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SECRET COMMUNICATION SYSTEM.

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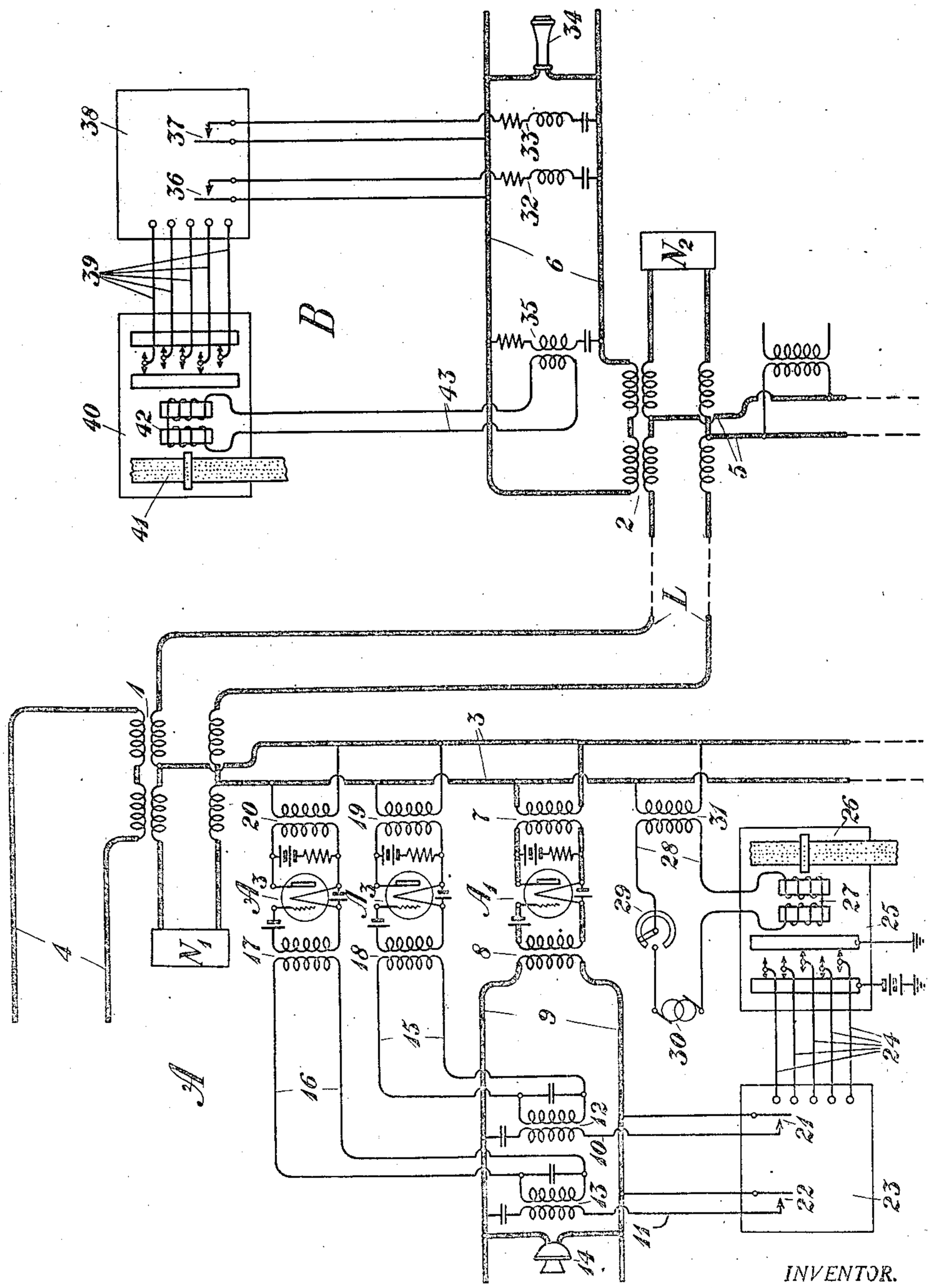
1,369,805. Patented Mar. 1, 1921.



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SECRET-COMMUNICATION SYSTEM.

1,369,805. Specification of Letters Patent. Patented Mar. 1, 1921.

Application filed December 27, 1919. Serial No. 347,717.

To all whom it may concern:

Be it known that I, BAXTER P. HAMILTON, residing at Brooklyn, in the county of Kings and State of New York, have invented certain Improvements in Secret-Communication Systems, of which the following is a specification.

This invention relates to transmission systems and more particularly to a method of and means for insuring secrecy in the transmission of messages over such systems.

It is a general purpose of the invention to provide a system of telephonic communication wherein secrecy may be assured in the transmission of messages between distant stations so that unauthorized persons who may have access to the medium through or over which the messages are transmitted will not be able to obtain information from such messages. The secrecy arrangements of this invention are applicable to both radio telephone systems and to telephone systems employing metallic conductors as the medium of transmission. Accordingly the arrangements of the invention provide means for preventing the possibility of information being obtained from a telephone system either by tapping the wires by direct metallic connection or inductive connection or by being tuned to the frequency of the sending station in a radio system. Other features and purposes of the invention will appear more fully from the detailed description hereinafter given.

In the arrangements of the invention there is associated with the transmitting circuit at the sending station a plurality of tuned shunts, each of said shunts being tuned to be resonant to a particular narrow band of the frequencies of the telephonic current. A sufficient number of differently tuned shunts may be provided to practically cover the voice range of frequencies. These tuned shunts are controlled by a selecting device operating in a continuously varying manner in accordance with a predetermined plan or scheme. With this arrangement certain bands of the frequencies of the talking current may be selected and these bands may be amplified and then impressed on the outgoing line. Accordingly certain frequencies of the outgoing telephonic currents may be amplified while others may not be amplified or certain bands may be amplified more than others and the talking current applied to the outgoing line will accordingly be distorted and rendered unintelligible. At the receiving station there is provided a plurality of tuned shunts or absorbing devices which operate to attenuate the frequency bands which were amplified and bring the amplitudes thereof back to their original relation to the other frequencies and so render the voice currents intelligible in a receiver. These tuned shunts or absorbing devices are controlled at the receiving station by a selecting device operating in synchronism with the selecting device at the sending station and operating in accordance with the same predetermined plan or scheme as said device. Accordingly by preserving secrecy as to the plan or scheme of selecting and amplifying the frequency bands at the sending station, or by constantly changing the plan or scheme therefor at both stations, it will be practically impossible for one who has unauthorized access to the medium through or over which the messages are transmitted to obtain the information contained in such messages.

The invention may be more fully understood from the following description taken in connection with the accompanying drawing in the figure of which is illustrated a circuit diagram embodying the arrangements of the invention as applied to a telephone system employing metallic conductors as the conducting medium.

In the drawing is shown a transmission line L interconnecting two stations A and B. The sending apparatus at station A is illustrated in full and the receiving apparatus at station B is shown in full, although each station will include both sending and receiving apparatus. The sending circuit 3 at station A is connected to line L by being bridged across the midpoints of the windings of the three winding transformer 1. Inductively related to line L at station A through transformer 1 is a receiving circuit 4. The line L terminates in a balancing network or artificial line N_1. Associated with the sending circuit 3 through a transformer 7, an amplifier A_1 and a transformer 8 is a local telephone circuit 9 which includes the telephone transmitter 14. Bridged across circuit 9 are a plurality of tuned shunts such as 10 and 11 and other shunts not shown. Each of these shunts is tuned to be resonant to a particular band

of frequencies within the voice range and a sufficient number of differently tuned shunts may be provided to practically cover the entire range of voice frequencies. Associated with each of the tuned shunts, such as shunts 10 and 11, are circuits, such as 15 and 16, which circuits are associated with the sending circuit 3 through transformers and amplifiers, such as amplifiers A_2 and A_3. The amplifiers A_2 and A_3 may be adjusted to give a greater degree of amplification than amplifier A_1, and furthermore the amplifiers A_2 and A_3 may even be adjusted to give different degrees of amplification as between themselves. Accordingly the frequency bands selected by the tuned shunts will be amplified to a greater degree than the other telephonic frequencies from the transmitter 14 and the electromagnetic waves transmitted out over line L will be considerably distorted and will be rendered unintelligible. The tuned shunts, such as 10 and 11, are controlled by switches, such as 21 and 22, included in the printing telegraph receiver 23. The printing telegraph receiver 23 may be of the type illustrated in the U. S. patent to Yorke, No. 1,215,604, issued Feb. 13, 1917, in which a plurality of selecting bars control the printing of characters. In the device 23 the selecting bars may be utilized to control switching mechanisms, such as the switches 21 and 22, and enough selecting bars may be provided to control any desired number of switches. The printing telegraph receiver 23 is associated with the usual type of printing telegraph transmitter 25 by the conductors 24. The conductors 24 are controlled in the usual manner by the customary set of contacts in the printing telegraph transmitter, which contacts are in turn controlled by the perforated tape 26. The perforated tape 26 is moved along step by step by the stepping magnet 27 which in turn is controlled by the circuit 28. Circuit 28 includes a generator 30 generating currents of a frequency outside of the voice range and which for purpose of illustration may be assumed to be of approximately 100 cycles. Circuit 28 is controlled by the distributer 29, the brush of which will come in contact with the segment thereof at certain intervals and momentarily close circuit 28. Every time circuit 28 is closed the magnet 27 will operate to move tape 26 along a step, and also a 100 cycle impulse will be transmitted through transformer 31 and out over line L for the purposes of causing the selecting apparatus at both ends of the system to operate in synchronism as will appear more fully hereinafter.

At station B the line L terminates in the balancing network or artificial line N_2 and includes the three winding transformer 2. Bridged across the midpoints of windings of the three winding transformer 2 is a circuit 5 with which may be associated sending apparatus similar to that already described with respect to station A. The receiving circuit 6 is associated with line L through transformer 2 and includes receiving apparatus such as the telephone receiver 34. Bridged across circuit 6 is a plurality of tuned shunts, such as 32 and 33 and other tuned shunts not shown. One of these tuned shunts is provided across circuit 6 for each of the tuned shunts across circuit 9 and is tuned to be resonant to the same narrow frequency band as its corresponding tuned shunt across circuit 9. Furthermore the impedance of the tuned shunts, such as 32 and 33, is so adjusted that the admittance characteristics of each shunt will serve to attenuate the amplified frequencies transmitted thereover so as to restore the amplitudes thereof to their original relation to the amplitudes of the other voice frequencies and accordingly remove the distortion and render such voice currents intelligible in the receiver 34. The tuned shunts across circuit 6 are controlled by switches, such as 36 and 37, included in a printing telegraph receiver 38, similar to the device 23 already described with respect to station A. The printing telegraph receiver 38 is controlled by conductors 39 and the contacts of a well known type of printing telegraph transmitter 40 in the usual well known manner. The contacts of transmitter 40 are controlled by a perforated tape 41 which is indentical to tape 26 at the sending station. Tape 41 is moved along step by step by the stepping magnet 42 which is controlled by the circuit 43. Circuit 43 is inductively related to a tuned shunt 35 across circuit 6. Shunt 35 is tuned to be resonant to the frequency of the currents produced by generator 30 and which for purposes of illustration have been assumed to be 100 cycle currents.

The operation of the arrangements of the invention is as follows. When it is desired to talk from station A to station B, the tape 26 will have been inserted in the printing telegraph transmitter 25 and its perforations will have caused the contacts of the transmitter to have assumed a certain arrangement and thereby operated device 23 in an arbitrary manner to close certain of the switches therein. For purposes of illustration let it be assumed that, when talk starts, switch 22 has been operated and the shunt 11 closed thereby. The voice currents will be transmitted from the transmitter 14, over circuit 9, through transformer 8, through amplifier A_1 which is adjusted to give low gain, through transformer 7 over circuit 3, and out over line L. The shunt 11 however is tuned to be resonant to a certain narrow band of frequencies within the frequency range of these voice currents. Accordingly

the portion of the voice currents within this frequency band will be transmitted over shunt 11, through transformer 13, circuit 16, transformer 17, through amplifier A_3, transformer 20, circuit 3, and thence over line L. The amplifier A_3 may be adjusted to give a greater degree of amplification than amplifier A_1 and accordingly the frequencies of the currents within the narrow frequency band will be amplified to a greater degree than the other frequencies of the voice currents and accordingly the currents transmitted out over line L will be distorted and rendered unintelligible. These currents in distorted form will be transmitted from line L through transformer 2 and over circuit 6 at station B. It is pointed out that the tape 41, which is identical to the tape 26 will have been inserted in the telegraph transmitter 40 in the same relative position with respect to its perforations as tape 26 and accordingly the contacts of transmitter 40 will have assumed an arrangement similar to the contacts of transmitter 25 and will have caused the device 38 to have operated to control certain of its switching mechanism in a similar manner to device 23. Let it be assumed that the device 38 has closed switch 36 and thereby closed shunt 32. Shunt 32 is tuned to be resonant to frequencies within the same band as shunt 11. Accordingly that portion of the incoming voice currents of frequencies within said band and which was amplified out of proportion to the other frequencies will be transmitted over shunt 32. The impedance of shunt 32 is so adjusted that the admittance characteristics of the shunt will serve to sufficiently attenuate these amplified frequencies to restore them to their original amplitude relation to the other frequencies of the voice currents and accordingly when the voice currents are transmitted through receiver 34 the distortion will have been removed and the voice currents rendered intelligible. As the talk continues from station A the distributer 29 will at intervals close the circuit 28 and operate the stepping magnet 27 and move tape 26 along another step. The new set of perforations in tape 26 will cause a new arrangement of the contacts of transmitter 25 and a new operation of device 23 and cause a different one of the tuned shunts across circuit 9 to be closed. Accordingly a different frequency band will be selected and impressed on the line in amplified form and the voice currents distorted in a different manner. However the closing of circuit 28 will also cause a 100 cycle impulse to be transmitted through transformer 31, over circuit 3, and out over line L. This 100 cycle impulse will be transmitted over circuit 6 and through the shunt 35 which is tuned to be resonant to this frequency and thence will be transmitted over circuit 43 and will operate the stepping magnet 42 simultaneously with the aforementioned stepping magnet 27. The magnet 42 will move the tape 41 along a step and thus change the arrangement of contacts and switches in devices 40 and 38 in an identical manner to devices 25 and 23. Accordingly every time a new tuned shunt is closed across circuit 9 and the manner of distorting the outgoing voice currents is thereby varied, a corresponding new tuned shunt will be closed across circuit 6 for removing the distortion. With this arrangement the outgoing voice currents may be distorted in a manner continuously varying in accordance with a predetermined plan or scheme, as determined by the selection of a key tape. Accordingly by maintaining secrecy as to the key tapes utilized or by frequently changing the identical key tapes, at each station, it will be impossible for one who has unauthorized access to the transmitting medium to obtain information from the messages transmitted therethrough or thereover.

While the arrangements of the invention have been illustrated in a transmission system employing metallic conductors as a transmitting medium, it is understood that they may equally well be employed in a radio system. Furthermore while the nature of the message currents has been referred to as telephonic, it is understood that the arrangements of the invention are applicable to systems in which the message carrying currents might be of a nature other than telephonic. While tuned circuits have been referred to as the selective means for picking out the various frequency bands, other selective devices, such as band filters of the types illustrated in the U. S. Patents #1,227,113 and #1,227,114 to G. A. Campbell may equally well be used. Accordingly while the arrangements of the invention have been disclosed as embodied in certain specific arrangements which are deemed desirable it is understood that they are capable of embodiment in many and widely varied forms without departing from the spirit of the invention as defined in the appended claims.

What is claimed is:

1. In a transmission system including a sending station and a receiving station the method of maintaining secrecy in the transmission of messages between said stations which consists in distorting the outgoing message currents by subjecting certain of the frequency bands of said currents to unequal degrees of amplification, and in restoring the amplitude relation of the several frequency bands of said message currents to normal at the receiving station by subject-

ing certain of the frequency bands of the incoming message currents to unequal degrees of attenuation.

2. A transmission system including a sending station and a receiving station, a transmitting circuit at said sending station, means for selecting certain of the frequency bands transmitted over said circuit, means for amplifying said selected frequency bands to a greater degree than the other of said frequency bands, means for transmitting all of said frequency bands to said receiving station, means at said receiving station for attenuating said selected frequency bands to a greater degree than the other frequency bands.

3. A transmission system including a sending station and a receiving station, a transmitting circuit at said sending station, means for selecting certain of the frequency bands transmitted over said circuit, means for amplifying said selected frequency bands to a greater degree than the other of said frequency bands, means for transmitting all of said frequency bands to said receiving station, means at said receiving station for attenuating said selected frequency bands to a greater degree than the other frequency bands, said first mentioned means and said last mentioned means operating in a variable manner and in accordance with a predetermined plan.

4. A transmission system including a sending station and a receiving station, an outgoing circuit at said sending station, a telephone circuit associated with said outgoing circuit, a plurality of normally open shunts across said telephone circuit, each of said shunts being tuned to be resonant to certain different bands of the frequencies transmitted over said telephone circuit, a local circuit associated with each of said shunts and with said outgoing circuit, amplifying means in each of said local circuits, means operating in a variable manner and in accordance with a predetermined plan for selecting and closing certain of said shunts, an incoming circuit at said receiving station, a plurality of normally open shunts across said incoming circuit, each of said shunts being tuned to be resonant to a frequency band corresponding to the frequency bands to which said shunts across said telephone circuit are tuned, and each of said shunts having admittance characterstics sufficient to counteract said amplifying means in said local circuits, and means for selecting and closing said last mentioned tuned shunts, said means operating in synchronism and in accordance with the same variable and predetermined plans as the selecting means at said sending station.

In testimony whereof, I have signed my name to this specification this 24th day of December 1919.

BAXTER P. HAMILTON.