

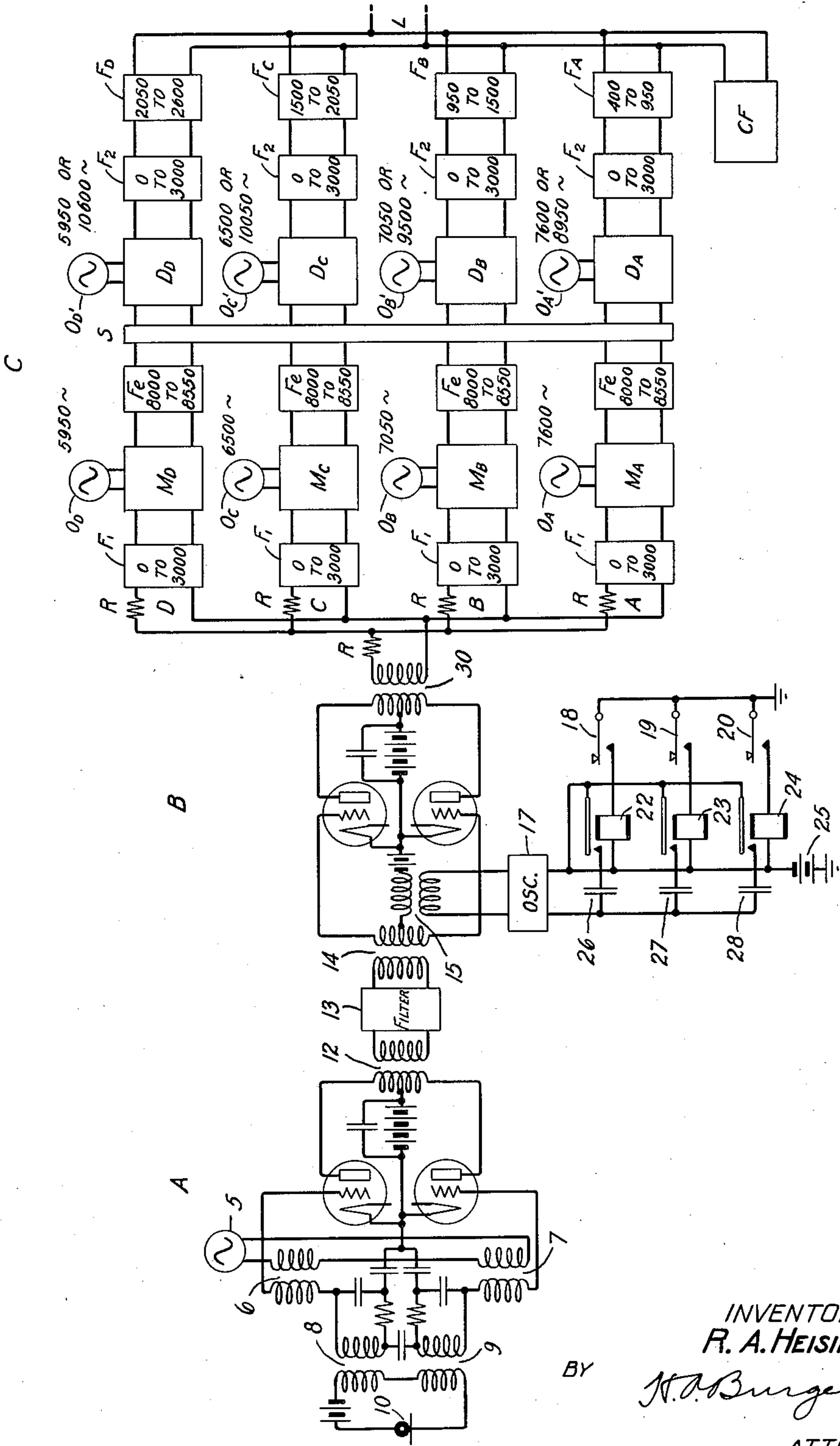
June 10, 1930.

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1,762,984

SECRET COMMUNICATING SYSTEM

Filed Oct. 8, 1928



UNITED STATES PATENT OFFICE

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SECRET-COMMUNICATING SYSTEM

Application filed October 8, 1928. Serial No. 310,966.

The present invention relates to the secret transmission and reception of electrical current waves for signaling at speech or radio frequencies.

5 An object of the invention is to enable a message to be rendered unintelligible when received by the ordinary receiving apparatus, or special apparatus when the receiving operator is unfamiliar with the secret method of
10 transmission in detail.

The principles of this invention are similar to those of the secrecy systems disclosed in Fletcher Patent No. 1,573,924, February 23, 1926, and R. W. Chesnut Patent No. 1,725, 15 566, issued Aug. 20, 1929, on application Serial No. 240,116, filed December 15, 1927 in which the frequency band of the message currents or waves is divided into sub-bands of narrower frequency ranges. In these systems, particularly the latter, secrecy, is obtained by shifting the positions of the sub-bands with respect to one another or by inverting the frequencies of any sub-band within its particular range of frequencies or by
20 shifting the sub-bands and inverting the frequencies within any other sub-band range to which it may be shifted. In this manner combinations of positions and inversions may be made while the transmitted band retains the
25 same overall frequency limits as the original message band. This is desirable from the transmission standpoint since it allows the use of ordinary broadcast and carrier modulation equipment.

30 In the present invention a higher degree of secrecy is obtainable than in the above systems by varying at times the extreme frequency limits in the frequency scale of the sub-bands while maintaining a constant
35 width message band for impressing on the transmitting equipment. Either a band of constant width may be selected from the range of message frequency currents or the entire band may be impressed on the system, 40 the reduction to any constant desirable range being made somewhere within the system.

Specifically this invention provides for shifting the entire band of waves that are destined to be treated in the manner referred to
45 above or disclosed in the Fletcher or Ches-

nut specifications, initially to a new and higher frequency level by means of modulation with a frequency say of 6000 cycles, and then shifting this last band down again to some predetermined level different from the original band by modulation or demodulation with a frequency say of 5900 or 6100 cycles, before the band is split up into its components or otherwise treated for purposes of secrecy. On the basis of the frequencies above
55 given, the original band will be shifted 100 cycles up or down respectively in the frequency scale. The time intervals for shifting may be made any desired length and synchronized with the changes in combinations of the sub-bands. This is especially advantageous because it prevents any one who may have been able to set his beating oscillators to one particular sub-band which is transmitting sufficient energy at the proper frequencies to make it intelligible, to know where to set them to continue picking up this one band.

A better understanding of the invention will be had from the detailed description to follow, in connection with the attached drawings in which the single figure is a partially blocked schematic of one embodiment of the invention.

The system has been divided into three portions for the purpose of description, such as a modulator A, a demodulator B and subdividing circuits C. This latter portion C of the system is identical with that shown in Fig. 1 of R. W. Chesnut patent referred to above and will be described only briefly in this application.

Modulator circuit A, of the well known balanced type, is supplied from an oscillator 5 with any desired modulating frequency through transformers 6 and 7. The signaling band to be modulated is impressed on the modulator circuit through transformers 8 and 9. The primaries of transformers 8 and 9 are connected to a source of signaling frequency such as microphone 10. The output of modulator A is passed through transformer 12 into a filter 13 which selects one side band as will be described hereinafter. From the filter 13 the side band passes through a trans- 100

former 14 and is impressed on the grids of the tubes of the modulator B. The modulator B is supplied through transformers 15 with various modulating frequencies from oscillator 17, the output frequency of which is controlled by keys 18, 19 and 20. These keys cause the actuation of relays 22, 23 and 24, respectively, through a battery 25 which permit the addition or subtraction of condensers 26, 27 and 28, respectively, to and from the tuned control circuit of the oscillator 17.

The output from the modulator B is impressed through transformer 30 on the subdivided circuits of the system shown in portion C. As disclosed in the R. W. Chesnut application, the signaling frequencies pass through the low pass filters F_1 having a 3000 cycle cut-off, and into four channels A, B, C and D having modulators M_A , M_B , M_C and M_D which are supplied with carrier frequencies from oscillators O_A , O_B , O_C and O_D of 7600, 7050, 6500 and 5950 cycles per second respectively. The resistances R are employed to match the impedances of the channels with the impedance of the input transformer 30.

After modulation the signaling band passes through band filters F_e with the common range of 8000 to 8550 cycles per second. The bands are thus reduced to a common frequency level but, of course, taken from different parts of the signaling band. These bands are then interchanged in the frequency spectrum in any desirable combination by the switching apparatus at S which is identical with that shown in Patent No. 1,725,032, issued Aug. 20, 1929, on C. L. Weiss, Jr., application, Serial No. 203,703, filed July 6, 1927. Working in conjunction with the switching apparatus are the demodulators D_A , D_B , D_C and D_D supplied from oscillators O_A' , O_B' , O_C' and O_D' with frequencies of 7600 or 8950 cycles per second from oscillator O_A' , frequencies of 7050 or 9500 cycles per second from oscillator O_B' , 6500 or 10,050 cycles per second from oscillator O_C' and 5950 or 10,600 cycles per second from oscillator O_D' . The bands next pass through filter F_2 having the same cut-off as filter F_1 into band filters F_A , F_B , F_C and F_D passing bands of frequencies from 400 to 950 cycles per second, 950 to 1500 cycles per second, 1500 to 2050 cycles per second and 2050 to 2600 cycles per second, respectively. Compensating filter CF of the type disclosed in Mills Patent 1,616,193 of February 1, 1927 aids the transmission through filters F_A , F_B , F_C and F_D at the cut-off points. A band of frequencies from 400 to 2600 cycles per second is thus put on the line for distance transmission.

Following the operation of the system, if we consider frequencies between 100 and 5000 cycles per second as practically all of those of importance which lie within the signaling band, and the frequency of oscillator 5 as 6000 cycles per second, there will occur two

side bands of frequencies from 6100 to 11,000 cycles per second and frequencies from 5900 to 1000 cycles per second. The filter 13 is constructed to pass only the upper side band of frequencies from 6100 to 11,000 cycles per second which is impressed on the demodulator B. Assuming that the closing of key 18 supplies the demodulator with a frequency of 5900 cycles per second from oscillator 17, then the two resulting side bands are of frequencies from 200 to 5100 cycles per second and 12,000 to 16,900 cycles per second, the latter side band being out of the range of the filters F_1 . However, the 200 to 5100 cycle per second side band is the original 100 to 5,000 cycle per second signaling band, except that it has been shifted 100 cycles. Considering an intermediate frequency of 1000 cycles per second in the original band this frequency now lies at a 1100 cycles per second frequency level.

Assuming that the closing of key 19 produces a demodulating frequency of 6000 cycles per second, the band impressed on the filters F_1 will be 100 to 5000 cycles per second or the original range. If the key 20 produces a demodulating frequency of 6100 cycles per second, then a resulting side band will be from 0 to 4900 cycles per second and a frequency which was originally 1000 cycles per second now lies at a frequency level of 900 cycles per second. As the keys 18, 19 and 20 are thus manipulated, the original signaling band will be shifted 100 cycles per second in either direction before impression on the filter F_1 or impressed on these filters at their original level.

The filters F_1 pass the signaling band of frequencies from zero to 3000, which are modulated and reduced to four bands having the common frequency range of 8000 to 8500 cycles per second as described in the R. W. Chesnut patent referred to above. If the original 1000 cycles per second frequency is modulated in M_B , it will be shifted to 8050 cycles per second, and will, if demodulated in D_C by a frequency of 6500 cycles per second, be shifted to 1550 cycles per second and transmitted at this frequency. When key 18 is closed therefore the 1000 cycles per second frequency will be transmitted at 1650 cycles and when key 20 is closed it is transmitted at 1450 cycles assuming the same conditions in the switching circuits S. A similar operation, of course, occurs for all the frequencies transmitted so that no frequencies or band of frequencies remains natural or in any one position sufficiently long to permit of its intelligible reception.

Frequency shifts of 200 or 300 cycles per second may also be made in the modulator B in any desired order and rapidity. This shifting of the entire band, together with the shifting and inversion of the sub-bands of the system in portion C provides a secrecy

system the output of which will be practically impossible to decipher without knowledge of the combinations used. For instance, it may be desirable to cooperate the shifting of the frequencies of oscillator 17 with the shifting and inversion of the bands by switch keys S, in which case the number of secret combinations may be greatly extended.

In the preceding description the apparatus has been described as a transmitter but the same system is used in the reception and re-establishing of the waves to their original positions. The received waves are impressed on transformers 8 and 9 and proceed to the receivers on line L.

It will be understood that the portion C of the system can be varied widely from that shown. For example any type of "scrambler" or means for mutilating the speech, that is suitable for transmission with secrecy may be used as the portion C of the system. Also the extent of the frequency shifts made in the modulators A and B may be varied, as may also the frequencies which have been mentioned, all of which are to be considered as illustrative only and not as limiting. The scope of the invention is defined in the claims.

What is claimed is:

1. In secret transmission of signaling waves comprising a band of frequencies sufficiently wide to permit intelligible reception, the method comprising selecting the band from different portions of the total available signal frequency range from time to time during transmission, and purposely altering the waves in the band after its selection but prior to their transmission to render them difficult of reception.

2. The method of telephone transmission comprising from time to time selecting from different portions of the speech range a given range of frequencies sufficiently wide to permit intelligible reception, and after its selection subdividing it into relatively narrow sub-bands and rearranging them in the frequency spectrum preparatory to their transmission.

3. The method of secret signaling comprising selecting from speech waves from time to time different bands of frequencies including sufficient components to be understandable, reducing the selected components to occupy the same frequency limits, subdividing the band including between the said limits into relatively narrow frequency bands, rearranging the last mentioned bands with respect to one another and transmitting the rearranged bands to a distance.

4. The method of signal transmission comprising selecting from the signaling waves a band of frequency components sufficiently wide to permit intelligible reception, subdividing said band into relatively narrow portions, rearranging said portions with respect

to one another preparatory to transmitting them, deriving by modulation a band of frequency components within the same limits as the first mentioned band but taken from a different part of the essential signal frequency range, subdividing the last mentioned band into sub-bands, rearranging the sub-bands preparatory to transmission and from time to time repeating the process while deriving the band to be subdivided from respectively different portions of the signaling frequency range.

5. A frequency transposing system comprising a source of frequencies, modulators and demodulators for shifting said frequencies without changing their relative positions with respect to one another, and modulators and demodulators for dividing said frequencies into relatively narrow bands and shifting and inverting said bands with respect to one another for distance transmission, the positions of said original frequencies in said bands being controlled by both sets of said modulators and demodulators.

6. A system for signal transmission comprising means for variably modulating the signaling waves, means for selecting from the modulated waves different bands of signaling components from time to time, said bands having the same frequency limits and respectively representing intelligible portions of the signal which differ from each other as to the frequency ranges that they occupy respectively in the original signal, and means for dividing each of said bands into relatively narrow sub-bands and rearranging said sub-bands preparatory to transmission.

In witness whereof, I hereunto subscribe my name this 6th day of October, 1928.

RAYMOND A. HEISING.