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E. E. CLEMENT

SECRECY SYSTEM OF RADIO BROADCAST DISTRIBUTION

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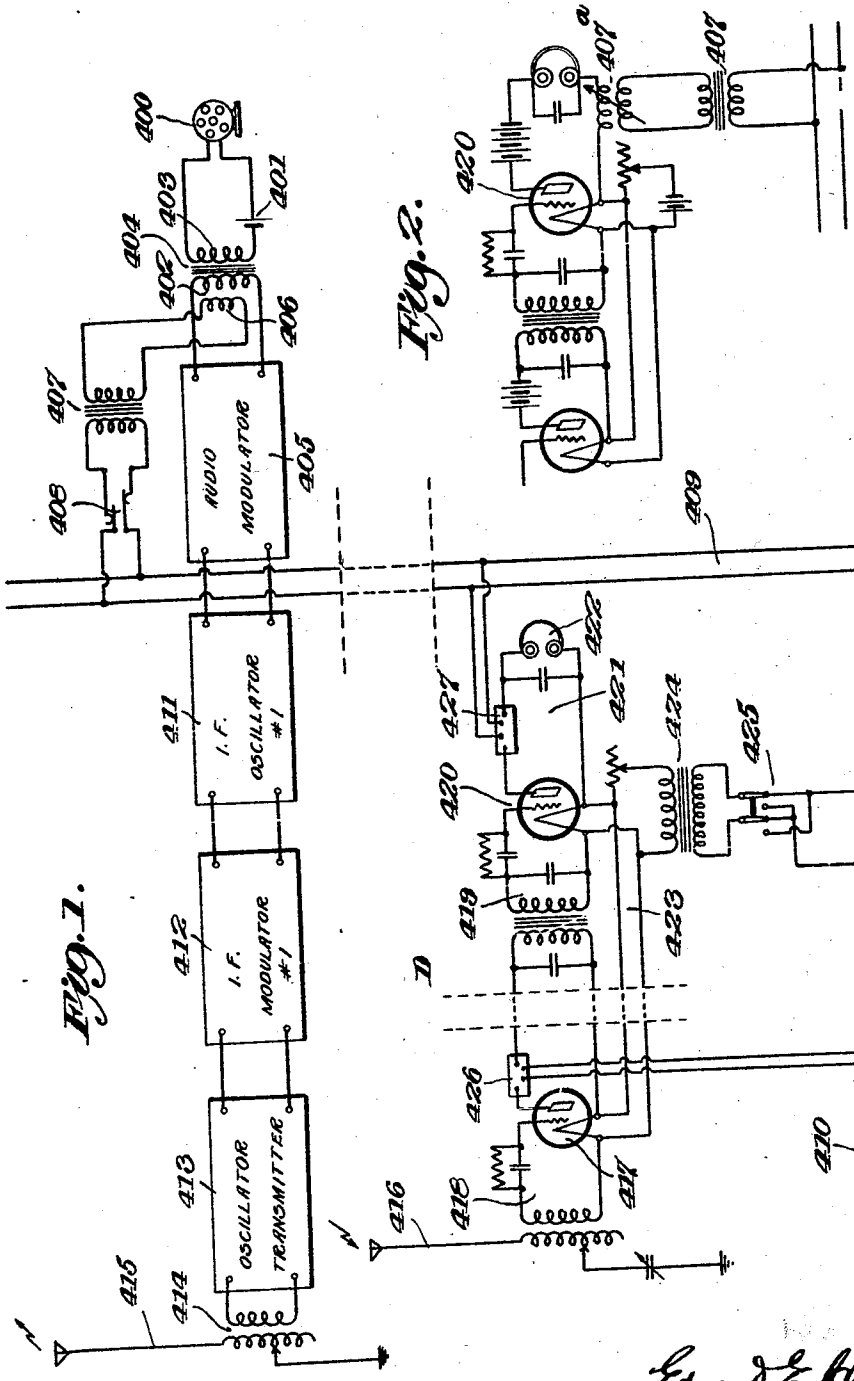


Fig. 1.

Fig. 2.

Inventor

Edward E. Clement

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EDWARD E. CLEMENT, OF WASHINGTON, DISTRICT OF COLUMBIA, ASSIGNOR TO EDWARD F. COLLADAY, OF WASHINGTON, DISTRICT OF COLUMBIA.

SECRECY SYSTEM OF RADIO BROADCAST DISTRIBUTION.

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My invention relates to systems of radio broadcast distribution, and the present application is a continuation in part of my prior copending application, filed October 21, 1925, Serial No. 63,977, patented July 5, 1927, No. 1,635,156. This invention has for its object to provide an organization for the broadcasting of intelligence in which orderly distribution may be secured, with maximum efficiency.

Very briefly stated, this system includes subdivision of the ultimate units or subscribers' stations into local groups in local areas, each group related to a local or regional distributing station; the grouping of these regional stations according to districts and relating each district group of reginal stations to a district master station; the grouping of districts into divisions, which may conveniently coincide with the geographical standard time divisions of the country; and finally the relation of the district master stations to a central master station.

National, district, and local programs will be made up day by day, from which any subscribers may select. Selection is determined by frequencies, which by the use of double modulation may be frequencies of the envelope or intermediate wave transmitted.

The great benefit of double modulation is that a great range of selection can thereby be afforded any local station and any local exchange, which will be the same for all parts of the country and for every exchange down to the smallest hamlet, or the most distant station. In other words, every subscriber in this system may have access to the entire program available to any other subscriber without regard to location, distance, time or circumstances.

The primary object of my present invention is secrecy, with special reference to the system of distribution employing double modulation as above outlined. Briefly stated I attain my object by modulating an audio signal or program on a long or intermediate frequency wave, together with a masking audio frequency wave, for example as that due to a 60 cycle commercial generator. The long or IF wave is then modulated on a short wave carrier and radiated in the usual manner. The IF wave may also be transmitted over a wire circuit, as set forth in my application above referred to, and it will be understood in that case the method of neutralizing the hum would be the same as when the message is transmitted by radiation. In either case the receiving instrument detects and rectifies the carrier wave or waves, and in so doing applies to the audio side of the long wave detector alternating current of the same frequency as that applied at the transmitter, but in opposite phase i. e., with a phase displacement of 180°, which neutralizes the hum in the receiving instrument. Where the masking wave is taken from an alternating current network, the neutralizing wave is preferably taken from the same network, and reversed in phase. A special generator or generators may be provided however, and I am not to be limited to any particular means for producing or applying the masking waves. An important feature of the invention is the use of such a masking wave on a secondary or intermediate frequency carrier wave, in the system employing double modulation. This produces no disturbance to those receiving other modulated waves. By employing the same generator, for supplying both masking and neutralizing waves, changes in frequency can be made at intervals, so as to render it difficult for unauthorized persons to pirate the messages.

My invention is illustrated in the accompanying drawing, in which Figure 1 is a diagram showing a transmitting station and a receiving station provided with one form of apparatus and circuit connections for practising the invention, and Fig. 2 is a diagram of a modification thereof.

This system comprises, generally, an arrangement whereby an audible obscuring hum is produced by suitable connection with a source of alternating current and combined with the audio modulations transmitted so as to render the matter so transmitted unintelligible to unauthorized listeners, and means for supplying the subscriber's receiving sets with alternating current from the same source at a phase displacement of 180° to neutralize the hum at the subscriber's receiver and leave only the desired audible modulations. To prevent annoying non-subscribers who may have ordinary receivers capable of picking up or responding to the carrier waves transmitted by the regional station, the obscured signals are transmitted

by a system of double modulation similar to that previously described so that the ordinary receiver not equipped with means for double demodulation or detection will not respond. Referring to Figure 1 in detail, the reference numeral 400 indicates a pick-up microphone supplied with current from a suitable source 401 and connected through the primary and secondary windings 402—403 of a transformer 404 to an audio modulator 405. A third winding 406 arranged in the magnetic circuit of the transformer 404 is connected in circuit with the primary winding of a bell ringing transformer 407 whose primary winding is connected through a connecting plug 108, suitably shaped to prevent accidental reversal of connections, to a suitable source of alternating current which in the present instance consists of a connection to the mains 109 of a 60 cycle alternating current electric power supply 410. An audible hum is thus combined with the audio modulations supplied to the modulator 405. The audio modulator 405 is connected to the input side of an intermediate frequency oscillator 411 whose modulated output is supplied to an intermediate frequency modulator 412 through which it is modulated onto the waves generated by a short wave or radiating oscillator transmitter 413 connected through coupling 414 to the transmitting antenna 415. The antenna 415 thus transmits a primary wave on which is modulated a secondary or intermediate frequency superaudio wave on which in turn is modulated the intelligible audio waves produced by the microphone 400, in combination or mixed with the audio waves or audible hum produced by the 60 cycle current in the third transformer winding 406. At D is represented one of the several subscribers' stations each of which comprises an antenna 416 and detector tube 417 having its input circuit 418 coupled to the antenna 416 and tuned to the short or primary waves transmitted from the antenna 415. The output circuit of the detector 417 is coupled to the input circuit 419 of a second detector 420 tuned to the secondary or intermediate frequency wave and arranged to detect therefrom the audio modulations and reproduce the same in its output circuit 421 and telephone receiver 422 here shown as a pair of head-phones but which of course may be a loud speaker or other audio responsive device. To neutralize the 60 cycle hum so that only the modulations produced by the microphone 400 will be audible in the receiver 422, the known fact that a receiver whose detector filament circuit is supplied with alternating current produces a 60 cycle hum in its output circuit is taken advantage of by so supplying the filaments of the present receiver, and so connecting the same to the same source of 60 cycle alternating varying potentials tending to produce a 60 cycle hum in the receiver that it will be in opposite phase to that of the hum modulated onto the transmitter at the sending station. To this end the filament circuit 423 is connected through a transformer 424 to the 60 cycle power supply main 409, the connection with the main 409 being made through a reversing or pole changer switch 425 to enable the filament current to be reversed in phase at will, to compensate for any reversal of connections between the sending or receiving stations and the power supply station such as might occur due to repair or alteration of the power wiring system, etc. To make the receiving station completely free of batteries, the plate circuits of the tubes used are supplied with current from the main 409 through "B battery eliminators" 426 and 427 which may be of any known or other suitable form. Except for the substitution of power supply from power mains for the usual A and B batteries, the receiving circuit just described is the same as the receiver for double modulation shown in the publication entitled "Principles of Radio Communication" by J. H. Morecroft, page 683. Where amplification of the intermediate frequency wave is desired, suitable amplifying means may be inserted between the two detector tubes 417—420 in the space between the dotted lines.

Referring to Fig. 2, the vacuum tube detectors are shown provided with the ordinary A and B batteries, while the secondary circuit of the bell ringing transformer 407 is connected through a coupler 407a with the plate circuit of the second detector 420. This obviates any liability to a harmonic or other distorted generation in the detector circuit due to the use of alternating current on the filament. It should be noted in addition, that suitable regulating devices are contemplated wherever needed in the system, as well as phase adjusting devices and such other expedients known in the arts as may be necessary to practice the invention successfully.

I claim:

1. The method of secret signaling which comprises controlling the action of signal transmitting apparatus so as to produce a signal modulated wave carrying also as a masking modulation one of two complementary components which when added together will produce a zero or silent wave, broadcasting the signal modulated wave with its said masking modulation, and separately supplying the other or complementary component by point to point transmission to those receiving stations, in the field of said broadcast component, with which it is desired to communicate.

2. A secrecy system of broadcast distribution comprising a transmitting apparatus

having elements for modulating a carrier wave with a signal, and also with one phase or complementary component of a low frequency current, means for radiating said compound or masked signal wave, means for receiving said wave, and means to supply by point to point transmission the second phase or complementary component of said low frequency current, to those receiving stations only, in the field of said broadcast component, with which it is desired to communicate.

3. A secrecy system of radio broadcast distribution comprising radio transmitting means arranged to radiate waves carrying desired audio modulations and also carrying masking audio modulations, means for point to point transmission in the field of said radiation of waves complementary to said masking waves or modulations, and means for receiving said radiated waves and for combining therewith said complementary waves, at those stations in the field of radiation with which communication is desired.

4. A secrecy system as claimed in claim 3, in which the masking impulses are periodic audio frequency modulations, and the receiving means at desired stations in the field of radiation is supplied with the same periodic current but of opposite phase to the masking component of the modulations received by radiation.

5. A secrecy system as claimed in claim 3, in which current for masking impulses is taken from one portion of an electric light network, and the complementary current for cancelling out said masking impulses at the receiving stations is taken from other parts of the electric light network anywhere within the field of radiation.

In testimony whereof I hereunto affix my signature.

EDWARD E. CLEMENT.