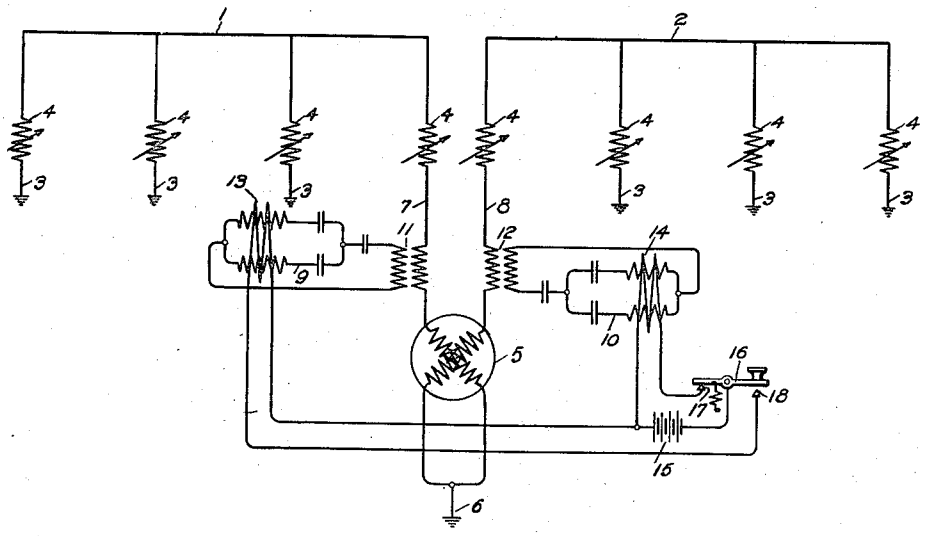
Dec. 2, 1924. 1,517,816

E. F. W. ALEXANDERSON

RADIO TRANSMITTING SYSTEM

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Inventor:
Ernst F. W. Alexanderson;
by Albert G. Davis
His Attorney

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ERNST F. W. ALEXANDERSON, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

RADIO TRANSMITTING SYSTEM.

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To all whom it may concern:

Be it known that I, ERNST F. W. ALEXANDERSON, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Radio Transmitting Systems, of which the following is a specification.

My present invention relates to radio transmitting systems, and more particularly to systems of the directive type.

The object of my invention is to provide a simple and efficient system for transmitting radio signals which will be adapted for high speed telegraphic communication or for radio telephony.

When a large amount of power is employed for transmitting purposes, a certain amount of time is required for charging the antenna to its full potential. After the power is applied and interrupted the antenna will continue to oscillate for some time by reason of the energy stored up therein. By reason of these facts the speed of the signal when the antenna is employed for radio telegraphy may be somewhat limited because of the slow building up and the slow dying down of the potential of the antenna. When the antenna is employed for radio telephony these same factors interfere with the effective modulation of the energy in the antenna.

In carrying my invention into effect, I overcome these disadvantages by providing a transmitting antenna which is made up of two separate parts and supplying energy to both of these parts continuously. If the two parts are located at the same point the currents supplied to the two parts are of opposite phase so that normally no effective radiation will take place. When signals are to be transmitted the phases of the currents will be shifted so that they will be approximately in phase and maximum radiation will be produced. If on the other hand the radiating system is divided into two distinct portions which are separated geographically by a distance which is at least an appreciable fraction of a wave length, then when signals are not being transmitted the phase of the currents supplied to the different portions of the antenna is such that the radiation in the direction toward which it is desired to transmit signals is a minimum. When it is desired to transmit signals the relative phase of the different currents is varied so that the radiation in the desired direction becomes a maximum. As a result in either case full energy is supplied to the antenna at all times and no time is lost in the building up of full voltage on the antenna or in the cutting down of the antenna voltage to a minimum as it is possible to very quickly shift the phase of the different currents.

The novel features which I belive to be characteristic of my invention are set forth in the appended claims. The invention itself, however, both as to its organization and method of operation will best be understood by reference to the following description taken in connection with the accompanying drawing in which I have indicated diagrammatically one way in which my invention may be carried into effect.

As indicated in the drawing, the radiating system is made up of two multiple tuned antennæ 1 and 2, each provided with a plurality of ground connections 3 and individual tuning coils 4. These antennæ may be close together or parallel to one another or they may be of such length and their centers of distribution separated to such an extent so as to produce a radiating system having marked directive properties. Energy is continuously supplied to the radiating system by means of a high frequency alternator, which in the present case is indicated as a quarter phase machine 5, through a common ground connection 6. Associated with the supply leads 7 and 8 to the antennæ 1 and 2 respectively I provide magnetic amplifiers 9 and 10. These magnetic amplifiers are coupled to the supply leads by means of coupling transformers 11 and 12. Current for saturating the cores of these magnetic amplifiers may be supplied to the saturating windings 13 and 14 from a direct current source 15 by means of a telegraph key 16 having contacts at 17 and 18.

In the case indicated, in the normal position of the key, contact 17 is closed and the core of amplifier 10 is saturated. When the key 16 is operated contact at 17 is opened and contact at 18 closed, the core of amplifier 9 thereby becoming saturated and the core of amplifier 10 desaturated.

If now, for example, the centers of distribution of the two antennæ are a half wave length apart and the two portions are de-

tuned so that the currents in the two antennæ have a phase difference of 180°, the radiation from the antennæ will be a maximum in the direction of their length and there will be substantially no radiation in a direction at right angles to their length. When the key 16 is operated the tuning of the two antennæ is changed in opposite directions. The proportions of the system may be arranged so that when the key is closed making contact at 18 the currents in the two portions of the radiating system are substantially in phase. The direction of the maximum radiation will then be shifted and the radiation will be a maximum in a direction at substantially right angles to the direction of the antennæ and there will be substantially no radiation in the direction of their length.

In case it is desired to employ the radiating system for radio telephony the same arrangement may be employed, the telephone current which is to be transmitted being supplied to the saturating windings in such a way that it opposes the effect of the steady D. C. current in one winding and assists the steady D. C. current in the other winding. The direction of maximum radiation will then be varied in accordance with variations in the telephone current so that the effect at a distant station in a desired direction will be the same as produced when the current transmitted is modulated in the usual way.

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

1. The method of operating a directive radio transmitting system to transmit signals which consists in continuously supplying energy to the radiating system and varying the phase of the currents supplied to the different portions of the system in such a way as to vary in a desired manner the direction in which the radiation will be a maximum.

2. The method of operating a directive radio transmitting system to transmit signals which consists in continuously supplying currents of different phase to different portions of the radiating system and varying the relative phase of the different currents in such a way as to vary in a desired manner the direction in which the radiation will be a maximum.

3. The method of operating a directive radio transmitting system which consists in continuously supplying currents of different phase to different portions of the radiating system which are separated by an appreciable fraction of a wave length and varying the relative phase of the different currents in such a way that when signals are to be transmitted the radiation in a desired direction will be a maximum and at other times the radiation in that direction will be a minimum.

4. The method of operating a directive radio transmitting system which consists in continuously supplying separate currents to different separated portions of the radiating system which are separated by an appreciable fraction of a wave length, the phase of the different currents normally supplied being so adjusted with respect to the separation of the different portions of the radiating system that the radiation in a desired direction will be a minimum, and varying the relative phase of the currents when signals are to be transmitted so that the radiation in the desired direction will be a maximum.

5. The method of operating a radio transmitting system which consists in continuously supplying currents of different phase to different portions of the radiating system, and varying the relative phase of the different currents in such a way as to produce in accordance with signals a desired variation in the direction of the effective radiation.

6. The method of operating a radio transmitting system which consists in continuously supplying energy to the radiating system and varying the relative phase of the currents flowing in different parts of the radiating system in such a way as to produce in accordance with signals a desired variation in the direction of the effective radiation.

7. The combination in a radio transmitting system of a source of radio frequency, means for continuously supplying energy from said source to a radiating system, and means for varying the relative phase of the currents flowing in different parts of the radiating system in such a way as to produce in accordance with signals a desired variation in the direction of the effective radiation.

8. The combination in a radio transmitting system of a source of radio frequency energy from which currents of different phase may be obtained, a radiating system comprising two portions separated by an appreciable fraction of a wave length, means for continuously supplying separate currents from said source to the different parts of said radiating system, and means for separately and simultaneously varying in accordance with signals the phase relation of the different currents supplied to the different parts of the radiating system.

9. The combination in a radio transmitting system of a source of radio frequency energy from which separate currents of different phase may be obtained, means for continuously supplying from said source separate currents to different portions of a radiating system, and means for varying the phase of the currents supplied to the different portions of the system in such a way as to vary in a desired manner in accordance

with signals the direction in which the radiation will be a maximum.

10. The combination in a radio transmitting system of a source of radio frequency energy from which separate currents of different phase may be obtained, means for continuously supplying from said source separate currents to different portions of a radiating system, and means for varying the relative phase of the different currents supplied to the different portions of the system in such a way as to produce in accordance with signals, a desired variation in the direction of the effective radiation.

11. The combination in a radio transmitting system of a source of radio frequency energy from which separate currents of different phase may be obtained, means for continuously supplying from said source separate currents to different portions of a radiating system which are separated by an appreciable fraction of a wave length, and means for varying the phase of the currents supplied to the different portions of the system in such a way that when signals are to be transmitted the radiation in a desired direction will be a maximum and at other times the radiation in that direction will be a minimum.

12. The combination in a radio transmitting system of a source of radio frequency energy from which currents of different phase may be obtained, a radiating system comprising two separate portions separated by an appreciable fraction of a wave length, means for continuously supplying separate currents from said source to the different parts of said radiating system, and means for separately and simultaneously varying the phase relation of the different currents supplied to the different parts of the radiating system so that when signals are to be transmitted the radiation in a desired direction will be a maximum and at other times the radiation in that direction will be a minimum.

13. The combination in a radio transmitting system of a source of radio frequency energy from which currents of different phase may be obtained, a radiating system comprising two separate portions, means for continuously supplying separate currents from said source to the different parts of said radiating system, and means for separately and simultaneously varying the phase relation of the different currents supplied to the different parts of the radiating system in such a way as to produce in accordance with signals a desired variation in the direction of effective radiation.

In witness whereof, I have hereunto set my hand this 23rd day of June, 1921.

ERNST F. W. ALEXANDERSON.