

Description

The present invention relates to modulated focus voltage circuits for television display picture tubes.

In typical television display picture tubes, electron beam defocussing tends to occur near the screen edges. It is desirable to maintain sharp focus near the screen edges, particularly when displaying alphanumeric characters, since such characters may be displayed on the picture tube screen at positions near the screen edges.

To provide sharper focusing of the electron beams landing near the screen edges, focus voltage modulating circuits are employed to vary the picture tube focus voltage from a substantially DC voltage to one which includes parabolically shaped components repeating at the line and frame scanning rates.

In a typical television picture tube deflection system, such as the horizontal or line deflection system of a conventional television receiver, a parabolically shaped signal repeating at the scan rate is produced across the capacitor commonly coupled in series with the deflection winding or yoke for providing the dual function of DC blocking and S-shaping such a system is, for example, described in US-A-4316 128. In general, however, the parabolically shaped voltage across the S-shaping capacitor is not suitable for direct application to the picture tube focus electrode, since its amplitude is too small and its polarity direction is opposite to that generally required. Conventional focus voltage modulating circuits use a transformer to step up the voltage and to invert the polarity direction. However, as has been mentioned, the S-shaping capacitor also serves to block the DC operating voltage which is required for the deflection circuit. In order to prevent this relatively high DC voltage from being applied across the transformer primary winding and thereby degrading the magnetic core characteristics through saturation, conventional focus voltage modulating circuits of this type typically employ a blocking capacitor. Such a capacitor is required to have a sufficiently large value to couple the parabolically shaped voltage and it must also withstand the DC voltage component.

A horizontal deflection system of a conventional television display tube typically includes, in parallel combination, one or more switches, a retrace capacitor, and a deflection winding coupled in series with the S-shaping capacitor. DC power is supplied to the parallel combination by way of an inductance. In accordance with an aspect of the invention, one end of a transformer primary winding is coupled to the point of series connection of the deflection winding and the S-shaping capacitor and

the other end of the primary winding is coupled to the DC power supply such that the average DC potential at each end of the primary winding is substantially the same as the power supply operating potential. The parabolically shaped horizontal scan rate voltage appearing across the secondary winding is combined with a further voltage to provide a focus voltage having scan rate modulation.

In the drawing, the sole FIGURE shows partly in block diagram form and partly in circuit schematic form a dynamic focus system including a preferred embodiment of the present invention.

In the dynamic focus circuit of the FIGURE, a conventional horizontal deflection system of a typical television receiver is generally designated as 100. The deflection system includes a deflection drive generator 102 for supplying switching signals to the base of a transistor 104 which, together with the oppositely poled and parallel coupled diode 106 forms the "deflection switch". The "deflection switch" is coupled between a circuit point 108 and a point of common potential, here conveniently designated as a ground 110. Also coupled between circuit point 108 and ground are retrace capacitor 112 and the series combination of a deflection winding 114 and an S-shaping and DC blocking capacitor 116, which are coupled in series at a circuit point 118, one plate of S-shaping capacitor 116 being coupled to ground. A DC operating potential is provided at circuit point 120 by way of a resistor 122 coupled between circuit point 120 and a terminal 124 to which an operating voltage $+V_s$ is applied. A capacitor 126 bypasses AC voltages on circuit point 120 to ground. DC current is supplied from circuit point 120 to circuit point 108 by way of an inductor 128, which is usually referred to in deflection systems as the flyback inductance, such as the primary winding of a horizontal output transformer. The circuit so far described corresponds to a horizontal deflection system which operates in a well-known manner.

Briefly, the "deflection switch", comprising transistor 104 and diode 106, is closed for the trace portion of the cycle. This produces a build-up of sawtooth current in deflection winding 114. Retrace of the deflection winding current occurs after transistor 104 is turned off by negative base current from deflection drive generator 102. During this transition, current flow is diverted from the collector of transistor 104 to retrace capacitor 112. The voltage on circuit point 108 rises at a substantially sinusoidal rate, resonating with the deflection winding reactance for one half cycle. Retrace is completed and trace started when diode 106 is forward biased. This forward biasing closes the "deflection switch" for the first part of the trace portion.

Such a deflection system provides a sawtooth deflection current through deflection winding 114

and a parabolically shaped voltage waveform across S-shaping capacitor 116. However, this parabolically shaped voltage is superimposed on a DC voltage which will not differ substantially from the supply voltage on circuit point 120. This is so because circuit point 118 is DC coupled to circuit point 120 by way of deflection winding 114 and inductor 128, both of which have low DC resistances. A transformer 130 having primary and secondary windings with substantial DC isolation therebetween has one end of its primary winding 132 coupled to circuit point 118 and the other end coupled by way of a series coupling of a resistor 134 and a variable resistor 136 to circuit point 120. As previously explained, circuit point 118 and 120 are substantially at the same DC potential. However, circuit point 120, which is bypassed by capacitor 126, is at a substantially constant DC potential, whereas the potential at circuit point 118 exhibits a parabolic variation superimposed on the DC potential. The voltage appearing across primary winding 132 will therefore essentially be that of the parabolically shaped waveform which appears across S-shaping capacitor 116, with substantially no accompanying DC components.

One end of secondary winding 138 is coupled to ground and the other end is coupled by way of a blocking capacitor 140 to a circuit point 142. A focus voltage supply generator 144 also supplies a focus voltage to circuit point 142 by way of a resistor 146. The voltage at circuit point 142 results from a combination of the parabolically shaped voltage appearing across secondary winding 138 and the focus voltage supplied by focus circuit supply generator 144 and is applied to focus voltage utilization means 147 which may, for example, comprise the focus electrode of a television display picture tube. For example, focus voltage supply generator 144 may provide a DC focussing voltage with which the parabolically shaped voltage is summed.

Variable resistor 136 provides amplitude adjustment of the parabolically shaped voltage waveform. Some variation in the phase of the parabolically shaped voltage waveform appearing across secondary winding 138 may occur when the resistance of resistor 136 is changed for amplitude adjustment. It has been found that such phase variations can be reduced by coupling a resistor 148 in parallel with primary winding 132.

As explained, no significant amount of DC voltage is applied across primary winding 132 and consequently no significant amount of DC current will flow through the winding, despite the fact that it is coupled to the deflection part of the circuit without the use of a blocking capacitor. Besides saving the cost and space requirements for the capacitor, this permits a relatively small transformer

to be used without risk of magnetic saturation of the magnetic core. A smaller transformer is relatively less costly and requires relatively less space.

Clearly, the implementation of the invention in accordance with the described embodiment is illustrative. Various modifications to the circuitry for implementing the invention in accordance with the foregoing description will readily suggest themselves to one skilled in the art. For example, the choice of ground for a common reference potential and the illustrated voltage polarity sense may be modified to suit a particular application. Furthermore, while one end of the secondary winding 138 has been shown as being coupled to ground, it may readily be returned to a source of vertical or frame rate modulation signal instead of ground, so as to provide full dynamic focus correction with regard to both horizontal and vertical deflection. Although focus voltage generator 144 has been illustratively described as supplying a DC voltage, it may instead supply a DC voltage having a modulated focus voltage superimposed. These and other modifications are contemplated to be within the scope of the present invention.

Claims

1. In a television deflection circuit including direct current (DC) power supply means ($+V_s$), and further including, in parallel combination, a switching transistor (104), a damper diode (106), a retrace capacitor (112) and a deflection winding (114) coupled in series with a DC blocking capacitor (116), and wherein inductance means (128) is coupled between said DC power supply means ($+V_s$) and said parallel combination for supplying a DC operating potential thereto, such that the average DC potential at the point (118) of series coupling of said deflection winding (114) and said DC blocking capacitor (116) is substantially the same as said operating potential, a focus voltage generating arrangement having scan rate modulation of the focus voltage, characterized by

focus voltage supply means (144) for providing a first focus voltage;

transformer means (130) having primary (132) and secondary (138) windings with substantial DC isolation therebetween, one end of said primary winding (132) being coupled to the point (118) of said series coupling of said deflection winding (114) and said DC blocking capacitor (116) and the other end of said primary winding (132) being coupled to said DC power supply means ($+V_s$) such that the average DC potential at each end of said primary winding (132) is substantially the same as said



and a parabolically shaped voltage waveform across S-shaping capacitor 116. However, this parabolically shaped voltage is superimposed on a DC voltage which will not differ substantially from the supply voltage on circuit point 120. This is so because circuit point 118 is DC coupled to circuit point 120 by way of deflection winding 114 and inductor 128, both of which have low DC resistances. A transformer 130 having primary and secondary windings with substantial DC isolation therebetween has one end of its primary winding 132 coupled to circuit point 118 and the other end coupled by way of a series coupling of a resistor 134 and a variable resistor 136 to circuit point 120. As previously explained, circuit point 118 and 120 are substantially at the same DC potential. However, circuit point 120, which is bypassed by capacitor 126, is at a substantially constant DC potential, whereas the potential at circuit point 118 exhibits a parabolic variation superimposed on the DC potential. The voltage appearing across primary winding 132 will therefore essentially be that of the parabolically shaped waveform which appears across S-shaping capacitor 116, with substantially no accompanying DC components.

One end of secondary winding 138 is coupled to ground and the other end is coupled by way of a blocking capacitor 140 to a circuit point 142. A focus voltage supply generator 144 also supplies a focus voltage to circuit point 142 by way of a resistor 146. The voltage at circuit point 142 results from a combination of the parabolically shaped voltage appearing across secondary winding 138 and the focus voltage supplied by focus circuit supply generator 144 and is applied to focus voltage utilization means 147 which may, for example, comprise the focus electrode of a television display picture tube. For example, focus voltage supply generator 144 may provide a DC focussing voltage with which the parabolically shaped voltage is summed.

Variable resistor 136 provides amplitude adjustment of the parabolically shaped voltage waveform. Some variation in the phase of the parabolically shaped voltage waveform appearing across secondary winding 138 may occur when the resistance of resistor 136 is changed for amplitude adjustment. It has been found that such phase variations can be reduced by coupling a resistor 148 in parallel with primary winding 132.

As explained, no significant amount of DC voltage is applied across primary winding 132 and consequently no significant amount of DC current will flow through the winding, despite the fact that it is coupled to the deflection part of the circuit without the use of a blocking capacitor. Besides saving the cost and space requirements for the capacitor, this permits a relatively small transformer

to be used without risk of magnetic saturation of the magnetic core. A smaller transformer is relatively less costly and requires relatively less space.

Clearly, the implementation of the invention in accordance with the described embodiment is illustrative. Various modifications to the circuitry for implementing the invention in accordance with the foregoing description will readily suggest themselves to one skilled in the art. For example, the choice of ground for a common reference potential and the illustrated voltage polarity sense may be modified to suit a particular application. Furthermore, while one end of the secondary winding 138 has been shown as being coupled to ground, it may readily be returned to a source of vertical or frame rate modulation signal instead of ground, so as to provide full dynamic focus correction with regard to both horizontal and vertical deflection. Although focus voltage generator 144 has been illustratively described as supplying a DC voltage, it may instead supply a DC voltage having a modulated focus voltage superimposed. These and other modifications are contemplated to be within the scope of the present invention.

Claims

1. In a television deflection circuit including direct current (DC) power supply means ($+V_s$), and further including, in parallel combination, a switching transistor (104), a damper diode (106), a retrace capacitor (112) and a deflection winding (114) coupled in series with a DC blocking capacitor (116), and wherein inductance means (128) is coupled between said DC power supply means ($+V_s$) and said parallel combination for supplying a DC operating potential thereto, such that the average DC potential at the point (118) of series coupling of said deflection winding (114) and said DC blocking capacitor (116) is substantially the same as said operating potential, a focus voltage generating arrangement having scan rate modulation of the focus voltage, characterized by

focus voltage supply means (144) for providing a first focus voltage;

transformer means (130) having primary (132) and secondary (138) windings with substantial DC isolation therebetween, one end of said primary winding (132) being coupled to the point (118) of said series coupling of said deflection winding (114) and said DC blocking capacitor (116) and the other end of said primary winding (132) being coupled to said DC power supply means ($+V_s$) such that the average DC potential at each end of said primary winding (132) is substantially the same as said



operating potential; and

signal combining means (140,146) coupled to said focus voltage supply means (144) and to said secondary winding (138) for providing a second focus voltage having scan rate modulation.

2. A circuit as recited in Claim 1 wherein

said inductance means comprises an inductor (128) having one end thereof coupled to said DC power supply means (+V_s) for receiving said operating potential, and wherein said other end of said primary winding (132) is coupled to said one end of said inductor (128).

3. A circuit as recited in Claim 1 wherein

said DC power supply means includes a common point of reference potential (ground), said parallel combination (104,106,112,114,116) being coupled between said other end of said inductor (128) and said common point of reference potential (ground).

4. A circuit as recited in claim 1,2, or 3 wherein

said transformer means includes a core of magnetic material exhibiting magnetic characteristics susceptible of substantial degradation when subjected to magnetization having an intensity greater than a predetermined value, and wherein said inductance means exhibits a sufficiently small DC resistance such that a direct current produced in said primary winding (132) is of smaller magnitude than the magnitude required for causing said predetermined intensity value of magnetization.

5. A circuit as recited in claim 1,2, or 3 wherein

said transformer windings (132,138) are wound on a core of magnetic material exhibiting magnetic characteristics susceptible of significant degradation when subjected to a magnetization having an intensity greater than a predetermined value, and wherein a direct current component flowing in said primary winding (132) is of smaller magnitude than the magnitude required for causing said substantial degradation.

6. A circuit as recited in any preceding claim wherein said scan rate corresponds to a television line scan rate.

7. A circuit as recited in any preceding claim wherein said first focus voltage exhibits scan rate modulation at a scan rate corresponding to a television frame scan rate.

8. A circuit as recited in any one of claims 1 to 7

wherein said signal combining means comprises a resistor signal summing network (140,146).

9. A circuit as recited in any preceding claim wherein said second focus voltage is applied to the focusing electrode of a television picture tube.

10. A circuit as recited in any one of claims 1 to 9 further comprising resistance means (148) coupled in parallel with said primary winding.

11. A circuit as recited in any preceding claim wherein said other end of said primary winding (132) is coupled to said DC power supply means (+V_s) by way of variable resistance means (136).

12. A circuit as recited in any preceding claim wherein said secondary winding (138) is further coupled to a source of television frame scan rate signal.

25 Revendications

1. Dans un circuit de déviation de télévision comprenant un moyen d'alimentation en courant continu (+V_s), et comprenant également en combinaison parallèle, un transistor de commutation (104), une diode d'amortissement (106), un condensateur de retour (112) et un enroulement de déviation (114) couplés en série à un condensateur de blocage en continu (116), et où un moyen d'inductance (128) est couplé entre le moyen d'alimentation en continu (+V_s) et la combinaison parallèle pour appliquer celui-ci à un potentiel de fonctionnement en continu, de telle sorte que le potentiel moyen en continu au point (118) de couplage en série de l'enroulement de déviation (114) et du condensateur de blocage en continu (116) soit sensiblement le même que le potentiel de fonctionnement, un agencement de production de tension de focalisation ayant une modulation de fréquence de balayage de la tension de focalisation, caractérisé par

un moyen d'application de tension de focalisation (144) pour produire une première tension de focalisation;

un moyen transformateur (130) ayant des enroulements primaire (132) et secondaire (138) avec une isolation substantielle en continu entre eux, une extrémité de l'enroulement primaire (132) étant couplée au point (118) du couplage en série de l'enroulement de déviation (114) et du condensateur de blocage en continu (116) et l'autre extrémité de l'enroule-



ment primaire (132) étant couplée au moyen d'alimentation en continu ($+V_g$) de telle sorte que le potentiel moyen continu à chaque extrémité de l'enroulement primaire (132) soit sensiblement le même que le potentiel de fonctionnement; et

un moyen de combinaison de signaux (140, 146) couplé au moyen d'application de tension de focalisation (144) et à l'enroulement secondaire (138) pour produire une seconde tension de focalisation ayant une modulation de fréquence de balayage.

2. Un circuit selon la revendication 1, où le moyen d'inductance précité comprend un inducteur (128) ayant une extrémité de celui-ci couplée au moyen précité d'alimentation en continu ($+V_g$) pour recevoir le potentiel de fonctionnement précité et où l'autre extrémité précitée de l'enroulement primaire (132) est couplée à l'extrémité précitée de l'inducteur (128).
3. Un circuit selon la revendication 1, où le moyen d'alimentation en continu précité comprend un point commun de potentiel de référence (masse), la combinaison parallèle précitée (104, 106, 112, 114, 116) étant couplée entre l'autre extrémité précitée de l'inducteur (128) et le point commun de potentiel de référence (masse).
4. Un circuit selon la revendication 1, 2 ou 3, où le moyen transformateur précité comprend un noyau en un matériau magnétique présentant des caractéristiques magnétiques susceptibles d'une dégradation substantielle lorsque soumis à magnétisation ayant une intensité supérieure à une valeur prédéterminée, et où le moyen d'inductance précité présente une résistance continue suffisamment petite de sorte qu'un courant direct produit dans l'enroulement primaire précité (132) soit de grandeur plus petite que la grandeur exigée pour provoquer la valeur d'intensité prédéterminée de magnétisation.
5. Un circuit selon la revendication 1, 2 ou 3, où les enroulements du transformateur précité (132, 138) sont enroulés sur un noyau de matériau magnétique présentant des caractéristiques magnétiques susceptibles de dégradation significative lorsque soumis à une magnétisation ayant une intensité plus grande qu'une valeur prédéterminée, et où une composante de courant direct circulant dans l'enroulement primaire précité (132) est de grandeur plus petite que la grandeur exigée pour provoquer

la dégradation substantielle.

6. Un circuit selon l'une des revendications précédentes, où la fréquence de balayage précitée correspond à une fréquence de balayage de ligne de télévision.
7. Un circuit selon l'une des revendications précédentes, où la première tension de focalisation précitée présente une modulation de fréquence de balayage à une fréquence de balayage correspondant à une fréquence de balayage d'image de télévision.
8. Un circuit selon l'une des revendications 1 à 7, où le moyen de combinaison de signaux comprend un réseau d'addition de signaux à résistances (140, 146).
9. Un circuit selon l'une des revendications précédentes, où la seconde tension de focalisation précitée est appliquée à l'électrode de focalisation d'un tube-image de télévision.
10. Un circuit selon l'une des revendications 1 à 9, comprenant de plus un moyen formant résistance (148) couplé en parallèle à l'enroulement primaire précité.
11. Un circuit selon l'une des revendications précédentes, où l'autre extrémité de l'enroulement primaire (132) est couplée au moyen d'alimentation en continu ($+V_g$) au moyen d'un moyen formant résistance variable (136).
12. Un circuit selon l'une des revendications précédentes, où l'enroulement secondaire précité (138) est couplé de plus à une source de signaux de fréquence de balayage d'image de télévision.

Patentansprüche

1. Schaltung zur Erzeugung einer Fokussierungsspannung mit Ablenkfrequenzmodulation in einer Fernsehblenkschaltung, die eine Gleichstromleistungsversorgungseinrichtung ($+V_g$) und weiterhin in Parallelschaltung einen Schalttransistor (104), eine Dämpfungsdiode (106), einen Rücklaufkondensator (112) und eine mit einem Gleichstrom-Blockkondensator (116) in Reihe geschaltete Ablenkwicklung (114) enthält und bei der eine induktive Einrichtung (128) zwischen die Gleichstromleistungsversorgungseinrichtung ($+V_g$) und die Parallelschaltung geschaltet ist, um dieser ein Betriebs-Gleichpotential zuzuführen, so daß das mittlere Gleichpotential am Punkt (118), wo die Ablenk-



wicklung (114) und der Gleichstrom-Blockkondensator (116) in Reihe geschaltet sind, im wesentlichen gleich dem Betriebspotential ist, **gekennzeichnet durch**

eine Fokussierungsspannungsversorgungseinrichtung (144) zur Erzeugung einer ersten Fokussierspannung;

eine Transformatoreinrichtung (130), die Primär- (132) und Sekundär- (138) Wicklungen mit einer beträchtlichen Gleichstromisolation zwischen diesen enthält, wobei ein Ende der Primärwicklung (132) mit dem Punkt (118), an dem die Ablenkwicklung (114) und der Gleichstrom-Blockkondensator (116) in Reihe geschaltet sind, gekoppelt ist und das andere Ende der Primär-Wicklung (132) mit der Gleichstromleistungsversorgungseinrichtung (+V_s) gekoppelt ist, so daß das mittlere Gleichpotential an jedem Ende der Primär-Wicklung (132) im wesentlichen gleich dem Betriebspotential ist; und

eine Signalkombiniereinrichtung (140, 146), die mit der Fokussierungsspannungsversorgungseinrichtung (144) und der Sekundär-Wicklung (138) gekoppelt ist, um eine zweite Fokussierungsspannung mit ablenkfrequenter Modulation zur Verfügung zu stellen.

2. Schaltung nach Anspruch 1, **dadurch gekennzeichnet**, daß die induktive Einrichtung eine Spule (128) enthält, deren eines Ende mit der Gleichstromleistungsversorgungseinrichtung (+V_s) gekoppelt ist, um das Betriebspotential zu erhalten und daß das andere Ende der Primär-Wicklung (132) mit diesem einen Ende der Spule (128) gekoppelt ist.
3. Schaltung nach Anspruch 1, **dadurch gekennzeichnet**, daß die Gleichstromleistungsversorgungseinrichtung einen gemeinsamen Referenzpotential-(Masse-)Schaltungspunkt enthält und daß die Parallelschaltung (104, 106, 112, 114, 116) zwischen das andere Ende der Spule (128) und den gemeinsamen Referenzpotential-(Masse-) Schaltungspunkt geschaltet ist.
4. Schaltung nach Anspruch 1, 2 oder 3, **dadurch gekennzeichnet**, daß die Transformatoreinrichtung einen Kern aus Magnetmaterial enthält, das magnetische Eigenschaften aufweist, welche sich bei einer Magnetisierung mit einer einen vorgegebenen Wert übersteigenden Intensität beträchtlich verschlechtern, und daß die induktive Einrichtung einen genügend kleinen Gleichstromwiderstand hat, so daß ein in der Primär-Wicklung (132) erzeugter Gleich-

strom einen kleineren Betrag hat als er erforderlich ist, um den vorgegebenen Intensitätswert der Magnetisierung zu erzeugen.

5. Schaltung nach Anspruch 1, 2 oder 3, **dadurch gekennzeichnet**, daß die Transformatorwicklungen (132, 138) auf einen Kern aus Magnetmaterial gewickelt sind, das magnetische Eigenschaften aufweist, die sich bei einer Magnetisierung mit einer einen vorgegebenen Wert übersteigenden Intensität beträchtlich verschlechtern, und daß eine Gleichstromkomponente, die in der Primärwicklung (132) fließt, einen kleineren Betrag hat als der, der erforderlich ist, um die beträchtliche Verschlechterung zu bewirken.
6. Schaltung nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet**, daß die Ablenkfrequenz einer Fernseh-Zäulenablenkfrequenz entspricht.
7. Schaltung nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet**, daß die erste Fokussierungsspannung eine ablenkfrequente Modulation mit einer Ablenkfrequenz aufweist, die einer Fernseh/Bildablenkfrequenz entspricht.
8. Schaltung nach einem der Ansprüche 1 bis 7, **dadurch gekennzeichnet**, daß die Signalkombiniereinrichtung ein Widerstands-Signalsummiernetzwerk (140, 146) enthält.
9. Schaltung nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet**, daß die zweite Fokussierungsspannung der Fokussierungselektrode einer Fernsehbildröhre zugeführt ist.
10. Schaltung nach einem der Ansprüche 1 bis 9, **dadurch gekennzeichnet**, daß sie weiterhin eine Widerstandsanordnung (148) enthält, die der Primär-Wicklung parallelgeschaltet ist.
11. Schaltung nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet**, daß das andere Ende der Primär-Wicklung (132) mit der Gleichstromleistungsversorgungseinrichtung (+V_s) durch eine veränderliche Widerstandsanordnung (136) gekoppelt ist.
12. Schaltung nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet**, daß die Sekundär-Wicklung (138) außerdem mit einer Quelle für ein fernsehbildablenkungs-frequentes Signal gekoppelt ist.