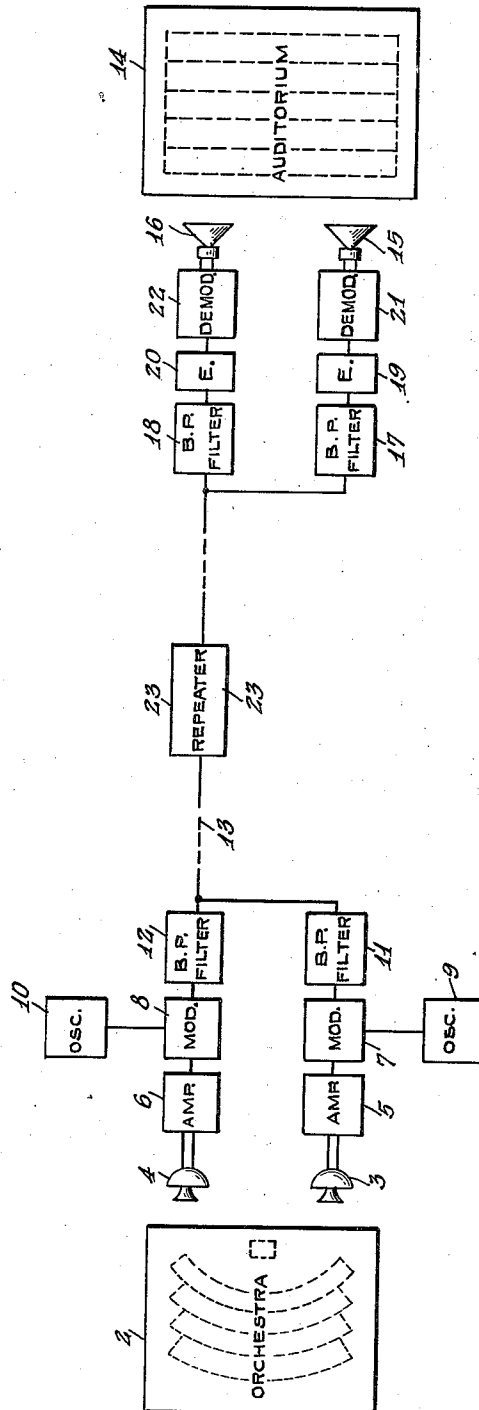


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 PROCESS FOR THE TRANSMISSION OF SOUNDS AND FOR
 THEIR RECEPTION IN THE PROPER VOLUME
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PROCESS FOR THE TRANSMISSION OF
SOUNDS AND FOR THEIR RECEPTION IN
THE PROPER VOLUME

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This invention relates to a method and a system for transmitting and receiving sound in proper auditory manner.

If a concert or a musical play performed on a stage is picked up by a microphone and transmitted to another place where it is reproduced by loudspeakers or head telephones, the proper acoustical and therefore musical effect is mostly lost. Therefore, it has been suggested to install a plurality of microphones on the stage, in different positions, and to conduct the sounds picked up by the microphones to individual transmission lines, and ultimately to receivers individually connected to those transmission lines. The receivers included loudspeakers or head telephones. Thereby the reproduction of the original music was improved. Different methods and systems based on this principal idea have been developed since. One system copies the position of the ears of a listener by arranging two microphones near the place or stage where the orchestra or the musical play are performed, while other systems arrange microphones in places where sounds of different character are originated, such as trumpets, violins, singers, etc., transmitting the sound waves through different channels to the place of reception. If two pick-up microphones are used, copying the position of the ears of a listener, the reproduction in the place of reception is to be done in such manner that the listener receives the sound adequately. If a plurality of microphones is positioned near the place of origin of different sounds, individual different loudspeakers are used in the place of reproduction which reproduce the different sounds.

It is an object of the invention to simplify those methods and systems independently of whether they are used for so-called binaural or for multi-channel transmission.

It is another object of the invention to transmit sounds deriving from a plurality of sources by means of apparatus used in ordinary broadcasting along existing open-air or cable wires.

It is still another object of the invention to transmit simultaneously sounds of different origin along open-air or cable wires without affecting other transmissions through the same channels within ordinary broadcast-range of carrier waves.

It is still another object of the invention to transmit simultaneously sounds of different origin along open-air or cable wires in a simple, efficient and undisturbed manner.

In particular, this application is a continuation in part of application Serial Number 682,922, filed July 31, 1933, and issued into Patent No. 2,110,444, of which I am a co-inventor.

According to my invention the sounds of different origin are picked up by microphones suitably positioned relative to the source of such different sounds, and the electrical impulses of sound frequency produced by the microphones are modulated upon carrier waves of a frequency substantially exceeding 60 kilocycles. The impulses originated in the microphones may be amplified modestly, if necessary, before modulating them upon the high frequency carrier wave. At the place of reproduction the sound impulses are demodulated from the carrier waves and reproduced in suitable devices, such as loudspeakers or head telephones.

The invention may be explained more in detail with reference to the drawing in which a transmitting system according to my invention is shown but in a diagrammatic way only.

In the drawing, 2 is a stage for an orchestra in front of which microphones 3 and 4 are positioned. Any number of microphones may be used, and they may be positioned either in front of the stage or on the stage proper, e. g., near the musical instruments of different character. The sounds picked up by the microphones are transformed by them into electrical impulses which are amplified in the amplifiers 5 and 6, respectively, if desired, and modulated in the modulators 7 and 8 upon carrier waves of sufficiently different frequencies originated by the oscillators 9 and 10. The frequency of these carrier waves is in any case substantially higher than 60 kilocycles, corresponding to a wave length of less than 5000 meters. As shown in the drawing, the modulated carrier waves pass band pass filters 11 and 12, respectively, and then pass along the single transmission line 13. The transmission line may consist of an open-air or cable wire. The modulated carrier waves of different frequencies may be led, however, along different transmission lines. Each modulated carrier wave may then go along a different open-air wire, or pair of wires insulated against each other within the same cable, or arranged in different cables.

The reproduction may be performed to an auditorium 14 by means of loudspeakers 15 and 16, arranged in front of that auditorium in similar relative position as the microphones are arranged in front of the orchestra. Thus, the loudspeaker 16 is controlled by the sounds picked

up by the microphone 4, and the loudspeaker 15 by the sounds picked up by the microphone 3. To this end band pass-filters 17 and 18 are arranged at the end of transmission line 13 whereby the modulated carrier wave which passed the filter 12 is separated by the filter 18 and the modulated carrier which passed filter 11 is separated by means of filter 17. Behind the filters 17 and 18 equalizers 19 and 20 are arranged permitting the amplification and regulation of the intensity of the waves relative to each other, whereupon these still modulated carrier waves are demodulated in the demodulators 21 and 22, and the demodulated sound waves are conducted to the loudspeakers 15 and 16. Low frequency amplifiers, not shown in the drawing, may be applied though high frequency amplification is preferred.

A number of repeaters, including one shown at 23, may be arranged along the transmission line, if necessary.

Instead of a stage for an orchestra there may be arranged a stage for a musical play, for speeches, for broadcasting purposes of any kind, including news, publicity and information.

By using the high frequency range according to this invention, transmission lines can be saved and existing ones, such as open-air lines and cable lines, may be used. If a plurality of lines is used, each of them can be utilized for transmitting one or more different sounds modulated upon sufficiently different high frequency (or short wave) carriers (channels). Thereby, e. g., a concert can be transmitted and reproduced to the highest degree of fidelity because a great number of carriers can be utilized along one line, and therefore, if a plurality of lines is used, the number of carriers can be multiplied accordingly.

Furthermore, if, e. g., concert music is transmitted it is imperative in general to transmit a wide frequency band. That is difficult, if at all possible, when carriers of ordinary broadcasting range are used. If, however, carriers of the high frequency range suggested by my invention are used, wide low frequency bands can be transmitted because those wide low frequency bands can easily be modulated upon carriers of highest frequency. As it is known to the art, not the absolute width of a low frequency band, but the ratio of its width to the frequency of the carrier is decisive. With my invention, amplification of the sounds picked up by the microphone is either not needed or only to a small degree. Thus, for instance, a single tube amplifier will, as a rule, suffice. Furthermore, amplifiers having a flat characteristic and a wide field of amplitude, insuring a regular amplification, are preferred. Amplifiers with steep characteristics and a high degree of amplification are undesirable, as a rule. The tubes of the modulator can be controlled by relatively small amplitudes of the sound waves if carriers of as high frequency as contemplated by my invention are concerned, and this accounts for the relatively small amplification of the low frequencies which satisfies my invention.

At the place of reproduction, amplification of the high frequency waves is advisable. Such amplification may be obtained in the equalizers, or demodulators, shown in the drawing, and low frequency amplifiers may be dispensed with.

By using solely amplifiers for the carrier, a high degree of fidelity of reproduction is assured. If a single line for the transmission is

used, carrier waves must be of sufficiently different high frequency. If a plurality of lines and a single one for each carrier is used, the latter ones may be altogether of the same high frequency. There will be no need for anticipating interference, this having been proven by tests.

If a single line is used and e. g. two carriers are transmitted, as shown in the drawing, one carrier may be e. g. of 300 and the other one of 160 kilocycles. Instead of the loudspeakers shown any other sound reproducing device may be used, such as head telephones.

What I claim is:

1. A method of picking up, transmitting, receiving and reproducing sounds of different character or origin and covering a wide frequency band, comprising the steps of transforming said sounds into electrical impulses by means of a number, including two as a minimum, of microphones arranged to pick up said individual sounds of different character or origin, slightly amplifying and modulating said impulses by means continuously in circuit individually upon individual carriers of a high frequency capable of being modulated by a wide frequency band and exceeding 60 kilocycles, transmitting said modulated carriers along at least one existing aperiodic non-concentric line for transmitting other communications within lower frequency ranges to the place of reception, demodulating said impulses individually from said individual carriers, and retransforming individually said demodulated impulses into acoustical impulses by means continuously in circuit.

2. In a method as described in claim 1, amplifying said modulated carriers on the place of reception by means of amplifiers having a flat characteristic.

3. In a method as described in claim 1, amplifying by means of wide band amplifiers individually said modulated carriers while passing their channel from the place of transmission to the one of reception.

4. A system for transmitting and receiving sound impulses of different character or origin and covering a wide frequency band, comprising a number, including two as a minimum, microphone groups, each of said groups comprising at least one microphone and arranged for picking up sound of individual character or origin, means for generating high frequency carrier waves in a number corresponding to the one of said groups, and of a frequency capable of being modulated by a wide frequency band and exceeding 60 kilocycles, means continuously in circuit for slightly amplifying and modulating said sound impulses originating from each of said microphones individually upon a carrier wave each, means for individually receiving said modulated carrier waves, at least one existing aperiodic non-concentric line for transmitting other communications within lower frequency ranges connecting said transmission and receiving stations for guiding said modulated carriers, means for demodulating therefrom said sound impulses, and means continuously in circuit for reproducing said latter ones.

5. A system for transmitting and receiving sound impulses of different character or origin and covering a wide frequency band, comprising a number, including two as a minimum, microphone groups, each of said groups comprising at least one microphone and arranged for picking up sound of individual character or origin, means

for generating high frequency carrier waves in a number corresponding to the one of said groups and of a frequency capable of being modulated by a wide frequency band and exceeding 60 kilocycles, means continuously in circuit for modulating sound impulses originating from each of said microphones individually upon a carrier wave each, at least one channel common to at least two of said carriers, means for individually receiving said modulated carrier waves, at least one existing aperiodic non-concentric line for

transmitting other communications within lower frequency ranges connecting said transmission and receiving stations for guiding said modulated carriers, wide band pass-filters for separating said carriers, means for demodulating therefrom said sound impulses, and spaced means continuously in circuit for reproducing said latter ones.

6. In a method as described in claim 1, the use of carrier waves within the range of 100 to 300 kilocycles.

JACOBO J. LAUB.