

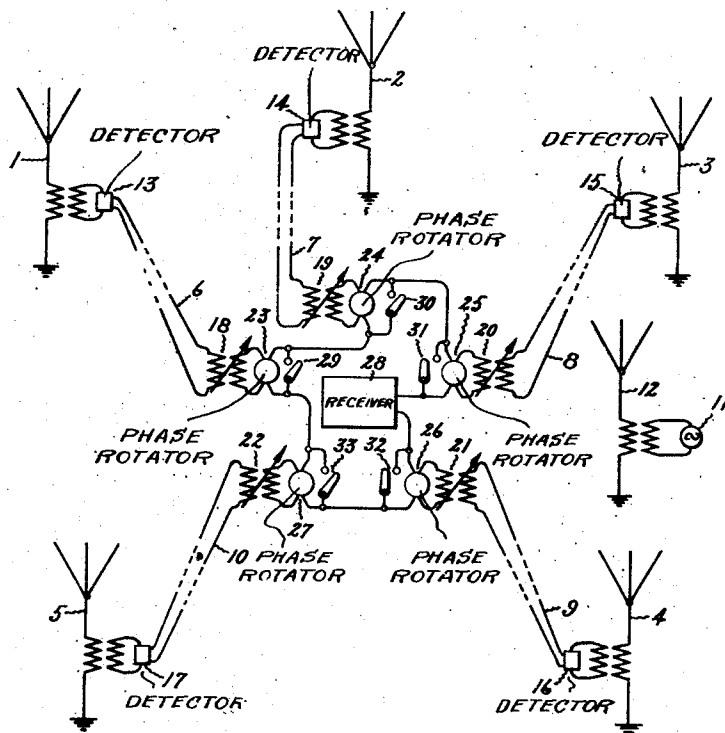
April 21, 1925.

1,534,719

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RADIO RECEIVING SYSTEM

Filed April 21, 1921



Inventor:
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Patented Apr. 21, 1925.

1,534,719

UNITED STATES PATENT OFFICE.

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RADIO RECEIVING SYSTEM.

Application filed April 21, 1921. Serial No. 463,265.

To all whom it may concern:

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

My present invention relates to radio receiving systems, and more particularly to systems of the class in which a plurality of widely separated receiving antennae are connected by transmission lines to a central receiving station.

One of the objects of my invention is to provide an improved method of operating such a system whereby an efficient reception of desired signals may be secured and the effects of disturbing influences either from nearby stations or from static may be minimized. Another object of my invention is to provide an improved system of the class described whereby a more efficient reception of desired signals may be obtained.

In order to attain the objects of my invention I provide a plurality of receiving antennae which are located at widely separated points, so chosen geographically that the intensity or phase relation between the signaling impulses and disturbing influences will be different at the different points of reception. I also provide means for selectively impressing the currents received upon the receiving apparatus so that it will be possible to select for the desired reception the currents having the most favorable ratio between signal and disturbing influence. In addition I provide means for varying the phase and intensity of the currents impressed upon the receiving apparatus so that by suitable adjustment the desired signaling currents received upon different antennae may be brought into phase or approximate phase with one another and caused to add amplitudes in the receiving apparatus while the disturbing influences will not be in phase and will combine in heterogeneous phase relation and therefore increase less rapidly with an increasing number of receiving antennae than the desired signals. As a result the stray ratio will be greatly improved.

When the receiving antennae are widely separated long transmission lines must be employed for transmitting the received sig-

naling currents to the receiving station. This involves difficulties in line construction to reduce the line losses to a minimum if radio frequency currents are to be transmitted. To overcome this disadvantage I may provide detectors at each of the receiving antennae and transmit the detected currents over the transmission lines to the central receiving station. As a result, the line construction may be greatly simplified and the line losses greatly reduced. In case continuous wave signals are to be received it is desirable that the detected currents shall all be of the same frequency, and maintain a fixed phase relation. To secure this result I provide a centrally located source of current preferably at the receiving station for controlling the operation of all of the detectors and radiate by means of this source a wave which will be received upon all of the receiving antennae and combined with the signaling currents received therein to produce a beat current which will be detected by each of the detectors in the usual way. The frequency of the wave radiated may be so chosen as to produce audible beats with the signaling wave to be received, or, if desired, the beats produced may be above audibility. In any event, however, the current transmitted over the transmission lines from the individual detectors will be of materially lower frequency than the frequency of the signaling wave and the principal difficulties in line construction will be largely obviated.

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 description taken in connection with the accompanying drawing in which I have shown diagrammatically a simple form of receiving system whereby my invention may be carried into effect.

As indicated in the drawing, my receiving system comprises a plurality of widely separated antennae 1, 2, 3, 4, 5, connected by individual transmission lines 6, 7, 8, 9, 10, with a central receiving station. These antennae may be of any particular type desired, their location may be so chosen and so widely separated that the intensity and phase relations between the desired signal-

ing currents and disturbing influences either of static or interfering stations will normally be different at the different antennæ.

While I have indicated all of the receiving antennæ as being located at a distance from the receiving station, it is obvious, that if desired, one of them may be located at the receiving station. I also provide at the receiving station a source of high frequency current 11 which is associated with a transmitting antenna 12 to radiate a high frequency wave which will be received upon all of the receiving antennæ, and combine therein with the signaling waves to produce beat currents which will be detected by means of the individual detectors 13, 14, 15, 16 and 17, and the detected current will be transmitted over the transmission lines to the receiving station. The currents transmitted over the transmission lines may be impressed by means of intensity couplers 18, 19, 20, 21 and 22, and phase rotators 23, 24, 25, 26 and 27 upon the receiving apparatus, which may be of any type desired, and which is indicated in the drawing merely by a rectangle 28. Any convenient means, such for example as switches 29, 30, 31, 32 and 33 may be employed for selectively impressing upon the receiving apparatus the currents received from any one or more of the antennæ. By varying the adjustment of the phase rotators and intensity couplers the desired signaling currents received upon any two or more of the antennæ may be brought into phase or approximate phase with one another so as to add amplitudes in the receiving apparatus while the currents due to disturbing influences will at the same time be more or less out of phase and will combine in heterogeneous phase relation and therefore increase less rapidly with an increasing number of receiving antennæ than the desired signals.

The apparatus indicated may be utilized for receiving in a large variety of ways. It may be found that currents received upon one of the antennæ have a much more favorable stray ratio than the currents received upon any of the other antennæ in which case the current having the more favorable stray ratio that is, the more favorable ratio between the strength of the signaling currents and stray currents may be selected for the desired reception and this current alone impressed upon the receiving apparatus. By selectively combining the currents in two or more different antennæ in different ways and with varying phase and intensity adjustments a combination may be obtained which gives a more favorable stray ratio, than any antennæ alone and this particular combination may then be utilized for the desired reception. By means of the apparatus indicated, the individual antennæ or

combination of antennæ employed for reception may be varied at will to meet varying disturbing conditions such, for example, as disturbances produced by thunderstorms, travelling across the country in such a way that at one time one of the antennæ is more seriously affected and a little later another antennæ is affected to a greater extent.

While I have indicated and described the preferred embodiment of my invention, it will be apparent that my invention is by no means limited to the particular embodiment described but that many modifications in the arrangement, connections and method of operating the apparatus may be made without departing from the scope of my invention as set forth in the appended claims.

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

1. The method of operating a radio receiving system comprising a plurality of widely separated antennæ connected by transmission lines to a central receiving station, which consists in radiating a high frequency wave of a frequency differing from that of the signaling waves to be received by an amount sufficient to produce audible beats with the signaling wave, detecting at each antenna the resultant beat current received thereon, transmitting the resultant audio frequency current to the receiving station, selectively impressing upon the receiving apparatus the audio frequency currents thus transmitted, and selecting for the desired reception of signals the currents having the most favorable stray ratio.

2. The method of operating a radio receiving system comprising a plurality of widely separated antennæ connected by transmission lines to a central receiving station which consists in radiating a high frequency wave of a frequency differing from that of the signaling waves to be received by an amount sufficient to produce audible beats with the signaling wave, detecting at each antenna the resultant beat current received thereon, transmitting the resultant audio frequency current to the receiving station, selectively impressing upon receiving apparatus the audio frequency currents thus transmitted, adjusting the phase of the currents impressed upon the receiving apparatus from the different detectors so that the currents produced by desired signals will add amplitudes in the receiving apparatus and currents produced by disturbing influences will combine in heterogeneous phase relation and selecting for the desired reception of signals the resulting combination of currents having the most favorable stray ratio.

3. The method of operating a radio receiving system comprising a plurality of widely separated antennæ connected by

transmission lines to a central receiving station, which consists in radiating a high frequency wave of a frequency differing from that of the signaling waves to be received,

6 detecting at each antenna the resultant beat current received thereon, transmitting the resultant currents to the receiving station, selectively impressing upon the receiving apparatus the current thus transmitted, and
10 selecting for the desired reception of signals the currents having the most favorable stray ratio.

4. The method of operating a radio receiving system comprising a plurality of
15 widely separated antennæ connected by transmission lines to a central receiving station which consists in radiating from the receiving station a high frequency wave of a frequency different from that of the signaling waves to be received, detecting at
20 each antenna the resultant beat current received thereon, transmitting the resultant currents to the receiving station, selectively impressing upon receiving apparatus the currents thus transmitted, adjusting the
25 phase of the currents impressed upon the receiving apparatus from the different detectors so that the currents produced by desired signals will add amplitudes in the receiving apparatus and currents produced by
30 disturbing influence will combine in heterogeneous phase relation, and selecting for the desired reception of signals the resulting combination of currents having the most
35 favorable stray ratio.

5. The method of operating a radio receiving system comprising a plurality of
widely separated antennæ connected by
40 transmission lines to a central receiving station, which consists in radiating a high frequency wave, utilizing currents produced by the wave thus radiated to control the detection at each antenna of the signaling currents to be received, transmitting the detected
45 signaling currents to the receiving station, selectively impressing upon the receiving apparatus the currents thus transmitted, and selecting for the desired reception of signals the currents having the most favorable
50 stray ratio.

6. The combination in a radio receiving system of a plurality of widely separated
receiving antennæ, receiving apparatus located at a central receiving station, trans-
55 mission lines connecting each of said receiving antennæ with the receiving station, individual detectors associated with each of said receiving antennæ, means for radiating a high frequency wave for controlling the operation of all of said detectors, means for
60 impressing upon the transmission lines the detected signaling currents received upon the receiving antennæ and means for selectively impressing upon the receiving ap-

paratus the currents thus transmitted, and
65 selecting for the desired reception of signals the currents having the most favorable stray ratio.

7. The combination in a radio receiving system of a plurality of widely separated
70 receiving antennæ, receiving apparatus located at a central receiving station, transmission lines connecting each of said receiving antennæ with the receiving station, individual detectors associated with each of
75 said receiving antennæ, means for radiating a high frequency wave of a frequency different from that of the signaling waves to be received for controlling the operation of all of said detectors to produce beat currents
80 therein, means for impressing upon the transmission lines the detected signaling currents received upon the receiving antennæ, means for impressing upon the receiving apparatus the currents thus transmitted,
85 means for adjusting the phase of the currents impressed upon the receiving apparatus from the different detectors so that the currents produced by desired signals will add amplitudes in the receiving apparatus and currents produced by disturbing influences will combine in heterogeneous phase relations, and means for selecting for the desired
90 reception of signals the resulting combination of currents having the most favorable
95 stray ratio.

8. The combination in a radio receiving system of a plurality of widely separated
receiving antennæ, receiving apparatus located at a central receiving station, trans-
100 mission lines connecting each of said receiving antennæ with the central receiving station, means for radiating a high frequency wave of a frequency differing from that of the signaling waves to be received,
105 detectors associated with each of said antennæ for detecting the resultant beat currents received thereon, means for impressing upon the transmission lines the detected beat current, and means for selectively impressing
110 upon the receiving apparatus the currents thus transmitted and selecting for the desired reception of signals the currents having the most favorable stray ratio.

9. The combination in a radio receiving system of a plurality of widely separated
115 receiving antennæ, receiving apparatus located at a central receiving station, transmission lines connecting each of said receiving antennæ with the central receiving
120 station, means for radiating a high frequency wave of a frequency differing from that of the signaling waves to be received by an amount sufficient to produce audible beats with the signaling waves, detectors as-
125 sociated with each of said antennæ for detecting the resultant beat currents received thereon, means for impressing upon the

transmission lines the detected beat current, means for impressing upon the receiving apparatus the currents thus transmitted, means for adjusting the phase of the currents impressed upon the receiving apparatus from the different detectors so that the currents produced by desired signals will add amplitudes in the receiving apparatus and currents produced by disturbing influences will combine in heterogeneous phase relation and means for selecting for the desired reception of signals the resulting combination of currents having the most favorable stray ratio.

In witness whereof, I have hereunto set my hand this 20th day of April, 1921.

EDWARD W. KELLOGG.