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OSCILLATOR

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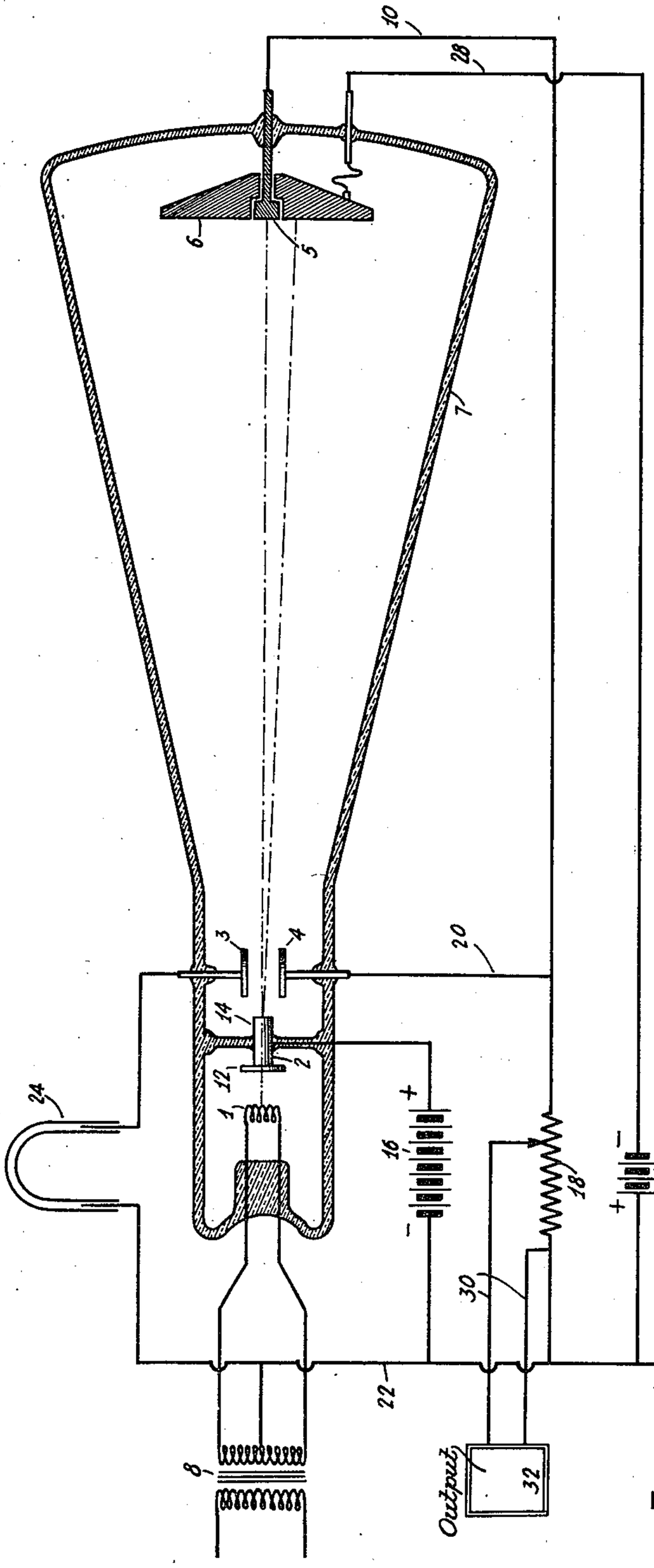

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OSCILLATOR

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13 Claims. (Cl. 250—36)

This invention relates to an oscillator and, especially to an oscillator of the cathode-ray type adapted to produce high frequency oscillatory electrical energy.

An object of this invention is to provide a cathode-ray oscillator having an anode and a cathode, wherein a stream of electrons flowing from the cathode to the anode is deflected in accordance with potentials arising due to the flow of the electrons through an impedance associated with the anode and cathode, to an electrode adjacent the anode.

Still a further object of this invention is to provide for the electrostatic deflection of the stream of electrons to an auxiliary electrode adjacent the anode which auxiliary electrode is, according to this invention, suitably biased to slow up the flow of electrons both thereto and to the anode.

Another object of this invention is to provide for the concentration of the stream of electrons flowing from the cathode to anode in order to efficiently control the deflection thereof.

And, another object of this invention is to provide for the regulation of frequency of the oscillatory energy generated by the oscillator together with the provision of means for obtaining harmonics of a fundamental generated by the oscillator.

The present invention is defined in particularity in the appended claims. However, the invention may best be understood, both as to its structural organization and mode of operation, by referring to the accompanying drawing which is illustrative only of the principles of this invention and is not in any way to be taken as confining it to the apparatus illustrated.

Referring to the drawing, within a container 7, of glass or of any other suitable material, hermetically sealed and evacuated or filled with any desired gas to any suitable degree or pressure, there is mounted a cathode 1 and an anode or target 5.

Cathode 1 may be of any suitable construction and is energized by suitable source of potential derived from, for example, a transformer 8. The anode, as shown, is connected to ground through resistance 18, but may be maintained at a positive potential by the insertion of a source of electromotive force (not shown) in the anode conductor or lead 10 or elsewhere.

Intermediate the anode and cathode, there is suitably mounted a cylindrical tube-like structure or directive and attracting electrode 2, having a disc-like portion 12 attached to tubular member 14, both of metal. The directive and attracting electrode 2 is maintained at a suitable positive potential by source of electromotive force 16.

Accordingly, electrons attracted to the directive electrode 2 will either impinge upon disc 12, or flow in a narrow stream through the orifice of the tube-like structure 14, which, consequently, concentrates the electrons in a small stream in going from the cathode towards target 5. Electrons reach target 5, of course, by virtue of the fact that after having been given a high velocity by the potential applied to the attracting electrode 2, they pass therethrough and strike the target or anode 5 which lies in the longitudinal axis of the cathode-ray tube so far described.

Electrons striking target or anode 5 flow through conductor 10 and impedance 18, preferably, in the form of a resistance. As a result of the current flow through the impedence 18, potentials are applied to deflecting electrodes 3, 4 about the electron stream, intermediate attracting electrode 2 and anode 5, through conductors 20, 22, the latter of which has inserted therein, preferably, a tunable member 24 in the form of a trombone slide.

With potentials, due to variations in current through impedance or resistance 18, applied to deflecting electrodes 3, 4, the electron stream from cathode 1 is deflected downwardly, as shown, so that the stream impinges upon an electrode 6 adjacent, concentric and about anode 5. Electrode 6, is maintained at a steady potential different from that of the steady potential applied to anode 5; and, the biasing of the shield or electron receiving electrode 6, adjacent anode 5, is accomplished by means of a source of potential 26 which, preferably, maintains electrode 6 at a relatively negative bias.

As soon as electrons strike electrode 6, they flow through conductor 28 to ground, as a result of which, due to the fact that there is no longer, at that time, a voltage variation or drop across impedance 18, the electron stream will again strike anode 5 and be again deflected due to another flow of current through the impedance. In this manner, extremely high frequency oscillations will be generated; and, this ultra short wave length energy, approaching a rectilinear or square wave form, may be taken from impedance 18 through leads 30 to a suitable output circuit 32, diagrammatically illustrated.

By varying the voltage applied to attracting electrode 2, the frequency of oscillations generated may be varied. The frequency of oscillations generated is also determined by the dimen-

sions chosen for the tube, and, in particular, the distance between anode or target 5 and attracting anode 2 as well as the distance between electrode 2 and cathode 1.

Application of a negative potential to the shield or receiving electrode 6, tends to slow up the electrons before they strike either it or the anode, thereby preventing overheating of the anode due to electron impact.

Multiples of the fundamental frequency of the square wave generated may be obtained by suitable adjustment of trombone slide 24, which will alter the length of the circuit including conductors 20, 22 and impedance 18, which, in this case, should preferably be made in the form of an inductance coil. With proper tuning, the electron stream from attracting electrode 2 to the anode 5 and adjacent electrode 6 will be broken up into several sections depending upon the tuning of the circuit including electrodes 3 and 4 which electrostatically deflect the electron stream. That is, variation in voltage across conductor 18 will be such, that as electrons are traveling from electrode 2 to anode 5, the stream will be deflected and a cloud of deflected electrons will move towards electrode 6. Then, before the original group of electrons and deflected group of electrons strike their respective electrodes, the stream will be allowed to return to its normal position, and so on. In this way, along the length of the tube, alternate groups of electrons between attracting electrode 2 and the striking electrodes will be directed towards different ones of the striking electrodes 5, 6.

Having thus described my invention, what I claim is:

1. In apparatus for generating oscillatory energy, the combination of a cathode, an anode, means for establishing an electronic stream between the anode and cathode, an electrode adjacent said anode, means for biasing the electrode negatively, and means for deflecting the stream from said anode to said adjacent electrode.

2. In apparatus for generating oscillatory energy, the combination of an anode, a cathode, means for establishing an electronic stream between said anode and said cathode, an impedance connected both to said anode and cathode and having potential variations thereacross due to said electronic stream, a receiving electrode adjacent said anode, means for applying a positive potential to said anode and a negative potential to said electrode, and means, connected across said impedance, for deflecting the electronic stream from said anode to said adjacent electrode in accordance with voltage variations across said impedance.

3. In apparatus for generating oscillatory energy, the combination of an anode; a cathode; means for establishing an electronic stream therebetween; an electrode adjacent said anode; a source of uni-directional potential, a connection from one point on said source to said anode and a connection from another point on said source to said receiving electrode for applying a potential which will effectively slow up the electrons before they strike said electrode; means comprising a positively biased cylindrical structure for concentrating the flow of electrons from said cathode to anode; and means responsive to the flow of said electron stream for deflecting said electronic stream away from said anode to said adjacent electrode.

4. In apparatus for the generation of oscillatory energy, the combination of an anode; a cathode; means for establishing an electronic stream therebetween; means, comprising a cylindrical positively biased structure for concentrating the stream; an electrode adjacent said anode; means for imparting a relatively negative bias to said electrode; a resistance between said anode and cathode having voltage variations therein in accordance with electronic flow to said anode; and means, connected across said resistance, utilizing said voltage variations for electrostatically deflecting the electronic stream from said anode to said adjacent electrode.

5. In apparatus for the generation of oscillatory energy, the combination of an anode; a cathode; means for establishing an electronic stream therebetween; means for concentrating the stream; an electrode adjacent and concentric with said anode, means for imparting a relatively negative bias to said electrode, an impedance between said anode and cathode having voltage variations therein in accordance with electronic flow to said anode; and means connected to said impedance, utilizing the voltage variations thereacross for deflecting the electronic stream from said anode to said adjacent, concentric electrode.

6. In apparatus for the generation of oscillatory energy, the combination of an anode; a cathode; means for establishing an electronic stream therebetween; means for concentrating the stream; an electrode adjacent said anode; means for imparting a relatively negative bias to said electrode, a resistance connected between said anode and cathode having voltage variations therein in accordance with electronic flow to said anode; and means comprising deflecting electrodes connected to said resistance, utilizing said voltage variations for electrostatically deflecting the electronic stream from said anode to said adjacent electrode.

7. In apparatus for generating oscillatory energy, the combination of an anode; a cathode; means for causing an electronic stream to flow from said cathode to said anode; a directive electrode, tubular in form, maintained at a positive potential for attracting electrons from said cathode to said anode and for concentrating the stream of electrons from said cathode to said anode, intermediate said anode and cathode; deflecting electrodes intermediate said directing electrode and said anode; a receiving electrode adjacent said anode maintained at a steady potential different from the anode steady potential; an impedance between said anode and cathode having voltage variations thereacross in accordance with electronic flow to said anode; said impedance being coupled to said deflecting electrodes whereby said electronic stream is deflected from said anode to said adjacent electrode in accordance with the voltage variations.

8. In apparatus for generating oscillatory energy, the combination of an anode; a cathode; means for causing an electronic stream to flow from said cathode to said anode; a directive electrode, tubular in form, maintained at a positive potential for attracting electrons from said cathode to said anode and for concentrating the stream of electrons from said cathode to said anode, intermediate said anode and cathode; deflecting electrodes intermediate said directing electrode and said anode; a receiving electrode adjacent said anode maintained at a relatively negative bias; a resistance between said anode and cathode having voltage variations thereacross in accordance with electronic flow to said anode, said resistance being coupled to said deflecting

electrodes whereby said electronic stream is deflected from said anode to said adjacent electrode in accordance with the voltage variations.

9. In apparatus for generating oscillatory energy, the combination of an anode; a cathode; means for causing an electronic stream to flow from said cathode to said anode; a directive electrode, tubular in form maintained at a positive potential for attracting electrons from said cathode to said anode and for concentrating the stream of electrons from said cathode to said anode, intermediate said anode and cathode; deflecting electrodes intermediate said directing electrode and said anode; a receiving electrode adjacent said anode maintained at a negative bias relative to the anode steady potential; an impedance between said anode and cathode having voltage variations thereacross in accordance with electronic flow to said anode; connections for coupling said impedance to said deflecting electrodes whereby said electronic stream is deflected from said anode to said adjacent electrode in accordance with the voltage variations; and, means for tuning the connections.

10. In apparatus for generating oscillatory energy, the combination of a cathode, an anode, and circuit means for establishing an electronic stream between said anode and cathode, an electrode adjacent said anode and means for biasing said electrode negatively with respect to said anode, a pair of deflecting electrodes intermediate said cathode and anode and connected across a portion of said means, said deflecting electrodes being responsive to voltage variations in said means for deflecting said electronic stream.

11. In apparatus for generating oscillatory energy, the combination of an anode, a cathode, means for establishing an electronic stream between said anode and said cathode, an impedance connected both to said anode and cathode and having potential variations thereacross due to said electronic stream, a receiving electrode adjacent said anode, a source of uni-directional potential, a connection from one point on said source to said impedance, and a connection from another point on said source to said receiving electrode for applying a potential which will slow up the electrons before striking said receiving electrode, and means connected across said impedance for deflecting the electronic stream from said anode to said adjacent electrode in accordance with voltage variations across said impedance.

12. An oscillation generator circuit comprising, in combination, a vacuum tube having within a single container a cathode and a pair of spaced anodes, a source of unidirectional potential external of said tube and in circuit with said cathode, and individual connections having unequal impedance values extending from said respective anodes to different points on said source of unidirectional potential, and a pair of deflecting plates directly connected across a portion of one of said connections, and operable in dependence upon the occurrence of current flow in said one connection for deflecting the electrons emanating from said cathode from one anode to the other, and energizing means for said cathode.

13. An oscillation generator circuit comprising, in combination, a vacuum tube having within a single container, a cathode and a plurality of spaced anodes, an external source of unidirectional potential in circuit with said cathode, individual external connections having unequal impedance values extending from said respective anodes to different points on said source, one of said connections including a resistance, an output circuit across at least a part of said resistance for taking off high frequency potentials, and deflecting means in shunt with said resistance and operable in dependence upon the occurrence of current flow in said one connection for electrostatically deflecting the electrons emanating from said cathode from one anode to another, and energizing means for said cathode.

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