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Manske

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[54] **AUTOMATIC DEGAUSSING IN A TELEVISION RECEIVER WITH CONSTANT VOLTAGE TRANSFORMER**

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[73] Assignee: **Zenith Radio Corporation,** Chicago, Ill.

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[52] **U.S. Cl.** **315/8,** 317/157.5, 328/270, 323/45

[51] **Int. Cl.** **H01j 29/06,** H01n 9/16

[58] **Field of Search** ..... 315/8; 317/157.5 TV; 328/268, 267, 270; 323/45, 60

[56] **References Cited**

UNITED STATES PATENTS

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Attorney, Agent, or Firm—Nicholas A. Camasto

[57] **ABSTRACT**

A solid state color television receiver incorporates a voltage regulating transformer having a filament winding supplying substantially constant operating voltage to the picture tube filament for prolonging picture tube life. Instant play operation is achieved by providing a filament transformer having a high impedance primary winding, connectable in series with the input of the regulating transformer and a secondary winding connected in series with the regulating transformer filament winding. Automatic degaussing of the picture tube is accomplished with a thermal element each time the receiver is switched on from a "cold start" with a degaussing circuit coupled across the transformer input. The receiver single pole, single throw on-off switch is connected across the primary winding of the filament transformer. When the switch is open, the regulating transformer input and the primary of the filament transformer are in series which substantially reduces the voltage across the regulating transformer input and drops its secondary voltages below operating levels for the television receiver. The filament transformer secondary winding supplies the tube filament with reduced power during standby operation and is "poled" on the transformer core to generate flux opposing that normally resulting from primary energization, reducing residual current in the degaussing coil and allowing the thermal element to cool.

7 Claims, 2 Drawing Figures

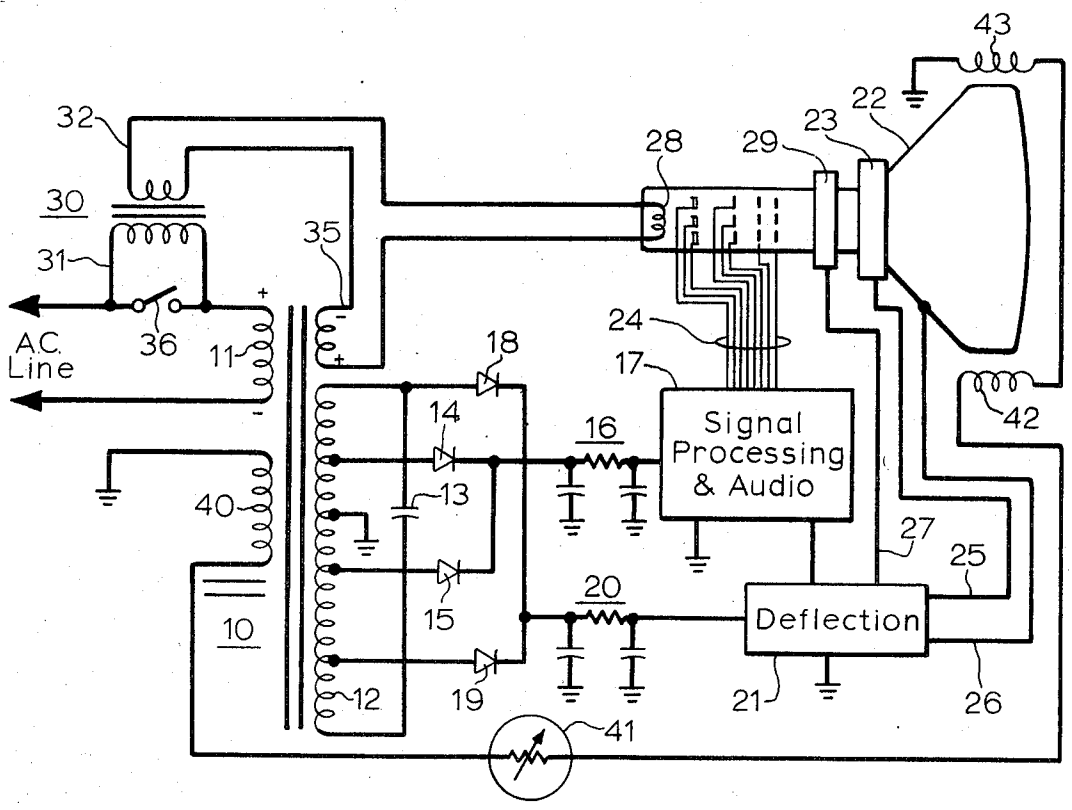
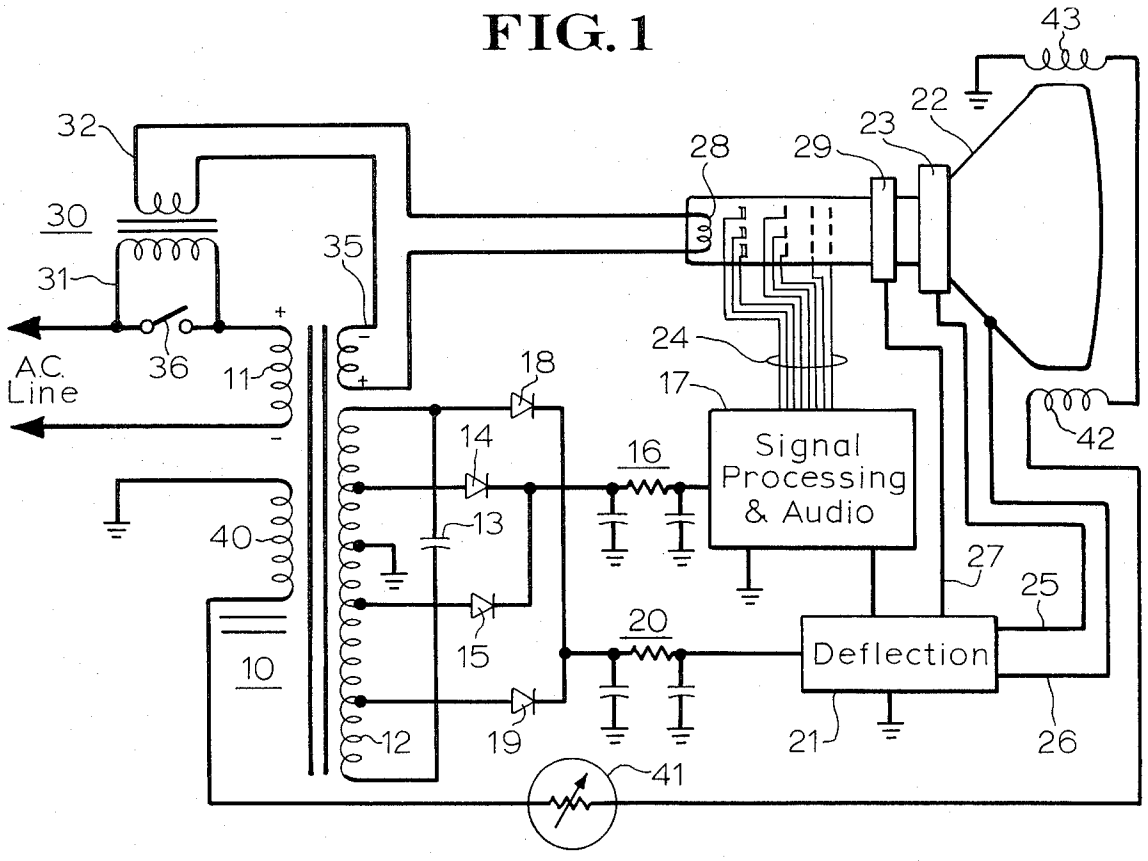


FIG. 1


43
22
23
32
28
29
30
35
31
24
A.C.
Line
36
11
18
17
14
16
Signal
Processing
& Audio
42
40
13
27
25
15
20
Deflection
10
12
19
21
26
41

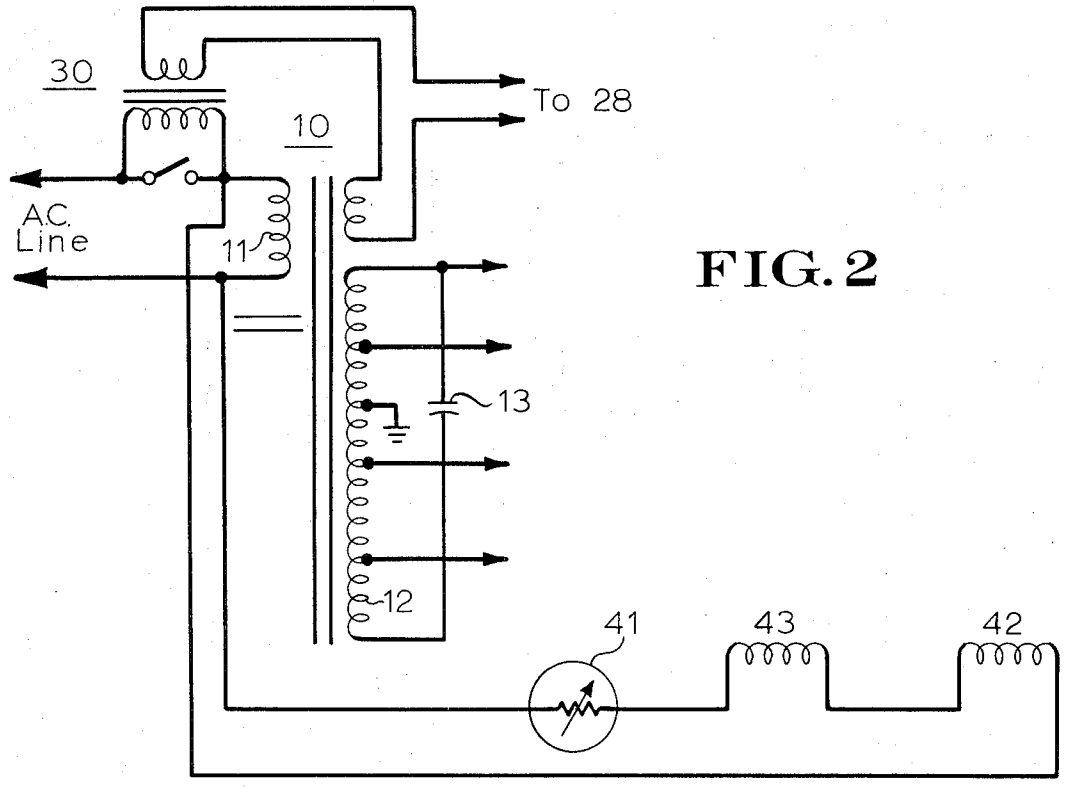

30
To 28
10
A.C.
Line
11
13
12
41
43
42

FIG. 2

AUTOMATIC DEGAUSSING IN A TELEVISION RECEIVER WITH CONSTANT VOLTAGE TRANSFORMER

RELATED APPLICATION

This application is related to application Ser. No. 255,350, filed May 22, 1972 entitled "INSTANT PLAY TELEVISION RECEIVER WITH CONSTANT VOLTAGE TRANSFORMER" in the name of Leonard Dietch and application Ser. No. 312,146, filed Dec. 4, 1972 entitled "SOLID-STATE TELEVISION RECEIVER WITH MAGNETICALLY REGULATED POWER SUPPLY" in the name of Hans E. Manske, both assigned to the assignee of the present invention.

BACKGROUND OF THE INVENTION

Conventional three gun color television tubes include a shadow mask having a large number of apertures for properly restricting the different electron beams so that each impacts only phosphor dots of appropriate color response. The steel shadow mask is generally mounted on a frame of magnetically permeable material, and consequently, both are susceptible to magnetization by spurious magnetic fields as well as by the earth's field. Magnetization of the shadow mask assembly may divert the electron beams onto incorrect phosphors causing a loss of registration and a readily detectable color distortion in the picture. Under extreme situations the receiver may be unviewable.

Periodic degaussing or demagnetization of the receiver is required and previously involved a call by a serviceman with special degaussing equipment. Portability in color receivers awaited development of degaussing apparatus within the receiver itself and all color television receivers of recent manufacture incorporate some form of degaussing apparatus. Such apparatus usually includes a pair of degaussing coils mounted adjacent to the picture tube and means for providing the coils with a tapering alternating current for establishing a decreasing alternating flux field. Numerous circuit arrangements have been used to "taper" the current, most of which incorporate a thermal resistance element having a negative temperature coefficient of resistance, i.e., one in which resistance increases with temperature.

In conventional color television receivers, the degaussing apparatus may be connected across a secondary winding of the power transformer or, in a non-transformer receiver, in a portion of the B+ generating system where an alternating current flows. The hot resistance of the thermal element must be sufficiently large to preclude magnetizing the tube with the residual current flow in the degaussing coils. Since complete degaussing is dependent, in part, on the maximum field produced, the thermal element must be allowed to return to its initial cold resistance value during off periods of the receiver to insure sufficient initial current flow. In receivers incorporating an instant play feature, resort to complex switching has often been necessary.

In the receiver of the invention, a constant voltage regulating transformer, which is not switched off in the standby condition, is used for reasons made clear in the above identified copending application. Because of the inherent current limiting characteristics of the secondary of the regulating transformer, insufficient peak current is available for proper degaussing with normal degaussing coils of inexpensive configuration. Further, in accordance with the invention, automatic degaussing is provided for the receiver without necessitating any complex switching which is extremely desirable for reliability and economy.

Accordingly, a general object of this invention is to provide an improved color television receiver.

A specific object of the invention is to provide a novel instant play color television receiver incorporating a voltage regulating transformer and simplified automatic degaussing.

SUMMARY OF THE INVENTION

In accordance with the invention, a color television receiver includes a voltage regulating transformer capable of maintaining substantially constant output voltages over a wide range of input voltage variation. The transformer incorporates a filament winding supplying constant operating potential to the picture tube through the secondary of a separate filament transformer. The receiver on-off switch changes the operating characteristics of the regulating transformer during receiver off periods to reduce its output to disable the receiver by energizing the filament transformer. The output current of the filament transformer flows through the filament winding on the regulating transformer in a direction tending to oppose normal flux development in the transformer.

BRIEF DESCRIPTION OF THE DRAWING

The invention will best be understood by reading the following specification in conjunction with the drawing in which:

FIG. 1 is a partial schematic diagram of a color television receiver incorporating the invention; and

FIG. 2 is an alternate arrangement for energizing the degaussing circuit of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1, a constant voltage regulating transformer **10** includes a primary winding **11** and a tapped secondary winding **12**. A capacitor **13** is coupled across secondary winding **12** for resonating the secondary magnetic path at approximately 60 Hz. A pair of rectifiers **14** and **15** is connected across a portion of secondary winding **12** and feed a conventional filter network **16**. The output of filter network **16** presents a DC voltage of a given magnitude which is used for powering block **17** labelled SIGNAL PROCESSING AND AUDIO. It will be understood that block **17** preferably incorporates solid state circuitry for receiving transmitted television signals, demodulating these signals to recover the video, color, audio and control information and properly processing the recovered information to reproduce the audio accompaniment, convey necessary control information to block **21** labelled DEFLECTION and, via a plurality of leads **24**, convey the color and video information to a color picture tube **22**.

Another pair of rectifiers **18** and **19** is connected across a larger portion of secondary winding **12** and feeds a filter network **20** for developing a DC potential of higher magnitude for driving the circuitry in block **21**, labelled DEFLECTION, which also preferably is of solid state construction. A common ground tap on

winding 12 provides a return for both DC supplies. One output lead 25 of block 21 drives a yoke 23 mounted on the neck of picture tube 22. It will be understood that portrayal of a single output lead 25 is representative only; in actuality, lead 25 comprises a number of conductors for delivering horizontal and vertical scanning voltages to yoke 23. Another output lead 27 feeds a convergence assembly 29 on the neck of the color picture tube. Block 21 may also include circuitry for developing a high unidirectional voltage for application to the picture tube via a high voltage output lead 26.

Color tube 22 has a filament 28 which is normally supplied power from another secondary winding 35 on transformer 10 which is connected in series with a secondary winding 32 of a separate filament transformer 30. The primary winding 31 of filament transformer 30 is connectable in series with primary winding 11 by means of a switch 36. Depending upon the position of switch 36, primary winding 31 of the filament transformer will either be energized in series with primary 11 of transformer 10 or shorted out. Another winding 40 is wound adjacent to primary winding 11 and feeds the degaussing circuit which consists of a thermal element 41 and a pair of degaussing coils 42 and 43 mounted adjacent to picture tube 22.

The following operational description assumes switch 36 is closed, which position corresponds to the on condition of the television receiver. Under these conditions, primary winding 11 is energized with the full voltage from the AC line (nominally 120 volts AC) and transformer 10 operates in its normal voltage regulating mode. As indicated by the horizontal and vertical lines schematically representing the core structure, regulating transformer 10 comprises a primary magnetic path loosely coupled to a secondary magnetic path. The short horizontal lines represent the shunting core about the primary responsible for the poor or "loose" primary to secondary coupling. It will be noted that winding 40 is in the primary magnetic path with primary 11. The secondary winding is resonated at line frequency (60 Hz) by a capacitor 13. The saturated core results in the output voltages remaining substantially constant irrespective of wide variations in the applied voltage across primary winding 11. The DC voltages developed across filters 16 and 20 are well regulated and contribute to enhanced operation and long term reliability of the television receiver.

The important benefits to tube life arising from a constant voltage are fully detailed in the above mentioned copending application. The voltage across secondary winding 35 of the regulating transformer is about 6.8 volts rms. Since winding 35 is in series with secondary winding 32 of filament transformer 30 (the primary of which is shorted by switch 36) a voltage drop of approximately 0.8 volts is experienced and picture tube filament 28 is supplied with 6.0±0.2 volts rms. Thus the picture tube filament experiences substantially constant voltage during operational periods. The regulating transformer also limits the amplitude and duration of line voltage transients, which while contributing materially to the reliability and performance of the entire receiver, puts a severe limitation on secondary current available for degaussing.

When switch 36 is opened, corresponding to the standby condition of the television receiver, primary winding 31 of filament transformer 30 is connected in series with primary winding 11 of the regulating transformer. The primary winding of the filament transformer has a much higher impedance than winding 11 and, consequently, substantially all of the input voltage drop occurs across winding 31. Secondary winding 32 develops approximately 5.2 volts rms and supplies filament 26 in series with secondary winding 35. Because of the low voltage across primary 11, the regulating transformer is, for all practical purposes, disabled and a very nominal voltage is developed across secondary winding 12. The picture tube filament experiences approximately 4.8 volts rms in the standby condition which, while sufficient to keep the cathode warm for instant play operation, is not low enough to result in deterioration of the cathode material. Closure of switch 36 shorts out primary winding 31 and results in winding 11 being operated at full line potential with consequent development of all normal secondary voltages as indicated above and substantially instantaneous operation of the television receiver.

Degaussing winding 40, as mentioned before, is in the primary magnetic path with primary winding 11 and is, therefore, not subject to the regulation that characterizes windings 12 and 35. One end of winding 40 is grounded and the other connected through a thermal resistance element 41 to a series pair of degaussing coils 42 and 43. Assuming the television receiver is turned on from a "cold start," that is, from a condition where thermal resistance element 41 is at a sufficiently low temperature to have attained its minimum resistance value, the voltage generated across winding 40 (which is substantially the same as that produced across winding 11) will produce a large current through degaussing coils 42 and 43. The current will have an initial amplitude determined by the impedance of the degaussing coils and the resistance of thermal element 41. The degaussing current sets up a magnetic field about picture tube 22 which diminishes with time since, as the current flows, the temperature of resistance element 41 rises and an increase in its resistance value occurs. This resistance increase results in tapering of the current and corresponding tapering of the magnetic field produced. When resistance element 41 reaches its "hot" state, its resistance is relatively high and very little current flow is experienced in the degaussing circuit.

When switch 36 is opened, corresponding to the television receiver being turned off (placed in the standby position), the high impedance of filament transformer winding 31 results in a substantial reduction in voltage across primary winding 11. This reduced input voltage is, of course, communicated to degaussing winding 40 and current flow in the degaussing circuit diminishes, followed by a decrease in resistance of thermal element 41, as it cools off. It will be noted that windings 11 and 35 have polarity markings. The polarity of filament winding 35 is such that current flow from the filament transformer tends to establish flux in the regulating transformer core in opposition to that normally produced by energization of primary winding 11. Hence, the effective impedance of winding 11 is decreased and the voltage drop thereacross also decreased. While the amount of decrease is not large, it is highly significant with respect to operation of the degaussing circuit.

For example, with normal phasing of winding 35, the AC voltage across primary 11 in the standby mode is about 4 volts rms and the voltage across degaussing coil 40 approximately 3 volts rms. With the filament winding poled to oppose flux development in the trans-

former in accordance with the inventive arrangement, the voltage across primary winding **11** is reduced to approximately 1 volt rms and that across degaussing coil **40** to approximately 0.8 volt rms. The reduction in voltage across the degaussing coil enables thermal element **41** to cool down sufficiently to attain its lowest resistance value. (With 4 volts across the degaussing circuit in the standby mode, thermal element **41** would not cool sufficiently and a separate switch would be required.) Consequently, when the receiver is again energized by closing switch **36** and applying full line voltage across primary winding **11**, the resistance of thermal element **41** is at its low value and the requisite large amplitude initial degaussing current flows.

The arrangement of FIG. **2** is similar to that of FIG. **1** and consists essentially of elimination of the separate degaussing winding **40** from the primary of the regulating transformer. In the circuit of FIG. **2**, direct connections across primary winding **11** are provided for feeding the degaussing circuit. It will, of course, be recognized that the line isolation obtained with the use of a separate transformer winding is not available in the circuit of FIG. **2** and, consequently, precautions must be taken to properly insulate the components in the circuit. Operation of the circuit is identical to that described in the circuit of FIG. **1** with the exception that the voltage across primary winding **11** is identical to that applied to the degaussing circuit.

While particular embodiments of the invention have been shown and described, it will be obvious to those skilled in the art that changes and modifications may be made without departing from the invention in its broader aspects, and, therefore, the aim in the appended claims is to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. In a color television receiver: a picture tube including a plurality of electrodes, a filament and a shadow mask of magnetically permeable material; signal processing and deflection circuit means supplying potentials to the electrodes of the picture tube for producing thereon a televised image; a power supply including voltage regulating transformer means having an input connected to a source of line potential and outputs supplying substantially constant voltages to said signal processing and deflection circuit means and to said filament; a standby transformer, for maintaining said filament warm during off periods of said receiver, having a primary winding serially coupled to said input and a secondary winding serially coupled to said filament and to the one of said outputs which supplies said filament; degaussing means responsive to the voltage across said input and including a thermal element having a low cold resistance and a high hot resistance for establishing a decaying alternating current magnetic field adjacent said picture tube when said input is activated and the temperature of said thermal element is low; and manually operated switching means connected to said voltage regulating transformer means and said standby transformer selectively rendering said voltage regulating transformer means and standby transformer effective, said standby transformer supplying standby current to said filament through said one output to assist said thermal element in cooling down.

2. In a color television receiver as set forth in claim **1** wherein said primary winding has an impedance which is high in comparison with the impedance of said regulating transformer means input; said switching means comprising a single pole, single throw switch connected across said primary winding.

3. In a color television receiver as set forth in claim **2** wherein said regulating transformer means includes a regulating transformer having a primary magnetic path and a resonant secondary magnetic path including a resonating capacitance, said input including a winding linking said primary magnetic path and partially linking said secondary magnetic path; said one of said outputs including a filament winding linking said secondary magnetic path; and wherein the secondary winding of said standby transformer is poled to generate flux tending to oppose normal flux in said regulating transformer.

4. In a color television receiver as set forth in claim **3** wherein said regulating transformer includes an additional winding linking said primary magnetic flux path, said additional winding supplying voltage for said degaussing means.

5. In a color television receiver: a picture tube including a plurality of electrodes, a filament and a shadow mask of magnetically permeable material; signal processing and deflection circuit means supplying potentials to the electrodes of the picture tube for producing thereon a televised image; a power supply including a voltage regulating transformer having an input winding connected to a source of line potential for establishing flux in a primary magnetic path, an output winding applying a substantially constant voltage to said circuit means and a filament winding supplying regulated power to said filament, both said output winding and said filament winding linking a resonant secondary magnetic path which includes a resonating capacitance; a normally disabled standby transformer having a primary winding connected in series with said input winding and a secondary winding connected in series with said filament winding, said primary winding being of substantially greater impedance than said input winding; degaussing means including; a degaussing coil situated adjacent said picture tube in series with a thermally variable resistance element having a low cold resistance and a high warm resistance; means applying a potential to said degaussing means which is related to the potential across said input winding, said thermally variable resistance element changing its resistance and tapering the alternating current through said degaussing coil for demagnetization of said picture tube; and manual switching means connected to said standby transformer simultaneously enabling said standby transformer for supplying standby current to said filament and decreasing the potential across said input winding to a level substantially below that required for operation of said circuit means, the standby current flow through said filament winding being such as to oppose flux in said primary magnetic path for further reducing the effective impedance of said input winding whereby said thermally variable resistance element experiences substantially zero current flow during standby periods.

6. In a color television receiver as set forth in claim **5** wherein said switching means comprise a single pole, single throw switch connected across the primary winding of said standby transformer.

7. In a color television receiver as set forth in claim **6** wherein said means applying a potential to said degaussing means comprises an additional winding on said voltage regulating transformer linking said primary magnetic path.

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