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SECRET SIGNALING.

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1,395,378.

Patented Nov. 1, 1921.

Fig. 1

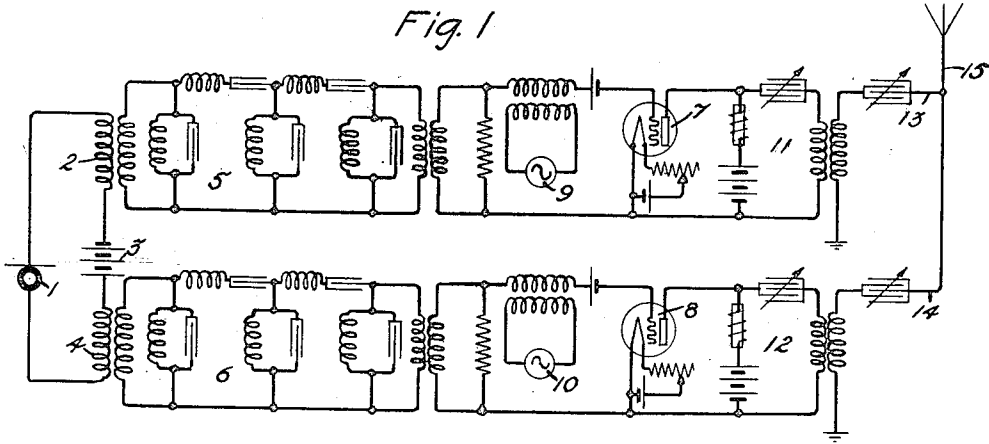
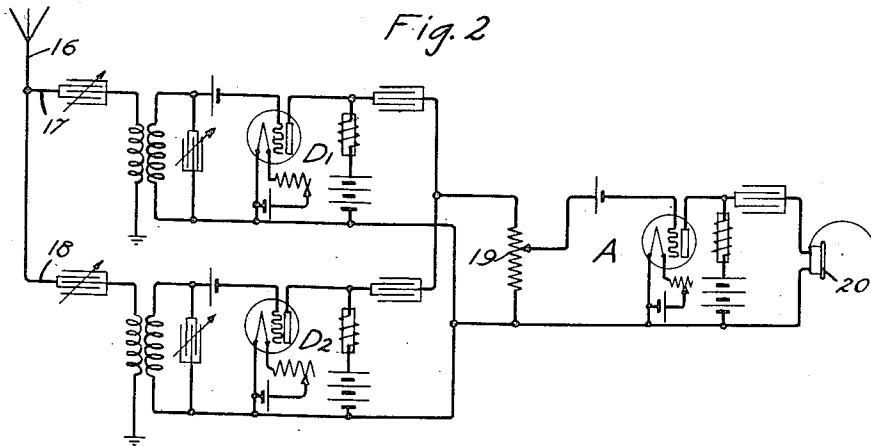


Fig. 2



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UNITED STATES PATENT OFFICE.

RICHARD H. WILSON, OF NEWARK, NEW JERSEY, AND JOHN P. SCHAFER, OF RICHMOND HILL, NEW YORK, ASSIGNORS TO WESTERN ELECTRIC COMPANY, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

SECRET SIGNALING.

1,395,378.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that we, RICHARD H. WILSON, a subject of the King of Great Britain, residing at Newark, in the county of Essex, State of New Jersey, and JOHN P. SCHAFER, a citizen of the United States, residing at Richmond Hill, in the county of Queens and State of New York, respectively, have invented certain new and useful Improvements in Secret Signaling, of which the following is a full, clear, concise, and exact description.

The present invention relates to the transmission of waves. More particularly it relates to the secret transmission of complex waves such as voice current waves, and is especially applicable to a system employing high-frequency carrier waves for conveying the voice waves. The high frequency waves may be radiated or they may be transmitted over wires as is done in well known carrier current systems. In either case, according to the invention, a plurality of high frequency waves may be used for transmitting a single voice wave, each of the high frequency waves being modulated by portions or elements of the voice waves. The portions or elements of the voice wave which are used to modulate any one high frequency wave are so chosen as to be unintelligible if received alone; thus, any single high frequency wave if received and detected for its modulation component would yield only unintelligible sounds. It is only when the whole plurality of high frequency waves are received and their modulation components properly combined, that the resulting wave is recognizable as the voice wave or other signal wave which was impressed upon the transmitter.

In the drawing Figure 1 represents a transmitting system according to the invention and Fig. 2 represents the corresponding receiving system.

In the microphone circuits 1, 2, 3 and 4 are produced the voice currents or other currents of complex frequency which it is desired to transmit. Any suitable means may be employed for breaking up the voice or other signaling wave into unintelligible fragments. In the system illustrated the band filters 5 and 6 coupled respectively to the coils 2 and 4 are used. Filter 5 is preferably so proportioned in the manner well

known in the art as to transmit freely only a limited range of the essential voice frequencies which are impressed upon it from coil 2. For example, filter 5 may transmit only the frequencies below 900. Filter 6, on the other hand, transmits only frequencies above the upper limit of the frequencies transmitted by filter 5. In a particular system used by us the filter 5 transmitted frequencies between about 500 and 900 while filter 6 transmitted frequencies between 900 and about 1500. The waves confined to either of these bands alone were found to give practically unintelligible transmission, while the frequencies from the extreme limits, 500 to 1500, gave intelligible voice transmission. These limits, however, are only arbitrary as are also the number of filters that are used to divide the voice frequency range.

Coupled to filters 5 and 6 are the respective modulators 7 and 8 which may be of any suitable type. Modulator 7 is fed with carrier current from a high frequency source 9, while current from source 10 of a different high frequency is applied to modulator 8. The frequencies of these carrier currents may be widely different, if desired, and may be changed from time to time. Due to the well known action of the modulators, there is produced in the output circuit 11 of modulator 7 a high frequency wave of the frequency of generator 9 with an amplitude which varies in accordance with the low frequency wave which is transmitted through the filter 5, and similarly in the output circuit 12 of modulator 8 there is a wave of the frequency of generator 10 modulated by the low frequency wave transmitted through filter 6. Circuits 11 and 12 are preferably tuned to transmit with maximum efficiency the respective modulated waves. These modulated waves are impressed upon the antenna 15 through the branches 13 and 14, tuned respectively to the frequencies of the waves from modulators 7 and 8. Instead of impressing the waves on the antenna 15 it would, of course, be obvious to transmit them on a line.

An outsider in attempting to pick up the conversation, would tune his receiving set to the frequency of one or the other of the transmitted carrier waves but would obtain

only unintelligible sounds from either wave alone. If the waves are intercepted at the station shown in Fig. 2, however, in which the antenna 16 has branches 17 and 18 tuned to the same frequencies as the respective branches 13 and 14, both waves will be selectively received for detection. The detectors D_1 and D_2 are coupled respectively to branches 17 and 18 and their output circuits are connected in multiple to the terminals of the potentiometer resistance 19 across which amplifier A is connected. D_1 detects the modulation component of the wave from modulator 7 and impresses upon the input of amplifier A a wave of the same general form as that transmitted by the band filter 5. Simultaneously from D_2 there is impressed on the amplifier A a wave of the form transmitted through filter 6. These two detected waves, which of themselves are each unintelligible, when they are combined make up the essential voice wave or other signal wave that was to be secretly transmitted. From the amplifier A they are received as the voice wave or other signal wave at receiver 20.

Instead of a branched antenna at the transmitter or receiver it would, of course, be obvious to provide two antennae at each station differently tuned and, if desired, separated a considerable distance from each other.

If more than two filters 5 and 6 are used to divide the signal wave into unintelligible parts, it is desired to have a correspondingly larger number of carrier frequencies so that each carrier frequency wave is modulated by the fragmentary wave transmitted by a single band filter, although this is not necessary and it is within the invention to modulate a carrier wave by a plurality of fragmentary or elemental waves.

Instead of the type of modulator shown, it is obvious that modulators such as that disclosed in the British Patent No. 102,503 could be used, in which case it is necessary to supply a current of the original high frequency in order to receive each portion of the signal wave that is separately transmitted.

It is to be understood that the methods and means of this invention are not to be limited in their use to secret signaling, but are of broad application to electric wave transmission.

Other details of the embodiment which has been illustrated and described, it is to be understood, are not to limit the invention, which is defined in the following claims.

What is claimed is:

1. The method of electric signaling which comprises separating a signal wave arbitrarily into different parts, transmitting the different parts separately and simultaneously, and recombining the different parts to form a signal wave.

2. The method of electric transmission of

signal waves which comprises dividing the signal waves into unintelligible elements, separately and simultaneously transmitting the wave elements, and recombining the wave elements to give an intelligible resultant signal wave.

3. The method of electric signaling which comprises dividing the signal waves into components, simultaneously transmitting the several components over respectively different high frequency paths, and recombining said components into the desired signal wave.

4. The method of electric signaling which comprises dividing the signal wave into component parts, simultaneously transmitting the several parts on waves having respectively different characteristics, and recombining the several parts into the corresponding signal wave.

5. The method of electric signaling which comprises dividing the signal waves into component parts, simultaneously transmitting the several component parts on waves of different high frequencies, and recombining the several component parts into the signal waves to be received.

6. The method of electric signaling which comprises dividing the signal waves into component waves, simultaneously modulating different high frequency waves in accordance with the respective component waves, separately transmitting said high frequency waves, detecting said component waves, and assembling said component waves into the signal waves to be received.

7. The method of secret telephony which comprises transmitting an unintelligible fragment of the speech wave simultaneously over each of a plurality of high frequency transmission paths, and combining said fragments into a speech wave.

8. The method of secret telephony which comprises simultaneously modulating each of a plurality of high frequency waves in accordance with an unintelligible fragment of the speech wave, separately transmitting said modulated waves, and combining said fragments into a speech wave.

9. The method of electric signaling which comprises transmitting unintelligible fragments of the same signal wave simultaneously over different transmission paths, and receiving all of said fragments in a common receiver.

10. The method of secret telephony which comprises dividing a voice wave into unintelligible parts, transmitting the several parts simultaneously over different transmission paths, and recombining said parts into the voice wave to be received.

11. The method of electric signaling which comprises dividing a signal wave into its frequency components, separately transmitting said frequency components, and

combining said components to give the signaling wave.

12. The method of electric signaling which comprises selectively dividing a signal wave in accordance with its frequency components, transmitting said components over respectively different paths, and combining said components to give the signaling wave.

13. The method of electric signaling which comprises partially analyzing a signal wave into its component frequencies, separately transmitting the signal waves of component frequencies, and recombining said waves of component frequencies to form a signal wave.

14. The method of secret telephony which comprises separating the essential voice frequencies into bands of frequencies, the frequencies constituting each band being insufficient to give intelligible transmission, transmitting each band over a different high frequency channel, and recombining the transmitted bands to form voice waves at the receiver.

15. The method of secret telephony which comprises dividing the essential speech frequency range into bands of frequencies, the frequencies of each band being insufficient to give intelligible transmission, modulating a different high frequency wave with the frequencies of each band, transmitting all of the modulated high frequency waves together, detecting the several modulation components of the high frequency waves, and recombining said components to produce an intelligible voice frequency wave.

16. An electric signaling system comprising a source of signaling current having a range of essential frequencies, a band filter for transmitting a portion of said frequencies of insufficient range to permit of recognizing the signal, and means for modulating a high frequency current wave in accordance with the frequencies transmitted by said filter.

17. An electric signaling system comprising a plurality of high frequency selective transmission channels, a source of current of a different high frequency for each of said channels, a receiver common to all of said channels, a source of signaling waves, and means for transmitting an unintelligible portion of said waves simultaneously over each of said channels, said waves being received as intelligible signaling waves in said common receiver.

18. An electric signaling system comprising a plurality of high frequency selective transmission channels, a source of current of a different high frequency for each of said channels, a source of signaling waves for said system, means for modulating all of said high frequency currents simultaneously in accordance with different unintelligible

portions of said signaling waves, a detector for each modulated wave, and a receiver common to all of said detectors.

19. An electric signaling system comprising a plurality of high frequency selective transmission channels, a source of current of a different high frequency for each channel, a source of signaling current for said system, means for modulating said high frequency currents as a whole in accordance with said signaling current, the modulation component of each of said high frequencies alone being unintelligible, and a receiver for receiving the modulation components of all of said high frequency waves together in the form of an intelligible signaling wave.

20. In an electric signaling system, a transmitting terminal and a receiving terminal, sources of current of different high frequencies at the transmitter, tuned branches for said transmitting terminal tuned to the respective high frequencies, tuned branches for the receiving terminal tuned to said respective high frequencies, a detector for each tuned branch of the receiving terminal, a receiver common to said detectors, a modulator for each high frequency at the transmitter, a source of signaling current, and means for impressing upon each modulator a different unintelligible portion of said signaling current.

21. In a system of telephony, a source of voice currents, band filters connected to said source for transmitting restricted bands of the frequencies comprised in the voice-frequency range, sources of currents of different high frequencies, and means for modulating each of said high frequency currents by the currents of restricted frequency range transmitted by one of said band filters.

22. In a system of telephony, a transmitting terminal, sources of currents of different high frequencies and modulators therefor connected to said terminal, a source of speech currents common to all of said high frequency sources and modulators, and selective circuits between said modulators and said source of speech currents for transmitting to each modulator a different portion of said speech currents.

23. In a system of telephony, a source of voice currents, circuits for transmitting said voice currents comprising filters, each of which transmits a different portion of the currents comprised in the range of essential voice frequencies, sources of currents of different high frequencies and modulators therefor, each of said modulators being coupled to a different one of said filters.

24. A telephone system comprising a transmitter and a receiver for transmitting and receiving voice current waves, circuits for transmitting between said transmitter and said receiver including a plurality of high frequency channels, and means for con-

tinuously transmitting a different portion of said voice currents selectively over each of said channels.

25. In a telephone system, a circuit for carrying voice currents, selective circuits connected thereto, each for selectively transmitting currents of different essential voice frequencies, sources of currents of different high frequencies for said system, and means for modulating each of said high frequency currents in accordance with the currents transmitted by different ones of said selective circuits.

26. In an electric signaling system, sources of current of different high frequencies and means for continuously transmitting current from said sources, and a modulator for each source of high frequency current for continuously modulating each high frequency current in accordance with a portion of a signaling wave.

27. In an electric signaling system, means for transmitting continuous waves of different high frequencies, a source of continuous signaling waves, means for deriving component continuous waves from said signaling waves, and means for modulating each of said high frequency waves by one of said component waves.

28. In an electric signaling system, means for transmitting a plurality of waves of different high frequencies, a source of signaling waves having different essential characteristics by which the wave is recognized, means for modulating each of said high frequency waves in accordance with a different characteristic of said signaling waves, and means for receiving the modulated waves and combining their modulation components to receive the signal wave.

29. In an electric signaling system, a plurality of transmission paths, means for producing a complex signaling wave, means for simultaneously transmitting different component portions of said wave over different transmission paths, and a common receiver for receiving all of said component portions together in the form of said complex signaling wave.

30. A radio telephone system comprising transmitting and receiving antennae having circuits tuned for the simultaneous transmission and reception of a plurality of waves of different frequencies, sources of currents of said different frequencies, a circuit for carrying speech currents, band filters connected with said circuit, each band filter selectively transmitting a different portion of the currents of essential voice frequencies, modulators for modulating each high frequency current in accordance with the current transmitted through a different one of said band filters, a detector for each high frequency current, and a receiver common to said detectors.

31. The method of transmitting a band of electric wave frequencies which consists in dividing the original frequency band into sub-bands, changing the normal relation of said sub-bands with respect to each other, and transmitting said sub-bands in said altered relation.

32. The method of transmitting a band of electric wave frequencies, which consists in dividing the original frequency band into sub-bands, shifting said sub-bands from their normal positions by modulation, and transmitting said sub-bands in said shifted positions.

33. The method of transmitting a band of electric wave frequencies which consists in dividing the original frequency band into sub-bands, changing the normal relation of said sub-bands with respect to each other, transmitting said sub-bands in said altered relation, and restoring said sub-bands to said normal relation.

34. The method of electric wave transmission which comprises separately and simultaneously transmitting a plurality of components of a signal wave, varying the frequency relation between said components, and deriving the signal wave from the components having a varied frequency relation.

35. The method of electric wave signaling which comprises separately and simultaneously transmitting a plurality of components of a signal wave, varying the frequency relation between said components, combining the resultant waves to form a complex wave, and receiving said complex wave.

36. The method of electric wave signaling which comprises separately and simultaneously transmitting a plurality of components of a signal wave, varying the frequency relation between said components, combining the resultant waves to form a complex wave, separating said complex wave into components, and detecting the components of said complex wave.

37. The method of electric wave signaling which comprises separately and simultaneously transmitting a plurality of components of a signal wave, varying the frequency relation between said components, combining the resultant waves to form a complex wave, separating said complex wave into components, separately detecting said components, and combining the detected components to reproduce the signal wave.

38. A method of electric wave signaling which comprises separately and simultaneously transmitting a plurality of components of a signal wave, varying the frequency relation between said components, combining the resultant waves to form a complex wave, and reproducing the signal wave from separately derived energy components of said complex wave.

39. The method of telephony which com-

prises simultaneously modulating each of a plurality of wave sources in accordance with an unintelligible fragment of the speech wave, separately transmitting said modulated waves, and combining said fragments into a speech wave.

40. In an electric signaling system, sources of current of different frequencies, and means for transmitting current from said sources, and a modulator for each source of different frequency current for continuously modulating each different frequency of current in accordance with a portion of a signaling wave.

41. The method of electric wave transmission which comprises transmitting a continuous wave band, separating out from said continuous band a plurality of smaller frequency range bands, the frequency components in any one of said smaller bands having substantially the same relative amplitudes as existed between said components in said continuous band, and transmitting energy corresponding to each of said smaller bands.

42. The method of electric wave transmission which comprises transmitting a continuous wave band, separating out from said continuous band a plurality of smaller frequency range bands, the frequency components in any one of said smaller bands having substantially the same relative amplitudes as existed between said components in said continuous band, transmitting energy corresponding to each of said smaller bands,

receiving said energy, and reproducing therefrom a wave band corresponding to said continuous band.

43. The method of electric wave transmission which comprises transmitting a continuous wave band, separating out from said continuous band a plurality of smaller frequency range bands, the frequency components in any one of said smaller bands having substantially the same relative amplitudes as existed between said components in said continuous band, transmitting energy corresponding to each of said smaller bands, receiving said energy, deriving therefrom waves corresponding to those in said continuous band, and combining said waves to reproduce a wave band corresponding to said continuous band.

44. The method of electric wave signaling which comprises transmitting a complex wave corresponding to a single message, separating out from said wave a plurality of smaller frequency range fragments, the frequency components in any one of said fragments having substantially the same relative amplitudes as existed between said frequency components in said complex wave, and transmitting energy corresponding to each of said fragments.

In witness whereof, we hereunto subscribe our names this 27th day of September A. D., 1919.

RICHARD H. WILSON.
JOHN P. SCHAFER.