

Dec. 30, 1941.

H. O. ROSENSTEIN

2,267,951

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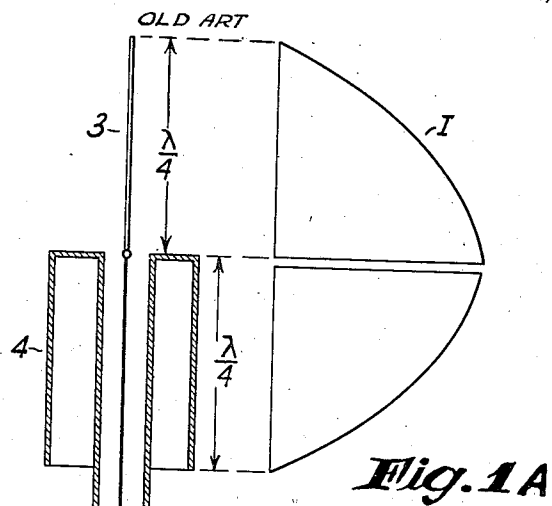
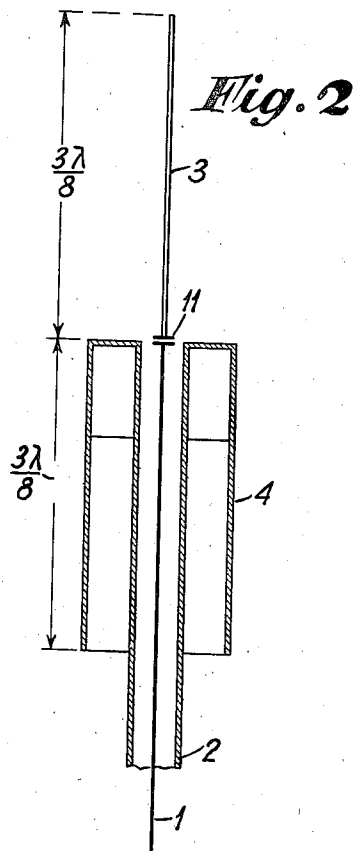
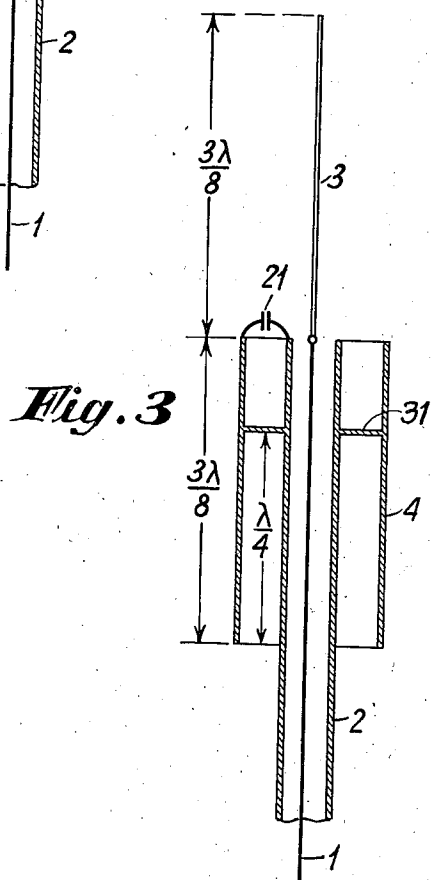


Fig. 1



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Fig. 4

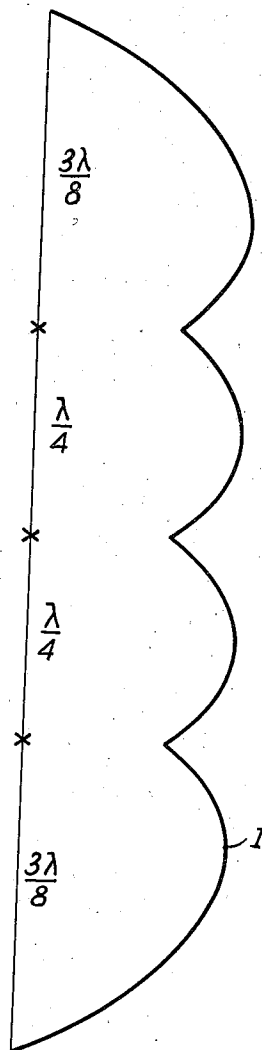
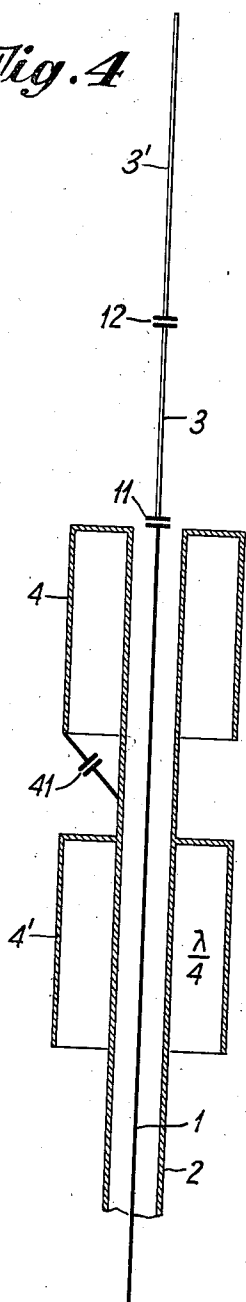


Fig. 4 A

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8 Claims. (Cl. 250—33)

The invention relates to an antenna consisting of a radiator connected to the inner conductor and a radiator connected to the outer conductor of a coaxial line whereby the latter radiator surrounds the end of the line in a coaxial fashion. This last-mentioned radiator part can be considered a counterpoise bent backwards and which may have the form of a cylinder, or cone, or pyramid.

In an antenna according to the invention, the lengths of the two radiators are so chosen that the effective antenna resistance is equal to the surge impedance (wave resistance) of the cable and the wattless resistance hereby realized is compensated by an additional reactance.

An object of the invention is the provision of an antenna which may be connected to a transmission line without the use of complicated impedance matching transformers.

Another object is the provision of an antenna having an effective surge impedance equal to the resistance of the transmission line.

Still another object is the provision of an antenna having an effective surge impedance equal to the resistance of the transmission line and in which any resultant reactance or wattless resistance is compensated for by an additional reactance.

Still a further object is the provision of an antenna having an effective height greater than its physical height.

Further objects, features and advantages will become apparent from the following detailed description which is accompanied by drawings in which,

Fig. 1 illustrates diagrammatically an antenna known in the art, the form of which may be modified in accordance with the invention, and Fig. 1A illustrates the current distribution therein, while Figs. 2 and 3 illustrate the application of the invention, Fig. 4 illustrates a modification of the invention, and Fig. 4A illustrates the current distribution in the antenna of Fig. 4.

It is known to design an antenna for instance, in accordance with Fig. 1 wherein item 1 is the inner conductor and 2 represents the outer conductor of a coaxial line. The inner conductor 1 has a radiator 3 connected thereto whose length equals $\lambda/4$; in like manner the outer conductor 2 has connected thereto the cylinder 4 surrounding coaxially the end of the line and which likewise acts as radiator. The current distribution obtained on the two radiators is indicated in Fig. 1A.

Fig. 2 shows an example of construction ac-

cording to the invention, in which the total length of each radiator amounts to about $3/8\lambda$, which results on the one hand in a matching of the effective antenna resistance with the surge impedance (wave resistance) of the line, 2 of for instance 150 ohms, while on the other hand the further advantage exists that the total radiator length is substantially increased against the arrangement illustrated by Fig. 1. The wattless resistance, or reactive component of the antenna resistance appearing at the place of connection of the cable at the radiator can be eliminated by means of a reactance placed in series to the antenna, or in parallel to the output of the line. This is done in the example of Fig. 2 through insertion of a capacity 11 between the radiator 3 and the inner conductor 1 of the lead-in cable. The radiator 4 connected to the outer conductor of the cable can be designed as hollow cylinder, or it may consist of a number of rods or wires connected preferably in a symmetrical fashion. The radiator 4 may also be built to advantage in the form of a wire network, thereby diminishing the wind resistance.

Figure 3 shows a similar antenna in which the compensating series reactance is arranged at the antenna section connected to the outer conductor. This may be accomplished for instance through suitable choice of the connection place 31 of the outer conductor 2 of the cable with the coaxial tube 4, whereby the upper part of the long section thus formed represents at a suitable length the proper value of the reactance. However, also an additional capacity 21 may be provided between the upper ends of the two cylinders. Such an antenna in which no compensation capacity is inserted between the inner conductor and the one radiator, is particularly suited also for the simultaneous reception of long waves whereby the radiator 3 acts in the manner of a known rod antenna.

A further increase of the effective height of dipoles in accordance with the invention is attained by placing in series several parts passed by current in the same phase and whose total length is more than $\lambda/2$. Such an antenna is shown, for example, in Fig. 4 in which the inner conductor 1 of the lead-in cable is connected to the radiator part 3 having a length equal to $\lambda/4$ across a capacity 11, and this part is connected in turn across a second capacity 12 with the radiator part 3' whose length is $5/8\lambda$. The same length is also chosen for the other dipole half consisting of the first outer conductor 4 whose length is $\lambda/4$ and of a second part 4' whose

length is $\lambda/4$ and which is disposed at a distance of $\lambda/8$ from the second part arranged at the lower end of the first part and these two radiator parts are likewise capacitively coupled with one another in 41. Through suitable choice of the capacities 11, 12 and 41 it is possible so to influence the current distribution on the antenna that currents of same phase flow in the entire length of the dipole. The current distribution is shown in Fig. 4A.

It can be readily seen that the current distribution indicated affords a favorable horizontal concentration of the antenna diagram. The described antenna can be utilized both for transmission purposes and for receiving purposes, especially in case of ultra-short waves. The invention is not limited to the examples of construction represented and it may also be used to advantage with other lengths of the radiator parts.

I claim:

1. An antenna system comprising a transmission line having a pair of parallel conductors, a first elongated radiator connected to one of said conductors and a second elongated radiator connected to the other of said conductors and having its length parallel to the conductors of said transmission line, said second radiator being connected to its associated transmission line conductor at a distance equal to a quarter of the operating wavelength from the end remote from the end of said line, and a compensating reactance serially connected with respect to said second radiator and said line.

2. An antenna system comprising a coaxial transmission line having an inner conductor and an outer shell, an elongated radiator connected to said inner conductor coaxially arranged with respect thereto, a hollow elongated radiator connected to and surrounding said outer shell, said hollow radiator being connected to said outer shell at a distance equal to a quarter of the operating wavelength from the end remote from the end of said coaxial line, and a compensating reactance serially connected with respect to said hollow radiator and said outer shell.

3. An antenna system comprising a transmission line having a pair of parallel conductors, a first radiator connected to one of said conductors and a second radiator connected to the other of said conductors, said radiators each having an end adjacent the end of said line, each of said radiators having a length equal to three-eighths of the operating wavelength, said second radiator being connected to its associated transmission line conductor at a distance equal to a quarter of the operating wavelength from the end remote from the end of said line, and a compensating reactance serially connected with respect to said second radiator and said line.

4. An antenna system comprising a coaxial transmission line having an inner conductor and an outer shell, a first radiator connected to said inner conductor coaxially arranged with respect thereto, a second hollow radiator connected to and surrounding said outer shell, each of said radiators having a length equal to three-eighths

of the operating wavelength, said second radiator being connected to said outer shell at a distance equal to a quarter of the operating wavelength from the end remote from the end of said coaxial line, and a compensating reactance serially connected with respect to said second radiator and said outer shell.

5. An antenna system comprising a transmission line having a pair of parallel conductors, an elongated radiator connected to one of said conductors and arranged in an end-to-end relationship thereto, a hollow elongated radiator connected to the other conductor of said line and surrounding said line, each of said radiators being divided into separate co-linear radiating sections by serially connected reactances, one section of each of said radiators having its length so chosen that the antenna resistance is equal to the surge impedance of said transmission line, said length causing a residual reactance, said serially connected reactances being so proportioned that the reactance of the radiators at the operating frequency is substantially compensated.

6. An antenna system comprising a coaxial transmission line having an inner conductor and an outer shell, an elongated radiator connected to said inner conductor and arranged in an end-to-end relationship thereto, a hollow elongated radiator connected to said outer shell and surrounding said line, each of said radiators being divided into separate co-linear radiating sections by serially connected reactances, one section of each of said radiators having its length so chosen that the antenna resistance is equal to the surge impedance of said line, said length causing a residual reactance, said reactances being so proportioned that the reactance of the radiator at the operating frequency is substantially compensated.

7. An antenna system comprising a transmission line having a pair of parallel conductors, a first radiator connected to one of said conductors, a second radiator connected to the other conductor of said line, each of said conductors being divided into separate co-linear radiating sections by serially connected reactances, one section of each of said radiators having its length so chosen that the antenna resistance is equal to the surge impedance of said transmission line, said length causing a residual reactance, said reactances being so proportioned that the reactance of the radiators at the operating frequency is substantially compensated.

8. An antenna system comprising a coaxial transmission line having an inner conductor and an outer shell, a first radiator connected to said inner conductor, a second radiator connected to said outer shell, each of said radiators being divided into separate co-linear radiating sections by serially connected reactances, one section of each of said radiators having its length so chosen that the antenna resistance is equal to the surge impedance of said line, said reactances being so proportioned that the reactance of the radiators at the operating frequency is substantially compensated.

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