Nov. 7, 1939. H. BÄHRING 2,178,772

TWO-TUBE DEFLECTING CIRCUIT

Filed Sept. 16, 1936

Fig. 1.

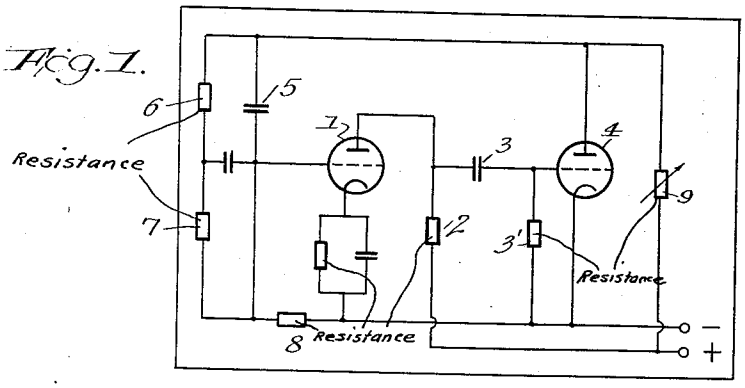


Fig. 2.

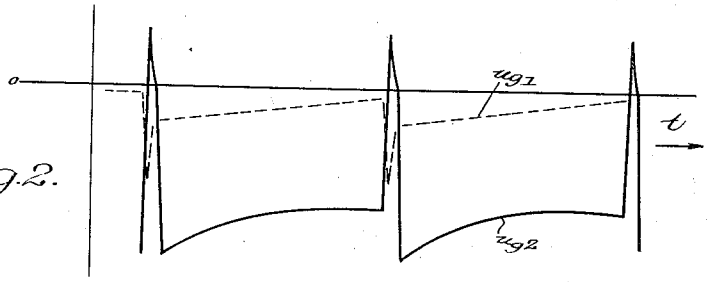


Fig. 3.

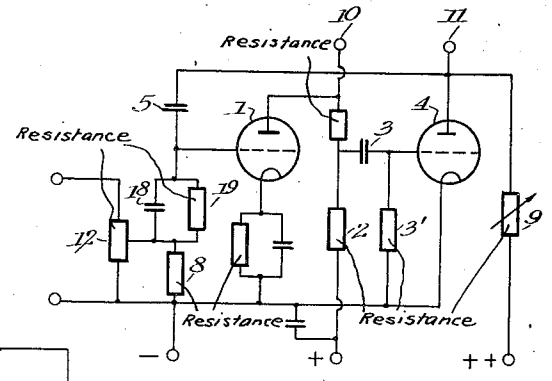
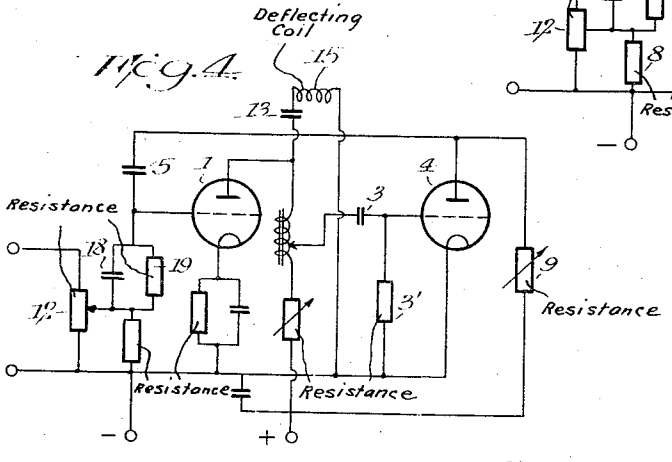


Fig. 4.



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TWO-TUBE DEFLECTING CIRCUIT

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In Germany October 10, 1935

1 Claim. (Cl. 250—36)

The invention relates to relaxation circuits and deals more particularly with a two-tube deflecting reflex circuit adapted for producing time-proportional voltages and currents.

The deflecting circuits contain two systems of tubes which act as blocking elements, and of which, at a given instant either one or the other is blocked. The charging or discharging of a condenser which occurs when one tube is blocked with current of as constant a value as possible is utilized to produce a current or voltage of zig-zag contour. In the deflecting circuits hitherto used for time deflection purposes in oscillographs, television transmitting and receiving tubes, it was necessary to use one or more additional amplifying tubes in order to obtain the necessary voltages or currents. The reason for this was that the tubes of the deflecting circuits could only be used as blocking elements but not as amplifying tubes.

In accordance with the invention a voltage of zig-zag contour is impressed on the grid of that tube which is blocked during the charging of the condenser, and this voltage is produced in the deflecting circuit per se at the charging condenser. It is thus possible to use these tubes both as blocking elements as well as amplifying elements. The zig-zag shaped voltage may be tapped off, e. g., with the aid of a voltage distributor, from the constantly rising condenser voltage. A capacitative voltage distributor is preferably used as a voltage distributor for this purpose.

The circuit is described in the present specification with the aid of a number of embodiments illustrated in the drawing.

Fig. 1 is a basic circuit diagram of the deflecting circuit.

Fig. 2 is a representation of the curves of the grid voltages of both tubes.

Fig. 3 and Fig. 4 show circuits for electrostatic or electromagnetic deflection of a cathode ray.

According to Fig. 1 the anode circuit of tube 1 contains the resistance 2 of an operating device. The charging circuit contains a device 9 which delivers current of as constant nature as possible, a condenser 5, and a resistance 8. The elements 6 and 7 constitute a voltage distributor, the tapping-off point of which is connected with the grid of tube 1. The discharge tube 4 is connected in parallel with condenser 5. The grid of this tube is connected through condenser 3 to the output circuit of tube 1. The grid is furthermore connected through resistance 3' with the cathode of the same tube 4.

The operation of the circuit of Fig. 1 is as follows: In order to initiate the relaxation procedure a negative impulse is impressed upon the grid of the first tube 1 or a positive impulse on the grid of the second tube 4. The grid voltage u_g1 becomes negative, the anode current becomes smaller, and the grid voltage u_g2 increases; the second tube becomes unblocked. The charged condenser 5 is discharged across the circuit elements 6, 7 and 8 and tube 4. The voltage drop occurring at resistance 8 decreases the anode current of the first tube still further and produces a still higher positive grid voltage u_g2. The second tube 4 remains unblocked until the end of the synchronizing impulse. During the impulse the grid of tube 4 acquires a strong charge which is retained through agency of condenser 3 but which is released after termination of the impulse so that the grid of tube 4 becomes very strongly negatively charged and the tube 4 alone becomes blocked. At this point the condenser 5 begins to become charged through device 9 and the circuit elements 6, 7 and 8. The grid voltage u_g1 rises proportionately with the charging voltage of the condenser 5, that is, in a self-proportional manner.

If the anode current of tube 1 and the grid voltage of tube 4 rise to such an extent that a current is produced in the anode circuit of tube 4, said current will increase very strongly since the grid voltage of this tube rises and the performance thereof follows the characteristic curve in a very steep fashion. The charging current drops very greatly corresponding to a negative impulse on the grid of the first tube. The device then acts as a relaxation circuit by itself. The synchronizing frequency must therefore be chosen equal to or smaller than this natural frequency.

Fig. 2 shows a dotted time curve of the grid voltage u_g1 of the first tube and clearly indicates the negative impulse as well as the linear rise. The grid voltage u_g2 of the second tube is indicated by the solid line curve.

Fig. 3 shows a symmetrical push-pull circuit for static deflection purposes. The voltage is taken off at points 10 and 11 in the anode circuits of both tubes 1 and 4. The anode voltages of the two tubes are in opposed phase relation. The synchronizing impulses are tapped off from a potentiometer 12 and fed through condenser 18 to the grid of tube 1. The synchronizing may however be effected equally well by means of a second grid. As a voltage distributor in this case there may be employed a capacitative voltage

distributor used together with condensers 5 and 18 where condenser 5 is appreciably smaller than condenser 18. The resistance 19 serves solely for determining the grid potential of the first tube and the resistance 8 for producing the feed-back blocking.

Fig. 4 shows a circuit adapted for magnetic deflection. The condenser 13 serves for direct current blocking of the deflecting coil 15. The retrogression of the relaxation curve is, in the circuit of Fig. 4 not determined solely by the synchronizing impulse, but rather also by the discharge of the choke 17 across the tube 1.

It is therefore preferable in order to obtain a small time constant and hence short retrogression, to use tubes having great internal resistance.

The two tubes may be united into a single bulb structure so as to constitute a double tube, thus effecting additional economy. It is preferable to form tube 1 as a screen grid tube.

I claim:

A sawtooth wave generator comprising an electron discharge device having an anode, cathode and control electrode; an input circuit including a resistance and a condenser shunted resistance in series, connected between said cathode and control electrode; a source of potential, a circuit connecting said anode and cathode and including said source of potential; a condenser; a charging circuit for said condenser including in series with said condenser, said source of potential, a resistance and at least a portion of said input circuit; and a second electron discharge device including an anode and cathode, means connecting the anode-cathode impedance of said second electron discharge device in shunt across said condenser and said portion of said input circuit, said second electron discharge device having an output circuit connected between its anode and cathode including said source of potential and said charging circuit resistance, means controlling said second electron discharge device from the circuit connecting the anode and cathode of said first discharge device, and means for interconnecting the anodes of both said discharge devices for deriving deflecting potentials from said generator.

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