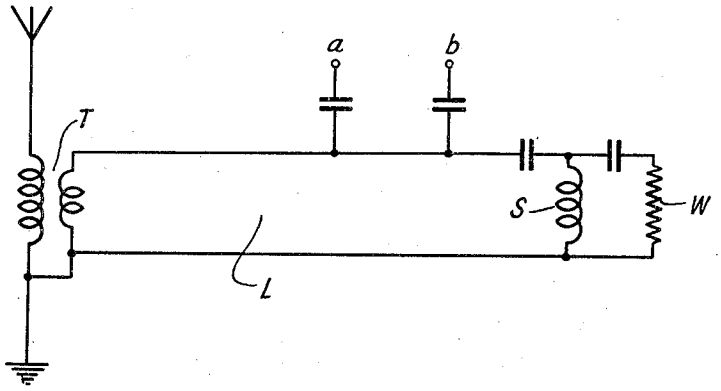
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RECEIVING SYSTEM FOR RECEIVING A WIDE RANGE OF FREQUENCIES

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## RECEIVING SYSTEM FOR RECEIVING A WIDE RANGE OF FREQUENCIES

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The invention relates to a receiving station in which the antenna is connected to one or several receivers across a double line such as, for instance, a shielded lead-in and whereby a wider wave range is to be transmitted.

It is known to terminate the double line with a resistor which is equal to the wave resistance, i. e. surge impedance, of the line, and to match the antenna with the cable line at the longest wave to be transmitted. The terminal resistance serves to prevent reflections along the line; that is, it serves at the shorter waves in which the length of the cable approaches the order of the wave length, to prevent standing waves appearing on the line. Such standing waves would cause voltages of different values to appear at the various tap points of the cable.

The impedance matching resides in transforming the resistance of the antenna down to the cable side so that it is equal to the wave resistance, i. e., surge impedance of the cable. The impedance matching is carried out at the longest wave in order that a uniform transfer take place over the wave range.

This condition can be explained as follows:

The voltage as such at the cable is the higher, the higher the ratio of cable resistance to the antenna resistance. Since however, the surge impedance of the cable is lower than the antenna resistance, the method of impedance matching by means of a transformer provides a higher voltage at the cable, namely when the transformation ratio is so chosen that the resistance of the primary side if transformed to the other side, is equal to the resistance of the secondary side. At an excessive impedance matching of the cable with the antenna it would be accomplished in fact that the antenna voltage has less chance to collapse, but in this case owing to the greater downward transformation towards the cable, a lower voltage would appear at the cable. At insufficient impedance matching, a lower transformation downwards would be obtained owing to a lower transformation ratio, but the voltage at the antenna would collapse more readily.

Since the resistance of the antenna depends on frequency, for each frequency the highest voltage would be obtained by a corresponding impedance matching. This highest voltage is higher at higher frequencies than at lower frequencies, because at higher frequencies the antenna resistance is lower, therefore, coming nearer to the resistance of the cable so that a lower downward transformation and hence, a lower voltage loss occurs.

For a single cable, obviously only a single matching is possible, if the total frequency range is to be transmitted simultaneously. With a matching at the highest frequency the highest voltage would, in fact, be attained at this voltage, but the voltage attainable with a lower value at the lower frequencies, for the reason already stated, would then drop still more owing to the then existing false matching. Therefore, the matching is carried out at the lowest frequency, so that for this frequency the highest voltage will be obtained. Owing to the false matching existing for the higher frequencies, the voltage does then not increase at the higher frequencies, but remains approximately uniform throughout the frequency range.

If the cable is so short that its capacitive resistance is higher than the surge impedance, a matching with a lower downward transformation would be obtained, so that in this case the attained voltage is higher; but since, especially in case of short cables, the length of the cable approaches the order of the wave length of the shortest wave to be transmitted, whereby standing waves appear, such impedance matching cannot be carried out with the known means.

In accordance with the present invention, the capacitive resistance, i. e. capacity reactance, of the double line is matched with the antenna across a transformer, and the double line is terminated simultaneously across a filter chain permeable only at higher frequencies, by a resistor having the value of the surge impedance. Consequently, a higher voltage will be attained and reflections will be avoided at the shorter waves.

In the single figure of the drawing, the antenna transformer is designated by "T", the double line is represented by "L", the filter chain is "S" and the terminal resistor is designated by "W". As an example, two connection points "*a*" and "*b*" for the receivers are herein given. A cable may be assumed to have a capacity of 30 pF per meter. For a cable of fifty meters in length, the cable capacity is thus 1500 pF, and at a wave length of 2000 meters represents a capacitive resistance, i. e. capacity reactance, of 666 ohms. If the surge impedance is equal to 150 ohms, as in shielded ordinary lead-ins, the impedance matching can be carried out for a four times higher resistance by the use of the present invention, so that in this case the transformation ratio is to be only one-half as high.

The voltage at the cable is uniform throughout that part of the wave range in which the impedance matching with the capacitive resistance,

i. e. capacity reactance, takes place, since capacitive resistances (capacity reactances) are here to be considered for the antenna resistance, as well as cable resistance, which capacitive resistances (capacity reactances) decrease in the same proportion with an increase of the frequency, so that an impedance match exists at each frequency. In order to avoid a jump in the frequency curve, the filter chain is suitably so dimensioned that the terminal resistance will be effective at a frequency at which the capacitive resistance, (i. e. capacity reactance), of the cable is equal to the surge impedance. However, it is also possible to render the terminal resistance effective at higher frequencies, at which reflection would occur without the terminal resistance.

The use of the present invention gives a still further advantage. Hitherto, the primary side of the transformer placed in the antenna was so dimensioned that a resonance appeared for the highest wave in order to avoid a falling of the frequency curve. Since when using the invention the capacitive resistance (capacity reactance) of the cable is transformed upon the primary side, a lower primary inductance suffices to obtain the same resonance. However, there is hereby attained at the same time a reduced stray induction, and therefore a wider frequency range of the transformer.

What is claimed is:

1. A receiving system for receiving waves over a wide range of frequencies, comprising an energy collector, a two-conductor transmission line coupled at one end to said collector and having a length comparable to a wavelength having the highest frequency of said range but small in length compared to a wavelength corresponding to the lowest frequency of said range, a terminating resistor connected across the other end of said transmission line, a high pass filter connected between said terminating resistor and said line, said filter being so constructed and arranged as to pass only the higher frequencies of said range, and a receiver coupled to said line at a location between said filter and said energy collector.

2. A receiving system for receiving waves over a wide range of frequencies, a two-conductor transmission line, an antenna, a transformer coupling one end of said line and said antenna, said transformer being constructed to match the capacity reactance of said line with the impedance of said antenna, a terminating resistor across the other end of said line, said resistor having a value which matches the surge impedance of said line, a high pass filter connected between said line and said resistor, said filter passing only the high frequencies of said range whereby standing waves on said line are materially reduced at the high frequencies of said range, and a receiver coupled to said line.

3. A receiving system for receiving waves over a wide range of frequencies, a two-conductor transmission line having a length comparable to a wavelength having the highest frequency of said range but small in length compared to a wavelength corresponding to the lowest frequency of said range, an antenna, a transformer coupling one end of said line and said antenna, said transformer being constructed to match the capacity reactance of said line with the impedance of said antenna, a terminating resistor across the other end of said line, said resistor having a value which matches the surge impedance of said line, a high pass filter connected between said line and said resistor, said filter passing only the high frequencies of said range whereby standing waves on said line are materially reduced at the high frequencies of said range and said resistor is operatively dissociated from said line at the low frequencies of said range, and a plurality of spaced connections on said line for connection to receivers.

4. A receiving system for a wide range of frequencies comprising an energy collector, a transmission line coupled at one end to said collector and having a length comparable to a wavelength at the highest frequencies of said range but small compared to a wavelength at the lowest frequencies of said range, a terminating resistance connected to the other end of the line through a high pass filter so as to substantially reduce standing waves at the high frequencies of said range while permitting said line to act as a lumped capacity substantially undamped, i. e. dissociated from said terminating resistance (by means of the filter) at the low frequencies of said range, whereby connections to utilization devices at various points along said line are substantially equally energized at both the higher and lower frequencies of said range.

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