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W. HOTINE

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HIGH-FREQUENCY OSCILLATOR

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Fig. 1.

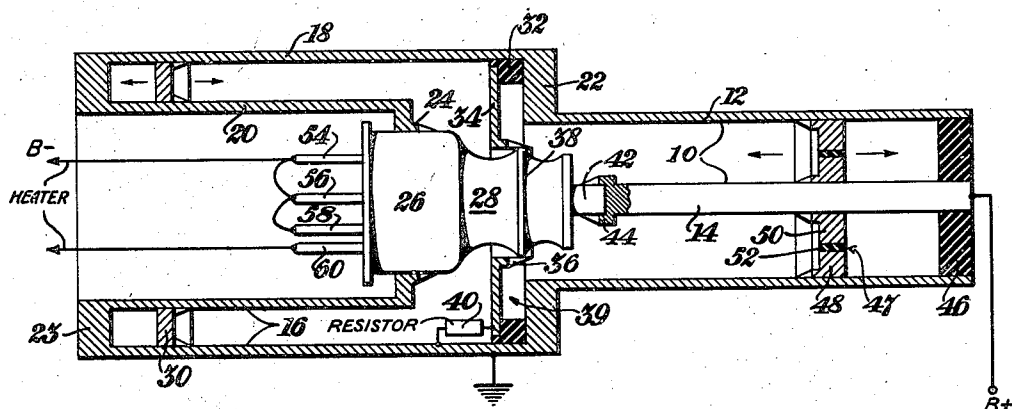
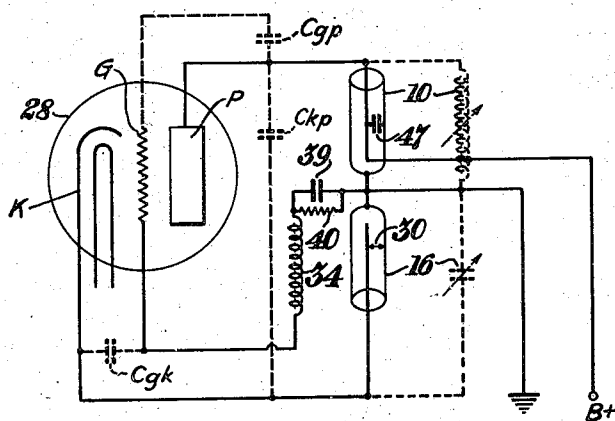


Fig. 2.

INVENTOR.
WILLIAM HOTINE

BY

ATTORNEY

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HIGH-FREQUENCY OSCILLATOR

William Hotine, Great Neck, N. Y., assignor to
Federal Telephone and Radio Corporation,
Newark, N. J., a corporation of Delaware

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1 Claim. (Cl. 250—36)

1

This invention relates to improvements in high frequency oscillators, and more particularly to vacuum tube oscillators adapted to operate at ultra-high frequencies.

An object of this invention is the construction of a high frequency vacuum tube line oscillator which will operate at higher frequencies with standard type tubes than heretofore possible.

Another object of this invention is to provide a new and improved high frequency line oscillator of the type adapted to receive standard types of vacuum tubes as part of a constructional unit.

A further object of this invention is to provide a high frequency vacuum tube line oscillator of the grounded grid type, in which coupling between the plate and cathode lines is effected by the inductive reactance of a common grid condenser.

A still further object of this invention is the provision of a high frequency oscillator in a novel construction forming such plate and cathode lines together with the common grid condenser as a structural unit.

Other objects and advantages of the present invention will appear to those skilled in this art from the following description of a preferred embodiment thereof, illustrated in the accompanying drawings, wherein:

Fig. 1 is a longitudinal cross-sectional view of a preferred form of oscillator constructed in accordance with the present invention; and

Fig. 2 is a circuit diagram of the oscillator illustrated in Fig. 1.

As appear in the drawings, the oscillator comprises a first coaxial line 10 formed of an outer metal cylinder 12 and an inner metal rod 14, and a second coaxial line 16 consisting of an outer metal cylinder 18 and an inner metal cylinder 20. The two lines 10 and 16 are connected together as a structural unit through a suitable ring-shaped member 22 connected on one hand to the outer metal cylinder 12 of the coaxial line 10, and on the other hand to the outer metal cylinder 18 of the coaxial line 16.

The outer co-planar ends of the cylinder 18 and 20 forming the coaxial line 16 are preferably electrically interconnected as indicated at 23. The inner end of the metal cylinder 20 is provided with suitable spring members 24, which may extend about and grip the metal shell 26 of an inserted vacuum tube 28. The cathode line 16 may be tuned by the provision of a longitudinally adjustable short-circuiting ring 30, which may be moved from without the oscillator by any suitable means (not shown).

2

Adjacent the ring-shaped member 22 connecting the outer metal cylinders 12 and 18 I place a ring 32 of insulating material adapted to support a metal disk 34 having a central opening provided with circumferentially spaced spring fingers 36 so positioned relatively to the vacuum tube 28 as to grip and contact a grid lead in the form of metal ring 38. The juxtaposed surfaces of the ring-shaped member 22 and the metal disk 34, insulated therefrom, are so designed as to form between them a condenser 39. This condenser may be shunted by a suitable grid resistor 40.

The vacuum tube 28 is preferably of the type having an anode cap 42 on the end of the tube opposite the metal shell 26, and the anode cap 42 is adapted to be gripped and contacted by suitable spring fingers 44 attached to the inner end of the rod 14. The outer end of the rod 14 is preferably co-planar with the outer end of its surrounding metal cylinder 12, and is supported relatively to the latter by a suitable insulator 46. Connection for alternating current voltages between the rod 14, which may form the high voltage anode lead, with the outer cylinder 12 forming the plate line, may be accomplished through a blocking condenser 47. In the preferred form of invention illustrated, the condenser 47 is formed as a slidably mounted unit between rod 14 and metal cylinder 12, consisting of an outer metallic ring 48 contacting the inner surface of the cylinder 12, and an inner metal ring 50 contacting the outer surface of the rod 14, separated by a ring of insulation 52. As will be clear to those skilled in this art, the coaxial line 10 may be tuned by varying the position of the condenser 47 in one direction or the other, and this movement may be controlled by various means well known to the art (not shown).

Extending from the base of the tube 28 I have indicated the cathode lead 54, the heater leads 56 and 60, and another lead 58 which is connected to the metal shell 26. The leads 54, 56 and 58 may be interconnected by suitable jumpers as illustrated, the heater potential then being connected across the leads 54 and 60, the lead 54 also being connected to the negative side of the high potential source.

The construction described above permits oscillations to be generated by providing means for impressing voltage of the proper phase and sufficient amplitude on grid G of tube 28. The schematic circuit diagram of Fig. 2 shows the electrical circuit. The plate to grid circuit includes 55 C_{sp}, the variable plate line 10, blocking condenser

3

47, condenser 39 with shunt resistor 40, and inductance 34 of the metal disc contacting the annular grid lead. The plate line 10 is tuned to less than a quarter-wave length at the operating frequency, so that it appears as an inductive reactor, and is shown in dotted lines as an inductor. The cathode to grid circuit includes C_{gk} , variable cathode line 16, condenser 39 with shunt resistor 40, and inductor 34. The cathode line 16 is tuned to more than a quarter wave length and less than one-half wave length at the operating frequency, so that it appears as a condensive reactor, and is shown in dotted lines as a capacitor. The plate to cathode circuit includes C_{pk} , plate line 10, and cathode line 16. An intermediate point between the coaxial line outer conductors may be grounded as indicated, and a suitable high voltage may be applied to anode P by a connection between ground and rod 14.

When using coaxial lines for cathode and plate circuits with the grid connected at the intermediate point of these lines, as is well known to the art in using the triode type of tube with annular grid lead out as a grounded grid, or inverted amplifier, the small effective plate to cathode capacity may be insufficient to produce oscillations.

The present invention provides means for impressing sufficient feedback voltage on the grid to produce oscillation by inserting the effective inductor 34 in series with the low inductance annular grid lead out. The mechanical arrangement of inductor 34 is made so that electrically, it is common to both plate to grid, and cathode to grid, circuits. The mechanical size of inductor 34 is designed so that its electrical inductance is of the proper magnitude at the operating frequency. In the oscillator shown, inductor 34 is also utilized as one plate of a condenser. Other mechanical arrangements may be made, as can readily be seen by those versed in the art, in which inductor 34 may take other suitable mechanical forms, while satisfying the electrical requirements stated above.

The constructional unit illustrated in Fig. 1 has been particularly designed for use with a vacuum tube of the type known to the art as "G. E. Z. P. 446," although it is to be made clear that the principles of the present invention and the structural unit itself are applicable to other types of tubes which are operable at high frequencies. Slight structural modifications may be necessary in the event that other tubes are used, but it is

4

considered that any modifications necessary would be wholly within the skill of those working in this art.

Accordingly, while I have described above the principles of my invention in connection with certain specific apparatus, it is to be clearly understood that this description is made only by way of example and not as a limitation on the scope of my invention as set forth in the objects and the accompanying claim.

I claim:

A high frequency oscillator comprising in combination a pair of coaxial transmission lines, means for coupling the outer conductors of each line, an electron discharge device having a metal shell section at one end thereof connected to its cathode, an anode connector projecting from the other end, and a ring-shaped grid connector between its ends, means for mounting said device within said coaxial lines including members on one end of the inner conductor of one coaxial line gripping said metal shell and other members on one end of the inner conductor of the other coaxial line gripping said anode connector, a metal disc having an opening at its center surrounding and gripping said grid connector, means for insulatingly supporting the periphery of said metal disc from said outer conductors substantially at their common connecting point, said inner conductor of the other coaxial line being in the form of a solid rod, and means for insulatingly supporting the outer end of said rod within the outer end of its surrounding conductor in combination with an integral slidable ring-shaped member positioned between and contacting said inner and outer conductors, said ring-shaped member including an outer metallic ring contacting the inner surface of the outer conductor, an inner metallic ring contacting the outer surface of the inner conductor, and a narrow band of insulation separating said two rings.

WILLIAM HOTINE.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,408,355	Turner -----	Sept. 24, 1946
2,411,424	Gurewitsch -----	Nov. 19, 1946