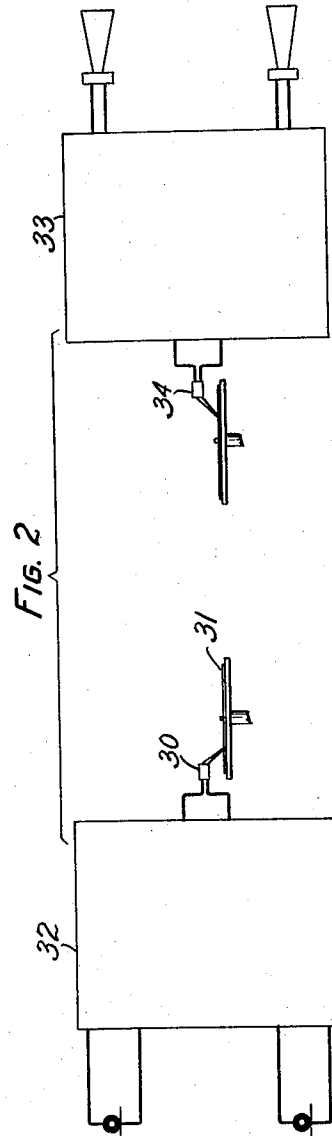
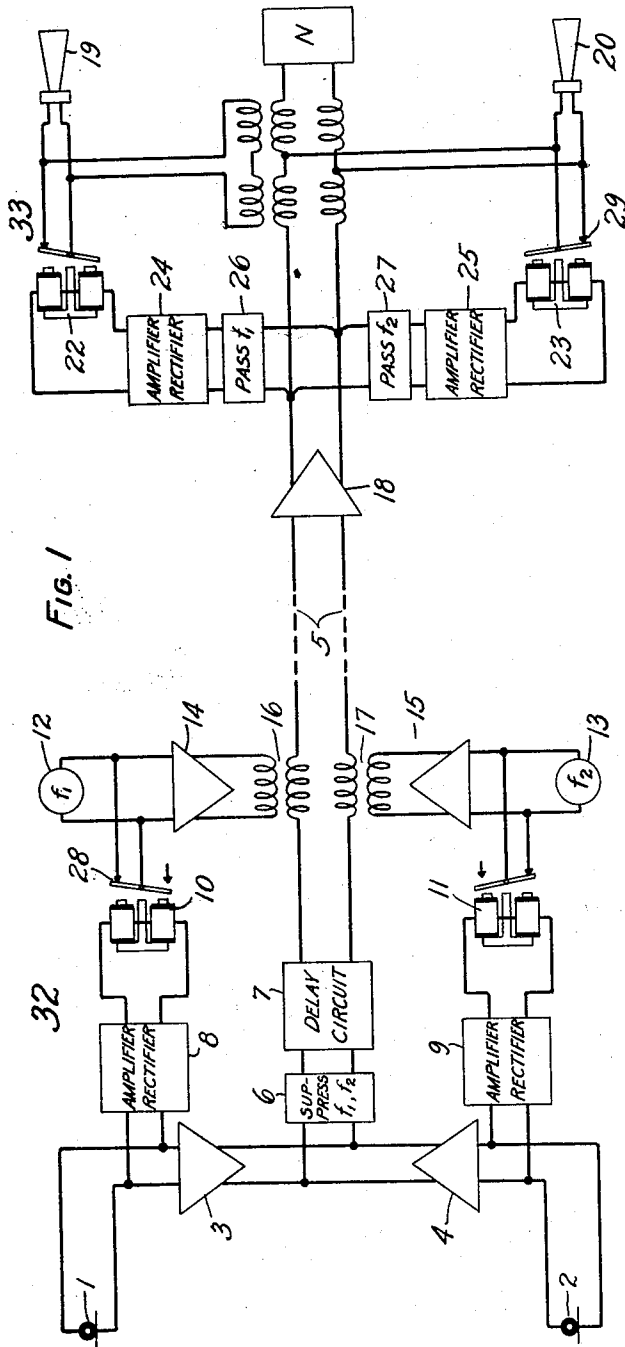


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H. D. ARNOLD  
SOUND TRANSMISSION  
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INVENTOR  
H. D. ARNOLD  
BY *J. M. Campbell*  
ATTORNEY

## UNITED STATES PATENT OFFICE

HAROLD D. ARNOLD, OF SUMMIT, NEW JERSEY, ASSIGNOR TO BELL TELEPHONE LABORATORIES, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK

## SOUND TRANSMISSION

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This invention relates to speech transmission systems and more particularly to binaural circuits suitable for use in sound picture systems.

ating the switching mechanism during reproduction.

5 The object of the invention is to make possible a space distribution of reproduced sounds similar to that of the original sounds by means of a single transmission system.

Various schemes for obtaining such a distribution have been proposed heretofore. 10 Some of them were of the so-called binaural type in which two pick-up transmitters, located one on each side of the sound scene, were associated over separate circuits directly, or indirectly by means of intermediate 15 sound records, with two correspondingly placed loud speaking receivers. In these systems two entirely separate channels are necessary from the transmitters to the receivers. Other systems contemplated moving 20 the loud speakers or selectively energizing certain speakers of a group so that the sounds always appeared to come from the proper part of the scene but these had the disadvantage of requiring intricate mechanical devices or commutators and considerable incidental wiring.

According to the present invention there are a number of pick-up transmitters variously located with respect to the original sound scene and a number of loud speakers similarly disposed with respect to the scene of reproduction. Switching means common to the speakers is selectively operated over 35 the single transmission system connecting them with the original scene by means of voice operated relays associated with the transmitters. In order that the necessary switching may be accomplished without interruption of the reproduction, the currents representing speech or music pass through a suitable delay network but the signal currents pass directly from the relays to the common line. When this scheme is used for sound pictures instead of directly in public address systems the recorder is energized from the common line so that the record contains not only the currents representing 50 speech but also the necessary signals for actu-

The invention may be clearly understood in a notation of the detailed description of the circuits shown in the drawings wherein Fig. 1 discloses the invention adapted for use in a public address system in such a way that the loud speakers reinforce the original speakers' voices and Fig. 2 shows how this circuit may be modified to adapt the invention for use in sound picture systems.

Referring to Fig. 1, 1 and 2 are pick-up transmitters preferably disposed on either side of the original stage and 3 and 4 are vacuum tube amplifiers associated with the transmitters and with the common transmission line 5 through anti-resonant circuit 6 and delay circuit 7. Also associated with transmitters 1 and 2 are amplifier-rectifier devices 8 and 9 which supply rectified speech energy to the polarized relays 10 and 11 respectively. Oscillators 12 and 13 generate signal currents of suitable frequencies which are impressed upon the line 5 at suitable times through amplifiers 14 and 15 and transformers 16 and 17. In the receiving circuit an amplifier 18 delivers the transmitted currents representing speech or music to the hybrid coil 21 and thence to the loud speaking receivers 19 and 20, which are properly placed to reinforce or reproduce the original sounds in a realistic manner. The receivers are normally short circuited, as indicated, by polarizing relays 22 and 23 which may be energized at the desired times by amplifier-rectifiers 24 and 25 associated with the receiving amplifier 18 through resonant circuits 26 and 27. In accordance with the usual practice in communication circuits the hybrid coil is terminated by a suitable network N so that the switching of one receiver does not affect the volume level of the other.

If then an actor in the vicinity of transmitter 1 begins to speak it is evident that the sensitive relay 10 will be operated immediately by rectified currents from the device 8 so that contact 23 is opened thereby permitting oscillator 12, which is generating a definite frequency  $f_1$  such as 3500 cycles, to supply current of this frequency to the line 5. This

current will be transmitted without delay and, resonant circuit 26 being tuned to its frequency, it will pass to the device 24 and operate the relay 22 thereby conditioning loud speaker 19 to reproduce the speech about to be transmitted. The delay circuit 7 is designed to retard the transmission of speech sufficiently to permit the foregoing operations to occur before the speech energy reaches the hybrid coil 21 so that even the first syllables of the speech will be reproduced by the receiver 19. As is well known in the art this delay need be only a very small part of a second. The amplifier 4 being a unilateral device it is evident that the relay 11 cannot operate so that the receiver 20 remains short circuited at contact 29. Also the anti-resonant circuit 6 is designed to suppress both the signaling frequencies such as 3500 cycles and 4000 cycles without material effect on adjacent frequencies so that the quality of the speech transmitted is substantially unimpaired. Obviously then, the receivers 19 and 20 cannot be operated inadvertently since the speech energy transmitted over the line 5 does not contain components of the signal frequencies generated by oscillators 12 and 13.

The relay 10 will, of course, be held operated as long as the actor adjacent transmitter 1 is speaking but will be released each time he pauses thereby deenergizing loud speaker 19 by releasing relay 22. Similarly when a speaker in the neighborhood of transmitter 2 begins to talk the loud speaker 20 will be energized and deenergized as soon as he has finished. If at any time both actors are speaking, both loud speakers will be energized but as soon as one has finished the corresponding speaker will be deenergized by its relay 22 or 23. These relays may be adjusted to remain operated during slight pauses in the conversation but preferably are permitted to release after a very short interval of silence to prevent possible misoperation when the speakers follow each other in close succession.

When the invention is applied to a sound picture system the transmission line 5 will, of course, terminate as shown in Fig. 2 in a recording device 30 which will engrave a record blank 31, the trace of which will contain both speech and signaling frequencies in proper sequence. In this figure the amplifiers, relays, etc. at the recording station in Fig. 1 are indicated collectively by 32. Similarly the apparatus at the receiving station is indicated by 33. The reproducer 34 will reproduce from the record 31, or a suitable copy of this record, the speech and signal frequencies recorded so that the loud speakers will be operated in the same manner as described in connection with Fig. 1.

While the invention has been described with reference to a particular system it is obvious that it may be modified in various ways, such as by the use of additional microphones

and loud speakers with their necessary associated circuits, without departing from the scope of the invention as defined in the following claims.

What is claimed is:

1. In a transmission system a plurality of variously located sound pick-up devices, a plurality of signaling means, a transmission line including means common to the devices for delaying currents of voice frequencies, circuits for the signaling means independent of the delaying means, a plurality of receivers variously located to correspond to the pick-up devices, and means responsive to the signaling means for selectively associating the receivers with the line.

2. In a transmission system, a plurality of sound pick-up devices, a transmission line including a delay circuit common to the devices, receiving means associated with the line, and means responsive to each of the pick-up devices for energizing the receiving means independently of the delay circuit and in accordance with the particular pick-up device operated.

3. In a transmission system, a plurality of sound pick-up devices, a transmission line including a delay circuit common to the devices, means including receivers individual to the pick-up devices associated with the line and a plurality of sources of characteristic signal currents severally controlled by energy derived from the pick-up devices for energizing the receivers in accordance with the operation of the corresponding pick-up devices.

4. In a transmission system, a plurality of sound pick-up devices and a plurality of normally inoperative receivers, a single transmission circuit connecting the pick-up devices and the receivers, means responsive to sounds picked up by one of the devices for impressing a characteristic signal on the line and means responsive to the signal for preparing the corresponding receiver to respond to currents from the pick-up device.

5. In a binaural recording and reproducing system, means for making a record of sounds and means for reproducing the record, said first means comprising at least two sound pick-up devices, a recorder, a line connecting the devices to the recorder and means responsive to each device for impressing upon the recorder a characteristic signal and said reproducing means comprising a reproducer, at least two receivers, a line connecting the reproducer and receivers and means responsive to the reproduced characteristic signals for selectively conditioning the receivers for operation.

6. The combination with a plurality of pick-up devices, a transmission line including a delay circuit and a circuit anti-resonant to predetermined signal frequencies and means for impressing the signal frequencies

on the line beyond said circuits in accordance with the operation of the pick-up devices, of means for recording currents and means responsive to the reproduced currents including receivers corresponding to the pick-up devices and selectively operated in accordance with the signal frequencies.

In witness whereof, I hereunto subscribe my name this 13th day of June, 1929.

HAROLD D. ARNOLD.