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RECEIVER FOR RADIO BROADCAST AND WIRE DISTRIBUTING SYSTEMS

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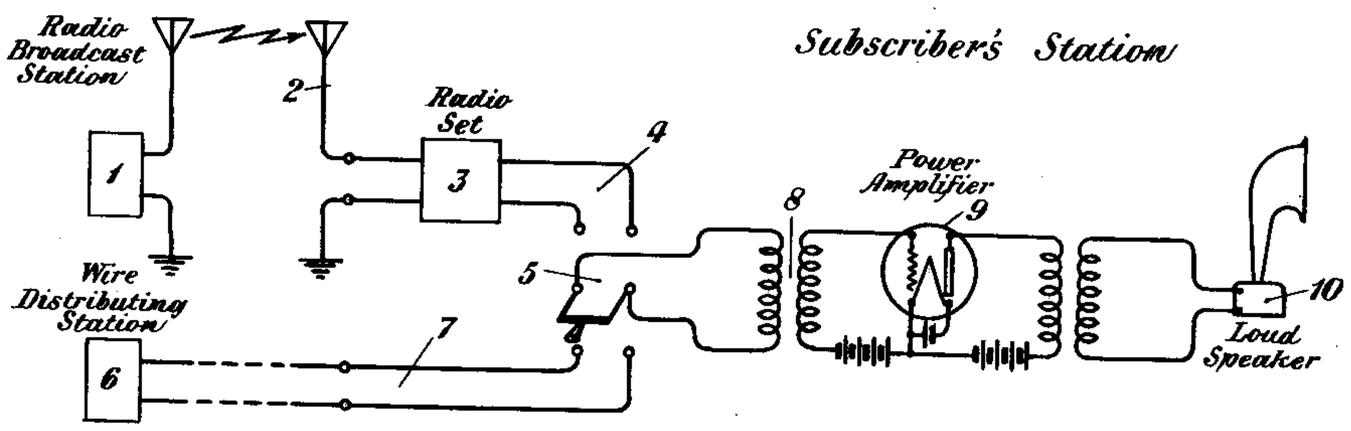

Fig. 1

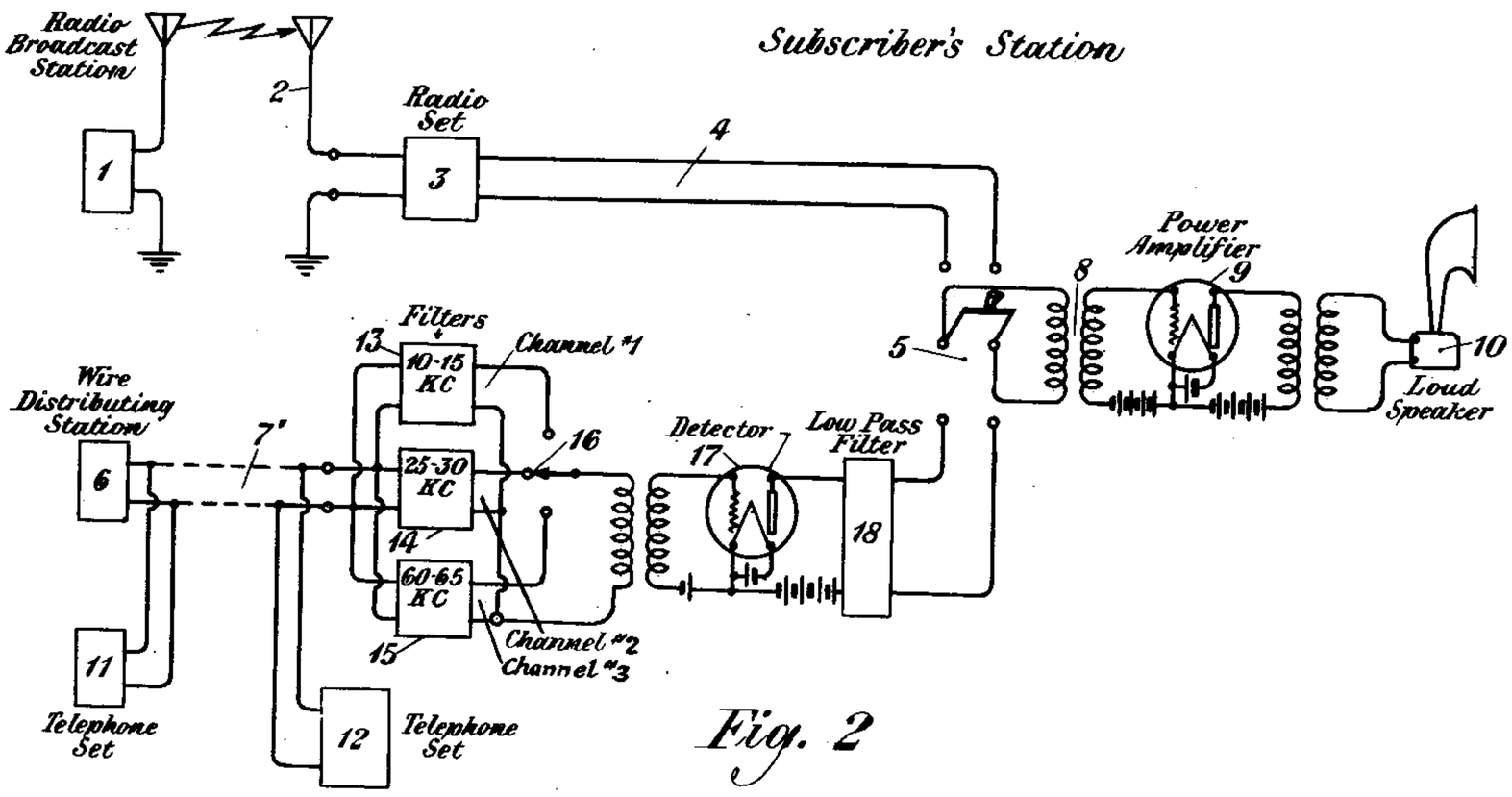

Fig. 2

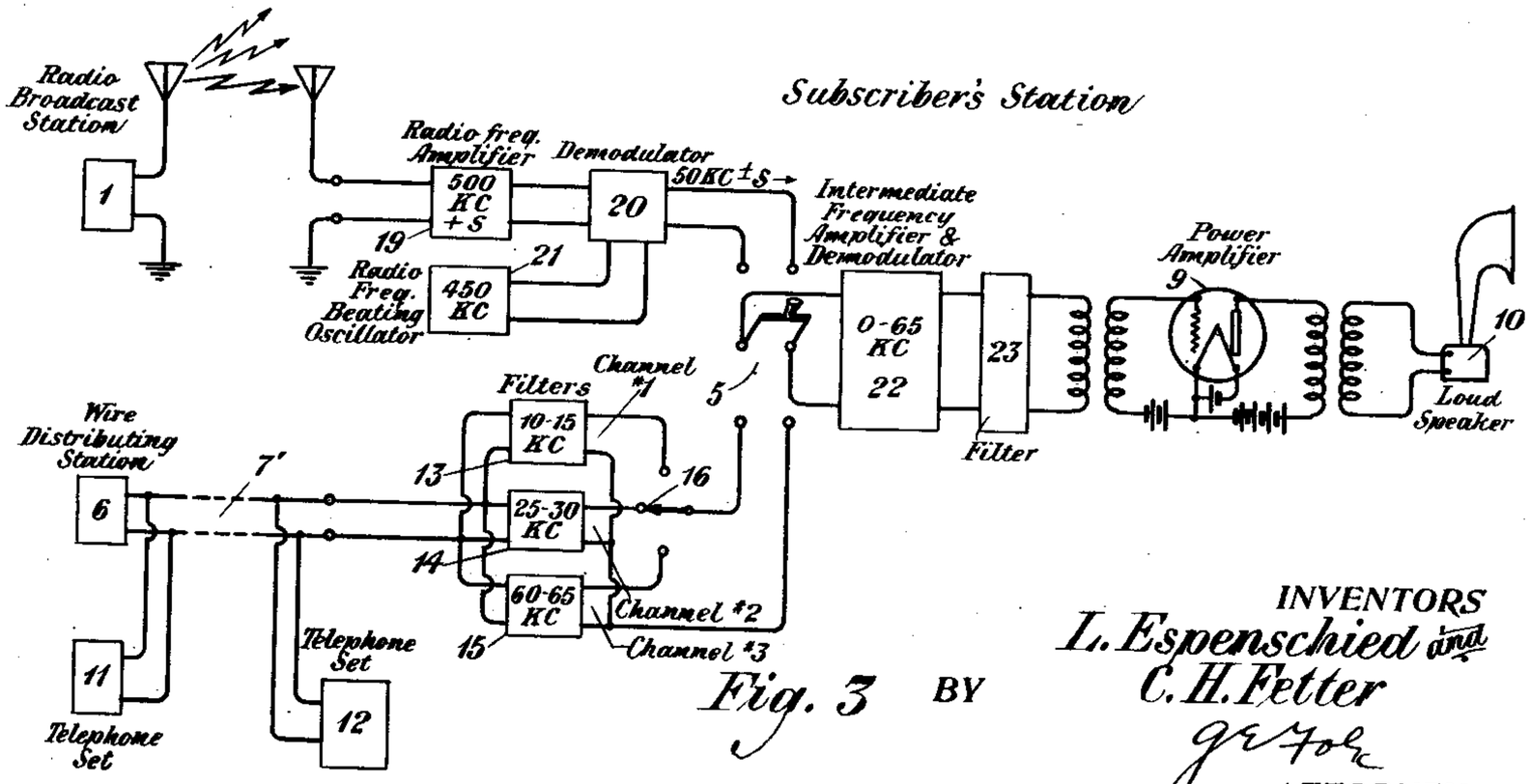

Fig. 3

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UNITED STATES PATENT OFFICE

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RECEIVER FOR RADIO BROADCAST AND WIRE DISTRIBUTING SYSTEMS

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This invention relates to receivers for radio broadcast and wire distributing systems, and particularly to a receiver having a translating circuit common to the wire and radio circuits.

Radio broadcast receivers have become well established in the art, and while some may differ in details, all embody means for detecting the audio frequency signal superimposed upon the radio frequency carrier, and amplifier and some form of receiver such as a telephone receiver or loud speaker. There has recently been developed a system for distributing speech, music or other sounds over wire lines, which wire lines may be employed solely for this class of service, or may be also employed in giving normal telephone service to subscribers. The apparatus for receiving at each station the material distributed over a wire line to a plurality of stations would depend upon the character of such transmission. Thus, if the distributing is effected by sending out over the line an audio frequency current, the apparatus at a subscriber's station for the reception of the said material would require only an amplifier and a loud speaker. If, on the other hand, the wire distributing system employed the principle of carrier transmission by which a plurality of channels are sent over the wire, each consisting of a band of frequencies produced by the modulation of a carrier frequency by an audio frequency, the carrier frequency of each channel differing from that of the others, the receiving apparatus would require a plurality of filters, one for each channel of transmission, and a detector in addition to the amplifier and loud speaker required in the case assumed above.

With the development of the art of broadcasting or distributing, it will be desirable to have a receiver capable of receiving the material broadcasted either by radio or by wire line. Such an arrangement avoids the duplication of apparatus which occurs where separate receiving sets are employed for radio-broadcast and wire-distributed reception.

This invention resides in a receiver capable of receiving material transmitted to the said receiver either by a radio-broadcast system or a wire distributing system, said receiver having means to translate the material received from both sources, which means are common to both the radio system and the wire system.

Other objects of this invention will be apparent from the following description when read in connection with the attached drawings, of which Figure 1 shows schematically a type of receiver that may be employed for radio broadcast and wire distributing reception where wire distributing is effected at audio frequencies; Fig. 2 shows a combined receiver characterized by a demodulator in the receiving end of the wire circuit for the detection of the carrier channels, and Fig. 3 shows an arrangement in which the radio channel is beaten to an intermediate frequency which is within or close to the range of the carrier frequencies transmitted over the wire line, and in which audio frequency detection occurs in a common circuit.

In Fig. 1, 1 represents a radio broadcast station which may be of any type, and 2 represents the receiving antenna of the radio branch of a combined radio broadcast and wire-distributing receiver. The antenna is connected with a radio receiving set 3, which may be of any type capable of detecting the audio frequency signal, such as speech or music, superimposed upon the radio frequency carrier. This audio frequency is impressed upon the output circuit 4 which is connected with the upper contacts of the switch 5. 6 represents a wire-distributing station having suitable apparatus for impressing an audio frequency wave upon the wire line 7. This audio frequency represents speech, music or other sound which is to be transmitted over the line 7 to the subscriber at the subscriber's station. The line 7 is terminated upon the lower contact points of the switch 5. The midpoints are connected through the transformer 8 with the amplifier 9 which may be of any number of stages capable of operating a loud speaker such as 10 connected with the output side of the said amplifier. If the subscriber desires to hear a program which is being broadcasted from station 1, he will

tune the radio receiver 3 for the reception of this program, and will throw the switch 5 to its upper contact points so as to connect the amplifier 9 and the loud speaker 10 with the output circuit, namely, the audio frequency circuit of the radio set 3. If, on the other hand, he desires to listen to a feature being distributed by station 6 over the wire line 7, which transmission takes place at audio frequencies, the subscriber will throw the switch 5 downward so as to connect the wire line with the amplifier 9 and the loud speaker 10. It will accordingly be seen that by means of the arrangements shown in Fig. 1, the amplifier 9 and the loud speaker 10, which apparatus is normally required in connection with the reception of wire-distributed programs, may be employed in connection with the radio set 3 for the reception of radio-broadcast programs, and in this way, duplication of apparatus is rendered unnecessary.

The arrangement shown in Fig. 2 differs from that shown in Fig. 1 in that wire-distributing is effected by means of a plurality of channels, each comprising an audio frequency superimposed upon a carrier frequency, the carrier frequency of each channel differing from that of the others. The radio broadcast receiving branch of the station is similar to that shown in Fig. 1. The wire-distributing station 6 is bridged across the line 7′, which line may be of the type intended also for the transmission of messages between subscribers' stations, and therefore has connected therewith the telephone sets 11 and 12, or it may be a special distributing circuit. At the subscriber's station, there are bridged across the line 7′ a plurality of filters 13, 14 and 15, each of which is intended to select one of the channels transmitted over the line 7′. The number of filters will, of course, depend upon the number of channels, and there may at least theoretically be any number of these. A switch 16 is arranged to connect any selected channel with the input circuit of a demodulator 17. The output circuit of the demodulator is connected with the lower contacts of the switch 5, the connection including a low pass filter 18. The middle contacts of the switch are connected with a terminal circuit, including the amplifier 9 and the loud speaker 10.

In this system, the broadcast subscriber will receive a radio-broadcast program in the same manner as in the system shown in Fig. 1, before described. If he desires to receive one of the features of a program being transmitted over a wire line 7′, he will operate the switch 5 downwardly so as to connect the wire-distributing circuit with the amplifier and loud speaker. He will also operate the switch 16 to select the channel over which the particular material is being transmitted from the distributing station 6. Assuming that it is the channel selected by filter 13, the band representing this channel will be detected by the detector 17, and the audio frequency resulting therefrom will pass through the low pass filter 18 to the amplifier 19, whereby it will be given the proper amplitude to operate the loud speaker 10. In this arrangement, the common terminal circuit embodies the power amplifier and the loud speaker.

The arrangement shown in Fig. 3 is similar to that shown in Fig. 2 in that a plurality of channels are transmitted by means of different carrier frequencies over the telephone line 7′. The arrangement differs from Fig. 2 in that the radio-broadcast channel is not reduced to an audio frequency in the radio branch circuit, but is reduced to an intermediate frequency which is within the range, or close to the range of the wire-distributed channels. This intermediate frequency and the wire-distributed channel frequencies are impressed upon an intermediate frequency amplifier and detector in a common circuit which includes also the power amplifier and the loud speaker. Thus, in the arrangement shown in Fig. 3, the broadcast subscriber's station would preferably include a radio frequency amplifier 19 and a detector 20 having an oscillator 21 connected therewith to reduce to an intermediate frequency the frequencies representing the incoming channel from station 1. This intermediate frequency may be 50 kilocycles plus and minus the audio frequency band. With the switch 5 in its upward position, the intermediate frequency band would be impressed upon the intermediate frequency detector 22 in the common terminal circuit. This detector may have an amplifier connected therewith, and its efficient range may be from zero to 65 kilocycles. Since the intermediate frequency produced by 20 is within the efficient range of the detector 22, the audio frequency signal representing the radio-broadcast program will be readily detected and will pass through the filter 23 and be impressed upon the power amplifier 9 and will operate the loud speaker 10. In order to receive the wire-distributed program, the switch 5 is thrown downwardly, and the switch 16 is operated in order to select the channel over which the desired feature of the program is being distributed. The band representing the desired channel will pass through the switch 5 to the detector 22, and the resultant audio frequency will pass through the amplifier 9 to the loud speaker 10.

It will be seen, therefore, that by means of the arrangements shown in the figures, or by equivalent means, it is practicable to receive at any time the features of either the radio-broadcast programs and wire-distributed programs with a single receiving set in which a substantial part of the apparatus is common to the circuits traversed by the radio-broadcast currents and the wire-distributed cur-

rents. In all these arrangements there will be only three terminations on the receiving apparatus, one for a radio antenna and ground or loop or for the output of a radio receiving set, one at which terminates a telephone line and one at which terminates battery supply for operation. This battery supply may be either local battery, or more preferably, may be a 110-volt power supply, either D. C. or A. C.

While this invention has been disclosed as embodied in particular forms, it is capable of embodiment in other and different forms without departing from the spirit and scope of the appended claims.

What is claimed is:

1. In a system for the reception of wire-distributed and radio-broadcast programs, the combination with a wire line transmitting a plurality of broadcast channels each based on a carrier frequency differing from the others, of a plurality of filters to effectively separate the several channels, switching means connected with the wire line to effectively select one of said channels, a radio-broadcast receiving circuit having means to beat the incoming radio channel to a lower frequency level, an audio frequency terminal circuit having a detector and an audio frequency responsive device, and switching means to connect the said terminal circuit with either the said wire line or the said radio circuit.

2. In a system for the reception of wire-distributed and radio-broadcast programs, the combination with a wire line transmitting a broadcast channel consisting of an audio frequency superimposed on a carrier frequency, of a plurality of subscribers' telephone sets connected with the said wire line, a radio receiving set to receive a band representing a radio-broadcast channel and to beat the frequencies in the said band to intermediate frequencies, a common terminal circuit having means to detect the audio frequency present in the said wire-broadcast channel and also in the radio-broadcast channel as beaten to an intermediate frequency, and a loud speaker connected with said detector, and switching means to connect the said terminal circuit with either the said wire line or the said radio receiving circuit.

3. In a system for the reception of wire-distributing and radio-broadcast programs, the combination with a wire line transmitting thereover a plurality of channels each based on a carrier frequency differing from the others, a plurality of subscribers' telephone sets also connected with said line, a plurality of filters to select the several channels, and switching means to pick one of the selected channels, a radio receiving circuit having means to receive a radio-broadcast channel and means to beat it to an intermediate frequency within or close to the range of frequencies of the wire-channels, a common terminal circuit including an intermediate frequency detector, and a receiver, and switching means to connect the said terminal circuit with either the wire line or the radio receiving circuit.

4. A combined space and wired radio receiving system comprising in combination at a subscriber station a space radio frequency energy collecting system, a line system having means for conveying wired radio signaling currents thereover, a wired radio receiving apparatus, a space radio receiving apparatus and means operative at the subscriber station for employing said wired radio receiving apparatus in connection with said line system for reproducing wired radio signaling currents and employing said space radio receiving apparatus in combination with said wired radio receiving apparatus for receiving signaling energy incident upon said space radio energy collecting system.

5. In combination a radio receiver of the superhetrodyne type having an intermediate frequency amplifier, a wired radio receiving line, and means selectively to connect said line to said amplifier.

6. In combination a radio receiver of the superhetrodyne type having an intermediate frequency amplifier, a separate source of signal oscillations operating at a frequency equal to the frequency of said amplifier, and means selectively to connect said source to said amplifier.

7. In combination a radio receiver having an amplifier stage operating at super-audible frequencies, an amplifier operating at radio frequencies, a line conducting signal oscillations at super-audible frequencies, and means selectively to connect said second mentioned amplifier or said line to said first mentioned amplifier, whereby broadcast or wired radio programs may be received on the same apparatus.

8. In combination, means for collecting space radiated signal energy, a superheterodyne receiver having an intermediate frequency amplifier coupled thereto, a wired radio line, and means for selectively connecting said line to said amplifier and simultaneously disconnecting said collecting means therefrom.

9. A combined space and wired radio receiving system comprising in combination separate high frequency circuits, one arranged to receive signaling energy conveyed by carrier currents over a line wire system and the other arranged to receive signaling currents transmitted through space, a receiving circuit associated with each of said high frequency circuits, frequency changing apparatus connected with each of said receiving circuits, a sound reproducer connected with the receiving circuit which connects with said first mentioned high frequency circuit, and

means for interconnecting the said receiving circuits, and disconnecting said line wire system whereby the frequency changing apparatus as thus combined functions for the reception and reproduction of the signals transmitted through space.

10. A combined space and wired radio signal receiving system comprising in combination a circuit arranged for the reception of signaling energy through space, a separate circuit arranged for the reception of signaling energy conveyed by carrier currents over a line wire system, detecting circuits connected with each of said circuits, and means for coordinating the operation of said detecting circuits whereby said circuits may be employed in combination for the reception of signal currents received through space.

11. A system for receiving space and wired radio programs comprising in combination a pair of independent circuits, one of said circuits being arranged for the reception of signaling energy transmitted through space and the other of said circuits being arranged for the reception of signaling energy by carrier currents over a line wire system, means associated with said first mentioned circuit for decreasing the effective frequency of the signaling energy received through space, means connected with said second mentioned circuit for receiving each of a plurality of separate frequencies corresponding to the frequency of transmission over said line wire system, and switching means for impressing upon said second mentioned circuit either the space signaling energy as changed in frequency, or the signaling energy represented by the carrier currents transmitted over the line wire system.

12. A combined wired radio and space radio receiving system comprising in combination an antenna for intercepting space radio signals, a line system over which wired radio signaling currents are conveyed, a translating circuit connected with the said antenna and including a detector and high frequency generator connected therewith to beat the space radio signals to a frequency within the range of wired radio signals conveyed by the wire line, another translating circuit connected with the said line system and adjusted to receive currents of the frequency transmitted thereover, a signal detector associated with the said other translating circuit to rectify the currents impressed thereon, an audio-frequency amplifier connected with the said signal detector, a sound reproducing device associated with the said audio-frequency amplifier, and means for connecting the said other translating circuit to the said line system for reproducing signals transmitted by wired radio and for connecting the said other translating circuit with the output of the said first-mentioned translating circuit to reproduce the signals transmitted by space radio.

In testimony whereof, we have signed our names to this specification this 19th day of December, 1925.

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CHARLES H. FETTER.