July 8, 1947. A. V. BEDFORD 2,423,546

CADENCE SUPPRESSION SYSTEM FOR SECRECY COMMUNICATION

Filed Sept. 24, 1945 2 Sheets-Sheet 1

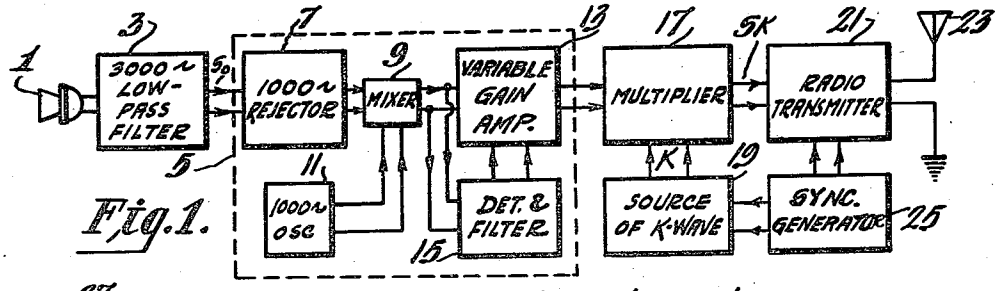


Fig. 1.

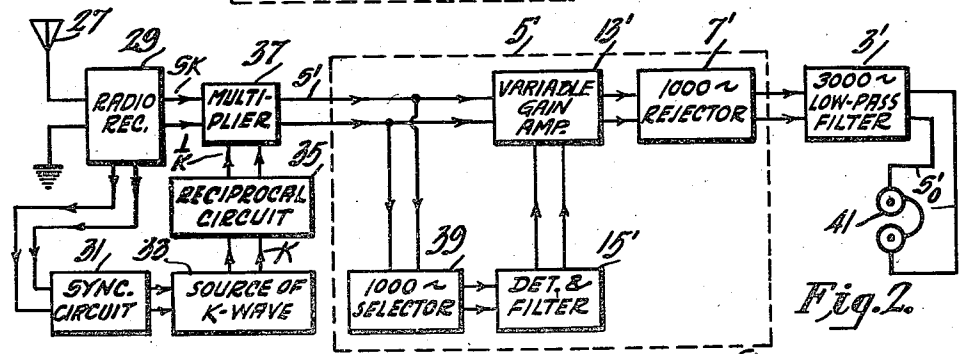


Fig. 2.

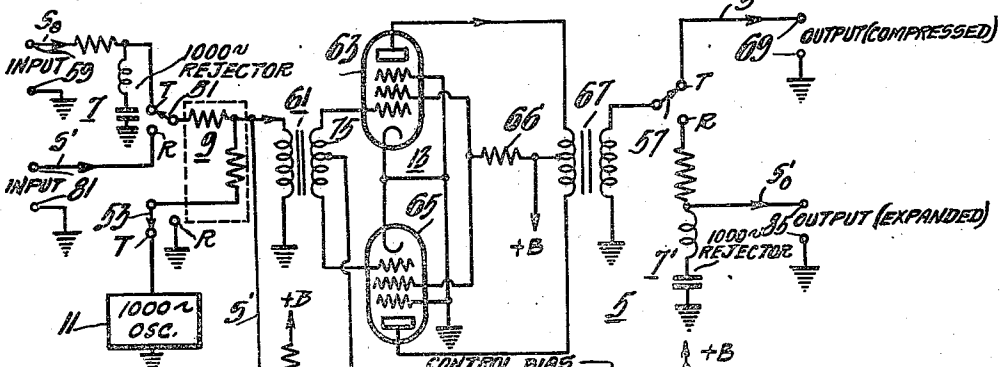


Fig. 3.

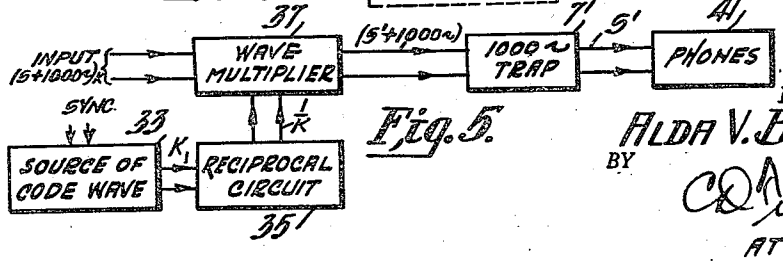


Fig. 5.

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CADENCE SUPPRESSION SYSTEM FOR SECRECY COMMUNICATION

Filed Sept. 24, 1945 2 Sheets-Sheet 2

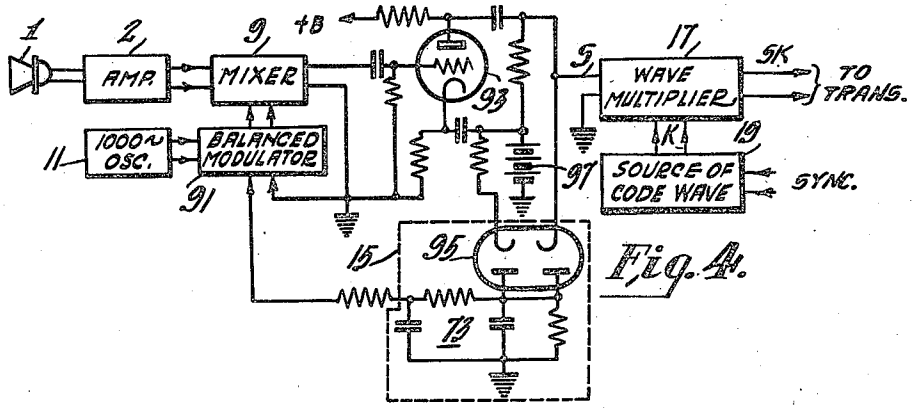


Fig. 4.

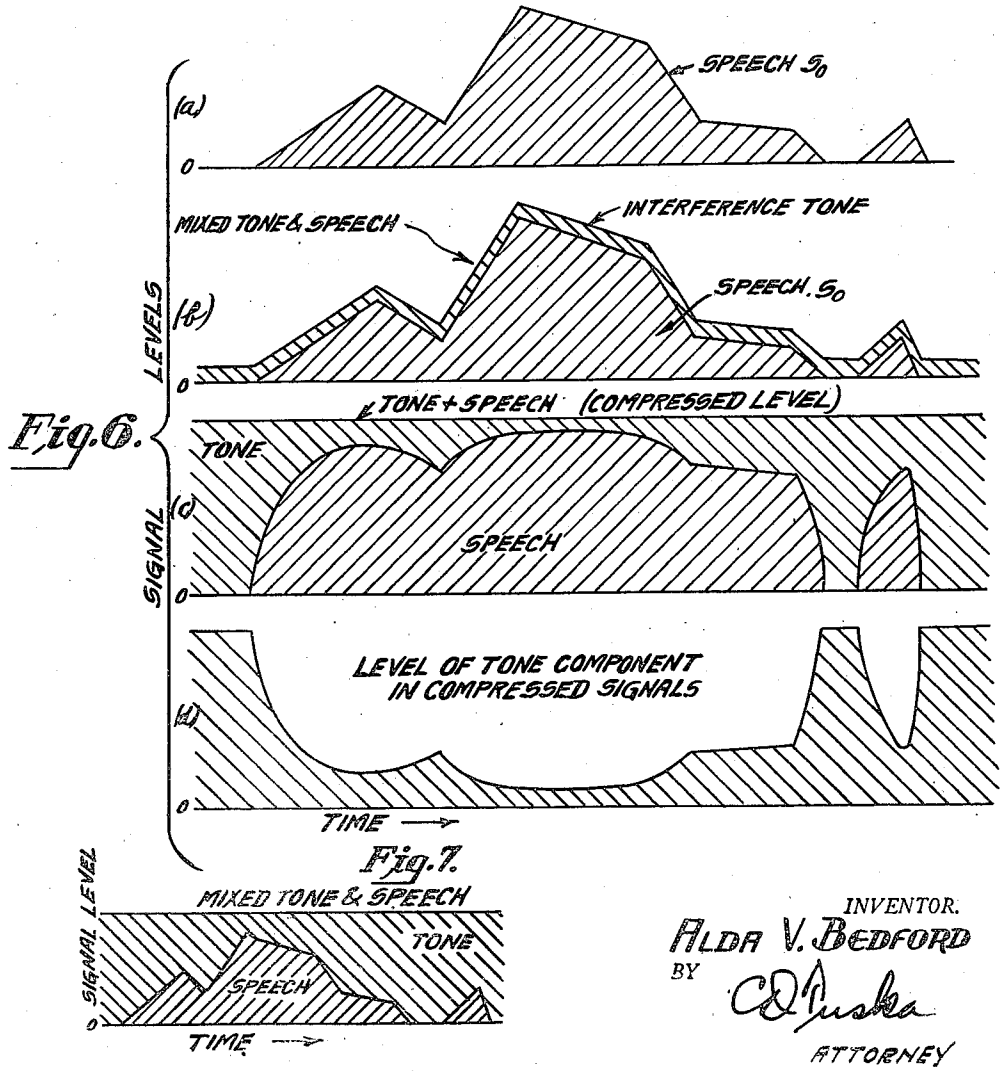


Fig. 6.

Fig. 7.

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UNITED STATES PATENT OFFICE

2,423,546

CADENCE SUPPRESSION SYSTEM FOR SECRECY COMMUNICATION

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Application September 24, 1945, Serial No. 618,339

24 Claims. (Cl. 179—1.5)

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The present invention relates to wave transmission systems and more particularly to an improved method of and means for improving the security of a secret telecommunication system by destroying the cadence of the communication signal.

The invention, by way of example, will be described hereinafter as an improvement in a secret telecommunication system of the general type described in the copending U. S. application of Alda V. Bedford, Serial No. 536,630, filed May 20, 1944, upon which Patent No. 2,401,405 was granted June 4, 1946. Said copending application discloses a system wherein, for example, a speech signal comprising a complex wave S is modified by means of a coding signal comprising a complex wave K, in a manner whereby the instantaneous ordinates of the resulting coded signals are the product SK of the corresponding instantaneous ordinates of the speech signal and the coding signal. The resulting unintelligible coded signals are transmitted by any conventional means to a receiver wherein the coded signals are combined with decoding signals generated in the receiver and having instantaneous ordinates corresponding to the reciprocal of the corresponding instantaneous ordinates of the coding signal component of the transmitted signal. The final signals, therefore, are derived from the product of the transmitted signal SK and the decoding signal 1/K. The coding and decoding signal generators at the transmitter and reeciver, respectively, are synchronized by a unique system wherein synchronizing pulse signals, each comprising a first signal pulse immediately followed by a second signal pulse of opposite polarity, are superimposed upon the coded signals SK at predetermined intervals. At the receiver, the reversal in polarity between the two synchronizing pulses is employed to synchronize the decoding wave generator.

Since due to the inherent cadence of speech, the signals may be partially intelligible even though the received signals are improperly decoded, the instant invention increases the security of such secret telecommunication by destroying the speech cadence before it is coded by the complex coding wave K at the transmitter.

In order to destroy the speech cadence, an interfering signal is combined with the speech signal, and the envelope of the combined signals is compressed to provide an output signal having uniform amplitude characteristics.

In a preferred embodiment of this invention, the interfering signal frequency components of

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the speech signal are first removed, and then the interfering signal is combined with the speech signal. The combined signal is applied to a variable gain amplifier which provides a compressed signal having constant amplitude characteristics. The compressed signal is coded by amplitude multiplication with the code wave and transmitted to a remote receiver. In the receiver the signal is decoded by means of a synchronized reciprocal code wave to provide the compressed transmitted signal. The interfering signal component of the compressed received signal is selected and utilized to control the gain of a variable gain amplifier which expands the compressed signal to its original envelope. The interfering signal frequency component is then rejected and the resultant signal is applied to a reproducer. In this embodiment of the invention both the communication signal and the interfering signal are compressed prior to coding and transmission.

In a second embodiment of this invention the interfering signal is combined with the speech signal in a manner whereby the speech signal amplitude remains unchanged and the interfering signal amplitude is selected to provide a mixed signal having a uniform amplitude. The combined signals are coded by amplitude multiplication with the complex coding wave K and transmitted to the remote receiver. At the receiver the wave is decoded by a synchronized reciprocal decoding wave 1/K and the interfering signal frequency components are removed by a suitable filter. The resultant signal is applied to the reproducer.

Since the apparatus required for both transmission and reception in either of the embodiments of the instant invention described heretofore includes some substantially identical circuit components, the cadence suppression circuit for both transmitting and receiving said signals may utilize the same circuit elements providing suitable switching means are included. The application of the "transmit-receive" switching feature to the first embodiment of this invention is illustrated hereinafter in the schematic circuit diagram of Figure 3.

Since both the speech signal and cadence destroying tone are coded by means of the coding wave K, it is necessary to decode the received signal before the cadence destroying tone may be separated from the speech signal S because of the spreading of the tone frequency and its harmonics throughout the spectrum of the coded signals.

Among the objects of the instant invention are

to provide an improved method of and means for secret telecommunication. Another object of this invention is to provide an improved method of and means for destroying cadence in a secret telecommunication system. A further object of this invention is to provide an improved method of and means for destroying the cadence of a speech signal, and then combining the modified speech signal with a coding signal for transmission to a remote decoding receiver. An additional object of this invention is to provide an improved method of and means for destroying the cadence of a speech signal by generating a cadence destroying signal, and thence combining the cadence destroying signal with the speech signal to provide a signal of uniform amplitude. Another object of this invention is to provide an improved method of and means for transmitting coded communication signals wherein the cadence of the communication signal is destroyed. A further object of this invention is to provide an improved method of and means for receiving, decoding, and restoring the cadence of a secret telecommunication signal wherein the cadence is removed prior to transmission. An additional object of this invention is to provide a signal cadence suppression circuit for communication signals wherein a spurious signal having periodic and amplitude characteristics of a frequency within the band of said communication signals is combined with said signals to destroy the syllabic characteristics thereof.

The instant invention will be described in greater detail by reference to the accompanying drawings of which Figure 1 is a block schematic circuit diagram of a first embodiment of a secret telecommunication transmitter employing the invention, Figure 2 is a block schematic circuit diagram of a receiver for use with said first embodiment of the invention, Figure 3 is a schematic circuit diagram of a combined coding signal transmitter and receiver illustrating the novel features of said first embodiment of the invention, Figure 4 is a block schematic circuit diagram of a transmitter employing a second embodiment of the invention, Figure 5 is a block schematic diagram of a receiver employing said second embodiment of the invention, Figure 6 is a family of graphs illustrating the characteristics of the cadence suppression signal utilized in said first embodiment of the invention, and Figure 7 is a graph illustrating the characteristics of the cadence suppression signal utilized in said second embodiment of the invention. Similar reference characters are applied to similar elements throughout the drawings.

Signal compression—Method I

Referring to Figure 1, a complete secret telecommunication system employing the features of the preferred embodiment of the instant invention may comprise a signal source, such as, for example, a microphone 1 (which may include a conventional input amplifier), connected to the input circuit of a low-pass filter network 3 having an upper frequency transmission limit determined by the frequency characteristics of the desired input signal and by the transmission characteristics of the communication circuit. The speech signal S_0 is applied to the input circuit of an expander network 5. The input circuit of the expander network 5 includes a 1000 cycle rejector network 7, the output of which is connected to a signal mixer circuit 9 in a manner whereby the 1000 cycle interfering signal and the speech signal S_0 (with its 1000 cycle component removed) are additively combined. The combined signals derived from the mixer 9 are applied to the input circuit of a variable gain amplifier 13. The combined signals also are applied to a detector and syllabic-frequency smoothing filter 15 to provide a negative bias voltage having a magnitude directly proportional to the amplitude thereof. The variable negative bias voltage derived from the detector and filter 15 is applied to the variable gain amplifier 13 to control the gain thereof in a manner whereby the amplifier output signal envelope is of uniform amplitude. The uniform amplitude output signal S derived from the variable gain amplifier 13 is applied to one input circuit of a signal amplitude multiplier 17 of the type described in applicant's copending application identified heretofore.

A source of coding signals 19 applies the coding wave K to a second input circuit of the signal multiplier 17 to provide a coded signal SK in which the instantaneous signal amplitudes are the product of the corresponding instantaneous amplitudes of the compressed speech signal S and the coding wave K with respect to the alternating current axes of said multiplier signals. The coded signal SK is applied to a radio transmitter 21 of conventional type which is connected to an antenna 23 or to any other communication channel. A sychronizing pulse generator 25 actuates the coding wave generator 19 and supplies synchronizing pulses which are combined in the radio transmitter 21 with the coded signal SK.

Signal expansion—Method I

Referring to Figure 2, the coded and synchronizing pulse signals derived from the transmitter are received on a receiving antenna 27 which is connected to the input circuit of a conventional radio receiver 29. The synchronizing signal pulses of the received signals are segregated and applied to a receiver synchronizing circuit 31 which controls the operation of a receiver coding wave generator 33 of substantially the same type as the transmitting generator 19. The receiver coding wave generator 33 is connected to a reciprocal circuit 35 which provides a decoding signal 1/K. The received coded signal SK and the reciprocal decoding signals 1/K are applied to a receiver signal multiplier circuit 37 to provide a decoded signal S'. The method of and means for coding and decoding as well as synchronizing said coding and decoding of the compressed communication signal are described in detail in applicant's copending application identified heretofore.

The decoded compressed communication signal S' is applied to a receiver signal expander 5' which includes several circuit components which are identical with those employed in the transmitter signal compressor network 5 and which are identified by prime reference characters. The compressed signals S' are applied to the input of a variable gain amplifier 13', and also are applied to the input of a 1000 cycle selector network 39. The 1000 cycle interfering signals selected from the compressed signal S' are applied to a detector and filter 15' which provides a bias voltage for the variable gain amplifier 13' for expanding the compressed signal S' to its original variable amplitude which it had before the signal compression operation in the transmitter signal compressor 5. The expanded received signal S' is passed through a 1000 cycle rejector 7' and a low-pass filter 3' to provide the original communication signal S'_0 which is applied to a signal reproducer 41. The

signal applied to the signal reproducer 81 is identified as S'_0 instead of the original signal S_0 since some frequency distortion is inherent in the communication channel and in the volume compression and expansion circuits.

It should be understood that the particular method of and means for coding and decoding the communication signal and synchronizing said coding and decoding operations may be accomplished in any other manner known in the secret telecommunication art. However, the system described herein by reference to applicant's copending application provides extremely high security because when coded by amplitude multiplication each original frequency is spread as side bands over a wide spectrum. The side bands from the speech frequencies thus are diffused with those from the interfering tone so that the tone cannot be isolated by a filter and used for operating the expander until after being decoded by the reciprocal wave 1/K.

Combined signal compressor-expander circuit—Method I

Figure 3 illustrates schematically the circuit 5 which may be employed, by means of four single-pole double-throw switches 51, 53, 55 and 57 for either compressing or expanding the mixed communication signals and interfering signals as described heretofore in the transmitter and receiver systems of Figures 1 and 2.

Signal compression

When the circuit 5 is employed for compressing the communication and interfering signals as in the system of Figure 1, signals are applied to input terminals 59 which are connected with the series-tuned 1000 cycle rejector network 7. All of the "transmit-receive" switches 51, 53, 55 and 57 have their movable switch elements connected to the fixed switch terminals T. Thus signals from the 1000 cycle oscillator 11 are applied through the switch 53, and signals from the input terminals 59 are applied through the switch 51 to the signal mixer 9. Signals derived from the mixer 9 are coupled through a transformer 61 to the control grids of a pair of variable gain pentode tubes 63 and 65. The cathodes and suppressor electrodes of the tubes 63 and 65 are grounded. The anode voltage source, not shown, is connected to the tube screen electrodes through a common resistor 66 having a value of the order of 1 megohm which serves to lower the screen voltage when the control grid bias is lowered, thus preventing over-control by the bias voltage. The anode voltage source also is connected through a center-tapped output transformer 67 to the anodes of the tubes 63 and 65. Output signals derived from the output transformer 67 are applied through the switch 57 to output terminals 69 for deriving the compressed signal S which is applied to the transmitter multiplier network 17.

The mixed signals derived from the mixer 9 also are applied through the switch 55 to the signal detector 71 which generates a control bias signal which is applied through the filter 73 to a center tap on the secondary winding 75 of the input transformer 61 whereby a control bias is applied to the control electrodes of both of the variable gain amplifier tubes 63 and 65. The control bias signal thus varies in magnitude in accordance with the mixed signal amplitude and provides the desired volume compression for deriving an output signal having uniform amplitude characteristics. A "magic eye" tube level indicator 77, having its grid connected to the output of the bias voltage filter 73 provides a visual indication of the mixed signal level which may be employed for adjusting said level to prevent overloading and distortion of the compressed signals.

Signal expansion

When the circuit 5 is employed as a volume expander in the receiver system of Figure 2, all of the switches 51, 53, 55, and 57 have their movable contacts connected to the fixed switch contacts R. Input signals derived from the receiver multiplier network 37 are applied to the input terminals 81 which are thus coupled through the mixer network 9 and input transformer 61 to the control electrodes of the variable gain amplifiers 63 and 65. The 1000 cycle oscillator 11 is disconnected from the system by means of the grounded switch contact R of the switch 53. The 1000 cycle component selected by the filter 39' from the signal S' applied to terminal 81 is applied to the control electrode of a triode amplifier tube 83. The anode of the triode amplifier tube 83 is connected through the switch 55 to couple the 1000 cycle signal to the signal detector 71. The bias voltage generated by the signal detector tube 71 is applied through the bias voltage filter 73 and the secondary winding 75 of the transformer 61 to control the gain of the variable gain amplifier tubes 63 and 65 in a manner whereby the output signals derived from the output transformer are restored substantially to the original signal envelope prior to its volume compression at the transmitter. Signals from the output transformer 67 are applied through the switch 57 to output terminals 85 which are shunted by the 1000 cycle series-tuned rejector network 7'. Output terminals 85 apply the expanded communication signal S'_0 to the reproducer circuit. The "magic eye" indicator tube 77 is permanently connected to the signal detector bias voltage circuit to provide an indication of the level of the received compressed signals for facilitating suitable signal amplitude regulation for minimizing signal distortion.

The signal compression and expansion circuits 5 and 5' described heretofore by reference to Figures 1, 2, and 3 are somewhat similar to the well known automatic-volume-control circuits employed in radio receivers and amplifiers. However, the customary automatic-volume-control circuits are of the regenerative type in which the control bias voltage is derived from a later portion of the circuit than the point at which the control potential is applied. In such prior art circuits it is essential that there be a threshhold value of output voltage below which no further control voltage is generated. Such known control systems could be employed herein but the system described heretofore provides more satisfactory control in that the control voltage is a function of the actual signal voltage in the circuit prior to, or at, the point at which the control voltage is applied.

The time constant of the smoothing filter network 73 in the control circuit is critical in that too much smoothing permits abrupt changes in the speech level to be amplified before the gain control is operative. Also, if the smoothing is inadequate, the audio-frequency components in the control signal result in wave-shape distortion of the output speech wave, although the use of push-pull variable gain amplifier tubes substantially reduces this effect. It has been found that, for the speech signal frequencies involved, a filter

circuit time constant of the order of .005 second is satisfactory.

Signal transmitter—Method II

A second method of minimizing the effects of speech cadence consists of adding to the speech wave a variable amplitude 1000 cycle tone having signal levels such as to provide a combined wave having a constant loudness. It may be stated that the low amplitude intervals between words and syllables are merely "filled in" with other signals comprising the interfering tone. At the receiving station it is essential only to filter out the interfering tone from the combined signals by means of any frequency selective device. However this filtering must be done after the received wave is decoded.

Referring to Figure 4, the source of speech **1** is amplified by a speech amplifier **2** and applied to the mixer network **9**. The 1000 cycle interfering signal oscillator **11** is connected to one input circuit of a balanced modulator **91**, the output circuit of which is connected to the signal mixer network **9**. The output of the signal mixer network **9** is applied to the control electrode of a triode amplifier tube **93**. The anode and cathode circuits of the triode amplifier **93** are connected to the cathodes of a double-diode rectifier tube **95**. The anodes of the double-diode rectifier **95** are connected together, and are connected to the input of the smoothing filter **73**. Thus full-wave detection of the combined signals is obtained, although half-wave detection would operate quite satisfactorily.

The control voltage derived from the smoothing filter **73** is effectively controlled by a threshhold voltage furnished by a battery **97**, and is applied as a control signal to a second input circuit of the balanced modulator **91**. Thus the negative control signal derived from the smoothing filter biases the balanced modulator in a manner whereby it supplies the 1000 cycle interfering tone only until the amplifier peak output voltage is equal to (or slightly greater than) the threshhold voltage provided by the reference battery **97**. When the amplifier voltage exceeds the threshhold voltage level the balanced modulator ceases to supply the interfering tone to the mixer network **9**.

Thus the system is somewhat analogous to conventional regenerative automatic volume control circuits. It differs in that the output signal is the sum of two signals (the speech signals and the interfering signal), wherein the speech signal varies independently, and the control circuit regulates the amplitude of the interfering signal to compensate for variations in the speech signal.

Output signals S derived from the anode circuit of the triode amplifier tube **93** are applied to one input circuit of the transmitter wave multiplier **17** wherein they are combined by amplitude multiplication with the coding wave K which is derived from the code wave generator **19**. The coded combined signals and the synchronizing pulses are transmitted as described heretofore by reference to the circuit of Figure 1.

Signal receiver—Method II

Referring to Figure 5, the received coded combined signals are applied to one input circuit of the receiver wave multiplier circuit **37** wherein they are combined with the decoding reciprocal signals 1/K derived from the reciprocal circuit **35**. The received synchronizing pulses control

the operation of the receiver coding wave generator **33** which actuates the reciprocal circuit **35**. Thus decoded signals including the interfering signal component (S'+1000 cycles) derived from the wave multiplier **37** are applied to the input of a 1000 cycle rejector network **7'** wherein the interfering tone is removed. The resultant decoded and restored signals S' are applied to the reproducer **41**.

The method of combining and compressing the speech and interfering signals in the preferred embodiment of the invention described heretofore by reference to Figures 1, 2, and 3 is illustrated graphically in Figure 6. Graph *a* illustrates the envelope of a single word comprising a portion of the speech signal S_0. Graph *b* illustrates the output signal derived from the mixer network **9** comprising the speech signal S_0 to which the interference tone having an amplitude of approximately 10 percent that of the maximum speech signal amplitude, is added. Graph *c* illustrates the combined speech and interfering tone signals after volume compression, as derived from the output circuit of the variable gain amplifier **13**. Graph *d* illustrates the level of the interfering tone component of the compressed mixed signals prior to the coding thereof by means of the coding signal K. It should be noted that the signal compression provided by the variable gain amplifier **13** changes the levels of the speech and interfering tone signals prior to the coding thereof.

Figure 7 shows graphically the envelope of the combined signals provided by the transmitter of the second embodiment of the invention. This graph illustrates the operation of the circuit of Figure 4 wherein the speech signal has added thereto an interfering signal having an amplitude sufficient to provide a mixed signal of constant amplitude. While the magnitude of the interfering signal varies as a function of the magnitude of the speech signal, the speech signal amplitudes remain unchanged.

In either of the embodiments of the invention described heretofore, the coding of the combined or compressed signals by means of signal amplitude multiplication with the coding wave K makes it extremely difficult to expand or segregate the mixed signals until the transmitted signal is properly decoded. When the transmitted signal is received and combined with a decoding wave which differs substantially from the transmitted coding wave, the interfering tone is spread irregularly over the speech signal spectrum so that a simple filter cannot isolate it for operating the expander circuit to restore cadence. Also a simple filter will not remove the interfering tone from the reproducing circuit. The result would be an unintelligible combination of coded speech and noise. It has been found that in order to obtain intelligibility of the decoded signal, the transmitted code wave and the receiver decoding wave must have a higher degree of similarity than is necessary in circuits in which signal compression and expansion is not employed. Thus the systems described herein greatly increase the transmission security.

Since coding and decoding of the transmitted signal and frequency limitations of the transmission channel introduce high frequency noise components in the decoded signal, the low-pass output filter network **3'** of the circuit of Figure 2 is employed to remove such high frequency distortion components from the reproducer circuit. A noise reducing filter of this type also might be

included between the 1000 cycle rejector network 7' and the reproducer 41 of the circuit of Figure 5.

Thus the invention disclosed comprises two embodiments of a signal cadence suppression system for improving the transmission security of coded telecommunication signals. An interfering tone is combined with communication signals in a manner which provides complex spurious signal components due to the coding of the combined signals.

I claim as my invention:

1. In a secret telecommunication system, the method of utilizing an interfering signal to increase the transmission security of a communication signal comprising the steps of combining said communication signal and said interfering signal to provide a distorted signal having an envelope of uniform amplitude, coding said distorted signal, transmitting said coded signal, receiving and decoding said transmitted signal to derive said distorted signal, segregating said interfering signal component from said received decoded distorted signal, and deriving said communication signal.

2. In a secret telecommunication system the method of utilizing an interfering signal to increase the transmission security of a communication signal comprising the steps of mixing said communication signal and said interfering signal, deriving from said mixed signals a distorted signal having an evelope of uniform amplitude, coding said distorted signal, transmitting said coded distorted signal, receiving and decoding said transmitted signal to derive said distorted signal, removing said interfering signal component of said received decoded distorted signal to derive a communication signal having a distorted envelope, and restoring the original envelope of said received distorted communication signal.

3. In a secret telecommunication system, the method of utilizing an interfering signal to increase the transmission security of a communication signal comprising the steps of mixing said communication signal and said interfering signal, compressing said mixed signals to provide a distorted signal having an envelope of uniform amplitude, coding said distorted signal, transmitting said coded signal, receiving and decoding said transmitting signal to derive said distorted signal, expanding said distorted signal to derive said mixed signal, and removing said interfering signal from said mixed signal to derive said communication signal.

4. In a secret telecommunication system, the method of utilizing an interfering signal to increase the transmission security of a communication signal comprising the steps of combining said communication signal and said interfering signal to provide a distorted signal having an envelope of uniform amplitude, said communication signal component of said distorted signal remaining substantially unchanged, coding said distorted signal, transmitting said coded signal, receiving and decoding said transmitted signal to derive said distorted signal, and segregating said interfering component from said received decoded distorted signal to derive said communication signal.

5. In a secret telecommunication transmission system, the method of utilizing an interfering signal to increase the transmission security of a communication signal comprising the steps of combining said communication signal and said interfering signal to provide a distorted signal having an envelope of uniform amplitude, coding said distorted signal, and transmitting said coded signal.

6. In a secret telecommunication transmitter system, the method of utilizing an interfering signal to increase the transmission security of a communication signal comprising the steps of mixing said communication signal and said interfering signal, expanding said mixed signals to provide a distorted signal having an envelope of uniform amplitude, coding said distorted signal, and transmitting said coded signal.

7. In a secret telecommunication transmitter system, the method of utilizing an interfering signal to increase the transmission security of a communication signal comprising the steps of combining said communication signal and said interfering signal to provide a distorted signal having an envelope of uniform amplitude, said communication signal component of said distorted signal remaining substantially unchanged, coding said distorted signal, and transmitting said coded signal.

8. In a secret telecommunication system, the method of utilizing an interfering signal to increase the transmission security of a communication signal comprising the steps of combining said communication signal and said interfering signal to provide a distorted signal, and utilizing said distorted signal to provide an output signal having an envelope of uniform amplitude.

9. In a secret telecommunication system, the method of utilizing an interfering signal to increase the transmission security of a communication signal comprising the steps of combining said communication signal and said interfering signal to provide a distorted signal, amplifying said distorted signal, and controlling the amplification gain of said amplified distorted signal to provide an output signal having an envelope of uniform amplitude.

10. In a secret telecommunication system, the method of utilizing an interfering signal to increase the transmission security of a communication signal comprising the steps of combining said communication signal and said interfering signal to provide a distorted signal, and varying the amplitude of said interfering signal component of said combined signals to provide an output signal having an envelope of uniform amplitude, the communication signal component of said output signal remaining substantially unchanged.

11. In a secret telecommunication system, apparatus for utilizing an interfering signal to increase the transmission security of a communication signal comprising means for combining said communication signal and said interfering signal to provide a distorted signal having an envelope of uniform amplitude, means for coding said distorted signal, means for transmitting said coded signal, means for receiving and decoding said transmitted signal to derive said distorted signal, means for segregating said interfering signal component from said received decoded distorted signal, and means for deriving said communication signal.

12. In a secret telecommunication system, apparatus for utilizing an interfering signal to increase the transmission security of a communication signal comprising means for mixing said communication signal and said interfering signal, means for deriving from said mixed signals a distorted signal having an envelope of uniform

amplitude, means for coding said distorted signal, means for transmitting said coded distorted signal, means for receiving and decoding said transmitted signal to derive said distorted signal, means for removing said interfering signal component of said received decoded distorted signal to derive a communication signal having a distorted envelope, and means for restoring the original envelope of said received distorted communication signal.

13. In a secret telecommunication system, apparatus for utilizing an interfering signal to increase the transmission security of a communication signal comprising a circuit for mixing said communication signal and said interfering signal, means for compressing said mixed signals to provide a distorted signal having an envelope of uniform amplitude, means for coding said distorted signal, means for transmitting said coded signal, means for receiving and decoding said transmitting signal to derive said distorted signal, means for expanding said distorted signal to derive said mixed signal, and means for removing said interfering signal from said mixed signal to derive said communication signal.

14. A secret telecommunication system including a source of communication signals, a source of interfering signals of a frequency within the frequency band of said communication signals, means for rejecting said interfering frequency from said communication signals, means for combining said interfering signal with communication signals lacking said interfering signal frequency component derived from said rejecting means, a signal amp'itude compressing circuit responsive to said mixed signals for deriving a distorted signal having an envelope of uniform amplitude, means for coding said distorted signal, means for transmitting said coded signal, means for receiving and decoding said transmitted signal, means for selecting said interfering signal component of said received decoded distorted signal to derive a control signal, a signal amplitude expanding circuit responsive to said received decoded distorted signals and to said control signal for restoring the original envelope of said combined signals, means for rejecting said interfering component of said expanded combined signals, and means for deriving said communication signal from said received signal rejecting means.

15. In a secret telecommunication system including a source of communication signals, a source of interfering signals of a frequency within the frequency band of said communication signals, first filter means for rejecting said interfering frequency from said communication signals, means for amplitude additively combining said interfering signal with communication signals lacking said interfering signal frequency component derived from said filter means, a signal amplitude compressing circuit comprising a variable gain amplifier and a signal detector responsive to said mixed signals, means for deriving control bias potentials from said detector for controlling the gain of said amplifier for deriving from said amplifier a distorted signal having an envelope of uniform amplitude, means for coding said distorted signal, means for transmitting said coded signal, means for receiving and decoding said transmitted signal, means for selecting said interfering signal component of said received decoded distorted signal to derive a control signal, a signal amplitude expanding circuit responsive to said received decoded distorted signals and to said control signal for restoring the original envelope of said combined signal, second filter means for rejecting said interfering component of said expanded combined signals, and means for deriving said communication signal from said received signal rejecting means.

16. Apparatus according to claim 15 including a wave smoothing network connected to said signal detector, said network having a time constant of the order of the lowest communication signal period.

17. In a secret telecommunication transmission system, apparatus for utilizing an interfering signal to increase the transmission security of a communication signal comprising means for mixing said communication signal and said interfering signal, means for deriving from said mixed signals a distorted signal having an envelope of uniform amplitude, means for coding said distorted signal, and means for transmitting said coded distorted signal.

18. A secret telecommunication transmitter system including a source of communication signals, a source of interfering signals of a frequency within the frequency band of said communication signals, filter means for rejecting said interfering frequency from said communication signals, means for amplitude additively combining said interfering signal with communication signals lacking said interfering signal frequency component derived from said rejecting means, a signal amplitude compressing circuit including an automatic bias voltage control network and a variable gain circuit responsive to said mixed signals and to said bias voltage for deriving a distorted signal having an envelope of uniform amplitude, means for coding said distorted signal, and means for transmitting said coded signal.

19. In a secret telecommunication receiving system responsive to a signal transmission source including a source of communication signals, a source of interfering signals of a frequency within the frequency band of said communication signals, means for combining and compressing said interfering signal with said communication signals for deriving a distorted signal having an envelope of uniform amplitude, means for coding said distorted signal, and means for transmitting said coded signal, the improvement comprising a receiver including means for receiving and decoding said transmitted signal, means for selecting said interfering signal component of said received decoded distorted signal to derive a control signal, a signal amplitude expanding circuit responsive to said received decoded distorted signals and to said control signal for restoring the original envelope of said combined signals, means for rejecting said interfering component of said expanded combined signals, and means for deriving said communication signal from said received signal rejecting means.

20. In a secret telecommunication system, apparatus for utilizing an interfering signal to increase the transmission security of a communication signal comprising circuit means for combining said communication signal and said interfering signal to provide a distorted signal having an envelope of uniform amplitude, means for maintaining the amplitude of said communication signal component of said distorted signal remaining substantially unchanged, means for coding said distorted signal, means for transmitting said coded signal, means for receiving and decoding said transmitted signal to derive said distorted signal, and means for segregating said interfering component from said received decoded

distorted signal to derive said communication signal.

21. A secret telecommunication system including a source of communication signals, a source of interfering signals, a modulator responsive to said interfering signals, a mixer circuit responsive to said communication signals and to said interfering signals derived from said modulator, a signal detector responsive to said mixed signals for deriving a control potential, means for applying said potential to said modulator to control the amplitude of said interfering signal applied to said mixer circuit to provide a mixed signal having an envelope of uniform amplitude, means for coding said mixed signal of uniform amplitude, means for transmitting said coded signal, means for receiving and decoding said transmitted signal to derive said uniform amplitude mixed signal, and means for separating said interfering signal component from said received mixed signal to derive said communication signal.

22. A secret telecommunication system including a source of communication signals, a source of interfering signals, a modulator responsive to said interfering signals, a mixer circuit responsive to said communication signals and to said interfering signals derived from said modulator, a full wave signal detector responsive to said mixed signals for deriving a control potential, smoothing filter means for applying said potential to said modulator to control the amplitude of said interfering signal applied to said mixer circuit to provide a mixed signal having an envelope of uniform amplitude, the amplitude of said communication signal component of said mixed signals remaining substantially unchanged, means for coding said mixed signal of uniform amplitude, means for transmitting said coded signal, means for receiving and decoding said transmitted signal to derive said uniform amplitude mixed signal, and means for separating said interfering signal component from said received mixed signal to derive said communication signal.

23. A secret telecommunication system including a source of communication signals, a source of interfering signals, a balanced modulator responsive to said interfering signals, a mixer circuit responsive to said communication signals and to said interfering signals derived from said balanced modulator, a full wave signal detector

responsive to said mixed signals for deriving a control potential, a source of fixed bias potential for said balanced modulator, means including smoothing filter, means for applying said control and bias potentials in opposite polarity to said balanced modulator to control within predetermined limits the amplitude of said interfering signal applied to said mixer circuit to provide a mixed signal having an envelope of uniform amplitude, the amplitude of said communication signal component of said mixed signals remaining substantially unchanged, means for coding said mixed signal of uniform amplitude, means for transmitting said coded signal, means for receiving and decoding said transmitted signal to derive said uniform amplitude mixed signal, and means for separating said interfering signal component from said received mixed signal to derive said communication signal.

24. A secret telecommunication transmitting system including a source of communication signals, a source of interfering signals, a modulator responsive to said interfering signals, a mixer circuit responsive to said communication signals and to said interfering signals derived from said modulator, a signal detector responsive to said mixed signals for deriving a control potential, a source of fixed bias potential for said balanced modulator, means for applying said control and bias potentials in opposite polarity to said modulator to control within predetermined limits the amplitude of said interfering signal applied to said mixer circuit to provide a mixed signal having an envelope of uniform amplitude, the amplitude of said communication signal component of said mixed signals remaining substantially unchanged, means for coding said mixed sigal of uniform amplitude, and means for transmitting said coded signal.

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