Control Circuits for Cathode Ray Apparatus

Fig. 1.

Fig. 2.

Inventor

By: Nellie & Patterson

Attorneys
This invention relates to means for deflecting a cathode ray beam, either recurrently or to a controllable position, at will. The invention has special but not exclusive application in panoramic radio receivers, and the nature of which was described in "Electronics" June 1940, and wherein, in brief, a waveband, or it may be any selected one of a plurality of wavebands, is scanned from end to end by the automatic variation of a tuning parameter at a rate comparable with the frequency of the persistence of vision, the output or outputs due to any received radio transmissions which may be taking place within the waveband being indicated as resonance or peak components perpendicular to a time base waveband component on the screen of a cathode ray tube, the time base component being provided synchronously with the scanning such as by means of a saw-tooth type of oscillation generator. Provision can be made whereby any selected one of the thus indicated transmissions can be tuned into manually and its modulation listened to or recorded or otherwise indicated, that is to say, the scanning of the waveband can be effected solely by such means as the turning of a knob about an associated dial indicating the wavelength. In such a panoramic receiver it has been convenient for the purpose of the rapid scanning of the waveband to wobble the value of certain tuning components of the oscillator section of a frequency changer valve in a superheterodyne circuit. It is known in such a panoramic receiver to effect the rapid scanning by means of a so-called reactor valve in one form of which the effective or apparent grid-cathode capacity of the valve is varied by varying the potential of the grid such as by means of a saw-tooth voltage generator, this reactor valve having a flatly tuned anode circuit and having its grid cathode circuit connected in parallel with a sharply tuned inductance-capacity circuit of the oscillator stage of the frequency changer which may be the second frequency changer in a circuit wherein there are in all three frequency changers with associated respective local oscillators. According to U. S. application Serial No. 503,281, filed September 21, 1943, the output of the oscillator means by which the reactor valve is associated in parallel is applied to the grid of a high frequency amplifier valve having a flatly tuned anode circuit, and the output of this amplifier valve is applied to the frequency changer. The present invention is directed to a specific arrangement conveniently enabling changeover from automatic scanning to hand scanning when magnetic deflection of the cathode ray beam is employed. According to the invention means for magnetically deflecting the beam of a cathode ray tube, either automatically recurrently, or to a manually controllable position, at will, comprise a source of recurrently varying voltage or current supplying at least one deflection coil and itself supplied from one source of operating power through a "common" busbar to which is connected the cathode circuit of a "reactor" valve for concomitantly and correspondingly effecting tuning scanning of another device (such as a panoramic radio receiver) providing a video output to be observed on the cathode ray tube, which reactor valve has its anode circuit supplied from a second operating power source the negative terminal of which is connected to said common busbar, whilst the grid of said reactor valve is supplied with the recurrent voltage (preferably through an amplifier) whilst furthermore switching means are provided for cutting off the recurrent voltage from the system and for connecting the grid of said reactor valve (preferably through the above indicated amplifier if provided) to a manually variable source of potential such as a potential divider. Thus the saw-tooth oscillation generator and the reactor valve are fed from respective power supplies such that the positive busbar of the former and the negative busbar of the latter are common and may conveniently be earthed, the saw-tooth voltage or current being conveniently supplied via a variable potential divider and a series resistor to the grid of one of a pair of amplifier valves, which may conveniently be directly coupled in push-pull in per se known manner such as by means of a common cathode resistor, and in the anode circuits of each of which valves is a deflection coil and a resistor in series, the two resistors being connected to the common busbar. This particular arrangement ensures that the voltage drop across the resistors follows exactly the current flowing through the coils and so a potential divider across the ends, remote from
The common busbar of the two resistors enables an adjustable voltage proportional to the coil current, that is, to the time-base deflection of the receiver, to be applied to the grid of the resistor valve and thus to alter the tuning of the radio receiver synchronously with the movement of the cathode ray beam by the saw-tooth current flowing in the deflection coils. The means whereby whenever desired the saw-tooth oscillator can be switched off and the grid of the first of the aforesaid amplifier valves connected directly to the tapping on the potential divider permits that, by adjusting this potential divider, the receiver can be manually tuned to any desired signal within the waveband while the cathode ray beam indicates the corresponding position on the screen otherwise exactly as when the saw-tooth oscillator is in operation.

The use of the aforesaid push-pull amplifier is preferred for reasons associated with the magnetic deflection of cathode ray beams, but it is in no way essential to the invention, the important aspect of which is that all circuits are direct coupled so that the tuning of the receiver and the indication of the setting are interdependent, whether they are controlled manually or automatically by the saw-tooth oscillation. It is therefore clear also that a saw-tooth wave form is not essential for the automatic operation; for example, the wave form may be "pyramidal" as produced by rotating or vibrating other means giving a recurrent voltage or current at the requisite frequency.

Figure 1 of the accompanying drawing is an electrical circuit diagram illustrating the invention.

Figure 2 is a detail view of the reactor valve and its circuits.

In the drawing the rectangle represents the saw-tooth voltage generator or other means whereby the cathode ray beam is deflected recurrently according to a predetermined law such as, more particularly, to provide the time base and whereby concomitantly to effect the scanning of the radio receiver of the panoramic type.

In the preferred circuit arrangement illustrated the output from the device 1, which will be hereinafter for convenience referred to as the saw-tooth voltage generator, is fed through the condenser 2, the tapping point 3 of the potentiometer 4 (which may be adjustable preset) and through the series resistance 5 to the control grid of an amplifier valve 6 having push-pull association with an amplifier valve 7, these valves having the common cathode resistor 8. As resistance 21 is very small in comparison with resistance 4, the grid of valve 7 has effectively no voltage variation applied to it. The anode circuits of valve 6 has the cathode ray tube deflector coil 11 in series with a resistance 12 connected to the "common" busbar 13. The anode circuit of the valve 7 has the complementary deflecting coil 14 in series with the resistor 15 also connected to the "common" busbar 13.

The "common" busbar 13 is preferably earthed as indicated at 16 and is connected with the positive terminal of a source of power supply indicated by the rectangle 17 for the saw-tooth generator 1 and amplifier valves 6 and 7, the negative terminal of this source being connected to what may be called for convenience the cathode busbar 18 of the saw-tooth generator 1 and valves 6 and 7. The bias of these valves in the circuit illustrated is conveniently determined in part by the tapping 19 between the resistances 20 and 21 connected in series across the source 17.

The rectangle 22 in Fig. 1 indicates the reactor valve the arrangement of which, along with the oscillator of the second frequency changer stage, is similar to that illustrated in the drawing of U.S. Patent No. 2,383,420, granted August 21, 1945. In the arrangement of this valve as shown in Fig. 2, V2 is the oscillator valve having a resistance R2 in its anode circuit, the output of this valve being passed to the mixer valve in a known manner or through an intervening amplifier as described in Application Ser. No. 503,281 aforesaid, and V1 is the reactor valve. Due to the feed-back coil L2 and valve V2, oscillations appear in circuit L1, C1, across which is the grid-cathode circuit of valve V1. The anode circuit of valve V1 is effectively resistance R, coil L3 being provided merely to tune out the stray capacitance, while C2 is a very small trimming condenser to enable the optimum tune to be obtained. As resistance of R is small, the anode circuit is very flat and, being predominantly resistive, the voltage appearing at the anode is approximately in anti-phase with that on the grid over a wide range of frequency. The frequency to which the circuit through the condenser C9 is resonant is altered by varying the bias voltage applied to the grid of valve V1 by means of the switch shown in Fig. 1. The saw-tooth voltage input to the reactor valve is taken from the adjustable preset tapping 24 on the potentiometer 25 connected across the respective lower ends of the resistances 12 and 15. The cathode circuit of the reactor valve arrangement 22 is connected to the "common" busbar 13, and the anode circuit of this valve and conveniently also of the local oscillator and amplifier associated therewith is supplied from the source 26 which is separate and distinct from the source 17 and which has its negative terminal connected to the common busbar 13. The power supply to the saw-tooth generator 1 is taken from the common busbar 13 through the manual switch 27 so that the automatic scanning or time base provision may be cut out when desired, and to enable the hand-scanning to be effected a manual switch 28 is provided which is connected to the control grid of the valve 6 through the resistor 29; the terminal of the switch being connected to the manually operable slider 30 on the potentiometer 31, which is conveniently connected between the common busbar 13 and the cathode busbar 18, the arrangement being such that when the normally open switch 29 is closed, by movement of the slider 30 manual scanning can be accurately effected otherwise in correspondence with the normal automatic scanning.

We claim:

1. The combination of a radio receiver providing a video output to be observed on a cathode ray tube, complementary coils for magnetically deflecting the beam of the cathode ray tube, a power system embodying a first source of operating power and a second source of operating power, a busbar common to said sources of operating power and connected to the negative terminal of said second source of operating power, a source of recurrently varying voltage supplied from one of said sources of operating power through said busbar and supplying said beam deflecting coils, a frequency varying reactor valve having an anode, grid and cathode, a cathode circuit for said reactor valve connected to said busbar for concomitantly and correspondingly effecting tuning.
scanning of the receiver, an anode circuit for said reactor valve connected to said second source of operating power, and a grid circuit for said reactor valve having means for supplying it with said recurrently varying voltage, a manually variable source of potential, and switching means for disconnecting said source of recurrently varying voltage from the system and for connecting the grid of said reactor valve to said manually variable source of potential.

2. The combination according to claim 1, including a pair of push-pull amplifying valves having anode circuits connected to the complementary beam deflecting coils for the cathode ray tube, and a potential divider for connecting said coils to the grid of said reactor valve.

3. The combination according to claim 1, including a pair of push-pull amplifying valves having anode circuits connected to the complementary beam deflecting coils for the cathode ray tube, a potential divider for connecting said coils to the grid of said reactor valve, a potentiometer connected across a suitable source of potential, and means including a switch and a slider for connecting the grid of one of said amplifying valves to said potentiometer.

JOHN MATHIESON DODDS,
GRAHAM JOHN SCOLES.

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