Nov. 28, 1950 G. C. IZENOUR 2,531,683

STABILIZED LINE TUNED OSCILLATOR

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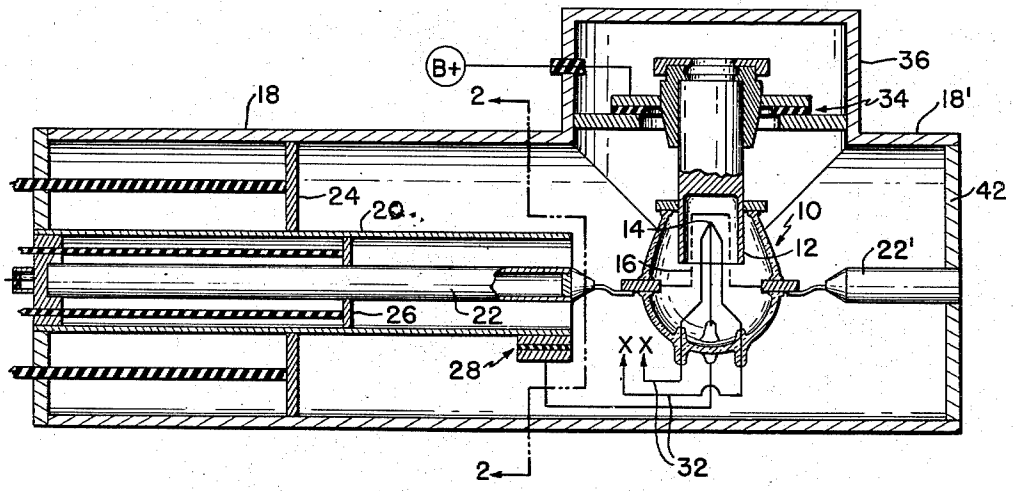


FIG. 1

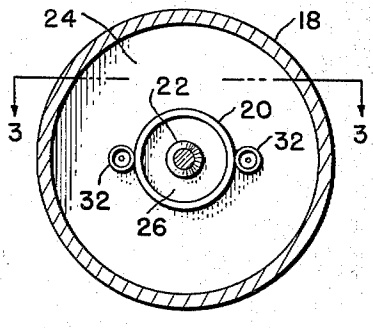


FIG. 2

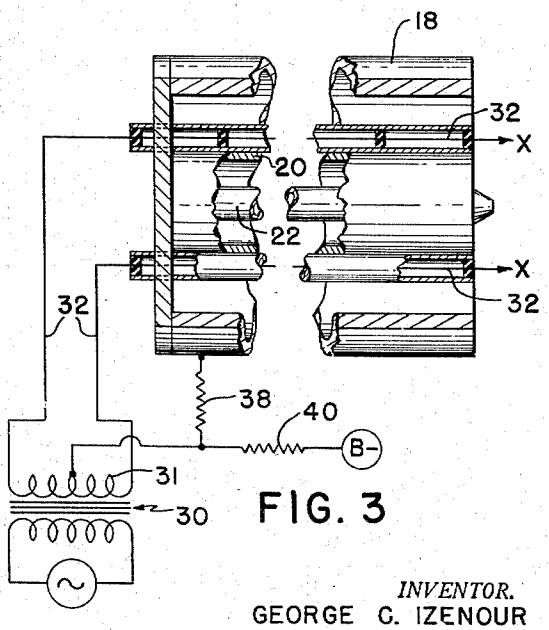


FIG. 3

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STABILIZED LINE TUNED OSCILLATOR

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Application October 31, 1945, Serial No. 625,888

3 Claims. (Cl. 250—36)

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This invention relates to high-frequency oscillators which are tunable by means of coaxial lines having slidable shorting rings.

According to the copending application of Paul S. Lansman for "Line-Tuned Oscillators," Serial No. 692,361, filed August 22, 1946, a compact tunable oscillator results when doubly concentric cylinders are used for tuning, the cathode line being intermediate the grid and plate lines. When the length of line is shortened at high frequencies so that its length approximates its diameter, operation becomes unsatisfactory. This is believed in part to be due to the field discontinuity adjacent the tube. When the axis of the triode is arranged perpendicular to that of the tuning lines and the triode plate is surrounded by a cylinder, the effects of discontinuity appear to be minimized. This is in accordance with copending application Serial No. 626,847, filed November 5, 1945, for "Improved Line-Tuned Oscillator," by Orrin W. Towner.

According to the present invention, a double concentric line is arranged to tune a triode oscillator, and tuning to higher frequencies is enabled through use of an additional concentric line between grid and plate. The additional line is on the side of the triode opposite the doubly concentric line. The theory of operation is not fully understood. It is thought that the plate-to-grid concentric line may amount to an inductance in parallel with the series of plate-to-cathode and cathode-to-grid inductances used for tuning the oscillator. This theory is predicated on the fact that addition of the plate-to-grid line requires a greater distance between the tuning rings and the triode for a given frequency. Another theory is that the plate-to-grid line decreases the reactive effect of the plate-to-grid capacity and thereby assures excitation in the proper phase.

The nature of the invention will be better understood from the following detailed disclosure of a specific embodiment and from the drawings in which:

Fig. 1 is a longitudinal section of a line tuned oscillator according to the invention,

Fig. 2 is a cross-sectional view taken along line 2—2 of Fig. 1 looking in the direction of the arrows; and

Fig. 3 is a view in cross section along the line 3—3 of Fig. 2.

Triode 10 having plate 12, filament center-tap or cathode 14 and grid 16 are associated with doubly concentric lines 18 (for the plate), 20 (for the cathode) and 22 (for the grid). Coaxial

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line 18, 20 is varied in effective length by shorting ring 24 and the grid-cathode line is similarly tuned by shorting ring 26. The cathode is coupled to its line 20 through capacitor 28. The filament is energized as with a center-tapped secondary winding 31 of a transformer 30 (Fig. 3) through shielded lines 32 symmetrically arranged about cylinder 20. Plate 12 is energized from B+ directly and is coupled to its cylinder 12 through capacitor 34, as shown in Fig. 1. Cylinder 36, which is coaxial with plate 12 and with the triode generally, minimizes the field discontinuity between the tuned lines and the triode.

When cylinders 18, 20 and 22 are proportioned according to the formula given in that application, a stable, compact and highly efficient oscillator is obtained which is tunable over a relatively wide range and up to a high frequency. The oscillator includes a grid bias resistor 38 between the center-tap of filament transformer secondary winding 31 and the oscillator portions which are at the D.- C. potential of the grid, and also includes protective resistor 40 between filament winding 30 and B—.

In order to reach higher frequencies, it was proposed to add a duplicate set of tuned coaxial lines extending oppositely from those illustrated. However, it was discovered that omission of the cathode connection to the center line of this added tuner immensely improved the performance. Subsequently, I found that the cathode line could be entirely omitted and that the shorting ring determining the length of this line could be left more or less fixed while the tuning rings 24 and 26 were operated for frequency changes. In the drawing, plate cylinder 18' and grid cylinder 22', with their shorting ring 42, have been added to the oscillator having a properly proportioned doubly concentric line extending in one direction from the triode. The effect is to require much greater distance between tuning rings 24, 26 and the triode for a given operating frequency and to enable much higher frequencies to be realized before the tuning rings reach their practical minimum distance from the triode.

It is to be understood that various modifications and changes may be made in this invention without departing from the spirit and scope thereof.

What is claimed is:

1. In a high-frequency oscillation generator which includes an electron discharge tube of the type having an anode, a cathode and a grid coaxially arranged about an axis of symmetry passing through said tube, the combination of a

double-coaxial line section having an axis substantially perpendicular to said axis of symmetry of said tube and including outer, inner, and intermediate conductors connected to said anode, grid and cathode, respectively, a coaxial line section substantially axially aligned with said double-coaxial line section and having an outer conductor connected to said anode and an inner conductor connected to said grid, and a cylindrical conductor having an axis in substantial alignment with axis of symmetry of said tube, said cylindrical conductor being connected between the outer conductors of said double-coaxial and coaxial line sections and forming with said outer conductors, a conductive closure for said tube.

2. The combination defined in claim 1 wherein coaxial line section is connected substantially in shunt with the line section formed by said outer and said inner conductors of said double-coaxial line sections.

3. In a high-frequency electron discharge tube oscillator wherein the electron discharge tube has an anode, a cathode and a grid coaxially arranged about an axis of symmetry passing through said tube, a three-conductor coaxial line section having a common axis substantially perpendicular to said axis of symmetry of said tube, reactive means connecting the outer conductor of said

three-conductor line to said anode, means conductively connecting the inner conductor of said three-conductor line to said grid, and further reactive means connecting the intermediate conductor of said three-conductor coaxial line to said cathode, and a coaxial line section substantially axially aligned with said double-coaxial line section and having an outer conductor and an inner conductor, said last-named outer conductor being connected through said reactive means to said anode and said last-named inner conductor being conductively connected to said grid.

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