

J. L. Pope

EDISON	}	<i>Telephone.</i>
<i>vs.</i>		
BLAKE	}	<i>Interference.</i>
<i>vs.</i>		
VOELKER		
<i>vs.</i>		
IRWIN.		<i>U. S. Patent Office.</i>

*Voelkers Specification and Papers.*

To all whom it may concern:

Be it known that I, William L. Voelker, of Morton, in the County of Delaware, in the State of Pennsylvania, have invented a new and usefull improvement in Telephones of which the following is a full and exact description:

In all electric telephones capable of transmitting articulate sound the electric current has been caused to assume the form of a series of connected pulsations or undulations without intervening disruptions by means of varying resistance at some point in the line circuit, controlled by the impact of sound waves.

A line circuit has therefore been divided, and the adjacent parts or electrodes have been brought together with such certain degree of pressure as is appropriate to the transmission of articulate sound, when one of the said parts or electrodes is made sensitive to the impact of sound waves, so that the pressure at said point of contact is varied in correspondence with said impact of sound waves.

The electrode which is sensitive to the impact of sound waves has usually been in the form of a circular disk of thin material, sometimes of membrane and sometimes of metal, against the center of which the opposite electrode is caused to press with a certain pressure as before stated. When said disk was composed of membrane or other nonconductor it was armed

at its center or contact point with a small disk of metal, which was connected to the line wire on that side. In the earlier telephones the electrode which was in contact with the disk, was kept in contact therewith by gravity only, and at each vibration of said disk the other electrode was thrown out of contact and the circuit broken. Hence said telephones transmitted *musical* tones instead of articulate sounds.

Later, telephones were made with a sensitive disk and a fixed electrode, in contact therewith at one extremity of each vibration of said disk, and out of contact at the other extremity, whereby the effect of gravity is eliminated. This telephone likewise transmitted musical tones. It was then discovered that the transmission of articulate sounds required a pulsating but unbroken current. And a certain delicacy of contact pressure between the electrodes, difficult to define and only to be secured by experiment. With a sensitive vibrating disk, to receive the impact of sound waves, forming one electrode in a circuit, and the other electrode in contact with said disk, the unbroken but pulsating current is obtained by making the other electrode capable of corresponding vibration. Then by bringing said electrodes into contact, with an elastic pressure, the vibration of the sensitive disk caused by the impact of sound waves will be correspondingly transmitted and responded to by similar vibrations of the other electrode, and the parts may be so adjusted that the contact will not be broken during said vibration, notwithstanding pressure and resistance will be varied in a degree corresponding with said vibrations.

My invention relates to the telephone as above described and consists in a non-sensitive electrode, maintained in contact with a sensitive electrode with an elastic pressure, whereby said non-sensitive electrode may respond to the vibration of the sensitive electrode with variable pressure and unbroken contact.

That others may understand my invention fully, I will more particularly describe it, having reference to the accompanying

drawings wherein Fig. 1 is a perspective view of an apparatus embodying and illustrating my invention.

Fig. 2 is a longitudinal section of the same.

It is to be understood that the apparatus represented in the figures is merely illustrative of the invention and not designed to represent a structure to which I propose to be confined.

*A* is the conical mouthpiece and *B* is a diaphragm of thin material, membranous or metallic, stretched across the end of the mouth piece *A*. *C* is the line wire in connection with the diaphragm *B*, which if membranous is armed with a small metallic disk *b*, at its centre, and the wire, *C*, is in that case in connection with said disk. In front of said diaphragm is the other electrode, *D*, mounted upon an elastic support, *E*, and in connection with the other line wire, *F*. The pressure of the electrode, *D*, against the diaphragm, *B*, is regulated and adjusted by a screw, *G*, which bears against the elastic support, *E*.

*H* and *I*, are ordinary binding screws for the attachment of the wires whereby the instrument is connected on the one hand with the battery and on the other with a receiving instrument of proper construction and with the return circuit to the battery.

When the instrument has been properly located in the circuit and placed in connection with the proper receiving instrument as above stated, and with the battery, an electric current flows through the instrument, passing the electrodes, *B* and *D*, with an unbroken current. If now articulate sounds be uttered so that the sound waves will fall upon the diaphragm, *B*, said diaphragm is caused to vibrate, and when the pressure of the electrode, *D*, against the diaphragm, *B*, has been properly adjusted by the screw, *G*, the electric current passing between the electrodes as set forth, will be transformed into a series of undulations, without intervening disruptions, and said articulate sounds will be thereby conveyed to and reproduced by the receiver.

The structure of the parts above described may be greatly varied without introducing any variation in the principle of operation, and hence, any instrument embodying a sensitive electrode on one side and an electrode in contact therewith with an elastic pressure, capable of corresponding vibrations, and the effect set forth, will be an embodiment of my invention.

Having described my invention what I claim as new is:

In a telephone, a spring forming or carrying one electrode of the circuit, and constantly pressing the same against the other electrode and the sensitive diaphragm whereon it is carried, whereby, the required initial pressure between said electrodes is maintained, and they yield to the movements of the diaphragm.

WILLIAM L. VOELKER.

Chas. T. R. Heuckeroth. }  
F. A. Wait. }

DEPARTMENT OF THE INTERIOR,  
UNITED STATES PATENT OFFICE,  
WASHINGTON, D. C., Oct. 21, 1879.

WM. L. VOELKER,  
Care R. D. O. SMITH,  
WASHINGTON, D. C.

Please find below a communication from the EXAMINER in charge of your application for patent for IMPROVEMENT IN Electric Telephones, filed Sept. 26, 1879.

Very respectfully,

H. E. PAINE,  
*Commissioner of Patents.*

This application has been examined. An anticipation of the invention is found in the "English Mechanic and World of Science," for Aug. 2, 1878, page 511, and the application is accordingly rejected.

UNITED STATES OF AMERICA, }  
EASTERN DISTRICT OF PENNSYLVANIA. } ss.

On this 23d day of October, 1879, before me, a Commissioner of the Circuit Court, U. S., for the Eastern District of Pennsylvania, personally appeared Wm. L. Voelker, who being first duly sworn deposeth that he is the same Wm. L. Voelker who filed an application for letters patent for an improvement in Telephones, on the 26 day of September, 1879. And that said application has been rejected by the Commissioner of Patents for the reason that a similar invention is shown and described in the "English Mechanic and World of Science," a periodical published in London and dated Aug. 2, 1878. And he further deposes and says that said invention was made and perfected in the form shown in his said application, prior to said 2d Aug. 1878.

WILLIAM L. VOELKER.

Sworn to and subscribed before me }  
this 23d day of Oct., 1879. }  
SAM'L BELL, }  
U. S. Commissioner. }

UNITED STATES OF AMERICA, }  
EASTERN DISTRICT OF PENNSYLVANIA. } ss.

On this, 23d day of October, 1879, before me, a Commissioner of the Circuit Court of the United States, for the Eastern District of Pennsylvania, personally appeared John H. Voelker, who being duly sworn deposes and says that he is personally well acquainted with William L. Voelker, and has personal knowledge that prior to the 21 day of Aug. 1878, the said Voelker had in his possession an improvement in telephones, represented in the annexed drawing, and that said

Voelker claimed the same to be his invention and deponent believes said claim to have been the truth.

JOHN H. VOELKER.

Sworn to and subscribed before me }  
 this 23d day of Oct., A. D. 1879. }  
 SAM'L BELL,  
 U. S. Commissioner.

(Attached drawing is a copy of the drawing filed with the case.)

DEPARTMENT OF THE INTERIOR,  
 UNITED STATES PATENT OFFICE,  
 WASHINGTON, D. C., Nov. 3, 1879.

WM. L. VOELKER,  
 Care R. D. O. SMITH,  
 PRESENT.

Please find below a copy of a communication from the EXAMINER concerning your application for patent for telephone, filed Sept. 26, 1879.

Very respectfully,  
 H. E. PAINE,  
*Commissioner of Patents.*

Room No. 118.

Your case, above referred to, is adjudged to interfere with the applications of the parties named below, and the question of priority will be determined in conformity with the Rules accompanying this. The preliminary statement, demanded by Rule 53, must be sealed up and filed on or before the 17th day of Nov., 1879, with the subject of the invention and the name of the party filing it, indorsed on the envelope. The subject-matter involved in the interference is a spring forming or carrying one electrode of the circuit of a telephone and constantly pressing against the other electrode and the diaphragm to maintain the required initial pressure between the electrodes and yield to the movements of the diaphragm (Blake's claim).

This is substantially covered by the claim of Voelker and the 3d claim of Irwin and is described and shown by Edison.

PARTIES.

Thomas A. Edison, of Menlo Park, N. Y., application filed July 20, 1877, Case 141, Att'y of Record, L. W. Serrell, Box 4689 N. Y. City.

Francis Blake, Jr., of Weston, Mass., application filed May 10, 1879, Att'y of Record, Wm. W. Swan, Boston, Mass.

John H. Irwin, of Philadelphia, Pa., application filed May 24, 1879, Att'y of Record, R. D. O. Smith, Present.

*Voelker's Preliminary Statement.*

BLAKE vs. VOELKER, ET AL. PRELIMINARY INTERFERECE.

To the Commissioner of Patents:

Sir:—I invented the telephone shown and described in my application for letters patent, filed Sept. 26, 1879, during the month of May, 1876. I made a model of the same, having a membranous diaphragm immediately, that is to say, during May, 1876, and within two or three days I made another with a metallic diaphragm. I substituted the metallic diaphragm for the membranous one because I found the membrane was affected by dampness. My experiments in telephones have been almost continuous from that time to the present, by myself and in connection with others, but I have been unable until recently to make application for letters patent. Moreover from the best information I could get, until advised otherwise by a recent decision in the Patent Office, I thought a patent would not be granted to me for the invention now in issue.

WILLIAM L. VOELKER.

Subscribed and Sworn before me this tenth day of Nov., 1879.  
 KINGSTON GODDARD, Justice of the Peace, Springfield Township, Del. Co., Pa.

DEPARTMENT OF THE INTERIOR  
 UNITED STATES PATENT OFFICE,  
 WASHINGTON, D. C., Nov. 22, 1879.

WM. L. VOELKER,  
 Care R. D. O. SMITH,  
 WASHINGTON, D. C.

Please find below a copy of a communication from the Examiner of Interferences concerning your application for a Patent for Telephones, filed the 26th day of Sept., 1879.

Very respectfully,

H. E. PAINE,  
*Commissioner of Patents.*

Room No. 3.

The parties hereinafter named are hereby notified that as to their inventions adjudged to interfere with each other in the particulars specified in Office letter of the 3d of Nov. 1879, a hearing will be granted on the 16th day of April, 1880.

The testimony of the respective parties must be closed previous to the dates hereinafter designated. The party first filing an application for a patent will be deemed the first inventor, in the absence of proof to the contrary.

Rebutting testimony, but no other, may be taken by parties on whom rests the burden of proof after the closing of the testimony of the party who first filed his application.

All testimony must be taken, forwarded, and printed, in accordance with the published Rules of Practice of the Office.

Wm. L. Voelker of Morton, Pa., filed application Sept. 26, 1879.

Testimony-in-chief must be closed Dec. 22, '79.

Attorney of Record R. D. O. Smith of Washington, D. C. John Irwin of Philadelphia, Pa., filed application May 24, '79.

Testimony must be closed Jan. 5, '80. Restricted to record date.

Attorney of Record R. D. O. Smith of Washington, D. C.

Francis Blake, Jr., of Weston, Mass., filed application May 10, '79.

Testimony must be closed Jan. 26, '80.

Attorney of Record W. W. Swan, of Boston, Mass.

Thos. A. Edison, of Menlo Park, N. J., filed application July 20, '77.

Testimony must be closed Feb. 26, '80.

Attorney of Record L. W. Serrell, of N. Y. City.

Rebutting testimony by Blake Jr. must be closed Mch. 15, '80.

Rebutting testimony by Irwin must be closed Mch. 20, '80.

Rebutting testimony by Voelker must be closed Mch. 28, '80.

EDISON,	}	INTERFERENCE.
<i>vs.</i>		
BLAKE,		
<i>vs.</i>		
VOELKER.	}	

Please to take notice that we shall proceed to take testimony on behalf of Wm. L. Voelker, at the office of Col. Bell, 435 Library Street, in the City of Philadelphia, Pennsylvania, commencing at 10 A. M., on the Eighth day of December 1879, and adjourning from time to time, until said examination shall have been completed. Witnesses to be examined are

T. A. McCLELLAND, S. E. Cor. 10th and Market Sts.

CHAS. BEECHER, 10th ab. Market St.

JOHN CARROLL, N. W. Cor. 7th and Market Sts.

JOHN BROWN, S. E. Cor. 13th and Chestnut Sts.

HORACE WHITMAN, N. W. Cor. 12th and Market Sts.

L. B. NEWELL, Sansom ab. 12th St.

VINCENT LAGRASSA, care of Jas. Bellak, Chestnut bel. 12th St.

PHILIP QUICK, Race ab. 2d St.  
 JOHN HENRY, 1119 Arch St.  
 J. H. VOELKER, 1203 Sansom St.  
 MRS. SUSAN CROULS, 1203 Sansom St.  
 J. H. IRWIN, Morton, Del. Co., Pa.  
 And others.

You are invited to be present and cross-examine if you shall desire to do so.

R. D. O. SMITH,  
 of Counsel for Voelker.

To Esq.

## INTERFERENCE.

*Telephone.* *Case 1.*  
*In Re.* application Francis Blake, Jr., for Patent for Telephone filed Jan. 3, 1879.

Blake v. Edison and v. Chinnock and v. Randall and v. Irwin and v. Phelps.	}	<i>Before the Commissioner of Patents.</i>
---	---	--

## PRELIMINARY STATEMENT OF FRANCIS BLAKE, JR.

Prior to the 4th of July, 1878, I made no inventions of my own, but had experimented for a few weeks trying to reproduce the inventions of others.

I made use of the device referred to in this interference during the month of July, 1879. The first instrument in which I made use of it is still in my possession. I have several instruments containing this device, which were made between July and November, 1878. On the last mentioned date, the Bell Telephone Co. began to manufacture the Blake Transmitters, and have used the said device in several thousand instruments.

FRANCIS BLAKE, JR.

New Hampshire, }  
 County of Carroll. } ss.

Subscribed and sworn to this 26th day of Sept. 1879.

Before me

LYCURGUS PITMAN,  
*Justice of the Peace.*

FRANCIS BLAKE, JR.

*Of Weston, Mass.*

Pending application Filed May 10, 1879.

IMPROVED SPEAKING TELEPHONES.

To all whom it may concern:

Be it known that I, Francis Blake, Jr., of Weston, in the State of Massachusetts, have invented certain new and usefull

improvements in speaking telephones, of which the following is a specification.

My said improvements relate to that form of transmitting telephones, in which the undulations or variations in the strength of an electric current necessary for reproducing sounds in a receiving instrument are produced by varying the resistance of the circuit through changes of pressure between two electrodes of the circuit. As heretofore constructed, one of the electrodes in such instruments is held in a fixed position while the other being free to move to some extent, is constantly held in contact with such fixed electrode and is pressed against it with greater or less force by the vibrations of the diaphragm with which it is connected. In using an instrument of this form it has been found necessary to adjust the initial static pressure between its electrodes with great care and delicacy, in order to secure such a variation of resistance between them under the vibrations of the diaphragm, as will enable the current to reproduce in a receiving instrument the sounds which fall upon the transmitting instrument. When such an adjustment has been obtained it is easily disturbed by slight causes such as a change in the temperature of the instrument or a trifling movement of some of its parts in relation to other parts.

By my inventions the proper adjustment is easily secured and is not liable to be disturbed in the practical use of the instrument. I support both the electrodes in such a manner that they can move freely with the diaphragm. One of them may be attached directly to and be supported by the diaphragm, but I prefer to support it in contact with the diaphragm but by an independent support.

The other electrode is supported so as to move freely, but is made so heavy or is so weighted that by its inertia it will offer a resistance to the slight and quick vibrations of the diaphragm, which will give a varying pressure between the electrodes and a consequent change in the resistance of the circuit. This second electrode is so supported that the initial static pressure be-

tween the two will not be sensibly affected by a change of temperature within the ordinary range of temperatures to which such instruments are exposed. It is on the end of a spring, the other end of which is connected to a lever, by means of which the proper initial pressure between the electrodes and against the diaphragm is obtained.

To secure contact between the electrodes independently of the pressure against the diaphragm, I support the one next to the diaphragm upon a spring which exerts its pressure against the opposite electrode.

The manner in which I construct instruments embracing my invention is shown in the drawings hereto annexed in which *A*, represents a box or casing, in which the mechanism of a telephone embracing my improvements is inclosed. This mechanism is for convenience attached to the cover or top of the box, *A'*.

Fig. 1 is a plan of the mechanism attached to the top or cover of the box. Figure 2 is a section of the box and mechanism taken through the middle on the dotted line, *h h*, of Fig. 1, and showing one of the screw cups for making connections with the exterior circuits. Figure 3 is a cross section of the box and mechanism on the dotted line, *h' h'*, of figures 1 and 2, and showing one of the screw cups for making connections with the exterior circuits. Figure 3 is a cross section of the box and mechanism on the dotted line *h' h'* of figures 1 and 2, and showing the screw cups for making connections with the exterior circuits.

*B* represents a metal ring or frame for holding the mechanism of the telephone. It is screwed to the cover *A'*, as shown, and has two ears, *A' B'*. On the inner surface of the ring, *B*, is a narrow ledge or lip, *b*, on which the disk or diaphragm, *C*, is placed. This diaphragm is formed as usual of a thin iron plate. A lining of paper or other suitable material is placed between it and the ledge or lip, and it is held in place by two springs, *D D*, attached to the metal rim or ring, *B*,

with their free ends pressing upon the back of the diaphragm near to its center, so as to hold it against the ledge. Thin pads of rubber, *a a*, are placed between the ends of the springs and the diaphragm. By this method of holding the diaphragm in place, it is less liable to become distorted by a change of temperature than when held wholly at its circumference.

The center of the ring and diaphragm is placed opposite the orifice, *E*, in the cover, *A'*, through which the sounds enter the instrument. On the other side of the diaphragm and at its center is placed one of the electrodes. It is a small metal bar (*e*), one end of which rests against the diaphragm. The other end is brought nearly to a point and is in contact with the other electrode (*e'*). It is desirable that it should be formed of or plated with such metal like platinum or nickle, which is not easily corroded. It may be attached directly to the diaphragm, but I prefer to support it independently, as shown, upon a light spring, *c*, which tends to press it away from the diaphragm, and towards the opposite electrode.

This method of supporting the electrode insures its contact with the other electrode under some circumstances, when otherwise they would be liable to be separated and the circuit broken.

The other electrode, *e'*, is formed on a weighted spring, *d*, which is supported on an adjusting lever, *F*, by which the tension of the spring is regulated. This spring must be stronger than the spring, *c*, which supports the electrode, *e*, and from its greater strength it tends to keep the electrode, *e*, in contact with the diaphragm. It may be made of a piece of common watch spring and it carries at its free end a weight, *g*, heavy enough to check very greatly the rate of vibration of the spring. This weight may be of metal which may serve directly as the electrode, but I have obtained better results by applying to it, at the point of contact with the other electrode, a piece of gas coke or a hard pressed block of carbon, *h*, such as is used for electric lights.

The employment of the coke or carbon does not, however, constitute a part of my invention, further than it contributes a portion of the weight carried by the spring. If the weight is a nonconductor, as it may be, there must be a metallic conductor between the carbon or other electrode used, and the spring or some other part of the circuit. The weight must be proportioned to the stiffness of the spring, a stiff spring requiring a heavier weight than a weaker one. The adjusting lever, *F*, to an arm of which one end of the spring, *d*, is attached, is a stiff bar connected at one end by a stiff spring, *j*, to the ear, *B'*, of the ring, *B*. The other end rests upon an adjusting screw, *G*, placed in the ear, *B<sup>2</sup>*, on the opposite side of the ring. The spring, *j*, tends to force the lever, *F*, away from the diaphragm, and against the adjusting screw, *G*.

The ear, *B<sup>2</sup>*, supporting the adjusting screw, *G*, is drilled and slotted, as shown in figures 1 and 2, to prevent the screw from wearing loose.

The part of the lever, *F*, which comes in contact with the screw is inclined to the axis of the screw, as shown, so that when the screw is forced inwards it will press the lever towards the diaphragm and when it is withdrawn the lever will by the tension of the spring, *j*, be forced away from the diaphragm. The outer end of the screw extends into a hole, *l*, through the casing and is fitted to receive a key by which it can be turned to adjust the lever to a desired position.

The pressure between the two electrodes and against the diaphragm obviously depends upon the position given to the adjusting lever by the adjusting screw, *G*, but it is obvious that as this pressure can be increased or diminished only by increasing or diminishing the tension of the spring *d*, the changes in the pressure by turning the screw will be much less rapid than they would be if the electrode was acted upon directly by the lever or the adjusting screw. Hence a proper adjustment of the initial static pressure between the electrodes can be much more easily obtained through the agency of the spring *d*, than



without it. It will also be easily seen that this pressure will not be sensibly affected by any slight change in the position of the electrodes, which might arise from the expansion or contraction of any part of the apparatus under a change of temperature. On the other hand it will be seen that if the diaphragm is thrown into the rapid but slight vibrations caused by sounds, the spring, alone, would yield to them so readily as to give but little change of pressure between the electrodes within the range of the vibrations, but by reason of the inertia of the weight, the tendency of the spring to follow the vibrations of the diaphragm will be checked and a greater range of pressure between the electrodes, will be obtained. At the same time it is easy to see that the changes of pressure will be very different from what they would be if the electrode was supported rigidly, and could not yield to the movements of the diaphragm.

I have before stated in substance that the main feature of my improvements, will be obtained even when the electrode  $e$  is attached directly to the diaphragm: but it should be observed that an additional improvement is gained by supporting that electrode on an independent spring which keeps it in contact with the electrode  $e'$  for it not unfrequently happens when the intermediate electrode is attached directly to the diaphragm that a too rapid vibration of the diaphragm, or some other disturbance in its vibrations, will throw the outer electrode out of contact with the intermediate electrode and thus break the circuit: but in my construction such irregular vibrations of the diaphragm will separate the diaphragm from the intermediate electrode  $e$  rather than separate the two electrodes from each other and the circuit will not be broken.

For convenience in construction when employing the independent spring  $e$ , for the purpose just stated; I attach it to the same arm of the adjusting lever  $F$ , to which the spring  $d$ , is attached, the two springs being separated by a piece of insulating substance  $r$ , but the spring  $e$ , might be attached to any conven-

ient portion of the instrument if properly insulated.

The wires for connecting this transmitting instrument with the receiving telephone are marked  $W$  and  $W'$ . I have, however, shown them as connected with the primary circuit of an induction coil  $I$  in connection with which  $s$  and  $s'$  are the screw cups leading to the battery, while  $s^2$   $s^3$  are screw cups for connecting the line wires with the secondary circuit of the coil  $I$ .

The use of the induction coil is not essential and the wires  $W$   $W'$  may go at once to the receiving instrument. The wire  $W$  is connected directly with the spring arm  $c$  of the electrode  $e$  as shown in figure 2. The wire  $W'$  is connected with one of the ears of the ring  $B$  as shown in figure 3, which is in metallic connection with the electrode  $e'$  as shown in figure 2.

I claim:

A spring forming or carrying one electrode of the circuit of a telephone and constantly pressing against the other electrode and diaphragm to maintain the required initial pressure between the electrode and yield to the movements of the diaphragm, substantially as described.

Witnesses:

E. S. Blake,	}	Francis Blake, Jr.
W. W. Swan.		

## IN THE UNITED STATES PATENT OFFICE.

In the matter of Interference.

THOMAS A. EDISON.

vs.

C. E. Chinnock, J. H. Irwin, Geo. M. Phelps, and F. Blake,  
Jr., for Patents on Speaking Telegraphs.

*Case No. 1.*

Preliminary Statement of Thomas A. Edison.

State of New Jersey }  
County of Middlesex. } s. s.

Thomas A. Edison, being duly sworn deposes that he conceived the point in controversy some time before March 1877, reduced it to practice March 25, 1877, and actually tested the instrument between Menlo Park and the Western Union Telegraph Office in New York City, which resulted in transmitting and reproducing fairly the human voice; several persons witnessed the exhibition. That he has a drawing of the instrument made and dated March 5, 1877.

That he feels sure that he used this device earlier than the above date but so far has been unable to find any sketches of it. That he thinks the point in controversy is shown in his patent, No. 203,014, of April 30, 1878.

That he has a sketch dated April 1, 1877, showing the point in interference, in a different shape.

That he has other sketches made in April and May; one May 25, 1877, especially contains the exact designs and devices shown in deponents application, No. 141.

Since these dates and up to the present time he has been engaged in experimenting and making telephones and is now engaged on experiments on telephones, in which devices of this character are employed.

THOMAS A. EDISON.

Subscribed and sworn to before me this 29th day September, A. D., 1879.

STOCKTON L. GRIFFIN.

*Notary.*

THOMAS A. EDISON

Of Menlo Park, New Jersey, Assor. to Western Union Telegraph Company of New York, N. Y.

*Pending Application, Filed July 20, 1877.*

SPEAKING TELEGRAPH.

TO ALL WHOM IT MAY CONCERN:—Be it known that I, Thomas A. Edison, of Menlo Park, in the County of Middlesex, and State of New Jersey, have invented an Improvement in Speaking Telegraphs, of which the following is a specification:

The object of this invention is to transmit the human voice over telegraphic wires for conversational purposes.

The invention consists in transmitting positive and negative currents of variable strength necessary to obtain the proper articulation, by means of double contact springs arranged on each side of a diaphragm, the extreme end of such springs being provided with points formed of semi-conductors such as plumbago, Peroxide of lead, and other oxides and conducting material.

The invention further consists in the arrangement of the batteries with the double contact springs to insure the transmission of positive and negative currents.

The invention further consists in the receiving instrument for reproducing the vibrations from the transmitter.

Fig. 1 shews the transmitter and receiver; *A* is the resonant chamber over the end of which the diaphragms stretched, either side of which may be made heavier in the centre by a small weight, if great amplitude is required of the diaphragm; *b*, *c*, are the two contact springs, having points made of compressed plumbago mixed preferably with gum rubber, but any substance not liable to rapid decomposition may be used; these points face each other on the opposite side of the diaphragm and make contact with platina disks secured to the diaphragm; the spring *b*,

passes through a hole or small slot in the side of the transmitter; 2 and 3 are the main batteries; the battery 2 has zinc to the line or point *c*, and the battery 3, has copper to the line or spring *b*.

When the springs *c*, and *b*, are adjusted so as to make contact with the diaphragm equally, no current passes to the line, but when the diaphragm is vibrated, its movement to one side, say *c*, causes a greater pressure upon the plumbago on that spring and a lessening of the pressure on the plumbago on *b*, hence the balance of the batteries 2 and 3 will be destroyed; 2 being given the advantage will send a negative current to the line; upon the return of the diaphragm, the battery currents will again neutralize each other. The vibration of the diaphragm to the other side, causes the pressure to be reversed, and the battery 3, will send a positive current to the line. As plumbago decreases and increases its resistance enormously under slight changes of pressure, it follows that the strength of the electric waves will be in proportion as the speaker's voice is strong or weak.

In fig. 2, is shown the contact spring which I prefer to use instead of *c*, and *b*, which are used merely to assist in explaining the operations more clearly.

5, is a U shaped spring secured to the screw 8, which is adjusted back and forward by the thumb-nut 9; 7 is the pillar holding such screws; *r*, is a piece of soft rubber or equivalent substance placed between the prongs of the spring 5; 6, is a wire or band which serves to bind the prongs tightly against the rubber *r*, so as to prevent the prongs acting as a tuning fork and transmitting harmonic vibrations not desirable; 10 is the plumbago contact point; the object of the U spring and rubber is to present a semi-rigid point for contact so as to prevent a rebound and allow of a slight yield when the plumbago is pressed by the diaphragm; *D* is the receiver which consists of a resonant chamber of any suitable character, either a tube, as in fig. 3, or as a box as at *D*, fig. 1; *f*, is a rigid arm secured to the

box and is provided upon its extreme end with an adjusting screw *h*. Near the end of the arm is secured a spring *g*, whose end rests upon the chemically prepared paper upon the drum *e*; the under side resting upon the paper it is platinized; the screw *h*, serves to increase and decrease the pressure of the platina spring upon the paper.

When the paper is moved slowly by rotating the drum *e*, the waves of electricity coming over the line pass through the arm *f*, to the platinized spring *g*, thence through the paper to the earth; if a negative current passes in the opposite direction, nearly all friction between the platina plate and the paper ceases and the resonant box or diaphragm regains its normal position.

When the positive current passes through the same channel the normal friction of the paper is augmented; and the chemical surface acting upon the platina serves to give a movement to the resonant box. Thus the mechanical force applied to move the chemical surface acts with the electric current to produce the vibration of the resonant chamber.

The principle of this method of obtaining motion by electro-chemical decomposition is described in my letters patent, No. 158,787, granted Jan. 19, 1875.

To facilitate the discharge of electricity from the receiving apparatus it may be shunted with an electro magnet.

Fig. 4 shows the device which may be employed to rotate the drum *e*, in a noiseless manner, so as to prevent interference with the weak hissing consonants which form a part of ordinary conversation.

*p*, is a worm and *o*, the wheel for revolving the roller *e*; *t*, is a universal joint connecting to the shaft *s*, the object of the shaft being to carry the actuating handle to the right side of the machine and the paper carrying devices to the left hand side; *v*, is a spring which serves to press the rubber wheel *w*, against the under surface of the wheel *u*, which also may be covered with rubber; *w'* is the handle by which to rotate the disk *u*, shaft *s*, worm *p*, and roller *e*.

The mouth of the speaking tube may be closed except a longitudinal slot through which the vibrations of the voice pass to the diaphragm or tympan, the object of the slot being to increase the power of the hissing consonants. Also that the point *v*, may be dispensed with on very short lines.

I claim as my invention :

First. In a telegraphic apparatus operated by sound, the combination with the diaphragm or tympan of two contact points in the electro circuit adjacent to the opposite surfaces, substantially as set forth.

Second. The combination with a diaphragm, in a telegraph operated by sound, of two contact points at opposite sides of the diaphragm and opposing batteries connected in the electric circuit, substantially as set forth.

Third. In a telegraphic apparatus operated by sound, the combination with the diaphragm of one or more contact points of plumbago or similar inferior conductor, in the electric circuit, whereby the rise and fall of electric tension is proportionate to the pressure exerted upon the point or points by the diaphragm, substantially as set forth.

Fourth. In a telegraphic apparatus operated by sound, a receiving instrument provided with a resonant surface in combination with a frictional surface, moved by power, and acting in connection with the electric current to vibrate such resonant receiver and to produce tones corresponding to those at the transmitting apparatus, substantially as set forth.

Signed by me this Ninth day of July, A. D., 1877.

THOMAS A. EDISON.

*Witnesses:*

Geo. T. Pinckney.  
William G. Mott.

}  
}

## IRWIN'S PRELIMINARY STATEMENT.

BLAKE,	}	PRELIMINARY INTERFERENCE.
vs.		
EDISON,		
vs.		
IRWIN,		
vs.	}	
VOELKER.		

TO THE COMMISSIONER OF PATENTS: *Sir*:—A telephone having “a spring, forming or carrying one electrode of the circuit, and constantly pressing against the other electrode and a diaphragm, to maintain the desired initial pressure between the electrodes and yield to the movements of the diaphragm” was devised by me in October, 1877, and the first instrument made by me, having those features, was completed in November, 1877. At the time when the invention was made by me, I had already been engaged for a considerable time in experiments on telephones, and such experiments have been continued uninterruptedly to the present time. Patents have been granted to me from time to time for such of my improvements as appeared to be of immediate importance.

J. H. IRWIN.

Subscribed and sworn to before me this 18th day of December, 1879.

R. D. O. SMITH,  
*Notary Public.*