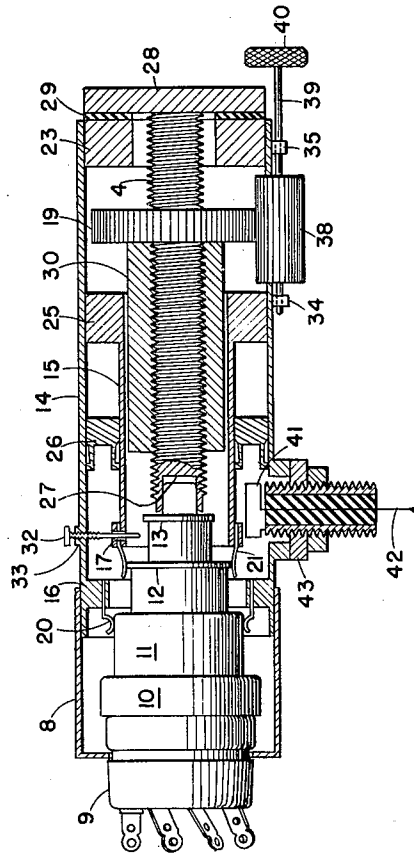


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VARIABLE FREQUENCY OSCILLATOR
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VARIABLE FREQUENCY OSCILLATOR

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4 Claims. (Cl. 250—36)

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sec. 266)

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This invention relates in general to a generator of high frequency oscillations and in particular to a line controlled type of oscillator which may be tuned over an extended frequency range by way of a single tuning means.

An object of this invention is to provide a line controlled type of oscillator having two resonant line sections adjustment of only one of which is necessary to tune the oscillator.

Another object of this invention is to provide a line controlled type of oscillator having two resonant line sections one of which is of low "Q" and the other of which is of high "Q."

Other objects and features of the present invention will become apparent from a careful consideration of the following detailed description taken together with the accompanying drawing, the single figure of which is an elevational view of a typical embodiment of the invention.

A number of triode vacuum tubes especially adapted for concentric line type of operation have been provided by the prior art. One of such vacuum tubes is provided with annular anode, grid, and cathode ring terminals projecting from the tube envelope in parallel planes normal to the longitudinal axis of the tube. These rings are each of a different diameter and are arranged in a step-wise manner so that the cathode has the largest ring, the anode the smallest ring and the grid the intermediate ring. Because of its functional design the tube has inherited the appellation "lighthouse tube."

With particular reference to the single figure, one such vacuum tube designated in general at 10 having a cathode ring 11, a grid ring 12 and an anode ring and cap 13 is shown as applied to the present invention. The tube itself has in addition to the annular ring terminals a number of base pin connections which are seated in a conventional type tube socket 9 which is carried by a metallic cup member 8. The latter is adapted to engage the outermost cylinder 14 of the oscillator assembly shown in general to the right of the tube. The cup member 8 may be held to the outer cylinder 14 of the oscillator assembly by means of a simple clamping ring (not shown) or by a number of longitudinal slots cut in the end of the cup member so as to form a fingered engagement to the outer cylinder 14. The oscillator assembly comprises an outer cylinder 14, an intermediate cylinder 15 concentrically disposed within the outer cylinder and finally an inner rod-like member 4 concentrically disposed in the inner cylinder 15. The outer cylinder 14 is provided at its left hand end with an annular

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shoulder member 16 to which is secured, for example, by means of machine screws or welding (not shown) a suitable fingered ring contacting member 20. The ring contacting member 20 may be made of phosphor bronze and is adapted to provide a good high frequency contact to the cathode ring 11 of the lighthouse tube 10. The corresponding or left hand end of the second cylinder 15 is similarly provided with a fingered annular contacting ring 21 which is adapted to electrically contact the grid ring 12 of the tube 10. At the opposite or right hand end of the inner cylinder 15 is an integral annular element 25 which is suitably fastened, by means of screws, for example, to the outer cylinder 14 to thereby provide good coaxial alignment between the cylinders 14 and 15. It may thus be seen that the space between the cylinders 14 and 15 forms a grid-cathode resonant line section of the oscillator. To tune this section a slidable dual cylinder 26 is inserted in the space between the outer cylinder 14 and the intermediate cylinder 15 and may be variably positioned to change the electrical length of this line section as desired.

Concentrically disposed within the inner cylinder 15 is a rod like member 4 the left hand end of which is provided with a recess 27 which is suitably adapted to seat the anode cap 13 of the tube 10. The right hand end of rod 4 is securely fastened, brazed for example, to an end plate 28 which in turn may contain a soldered connection to the plate supply for the tube. Interposed between the end plate 28 and the annular terminating lug 23 of the outer cylinder is a dielectric washer 29. The function of this dielectric washer is to isolate the high plate voltage from the outer cylinder 14. Threadably engaging bar 4 is an internally threaded sleeve 30 which is machined to a diameter slightly less than the inner diameter of the intermediate cylinder 15. The annular space existing between the sleeve 30 and the internal periphery of cylinder 15 functions as a capacitative short circuit at the high frequency of operation of the oscillator. The space between the intermediate cylinder 15 and the anode bar 4 which is bounded by the grid contacting member 21 and the grid ring terminal 12 at the left end and by the sleeve 30 at the right hand end forms the grid-anode resonant line section of the oscillator. To tune this line section a fiber gear 19 is securely fixed to the right hand end of the sleeve 30. This gear meshes with a second gear 38 which is suitably journaled to the outer cylinder 14 as shown at 34 and 35. Gear 38 is driven by means of shaft 39 and thumb wheel 40. Rotation

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of thumb wheel 40 is translated into longitudinal movement of the sleeve 30 to thus provide a means for varying the electrical length of the grid-anode line section. Typical operation of the oscillator shown was with the quarter wavelength mode in both resonant sections.

To complete the oscillatory circuit energy must be fed back from the grid-anode line section to the grid-cathode line section. This effect is accomplished by means of, for example, a suitable screw member 32 which threadably engages the boss member 33 and extends into the grid-anode section through an aperture 17 cut in the grid cylinder 15. Screw 32 is positioned at a point of maximum electrostatic field in the grid-anode cylinder and thus provides a capacity type coupling between the grid-anode section and the grid-cathode section of the oscillator. The amount of feedback is made controllable by adjustment of the penetration depth of the screw member 32. Output energy may be coupled, for example, from the grid-cathode circuit by means of a suitable magnetic pick up loop 41 positioned at a point of maximum electromagnetic field intensity and brought out of the cylinder through a suitable coaxial connector 42 which is threaded to boss member 43.

In the physical construction of the oscillator assembly the ratio of the internal diameter of the grid cylinder 15 to the external diameter of the anode bar 4 is made larger than the ratio of the internal diameter of the cathode cylinder 14 to the external diameter of the grid cylinder 15. It is thus apparent that the volume to surface ratio of the grid-anode line section is greater than the corresponding ratio in the grid cathode line section which consequently provides the former line section with a higher "Q" than that of the latter line section. Furthermore the insertion of the energy output coupling loop 41 in the grid-cathode line section operates to further reduce the "Q" of this section. With this arrangement it becomes only necessary to adjust the electrical length of the higher "Q" circuit in order to tune the oscillator over a considerable frequency range. For example, in a typical case the ratio of diameters in the grid-cathode section was set at 3-2 while that of the grid-anode section was set at 3-1.3 which permitted easy tuning (solely by means of the sleeve 30) over a frequency range having a ratio of 5-4, without serious loss in power at either end of the operating range.

Although only one specific and preferred embodiment of the invention has been shown it is to be understood that many modifications of the invention are possible without departing from the spirit of the invention. Therefore, this invention is not to be limited except insofar as is necessitated by the spirit of the prior art and the scope of the appended claims.

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

What is claimed is:

1. An oscillator assembly comprising a pair of cylindrical elements of different diameters, the smaller of which is concentrically disposed within the other, a rod-like member concentrically disposed within the inner of said pair of cylinders, a sleeve member of a diameter slightly less than said inner cylinder, spaced therefrom to form a capacitance short therebetween and

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mounted on said rod-like member and movable therealong, a triode vacuum tube connected to said rod and cylinder assembly so as to form both a low Q grid-cathode and a high Q grid-anode resonant line section, means feeding back energy from said grid-anode section to said grid-cathode section so as to cause and sustain oscillations, and means for coupling energy from the line section between the cylinders to an external load, whereby the selectivity of the low Q resonant line section is broadened to permit tuning of the assembly over a wide frequency range by a variation of the high Q resonant line section alone.

2. An oscillator assembly comprising a pair of cylindrical elements of different diameters the smaller of which is concentrically disposed within the other, an annular shorting element movably positioned in the space between the two cylinders, a rod-like member concentrically disposed within the inner of said pair of cylinders, a sleeve member of a diameter slightly less than said inner cylinder, spaced therefrom to form a capacitance short therebetween and mounted on said rod-like member and movable therealong, a triode vacuum tube connected to said rod and assembly so as to form both a low Q grid-cathode and a high Q grid-anode resonant line section, means feeding back energy from said grid-anode section to said grid-cathode section so as to cause and sustain oscillations, and means for coupling energy from the line section between the cylinders to an external load, whereby the selectivity of the low Q resonant line section is broadened to permit tuning of the assembly over a wide frequency range by a variation of the high Q resonant line section alone.

3. An oscillator assembly comprising a pair of cylindrical elements of different diameters the smaller of which is concentrically disposed within the other, an annular shorting element movably positioned in the space between the two cylinders, a rod-like member concentrically disposed within the inner of said pair of cylinders, a sleeve member of a diameter slightly less than said inner cylinder, spaced therefrom to form a capacitance short therebetween and mounted on said rod-like member and movable therealong, the ratio of the internal diameter of the outer cylinder to the outer diameter of the inner cylinder being smaller than the ratio of the internal diameter of the inner cylinder to the diameter of the rod-like member, a triode vacuum tube connected to said rod and cylinder assembly so as to form both a grid-anode and a grid-cathode line section, means feeding back energy from said grid-anode section to said grid-cathode section so as to cause and sustain oscillations, and means for coupling energy from the outer line sections to an external load, whereby the selectivity of the grid-cathode line section is broadened to permit tuning of said assembly over a wide frequency range by a variation of the grid-anode line section alone.

4. An oscillator assembly comprising a pair of cylindrical elements of different diameters the smaller of which is concentrically disposed within the other, an annular shorting element movably positioned in the space between said pair of cylinders, a rod-like member concentrically disposed within the inner of said pair of cylinders, a sleeve member threaded on said rod-like member, said sleeve member being of a slightly smaller diameter than said inner cylinder so as to form a capacitance short therebetween, a tri-

ode vacuum tube of the species described having annular anode, grid and cathode terminals projecting from the tube envelope in parallel planes normal to the longitudinal axis of the tube, said tube adapted to be fitted into said rod and cylinder assembly in such manner that said cathode, grid and anode terminals electrically contact the outer cylinder, the inner cylinder and the rod-like member respectively, whereby grid-anode and grid-cathode resonant line sections are formed, 5 means feeding back energy from said grid-anode section to said grid-cathode section, gear means for adjusting the position of said sleeve member on said rod-like member to effect a tuning of the oscillator, and means for coupling energy from 15 the line section formed between the cylinders to an external load.

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