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HIGH FREQUENCY ELECTRICAL SYSTEM

Filed May 15, 1924

Fig. 1

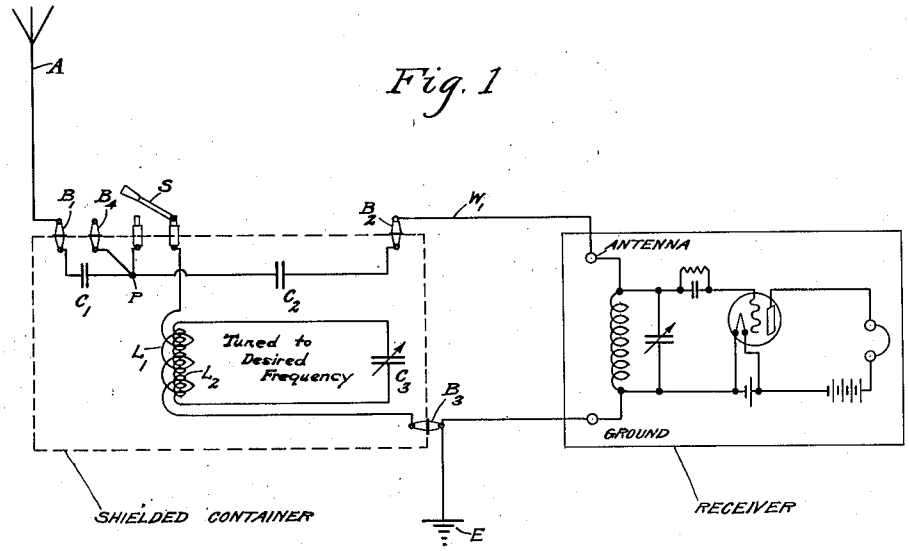
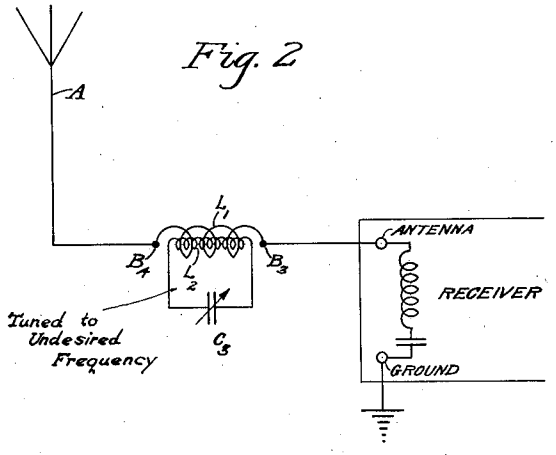


Fig. 2



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HIGH-FREQUENCY ELECTRICAL SYSTEM.

Application filed May 15, 1924. Serial No. 713,546.

While our invention relates generally to high frequency electrical systems, it refers particularly to the reception of high frequency electrical currents or oscillations such as the reception of radio signals.

A particular object of our invention is the provision of a simple unit for connection to an antenna or collector of high frequency electrical oscillations and to a receiver of such oscillations, the unit being for the purpose of making the system more selective, permitting employment of a plurality of receivers connected to the same antenna without mutual adjustment interference, and for preventing a receiver which is capable of generating high frequency oscillations from efficiently transferring such oscillations to the antenna and preventing the antenna from efficiently radiating these oscillations. In a co-pending application we have fully described a high frequency electrical system having its various elements properly coordinated to obtain the objects of our invention, and in this application we describe and illustrate a conveniently arranged unit for employment in the high frequency electrical system whereby all of the advantages ascribed to our invention may be obtained.

Figure 1 is a schematic diagram showing the application of my invention. Figure 2 illustrates the employment of a part of my invention as a wave trap.

Referring to Figure 1 of the drawing L_2 is an inductance coil having in parallel therewith a variable condenser C_3, the inductance of the coil L_2 and the capacity range of the condenser C_3 being properly selected to permit the circuit to be tuned or adjusted through a desired range of frequencies. The coil L_1 is preferably made of large wire or other form of conductor to offer very low resistance to high frequency electrical currents, and has a comparatively small number of turns to offer low reactance to passage of high frequency electrical currents. This arrangement provides a path of low impedance. The coil L_1 is preferably tightly coupled to the coil L_2, as by being wound on the same form directly over the turns of the winding of coil L_2. Such an arrangement is known as a coupled rejector.

The switch S is in series with the coil L_1, and there is inserted between the switch S and a binding post or electrical connector B_1 a condenser C_1 of very small capacity to offer a low conductance to the flow of high frequency electrical currents. The small capacity condenser C_1 may be replaced by a high resistance. Binding post B_4 connects to branch point P.

From a branch point P between the switch S and the condenser C_1 a connection leads to a condenser C_2 having very small capacity, and therefore high reactance to the flow of high frequency electrical currents. There is a connection from the condenser C_2 to a binding post B_2.

The second terminal of the coil L_1 is connected to a binding post B_3. It is desirable that the connection of the coil L_1 to the branch point P and the binding post B_3 be made of heavy wire or other form of low resistance conductor in order that the resistance of the path from the branch point P to the binding post B_3 be a minimum.

The unit is shown as housed in a screened container, which may be accomplished by lining a wooden box with thin sheet metal or wire mesh, this screening being for the purpose of preventing the magnetic fields of coils L_1 and L_2 from extending outside of the container to establish magnetic couplings of these elements with nearby coils such as would be found in a receiver to which the unit is proposed to be connected. An antenna is shown connected to the binding post B_1, a ground connection to the binding post B_3, and a receiver to the binding post B_2 and B_3, and thus connected the operation is as follows:

The high frequency electrical currents collected in the antenna A are delivered to the branch point P through the low conductance element C_1. With the switch S closed, the currents arriving at the point P have the choice of going to ground E through two paths, one including the high reactance element C_2 and the receiver, and the other including the coupled rejector. The path including the coupled rejector is normally of low impedance compared to the path including the high reactance element C_2, and normally the currents will choose the coupled rejector path and not affect the receiver. However, if the coupled rejector be tuned to a frequency which it is desired to select and send through the receiver for reception, the coupled rejector path will offer a high impedance to this frequency and force it to take the path through the high reactance element C_2, and if the receiver be tuned to this desired frequency this tuning will aid in drawing the

desired frequency current through the high reactance element. With the coils L_1 and L_2 screened from the coils in the receiver there will be little or no magnetic coupling between these elements, which coupling otherwise would tend to reduce the effectiveness of the high reactance element C_2.

As explained in our co-pending application Serial Number 713,545 filed May 15, 1924, a number of these units may be connected to a single antenna or collector A and the low conductance element C_1 and the high reactance element C_2 will prevent the adjustment of receivers and rejectors from interfering one with the other, thus enabling multiple reception of signals employing the same collector.

The capacity of the condenser C_2 should be very small in order to offer high reactance, and will depend for its value of capacity upon the range of frequencies being dealt with. Dealing with frequencies of the order of 1000 kilo-cycles per second we have found that the very small capacity of twenty-five micro-micro-farads successfully accomplishes this purpose. The capacity of the condenser C_1, or the value of the resistance, if a resistance is substituted for the condenser, depends upon not only the frequency with which the system is dealing but upon the extent of the collector or antenna A. If the antenna is short, such as 20 to 30 feet, it may be desirable to short circuit this capacity C_1. If the antenna is long, as from 50 feet up, capacity or resistance is desirable. For an antenna of about 90 feet in length we have found a capacity of from 25 to 100 micro-micro-farads quite satisfactory. To operate successfully as a multiple system a small capacity at C_1, or a high resistance, is practically essential in order to avoid reactions between the several receivers and rejectors when being adjusted.

If the antenna is small and no capacity in series therewith is desired the unit as shown satisfactorily permits cutting out this element. This is accomplished by short circuiting the condenser C_1, or by connecting antenna to binding post B_4.

Figure 2 illustrates the employment of the unit of Figure 1 as a wave trap. By connecting the antenna A to the binding post B_4, and the wire W_1 of the receiver to the binding post B_3, there is provided a path from the antenna through the coupled rejector and receiver, all in series. The coupled rejector will permit all frequencies to freely flow to the receiver, except the one frequency to which the coupled rejector is tuned, this arrangement being known as a wave trap instead of a rejector, one frequency being trapped out while all other frequencies are freely passed and not rejected.

Having described our invention we claim:

1. A high frequency electrical current selective unit arranged for connection between the input of a high frequency signal receiving circuit and a high frequency energy collecting system comprising a casing, two pairs of terminal connectors mounted on said casing adjacent each other, an additional pair of terminal connectors mounted on said casing remote from said first mentioned terminal connectors, connections between said additional pair of terminal connectors and said high frequency signal receiving circuit, a pair of fixed condensers interposed in said casing and electrically connected in series with opposite ends thereof connected to one of said first mentioned terminal connectors and with one of said last mentioned pair of terminal connectors, connections intermediate said condensers with individual ones of said first mentioned pairs of terminal connectors, a coupled rejector within said casing and connected with an individual one of said first mentioned pairs of terminal connectors and with an individual one of said additional pair of terminal connectors, a switch for bridging one pair of said first mentioned pairs of terminal connectors, connections between another of said first mentioned terminal connectors and one of said additional terminal connectors with said radio frequency energy collecting system, whereby said coupled rejector may be selectively connected in shunt with said receiving circuit.

2. A high frequency electrical current selective unit for connection between the input of a high frequency signal receiving circuit and a radio frequency energy distribution circuit comprising a casing, an apparatus unit having terminals interposed in said radio frequency energy distribution circuit and in said signal receiving circuit, said apparatus unit including a pair of fixed condenser units interposed in series and connected between individual terminals on said casing, a coupled rejector within said casing connected with terminals thereon, and switching means carried by said casing for connecting said coupled rejector with a point intermediate said fixed condensers for preventing transfer of high frequency signaling energy from said high frequency signal receiving circuit to said high frequency energy distribution circuit.

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