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COMMUNICATION SYSTEM

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Fig. 2.

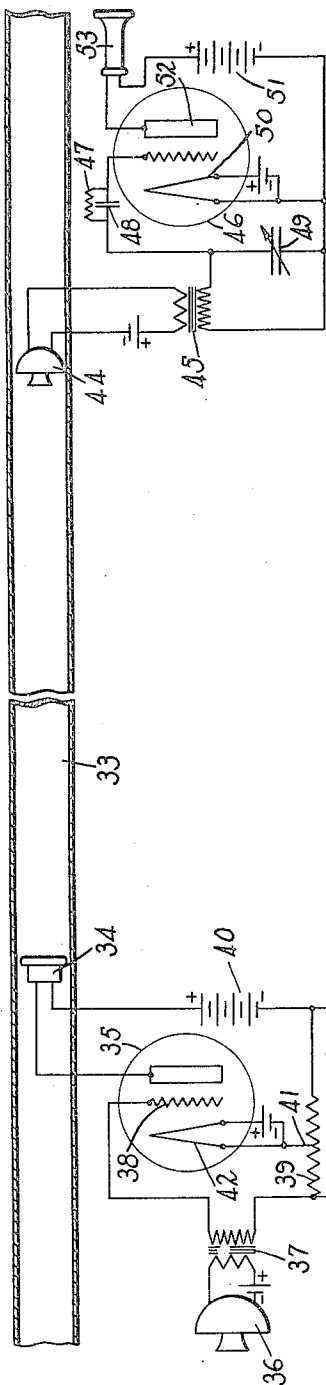
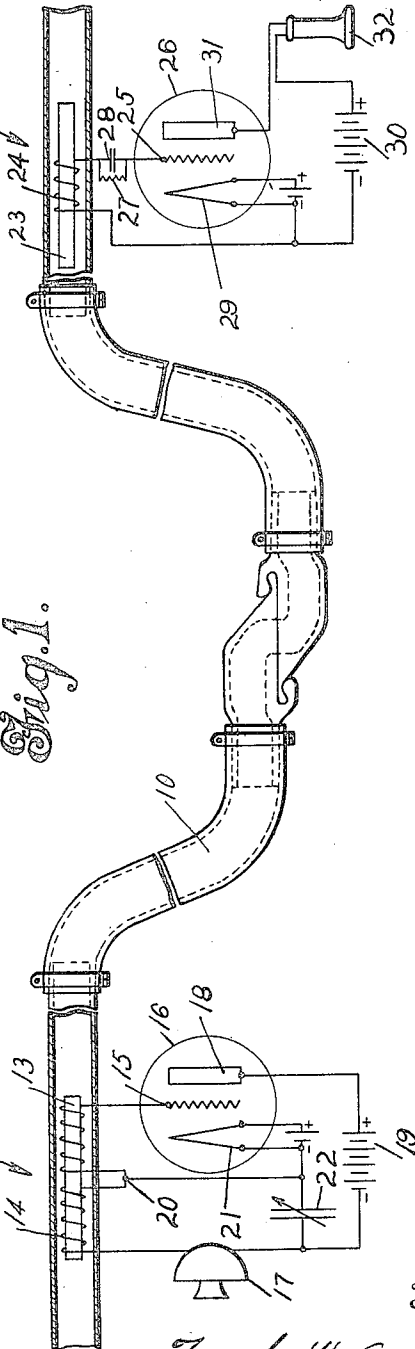


Fig. 1.



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COMMUNICATION SYSTEM

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My invention relates to a system for communication over short distances, and more especially to a system in which a high frequency sound wave is used as a carrier for the transmission of voice or other relatively low frequency sound waves.

The invention relates particularly to a system for communication in places where it is not practical to run telephone or telegraph lines, and especial reference will be had in the description of the invention appearing hereinafter to its use in connection with train communication systems, as, for example, between the cab and cabooses. Previous attempts have been made to use wired and wireless transmission systems for trains. The first of these has generally failed owing to the difficulties experienced in having brakemen or other train attendants make the proper connections between the cars, while the second system involves costly apparatus which requires considerable skill in order to be operated successfully.

Generally speaking, it is an object of the invention to provide a communication system for railway trains and the like, which is relatively simple in form and operation and which will not be subject to interference by the noises incident to the operation of the train.

More specifically, it is an object of the invention to provide a train communication system or the like in which a high frequency sound wave is used as a carrier wave for voice or other relatively low frequency waves.

A further object of the invention is to provide means for controlling the high frequency sound waves after they are set up by a transmitting station and to guide these waves to a receiving station.

Still another object of the invention is to provide a communication system of the above nature in which it is unnecessary for a trainman or attendant to make special connections in coupling up the cars of a train.

To these and other ends, the invention consists in the novel features and combination of parts to be hereinafter described and claimed.

In the drawings,

Fig. 1 shows somewhat diagrammatically a train communication system according to my invention, and

Fig. 2 shows a modification thereof.

Fundamentally, the communication system consists of a transmitter and receiver with an air line acting as an intervening connecting link or speaking tube. If one were to speak directly into the end of an air line, such as that connected with the braking system of a railroad train, the noises incident to the operation of the train would interfere with the sound waves traveling down the tube to such an extent that it would be practically impossible to hear the sounds spoken or otherwise transmitted from the sending end. In the present invention, this difficulty is effectively overcome by the use of a high frequency carrier wave upon which the relatively low frequency sound waves set up by the voice are impressed. By a high frequency sound wave, I refer to a wave of such frequency that it cannot be heard by the human ear, as, for example, one of from 40,000 to 50,000 cycles per second. This high frequency sound wave is modulated by means of an impressed voice sound wave in the transmitter so that at any time the effective amplitude of the high frequency sound wave or carrier is proportional to the amplitude of the voice wave, the high frequency wave being demodulated by a receiving set in a manner similar to the reception of speech over a radio telephone. Incidental train noises will have little or no effect upon the high frequency sound wave, so that they will not interfere with the sounds heard by the listener at the receiving end of the line.

In the particular system illustrated in Fig. 1, I make use of a magnetostriction oscillator to secure the constant high frequency sound wave in the air line or tube which also serves a double purpose by acting as the transmitter. A microphone is placed in the circuit of the magnetostriction oscillator so that the output of the oscillator may be modulated by speaking into the mouth-piece of the microphone.

Referring to the drawings in which I have

illustrated my invention by showing a preferred embodiment of the same and particularly to Fig. 1, the reference numeral 10 indicates in general the air line of a railway train or the like, which while shown diagrammatically in the drawings will be understood to be of any desired length and extending through whatever number of cars may be necessary in order to connect the transmitting and receiving stations. The reference numerals 11 and 12 indicate the transmitting and receiving stations which may be located, for example, in the cab and caboose of the train. Mounted in air line 10 adjacent the transmitting station 11 is a rod 13 made of iron, nickel, or nichrome, or the like, and having a natural frequency, that is, the frequency at which the rod would vibrate freely if given a slight displacement and then released, of from 40,000 to 50,000 cycles per second, or at least a natural frequency high enough to be inaudible to the ear. Surrounding rod 13 is a coil of insulated wire 14 having one end connected to grid 15 of vacuum or audion tube 16, the other end of coil 14 being connected to a microphone 17, which may be of any usual type, and which is connected in the plate circuit of the tube 16, the reference number 18 indicating the plate of the tube, and the reference numeral 19 indicating a high tension battery or other suitable source of plate supply. A tap 20 intermediate the length of coil 14 is connected to the negative side of the filament 21, which is likewise connected to one set of plates of variable condenser 22, the other set of plates being connected to the negative side of battery 19.

The vacuum tube circuit will oscillate freely when the rod 13 is not present. However, when the rod 13 is in place, if the frequency of the oscillation set up in the vacuum tube circuit is made equal to that at which the rod would vibrate freely if given a slight displacement and then released, then the oscillations will be very strongly increased, since the rod changes in length when placed in a magnetic field, which is, in this case, inside of a coil in an oscillating circuit. Thus, the rod 13 will vibrate at a fixed frequency which depends upon its length and mass, the circuit of the vacuum tube oscillator being tuned to this frequency by means of the condenser 22. When the microphone 17 is spoken into, the amplitude of these vibrations is changed, and since the rod 13 is vibrating in air in the end of tube 10, a modulated high frequency sound wave travels down the tube.

This high frequency sound wave strikes a similar rod 23 at the receiving end of the tube and starts it vibrating also, the natural period of rod 23 being the same as that of the rod 13. The rod 23 is placed inside of a coil 24 having one end connected to grid 25 of vacuum tube 26 through a grid leak 27 and grid condenser

28, the other end of coil 24 being connected to the negative side of vacuum tube filament 29, which is likewise connected to the negative side of plate battery 30, furnishing a supply of current to plate 31. Since the magnetic conditions of the receiving set are changed as the rod 23 moves in coil 24, the receiving set or demodulator receives a modulated high frequency current. These currents are changed to a low frequency or audio frequency current, in the usual manner of a radio receiving set, which may be heard in the telephone receiver 32, the latter being connected in the plate circuit of the tube 26.

When my improved system of communication is used in connection with a railroad train, no special connections between the cars are necessary, since as the brakeman or other train attendant couples up the braking system of the train he likewise completes the connections in the communication system.

In Fig. 2 of the drawings I have shown a modification in which the high frequency sound wave is set up in tube 33 by means of a member 34 similar in form to a telephone receiver and connected in the plate circuit of vacuum tube 35. The reference numeral 36 indicates a microphone connected in the primary circuit of microphone transformer 37, the secondary circuit of the latter being connected to grid 38 and to one end of coil 39, the other end of coil 39 being connected to the negative side of B battery 40. Coil 39 is provided with an intermediate tap 41 which is connected to the negative side of filament 42, a variable condenser 43 being connected in parallel with coil 39. The vacuum tube circuit oscillates freely, the frequency of an oscillation being controlled by variable condenser 43. As the telephone receiver 34 is connected in the plate circuit, the diaphragm of the telephone receiver will vibrate at the same frequency as the oscillations in the vacuum tube circuit and will send out a high frequency sound wave which travels through tube 33. When the microphone 36 is spoken into, the amplitude of these vibrations is changed and since the diaphragm of receiver 34 is vibrating in air in tube 33 a modulated high frequency sound wave travels down the tube.

The modulated high frequency sound wave strikes a microphone 44 located adjacent the receiving end of tube 33, microphone 44 being connected in series with the primary winding of microphone transformer 45, the secondary winding of the latter being connected in the grid circuit of vacuum tube 46 through grid leak 47 and grid condenser 48. The reference numeral 49 indicates a variable condenser by means of which the natural period of the vacuum tube circuit may be tuned to equal that of the high frequency sound set up by receiver 34, and variable condenser 49 being connected in parallel with the secondary

winding of transformer 45 and having one side connected to the negative lead of filament 50 and to the negative side of B battery 51 which is connected to plate 52, through receiver 53. The receiving set or demodulator receives a modulated high frequency current which is changed to a low frequency or audio frequency current in the usual manner of a radio receiving set.

While I have shown and described a preferred embodiment of my invention, it will be understood that it is not to be limited to all the details shown, but is capable of modification and variation within the spirit of the invention and the scope of the appended claims.

What I claim is:—

1. In a communication system, a pipe line for a transmitting medium, means at one point in said pipe line for setting up therein a continuous high frequency super-audible sound wave, means for impressing a sound wave of relatively low voice frequency on the high frequency sound wave, and means associated with said pipe line and remote from the means for setting up the high frequency sound wave for demodulating the high frequency sound wave to permit reception of the sound waves of relatively low voice frequency.

2. In a communication system, a pipe line for a transmitting medium, means at one point in said pipe line for setting up a continuous high frequency superaudible sound wave in the pipe line, means for impressing a sound wave of relatively low audible frequency on the high frequency sound wave, means associated with said pipe line and remote from the means for setting up the high frequency sound waves adapted to be set in synchronous vibration by the high frequency sound waves, means acted on by said associated means for setting up a vibratory electric current having a frequency corresponding to the sound waves set up by said first named means, and means for translating the vibratory electric current into sound waves, the sound waves having a frequency corresponding to the impressed sound waves.

3. In a communication system, a pipe line for a transmitting medium, electrical means for setting up a high frequency super-audible sound wave in said pipe line, means for impressing a sound wave of audible frequency on the high frequency sound wave, and means associated with said pipe line and remote from the means for setting up the high frequency sound wave for demodulating the modulated sound wave to permit reception of the sound wave of audible frequency.

4. In a communication system, a pipe line for a transmitting medium, electrical means for setting up a high frequency super-audible sound wave in said pipe line, means for impressing a sound wave of audible frequency

on the high frequency sound wave, and electrical means associated with said pipe line and remote from the means for setting up the high frequency sound wave for demodulating the modulated sound wave to permit reception of the sound wave of audible frequency.

5. In a communication system, a pipe line for a transmitting medium, a pair of elements remotely spaced from one another in said line and adapted to vibrate synchronously, electric means for setting the first of said elements into vibration to send out sound waves of super-audible frequency, means associated with said electric means for controlling the intensity of the vibrations of the first of said elements by sound waves of voice frequency, the second of said elements being set into synchronous vibration by the sound waves transmitted by the first of said elements, and means for demodulating the sound waves received by the second of said elements to permit reception of the sound waves of audible frequency.

6. In combination, a conduit containing a fluid under pressure, a rod-like element in said conduit with its axis substantially parallel to the axis of the conduit, said rod-like element having a natural period of vibration of relatively high frequency, means for causing said element to vibrate, the vibration of said element producing a sound wave in said conduit of relatively high frequency, means for modulating the vibrations of said element by a sound wave of relatively low frequency, and means remote from said element for receiving the modulated sound waves set up by said element.

7. The combination with an air line of a railway train or the like, of a pair of spaced elements mounted in said air line and having substantially equal natural periods of vibration, said elements when set in vibration being capable of sending out sound waves of relatively high superaudible frequency, means for causing one of said elements to vibrate at its natural period, means for controlling the intensity of the vibrations of said member by a sound wave of relatively low frequency, the other of said spaced elements being caused to vibrate by the sound wave set up in the air line, and means for translating the vibrations in the second of said elements into sound waves corresponding to the sound wave of relatively low frequency.

In witness whereof, I have hereunto set my hand this 27th day of April, 1929.

FRANK W. GODSEY, JR.