

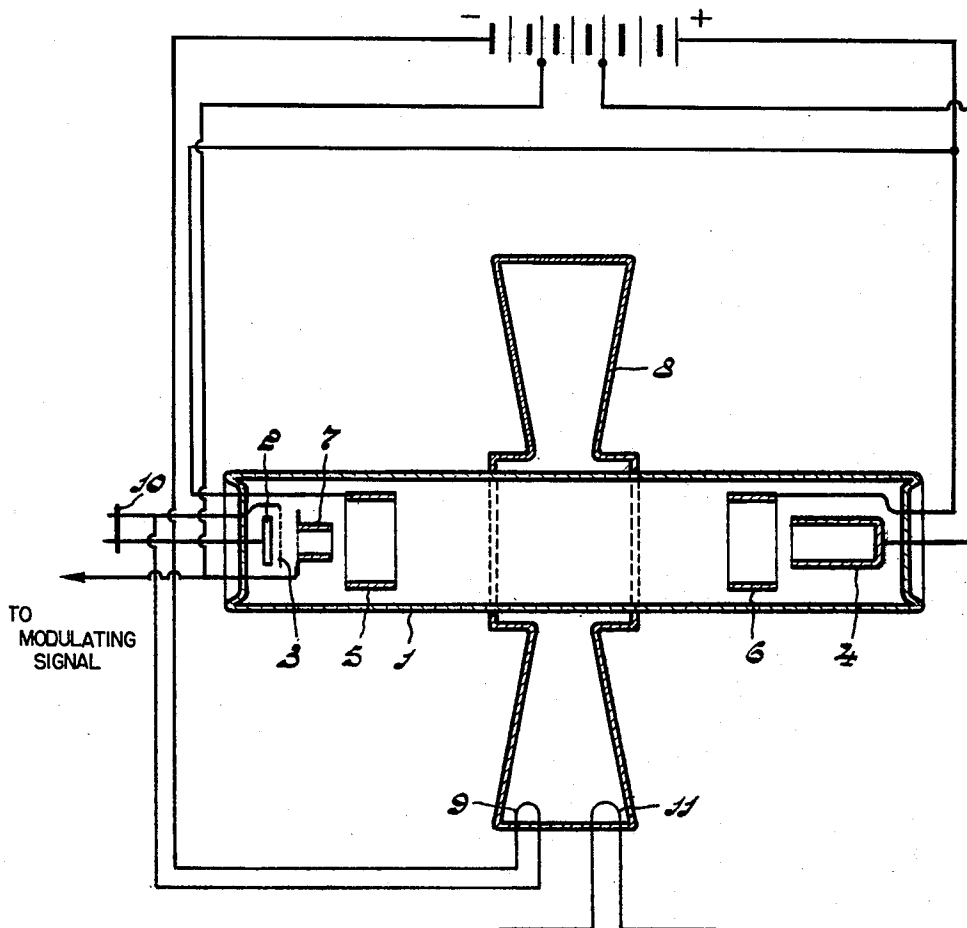
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PHASE MODULATED INDUCTIVE OUTPUT TUBE OSCILLATOR SYSTEM

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PHASE MODULATED INDUCTIVE OUTPUT
TUBE OSCILLATOR SYSTEM

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4 Claims. (Cl. 332-7)

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This invention relates to a device for producing phase-modulated ultra-high frequency oscillations, which comprises an electric discharge tube in which an electron beam is produced, that is, a so-called inductive output tube or Haeff tube.

It is known that the frequency of the produced oscillations with these tubes depends upon the beam voltage and that with the klystrons related thereto phase-modulation is obtained by modulating the beam voltage.

Unless special precautions be taken this involves strong amplitude-modulation. Another serious disadvantage is that modulating voltages of from 10 to 20% of the beam voltage are required for obtaining adequate phase-modulation. This necessitates a large modulation amplifier.

According to the invention these disadvantages are met by supplying, in a device for producing phase-modulated ultra-high frequency oscillations comprising an electric discharge tube in which an electron beam is produced, the modulating voltage to a cylindrical electrode which is placed between the cathode and the first of the electrodes determining the beam voltage, this modulating electrode having a positive voltage with respect to the cathode which voltage is smaller than the beam voltage and preferably less than $\frac{1}{5}$ thereof.

If the modulating electrode has a sufficient size in the direction of motion of the electrons, the modulating voltage need not exceed 15% to 20% of the voltage set up between the modulating electrode and the cathode. The electrons, in effect, travel at a low velocity in the modulating electrode, so that a small variation thereof has a comparatively great influence on the transit time of the electrons.

Since the beam voltage is constant, only a small degree of amplitude modulation occurs, even if no special measures be taken.

At a low direct voltage on the modulating electrode it is advantageous to provide a grid having wide meshes on the cathode side of the modulating electrode, thus ensuring an equipotential surface so that the transit time is constant throughout the cross-section of the beam.

In order that the invention may be clearly understood and readily carried into effect it will now be explained more fully with reference to the accompanying drawing in which a tube according to the invention and the associated apparatus are represented by way of example.

In this drawing the reference numeral 1 represents the quartz wall of the discharge tube

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which comprises at one end a flat cathode 2 and a control grid 3 in front of the latter. At its other end the tube is provided with a hollow collecting electrode 4 which, during operation, acquires a voltage of, say, 2000 volts with respect to the cathode. The reference numerals 5 and 6 denote two annular electrodes which surround the discharge path and attain a voltage of 4000 volts with respect to the cathode during operation. Between the electrode 5 and the control grid 3 is provided an elongated cylindrical electrode 7 in which a grid having wide meshes is provided at the end facing the cathode. During operation of the tube this electrode is given a voltage of 500 volts. The tube is surrounded by a cavity resonator 8, the initial frequency of which corresponds with that of the oscillations to be produced. A coupling loop 9 which is connected to the supply conductors for grid and cathode, is provided in an aperture of this resonator. On the said two conductors is provided a movable short-circuiting bridge 10 which permits the grid circuit to be tuned. Furthermore the cavity resonator contains the coupling loop of the aerial 11. The modulating voltage is supplied to the electrode 7 and amounts to 50 to 80 volts only. For focusing the electron beam magnet coils producing a magnetic field in the direction of the axis of the tube are provided around the tube at both sides of the resonator 8. For the sake of clarity these coils are not represented.

What I claim is:

1. A system for producing phase-modulated ultra-high frequency oscillations comprising an inductive-output electron beam discharge tube having successively arranged within an evacuated envelope a cathode, a grid, a tubular modulating electrode, a first accelerating electrode, a second accelerating electrode and a collecting electrode, a cavity resonator surrounding said envelope and provided with an excitation gap disposed intermediate said first and second accelerating electrodes, means to supply a first positive voltage relative to cathode to said first and second accelerating electrodes, means to supply a second positive voltage whose magnitude is less than the voltage for said accelerating electrodes to said modulating electrode, means to supply a third positive voltage relative to said cathode having a magnitude intermediate said first and second voltages to said collecting electrode and means to apply a signal voltage to said modulating electrode to effect phase-modulation.

2. A system for producing phase-modulated ultra-high frequency oscillations comprising an

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electron beam discharge tube having successively arranged within an evacuated envelope a cathode, a grid electrode, a tubular modulating electrode whose end facing the cathode is enclosed by a grid member, a first annular accelerating electrode, a second annular accelerating electrode and a collecting electrode, a cavity resonator surrounding said envelope and provided with an excitation gap disposed intermediate said first and second accelerating electrodes, means to supply a first positive voltage relative to cathode to said accelerating electrodes, means to supply a second positive voltage having a magnitude less than the first voltage to said modulating electrode, means to supply a third positive voltage having a magnitude intermediate said first and second voltages to said collecting electrode, and means to apply a signal voltage to said modulating electrode to effect phase-modulation.

3. A system, as set forth in claim 2, further including a feed-back loop disposed within said resonator and connected between said cathode and said grid.

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4. In a system for producing phase-modulated ultra-high frequency oscillations, an inductive output electron discharge tube including in successive coaxial arrangement within an evacuated envelope, a cathode, a grid electrode, a tubular modulating electrode whose end facing the cathode is enclosed by a grid member, a first annular accelerating electrode, a second annular accelerating electrode and a collecting electrode.

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