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R. D. PARKER ET AL

SECRET COMMUNICATION SYSTEM

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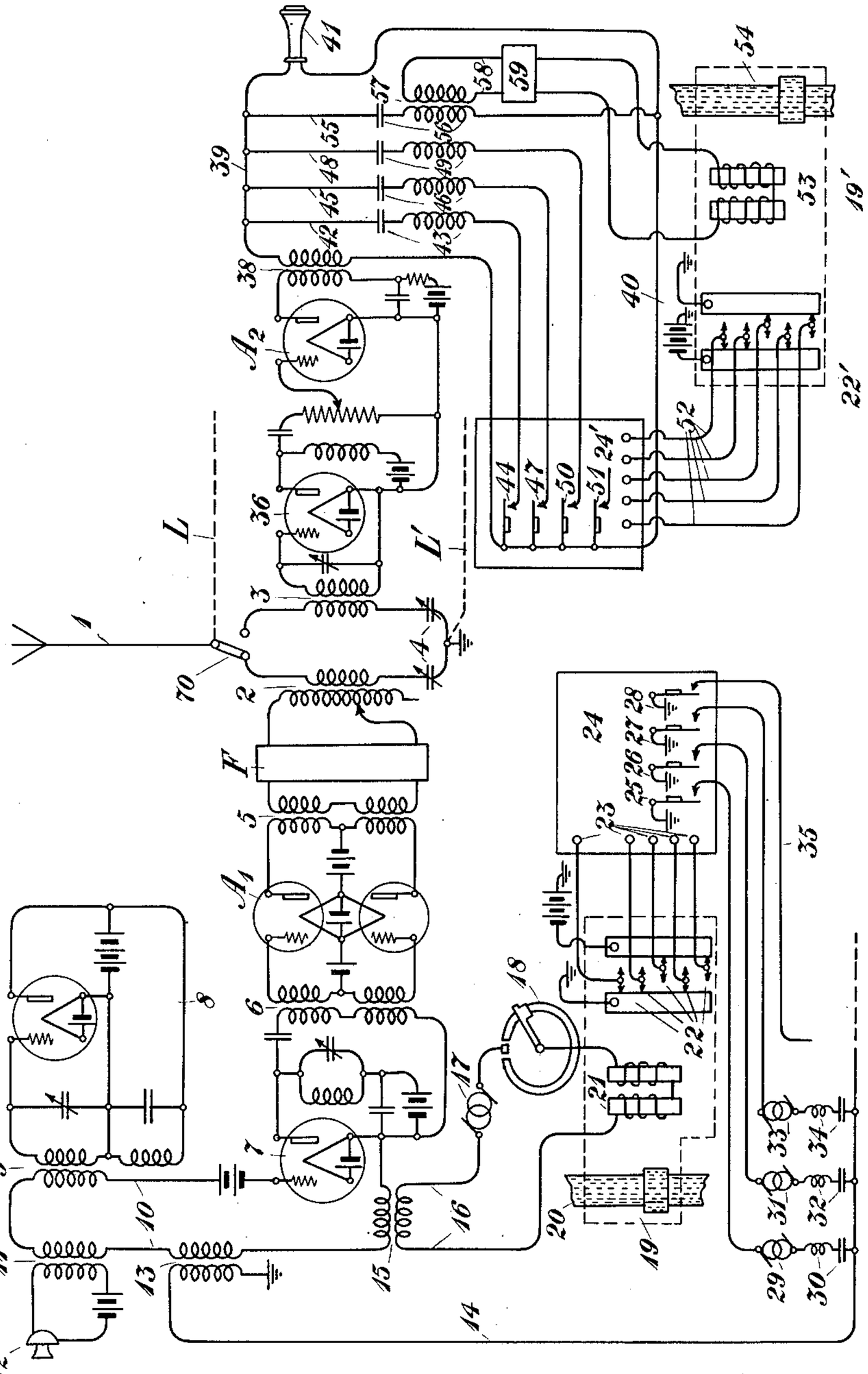

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UNITED STATES PATENT OFFICE.

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SECRET-COMMUNICATION SYSTEM.

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To all whom it may concern:

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

This invention relates to systems of communication and more particularly to arrangements for providing secrecy in the operation of such systems.

It is the general purpose of the invention to insure secrecy in transmission of messages between two or more stations in a system of communication, so that unauthorized persons, who may have access to the medium through or over which the messages may be transmitted, will be unable to receive or read such messages. A further feature of the secrecy arrangements of the invention consists in the fact that they are applicable both to systems of radio telephone transmission in which the messages are transmitted through the ether, and also to telephone systems employing metallic conductors capable of being tapped. Other purposes and features of the invention will appear more fully from the detailed description hereinafter given.

In the arrangements of this invention one or more electromotive forces of constant frequency are superimposed at intervals upon the voice or telephonic frequencies at the sending station for the purpose of distorting the voice frequencies and rendering them unintelligible while being transmitted through the medium connecting the sending station to the receiving station. The distorting frequency or combinations thereof are selected from a group of alternating electromotive forces within and of a range sufficient to cover the voice range of frequencies and are selected in accordance with a particular plan or scheme known only to the sending and receiving stations and are changed at certain intervals of time. At the receiving station are provided a plurality of absorbing devices or shunts tuned to correspond to each of the definite distorting frequencies superimposed on the system at the sending station. A selecting device operating in step or in synchronism and in accordance with the same plan or scheme as the selecting device at the sending station is provided at the receiving station to connect the proper shunt or shunts across the receiving circuit at the proper intervals to absorb or remove the distorting frequencies and thus render the voice currents intelligible in the telephone receiver. The selection of the interfering or distorting frequency and of a corresponding absorbing shunt may be performed by key tapes and equipment similar to that used in printing telegraphy although other arrangements may equally well be employed. To prevent one who is tuned to the transmitting station in a radio system or who may have tapped the wires in a metallic system from connecting similar shunts or absorbing devices across the receiving circuit at his receiving station which would render the voice currents intelligible thereat, the combination of distorting frequencies is varied in a random manner under control of the key tapes over a wide range and the tuned absorbing shunts at the receiving station are varied in the same manner. It is desirable that the distorting frequencies used cover the entire range of audible frequencies used for the reproduction of speech, which frequency range might be between 200 and 3000 cycles. Thirty two definite distorting frequencies might in practice be utilized within these limits, but it is understood that the arrangements of the invention are not specifically limited to this number. However, it is desirable to provide a sufficient number of frequency changes which may be applied to the system to make it impossible for corresponding tuned absorbing shunts to be connected permanently to the system and still allow enough of the voice currents to reach the receiver to be intelligible.

The invention may be more fully understood with reference to the accompanying drawing in which is illustrated a circuit diagram embodying a preferred form of the arrangements of the invention.

In the drawing is illustrated a terminal station for a radio telephone system, in which is included the antenna 1. In the transmitting arrangements associated with the antenna 1 is the telephone transmitter 12

and a local circuit therefor. The local telephone circuit is associated with a main transmitting circuit 10. Associated with circuit 10 is the vacuum bulb oscillator 8 which is of a well known type and which serves to generate high frequency carrier currents. The telephonic variations from transmitter 12 are impressed on the high frequency carrier current from generator 8 by the vacuum bulb modulating apparatus 7. The modulating apparatus 7 may be one of many types well known in the art. Associated with the output circuit of modulator 7 is a high frequency amplifier A_1 which may be of the well known "push and pull" type, although other types may equally well be used. Associated with the output circuit of amplifier A_1 is the filter F, designed to readily transmit a band of frequencies within the range of modulated frequencies from the oscillator 8, but which serves to attenuate and extinguish currents of frequencies outside of this band. Filter F may be of the type illustrated in the U. S. Patents Nos. 1,227,113, 1,227,114, issued to G. A. Campbell on May 22, 1917. The filter F, is inductively related to the antenna circuit by means of transformer 2. The antenna circuit includes the usual tuning devices 4. Associated with the main transmitting circuit 10 through transformer 13 is the circuit 14, with which are associated a plurality of alternating current generators, such as generators 29, 31, 33 and other generators not shown. These generators are adapted to generate currents of different frequencies which are superimposed upon the talking currents to distort said talking currents and render them unintelligible. The alternators indicated in the drawing may be replaced by vacuum tube oscillators or a single oscillator with variable inductance and capacity for obtaining different frequencies. The different distorting frequencies produced by these generators should be within the audible range of frequencies such as between the limits of 200 cycles to 3000 cycles; for example, for purposes of illustration, generator 29 may generate current of 300 cycles, while generator 31 may generate current of 500 cycles, and generator 33 may generate current of 700 cycles. Associated with each of the generator circuits are the tuning devices 30, 32 and 34, which tune said circuits to be resonant to the particular frequency produced by the generators. While only three generators and circuits therefor have been illustrated, it is understood that a considerably larger number of generators and circuits may be associated with circuit 14. The circuits of the generators are controlled by switches, such as the switches 25, 26, 27, 28 and other similar switches not shown in the printing telegraph selecting mechanism 24. The printing telegraph selecting mechanism 24 may be substantially similar to the arrangements illustrated in the U. S. patent to Yorke No. 1,215,604, issued February 13, 1917. In this type of apparatus a plurality of selecting bars are utilized to control the printing of a plurality of characters. However, the selecting bars in the arrangements of this invention may be utilized to control the switching mechanisms 25, 26, 27 and 28, and the number of selecting bars and switches may be varied so as to control any desired number of generator circuits. The operation of the selecting bars in device 24 is controlled by the usual type of printing telegraph transmitter herein illustrated as device 19. The selecting bars are controlled by conductors 23, which in turn are associated with the usual contacts 22, which are associated with bus-bars in the usual manner. The contacts 22 are controlled by the perforated tape 20 in the usual well known manner. A magnet 21 is also provided which moves the tape 20 along step by step as is desired. The magnet 21 is controlled by a circuit 16 which includes a generator 17, which generates currents below the telephonic range of frequencies and which for purposes of illustration may be assumed to be in the neighborhood of 100 cycles. The circuit 16 is closed intermittently by the brush of distributor 18 coming in contact with a segment thereof. When the circuit 16 is closed, the stepping magnet 21 is operated and also a 100 cycle impulse is transmitted through transformer 15 and is superimposed on the high frequency carrier current transmitted out from the antenna 1, for purposes which will be pointed out more fully later.

The receiving apparatus associated with antenna 1 includes a detector 36 which may be one of many types well known in the art. Associated with detector 36 is a vacuum bulb amplifier A_2 which amplifies the incoming messages to a desired degree. Associated with the output circuit of amplifier A_2 is the telephone receiving circuit which includes the conductors 39 and 40, and the telephone receiver 41. Bridged across conductors 39 and 40 of the telephone receiving circuit are a plurality of shunts such as 42, 45 and 48. These shunts include tuning devices 43, 46 and 49, respectively, whereby each one of the shunts may be tuned to be resonant to a corresponding frequency generated by one of the previously mentioned generators at the sending station, such as generators similar to 29, 31, 33, etc. For example, if a generator at the sending station similar to generator 29 was producing currents of a frequency of 300 cycles, the shunt 42 would be tuned to be resonant to 300 cycles. If a generator such as 31 was producing 500 cycle currents, shunt 45 would be tuned to be resonant at 500 cycles. In a

similar manner other shunts would be provided across conductors 39 and 40 to correspond to the number of generators at the sending station and would be tuned to be correspondingly resonant to the frequencies produced by said generators. The shunts 42, 45, 48 and other shunts not shown are normally open and are under the control of switches 44, 47, 50, 51 and other similar switches not shown in the usual type of printing telegraph selecting mechanism 24'. The printing telegraph selecting mechanism 24' is substantially similar to the printing telegraph mechanism 24 heretofore mentioned. The switching mechanisms in device 24' are controlled by conductors 52 and contacts 22' of the usual type of printing telegraph transmitter 19', which is of a type well known in the art. Included in the printing telegraph transmitter 19' is a perforated tape 54 which is identical with the tape being used at the sending station. The tape 54 is moved along step by step by the magnet 53, which in turn is controlled by the circuit 58 which is inductively related to a shunt 57 bridged across conductors 39 and 40 of the telephone receiving circuit. By means of the tuning device 56 the shunt 55 is tuned to be resonant to the 100 cycle currents transmitted from the sending station by a device similar to the circuit 16 and the generator 17 heretofore mentioned.

The operation of the invention is as follows: The telephonic variations produced by transmitter 12 will be transmitted over circuit 10 and will be impressed on the high frequency carrier current from source 8 by the modulating device 7. The high frequency carrier currents, modulated by the voice currents, will then be transmitted through the filter F and thence through transformer 2 and over the antenna circuit to the antenna 1, from which they will be transmitted to a distant receiving station. However, these messages will not be intelligible to anyone having a receiving device tuned to the transmitting station for the following reasons: when it is desired to transmit messages from the antenna 1 to a distant station, the perforated tape 20 will be inserted in the printing telegraph transmitter 19. The tape 20 will in a well known manner control the contacts 22, which in turn will control the selecting bars in the printing telegraph selecting mechanism 24 so as to operate certain of the switches 25, 26, 27, 28, etc., included therein. For purposes of illustration, let it be assumed that the perforations of tape 20 when inserted in the printing telegraph transmitter 19 will operate the printing telegraph selecting mechanism in such a manner as to close switch 25. The closing of switch 25 will complete the following circuit: from ground, armature and contact of switch 25, through the generator 29 and tuning device 30 over conductor 14, lefthand winding of transformer 13 to ground. Upon the closing of this circuit currents, which for purposes of illustration may be assumed to be of 300 cycle frequency, will be transmitted from the generator 29 and through the lefthand winding of transformer 13. These 300 cycle currents will then be applied through transformer 13 to circuit 10 and will thus be superimposed upon the voice currents and the carrier currents transmitted out from antenna 1. These 300 cycle currents will be within the range of frequencies of the voice currents and will be of sufficient magnitude to render them unintelligible. When the perforated tape 20 was inserted in the printing telegraph transmitter 19 the distributor 18 which may be operating continuously will at intervals close the circuit 16 and thereby operate the stepping magnet 21. The stepping magnet 21 will move the tape along step by step. At each step of the tape a new set of perforations will vary the arrangement of contacts 22 and cause the selecting bars in the printing telegraph selecting mechanism 24 to close different combinations of the switches 25, 26, 27, etc. Accordingly, as tape 20 moves along and different combinations of the switches 25, 26, 27, etc., are closed, other of the generator circuits will be completed and the different frequencies therefrom will be impressed on circuit 10 and will distort the telephone currents transmitted out from antenna 1. Accordingly, with this arrangement the distorting frequencies which are sufficient in number and in range to cover the voice range may be superimposed in a widely varied manner and in accordance with a desired plan or scheme on the telephonic currents transmitted out from antenna 1, and will render such telephonic currents unintelligible. Furthermore, every time that distributor 18 closes circuit 16 and operates the stepping magnet 21 to move tape 20 along a 100 cycle impulse will be transmitted from generator 17 through the transformer 15 and will be superimposed upon the outgoing current for purposes which will appear more fully hereafter.

The receiving apparatus at the distant station will be similar in all respects to the receiving apparatus associated with the station herein illustrated, and accordingly reference will be had to the receiving arrangements associated with this station. When telephonic communication is started from the distant station, a perforated tape 54 identical to the tape 20 at the sending station will have been inserted in the printing telegraph transmitter 19' at the receiving station. Tape 54 will be inserted in the printing telegraph receiver in the same position with respect to its perforations as the tape at the sending

end. The incoming impulses from the sending station will be transmitted over the antenna circuit and will be detected and amplified by the detector 36 and the amplifier A_2 in the usual well known manner. These impulses will then be transmitted through transformer 38 and over the conductors 39 and 40 to the telephone receiver 41. These currents would normally not be intelligible in receiver 41, due to the fact that they had been distorted by the distorting frequencies superimposed thereon at the sending station by the apparatus thereat. However, the perforated tape 54 will operate to control the contacts 22′ in a manner identically similar to the tape 20 and the contacts 22 at the sending station. The contacts 22′ will then serve to control the switching mechanisms 44, 47, 50, 51, etc., in the printing telegraph selecting mechanism 24′ in an identically similar manner to the switches 25, 26, 27, 28, etc., in the printing telegraph selecting mechanism 24 at the sending station. Accordingly, for purposes of illustration, when the tape 20 at the sending station has caused the generator 29 to superimpose on the telephone currents a distorting frequency of 300 cycles, the tape 54 will cause a switch such as switch 44 to operate and close the shunt 42 which is tuned to be resonant to 300 cycle frequency. In such an arrangement the distorting frequency will be shunted out over shunt 42 and only the telephonic or voice currents will be transmitted over conductors 39 and 40 to the receiver 41. When the stepping magnet 21 is operated by the closing of circuit 16 at the sending station and moves the tape 20 along so as to superimpose another distorting frequency or frequencies on the telephonic current, the 100 cycle impulse transmitted through transformer 15 and superimposed on the out-going current will be transmitted at the receiving station over the shunt path 55 as this path is tuned to be resonate to a frequency of 100 cycles. This 100 cycle impulse will be transmitted through transformed 57 and over circuit 58 to the device 59, which may be either an alternating current relay or a vacuum bulb rectifier and a D. C. relay, and will operate the device 59. The device 59 will operate the stepping magnet 53, which will move tape 54 along one more step, so that the perforations on tape 54, which is identical to tape 20, will always maintain their relative position with respect to tape 20 and will control the contacts 22′ simultaneously and in a corresponding manner with contacts 22. Accordingly, as tape 20 is moved along and changes the distorting frequencies which are superimposed on the telephone currents at the transmitting station, the tape 54 will be moved along simultaneously and will close across conductors 39 and 40 different combinations of the shunt paths or absorbing devices, so as to shunt out the distorting currents and to render the voice currents intelligible in the receiver.

While the invention has been illustrated herein as adapted for a radio telephone system, it is understood that it may equally well be employed in a system utilizing metallic conductors such as the conductors L and L′ associated with the antenna circuit and the switch 70 thereof. Furthermore, while reference has been made to distorting currents of certain specific frequencies and number, it is understood that the invention is not specificially limited in its operation to currents of these frequencies, such frequencies having been referred to for purposes of illustration merely. Accordingly, while the invention has been disclosed as embodied in certain specific arrangements which are deemed desirable, it is understood that it is 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. A telephone transmission system including a sending station and a receiving station, means at said sending station for intermittently superimposing on the telephone current a distorting current, a normally inoperative shunt across the telephone circuit at said receiving station tuned to be resonant to the frequency of said distorting current, and means for rendering said shunt operative whenever said distorting current is superimposed on said telephone current.

2. A telephone transmission system including a sending station and a receiving station, means at said sending station for superimposing at intervals on the telephone current different distorting currents of certain definite frequencies, a plurality of normally inoperative shunts across the telephone circuit at said receiving station, each of said shunts being tuned to be resonant to a different one of said frequencies, and means for rendering operative the shunt tuned to a particular frequency whenever the distorting current of that frequency is superimposed on the telephone current.

3. A telephone transmission system including a sending station and a receiving station, a plurality of sources of current of certain different and definite frequencies at said sending station, means at said sending station operating in accordance with an arbitrary plan for selecting certain of said sources of current and superimposing the currents therefrom at certain intervals on the telephone current for distorting said telephone current, a plurality of normally inoperative shunts across the telephone circuit at said receiving station, each of said shunts being tuned to be resonant to a different one of said different and definite fre-

quencies, and means at said receiving station operating in accordance with the same arbitrary plan as the selecting apparatus at said sending station for controlling said shunts.

4. A telephone transmission system including a sending station and a receiving station, means at said sending station for rendering the outgoing telephonic signals unintelligible by superimposing thereon certain of a plurality of definite frequencies, said means operating in a variable manner in accordance with an arbitrary plan, and an absorbing device associated with said receiving station for absorbing the superimposed frequencies so as to render the incoming telephonic signals intelligible, said absorbing device operating in a variable manner in accordance with the same arbitrary plan as the first mentioned means at said sending station.

5. The method of maintaining secrecy in the transmission of signals over a system of communication which consists in distorting the outgoing signals by impressing thereon at the sending station in accordance with a predetermined and variable plan a plurality of distorting currents, and in absorbing said distorting currents at the receiving station by passing said currents through a series of shunt devices operated synchronously and in accordance with the same predetermined and variable plan utilized at the sending station.

6. A telephone transmission system including a sending station and a receiving station; said sending station comprising an output circuit upon which the telephonic currents are impressed, a telegraph transmitter controlled by a key tape, a telegraph selecting mechanism controlled by said telegraph transmitter, a plurality of circuits controlled by said telegraph selecting mechanism including sources of distorting current of different and definite frequencies, and means for impressing the currents transmitted over said circuits on said output circuit for distorting said telephonic currents; said receiving station comprising an input circuit, a plurality of normally inoperative shunts across said input circuit each of said shunts being tuned to be resonant to a different one of the frequencies of said distorting currents at said sending station, a telegraph selecting mechanism controlling said shunts, a telegraph transmitter controlling said telegraph selecting mechanism, and a key tape similar to said key tape at said sending station controlling said telegraph transmitter; and means associated with said system for operating said key tapes in synchronism.

7. A transmission system including a sending station and a receiving station; said sending station comprising an output circuit upon which the message currents are impressed, a telegraph transmitter controlled by a key tape, a telegraph selecting mechanism controlled by said telegraph transmitter, a plurality of circuits controlled by said telegraph selecting mechanism including sources of distorting current of different and definite frequencies, and means for impressing the currents transmitted over said circuits on said output circuit for distorting said message currents; said receiving station comprising an input circuit, a plurality of normally inoperative shunts across said input circuit, each of said shunts being tuned to be resonant to a different one of the frequencies of said distorting currents at said sending station, a telegraph selecting mechanism controlling said shunts, a telegraph transmitter controlling said telegraph selecting mechanism and a key tape similar to said key tape at said sending station controlling said telegraph transmitter; and means associated with said system for operating said key tapes in synchronism.

8. The combination with a secret telephone communication system, including a sending station and a receiving station, and means at said sending station for distorting the message currents and rendering them unintelligible, and means at said receiving station for restoring said message currents to their original and intelligible condition, of printing telegraph equipment at said stations for controlling said distorting and restoring apparatus whereby said apparatus will operate synchronously in a continually varying manner and in accordance with a predetermined arbitrary plan.

9. A secret telephone communication system, including a sending station and a receiving station, means at said sending station for distorting the outgoing message currents and rendering them unintelligible, printing telegraph apparatus at said sending station for controlling said last mentioned means whereby said message currents will be distorted in a continuously varying manner, means at said receiving station for restoring said message currents to their original and intelligible condition, printing telegraph apparatus at said receiving station for controlling said last mentioned means, and means for synchronously operating the printing telegraph apparatus at both of said stations.

In testimony whereof, we have signed our names to this specification this 24th day of December, 1919.

RALZEMOND D. PARKER.
BAXTER P. HAMILTON.