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H. GUTTON ET AL

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OSCILLATION GENERATION CIRCUIT

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Fig. 1

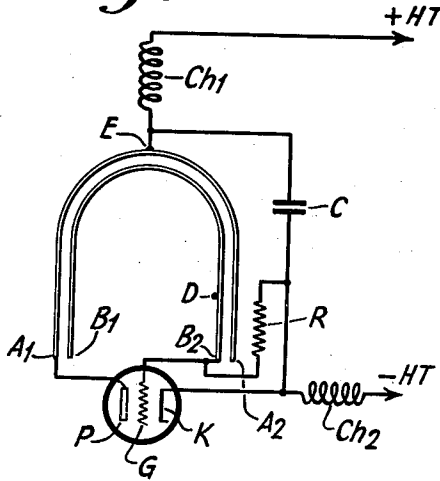


Fig. 2

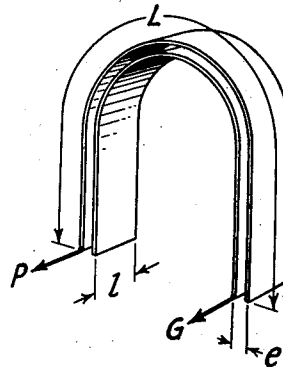


Fig. 3

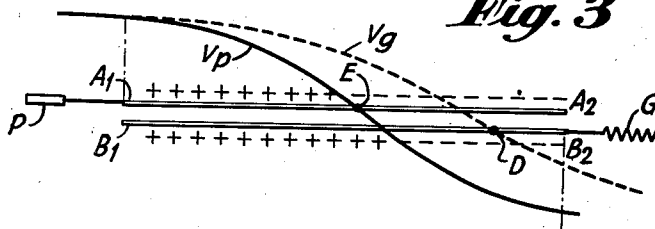
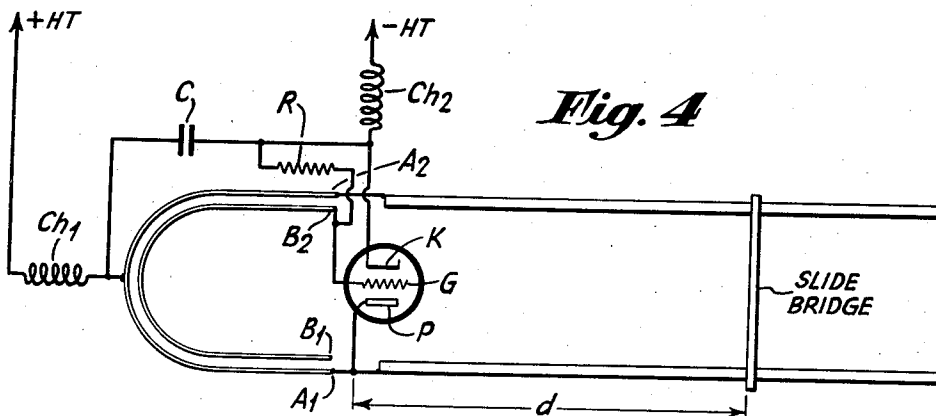


Fig. 4



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OSCILLATION GENERATION CIRCUIT

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The production of oscillations having frequencies above 300 megacycles by means of triodes necessitates in general the use of special tubes.

The dimensions of these tubes depend in fact upon the mean value of the travel time of the electrons between the cathode and the anode, this mean travel time to be a very small fraction of the oscillation period to be obtained, for instance of the order of $\frac{1}{10}$ of this latter period. If waves are to be generated having a length below 1 meter, it is found to be necessary to reduce considerably the cathode-anode space. It follows therefrom that the tubes present high inner capacities.

The circuits actually in use for these waves are similar to the circuits utilized for the longer waves. They generally comprise a self inductance and a capacity, whereby in the majority of cases the capacity is limited to the grid-plate capacity of the tube. Since in the tubes for ultra short waves this capacity is high, it becomes necessary to utilize circuits having very low self inductance. Consequently, a weak reaction is obtained and the volts applied to the grid are very insufficient for exciting the tube thoroughly. This explains in part the low output obtained on these waves.

The object of the present invention is to remedy these drawbacks by utilizing circuits having relatively large dimensions, but so adapted as to permit sustaining oscillations having a very short wavelength.

According to the invention, such circuits may be formed for instance by two conducting metal loops, preferably by two red copper bands bent into a U-shape and the one placed into the other one. The Figs. 1 and 2 attached hereto represent such a circuit. Fig. 3 shows a potential distribution diagram of said circuit, and Fig. 4 shows a combination thereof with a Lecher line. In Figs. 1 and 2, the letter l designates the width of the loops A1—A2 and B1—B2, and L is the length. The space e between the bands or loops can be of the order of 1 millimeter.

The extremity A1 of the one of the loops A1—A2 is connected to the plate P of the oscillator tube, and the opposite end B2 of the other loop B1—B2 is connected to the grid G. The point E near the center of the loop A1—A2 is connected through a choke Ch1 to the positive terminal +HT of the feed voltage source, and this point E is also connected to the cathode K of the tube through a capacity C. This capacity C serves only for improving the output of the oscillator. The cathode, assumed to be of the in-

directly heated type, is blocked for the passage of radio frequency energy by a choke coil Ch2.

The return of the grid to the cathode takes place across the resistor R which is connected near the extremity B2 of the grid circuit.

The arrangements of the feed wires are above indicated only by way of example and it should be understood that they may be modified in any suitable manner without changing the mode of operation of the oscillator. The functioning of this oscillator will be explained below in reference to Fig. 3, showing the distribution of potentials in the anode and grid circuits of the oscillator, during oscillation. As regards the anode circuits, the two extremities of the band A1—A2 show in A1 and A2 potential loops. The center point E at which the feed potential of the tube is applied corresponds to a potential node. The distribution of the potentials on the band A1—A2 will moreover be substantially symmetrical with respect to a point near its center E.

The free extremity B1 of the grid circuit will likewise present a potential loop. The point D near the grid terminal of the tube will on the other hand be in a potential node while the grid will again be in a potential loop.

This distribution of the potentials shows that the currents in the plate circuit can react upon the grid circuit so as to sustain oscillations in the tube. The necessary conditions for this is in fact that the grid be in phase opposition with the plate. This corresponds to a potential distribution of the same sign in the grid circuit and plate circuit except between the two potential nodes. This condition is schematically indicated in Fig. 3 in which the circuit is shown developed.

It should be remarked that the phase angle increases for the two opposite parts from 0° at the extremities A1—B1 in order to pass through 90° in E, then through a maximum between E and D to diminish thereafter in passing through 90° in D but without attaining the value 0°.

In view of this fact, reaction is thereby obtained from the one of the circuits to the other one owing to the effect of the capacity, which results in the possibility of oscillation.

It should be pointed out on the other hand, that by increasing the length L of the circuits, the wavelength will be increased. When increasing on the contrary the width l while L remains constant, the wavelength decreases. The form of the circuits could obviously also differ from the U-shape which was given by way of example, without the essential properties of the circuit being thereby modified.

It should be remarked that the value of L is high against that of the circuits generally utilized in the same wavelengths. For instance, there was obtained a wavelength of the oscillation of 55 cm. with the use of type 955 RCA Acorn tubes and circuits having the following dimensions:

$$L=105 \text{ m/m.}$$

$$l=12 \text{ m/m.}$$

$$e=1\frac{1}{10} \text{ m/m.}$$

When $l=20$ m/m. was used, the wavelength decreased to 53 cm.

The system above described, however, would not permit the wavelength to vary in a continuous manner. This can be easily achieved by adding a Lecher wire system, having a bridge with slide, to the ends A1 and A2 of the plate circuit (ends which are in opposite phase).

Such a mode of construction is shown in Fig. 4, likewise given by way of example and without the invention being limited thereto.

With a circuit such as that whose dimensions are given above and with a Lecher line constituted by two tubes of 12 mm. spaced 24 mm. between the axes, the variation obtained may be, for instance, from 47 cm. to 57 cm. for a displacement of the bridge from 15 to 170 mm. from the extremities A1 and A2.

These figures reveal one of the important advantages of the proposed arrangement; i. e., a relatively large displacement of the bridge for a definite variation of the wavelength. From this results a very easy adjusting of the different wavelengths. On the other hand, since a great change of the length of the circuit causes but a slight variation of the wavelength, the stability of the generated wave is as high as that of an oscillator operating on a very long line.

This characteristic feature enables the system to sustain oscillations having a very stable frequency by utilizing Lecher lines having a high Q factor.

What we claim is:

1. In a thermionic tube oscillation generator, an oscillating circuit formed by two conducting loops placed one into another at a predetermined distance, the one extremity of the first loop being connected to one electrode of the tube, and the opposite extremity of the second loop being connected to another electrode of the tube, and a Lecher wire system connected between two extremities of the said first loop.

2. In a thermionic tube oscillation generator, the combination of a thermionic tube having a cathode, a grid and an anode with an oscillating circuit formed by two U conductors placed one into another at a predetermined distance, the one extremity of the first U being connected to the grid of the tube, and the opposite extremity of the second U being connected to the anode of the tube.

3. In a thermionic tube oscillation generator, the combination of a thermionic tube having a cathode, a grid and an anode with an oscillating circuit formed by two metallic bands bent into a U-shape and placed one into another at a predetermined distance, the one extremity of one band being connected to the grid of the tube, and the opposite extremity of the second band being connected to the anode of the tube.

4. In a thermionic tube oscillation generator, the combination of a thermionic tube having a cathode, a grid and an anode with an oscillating circuit formed by two U conductors placed one into another at a predetermined distance, the one extremity of the first U being connected to the grid of the tube, and the opposite extremity of the second U being connected to the anode of the tube, and a Lecher wire system connected between two extremities of the said second U conductor.

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