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A. JAUMANN
SHORT WAVE OSCILLATORY CIRCUIT
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Fig. 1

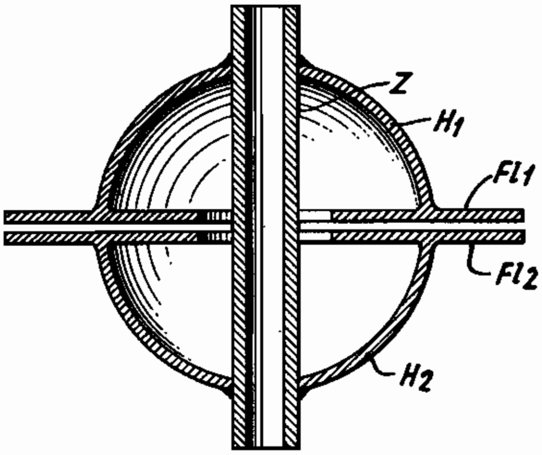
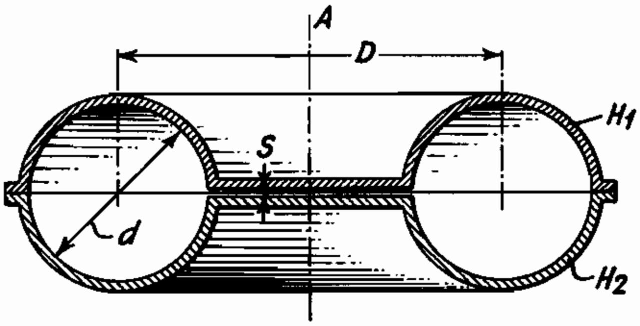


Fig. 2



INVENTOR.
ANDREAS JAUMANN
BY H. S. Grover
ATTORNEY.

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ALIEN PROPERTY CUSTODIAN

SHORT WAVE OSCILLATORY CIRCUIT

Andreas Jaumann, Berlin-Charlottenburg, Germany; vested in the Alien Property Custodian

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The elements (more particularly the inductance) of oscillatory circuits for short waves and ultra short waves are required to have a particularly high quality (i. e., high Q). When resorting to ever shorter waves the fact is that the resultant capacitance of the oscillatory circuit cannot be reduced in the same measure as the wavelength. The limits are set by the capacitances of the circuit and of the tubes. But, if despite this fact the resonance resistance of the oscillatory circuit should be sufficiently high, the quality of the inductance is required to be greater accordingly.

In this connection oscillatory circuits having coils designed to represent surfaces of bodies were found to be favorable; these circuits have become known in the form of so-called sphere circuits. Fig. 1 shows schematically a known type of so-called sphere oscillatory circuit.

The inductance of the oscillatory circuit of Fig. 1 consists of a central copper tube Z and two copper cups H_1 and H_2. The capacitance of the oscillatory circuit is determined by the capacitance of the two annular flanges Fl_1 and Fl_2. This is increased by the natural capacity of the sphere which is low as such. The spherical construction affords as such already among other advantages an economical structure as regards the means required and space required. The disadvantage of this oscillatory circuit lies in the comparatively small surface of the coil and in the unfavorable distribution of the surfaces. Thus, the current loop (central copper tube) shows a very small surface. This disadvantage is particularly annoying if the variation of the tuning is carried out by changing the distances between the flanges, because unless provision is made at the outer edges of the flanges for displacing the same, the central inner conductor is to be provided with a threading, for instance, for the purpose of shifting the cups and therewith the flanges relative to each other. In the spherical circuit the especially unfavorabe condition is that owing to the condenser being situated at the outside, a complete shielding is not insured with simple means. It is not possible to bring about a complete shielding by connecting to each other the outer edges of the flanges forming the condenser, since in this case the condenser would thereby be short circuited. Hence, it is necessary to provide an additional shield to be placed around the sphere circuit but aside from additional means thereby required there would be obtained a further influence upon the values of the capacitance and inductance.

These drawbacks of the known sphere circuit are avoided to a great extent by the circuit according to the invention without sacrificing the advantages of the known arrangement. The fundamental idea of the invention resides in placing the condenser of the oscillatory circuit in the inside, i. e., in connecting the condenser plates at all limit edges through the coil representing the surface of a body. The oscillatory circuit for short waves and for ultra-short waves, according to the invention and in which the coil is designed to represent the surface of a body, thus consists of a closed hollow body, more especially one which is symmetrical to the rotational axis and forming at the same time the coil and the condenser; for example, a single turn toroid. Preferably, the coil is formed by an annular hollow body slotted at the inside and the condenser is formed by flat plates joined through the annular slot. The radiation of such a circuit towards the outside is null because the magnetic field as well as the electrical field remain exclusively inside the hollow space. Since the inner surface of the coil is very large and since furthermore the distribution of the surfaces is more favorable as compared with that of the spherical circuit, namely a large surface in the current loop and a small surface in the current node, there is obtained a high quality of the oscillatory circuit.

A better understanding of the invention may be had by referring to the accompanying drawing wherein Fig. 1 represents a known type of oscillatory circuit given for the purpose of exposition, and Fig. 2 represents, by way of example, an oscillatory circuit in accordance with the invention.

Referring to Fig. 2, which illustrates a preferred embodiment of the invention, it will be seen that the oscillatory circuit consists of two equal cup shaped halves H_1 and H_2 having the form shown, which are joined together in a suitable manner at the outer edges therof, such as for instance flanged together, or soldered together. The two cups which are arranged in the example shown, symmetrically to a plane extending at right angle to the rotational axis A, are pressed preferably from sheet metal more especially from copper sheet material, so that after completing the rigid joining of the two halves, the body is highly flexible. The inner surface of the cups is suitably silvered. The oscillatory circuit, according to the invention, is not limited to the mode of construction shown in Fig. 2. In another appropriate mode of construction one of the two cup-shaped halves may be substituted, for instance, by a flat plate.

The inductance of an annular coil having but a single winding is expressed as is known as follows:

$$L=2\pi(D-\sqrt{D^2-d^2}).10^{-9}H \qquad (1)$$

Herein is D the mean diameter of the ring and d the diameter of the circular cross section. When choosing $D=2d$, the following simplified equation is obtained:

$$L=2\pi(2-\sqrt{3})d.10^{-9}=1{,}68d.10^{-9}H \qquad (2)$$

For $d=5$ cm there is:

$$L=8{,}4.10^{-9}H \qquad (3)$$

The distance between the two condenser plates is, for instance, chosen to be:

$$\delta=0{,}2 \ . \ . \ . \ 0{,}02 \text{ cm.}$$

Then the capacity will be:

$$C=\frac{d^2}{1669.10^{11}}=\text{approx. 10–100 pF} \qquad (4)$$

The resonance frequency of the circuit will then be:

$$f=\frac{1}{2\pi\sqrt{LC}}=170-550\text{MHz}(\lambda=1{,}7-0{,}55\text{m}) \qquad (5)$$

Higher natural frequencies can be readily obtained by reducing the dimensions of the circuit.

The natural frequency of the oscillatory circuit can be varied continuously by varying mechanically the distance between the condenser plates. The mechanical change of the said distance can be carried out without play in the case of a hollow body produced from flexible sheet metal, for instance by means of a screw pressing from the outside eventually together with a round disc. However, it may also be of advantage to carry out the varying of the said distance by screwing the two halves of the hollow body together or by means of a surrounding nut which presses the two halves against one another to a greater or lesser degree. In the case of a hollow body being sealed up in an air tight fashion, a further advantageous solution in varying the plate distance resides in changing the pressure prevailing in the hollow space. To this end the hollow space may be filled with any gas including air or with a non-conducting liquid having an especially favorable value of the dielectric constant.

Another way of varying the tuning exists in introducing or turning a metal disc or a dielectric inside the hollow body or between the condenser plates. Thus, inside the hollow ring an annular metal disc may be rotatably arranged so that in this way the inductance will be more or less short circuited. It is also possible to move in and out a metal disc or a dielectric between the condenser plates.

The oscillatory circuit according to the invention is utilized to advantage, for instance, in generator circuits. In this case one or several oscillation tubes may be arranged suitably inside the hollow body, whereby very short connection lines are obtained. The operating potentials are hereby applied in the neutral zone (at the outer circumference of the annular body). The energy may be derived across a wire loop rotatably arranged inside the ring.

The oscillatory circuit may also be used advantageously alone as filter element, or wherever there is need for a tuned circuit such as in an oscillator or amplifier circuit, or in connection with other elements of a circuit arrangement such as, for instance, in bridge arrangements for measurements. The oscillatory circuit of the invention can also be used for influencing an electron stream passing through the electric field of the structure, or vice versa.

ANDREAS JAUMANN.