Dec. 7, 1937. A. A. LINSELL 2,101,440

SHORT WAVE RADIO TRANSMITTING APPARATUS

Filed April 9, 1935 2 Sheets-Sheet 1

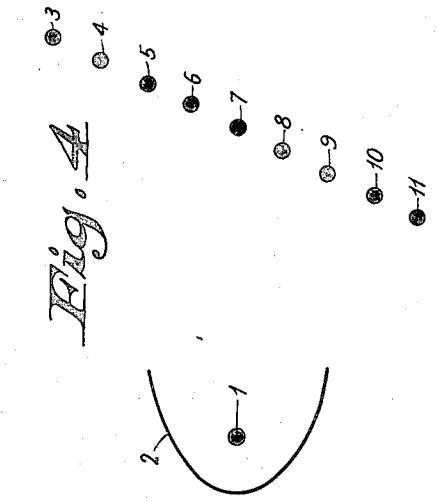


Fig. 4

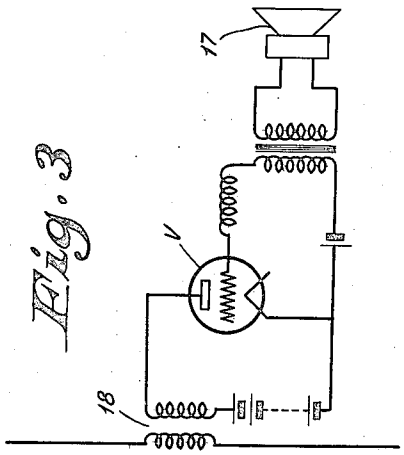


Fig. 3

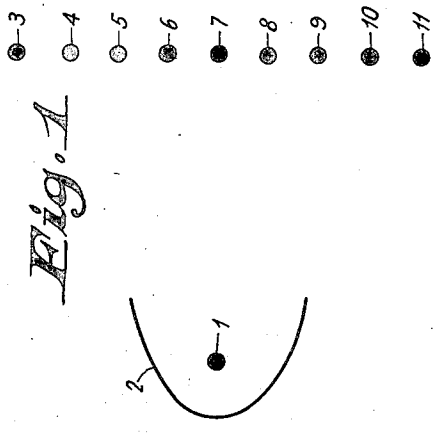


Fig. 1

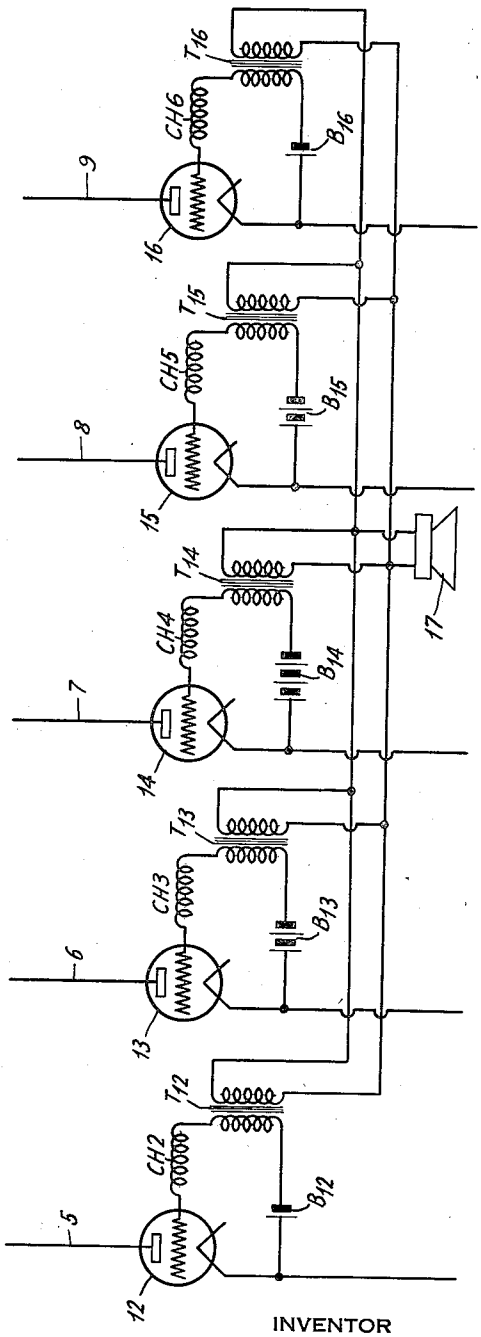


Fig. 2

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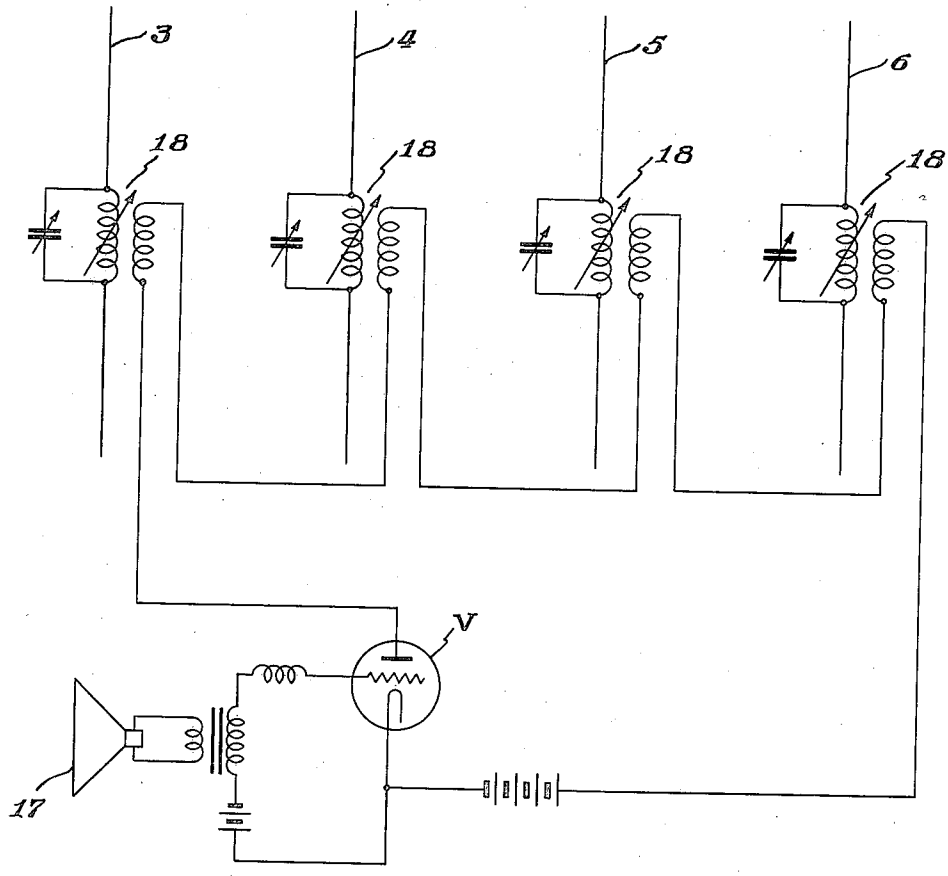


FIG. 5.

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SHORT WAVE RADIO TRANSMITTING APPARATUS

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Application April 9, 1935, Serial No. 15,384
In Great Britain April 28, 1934

6 Claims. (Cl. 250—17)

This invention relates to very short wave radio transmitting apparatus.

The invention has for its object to provide an improved transmitting system whereby the degree of convergence or divergence of a radiated transmitted beam and/or the direction of said beam may be predetermined or varied in a simple manner.

The invention also provides improved apparatus whereby a very short wave radiated beam may be modulated by altering the shape of the beam, or its direction, degree of convergence, or degree of divergence.

In the preferred embodiments of this invention, use is made of the same principle as is employed in the invention described in my Patent No. 2,073,642, March 16, 1937; i. e., use is made of the fact that if a conductor is placed in the path of a very short wave beam of radiation, an energy absorbing effect takes place, and by suitably arranging the conductor and varying its effective impedance, modulation may be achieved by varying this energy absorbing effect.

According to this invention, a very short-wave radio transmitting apparatus comprises an aerial system adapted to transmit a beam of very short wave radiation in a given direction and a plurality of energy absorbing conductors interposed in the path of said beam, said conductors being arranged side by side along an imaginary surface of predetermined shape and being so arranged and dimensioned as to give a desired degree of convergence, divergence or direction to the beam passing said conductors. In the preferred embodiments of the invention, means are provided for varying the impedances of the interposed conductors and in this manner to modulate the beam.

The invention is illustrated in Figs. 1 to 5 of the accompanying drawings, which shown diagrammatically or schematically a number of embodiments in accordance therewith.

In the embodiment shown in Fig. 1, a very short wave radio transmitting system comprises an aerial 1 which is energized at a desired operating wave length and is situated at the focus of a suitable reflector 2, for example a cylindro-parabolic sheet reflector so that the reflector-aerial combination gives a beam of radiated energy in a desired direction determined by the reflector. Interposed in the path of the beam is a plurality of conductors 3, 4—10, 11 arranged side by side, said conductors being in a plane which is transverse to the general direction of propagation from the reflector. There may be, for example as shown, nine interposed conductors arranged in a plane, all these conductors being parallel to one another and each of them being parallel to the main aerial 1. The conductors 3 to 11 are so arranged that their impedances vary in steps throughout the interposed conductor system; for example the natural wave length of the central conductor 7 (where an odd number of interposed conductors is employed) may be made substantially equal to that of the radiated wave, the natural wave lengths of the two conductors 6, 8 on either side of the central one 7 may be made equal to one another, and slightly greater than the radiated wave length, and the natural wave lengths of the next pair of conductors 5, 9 outside of the central one 7 may also be equal to one another but still further removed from the radiated wave length—and so on. Instead of arranging the conductors of the interposed conductor system to increase progressively in natural wave length from the center of the system outwards, they may decrease from the center outwards. Or again, instead of increasing or decreasing the natural wave lengths of the interposed conductors from the center of the system outwards, the said wave lengths may vary progressively from one side of the interposed conductor system to the other.

In this manner the convergence and/or direction of the beam may be determined as desired.

The invention also envisages the modulation of a transmitted very short wave beam by varying the convergence or divergence thereof by means of an interposed conductor system, arranged generally as hereinbefore described but consisting of individual conductors adapted to have their effective impedances varied in accordance with modulating potentials. For example as shown in Fig. 2, each individual conductor in an interposed conductor system as hereinbefore described (and represented by the conductors 5 to 9 in Fig. 2) may include (preferably at its center) the anode-cathode space of a thermionic valve 12, 13, 14, 15, or 16, each conductor therefore consisting of two co-linear conductive portions one of which is connected to the anode of one of the valves and the other of which is connected to the cathode of that valve, the two portions extending in opposite directions from said valve. Modulation may be effected by varying, in accordance with modulating potentials, the internal impedances of the individual valves thus inserted in the individual conductors of the interposed conductor system. For example, the grid cathode circuit of each valve may include the secondary of a

modulation transformer T12–T16 in series with a source of bias potential B12–B16 and a radio choke CH2–CH6 and the primaries of all the modulation transformers may be connected in parallel to a source 17 of modulating potentials, e. g. a microphone. Where, as hereinbefore specifically described, the interposed conductor system consists of a plurality of conductors of different natural wave lengths—for example where the central conductor of an odd number of conductors forming an interposed system is equal in natural wave length to the working wave length and the natural wave lengths of the individual conductors increase symmetrically outward from the center of the system—the degree of modulation applied to the valve inserted in each conductor may be the same, but instead of adopting this arrangement it is possible to make all the conductors in an interposed conductor system of equal impedance initially and to make the degree of modulation applied to the various valves different, e. g. the modulation degree may increase or decrease from the center of the system outwardly or from one side of the system to the other. In fact such progressive variation in modulation degree may be provided for whether the conductors are of equal initial impedance or not. One convenient method (Fig. 2) of securing progressive variation in modulation degree is to use different amounts of grid bias on the different valves in the different conductors of the system so that the superimposition of equal modulating potentials to the grids of all the valves will cause progressive variations in impedance. A similar result can, of course, be effected by using similar amounts of bias for each valve and making the couplings of the different modulating transformers different from valve to valve.

Instead of connecting the anode-cathode space of a valve directly, as above described, in a conductor of an interposed conductor system arranged in accordance with this invention, the secondary winding of a high frequency transformer 18 may be (as represented in Fig. 3 which shows the arrangement for one conductor of a system; the system for a plurality of conductors is represented in Fig. 5) correspondingly inserted in such a conductor (in lieu of the said anode-cathode space) this secondary winding being coupled to a primary winding in the anode circuit of a valve V to which modulated potentials are applied from 17. This use of transformer coupling between a modulating valve and an interposed conductor has the advantage that it enables the interposed conductor and the valve to be "fitted" to one another for the primary of a high frequency transformer thus employed may be designed to suit the valve in whose anode circuit it is connected. Where high frequency transformer coupling is used, as just described, the primary and/or the secondary of such a high frequency transformer 18 may be tuned.

With regard to the use of high frequency transformer coupling in the manner just described, a further feature of the present invention resides in modifying any of the systems described in my Patent No. 2,073,642, March 16, 1937, referred to above, by utilizing high frequency transformer coupling (with or without tuned primary and/or secondary windings) between a modulating valve and an energy absorbing conductor interposed in the path of a radiated beam, instead of inserting the anode-cathode space of a modulating valve directly in an interposed conductor, as is described in my copending application, supra.

Although in the specific arrangements hereinbefore described the conductors of the interposed conductor system have been stated to be arranged in a plane which is transverse to the direction of the beam propagated from the "original" radiating system (energized aerial and reflector), the invention is not limited to arrangements in which the imaginary surface in which the interposed conductors lie is a plane at right angles to the direction of beam propagation from the "original" system; for example, as shown in Fig. 4, the conductors 3–11 of an interposed conductor system employed in carrying out this invention may be arranged in an imaginary plane surface making an angle other than a right angle to the direction of beam propagation from the "original" aerial and reflector system 1, 2 or equivalent system. Again it is not necessary that the conductors of an interposed conductor system employed in carrying out this invention be at right angles to the direction of propagation; for example, the conductors may be tilted and the tilting progressively varied from conductor to conductor throughout the system, either from side to side of the system or from the center outwardly, or in any other desired manner.

What is claimed is:

1. A very short wave radio transmitting apparatus comprising means for generating and projecting a polarized beam of very short wave radiation in a predetermined direction, a conductor system comprising a plurality of energy absorbing conductors extending across the path of said beam, said conductors being arranged side by side along an imaginary surface of predetermined shape and being so arranged as to alter the beam passing said conductor system, and means for differently varying the effective impedance of several of said conductors in accordance with desired modulating currents.

2. Apparatus as claimed in claim 1 and wherein said plurality of conductors have different effective lengths and means are provided for varying the effective impedance of several of the interposed conductors of different lengths and thus modulating the beam passing the system composed of said conductors.

3. Apparatus as claimed in claim 1 and wherein the anode-cathode space of an electron discharge device is inserted in each conductor, means being provided for varying the internal impedances of said electron discharge devices in accordance with modulating potentials.

4. A modification of apparatus as claimed in claim 1 and wherein the secondary of a high frequency transformer is interposed in each conductor, the primary of this transformer being energized by the output from an electron discharge device to whose input circuit modulating potentials are applied.

5. An ultrashort wave modulated carrier transmitting system comprising a transmitting aerial, means for energizing said aerial with unmodulated energy at an ultrashort wave length whereby said aerial radiates said energy, and an auxiliary conductor system interposed in the path of the energy radiated from said aerial, said auxiliary conductor system consisting of a plurality of conductive portions, a plurality of transformers including primary and secondary windings, means for connecting said secondary windings to said conductive portions, means for energizing said primary windings with modulating signal currents, an electron discharge device having input and output circuits, means for im-

pressing signal currents on said input circuit, and means for connecting said output circuit to said transformer primary windings.

6. An ultrashort wave modulated carrier transmitting system including, in combination, a transmitting aerial, means for energizing said aerial with unmodulated energy at an ultrashort wave length whereby said aerial radiates said energy, a reflector for directing said ultrashort wave length energy in a beam, an auxiliary conductor system interposed in the path of the energy radiated from said aerial, said auxiliary conductor system consisting of a plurality of individual conductors, an electron discharge device having input and output circuits, means for impressing signal currents on said input circuit, and a plurality of means effectively coupling said output circuit with each of said individual conductors and so arranged that said signal currents impress modulating signals through said coupling means and said individual conductors on said radiated energy.

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