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W. W. BROWN

AUTOMATIC ANTENNA REGULATOR

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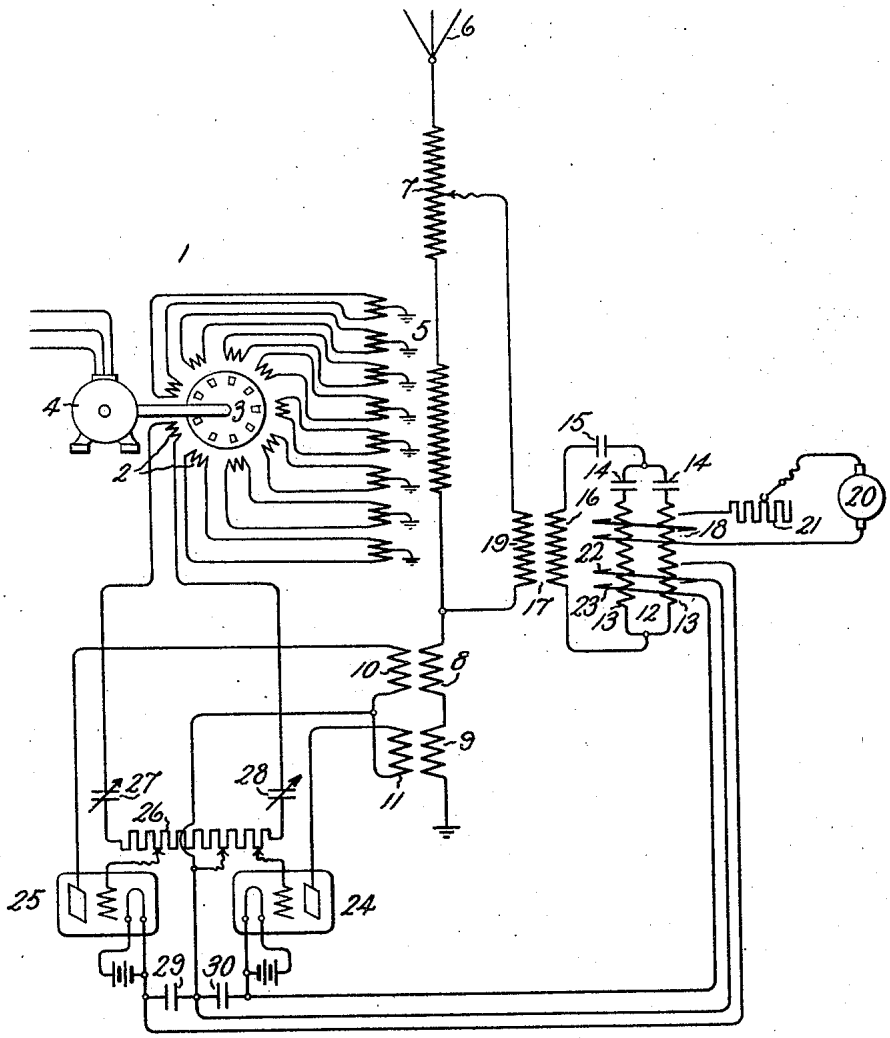

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UNITED STATES PATENT OFFICE.

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AUTOMATIC ANTENNA REGULATOR.

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My present invention relates to means for regulating the resonant wave length of an antenna system.

The object of the present invention is to provide a simple, reliable and quick-acting means whereby the desired relation between capacitive and inductive reactances of an antenna system may be automatically maintained.

In carrying my invention into effect, I associate with the antenna to be controlled, a magnetic amplifier or controller of the type described in the Letters Patent of the United States to James C. Armor, No. 1,219,215, while the particular form of the controller which may be used may be of the type described at length in Letters Patent of the United States to Ernst F. W. Alexanderson, No. 1,328,797. The variation of magnetization of the amplifier varies the inductive reactance of the antenna circuit.

The magnetization of the amplifier in the present instance is controlled by means of a pair of electric discharge devices which supply magnetizing current to a pair of differentially related windings on the magnetic amplifier. Included in the output circuit of each device is a winding adapted to be supplied with an electromotive force having a definite phase relation with the antenna current. The control members of the discharge devices are connected to a source of electromotive force having a definite phase relation with the electromotive force supplied to the antenna.

The phase relation of the electromotive forces supplied to the input and output circuits of the discharge devices are so related that, normally, pulsating current will be supplied equally from the two devices to each of the differentially related windings of the magnetic amplifier, so that the magnetization of the amplifier will be maintained substantially constant. When the capacity reactance of the antenna changes, however, one of the devices will supply current to one of the differential windings for a longer period of time than the other device will supply current to the other differential winding, with the result that the degree of magnetization of the magnetic amplifier will be increased or decreased, producing thereby a corresponding change in the inductive reactance of the antenna circuit which will restore the desired relations between the capacitive and inductive reactances.

The novel features which I believe to be characteristic of my invention are set forth with particularity in the appended claims. My invention, itself, however, both as to its organization and method of operation will best be understood by reference to the following specification taken in connection with the accompanying drawing in which the single figure shows diagrammatically a circuit organization whereby my invention may be carried into effect.

Referring to the drawing, I have indicated at 1^a well-known type of high frequency inductor alternator, having a plurality of stationary armature windings 2, and a rotating field member 3, the latter being driven by a constant speed motor 4. Certain of the armature windings 2 are connected to the primary winding of a transformer 5, the secondary winding of which is connected in series relation with an antenna 6. Included in circuit with the antenna 6 are a variable inductance 7, by means of which initial adjustment of the antenna tuning may be made, and a pair of transformer windings 8 and 9 which are inductively related to a pair of secondary transformer windings 10 and 11.

A magnetic amplifier 12 is employed to control the tuning of the antenna system. The amplifier, or saturated core regulator, includes the usual high frequency windings 13, connected through condensers 14 and 15 to the secondary winding 16 of a transformer 17 and a regulating winding 18. The primary winding 19 of the transformer 17 is connected in shunt with the secondary winding of transformer 5 and a portion of inductance 7. The regulating winding 18 is supplied with current from a direct current source of energy 20 through a variable controlling resistor 21. Variations in the magnetization of the amplifier produce corresponding variations in the inductance of the circuit including the secondary transformer winding 16, and, therefore, through transformer 17 in the inductance of the antenna circuit. Normally, the source of energy 20 supplies an amount of current to the regulating coil 18 which will maintain

the impedance of the circuit, including winding 16, substantially constant.

Mounted on the saturated core regulator, is a pair of differentially related windings 22 and 23 which are connected in the output circuit of a pair of 3-element electric discharge devices 24 and 25, respectively. The grids of the respective discharge devices are connected through a portion of a resistor 26 with one of the armature coils 2 of the alternator 1. Connected in circuit with the latter armature coil, is resistor 26 and a pair of condensers 27 and 28. Without the resistors or condensers the electromotive forces supplied to the two grids will differ in phase by 180°. The use of the resistors and condensers, however, provides means whereby the phase relation of the electromotive forces supplied to the grids of the two tubes may be varied as desired. I have found that the operation of the alternator 1 is more stable if the antenna is kept tuned to a frequency slightly higher than that generated by the alternator. This condition may be maintained by the following arrangement:

The plate circuit of the electric discharge device 25 is connected in circuit with the secondary transformer winding 10, while the plate circuit of electric discharge device 24 is connected in circuit with the winding 11. Windings 10 and 11 are connected to the plates of the discharge devices 25 and 24 in such a way that the electromotive forces supplied to the two plates are equal and in phase. Due to the transformer connection shown, the phase of the electromotive forces supplied to the plates would, in the absence of resistor 26 and condensers 27 and 28, be in quadrature with the electromotive forces supplied to the grids of the two discharge devices. This relation is changed, however, on account of the presence of the resistance element 26 and capacity units 27 and 28. The electromotive force supplied to the plates is, however, normally displaced in phase equally from the electromotive forces supplied to the grids of discharge devices 24 and 25.

Condensers 29 and 30, which are associated with discharge devices 24 and 25, smooth out the direct current impulses and tend to maintain the current supplied to the differential windings 22 and 23 substantially constant. These condensers also act as bypasses for radio frequency currents.

In operation, when the electromotive force of the high frequency alternator and the current in the antenna are in tune, current will be supplied equally from the discharge devices 24 and 25 to the differentially related windings 22 and 23 of the magnetic amplifier so that no change will occur in the resultant energization of the magnetic amplifier. When there is a change, however, in the capacity of the antenna, the phase relation of the electromotive forces supplied to the plates and grids is varied so that current will flow through one discharge device for a longer period than it will flow through the other. The current flowing through one of the differentially related windings 22 and 23 will, therefore, persist for a longer period of time than the current which flows through the other winding. This will result either in a decrease or increase in the magnetization of the saturated coil regulator 12, depending on the nature of the change which has occurred in the antenna capacity. Variations in the impedance of the circuit including winding 16, produces a variation in the antenna circuit inductive reactance, and thereby restores the tuning of the antenna to normal. Variations in the capacity of the antenna produce a substantially instantaneous response in the magnetic amplifier so that substantial variations from normal in the capacity of the antenna are practically impossible.

What I claim as new, and desire to secure by Letters Patent of the United States, is:

1. In combination, an antenna, means for maintaining the tuning of the antenna substantially constant, said means including a saturated core regulator and means for energizing said regulator in response to variations in said antenna tuning.

2. In combination, an antenna, means for maintaining the tuning of the antenna substantially constant, said means including a saturated core regulator, and means including an electric discharge device operable responsively to changes in the tuning of said antenna for controlling the energization of said regulator.

3. In combination, an antenna, means for automatically controlling the tuning of the antenna, said means including a saturated core regulator, a plurality of related windings associated with said regulator, and means including a plurality of electric discharge devices for differently energizing said windings.

4. In combination, an antenna, means including a magnetic amplifier for maintaining the tuning of the antenna substantially constant, and means controlled by variations in the capacity of the antenna for controlling the operation of the magnetic amplifier.

5. In combination, an antenna, a saturated core regulator associated therewith, means including a plurality of differentially related windings for controlling the energization of said regulator, and means for varying the energization of said differentially related windings in accordance with variations in the capacity of the antenna.

6. In combination, an antenna, a saturated core regulator associated therewith, means including a plurality of differentially re-

lated windings for controlling the energization of said regulator, and means including an electric discharge device for varying the energization of the differentially related windings in accordance with variations in the capacity of the antenna.

7. In combination, an antenna, a saturated core regulator associated therewith, and means including an electron discharge device controlled by variations in the capacity of the antenna for varying the magnetization of the regulator.

8. In combination, an antenna, a saturated core regulator associated therewith, and means controlled by variations in the tuning of the antenna for varying the magnetization of the regulator, said means including a plurality of differentially related electric discharge devices.

9. In combination, an antenna, a saturated core regulator associated therewith, a pair of differentially related windings mounted on said regulator, and means controlled by variations in the tuning of said antenna for controlling the energization of said differentially related windings.

10. In combination, an antenna, a saturated core regulator associated therewith, a pair of differentially related windings mounted on said regulator, and means including an electron discharge device controlled by variations in the tuning of said antenna for controlling the energization of said differentially related windings.

11. In combination, an antenna, a saturated core regulator connected therewith, a winding cooperating with said regulator, and means controlled by variations in the tuning of the antenna for varying the energization of said winding.

12. In combination, an antenna, a saturated core regulator associated therewith, an electric discharge device, said device including a cathode, an anode and a grid, means for supplying an electromotive force having a substantially constant frequency to said grid, and means for supplying to the anode an electromotive force having a phase relation to the grid electromotive force which varies with variations in the capacity of the antenna, and a connection between said regulator and said discharge device whereby variations in the capacity of the antenna may control the operation of said regulator.

13. In combination, an antenna, means whereby high frequency current may be supplied to the antenna, a magnetic amplifier associated with the antenna, a pair of electric discharge devices, each of said devices including an anode, a cathode and a grid, means for supplying electromotive forces having a substantially constant frequency to the grid elements of the discharge devices, means for supplying to the anodes an electromotive force having a phase relation to the grid electromotive forces which varies with variations in the capacity of the antenna and connections between said magnetic amplifier and said discharge devices whereby the energization of said magnetic amplifier may be controlled in accordance with variations in the capacity of the antenna.

In witness whereof, I have hereunto set my hand this 24th day of December, 1925.

WILLIAM W. BROWN.