

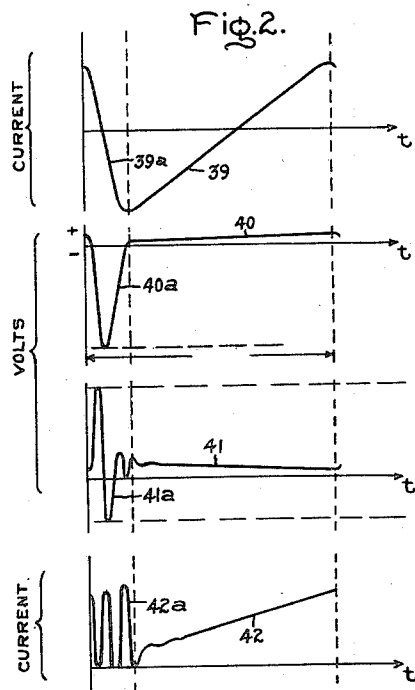
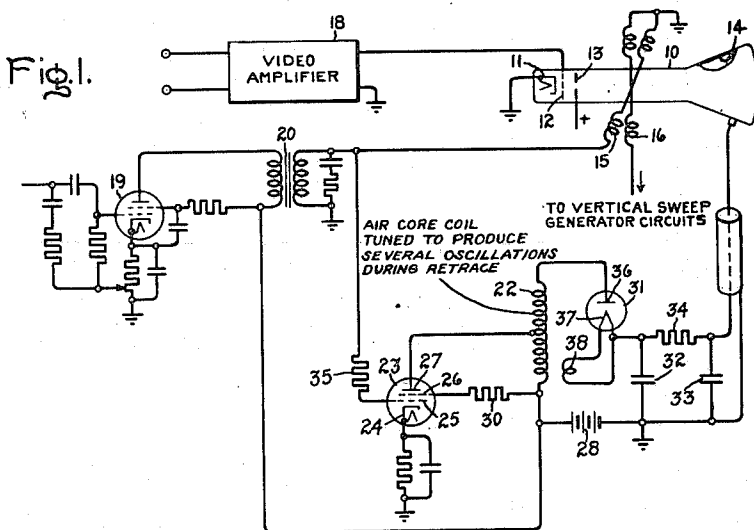
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TELEVISION APPARATUS

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TELEVISION APPARATUS

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7 Claims. (Cl. 315--22)

My invention relates to television apparatus of the type employing a cathode ray picture tube and particularly to circuits for supplying high unidirectional voltages to the anodes of the cathode ray tubes in such apparatus.

It is an object of my invention to provide an improved high voltage generating circuit of small size and light weight for supplying the unidirectional voltage for the anodes of cathode ray tubes.

It is another object of my invention to provide an improved circuit for television apparatus or the like for providing high unidirectional voltages for the anodes of cathode ray tubes which shall result in minimum interference with the operation of the associated circuits.

The features of my invention which I believe to be novel are set forth with particularity in the appended claims. My invention itself, however, both as to its organization and method of operation together with further objects and advantages may best be understood by reference to the following description taken in connection with the accompanying drawing in which Fig. 1 diagrammatically represents one form of television apparatus embodying my invention, and Fig. 2 represents curves showing certain characteristics of the apparatus of Fig. 1.

Referring now to Fig. 1, I have shown a portion of a television apparatus which, for example, may be a television receiver, and which includes a cathode ray electron discharge device or tube 10. The tube 10 is provided with an electron gun including a cathode 11, a control electrode or grid 12 and an anode 13. A second anode 14 comprising an annular metallic coating on the inner surface of the tube is provided to accelerate the electrons projected from the cathode and to aid in focusing the beam. The tube 10 is also provided with horizontal and vertical deflecting members 15 and 16, respectively, which have been illustrated as coils for deflecting the beam magnetically. Composite television picture and synchronizing signals are received and detected by suitable apparatus (not shown) and the picture or video signal is supplied by a suitable amplifier 18 connected to impress the picture signal between the control grid 12 and the cathode 11 of the cathode ray tube to control the intensity of the electron beam in the usual manner. The horizontal deflecting coil 15 is supplied with a saw-tooth current wave from a suitable saw-tooth generator (not shown) which is synchronized in the usual manner. The saw-tooth wave produced by the generator is amplified by an electron discharge device 19 and is supplied to the coil 15 from the

secondary of a transformer 20 the primary of which is connected in the load circuit of the device 19. A similar deflection circuit (not shown) is provided to energize the vertical deflection coil 16.

For satisfactory operation of the tube 10 it is necessary that the anode 14 be supplied with very high unidirectional voltage which may be of the order of 7500 volts or higher. In order to supply the high voltage for the anode 14 I provide an air core induction coil or autotransformer 22 having an electron discharge device 23 connected to supply current to its primary circuit. The device 23 includes a cathode 24, a control grid or electrode 25, a screen grid 26 and an anode 27. A suitable source of direct current potential such as a battery 28 is connected to the anode 27 through the primary of the transformer 22 and the screen grid 26 is connected to the battery 28 through a suitable resistance 30. The device 23 is normally conducting so that a substantial current flows through the primary of the transformer 22. In order to produce a high voltage across the secondary of the transformer 22 the current through the primary is interrupted intermittently to produce a high rate of change of flux through the transformer coil to induce a high voltage across the coil. A rectifier tube 31 is connected across the autotransformer to rectify the voltage and supply it to a smoothing filter comprising condensers 32 and 33 shunting a resistance 34, the filter being connected to the anode 14 of the cathode ray tube to supply the necessary high unidirectional voltage.

It is desirable that transient voltages existing in the circuit during the generation of the high voltage should be prevented from causing interference with the picture signal. For this reason the tube 23 is cut off to produce the high transient voltage only during the retrace period when no picture signal is being transmitted. In order to accomplish this, the control grid 25 is connected through a resistor 35 to the secondary of the transformer 20. The voltage appearing at the secondary of the transformer 20 comprises a series of steep pulses of negative polarity produced by the sudden rate of change of current in the secondary circuit during the retrace periods. These negative pulses are employed to cut off the tube 23 during the retrace periods so that the transient voltages appearing in the high voltage generating circuits occur only during the retrace periods and do not produce interference with the picture signals.

The magnitude of the effective unidirectional voltage is substantially increased by employing

the air core autotransformer 22 and particularly by tuning the transformer coil with the capacities associated therewith so that several oscillations occur during the retrace period. The capacities include the capacity of the rectifier tube, the plate circuit capacity of the tube 23 and the distributed capacity of the coil 22. The rectifier 31 includes an anode 36 connected to the coil 22 and a cathode 37 connected to the resistance 34 of the filter. Heating current for the cathode is derived from the transformer 22 through a secondary coil 38 comprising about two turns, the transformer 22 usually having several thousand turns.

A further understanding of the operation of the circuit may be obtained upon reference to Fig. 2 in which curves 39, 40, 41 and 42 represent, respectively, the current through the deflection coil 15, the voltage at the deflection coil terminal, the voltage across the transformer 22, and the plate current of the tube 23. These curves are plotted on the same vertical time axis and represent one cycle of operation. The steep retrace portion of the current curve as indicated at 39a produces a steep negative pulse 40a in the voltage curve 40 during the retrace period, the remainder of the curve 40 being substantially flat since the trace portion of the current curve has a substantially constant rate of change. The negative pulse 40a when applied to the control grid 25 of the tube 23 cuts off the flow of current through the tube and, therefore, through the primary circuit of the transformer 22. This sudden rate of change of current through the primary circuit produces a high voltage surge in the transformer and, since the transformer is tuned to a frequency sufficiently high to produce several oscillations during the retrace period, a voltage curve as indicated at 41a is produced, this voltage being the stepped-up voltage across the secondary circuit of the transformer. Since the transformer is connected to the plate 36 of the rectifier tube, only the positive portions of the oscillation wave produce a flow of current through the rectifier and a high positive voltage is applied to the anode 36 of the cathode ray tube. The value of this voltage is substantially that of the positive peak of the oscillation curve 41a, the condenser 32 being charged to this voltage and substantially maintaining its charge during the trace period of the wave when the rectifier is non-conducting. The transformer coil 22 is lightly damped during the retrace period when the electron discharge device 23 is non-conducting. However, upon the termination of the negative pulse 40a, the resistance of the tube 23 falls and produces heavy damping of the coil 22. This insures one or more complete oscillations during retrace and prevents the continuation of the oscillations during the trace period of the saw-tooth wave and minimizes interference with the picture signals which might otherwise result from the generation of the high voltage oscillations.

The high voltage generator described above may be constructed to occupy an extremely small space and weighs very little since it does not require a heavy iron core transformer. The coil 22 has a high Q, that is, a high ratio of stored energy to dissipated energy which is determined by the ratio of the reactance of the coil to its resistance. It is, therefore, apparent that the circuit of Fig. 1 makes it possible to construct an extremely high voltage generator of small dimensions and light weight which is particularly useful in apparatus such as television receivers where space is limited.

In television apparatus and the like in which the frequency of the wave applied to the sweep coils 15 is of the order of several thousand cycles per second or higher, the time constant of the filter 32, 33 and 34 can be made sufficiently low so that the energy storage in 32 and 33 is far below the dangerous limit for bodily contact. In a typical case of a television receiver 32 and 33 can be of the order of 100 μ f. each and 34 can be of the order of 0.25 megohm. Direct contact produces no more than a slight burn even though the voltage is of the order of 7500 volts because the stored energy is low and the regulation of the supply is very severe above a current of 2 milliamperes. The capacity 33 may in the case cited be the conductor-to-shield capacity of the high voltage anode connecting cable usually employed with such circuits.

While I have illustrated one embodiment of my invention in connection with a television receiving circuit employing magnetic deflecting members, other modifications and applications will readily occur to those skilled in the art. I do not, therefore, desire my invention to be limited to the particular embodiment illustrated and described and I contemplate by the appended claims to cover all modifications which fall within the spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In a television apparatus or the like a cathode ray electron discharge device having an anode and a ray deflecting member, means for impressing on said member a saw-tooth deflecting wave having a rapid retrace portion, an electron discharge device, an air core induction coil connected in the output circuit of said device, means dependent upon the retrace portion of said saw-tooth wave for intermittently cutting off the flow of current through said coil to produce a high voltage surge, and means including a rectifier connected in series with said coil for producing a high unidirectional voltage, said coil being tuned to produce several high voltage oscillations during the retrace portion of said wave whereby the maximum unidirectional voltage is effectively increased.

2. In a television apparatus or the like, a cathode ray electron discharge device having an anode and a ray deflecting member, means for impressing on said member a saw-tooth deflecting wave having a rapid retrace portion, an air core induction coil, means including an electron discharge device having a cathode and an anode and a control electrode for producing a flow of current through said coil, means for deriving negative pulses from the retrace portions of said wave and for impressing said pulses on said control electrode intermittently to cut off the flow of current through said coil whereby high voltage peaks are produced across said coil, said coil being tuned to produce several oscillations during the retrace portion of said wave, and means including a rectifier connected in series with said coil for producing a high unidirectional voltage.

3. In a television apparatus or the like, a cathode ray electron discharge device having an anode and a magnetic ray deflecting coil, means for producing in said coil a saw-tooth current wave having a rapid retrace portion whereby a high negative voltage pulse is produced at said coil during the retrace portion, an air core induction coil, means including an electron discharge device for producing a flow of current through said coil, means utilizing said negative pulse for con-

trolling said device intermittently to cut off the flow of current through said coil whereby high voltage peaks are produced across said coil, said coil being tuned to produce several oscillations during the period of interruption of the flow of current therethrough, and means including a rectifier connected with said coil for producing a high unidirectional voltage and for applying said unidirectional voltage to said anode.

4. In a television apparatus or the like, a cathode ray electron discharge device having an anode and a ray deflecting member, means for impressing on said member a saw-tooth deflecting wave having a rapid retrace portion, an air core autotransformer, means including an electron discharge device for producing a flow of current through the primary circuit of said transformer, means dependent upon the retrace portion of said saw-tooth wave for intermittently cutting off the flow of current through said device to produce a high voltage surge in said transformer, and means including a rectifier connected in the secondary circuit of said transformer for producing a high unidirectional voltage and for applying said unidirectional voltage to said anode.

5. In a television apparatus or the like, a cathode ray electron discharge device having an anode and a ray deflecting member, means for impressing on said member a saw-tooth deflecting wave having a rapid retrace portion, an air core autotransformer, means including an electron discharge device for producing a flow of current through the primary circuit of said transformer, means dependent upon the retrace portion of said saw-tooth wave for intermittently cutting off the flow of current through said device to produce a high voltage surge in said transformer, and means including a rectifier connected in the secondary circuit of said transformer for producing a high unidirectional voltage and for applying said unidirectional voltage to said anode, said transformer as connected to said circuits having a natural period of oscillation such that several oscillations occur during the retrace portion of said wave whereby the maximum unidirectional voltage is effectively increased.

6. In a television apparatus or the like, a cathode ray electron discharge device having an anode and a ray deflecting member, means for impress-

ing on said member a saw-tooth deflecting wave having a rapid retrace portion, an electron discharge device, an air core induction coil connected in the output circuit of said device, said coil being lightly damped when said device is nonconducting and heavily damped when said device is conducting, means dependent upon the retrace portion of said saw-tooth wave for intermittently cutting off the flow of current through said coil to produce a high voltage surge, and means including a rectifier connected in series with said coil for producing a high unidirectional voltage, said coil being tuned to produce several high voltage oscillations during the retrace portion of said wave whereby the maximum unidirectional voltage is effectively increased, said oscillations being effectively stopped by the heavy damping of said coil at the end of said retrace portion when said device becomes conducting.

7. In a television apparatus or the like, a cathode ray electron discharge device having an anode and a ray deflecting member, means for impressing on said member a saw-tooth deflecting wave having a rapid retrace portion, an air core autotransformer, means including an electron discharge device for producing a flow of current through the primary circuit of said transformer and for effecting heavy damping of said transformer, said transformer being lightly damped when said device is nonconducting, means dependent upon the retrace portion of said saw-tooth wave for intermittently cutting off the flow of current through said device to produce a high voltage surge in said transformer, and means including a rectifier connected in the secondary circuit of said transformer for producing a high unidirectional voltage and for applying said unidirectional voltage to said anode, said transformer as connected to said circuits having a natural period of oscillation such that several oscillations occur during the retrace portion of said wave whereby the maximum unidirectional voltage is effectively increased, said oscillations being effectively terminated by the heavy damping of said autotransformer when said device becomes conducting at the end of said retrace portion.

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