July 14, 1953 F. COETERIER 2,645,738

CIRCUIT ARRANGEMENT COMPRISING A REFLEX DISCHARGE TUBE

Filed July 25, 1947

Fig. 1

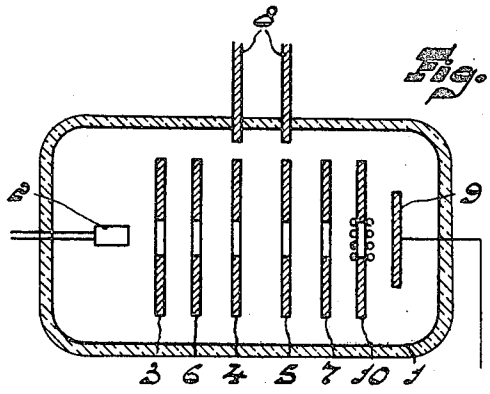
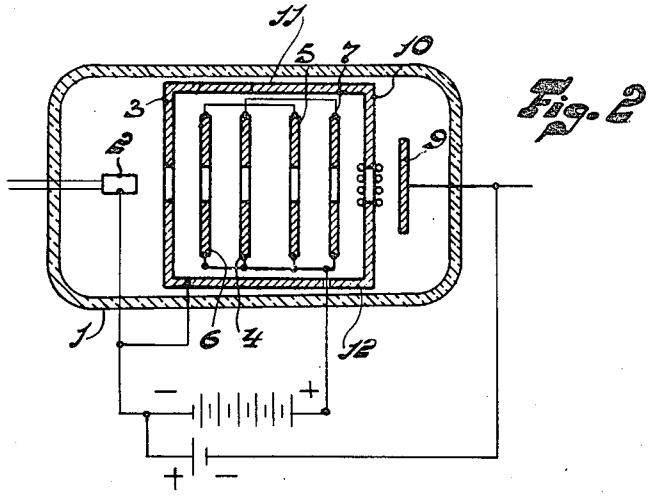


Fig. 2



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CIRCUIT ARRANGEMENT COMPRISING A REFLEX DISCHARGE TUBE

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6 Claims. (Cl. 315—4)

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This invention relates to a circuit arrangement comprising a reflex discharge tube and is an improvement of the device disclosed in copending application Serial No. 662,968, filed April 18, 1946.

The invention has for its object to provide a device in which the high-frequency energy of the density-modulated electron beam is transmitted as completely as possible to the external circuit.

According to the invention, in an arrangement comprising a discharge tube in which an electron beam is produced, the velocity of the electrons in the beam is controlled by an ultra high-frequency oscillation by use of an electrode system, the velocity variations are then converted into density variations by use of a brake field electrode which inverses the direction of movement of the velocity-varied electrons during the conversion of velocity variations into density variations, the brake field space located on the side of the control electrode system remote from the cathode accommodating a double grid which embraces an equi-potential space and the distance of the double grid relative to the control-electrode system, and the distance of this system relative to the cathode and the associated diaphragm being chosen, in view of the length of this system, to be such that the density-modulated electrons are capable of passing at least twice through the control-electrode system, inducing in it currents which maintain the high-frequency oscillations, the two brake spaces as well as the velocity-control space of the control electrode system form part of a complex oscillatory system which may be used to obtain energy for an external circuit.

In order that the invention may be more clearly understood and readily carried into effect, it will now be explained more fully with reference to the accompanying drawing, in which a tube for use in an arrangement according to the invention is shown in two sectional views.

Referring to Figs. 1 and 2, 1 designates the glass wall of a discharge tube comprising a cathode 2 and a diaphragm 3. The velocity of the electrons in the beam emanating from the cathode and sharply defined by the diaphragm is controlled by means of a control-electrode system which comprises four control electrodes 6, 4, 5 and 7. The control system is formed as a triple Lecher-wire system which is tuned to a quarter wavelength of the high-frequency oscillations to be generated. The control electrode system has applied to it a positive voltage which is high with respect to the cathode. On the side remote from the cathode is located a brake electrode system 9 and 10, of which the perforated electrode 10 is

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constructed formed as a double grid and exhibits cathode potential, whereas the plate 9 has placed on it a voltage which is negative with respect to the cathode. In order to provide protection from radiation, the electrodes 3 and 10 are formed with plates 11 and 12 as a rectangular box (Fig. 2) surrounding the control electrode system. The strips of the control electrode system which are supposed to oscillate in phase opposition with the adjacent strips, may be connected in pairs by coupling wires, 6 to 5 and 4 to 7. The operation of the arrangement is such that the fields between the electrodes 3 and 6 and between the electrodes 7 and 10 respectively also contribute both to the velocity control of the electron beam emanating from the cathode and to the withdrawal of energy from the density-modulated beam after the first reflection. Energy is conducted away through two strips 8 forming part of a Lecher-line taken through the wall of the discharge tube and capacitatively coupled to two strips of the control electrode system which are adjacent and thus oscillate in phase-opposition.

What I claim is:

1. A high-frequency circuit comprising an electron discharge tube of the velocity modulation type including in successive axial arrangement an electron-emissive cathode, a focussing electrode for forming an electron beam, four spaced electrodes defining a beam control system for effecting velocity variations in said beam, a double-grid electrode and a repelling electrode constituting with said double-grid electrode a brake system for converting the velocity variations into density variations, means including a source of potential connected to the said four spaced electrodes to impress on the said electrodes of said control system a potential which is positive relative to said cathode, means connected to said repelling electrode to impress on said repelling electrode a potential which is negative relative to said cathode, and connecting means to apply to said focussing and double-grid electrodes a cathode potential whereby said grids are at the same potential to define a field free drift space therebetween, said focussing electrode and the adjacent electrode of said control system defining a first brake field therebetween, said double-grid electrode and the adjacent electrode of said control system defining a second brake field therebetween, the electrodes of said control system forming a complex oscillatory circuit, the axial dimension of said first brake field and the axial dimensions of said second

brake field having values with respect to the axial dimension of said control system at which the density-modulated electron beam is capable of passing through the control system at least twice to induce in the oscillatory circuit currents sustaining high frequency oscillations.

2. A high-frequency circuit as set forth in claim 1 wherein the electrodes in said control system of the tube each have a cross-sectional area and are spaced apart from each other a distance at which the first and second electrodes form a first Lecher line, the second and third electrodes form a second Lecher line, and the third and fourth electrodes form a third Lecher line, said electrodes being interconnected to form a triple Lecher wire system adjusted to a quarter wave length of the oscillations to be produced and together constituting said complex oscillatory circuit.

3. A high-frequency circuit as set forth in claim 1 further including a pair of plates interconnecting the extremities of the focussing electrode and the double-grid electrode defining a rectangular shield surrounding the electrodes of said control system.

4. A high-frequency circuit comprising an electron discharge tube of the velocity modulation type including in successive axial arrangement within an evacuated envelope an electron emissive cathode, a focussing electrode for forming an electron beam, four spaced electrodes defining a beam control system for effecting velocity variations in said beam, a double-grid electrode and a repelling electrode constituting with said double-grid electrode a brake system for converting the velocity variations into density variations, means including a source of potential connected to the four spaced electrodes to impress on the said electrodes of said control system a potential which is positive relative to said cathode, means connected to said repelling electrode to impress on said repelling electrode a potential which is negative relative to said cathode, connecting means to apply to said focussing and double-grid electrodes at cathode potential whereby said grids are at the same potential to define a field free drift space therebetween, said focussing electrode and the adjacent electrode of said control system defining a first brake field therebetween, said double-grid electrode and the adjacent electrode of said control system defining a second brake field therebetween, the electrodes of said control system forming a complex oscillatory circuit, the axial dimension of said first brake field and the axial dimensions of said second brake field having values with respect to the axial dimension of said control system at which the density-modulated electron beam is capable of passing through the control system at least twice to induce in the oscillatory circuit currents sustaining high frequency oscillations, and a transmission line for extracting energy from said oscillatory circuit, said transmission line extending through said envelope into said tube and being disposed therein in capacitive relation to the second and third electrodes of said control system.

5. A high frequency circuit as claimed in claim 4 in which the electrodes in said control system of the tube each have a cross-sectional area and are spaced apart from each other a distance at which the first and second electrodes form a first Lecher line, the second and third electrodes form a second Lecher line, and the third and fourth electrodes form a third Lecher line, said electrodes being interconnected to form a triple Lecher wire system adjusted to a quarter wavelength of the oscillations to be produced and together constituting said complex oscillatory circuit.

6. A high frequency circuit as claimed in claim 5 further including a pair of plates interconnecting the extremities of the focussing electrode and the double-grid electrode defining a rectangular shield surrounding the electrodes of said control system.

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