(No Model.)

W. W. JACQUES.

TELEPHONY.

No. 535,289. Patented Mar. 5, 1895.

Fig. 1.

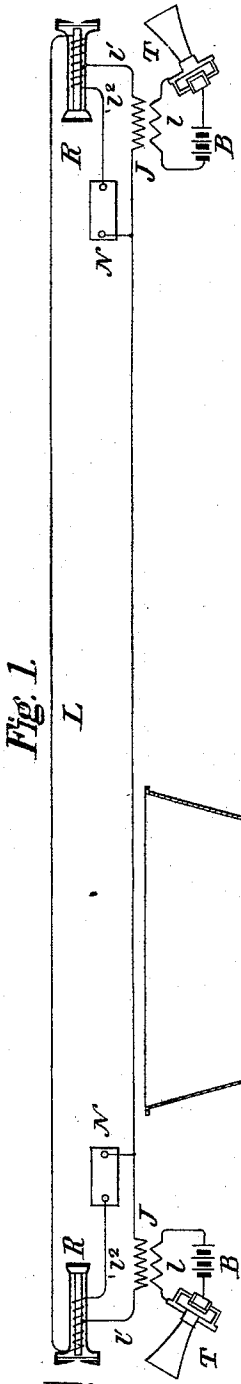


Fig. 3.

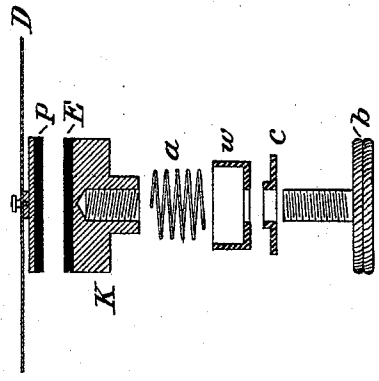
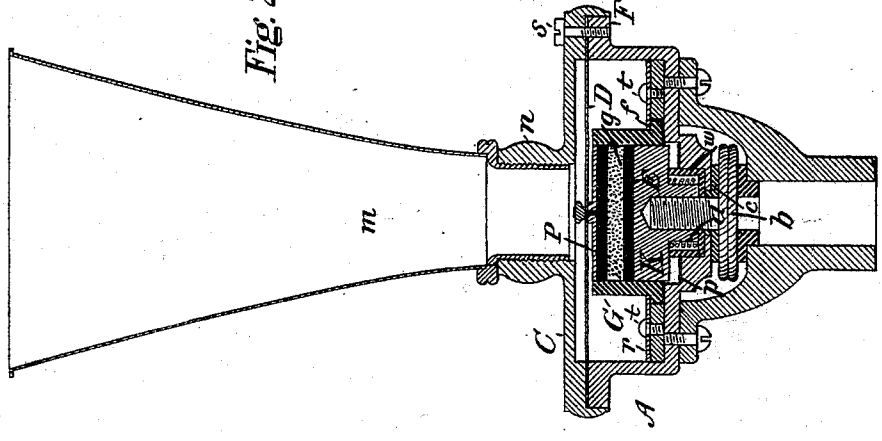


Fig. 2.



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UNITED STATES PATENT OFFICE.

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TELEPHONY.

SPECIFICATION forming part of Letters Patent No. 535,289, dated March 5, 1895.

Application filed May 26, 1892. Serial No. 434,402. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM W. JACQUES, residing at Newton, in the county of Middlesex and State of Massachusetts, have invented certain Improvements in Telephony, of which the following is a specification.

It is well known that when a multitude of electrodes are maintained in loose contact with each other and an electric current of moderate strength is passed through them, these electrodes will remain normally at rest, and a telephone receiver connected in circuit will be normally silent. If, however, the strength of the current be increased, these electrodes will, at some definite strength of current, dependent upon the number and character of the electrodes and the normal pressure existing between them, break into rapid and continuous vibration to and from each other, and there will be heard in the receiving telephone a rustling sound made up of a multitude of simultaneous pitches.

Hitherto in the commercial use of multiple contact transmitters, of which the Hunnings transmitter may be considered the type, it has been customary to use a current which shall not be so strong as to set the electrodes in vibration. Whenever, either by accident or as an experiment, a stronger current has been used and the electrodes have been set in vibration, the telephonic system, consisting of the transmitter and its corresponding receiver, has prooved less efficient in the transmission of speech, because the resulting noise due to the vibration of the transmitter electrodes, has acted upon the listening ear to make it less sensitive and therefore less fitted to receive and understand transmitted speech.

I have discovered that when a multitude of electrodes in loose contact are normally kept in a state of rapid and continuous vibration, they are much more sensitive to sound waves falling upon them than are the same contacts normally at rest. Though the discovery was in fact an accident, the explanation probably is that the resultant normal pressure existing between the various pairs of electrodes of a multitude of electrodes is less when all of the electrodes are in vibration to and from each other, than when they are at rest; and it is well known that, within limits, the sensitiveness of any microphone contact increases as the normal pressure is decreased. My invention is founded in part on this discovery.

In practicing my invention, a multitude of loose contact electrodes are kept in rapid and continuous vibration by passing through them a very strong electric current. I use a current from a low resistance battery (as, for example, a storage battery or standard Fuller bichromate battery) having an electro-motive force of about twenty volts. A much larger battery maintains the electrodes in too sensitive a condition for practical use. Heretofore in transmitters of the Hunnings type, it has been customary to use eight volts with the Lyons and Keller form and six volts with the "solid back" transmitter. Ten volts have been found impracticable to use with either of these instruments for the reason that they set the electrodes in vibration. By using so strong a battery I am not only enabled to maintain the electrodes of the transmitter in the most desirable condition of sensitiveness to sound waves, but these sound waves cause the electrodes to vary the resistance of a current of much higher electro-motive force than has hitherto been found practicable to use.

I have further discovered that upon a long telephone line, undulations of current due to the vibrations of the electrodes of the transmitter produced by the normal action of the battery will fade out and disappear at a greater or less distance from the transmitter; while undulations of current due to the action of sound waves upon the normally vibrating electrodes will persist and the sounds be heard in the telephone at the distant end of the line.

The invention relates to long distance telephony and its principal feature is a new method of transmitting vocal or other sounds electrically, which consists in passing through a multitude of loose contacts in a circuit an electric current sufficiently strong to keep said contacts in continuous rapid vibration and superimposing upon such vibrations the vibrations due to sound waves.

The invention consists further in apparatus for practicing said new method. It is essential that the transmitting instrument shall be indestructible by heat resulting from the operation of the instrument. I have never known,

prior to my invention, of a transmitter whose construction in this respect was such as to admit of the successful practice of my present invention. It is also essential for talking in both directions over the line, that the current from the transmitting instrument shall not be allowed to act with its full intensity upon the telephone receiver at the transmitting end of the line.

The apparatus is shown in the accompanying drawings.

Figure 1 is a diagram representing the apparatus as a whole. The local circuits with the instruments therein at the two ends of the main line are duplicates each of the other. Fig. 2 is a view of the transmitter in section. Fig. 3 represents detached portions of the same.

L is the main line and *l*, *l* are the two local circuits.

J is an induction coil at either end of the main line electrically connecting it with the local circuit.

T is the transmitting telephone, R the receiving telephone, and B the battery in either local circuit.

In the figures having special reference to the construction of the transmitting instrument, A is a cup-shaped metallic frame supporting the operative parts of the instrument. C is a metallic cover secured to the said frame A by screws *s*.

D is the sound receiving diaphragm rigidly clamped between frame F and cover C. A mouthpiece *m* is screwed into a projection *n* from the cover as shown.

G is a cylinder made of slate-stone or other similar fire proof insulating material having a small coefficient of expansion. It has a flange *f* and is secured to the interior of the cup-shaped frame F by a brass ring *r* which rests upon said flange and is there held by screws *t* screwing into the frame.

E is the back electrode, being a disk of hard carbon brazed to a brass disk K, a projection from which lies, as shown, within a hollow projection *p* from frame F, the two said projections being insulated from each other by a cup-shaped washer *w* of vulcanized fiber.

P is the front or working electrode, being a disk of hard carbon rigidly secured to the sound receiving diaphragm D by a screw and nut as shown.

The two said electrodes E and P fit the cylinder G closely. For a variable resistance material between them I employ granulated carbon, *g*, the grains being of such size, varying from nineteen one-thousandths to twenty-eight one-thousandths of an inch in diameter, that they will not pass between the peripheries of the said electrodes E and P and the inner wall of the said cylinder G. These grains make the numerous loose contacts, which, in the operation of the instrument to practice the present invention, are kept in violent vibration by the strength of the battery current while serving also as the variable resistance medium between the working electrode P and the back electrode E, to take up the vibrations due to vocal waves in the ordinary manner.

The back electrode E is made adjustable by means of a spring *a* tending to push the brass disk K into the cylinder G and a brass thumb screw *b*. A flanged washer *c* of vulcanized fiber insulates frame F from the thumb screw *b*. The frame F, as has already appeared, is in metallic connection with the working electrode P, while the thumb screw *b* is in metallic connection with the back electrode E. Connection with a strong battery B may be made in any practical way. For very long distances, one thousand miles, I use a battery of twenty volts.

The instrument constructed of materials as above described and in the manner described is proof against heat derived from the battery in the operation of the instrument.

In the operation of the instrument as above directed, it would seem that the notes or sounds due to vibrations of the loose contacts induced by the voice, find reinforcement or additional strength in similar notes or sounds due to vibrations set up by the strong battery and reach the receiver at the distant end of the line, while notes or sounds due to the battery alone fail to reach the receiver at the distant end of the line. The noise in the receiving instrument, however, resulting from the two sets of vibrations in the transmitting instrument at the same end of the line, when the latter is constructed and operated as above described, is not only painful to the ear but interferes with the proper reception by the ear of sounds coming from the other end of the line. To obviate this difficulty I so construct the receiving telephone that the current coming from the transmitting telephone at the same end of the line is divided and passes around the core of the receiving instrument in two directions, while the current from the transmitting telephone at the farther end of the line passes around the core always in one direction. This winding is shown in the diagram at Fig. 1 where L represents the main line, *l* the local circuit and J the induction coil, from the secondary of which a wire *l'* leads to the core of the adjacent receiver R, about which, dividing, it is wound in two directions; one portion, wound in one direction, going to the main line L and by the said main line back to the secondary of the induction coil, while the other portion, wound in the opposite direction, returns to the secondary of the induction coil by wire l^2. A resistance N is placed in wire l^2 to equalize or vary, as may be desired, the proportions of the current passing through L and l^2. It may perhaps be advantageous to maintain a slightly imperfect balance in order that the user of the transmitting instrument may hear his own voice in the receiver.

I claim—

1. The herein described method of trans-

mitting vocal or other sounds electrically, which consists in passing through a multitude of loose contacts in a circuit an electric current sufficiently strong to maintain said contacts in continuous rapid vibration, and superimposing upon such vibrations the vibrations due to sound waves.

2. The combination with a transmitting telephone containing a multitude of loose contacts and a battery of sufficient strength to keep said contacts in rapid vibration, of a differentially wound receiving telephone so connected and balanced that a current from the said transmitting telephone will pass around the core of the said receiving instrument in two directions substantially as described.

3. The combination with a local circuit containing a powerful battery or similar source of electrical energy, a telephone indestructible by the heat resulting from said source of electrical energy and the primary of an induction coil, of a main line containing the secondary of said induction coil and a receiving telephone differentially wound, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses, this 23d day of May, 1892.

WILLIAM W. JACQUES.

Witnesses:
GEO. WILLIS PIERCE,
H. R. MASON.