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CATHODE RAY TUBE SYSTEM

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Fig. 1.

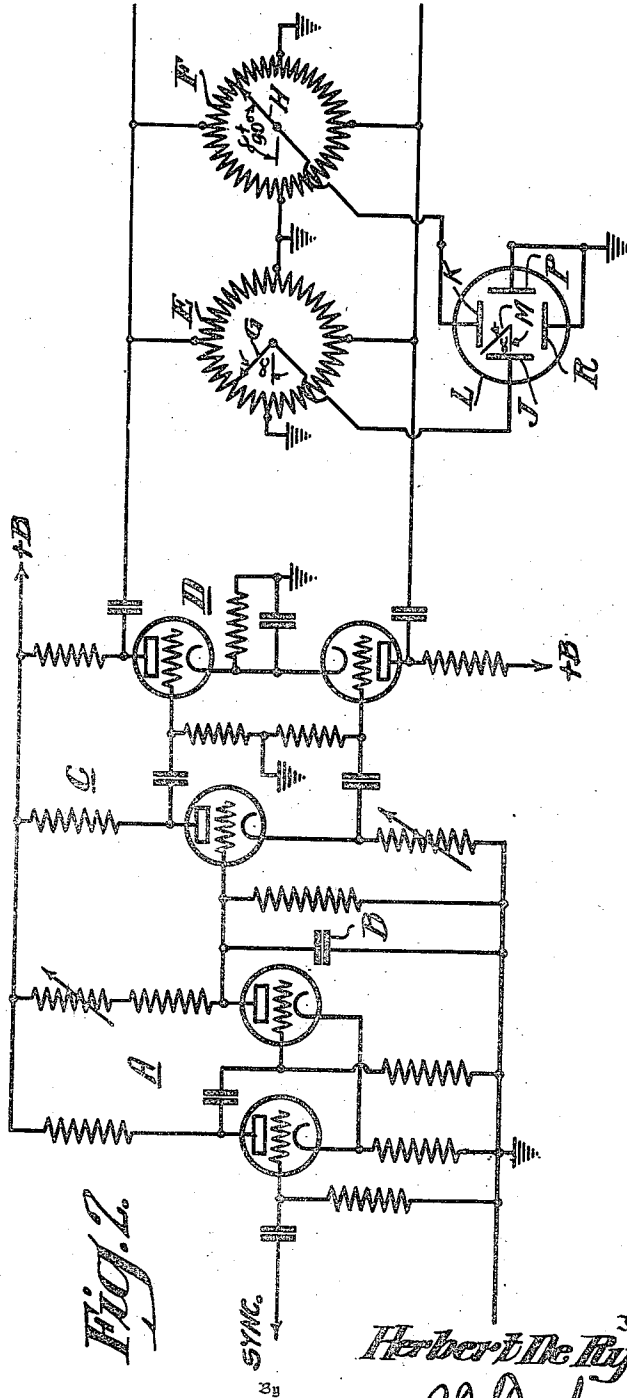


Fig. 2.

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CATHODE-RAY TUBE SYSTEM

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3 Claims. (Cl. 315-24)

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This invention relates to cathode ray tube systems and more particularly to means for generating beam deflection voltages. In certain applications of cathode ray tubes it is desirable to produce a linear radial trace lying in a direction on the cathode ray tube screen corresponding to the angular position of a remote control shaft, and rotatable around the axis of the tube in synchronism with the rotation of said remote control shaft. This can be done in a number of ways, most of them unsatisfactory for one reason or another. For example a magnetic deflection circuit may be used, energized with the sawtooth wave current required for linear deflection and the deflection coils may be moved bodily around the axis of the tube for rotation of the trace. In addition to the sawtooth current it is necessary to provide a bias current to produce a radial, rather than diametral trace. The mechanical awkwardness of such a system becomes particularly evident when the cathode ray tube is to be used at a location remote from the shaft by which the direction of the trace is to be controlled. Another method is to produce a circular trace by applying sine waves in quadrature to the two pairs of rectangularly disposed deflecting means in a conventional cathode ray tube and modulating the velocity of the beam and hence its stiffness or deflection sensitivity, by varying the second anode voltage. When this is done it is necessary to vary the other electrode voltages so as to maintain the beam in focus. One of the difficulties in the use of this system lies in the fact that the radial deflection sensitivity as a function of second anode voltage is relatively low, requiring large variations in voltage and hence large deflection power to produce the required trace.

The principal object of this invention is to provide an improved method and means for producing a rotatable radial deflection sensitivity as a function of second anode voltage is relatively low, requiring large variations in voltage and hence large deflection power to produce the required trace.

The principal object of this invention is to provide an improved method and means for producing a rotatable radial deflection of the beam in a cathode ray tube. A further object is to accomplish the desired result by application of modulated sawtooth wave voltages to the deflection means of a conventional cathode ray tube. Still another object is to provide a method and means for producing modulated sawtooth wave voltages of the form required to be applied to the deflecting means of a conventional cathode ray tube in

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order to produce a rotatable radial deflection of the beam. Other and incidental objects will appear to those skilled in the art upon consideration of the following description with reference to the accompanying drawing, of which Fig. 1 is a graphical representation of a sinusoidally modulated sawtooth wave, and Fig. 2 is a circuit diagram of a specific embodiment of the invention. A voltage wave of the form shown in Fig. 1 must be applied to each of the rectangularly disposed pairs of deflecting means of a cathode ray tube to produce a rotating radial deflection of the beam. The sinusoidal envelope is shifted 90 degrees in phase on one of the deflection circuits with respect to sinusoidal envelope of the wave applied to the other deflection circuit. When the linear trace is at an angle α with respect to a reference line for example, the line parallel to the axis of one pair of deflecting plates in an electrostatically deflected tube, the amplitude of the sawtooth voltage applied to that pair of plates must be proportional to cosine α , while the amplitude of the voltage applied to the other pair of plates must be in the same proportion to sine α .

Referring to Fig. 2, a circuit for producing voltage waves of the required form is shown. A sawtooth wave generator, such as a multivibrator A with a capacitor B shunted across its output circuit, is connected to a phase inverter C and thence to the input circuit of a push-pull power amplifier D. Two potentiometers E and F are connected across the output of the amplifier D. These potentiometers are wound with a sinusoidal resistance-rotation taper, so that as their arms G and H are rotated, the voltage appearing between each of the rotary arms and ground is proportional in amplitude to the sine of the angle of rotation, reversing the polarity each time the arm crosses the grounded parts of the potentiometer. The arm of the potentiometer H is spaced 90 degrees from the arm of the potentiometer G, and the two rotors are mechanically connected to rotate together, maintaining the 90 degree difference in angular position. The arm G is connected to the deflecting plate J of a cathode ray tube L, and the arm H is connected to the deflecting plate K. The potentiometer arms G and H are mechanically connected to the shaft (not shown) which is to control the direction of the radial trace.

The sawtooth wave generated by the multivibrator A across the capacitor B is inverted by the circuit C to produce two sawtooth waves of equal amplitudes and opposite polarities, which

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are amplified at D and applied across the potentiometers E and F. The output of each potentiometer is then a sawtooth wave having an amplitude proportional to the sine of the angular position of its rotor, which is indicated at α for potentiometer G and $\alpha+90$ degrees for potentiometer H. The output of the potentiometer H is thus proportional to sine (90 degrees + α) or cosine α . The trace M of the cathode ray beam caused by the voltages applied to the deflecting plates J and K is then at an angle α with respect to the line through the plates J and P. If symmetrical deflection voltages are required, the plates P and R may be disconnected from ground and supplied with voltages derived from the potentiometer arms G and H respectively through phase inverter circuits. For magnetic deflection, the outputs of the potentiometers G and H may be connected to corresponding deflection coils.

I claim as my invention:

1. A deflection system for cathode ray tubes comprising a source of voltage pulses, a plurality of variable voltage dividers connected to said source and mechanically connected to a common control shaft, said voltage dividers being so constructed and arranged that the amplitudes of the voltages appearing at the output terminals of one group of said voltage dividers are proportional to the cosine of the angle of position of said control shaft, and the amplitudes of the voltages appearing at the output terminals of another group of said voltage dividers are proportional to the sine of the angle of position of said control shaft.

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2. A deflection system for cathode ray tubes comprising a source of voltage pulses, a control shaft, and voltage divider means electrically connected to said source and mechanically connected to said shaft to derive from each of said voltage pulses a plurality of similar pulses of amplitudes proportional respectively to the cosine and to the sine of the angle of the position of said shaft with respect to a reference position.

3. A deflection system for cathode ray tubes comprising a sawtooth wave generator, a phase inverter connected to derive from the sawtooth wave output of said generator two equal sawtooth wave voltages of opposite polarities, means for applying said latter voltages to the input terminals of each of two voltage divider networks, each provided with a variable position contact, and comprising resistors with sinusoidally tapering values of resistance per unit length, whereby the proportion of the output voltage to the input voltage of each of said voltage dividers is equal to the sine of the angle of position of said contact with respect to a reference position, a shaft mechanically connected to both of said contacts so that the position of one of said contacts is at an angle of 90 degrees with respect to the position of the other of said contacts, means for applying the respective output voltages of said voltage dividers to corresponding circuits of rectangularly related deflection elements of said cathode ray tube.

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