

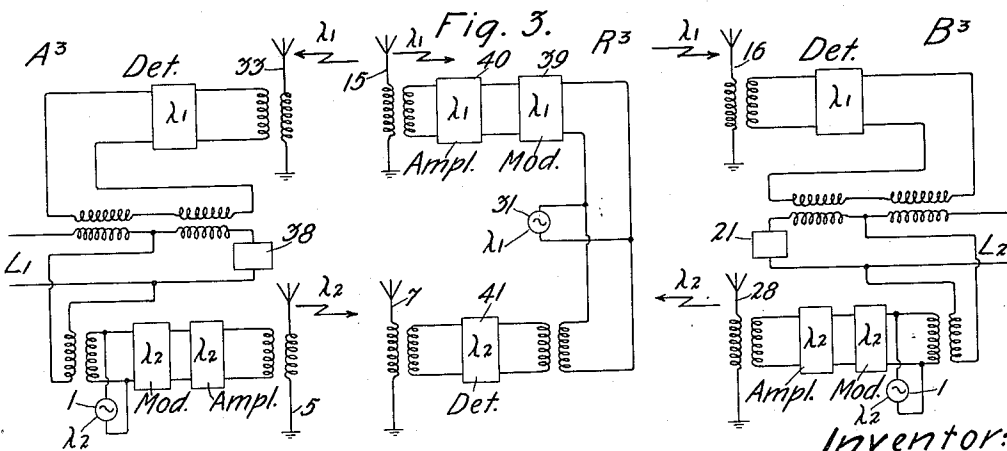
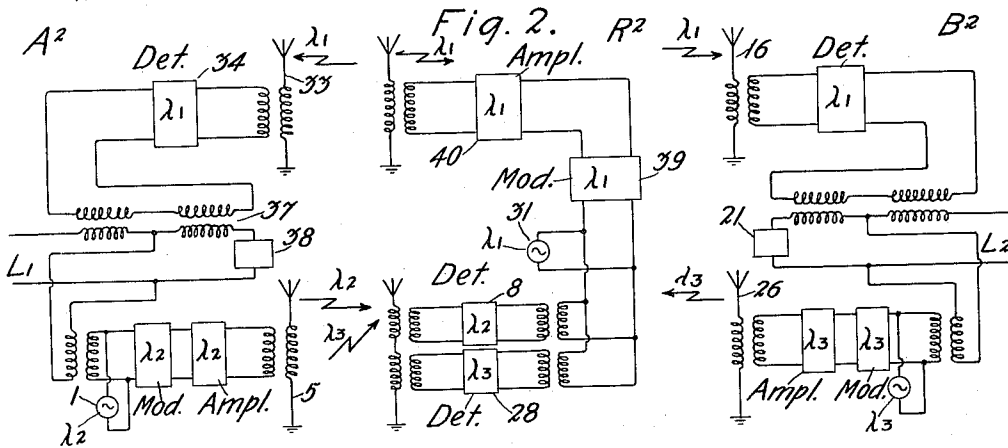
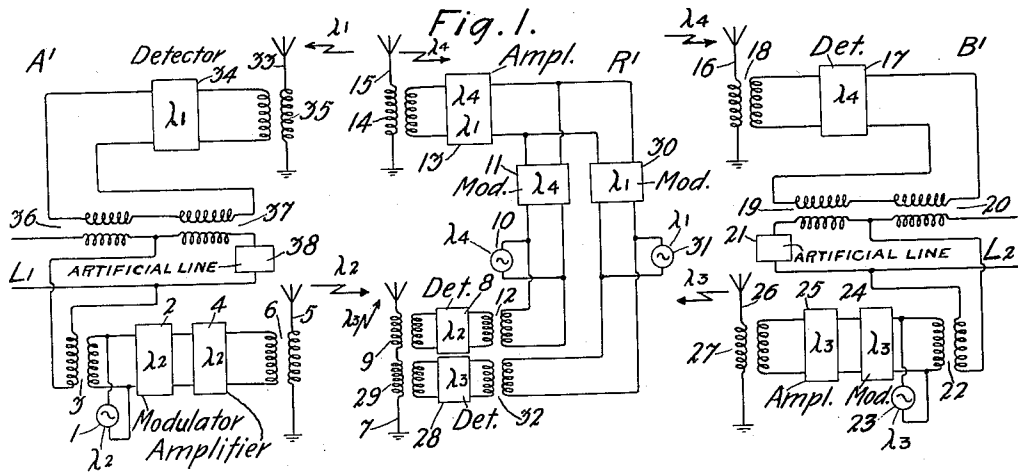
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E. H. COLPITTS

HIGH FREQUENCY SIGNALING

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UNITED STATES PATENT OFFICE.

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HIGH-FREQUENCY SIGNALING.

Application filed August 23, 1916. Serial No. 116,447.

To all whom it may concern:

Be it known that I, EDWIN H. COLPITTS, a subject of the King of Great Britain, residing at East Orange, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in High-Frequency Signaling, of which the following is a full, clear, concise, and exact description.

This invention relates to high frequency signaling and more particularly to the relaying or repeating of telephonic messages transmitted by means of high frequency carrier oscillations modulated in accordance with the form of the message wave.

It is an object of the invention to provide a system for two-way repeating and to prevent at a repeating station, a useless local circulation of power which gives rise to the objectionable phenomenon known as "sing-ing."

The invention provides for accomplishing this by receiving at a repeating station a modulated wave transmitted from either or both of two terminal stations. On receiving a modulated wave at the repeating station, a new carrier frequency is substituted having a value different from the carrier frequency for which the repeating station's receiving apparatus is tuned. In other words the receiving apparatus at the repeating station will not be receptive to the carrier wave transmitted from that repeating station, and the objectionable local circulation of power is prevented. However, the new carrier wave is received at the proper terminal station.

For a detailed description of various systems which may be used in practising the invention, reference may be made to the drawing in which—

Figs. 1, 2 and 3 show different systems in which a wireless repeating station is intermediate two wire terminal stations.

To illustrate how the invention may be practised it is proposed to use amplifiers, modulators and rectifiers. However, no details of these elements are shown as the invention does not relate to these details, and furthermore, many schemes are known for amplifying, modulating and rectifying. If desired, there may be used the modulating system shown in the patent to Colpitts 1,137,384, April 27, 1915, or in the U. S. Patent to Van der Bijl for high frequency sig-

naling, No. 1,350,752, patented August 24, 1920. According to the disclosure of the latter patent the high and low frequency oscillations are impressed on the input circuit of a 3-element vacuum tube, the output circuit of which transmits the modulated oscillations. The patent to Arnold 1,129,942, Mar. 2, 1915, discloses an amplifier of the audion type which may be used in the repeating system, although any suitable amplifier may be used.

In Fig. 1 is shown the 2-way wireless repeating station R' intermediate the terminal stations A' and B'. The line L₁ at terminal A' is associated with the high frequency generator 1 and the modulator 2 by means of the transformer 3. Low frequency signal oscillations, controlling impulses or other variation currents transmitted by line L₁ then modulate oscillations of high frequency λ_2 furnished by generator 1. The modulated oscillations are amplified by amplifier 4 and transmitted to the sending conductor 5 by transformer 6. The signals sent from antenna 5 are received at repeating station R' by antenna 7 which is coupled to detector 8 by means of transformer 9. Detector 8 is also inductively associated with the high frequency generator 10 and the modulator 11 by means of transformer 12. The modulated oscillations of frequency λ_2 are detected by detector 8 and the low frequency detected oscillations are used to modulate oscillations of high frequency λ_4 supplied by generator 10. The modulator 11 is connected to an amplifier 13 and the amplified oscillations of frequency λ_4 are transferred to the antenna 15 by means of transformer 14. The modulated oscillations of frequency λ_4 are received at terminal B' by antenna 16 coupled to detector 17 by the transformer 18. The output circuit of detector 17 includes the primary coils of two transformers 19 and 20 the secondaries of which are reversely connected in series in the line L₂. The artificial line 21 simulates the line L₂ so that the currents are equal and opposite in the secondaries of transformers 19 and 20 whereby the incoming signal energy is sent out over line L₂ but the balancing network eliminates any potential difference which might otherwise send current to transformer 22 of the local sending apparatus.

It will be apparent then that low fre-

quency signals originating in line L_1 modulate oscillations of frequency λ_2 which are transmitted from antenna 5 and received at the repeating station. Here the modulated

5 oscillations of frequency λ_2 are detected and the detected oscillations are utilized to modulate oscillations of frequency λ_4 . In this manner, modulated carrier oscillations are combined with electrical energy of different characteristic so as to change the carrier frequency of the carrier oscillations. Since the frequencies λ_2 and λ_4 represent different frequencies the energy transmitted from the repeating station will not affect the local receiving apparatus. The modulated oscillations of frequency λ_4 are received at terminal B' detected and the detected oscillations are sent over the line L_2 to a suitable receiving apparatus.

20 To provide for two-way transmission the line L_2 is coupled to modulator 24 and to a high frequency generator 23 by transformer 22. The modulator 24 is associated with an amplifier 25 the latter being coupled to antenna 26 by transformer 27. Low frequency signals in line L_2 then modulate oscillations of high frequency λ_3 supplied by generator 23 and the modulated oscillations are amplified by amplifier 25 and transmitted from antenna 26 to the repeating station.

30 At repeating station R', the antenna 7 is coupled to detector 28 by means of transformer 29. The detector 28 is also coupled to modulator 30 and generator 31 by transformer 32. The output circuit of modulator 30 is connected to amplifier 13 which as above described supplies amplified oscillations to antenna 15 through transformer 14.

40 The oscillations of frequency λ_3 sent from antenna 26 are then received by antenna 7, detected by detector 28 and the detected oscillations modulate oscillations of high frequency λ_1 supplied by generator 31. The modulated oscillations after traversing the amplifier 13 are transmitted from antenna 15 to be received at terminal station A' by antenna 33.

50 Consequently antenna 7 serves not only to receive at frequency λ_2 from terminal A', but also at the frequency λ_4 from terminal B'. The oscillations of frequencies λ_2 and λ_3 are detected and the detected oscillations respectively modulate the frequencies λ_4 and λ_1 . Modulated oscillations of the latter frequencies are supplied to the common amplifier and transmitted to the proper terminal stations.

60 The receiving apparatus at terminal A' is similar to that at terminal B' and comprises detector 34, the input circuit of which is coupled to antenna 33 by transformer 35, the detector output circuit being coupled to line L_1 through the agency of the transformers 36 and 37. These transformers and the artificial line 38 provide a balancing

network for the line L_1 so that energy received by antenna 33 will be sent out onto line L_1 without affecting the transformer 3 in the local sending apparatus.

To eliminate the necessity of having two generators at the repeating station and the consequent necessity of repeating at two different frequencies, the system shown in Fig. 2 may be employed.

70 In Fig. 2 the terminal station A² is identical with A' in Fig. 1, both terminals A' and A² sending at frequency λ_2 and receiving at frequency λ_1 . The sending apparatus at terminal station B² is identical with the sending apparatus at terminal B' the sending frequency λ_3 being employed. The terminal B², however, is adapted to receive at frequency λ_1 this being the only frequency transmitted from the repeating station R² where both the received frequencies λ_2 and λ_3 are detected, and the detected oscillations used to modulate oscillations of high frequency λ_1 supplied by generator 31. For both frequencies λ_2 and λ_3 are provided the common modulator 39 and the common amplifier 40.

It will be apparent then that signals may be transmitted from line L_1 to L_2 and vice versa as in Fig. 1.

85 A further simplification may be made by transmitting at the same frequencies from the two terminal stations and by repeating at a single different frequency. Such a system is shown in Fig. 3 in which the terminal A³ is identical with terminals A' and A². Furthermore, the wireless sending and receiving apparatus at terminal B³ is identical with the corresponding apparatus at terminal A³. Both terminals A³ and B³ send at the frequency λ_2 and receive at the frequency λ_1 . In this case, however, it is only necessary to use a single detector 41 at the repeating station R³.

90 While by way of illustration my invention has been shown as applied to a wireless system, it is to be understood that it is just as applicable to a system in which the signals are transmitted along wires instead of through the space between the stations. It will moreover be obvious to those skilled in the art that controlling impulses or the energy of other variation currents may be transmitted by this system in the same manner. The invention is therefore not to be limited to the particular system and features of the system disclosed but only by the scope of the appended claims.

What is claimed is:

1. In combination, two widely separated stations each comprising a two-wire two-way telephone line, a balancing network simulating the impedance of said line connected to a terminal thereof, means including an antenna for transmitting high frequency waves modified in accordance with

telephone currents received over said line, means, including a second antenna spaced from said first named antenna and differently tuned, for receiving different frequency waves modified in accordance with telephonic variations and for impressing corresponding telephonic currents on said line. said transmitting means and said receiving means being conjugately connected with respect to each other to said line and said network, and a two-way radio repeating apparatus located between said two widely separated stations for repeating energy transmitted from each of said stations to the other of said stations.

2. In a signaling system, the combination of two terminal stations each comprising a wireless telephone transmitting and receiving system adapted to transmit and receive modulated carrier oscillations, and an intermediate two-way wireless telephone repeating system comprising an antenna adapted to receive modulated carrier oscillations from both said terminal stations, means associated with said antenna for translating the received oscillations, a generator of carrier oscillations, a modulator, means for impressing the translated and the generated oscillations on the input circuit of said modulator, the output circuit of said modulator being associated with an antenna adapted to transmit modulated oscillations to both of said terminal stations.

3. In a signaling system, the combination of two terminal stations each comprising a wireless telephone transmitting and receiving system adapted to transmit and receive modulated carrier oscillations, and an intermediate two-way wireless telephone repeating system comprising an antenna adapted to receive modulated carrier oscillations from both said terminal stations, means associated with said antenna for translating the received oscillations, a generator of carrier oscillations of frequency different from that of said received oscillations, a modulator, means for impressing the translated and the generated oscillations on the input circuit of said modulator, the output circuit of said modulator being associated with an antenna adapted to transmit modulated oscillations

of changed frequency to both of said terminal stations.

4. In combination, two widely separated transmission systems each comprising a two-wire circuit, a balancing network of similar impedance characteristic connected to said circuit at its terminal, high frequency transmitting apparatus and high frequency receiving apparatus connected to said circuit and network conjugately with respect to each other, said transmitting apparatus comprising means for modifying a high frequency carrier wave in accordance with currents received over said circuit without interrupting the continuity of said wave, said receiving apparatus comprising means for receiving a modified carrier wave detecting it and impressing the detected wave upon said circuit, and an intermediate two-way repeating apparatus for repeating energy transmitted from one system to the receiving apparatus of the other system including means for changing the frequency of the carrier wave as repeated.

5. Means for carrying on a two-way telephonic conversation between two widely separated points comprising an antenna for transmitting signals, a source of high frequency energy and apparatus for controlling the same connected to said antenna, a receiving antenna having suitable receiving apparatus operatively connected thereto at all times and separated from said transmitting antenna and differently tuned so that the effect of the transmitted signals may be eliminated in the receiving apparatus, a telephone line, means for connecting the telephone line simultaneously to both the transmitting and receiving apparatus, a second telephone line, means for connecting the second telephone line to two separate antennæ arranged in a manner similar to the first mentioned antennæ, and a two-way radio repeating apparatus intermediate said two widely separated points for repeating energy transmitted from each of said points to the other of said points.

In witness whereof, I hereunto subscribe my name this 15th day of August A. D., 1916.

EDWIN H. COLPITTS.