Aug. 27, 1940. K. SCHÜSSLER 2,213,054

IMPEDANCE MATCHING DEVICE

Filed Oct. 4, 1938

Fig. 1

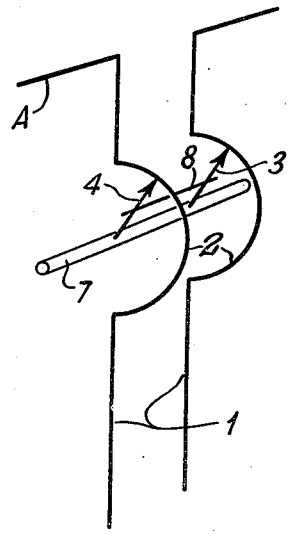
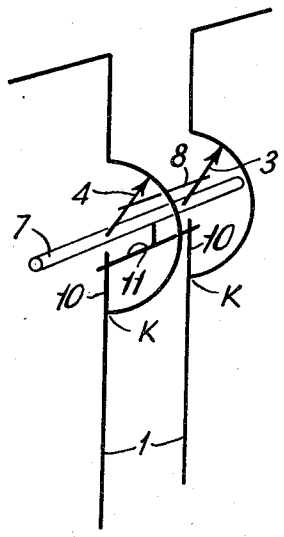



Fig. 2




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## IMPEDANCE MATCHING DEVICE

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3 Claims. (Cl. 178—44)

In order to match the resistance of high frequency loads with the wave resistance of the energy line feeding into the load it is known to place a reactance in parallel to the line at a certain place ahead of the connection point of the load (for instance of an antenna). The line section between the actual load and the reactance transforms the load resistance so that its real part at the connection place of the reactance is equal to the wave resistance of the energy line. Thus, resistance matching is assured. The likewise transformed wattless resistance of the load can be compensated for by suitable dimensioning of the reactance. In this way standing waves on the energy line are suppressed.

The novel idea relates to an advantageous structural embodiment of the above described matching member, more especially for ultra short decimeter waves.

In the accompanying drawing Figure 1 shows in perspective an embodiment of the invention, while Figure 2 shows a modification of the mechanical structure of the invention.

Figure 1 shows an energy line 1 in the form of a double wire line which connects the load, antenna A for instance, to a high frequency source. In the vicinity of the load the energy line is bent for a distance into a semi-circular shape 2. At the center of this circular bend there is mounted a rotatable shaft 7 to which the reactance 8 is fastened in a tilting manner. This reactance 8 is displaceably connected to the energy line so that when turning the shaft 7 the connection point of the reactance to the energy line will be moved. In this manner an accurate setting of the optimum resistance matching can be carried out. The reactance 8 as shown may consist of a short parallel wire line bridged by means of a displaceable short circuit strap. In this figure the turning connection line is indicated by 3, the displaceable short circuit strap is 4 and the rotatable shaft is represented by 7. The shaft consists preferably of insulating material so that the conductors of the line 3 can be fastened thereto directly. As already pointed out, the novel idea is not limited to any particular form of the parallel reactance. Moreover, it is not necessary to design the energy line as parallel wire line. A concentric line may also be employed whose outer conductor has a slot along the circular distance through which the reactance can be movably connected to the inner conductor.

The length of the arcuate portion of the energy line is preferably equal to either a half wave or full wave of the oscillations to be transmitted. It is so chosen since in a half wave length portion of an energy line a current maximum and a current minimum position may each be found. A load having a reactive component is always equivalent to a pure resistance load located at a current maximum or minimum position, the equivalent value being lower than the surge impedance at a current maximum or higher than the surge impedance at a current minimum. The mathematical relations giving the exact distances and value of shunt reactance for any equivalent resistance may be found in a patent to Philip S. Carter No. 2,019,809, patented November 5, 1935. Applicant's present invention is not concerned with the theory involved in these mathematical relations but entirely with a convenient mechanical structure for utilizing these principles in a transmission line. The theory heretofore discussed thus shows that within a distance equal to one half wave two points exist at which the reactance can be connected in order to obtain optimum matching, i. e. points in which any load resistance, as regards its ohmic part, will be transformed exactly to the wave resistance of the energy line. Since the load resistance is unknown, the matching, therefore, can always be attained since the connection point of the reactance may be moved across a distance equal to at least one half wave length.

In order to suspend an energy line extending, for its greater part, straight downwards from the antenna, it is convenient to support the line from a line section equal to one-quarter wave length at the point at which the circular part begins as indicated in Figure 2. At the bent place K the lower part of the energy line 1 is supported from a convenient part of the remaining structure of the matching member such as shaft 7 by means of a line section 10 whose length is equal to one-quarter wave length and which is bridged by a movable short circuit strap 11. The intermediate piece whose length is equal to one-quarter wave length makes it possible to ground the point of fastening without grounding at the same time the energy line.

I claim:

1. An arrangement for matching a high frequency load to an energy line comprising a section of said energy line having a length equal to a half the length of the operating wave, said section being bent into a semi-circular formation and a reactance mounted to rotate about the center of said semi-circle in contact with said energy line whereby the point of connection of said re-

actance with said energy line may be varied over said length.

2. An arrangement for matching a high frequency load to an energy line comprising a section of said energy line having a length equal to a half the length of the operating wave, said section being bent into a semi-circular formation and a short parallel wire line having one end mounted to rotate about the center of said semi-circle and with the other end in contact with said energy line whereby the point of connection of said parallel wire line with said energy line may be varied over said length.

3. An arrangement for matching a high frequency load to an energy line comprising a section of said energy line having a length equal to a half the length of the operating wave, said section being bent into a semi-circular formation and a short parallel wire line having one end mounted to rotate about the center of said semi-circle and with the other end in contact with said energy line whereby the point of connection of said parallel wire line with said energy line may be varied over said length, and a movable short-circuiting strip across said parallel wire line.

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