Feb. 16, 1943. H. O. ROOSENSTEIN 2,311,472

ANTENNA

Filed June 4, 1941

Fig. 1

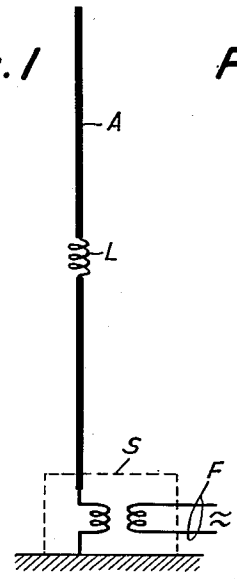


Fig. 2

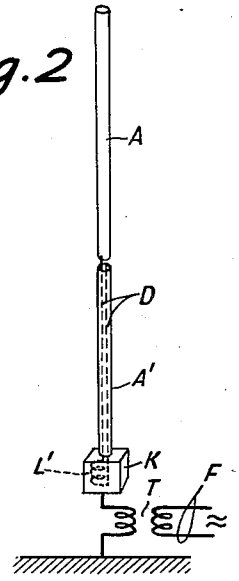


Fig. 3

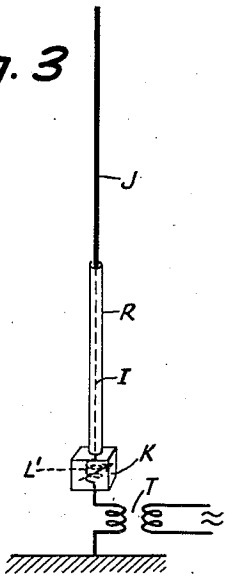


Fig. 5

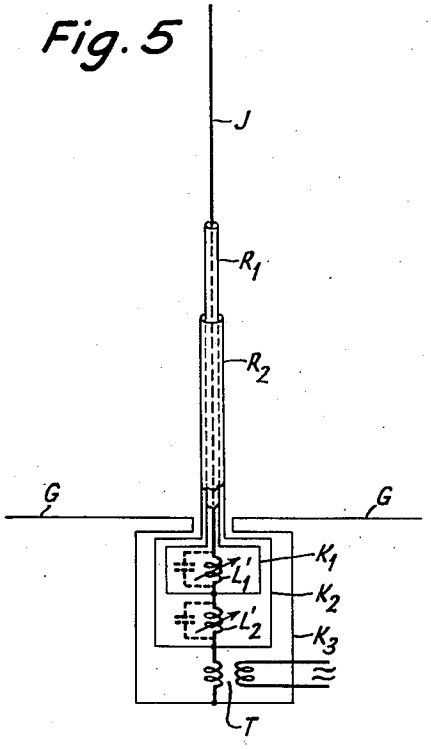
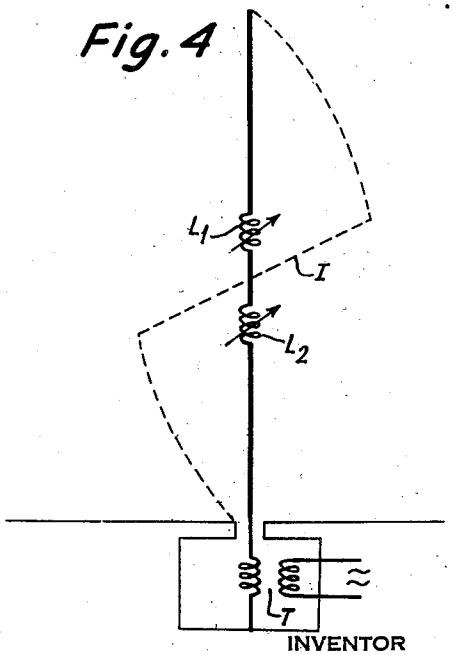


Fig. 4



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Patented Feb. 16, 1943 2,311,472

UNITED STATES PATENT OFFICE

2,311,472

ANTENNA

Hans Otto Roosenstein, Berlin, Germany; vested in the Alien Property Custodian

Application June 4, 1941, Serial No. 396,484
In Germany January 31, 1940

8 Claims. (Cl. 250—33)

It is known in the antenna art to insert at one or more suitable places impedances, particularly inductances, but also capacities or even oscillatory circuits, for the purpose of acting upon the current distribution in the antenna. This may serve to suppress one half-wave in an antenna on which two or more half-waves arise with the result that only the remaining half-wave radiates. Associated with this is also a variation in length. Thus, a coil connected in series with the antenna lead takes up a more or less large phase angle of the standing wave with the result that for a given antenna the electrical length is increased, or for a given electrical length the constructional length of the antenna may be decreased.

In the prior art, of which I am aware, the said series inductances were arranged directly at the place determined by the desired current distribution and inserted between the ends of the antenna resulting from the interruption at this point. However, in practice this is very often inconvenient. In the first place, at these places the available space is often limited. Moreover, by inserting the impedance the stability of the antenna is impaired. Furthermore, it is often difficult to protect the inserted impedances at these places against atmospheric inclemencies. An inserted coil must also be considered as part of the radiator, its effect increasing as its length is increased. Furthermore, a series connected capacity always acts simultaneously like a shunt capacity as a result of distributed capacitances to ground. Particular difficulties arise in this arrangement if the impedance or impedances are to be made adjustable.

The invention precludes these drawbacks and makes it possible to arrange the impedance to be inserted at some suitably situated or easily accessible place of the antenna lead rather than at the place of connection itself. This is made possible without changing the conditions of radiation by connecting the series impedance arranged at the most suitable place with the open ends of the antenna lead at the desired place of connection by way of an RF two-wire line within the antenna lead. One conductor of the two-wire line may consist of the antenna lead itself.

More particularly, an inner lead with a tubular outer or external lead is to serve as the antenna, the external lead surrounding the internal lead from the desired place of connection to the impedance, the latter being directly connected with one of its terminals to the inner conductor and with the other terminal to the outer conductor. Where a number of impedances are to be connected at various places, these may be arranged at the same place in space, usually at the end of the antenna nearest ground, a special outer conductor being provided for each impedance. The said special outer conductor extends to the corresponding place of connection. The impedance under consideration is inserted between the said outer conductor and the antenna lead surrounded thereby.

An exemplified embodiment of the invention is shown in Figs. 1 and 2 of the appended drawing, while Fig. 3 illustrates a modification of Fig. 2 and Figs. 4 and 5 illustrate a further development of the present invention. Fig. 1 illustrates a vertical rod antenna A which comprises at its middle a coil L directly arranged at this point and connected in series for the purpose of decreasing the constructional length of the antenna as known in the prior art. Connected to the bottom end of the antenna is a coupling coil which, together with a suitable coil connected in the feeder line F, forms the matching transformer T. The matching transformer may be placed within a shield S if desired. This arrangement known in the prior art is replaced according to the invention by the arrangement shown in Fig. 2. Coil L is replaced by an impedance L' (for instance, another coil) which is accommodated in a shielding box K at the lower end of the antenna in which the tubular antenna conductor A terminates. The ends of the antenna at the place of interruption herein again situated in the middle are connected with the ends of impedance L' by means of a two-wire line D in the lower half of the antenna conductor A'. The small box K and thus the lower end of the antenna are connected with transformer T in the same way as in Fig. 1.

What must be taken into account in the dimensioning of L' is that its value is transformed by the line D with the result that the transformed value, instead of its actual value, appears at the space between the antenna conductors A and A'. In order to have, for instance, an inductance at this place, the impedance L' itself may very well be capacitive if the length of line D just happens to require this. It is most advantageous to place an entire oscillatory circuit in the small box K, the said circuit being tunable towards the inductive end or capacitive end at will. This is shown in subsequent figures.

Between the two halves of the antenna conductor only a small space is needed. Therefore, the two halves may be attached to each other by means of an insulation piece so as to result in a rugged construction. Impedance L' has ample space in the small shielding box K, is protected from atmospheric inclemencies, screened, and adjustable in a simple manner.

As can be seen from Fig. 3, one lead of the RF two-wire line D in the arrangement Fig. 2 may be replaced by the antenna lead itself. Arrangements can then be made in such a manner that the antenna consists of a continuous, solid inner conductor J and a tubular concentric outer con-

ductor or lead R which surrounds the inner conductor from the small box K to the desired point of separation or break. One end of the loading inductance L' is connected to the lower end of the inner conductor I, while the other end is associated with the lower end of the outer conductor or the small box K. In this case the free upper end of the inner conductor J and the outer conductor R serves as the radiator. The free end of the inner conductor is preferably made thicker so that the radiating parts at least have the same diameter as far as their size is concerned.

In a similar manner also a number of impedances may be inserted at various places in the antenna lead or conductor. If, for instance, it is desired to insert a loading coil slightly above the middle as well as slightly below as shown in Fig. 4 (L_1 and L_2) in order to obtain a current distribution curve corresponding to the curve I shown next to the antenna (shortened antenna) then this arrangement may be effected according to the invention as shown in Fig. 5. In this instance the antenna consists of a continuous inner conductor J and two concentric, tubular outer conductors R_1 and R_2 which go from the base of the antenna up to the desired places of connection, while at the base they terminate in shielding boxes K_1 and K_2, respectively. In K_1 is accommodated the impedance L'_1 connected between the inner conductor and K_1, and in K_2 is arranged the impedance L'_2 inserted between K_1 and K_2. The values of the impedances L'_1 and L'_2 may be obtained from the impedance values of L_1 and L_2 by transformation to the places of connection by way of the corresponding two-wire lines. Another shielding box K_3 surrounds K_1 and K_2. The same also accommodates the matching transformer T for coupling to the transmitter and terminates in a counterpoise G (in place of ground).

If the lengths of the conductors R_1 and R_2 are such that the impedances L'_1 and L'_2 have to be inductive, then the said inductances may be made tunable employing iron cores which may be shifted. The iron cores may be shifted axially along the coils by means of a screw-driver or by means of fixed shafts which pass through openings in the screening boxes K_1, K_2, K_3, and which have control knobs at their outer ends.

By employing the present invention any desired number of impedances of any desired type may be inserted into and RF conductor or lead (in the exemplified embodiments it is an antenna, though the invention is not limited thereto since, for instance, also shielded conductors used for filtering purposes are often provided with series impedances) so that any desired current distributions or any desired filter characteristics may be obtained.

I claim:

1. A short wave antenna including a plurality of coaxially arranged radiator sections, some of said sections being hollow, said sections being connected together at their adjacent ends by series impedances, all of said impedances being located at one end of said antenna in separate shielding boxes, the connections between said ends and said impedances being carried within the intervening ones of said radiator sections between said ends and said impedances.

2. A short wave antenna including a plurality of coaxially arranged radiator sections, some of said sections being hollow, said sections being connected together at their adjacent ends by series impedances, all of said impedances being located at one end of said antenna in separate shielding boxes, the connections between said ends and said impedances being carried within the intervening ones of said radiator sections between said ends and said impedances and means for energizing said antenna having a connection to one end section.

3. A short wave antenna including a plurality of coaxially arranged radiator sections, some of said sections being hollow, said sections being connected together at their adjacent ends by series impedances, all of said impedances being located at one end of said antenna in separate shielding boxes, one within the other, the connections between said ends and said impedances being carried within the intervening ones of said radiator sections between said ends and said impedances and means for energizing said antenna having a connection to the outer of said shielding boxes.

4. A short wave antenna including a pair of coaxially arranged radiator sections, one of said sections being hollow, said sections being connected together at their adjacent ends by a series impedance, said series impedance being located at one end of said antenna in a shielding box, the connection between said ends and said impedance being carried within the intervening one of said radiator sections and means for energizing said antenna having a connection to said one end section.

5. A short wave antenna including a pair of vertically arranged coaxial radiator sections, the lower of said sections being hollow, said sections being connected together at their adjacent ends by a series impedance, said impedance being located at the lower end of said antenna in a shielding box connected to said lower end, the connections between said adjacent ends and said impedance being carried within the intervening one of said radiator sections and means for energizing said antenna having a connection to said shielding box.

6. An antenna including a pair of coaxially arranged radiator sections, said sections being connected together at their adjacent ends by a series impedance, said series impedance being located at one end of said antenna within a shielding box connected to said one end.

7. An antenna including a pair of coaxially arranged radiator sections, said sections being connected together at their adjacent ends by a series impedance, said series impedance being located at one end of said antenna within a shielding box connected to said one end, the connections between said adjacent ends and said impedance being carried within the intervening one of said radiator sections, said one section being hollow.

8. An antenna including a pair of coaxially arranged radiator sections, said sections being connected together at their adjacent ends by a series impedance, said series impedance being located at one end of said antenna within a shielding box connected to said one end, the connections between said adjacent ends and said impedance being carried within the intervening one of said radiator sections, said one section being hollow, one of said sections being constituted by an extension of the other of said radiator sections within said hollow section and the other connection being constituted by the interior surface of said hollow section.

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