Dec. 3, 1929. S. E. ANDERSON 1,738,274

WAVE TRANSMISSION MEANS

Filed Jan. 15, 1925

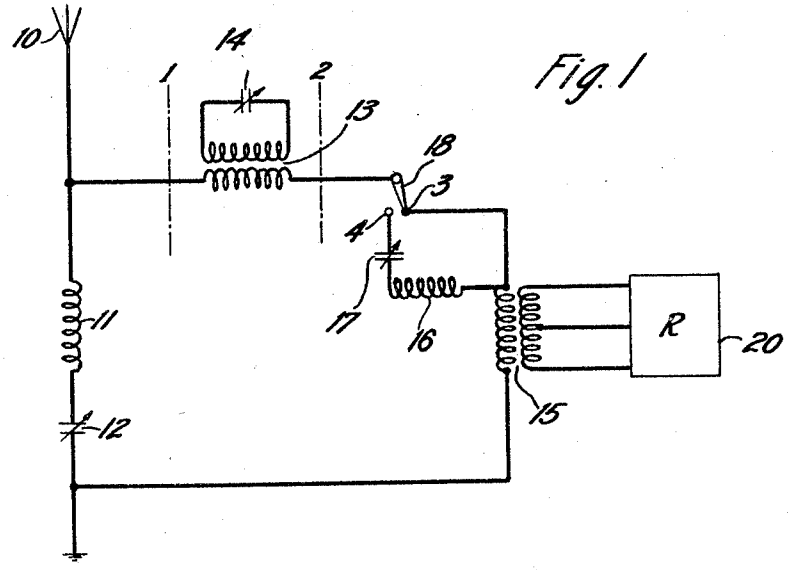
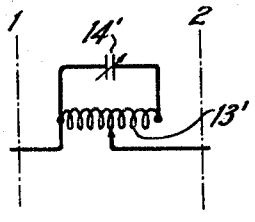


Fig. 1

Fig. 2



Inventor:
Sidney E. Anderson,
by R. W. Adams Atty

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UNITED STATES PATENT OFFICE

SIDNEY E. ANDERSON, OF MAPLEWOOD, NEW JERSEY, ASSIGNOR, BY MESNE ASSIGNMENTS, TO WESTERN ELECTRIC COMPANY, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK

WAVE TRANSMISSION MEANS

Application filed January 15, 1925. Serial No. 2,477.

This invention relates to wave transmission means and particularly to frequency selective structures.

A special problem presents itself to the radio engineer, when it is desired to construct a radio receiving system to be connected to a receiving antenna which is relatively near to a transmitting antenna. This problem relates to the exclusion of waves of the transmitted frequency from the receiving set and to the protection of the receiving circuit from the excessive voltages generated in the receiving antenna. The difficulties encountered become greater and the solution of the resulting problems becomes more difficult when the sending station transmits considerable power.

The present invention provides a frequency selective and voltage protective arrangement for guarding a receiving system against large voltages developed in its circuits and from interference to received signals caused by a nearby transmitting station, and at the same time enables desired waves to be efficiently received.

An object of the invention is to protect the circuits and apparatus of an electric wave signaling system from excessive electric stresses.

Another object is to prevent interference with the received signals.

A further object is to trap undesired waves in an electric wave signaling system.

An additional object is to cause a wave receiving conductor to function as an element of a wave filter network.

A still further object is to secure a maximum efficiency of transmission of desired waves in a wave trapping and selecting network.

The invention is capable of embodiment in a filter network having one or a plurality of sections in an antenna circuit and functions to divert undesired waves from a receiving circuit connected to the antenna, to prevent interference with desired waves and to protect the circuit from excessive voltages. Each section of the filter includes in addition to a shunt element, a series impedance element adjusted to offer high impedance to electric waves of undesired frequency, and low impedance to desired waves. Means is also provided to adjust the impedance of the series element to match the impedance of the rest of the system in order to obtain a maximum efficiency in wave transmission.

In the drawings, Fig. 1 represents a radio receiving system arranged in accordance with the present invention;

Fig. 2 represents a modified form of the series element of the filter network shown between the dotted lines 1 and 2 of Fig. 1.

A circuit embodying the invention will now be described in detail. In Fig. 1, an antenna 10 is connected to ground in series with an inductance 11 and an adjustable condenser 12. The antenna 10, in conjunction with the inductance 11 and condenser 12 forms a portion of a band filter, which includes in addition, a series element. The series element comprises a two winding transformer 13 having an adjustable condenser 14 connected to its secondary winding. The use of a two winding transformer enables the impedance of its winding to be matched to the impedance of the connected circuit to provide increased efficiency in the transmission of waves. Also by a proper impedance ratio between windings, the condenser 14 may be of convenient proportions. By means of a switch 18, the series element of the filter may be connected directly to the transformer 15 or in series with adjustable condenser 17 and inductance 16. The secondary winding of transformer 15 is provided with leads extending from its outer and middle terminals to a radio receiving system, represented by block 20, which may be of any one of several types.

The inductance 11 is so designed and the condenser 12 is so adjusted as to form a resonant circuit tuned to the frequency of waves impressed upon the antenna 10 which it is desired to exclude from the receiving circuit 20. By so tuning this portion of the antenna path, waves of the undesired frequencies are prevented from producing a large voltage between the outer terminal of inductance 11 and ground since this path has low impedance to these waves. Moreover, this element of the filter produces great attenuation of the un-

desired waves transmitted to the receiving circuit by affording a low impedance path to ground in shunt thereto.

The circuit including the secondary winding of transformer 13 and the adjustable condenser 14 is also tuned to the frequency of undesired waves. This circuit, being of the parallel tuned type, has high impedance to these waves and since its impedance is reflected in the primary winding of transformer 13, it operates to further attenuate waves of the undesired frequency. It is an important function of the path 11—12 to reduce the voltage applied to the series element 13—14 of the band elimination filter as well as the other elements of the system, thereby making it unnecessary to design the apparatus associated therewith to withstand high voltages.

An advantage of the present invention in functioning as a band filter relates to the fact that not only the carrier frequency interfering waves may be substantially completely excluded, but also the side band frequency waves as well. The sharpness of the filter cut-off or the slope of the sides of its characteristic curve may be increased by adding thereto additional sections such as that constituted by shunt element 11, 12 and series element 13, 14.

In operating the system, the switch 18 may normally be closed on contact 3 so that selection of a desired station may be obtained without adjusting condenser 17. Increased selectivity may subsequently be obtained by shifting switch 18 to contact 4, thereby including the condenser 17 and inductance 16 in the antenna circuit whereby the latter may be tuned to the frequency of waves which it is desired to receive.

In Fig. 2, a modified form of the series element of the band elimination filter is represented. This includes an auto-transformer 13′ having an adjustable contact whereby its impedance may be matched to the impedance of the remaining portions of the antenna circuit so as to obtain maximum efficiency in the transmission of waves to the receiving set. Condenser 14′ corresponds to condenser 14 of Fig. 1 and serves to enable the series element to be tuned to the frequency of undesired waves. The circuit shown in Fig. 2, when substituted for the corresponding element of Fig. 1, functions in substantially the same manner.

What is claimed is:

In a radio receiving system, the combination of an antenna, a series resonant path from said antenna to ground, a second path from said antenna to ground in shunt to said first path, a serially connected inductance and capacity arranged to be tuned to desired waves, in said second path, a switch for connecting said serially connected inductance and capacity in said second path, and a parallel resonant circuit tuned to the frequency of undesired waves and a receiving circuit, coupled to said second path.

In witness whereof, I hereunto subscribe my name this 13th day of January, A. D. 1925.

SIDNEY E. ANDERSON.