operation of the television receiver and particularly the deflection circuits. Unless considerable care and expense are applied in the design and construction of such a power supply unit, it is evident that when the television section of the combination receiver is disabled, the reduced current demands on the power supply will be accompanied by a substantial rise in power supply terminal potential. Since, as in the case of most designs, the electron tubes incorporated in the AM and FM receiver circuits are preferably operated at potentials less than the potentials provided by the power supply when not heavily loaded by the television circuits, it is required that some voltage reducing means be included either in the AM or FM circuits themselves or in combination with the selector switch applying power supply potentials thereto.

The present invention takes advantage of the above recited peculiarities of a combination television receiver by providing a resistance that may be introduced in series with the single power supply when only the AM or FM receiver circuits which require less current and operating potentials are placed in operation. The present invention then utilizes the voltage drop present across this series resistance to immediately disable the television reproducing device.

It is, therefore, a purpose of the present invention to provide a power distribution system

for combination television receivers operating from a single power supply which permits filamentary disabling of the television circuits with simultaneous disabling of the image reproducing device such that no action of the television circuit may be evidenced on the television viewing screen during the filament cooling period following discontinuance of filament power supply thereto.

It is another purpose of the present invention to provide a novel switching arrangement for selectively controlling the application of power to television circuits or other electrical circuits from a common power supply.

It is further an object of the present invention to provide a novel disabling system for electrical circuits wherein a plurality of electrical utilization means are separately and selectively operated from a common power supply source such that selective disabling of one of said utilization means or a portion thereof is based upon the difference in power supply requirements of each of said utilization means.

The novel features which are believed to be characteristic of the present invention are set forth with particularity in the appended claims. The invention itself, however, both to its organization and method of operation together with further objects and advantages thereof may be best understood by reference to the following description taken in connection with the accompanying drawings in which the single figure shows application of the present invention to a typical combination television receiving system.

Referring now to the figure, there is shown a television receiving circuit 10 and a broadcast receiving circuit 12 adapted for selective operation from a central power supply unit 14 by means of a selector switch gang connected as depicted by dotted line 16. In the operational phase shown, the selector switch 16 is positioned for operation of the television receiver 10 and its associated circuits.

The television receiver 10 is supplied in a conventional manner with radio frequency television image signals picked up by antenna 17 and after amplification and demodulation of these signals the composite image signal is applied through resistance condenser combination 18 to the grid 20 of the cathode ray reproducing device 22. The composite video signal output of the receiver is also applied through coupling condenser 24 to a sync clipper 26 which extracts horizontal and vertical synchronizing signals from the composite video signal. The horizontal and vertical sync signals are then separated by means of a circuit represented by block 28 and respectively applied to control the horizontal and vertical deflection drive generators 30 and 32. The vertical deflection drive generator 32 then supplies driving signal for the vertical deflection output circuit 34 having its output terminals 36 and 38 indicated for connection with the vertical deflection winding terminals 40 and 42 of the deflection yoke 44.

The horizontal deflection output stage is shown in more detail and comprises vacuum tube 46 having a control grid 48 adapted for excitation from the horizontal deflection drive generator 30. The anode 50 of the vacuum tube 46 is connected with a B+ power supply bus 52 at terminal 54 through the primary 56 of the horizontal deflection output transformer 58. Horizontal deflection signal is applied to the terminals X—X of the yoke horizontal deflection winding by connection of the terminals 60 and 62 to the termi-

nals 64 and 66 of the output transformer secondary 68. A damper circuit shown in block form at 70 is connected across the output transformer secondary 68 in a manner well known to those skilled in the art. By means of a high impedance secondary winding 72 connected with the primary 56 of the output transformer 58 with an autotransformer type of connection, high voltage impulses are rectified by diode 74 to supply a high unidirectional potential at terminal 76 suitable for application to the accelerating electrode 78 of the cathode ray image reproducing device 22. This method for obtaining accelerating potential for the reproducing device 22 is well known in the art and may incorporate a filtering or storage capacitor 79, which operates in conjunction with a series resistor such as 80 and a shunt capacitor 82 to provide filtering for the pulsating D. C. appearing at terminal 76. As shown, polarizing potential for the screen 86 of the output tube 46 is conveniently obtained through dropping resistor 88 also connected with terminal 54 of the power supply bus 52. By-pass condenser 90 acts to provide a low impedance path for A. C. from the screen 86 to ground.

The power supply for the conventional circuits just described is provided by a typical full-wave rectifying system operating from power transformer 92 having a primary 94 connected through switch 96 to a source of power line potential indicated by terminals 98 and 100. The high voltage secondary 102 is shown in a well-known full-wave rectifier connection including rectifying tubes 104 and 106, filter input capacitor 108, filter choke 110, and output filter capacitor 112, the positive output terminal of the power supply 14 being indicated by index 114. The center tap 116 of the power supply transformer high voltage secondary 102 is connected with the terminal 118 of switch 120, which operates to connect the center tap 116 either directly to ground, in the position shown, or indirectly to ground through dropping resistor 122 when the switch is thrown to the broadcast (BDCST) position. Positive power supply potential, in the arrangement shown, is applied to the television receiver 10 and associated synchronizing deflection circuits by means of positive B+ power supply bus 52 connected with the output terminal 114. Output terminal 114 is also connected with the switch 130 which may be positioned to supply positive power supply potential through bus 132 to broadcast radio receiver 12. In some instances the switch 130 may be connected for interrupting the B+ supply to only those broadcast stages whose filamentary cooling lag is great enough to interfere with immediate operation of the television system whereas the remaining broadcast stages, and in particular such stages as can be utilized as part of the television system, may receive their B+ voltage directly from bus 52.

Filamentary power for the selective operation of the television receiver 10 and associated circuits or the broadcast receiver 12 may be conveniently obtained from a low voltage winding 140 on the power transformer 92. As shown, one terminal of the low voltage or filament winding 140 is connected with ground potential while the other terminal is, through connection 142, applied to the switch 144 which as before noted is shown in position for application of filament power to the components of the television receiving circuit. Correspondingly, all television block elements, including the horizontal output tube 46, are provided with a terminal designated

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"F" which is connected with the terminal "F" of the switch 144. For purposes of clarity, this connection has not been shown. If operation of the broadcast receiver is desired, switch 144 adapted for ganged operation with the switches 130 and 120 will be moved in the "broadcast" position and supply filament power to the broadcast receiver 12 through the connection 146.

In the general form of a combination television system suggested by the figure, it is clear that should the switch handling the filament power be positioned for disconnection of filament power to the television system and connection of filament power to another instrumentality, such as the broadcast receiver in the figure, while positive power supply potential still maintained to the various components of the television receiver, the horizontal deflection output tube 46 with its related circuits would continue to function until the filaments in the vacuum tubes cool sufficiently to discontinue thermionic emission from the cathodes within the tubes. With such an arrangement, this would mean that a high unidirectional potential as developed from pulse energy rectified by diode 74 would continue to be applied to the cathode ray image reproducing device 22 for a good portion of this "cool-off" period and consequently as the deflection signal produced by the horizontal and vertical deflection circuits reduced in amplitude, the scanning raster on the face of the reproducing tube would visibly deteriorate and become badly distorted. Gradually, the illumination on the face of the tube 22 would fade out in a time determined by the thermal lag of the vacuum tubes in the television system as well as the time constant of the circuit associated with the accelerating electrode 78 of the reproducing tube 22. This visible distortion and deterioration of the scanning raster during the "cool-off" time in many instances may be of such a pronounced character that the effect becomes quite undesirable.

Furthermore, in the switch-over from television to broadcast, and as the television circuits become slowly disabled in accordance with filament "cool-off," it is evident that the current demand imposed upon the central power supply, such as 14 in the figure, in most instances becomes decidedly reduced since broadcast receiver circuits seldom require as much current as television receiving circuits. Consequently, unless special regulatory precautions are taken, the output voltage of the central power supply will substantially increase under the reduced loading conditions and hence apply to the broadcast receiving equipment a substantially higher voltage than even that applied to the television system. In general, broadcast receiving circuits require less operating voltage than television deflection systems so it becomes evident that some voltage dropping means must be imposed between the central power supply unit and the broadcast receiver apparatus to not only reduce the nominal potential produced by the central power supply unit while under load but also compensate for its increased potential due to reduced loading conditions.

As before brought out, the present invention provides correction for the above two circuit peculiarities by means of applying the voltage drop necessary in the reduction of the power supply potential to discontinue the electron beam in the cathode ray reproducing device 22 so that no visible effects will manifest on the face of the kinescope during "cool-off" time. In the particular embodiment of the present invention

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shown in the figure, this is accomplished as follows:

In the "television" position of switches 120, 130 and 144, the center tap 116 of the power transformer secondary 102 is connected directly to ground through the switch 120 thereby providing maximum available output voltage at terminal 114 of condenser 112. The deflection output tube 46 is in turn provided with sufficient cathode bias by means of resistor 150 intercalated in its cathode ground circuit that the grid 48 may be placed at ground potential. By-pass condenser 152 may be connected thereacross for reducing the cathode to ground impedance for alternating currents if so desired. The grid 48 of the vacuum tube 46 is therefore operable at ground potential through resistor 154 and 156, the lower terminal of 156 being connected to the terminal 118 on switch 120. Also, the cathode ray reproducing device 22 is provided with proper normal operating bias by means of a cathode resistor 158 a portion of which is included in the cathode ground circuit of the reproducing tube. The arrangement shown provides a variable tap 160 on the resistor 158. Since the resistor 158 is in effect placed across the B+ power supply potential by means of its connection 162 to the power supply bus 52, positioning of the tap 160 thereon allows a conventional form of brightness control to be realized. The grid 20 of the kinescope 22 may then in turn be returned to ground through resistors 164 and 166, resistor 166 being also connected with terminal 118 of switch 120.

Thus, when the switches 120, 130 and 144, ganged for simultaneous operation as indicated by dotted line 16 are moved into broadcast position, the center tap 116 of the power transformer secondary 102 is no longer returned directly to ground but goes indirectly to ground through resistor 122. This naturally reduces the terminal voltage to ground made available at terminal 114 and hence reduces the effective voltage applied through switch 130 to the positive bus 132 of the broadcast receiver 12. Filament power, of course, is now applied to the broadcast receiver 12 through switch 144 and the television circuit filaments now begin to cool. Inasmuch, however, as resistor 122 is now effecting a voltage drop, it is seen that its terminal 123 will be negative with respect to ground by an amount equal to the voltage drop thereacross and that if this negative voltage is sufficient, both the vacuum tube 46 and the kinescope 22 will undergo grid cut-off by merit of the high negative potential applied to their grids 48 and 20. Accordingly, the accelerating potential produced by the deflection circuit associated with the vacuum tube 46 will be immediately discontinued and hence suspend the electron beam in the kinescope 22. This discontinuance of electron beam, of course, is enhanced by the negative cut-off potential applied to the kinescope 22, the value of this potential being sufficient to normally drive the grid negatively in excess of that required to extinguish the electron beam.

It is observed that although two simultaneous methods are shown in the circuit of the figure to disable the image reproducing device 22, either one may be separately employed to effect satisfactory disablement of the reproducing device 22 depending upon the particular nature and operation of the associated circuits. It has been found in practice that in many instances simple discontinuance of the high voltage accelerating

potential as applied to the reproducing tube 22, is not sufficient to prevent flashes of light on the face of the tube during the "cool-off" period and that therefore it may be desirable to assist in beam current cut-off by means of simultaneously applying cut-off voltage to the kinescope grid shown. In the particular arrangement shown, the negative disabling potential developed across the resistor 122 will be pulsating in nature and hence may be desirably filtered before application to the respective grids of the vacuum tube 46 and the kinescope 22. This is accomplished respectively by capacitors 170 and 172 connected to ground from resistors 156 and 166.

From the foregoing, it is seen that the present invention affords a simple, economical, novel method of disabling a television reproducing device employed in a combination television system wherein instrumentalities other than the television receiving circuit are selectively operated from a common power supply.

What is claimed is:

1. In electrical system a first electrical instrumentality depending for operation upon the application of an activating potential of suitable magnitude to terminals thereof, a second electrical instrumentality incorporating at least one thermionic emission device having at least an anode and a heater, said second instrumentality requiring for operation the application of heater energy and anode polarizing potential to respective terminals thereof, said heater having sufficient thermal lag to permit operation of said second instrumentality for a period following any interruption in heater energy supply during maintenance of anode polarizing potential, a power supply productive of an output potential in excess of that suitable as an activating potential for said first instrumentality, a source of heater energy for said thermionic emission device, a connection from said power supply to said thermionic emission device anode, a resistance, a first switch connecting said power supply with said first instrumentality through said resistance to apply an activating potential thereto of a value less than said power supply potential, a second switch connected between said source of heater current and said thermionic emission device heater, electrical coupling between said resistance and said thermionic tube for applying a disabling potential to said tube upon the action of said resistance to reduce the potential supplied by said power supply, and a control mechanism between said first and second switch to synchronize their respective actions so that heater current to said thermionic emission device heater is interrupted upon action of said first switch to supply said activating potential to said first instrumentality.

2. An interlocking arrangement for a combination radio receiving system of the type including a first electronic circuit for receiving and reproducing television image signal information and at least a second electronic circuit for communicating another form of signal information, the first circuit incorporating an image reproducing device with a first series of related thermoemissive electron tubes, and the second circuit incorporating a second series of thermionic tubes, each of said circuits having respective terminals for application of heater energy and anode supply potential for the respective thermoemissive electron tube series, said interlocking arrangement comprising in combination, a source of heater energy, means for selectively connecting

said source of heater energy with said first circuit heater energy supply terminals and said second circuit heater energy supply terminals, means other than said heater energy connecting means for disabling said image reproducing device in response to a control potential, a power supply developing an output terminal potential of substantially proper magnitude for anode supply of said first circuit but of excessive magnitude for proper anode supply of said second circuit, means for connecting said power supply output terminals with said first circuit anode supply terminals, an anode supply switch connected with said power supply output terminals for conditionally applying anode supply potential to said second circuit anode supply terminals, a resistance connected in series with said second circuit anode supply terminals and said anode power supply to effect a voltage drop of sufficient magnitude to permit application of a proper anode supply voltage to said second circuit anode supply terminals and electrical coupling between said resistance and said disabling means to apply thereto a control voltage derived from said voltage drop across said resistance whereby to disable said image reproducing device during supply of heater energy and anode potential to said second circuit.

3. A disabling arrangement for a combination radio receiving system of type including a first electronic circuit for receiving and reproducing television image signal information and at least a second electronic circuit for communicating another form of signal information, said first circuit incorporating a cathode ray type image reproducing device having a cathode, a control grid and beam accelerating electrode with a first series of related thermoemissive electron tubes for operation thereof and said second circuit incorporating a second series of thermoemissive electron tubes, said first circuit having a disabling terminal to which control voltage may be applied for disabling said reproducing device electron beam, each of said circuits having respective terminals for application of heater energy and anode supply potential to the respective thermoemissive electron tube series, said disabling arrangement comprising in combination, a source of heater energy, switching means for selectively connecting said source of heater energy with said first and second circuit heater energy supply terminals, a power supply developing an output terminal potential of substantially proper magnitude for anode supply of said first circuit but of excessive magnitude for proper anode supply of said second circuit, an anode supply circuit connected from said power supply output terminals to said second circuit anode supply terminals, a resistance connected in series with said second circuit anode supply terminals and said anode supply to effect a voltage drop of sufficient magnitude to permit application of a proper anode supply voltage to said second circuit anode supply terminals and electrical coupling between said resistance and said first circuit disabling terminal to apply thereto a voltage representative of the voltage drop across said resistance to effect discontinuance of the cathode ray image reproducing device electron beam upon the simultaneous supply of heater energy and anode potential to said second circuit.

4. Apparatus according to claim 3 wherein said electrical coupling between said resistance and said first circuit disabling terminal comprises electrical connections placing at least a portion

of said resistance in series with the control grid-cathode circuit of said cathode ray image reproducing device, the polarity of said electrical connections being such that the voltage drop appearing across said resistance during the supply of anode potential to said second circuit will act to effect beam current cut-off in said cathode ray reproducing device.

5. Apparatus according to claim 3 wherein said first circuit incorporates a circuit for developing a unidirectional potential suitable for application to said cathode ray image reproducing device accelerating electrode, said potential developing circuit having thereon said disabling terminal for application of a control voltage for conditionally disabling said potential developing circuit and thereby interrupt application of beam accelerating potential to said cathode ray image reproducing device.

6. A disabling arrangement for a combination radio receiving system of type including a first electronic circuit for receiving and reproducing television image signal information and at least a second electronic circuit for communicating another form of signal information, said first circuit incorporating a cathode ray type image reproducing device having a cathode, a control grid and beam accelerating electrode with a first series of related thermoemissive electron tubes for operation thereof and said second circuit incorporating a second series of thermoemissive electron tubes, each of said circuits having respective terminals for application of heater energy and respective positive and negative terminals for supply of anode potential for the respective thermoemissive electron tube series, said disabling arrangement comprising a source of heater energy, a heater switch connected with said source of heater energy for conditionally applying heater energy to either said first circuit or said second circuit heater energy supply terminals, a power supply developing an output terminal potential of substantially proper magnitude for anode supply of said first circuit, said power supply having a positive and negative output terminal, means for connecting the output terminals of said power supply with said second circuit anode supply terminals, a connection between said power supply positive output terminal and the positive terminal of said first circuit anode supply terminals, a resistance connected from said first and second negative anode supply terminals and said power supply negative supply terminal, a switch connected in shunt with at least a portion of said resistance, communicating means from said power supply negative terminal to said cathode ray image reproducing device and a mechanical linkage for synchronizing the action of said switches whereby at least a portion of said resistance is bypassed by said shunting switch upon simultaneous application of positive anode potential and heater energy to said first circuit.

7. Apparatus according to claim 6 wherein said communicating means from said power supply negative terminal to said cathode ray image reproducing device comprises electrical connections placing a portion of said resistance in series with the control grid cathode circuit of said cathode ray image reproducing device, the polarity of said electrical connections being such that the voltage drop appearing across said resistance during the supply of anode potential to said second circuit will act to cause substantial beam current cut-off in said cathode ray reproducing device.

8. Apparatus according to claim 6 wherein there is included in said first circuit an accelerating voltage generator for producing accelerating voltage for said cathode ray tube, said generator having voltage sensitive control terminals thereon for conditionally disabling the same and wherein said communicating means from said power supply negative terminal to said cathode ray image reproducing device comprises connections from said resistance to said accelerating voltage generator control terminals for suitably disabling the accelerating voltage generator upon actuation of said second circuit.

9. Apparatus according to claim 6 wherein said first circuit includes a combination horizontal deflection circuit and cathode ray tube accelerating potential generator employing an actuating vacuum tube therefor having at least a cathode and a control grid and wherein said communicating means from said power supply negative terminal to said cathode ray image reproducing device comprises connections from said power supply negative terminal and said vacuum tube grid-cathode circuit to effect plate current cut-off of said vacuum tube upon operation of said second circuit.

10. Apparatus according to claim 6 wherein there is provided an accelerating voltage generator for production of a voltage suitable for application to said cathode ray device beam accelerating electrode said voltage generator having voltage sensitive control terminals thereon for conditionally disabling the same, and wherein said communicating means from said power supply negative terminal to said cathode ray image reproducing device comprises in combination a connection from said resistance to said voltage generator control terminals, and connections placing a portion of said resistance in series with the control grid-cathode circuit of said cathode ray image reproducing device, said connections from said resistor to said cathode ray tube grid-cathode-circuit and said connections between said resistance and said voltage generator control terminals being such to permit the voltage drop appearing across said resistance during the supply of anode potential to said second circuit to simultaneously disable said voltage generator and effect beam current cut-off in said cathode ray tube grid-cathode circuit.

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References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,916,016	Rives	June 27, 1933
2,017,515	Sinnett	Oct. 15, 1935
2,097,874	Farnham	Nov. 2, 1937
2,242,983	Thompson	May 20, 1941
2,280,670	Spielman	Apr. 21, 1942
2,289,000	Faudell	July 7, 1942
2,435,061	Turkat	Jan. 27, 1948
2,439,408	Mitchell	Apr. 13, 1948
2,457,790	Wild et al.	Dec. 28, 1948
2,502,126	Campbell	Mar. 28, 1950

FOREIGN PATENTS

Number	Country	Date
568,747	Great Britain	Apr. 18, 1945

OTHER REFERENCES

R. C. A. Tube Manual, page 210, Fig. 14-10, RCA Manufacturing Co., Inc., 1940.

General Electric Model 802, Television Receiver Schematic diagram, July 27, 1948.