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SHORT WAVE RADIORECEIVER

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Fig. 1.

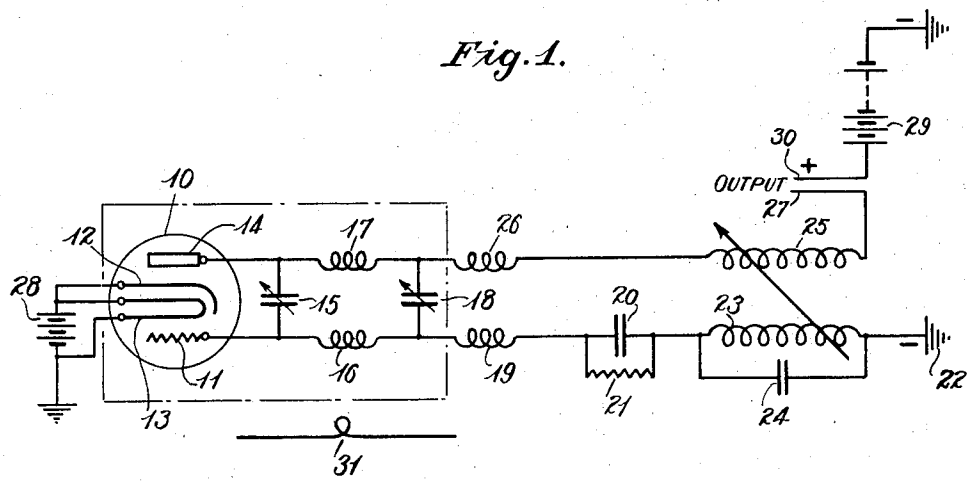
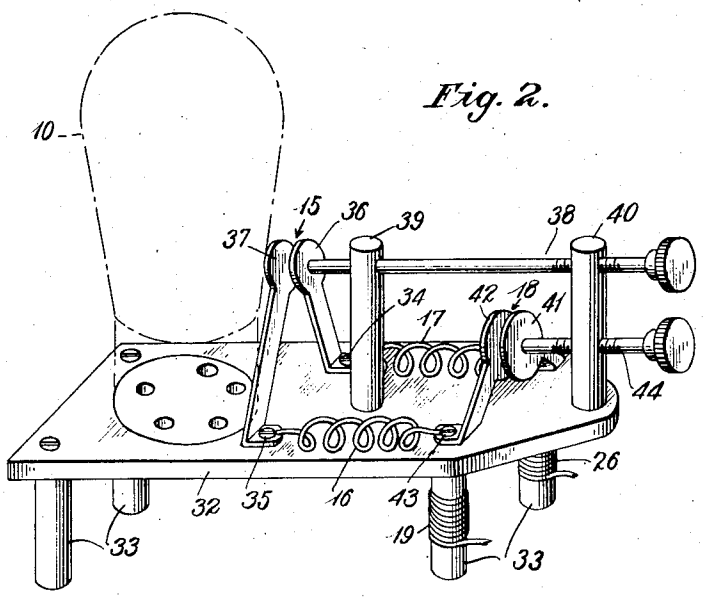


Fig. 2.



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SHORT WAVE RADIORECEIVER

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7 Claims. (Cl. 250—27)

Our invention relates to radio receivers and particularly to devices for receiving and detecting signals of ultra-high frequency of the order of 100 to 300 megacycles.

One object of this invention is to provide a receiver of ultra-short waves, the elements of which may be disposed in a compact unit without undesirable interference between the fields of the various elements thereof.

Another object is to provide a compact short wave receiving unit which is electrically and mechanically balanced.

Another object of the invention is to provide a tuning circuit for ultra-high frequency receivers, the parts of which are constructed and combined to practically eliminate the use of leads therebetween.

A further object of the invention is to provide a novel means for tuning a device for receiving and detecting signals of ultra-high frequency.

A still further object of the invention is to provide a single tube receiver for ultra-high frequency signals which will detect very weak signals and deliver a relatively large output.

Other objects and advantages of the invention will appear in the following description of the preferred embodiment of the invention which is shown in the accompanying drawing of which

Figure 1 is a schematic drawing of the circuit of the receiver; and

Figure 2 is a perspective view of a portion of the device.

Referring more particularly to the drawing, 10 is a standard detecting or amplifying tube having a grid 11, a cathode 12, a heater unit 13 for the cathode 12, and a plate 14. As shown in Figure 1 the grid and plate are bridged closely adjacent the tube by a low capacity variable condenser 15. A small inductive reactance 16 is connected to the common terminal of the grid and one side of the condenser 15 and similarly a small inductive reactance 17 is connected to the common terminal of the plate and the opposed side of the condenser 15. A second low capacity variable condenser 18 is bridged across the opposite terminals of the inductances 16 and 17.

The inductances 16 and 17 and the condensers 15 and 18 together with the tube 10 compose a tuning circuit for ultra-high frequencies, the natural frequency of which may be varied, by varying the capacities of the condensers 15 and 18.

A radio frequency choke 19 is connected to the common terminal of inductive reactance 16 and condenser 18 and the opposite terminal of the radio frequency choke 19 is connected to a fixed condenser 20 bridged by a high resistance 21. The opposed terminal of the condenser 20 is connected to ground at 22 through an inductance 23 bridged by a tuning condenser 24.

The common terminal of the condenser 18 and inductive reactance 17 is connected to one terminal of an inductance 25 through a radio frequence choke 26 similar to the choke 19, and the opposite terminal of the inductance 25 is connected to an output terminal 27. It is to be noted that the inductances 23 and 25 are inductively coupled and that such coupling is variable for reasons which will appear below.

A half wave center loop rod antenna 31 is inductively coupled to inductance 16 as shown in Figure 1.

The heater element 13 of the tube 10 is excited by a low voltage battery, the negative terminal of which is connected to ground. The cathode 12 of the tube is connected to the positive terminal of the battery 28.

Plate voltage for the set is furnished by a battery 29, the negative terminal of which is connected to ground and the positive terminal of which is connected to an output terminal 30.

The grid circuit may be traced from the grid 11 through the inductance 16, condenser 20 and resistance 21, through inductance 23 and condenser 24, and then through ground and the battery 28 to the cathode 12. It will be noted that the grid is maintained at a negative potential with respect to the cathode by the battery 28 and in addition electrons impinging upon the grid from the cathode 12 produce upon the grid an additional negative potential with respect to the cathode, which potential is maintained at a constant average value by a small current flowing through the high resistance 21.

The plate circuit may be traced from the plate 14 through the inductance 17, radio frequency choke 26, inductance 25, the load connected to the output terminals 27 and 30, battery 29, and then through ground and the battery 28 to the cathode 12. It is noted that the batteries 28 and 29 are connected such that their voltages add to impress a voltage across the cathode and plate.

The tuning circuit comprising the condensers 15 and 18, the inductances 16 and 17, together with the tube 10 are preferably mounted upon a base 32 supported upon pillars 33 as shown in Figure 2. The left end of the base 32 as seen in Figure 2 forms a socket for the tube, the prongs of which extend through holes in said base and engage contacts upon the lower side thereof as

will readily be understood. The leads shown on Figure 1 extending from the grid and plate to the condenser are connected to fastening members 34 and 35 securing the plates 36 and 37 which make up the condenser 15. As shown in Figure 2, the plates 36 and 37 extend toward each other from opposite sides of the base 32 and terminate in enlarged portions which are approximately parallel. The distance between these plates and the base is exaggerated in Figure 2 for clearness.

The plate 36 which is remote from the tube 10 is resilient and tends to spring away from the plate 37. An adjusting screw 38 is supported by posts 39 and 40 mounted upon the base 32 and extends through aligned bores formed in said posts. The bore in post 40 is threaded to receive the threaded portion of screw 38. It is evident that rotation of the screw 40 will vary the distance between the plates 36 and 37 and will thereby vary the capacity of the condenser 15. The peculiar construction of the condenser 15 allows it to be positioned very close to tube 10 and thus the leads from the grid and plate to said condenser are of minimum length. Also the inductances 16 and 17 may be directly connected to the plates of the condenser without the use of intermediate leads. The condenser 18 is of greater capacity than condenser 15 and is constructed similarly thereto, having two plates 41 and 42 secured to the base 32 at the end thereof remote from the tube 10 by means of screws 43 which also retain pillars 33 in position. As shown, the plates of condenser 18 are directly connected to the inductances 16 and 17, eliminating intermediate leads between the inductances and the condenser. Condenser 18 may be adjusted by means of an adjusting screw 44 mounted in post 40. In the above described construction inductances 16 and 17 are secured in spaced parallel relation on the upper surface of base 32.

Condenser 15 is used for the actual tuning of the circuit to a signal of a given frequency and condenser 18 is used to determine the wave band upon which it is desired to operate the receiver. That is, a certain setting of condenser 18 would suffice to receive signals over a band of frequencies or wave lengths for example, say 1.9 meters to 2.1 meters and condenser 15 would be used to select the desired frequency within this band. If it is desired to provide a receiver operating over a restricted band of wave lengths such as mentioned above, it is understood that a fixed condenser of the predetermined capacity necessary can be locked in the position of the variable condenser 18 and the adjusting screw 44 eliminated.

It will thus be seen that I have provided a complete tuning circuit for ultra-high frequencies, the parts of which combine to form a structure which is mechanically symmetrical and which practically eliminates the use of leads between the various parts thereof with their undesirable distributed inductance and capacitance.

The pillars 33 which support the right end of the base 32 as viewed in Figure 2, may also serve as supports for the radio frequency chokes 19 and 26 which may be connected to the screws 43 below the base 32 and terminals (not shown) may be positioned at the lower end of pillars 33 for connecting the chokes to the remainder of the circuit as indicated in Figure 1.

In operation the condenser 18 is adjusted such that the tuning circuit corresponds to the desired wave band and condenser 15 is adjusted such that the circuit is resonate at the frequency of the signal it is desired to receive. If a signal of that frequency is then impressed upon the inductance 16 by the antenna an electrical oscillation will be set up in the tuning circuit, comprising the inductances 16 and 17, the condensers 15 and 18, and the grid-plate capacity of the tube. The potential of the grid will vary at the frequency of the signal and as a function of the amplitude thereof and will control the current in the plate circuit, as will be understood. Since inductance 17 in the plate circuit forms part of the oscillating circuit and the plate circuit is capacitively coupled to the grid circuit by the condensers 15 and 18, variations in the plate potential and current will increase the electrical oscillation of the tuning circuit, thus increasing the variation of the grid potential and the amplitude of the plate current. The ultra-high frequency current is confined to the tuning circuit and the radio frequency chokes 19 and 26 are effective to prevent the flow of such high frequency current in the remainder of the circuit.

Since the plate current is not a straight line function of the grid potential, a variation in the amplitude of the impressed signal at a lower frequency will produce as a component of the plate current, an alternating current of the lower frequency. This alternating current will flow through inductance 25, and since this inductance is inductively coupled to inductance 23, the potential of the grid will also be varied at the lower frequency, thus increasing the amplitude of the lower frequency component of the plate current. The coupling between inductances 23 and 25 is variable to provide a control over this increase in the amplitude of the lower frequency current.

As shown in Figure 1, this current will also flow through a load connected to the output terminals 27 and 30, which load may be an indicating device such as an annunciator, relay or meter, or a second vacuum tube circuit employed as a linear amplifier.

The above description of the operation of the device is merely for the purpose of explanation, and it is understood that applicants are not to be limited to any particular theory of operation.

By way of example the values of the capacitance and resistance of certain of the elements which may be used in the device are given below:—

Condenser 15	1 to 50 mmfd.
Condenser 18	50 to 100 mmfd.
Condenser 20	100 to 1000 mmfd.
Resistance 21	1 to 5 megohms.

The foregoing description is illustrative only of the invention and is not to be construed in a limiting sense, as the scope of the invention is defined by the appended claims.

Having thus described our invention, what we claim is,—

1. In a radio receiver for ultra high frequencies modulated at a lower frequency, said receiver including an audion and having a plate circuit, and a grid circuit, means including an ultra high frequency oscillatory circuit for capacitively coupling said grid and plate circuits at said ultra high frequency, a primary inductance in said plate circuit and a secondary inductance in said grid circuit, said inductances having mutual inductance for coupling said grid and plate circuits

at said lower frequency, said mutual inductance being variable.

2. In a receiver for ultra high frequencies, a tuning circuit comprising a tube mounted upon an insulating base and having a grid and an anode, a variable condenser having vertically disposed plates arranged transversely of said base, one of said plates being connected to said grid and another of said plates being connected to said anode, inductances positioned upon said base having their axes parallel to said base and to each other and being directly connected to said condenser plates, a second condenser mounted upon and arranged transversely of said base and having its terminals directly connected to the ends of the inductances remote from the first mentioned condenser, said base being mounted upon pillars, radio frequency chokes mounted upon said pillars and having a terminal of each connected to the terminals of said second condenser.

3. In a radio circuit for ultra high frequencies, a vacuum tube having a grid, plate and cathode, a grid circuit connected to said grid and said cathode, a plate circuit connected to said plate and said cathode, and a tuning circuit for said ultra high frequencies comprising a series inductance in said grid circuit adjacent said tube, a series inductance in said plate circuit adjacent said tube, said grid and plate circuits being bridged adjacent said tube by a condenser and being bridged at the ends of said inductances remote from said tube by a second condenser, each of said condensers comprising a pair of parallel plates carried by resilient arms and means to flex one of said arms of each condenser to vary the capacity thereof.

4. In a radio circuit for ultra high frequencies, a vacuum tube having a grid, plate and cathode, a grid circuit connected to said grid and said cathode, a plate circuit connected to said plate and said cathode, and a tuning circuit for said ultra high frequencies comprising a series inductance in said grid circuit adjacent said tube, a series inductance in said plate circuit adjacent said tube, said grid and plate circuits being bridged adjacent said tube by a condenser and being bridged at the ends of said inductances remote from said tube by a second condenser, and radio frequency chokes in series in said grid and plate circuits adjacent said second condenser to confine ultra high frequency currents to said tuning circuit.

5. In a radio circuit for ultra high frequencies, modulated at a lower frequency, a vacuum tube having a grid, plate and cathode, a grid circuit connected to said grid and said cathode, a plate circuit connected to said plate and said cathode, and a tuning circuit for said ultra high frequencies comprising a series inductance in said grid circuit adjacent said tube and a series inductance in said plate circuit adjacent said tube, said grid and plate circuits being bridged adjacent said tube by a condenser and being bridged at the ends of said inductances remote from said tube by a second condenser, said grid and plate circuits being inductively coupled at said lower frequency.

6. In a radio for ultra high frequencies, a vacuum tube having a grid, plate and cathode, a grid circuit connected to said grid and said cathode, a plate circuit connected to said plate and cathode, a tuning circuit for said ultra high frequencies comprising a series inductance in said grid circuit adjacent said tube and a series inductance in said plate circuit adjacent said tube, said grid and plate circuits being bridged adjacent said tube by a condenser and being bridged at the ends of said inductances remote from said tube by a second condenser, said grid and plate circuits being provided with series inductances having mutual inductance and radio frequency chokes connected between said tuning circuit and said last named inductances.

7. In a radio for ultra high frequencies, modulated at a lower frequency, a vacuum tube having a grid, plate and cathode, a grid circuit connected to said grid and said cathode, a plate circuit connected to said plate and said cathode, and a tuning circuit for said ultra high frequencies comprising a series inductance in said grid circuit adjacent said tube and a series inductance in said plate circuit adjacent said tube, said grid and plate circuits being bridged adjacent said tube by a condenser and being bridged at the ends of said inductances remote from said tube by a second condenser, said grid and plate circuits being inductively coupled at said lower frequency, said grid circuit having a grid leak bridged by a condenser between said radio frequency choke and the last named inductance therein.

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