

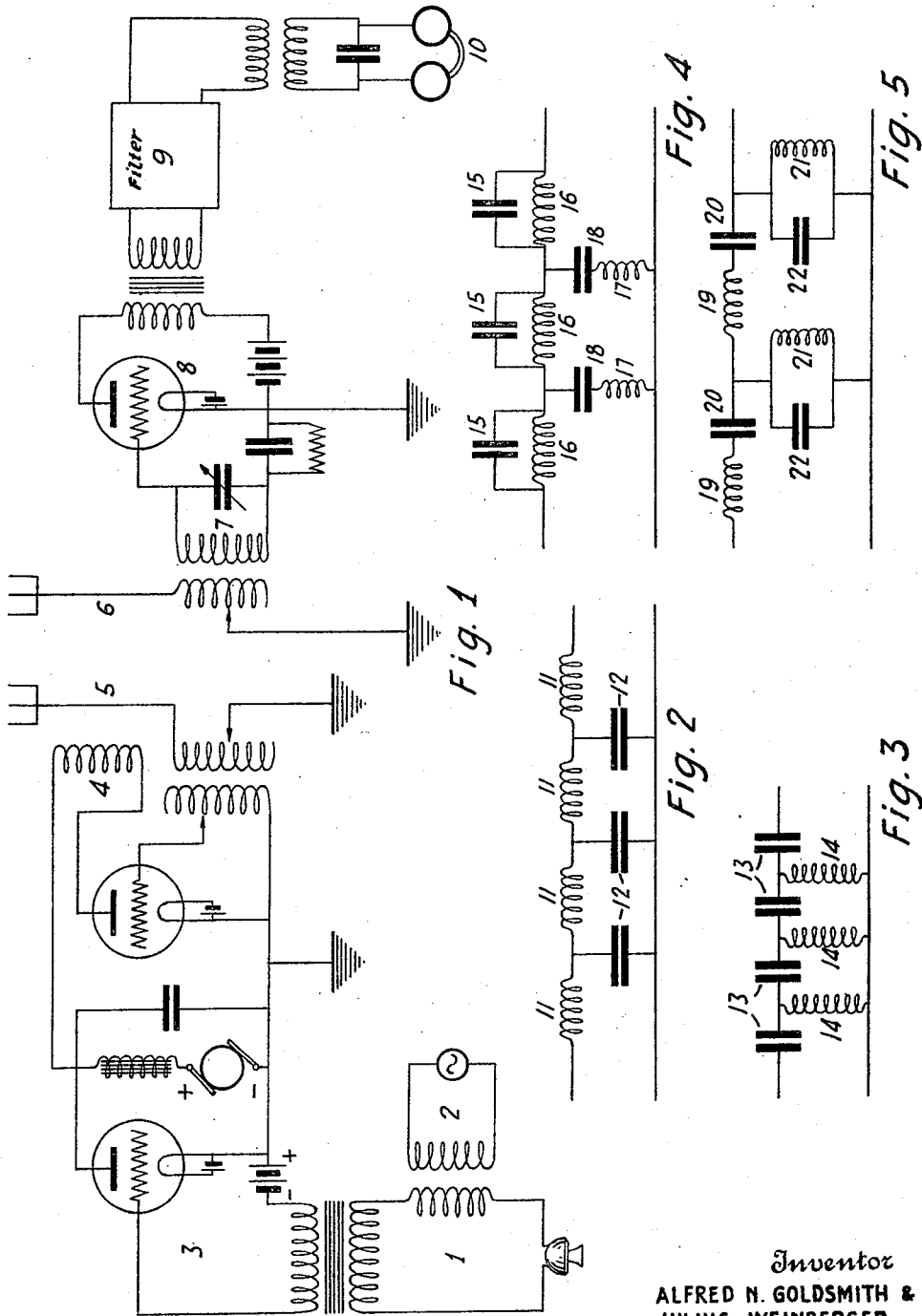
March 22, 1927.

A. N. GOLDSMITH ET AL

1,622,033

RADIOTELEPHONY

Filed May 26, 1922



By their Attorney

Inventor
ALFRED N. GOLDSMITH &
JULIUS WEINBERGER

W. J. Adams

UNITED STATES PATENT OFFICE.

ALFRED N. GOLDSMITH AND JULIUS WEINBERGER, OF NEW YORK, N. Y., ASSIGNORS
TO RADIO CORPORATION OF AMERICA, A CORPORATION OF DELAWARE.

RADIOTELEPHONY.

Application filed May 26, 1922. Serial No. 563,836.

This invention relates to methods and apparatus for accomplishing limited or restricted communication between radio transmitting and receiving stations. While the invention may be generally useful under some circumstances, in radio signaling it is particularly applicable to preventing unauthorized reception in radio telephony. In broadcasting systems as used at present any person having a radio receiving set capable of receiving the wave length on which the music or speech is transmitted may derive full benefit therefrom regardless of whether such person or persons contribute toward the cost of operation of the broadcasting station. It is therefore desirable in some cases to limit the reception to authorized stations, which type of service we term "narrowcast transmission".

It is also desirable to provide a method and apparatus in which the receiver can be sold outright but which will permit the transmitting station to exact a charge at certain intervals from its subscribers.

The general objects of the invention are to fulfill the above requirements. The more particular objects of the invention will appear more fully in the course of the following description.

The novel features which we believe to be characteristic of our invention are set forth with particularity in the appended claims. Our invention, itself, however, both as to its organization and method of operation will best be understood by reference to the accompanying drawing in which Fig. 1 is a diagrammatic representation of a transmitting and a cooperating receiving station utilizing the invention.

Figs. 2 to 5 are diagrammatic representations illustrating certain kinds of electrical filter circuits applicable to "narrowcast receivers".

In accordance with the invention we add to the outgoing music or speech powerful interfering tones which distort the transmission and which would spoil the quality of the reception in an ordinary receiver, and then eliminate the interfering tones or tones in our receivers. The tones or tones may be added to the transmitted wave in various suitable ways and eliminated from the receiver in any suitable manner. The added interfering frequencies may be practically any frequencies which will produce an audible tone or tones in an ordinary receiver, but preferably frequencies will be selected which are not likely to occur frequently in the music or speech which is to be transmitted. By way of example the following interfering tones may be used which may be sent continuously or at regular or irregular intervals.

(a) Very low tones below the normal range of frequencies of speech or music; e. g. 30 cycles per second.

(b) High tones above the normal range of frequencies of speech or music; e. g. 2500 cycles and over.

(c) Tones in the normal range of musical or speech frequencies, but preferably at frequencies between two of the frequencies used in the scale of "international pitch" such as is employed by orchestras or any other pitch employed, and preferably also such frequencies as are not important in speech for the case of speech.

(d) Two tones or two ranges of tones, separated by a few cycles per second, so that they will produce marked beats.

(e) Two tones, or sets of tones at markedly discordant intervals.

(f) One or more tones, the frequencies of which are varied in any desired fashion within any desired range or ranges, for example in the zones of frequencies midway between the frequencies of tones in the scale of international pitch.

(g) Any combination of the above.

To accomplish the reception of the transmitted waves any suitable acoustic or electrical filtering means may be used to eliminate the added frequencies, but we prefer to use electrical filters in which case the requirements for receiving waves transmitted in accordance with (a) to (g) will be as follows:

(a) A high pass filter for passing all frequencies above the injected low tone and cutting out the latter.

(b) A low pass filter for passing all frequencies below the injected high tone and cutting out the latter.

- (c), (d), (e) and (f) One or more highly selective band filters for cutting out the injected tone or tones, but not affecting appreciably the nearby notes of the scale.

(g) An appropriate combination of the above.

- 10 Any appropriate receiving and transmitting circuits may be used in conjunction with the means for producing and eliminating an interfering tone or tones and it will be understood that the system of Fig. 1 is merely representative of one of the many possible forms which may be used. Referring to this figure, 1 is a telephone circuit for impressing the speech or music on the high frequency transmitting circuits. The interfering tone or tones may be produced and radiated in a variety of ways, either using the same or a different high frequency radiating system. For simplicity the arrangement is illustrated in an arrangement in which the interfering source 2 is directly associated with the telephone circuit, for example, by coupling thereto. The radio frequency circuits shown comprise the amplifying and modulating tube circuits 3 and the oscillating feed back tube circuits 4 for producing the modulated high frequency waves in the antenna 5. These waves will be modulated not only by the speech or music to be received but also by the interfering tone or tones. The speech or music modulated in this manner received by an ordinary receiving station will be of poor quality or even only partly comprehensible and of little practical value for entertainment or other purposes.

- The original quality may be completely restored for a subscriber by means of electrical or mechanical filters of suitable acoustic properties before actuating the telephone or other receiver. The filtering means may be arranged in any appropriate manner relative to the receiver. The receiving circuits shown comprise a receiving antenna 6, receiving circuit 7 and amplifying and detecting tube 8 having its output circuit coupled to the circuit containing the filtering means 9. The telephone or other receiver 10 is connected after the filtering means. By appropriate selection of the frequency characteristics of the filtering means substantially all of the injected undesired tones are eliminated while all of the desired music or speech passes through to the receiver substantially unaffected.

- Although our invention is not specific to the particular type of filter or electrical circuits, in Figs. 2 to 5 a number of known circuits of electrical filters are shown by way of example. The circuit of Fig. 2, comprising for example, a number of meshes

of inductance 11, in series and capacity 12 in parallel (usually termed a "low pass" filter) may by appropriate selection of the values of the inductance and capacity, be made to act as a shunt for all frequencies above 5000 cycles and as a relatively low impedance for frequencies below this value in a well known manner. If an interfering tone above 5000 cycles is used this will not be heard in the receiver, but all frequencies below this value will be heard substantially perfectly, as this type of filter may be constructed or adjusted to have a cut off frequency which is relatively sharp. As practically all of the tones of speech or music are below this frequency the quality of the reception will not be impaired.

Fig. 3 shows a high pass filter comprising a number of meshes of capacity 13 in series and inductance 14 in parallel. If an interfering frequency of 30 cycles is selected the filter will act as a substantially infinite impedance thereto and only the frequencies of the speech or music (which are mainly above this frequency) will pass through to the receiver.

By means of the more complex filter of Fig. 4, which is of known types we may selectively eliminate a desired band of frequencies which correspond to the injected interfering tone or tones of *c* to *g*. The arrangement of Fig. 4, which has meshes of capacity 15 shunted across inductances 16, in series in the line, and inductance 17 in series with capacity 18 across the line, may be adjusted to eliminate a narrow band of frequencies. This band may correspond to a tone or tones between two notes of the international pitch or other pitch used.

Similarly the band filter of Fig. 5, using meshes of inductance 19 in series with capacity 20 in the line and inductance 21 in parallel with capacity 22 across the line, may be adjusted to pass two wide bands of frequencies eliminating a band of frequencies between these.

By an appropriate selection of two or more of the filters two or more frequencies differing widely from each other may be eliminated in case two or more widely different tones are used.

In the actual operation of the system each subscriber will be supplied with filtering means to be connected in his receiving circuits which will eliminate the frequency which the transmitter injects into the speech or music which it transmits. This injected tone will be changed at the transmitter at regular times and the subscriber will then find it necessary to purchase new filtering means which will be supplied only by those in control of the transmitting station.

In order to make it difficult to duplicate the filtering means, thereby avoiding payment of a subscription fee, we preferably

pour cement around the impedances which makes it exceedingly difficult to discover and duplicate the combination as the destruction of the cement block without damaging the elements is a tedious and troublesome process.

From the foregoing it will be seen that practically any receiving station may be readily equipped for this type of narrow cast reception and the apparatus for this purpose may be sold outright to those subscribing to the desired entertainment.

Having described our invention, what we claim is:

1. In a radio signaling system, a method of restricted communication which consists in generating radio frequency oscillations, modulating said oscillations in accordance with a signal current and a confusion alternating current, said confusion current having a minimum frequency of 2500 cycles per second, and transmitting said modulated oscillations.

2. In radio signaling systems, a method of restricted communication between transmitting and receiving stations, which consists in generating radio frequencies, modulating the radio frequencies in accordance with said communication, modulating the transmission at an interfering tone frequency differing from the frequencies generally existing in said communication, said interfering tone comprising beat notes produced by two tones separated by a few cycles per second, filtering out the interfering tone at the receiving station and receiving the desired communication.

3. In radio signaling systems, a method of restricted communication between transmitting and receiving stations, which consists in generating radio frequencies, modulating the radio frequencies in accordance with said communication, modulating the transmission at as interfering tone frequency intermediate to two of the note frequencies of a standard musical pitch, filtering out the interfering tone at the receiving station and receiving the desired communication.

4. In a radio signaling system, the combination of a transmitter, means for generating an interfering tone of a frequency differing from that of a tone of standard musical pitch, and a receiver having filtering means for eliminating said interfering tone.

5. In a radio signaling system, the combination of a transmitter, means for modulating the radiation from said transmitter in accordance with a desired communication and at a frequency corresponding to an interfering tone of a frequency differing from that of a tone of standard musical pitch, and a receiver having filtering means for eliminating said interfering tone.

6. In a radio signaling system, the combination of a radio telephone transmitter, means for radiating an interfering tone of a frequency differing from that of a tone of standard musical pitch, and a receiver having filtering means for eliminating said interfering tone.

7. In a radio signaling system, the combination of a radio telephone transmitter, means for radiating an interfering tone of a frequency differing from that of a tone of standard musical pitch, and a receiving station having an electrical filter adapted to eliminate said interfering tone.

8. A radio telephone transmitting station for restricted communication having means for modulating radiations in accordance with a desired communication, and means for introducing in the transmission an auxiliary effect adapted normally to produce audible tones interfering with the comprehension of the reception of the desired communication, said audible tones consisting of frequencies varied in a range intermediate of the frequencies of tones in the scale of international pitch.

9. A radio telephone transmitting station for restricted communication having a single means for modulating the radiation in accordance with a desired communication, and means for introducing in the transmission an auxiliary effect adapted to normally produce audible tones interfering with the comprehension of the reception of the desired communication, said audible tones consisting of frequencies within a range of frequencies intermediate of that of tones in the scale of standard pitch.

10. A radio telephone transmitting station for restricted communication comprising a pair of radio telephone transmitters, operating on substantially the same wave lengths, one being modulated by normal communication and the other by interfering tone of a frequency differing from that of a tone of a standard musical pitch.

11. In a radio signaling system means for generating a radio frequency, means for modulating said radio frequency in accordance with an audio frequency, means for modulating said radio frequency in accordance with a confusion frequency having a frequency component within the range of the audio frequency and differing from the frequency of a tone of a standard musical pitch, and means for transmitting said last modulated radio frequency.

12. The method of receiving high frequency oscillations which have been modulated in accordance with an audio frequency and also in accordance with a confusion current having a frequency component within the range of audible frequencies and differing from the frequency of a tone of a stand-

ard musical pitch, comprising demodulating said oscillations, and filtering said confusion currents from said audio frequency.

13. In radio signaling systems, a method
5 of receiving restricted communications comprising the steps of demodulating the radio frequency to produce an audio frequency band having a range of frequencies includ-

ing the restricting frequency, said restricting frequency differing from the frequency 10 of a tone of a standard musical pitch, filtering out said restricting frequency, and rendering the communication intelligible.

ALFRED N. GOLDSMITH.
JULIUS WEINBERGER.