Nov. 11, 1924. 1,515,152

L. DE FOREST

COMMUNICATION SYSTEM FOR RAILWAY TRAINS

Filed Dec. 10, 1919

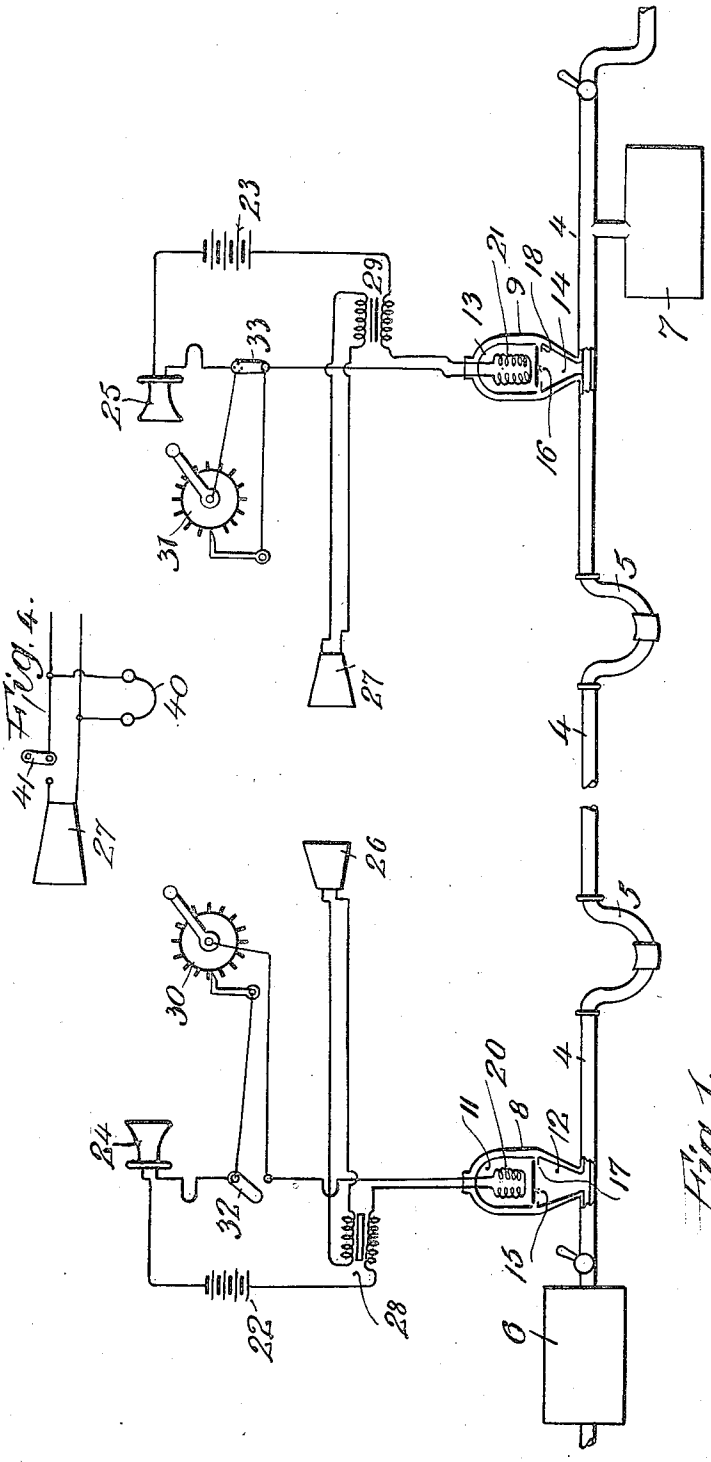


Fig. 1.

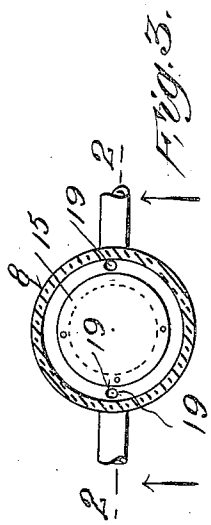


Fig. 3.

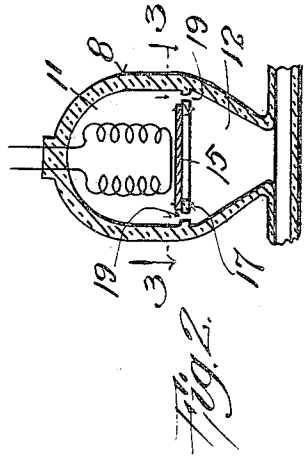


Fig. 2.

Fig. 4.

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UNITED STATES PATENT OFFICE.

LEE DE FOREST, OF SPUYTEN DUYVIL, NEW YORK, ASSIGNOR TO DE FOREST RADIO TELEPHONE AND TELEGRAPH COMPANY, OF JERSEY CITY, NEW JERSEY, A CORPORATION OF DELAWARE.

COMMUNICATION SYSTEM FOR RAILWAY TRAINS.

Application filed December 10, 1919. Serial No. 343,847.

To all whom it may concern:

Be it known that I, LEE DE FOREST, a citizen of the United States, residing at Spuyten Duyvil, county of Bronx, State of New York, have made a certain new and useful Invention in Communication Systems for Railway Trains, of which the following is a specification.

This invention relates to communication systems, and, particularly, to communication systems for use on railway trains.

The object of the invention is to provide a system which is simple and efficient, wherein communication between separated points is effected electro-pneumatically.

A further object is to provide a system of communication, particularly for use on railway trains, as, for example, for communication between the caboose at one end of a freight train and the engine at the other end of the train, and wherein use is made of the train pipe of the air-brake system of the train.

A further object is to employ sound waves to control suitable electrical devices which impart mechanical impulses or vibrations in accordance with or which correspond to the inducing sound waves, to the column of compressed air contained in the train pipe forming part of the air brake equipment of a railway train, and utilizing said mechanical impulses or vibrations to electrically reproduce the original sound waves at a distant point.

Other objects of the invention will appear more fully hereinafter.

The invention consists substantially in the construction, combination, location and arrangement of parts, all as will be more fully hereinafter set forth, as shown in the accompanying drawing, and finally pointed out in the appended claims.

In the accompanying drawing:—

Fig. 1 is a view in diagram showing a combined electro-pneumatic communication system embodying my invention, illustrating the application thereof to the train pipe of the brake system of a railway train.

Fig. 2 is a broken detail view in section through one of the diaphragm chambers, the plane of section being on the line 2, 2, Figure 3.

Fig. 3 is a similar view on the line 3, 3, Fig. 2.

Fig. 4 is a view in diagram showing a slight modification embodying the invention.

In carrying out my invention I propose to impart, electrically or otherwise, mechanical vibrations or impulses to a column or body of air contained in a pipe system, and to control the electrical or other means employed to impart the mechanical impulses or vibrations, by or in accordance with sound vibrations, or voice waves, and utilize the mechanical impulses or vibrations thus imparted to the column or body of air to reproduce, through suitable electrical or other devices, at a distant point in the pneumatic system, the sound waves initially employed to cause the mechanical impulses or vibrations to be imparted to the air column or body of air.

In the drawing I have shown my invention as applied to the train pipe of the air brake equipment of a train, wherein 4 is the train pipe, 5 the usual flexible couplings between adjacent cars of the train, and 6, 7, the compressed air tanks or cylinders of the air brake system, one located, for example, on the locomotive, at one end of the train and the other on the caboose at the other end of the train, in the case of a freight train. Also respectively located on the locomotive and on the caboose, though, as is obvious, they may be located at other suitable or desired points in the system between which communication is to be effected, are closed chambers 8, 9, which are in free communication with the train pipe. The chambers are divided into compartments 11, 12, and 13, 14, respectively, by suitable flexible diaphragms 15, 16. These diaphragms are supported within the chambers in any suitable or convenient manner. A simple arrangement is shown as one embodiment wherein the diaphragms are in the form of circular disks and are supported at their peripheral edges upon annular shoulders 17, 18, formed on or carried by the interior walls of the chambers.

In order that the diaphragms may not vibrate or respond to variations in the pressure of the air in the train pipe system I propose to equalize the pressure on opposite

sides of the diaphragm. This may be readily accomplished by forming openings, indicated at 19 in Figs. 2 and 3, through the ledges or shoulders on which the diaphragms are supported.

With the arrangement above described, it will be readily understood that by imparting vibrations to one of the diaphragms, like vibrations or impulses are imparted to the column of air contained in the pipe system and are transmitted to and correspondingly reproduced in the other diaphragm analogous to the action of a speaking tube, except that in the present case a column of compressed air is utilized. I have found, however, that a suitable and satisfactory degree of sensitiveness is attained in the use of a column of compressed air, and through distances to render this method of communication thoroughly practical for communication from end to end of even very long trains, using the train pipe of the air brake system for this purpose.

The vibrations may be initially imparted to the diaphragm at the transmitting end in any suitable manner, and likewise the corresponding vibrations developed in the diaphragm at the distant receiving station may be utilized in any suitable or convenient manner to render the transmitted communication intelligible. In practice each station will be both a transmitting and a receiving station.

For transmitting and reproducing voice or sound communication I have shown for illustrative purposes, suitable electrical devices, 20, 21. These are in the form of electric coils similar to telephone magnet coils, which are disposed within the chambers 8, 9, in such relation to the diaphragms as to influence or to be influenced by said diaphragms. For this purpose the coils 20, 21, are respectively included in circuits which contain in series a battery 22, 23, and a telephone transmitter 24, 25. For receiving purposes, in the case of voice or sound transmission, I associate a "loud speaking" telephone receiver 26, 27, with the circuits of the electrical devices 20, 21. This may be accomplished through the transformer couplings 28, 29.

Any suitable arrangement for calling one station from the other may be employed. I have shown a simple illustrative arrangement wherein a mechanically operated interrupter 30, 31, may be switched into series relation in the circuits of devices 20, 21. The switches 32, 33, are shown for accomplishing the desired purpose.

If desired, or preferred, ordinary head telephones may be employed instead of loud speaking telephones, to receive the transmitted call or message. Such an arrangement is shown in Fig. 4 wherein head telephones 40 are shown in place of the loud speaker receiver 27. It is to be noted, however, that a loud speaking receiver is useful to receive a calling signal when, for example, an interrupter 30, 31, at the transmitting station is employed, whereas the head telephones would be employed to receive the transmitted message. In this case the head telephones would be preferably connected in shunt to the loud speaking receiver as indicated, or the latter might be cut out by means of a switch 41, which, if desired, may be automatically operated when the head telephones are lifted from their supporting hook as in the case of ordinary telephone receivers.

With an arrangement such as above described the operation is as follows:—

Assuming that the station indicated at the left hand side of Fig. 1 is to communicate with the station indicated at the right hand side of said figure, the switch 32 is opened and the interrupter 30 is operated. This causes current impulses to traverse the circuit of the device 20, thereby causing corresponding vibrations to be imparted to the diaphragm 15, and thereby to the column of compressed air in the train pipe. These vibrations are transmitted to and reproduced by the diaphragm 16, thereby causing fluctuations of current in the circuit of device 21. These fluctuations are renderd audible in the loud speaking telephone 27 through the association of its circuit with that of the device 21. As above indicated, other calling arrangements may be employed. After the call is made the interrupter 30 is cut out or short circuited, as by closing switch 32, and the desired message is spoken into the transmitter 24. This again causes vibrations to be imparted to the diaphragm 15, which are in accordance with the sound waves of the voice employed in speaking the message into the transmitter. Corresponding current fluctuations are thereby caused in the circuit of device 21 through the resulting vibrations thus transmitted to diaphragm 16, and these current fluctuations influence the circuit of the loud speaking telephone 27, or of the head telephone receivers 40, through the transformer coupling 29, thereby causing said telephone 27 or 40 to reproduce the transmitted communication or message.

Thus communication may be transmitted from either station and received at the other station.

Since the transmission of the sound waves is accomplished mechanically through a column of compressed air, appreciable energy is required to properly operate the transmitting diaphragm. I therefore propose to use microphones 24, 25, which are capable of carrying heavy current, for example, two to three amperes, for short periods of time, and I likewise wind the telephone receiver or diaphragm actuating coils to handle large currents.

Having now set forth the objects and nature of my invention and an arrangement embodying the principles thereof, I wish it to be understood that many variations and changes in the details might readily occur to persons skilled in the art and still fall within the broad scope of my invention. It is also to be understood that while I have described my invention as applied in utilization of the column of compressed air contained in the train pipe of the air brake equipment of railway trains, my invention is not to be limited or restricted in this respect as it may be applied in utilization of gas supply pipes in buildings, and in air, ventilating or other pipe systems of buildings.

What I claim as new and useful and of my own invention and desire to secure by Letters Patent of the United States is:—

1. In a communication system, a pipe line for a transmitting medium, an elongated chamber in immediate communication with said pipe line, a perforated annular ledge on the walls of said chamber, a diaphragm arranged in and extending transversely across said chamber, electrical devices controlled by and in accordance with a message to be transmitted for vibrating said diaphragm, and means at a distant point in said pipe line and controlled by the resulting vibrations or impulses imparted to the air or other medium in the pipe line for reproducing the transmitted message.

2. In a communication system, a pipe line for a transmitting medium, an elongated chamber in immediate communication therewith, a perforated annular ledge on the walls of said chamber, a diaphragm arranged in and extending transversely across said chamber, an electrical device to impart vibrations to said diaphragm, a circuit for said electrical device, said circuit including a current source and a telephone transmitter, and means at a distant point in said pipe line and controlled by the resulting vibrations or impulses imparted to the air or other medium in the pipe line to reproduce the transmitted message.

3. In a communication system, a pipe line for air or other medium, an electrical device to impart impulses or vibrations to the medium contained in said pipe line, including a telephone transmitter and an interrupter arranged in series to the telephone transmitter, and means at a distant point in the pipe line controlled by the resulting vibrations or impulses imparted to the transmitting medium for reproducing the transmitted message.

4. The combination with the train pipe of the brake system of a railway train, of equalized vibrating members arranged at distant points and in communication with said train pipe, an electrical coil in proximity with each vibrating member to influence or to be influenced by said vibrating member, a telephone transmitter connected into the circuit of one of said coils and a telephone receiver connected with the other of said coils.

In testimony whereof I have hereunto set my hand on this 1st day of December, A. D. 1919.

LEE DE FOREST.