EVIDENCE FOR COMPLAINANT.

TAKEN PURSUANT TO THE SIXTY-SEVENTH RULE OF THE SUPREME COURT OF THE UNITED STATES, IN EQUITY, AS AMENDED, BEFORE ME,

W. P. PREBLE, *Examiner.*

BOSTON, Jan. 25, 1879.

Present: CHAUNCEY SMITH, Esq., and C. E. HUBBARD, Esq., *of Counsel for Complainant:*
CAUSTEN BROWNE, Esq., *of Counsel for Defendant.*

[*Complainant's counsel put in evidence certified copy of Letters Patent, granted to Alexander Graham Bell, March 7, 1876, No. 174,465, marked "Complainant's Exhibit 1, W. P. Preble, Jr., Examiner." Also, certified copy of Letters Patent, granted to Alexander Graham Bell, Jan. 30, 1877, No. 186,787, marked "Complainant's Exhibit 2, W. P. Preble, Jr., Examiner." Also certified copy of assignment from A. G. Bell to G. G. Hubbard, trustee of certain Letters Patent, recorded Lib. R 21, p. 399, marked "Complainant's Exhibit 3, W. P. Preble, Jr., Examiner." Also certified copy of assignment from G. G. Hubbard, trustee, to Bell Telephone Co. Recorded Lib. Y 22, page 460, marked "Complainant's Exhibit 4, W. P. Preble, Jr., Examiner."*]

Also, a box telephone, called the "Phelps Box Telephone," marked "Complainant's Exhibit 6, W. P. Preble, Jr., Examiner." Also a telephone called the Phelps Duplex Telephone, marked "Complainant's Exhibit 7, W. P. Preble, Jr., Examiner." Also a telephone called the "Crown" Telephone, marked "Complainant's Exhibit 8, W. P. Preble, Jr., Examiner."]

[*The defendant admits that prior to the filing of the bill he had used, in Boston, instruments like each of those marked "Exhibits 6, 7, and 8," connected in an electric circuit for transmitting and receiving spoken words and messages.*]

DEPOSITION OF HENRY B. RENWICK.

Direct Examination by CHAUNCEY SMITH, Esq., *of Counsel for Complainant.*

Int. 1. Please state your name, age, residence and occupation.

Ans. Henry B. ~~Remick~~ Renwick; sixty-one years of age. I reside in the city of New York. I am by profession a civil and mechanical engineer, and have for the last fifteen years been principally occupied in matters relating to machinery, processes and patents.

Int. 2. State how far your experience in relation to the matters mentioned in the last answer have been directed to the comparison of machines and inventions with reference to their substantial likeness or differences, and especially with reference to electrical machines or electro-magnetic apparatus.

Ans. I have been frequently, during every year for the last twenty-five years, or perhaps more, examined as expert in suits in which patents were in question, among which, I think, were three or more relating to electro-magnetic telegraphs, and I have taken out some and reissued other patents relating to telegraph and telegraphic machinery, and when taking out one of those patents and reissuing one of the others, I had occasion to examine carefully all descriptions in patents or other places of all telegraphic machines or apparatus prior to the dates of the patents in each case.

Int. 3. Have you examined the two patents which have been put in evidence, and marked "Exhibits 1 and 2," granted to Alexander Graham Bell, and numbered respectively, 174,465 and 186,787, and made yourself acquainted with the mechanism or apparatus therein described?

Ans. I have carefully examined the patents named in the question, and believe I understand the apparatus described in them.

Int. 4. If you find in the patent Exhibit No. 1 a description of an apparatus for transmitting or reproducing vocal sounds, will you state what the agencies or instrumentalities are which are brought into play to produce that result, and how the apparatus operates under the force accompanying or derived from sounds to reproduce the sounds?

Ans. I do find, described in Exhibit No. 1, an apparatus for transmitting to a distance the sounds of the human voice (vocal sounds). In order to understand the operation of the apparatus, it is necessary to read the whole patent, but the apparatus itself is described towards the end of the patent before the claims, and is represented at Fig. 7 of the drawing thereof. The apparatus consists essentially of two electro-magnets connected by a wire, one magnet at the receiving, and the other at the transmitting station, second of two diaphragms and two armatures, one set for each station, placed in such relation to the magnets that the armature will be acted upon by the varying force of the magnet at the receiving end of the apparatus and so that the armature at the other end, when vibrated by the vibrations of the diaphragm, will cause the attractive force of the magnet at the other end to vary. These diaphragms are described in the patent as made of a stretched membrane and the armature of a piece of spring steel attached at one end to the diaphragm and hinged at the other end, so that when the diaphragms vibrate the armatures also vibrate and *vice versa*. There is shown in the drawings a battery connected with the line in the usual manner, and the operation of the apparatus is as follows. When the diaphragm at the transmitting end is set in vibration by the sounds of the human voice its armature vibrates with it in front of the magnet at the transmitting station, and by the vibrations of the armature electrical undulations, as the patent calls them, are created in the circuit which vary the attractive force of the magnet at the receiving, station and this varying force of the magnet at the receiving station causes the armature in front of it, and the receiving diaphragm to vibrate in a similar manner to that in which the transmitting diaphragm vibrates and it is stated in the patent, in substance as the result of this apparatus, that the motions of the armature at the transmitting end due to the action of the human voice on the diaphragm, are copied by the armature at the receiving end, and consequently by the diaphragm attached to it, so that a sound similar to that uttered in the transmitting end is heard to proceed from the diaphragm at the receiving end. If follows from this that if a word be spoken in front of the transmitting diaphragm that the diaphragm will be set into vibration resulting from such enunciation of the word, that the receiving diaphragm will copy these vibrations, and that the word will be heard by a person having his ear at the diaphragm of the receiving of the apparatus.

Dup.

Int. 5. Will you state whether or not you find either of the claims of the patent, as you understand them, to refer especially to the apparatus which you have described, and if so, to which one of them?

Ans. I find that the fifth claim of the patent refers to the apparatus which I have described, and which is represented in Fig. 7 of the drawings.

Int. 6. Have you examined the instruments which have been produced in evidence as those used by the defendant, marked respectively Exhibits 6, 7 and 8?

Ans. I have, and have taken them apart, so as to be able to inform myself accurately as to their construction.

Int. 7. Assuming these instruments to be used respectively in the manner specified in the admission of the defendant accompanying their introduction in evidence, will you state how you find them to correspond with or differ from substantially the apparatus described in Mr. Bell's patent, marked Exhibit 1, and referred to in the fifth claim, with respect to the results to be secured by the use of the instruments, the agencies employed in the apparatus, and the manner in which the apparatus is operated by vocal sounds or by the force accompanying or derived from such sounds?

Ans. I will answer, first, with regard to results to be secured by the use of the instruments, Exhibits 6, 7 and 8. The results in all of them are the same when used as stated in the question, namely, that when a word is spoken to that end of the instrument which is the transmitting instrument, it is heard by the person applying his ear to the receiving instrument at the other end of the wire. And in these respects all these instruments are like the apparatus described in Bell's patent. In all three of these instruments there is a diaphragm, one for the receiving and one for the transmitting instrument, and in Exhibits 6 and 7 these diaphragms are duplicated, but as each diaphragm acts precisely like the other I will leave out, for the present, reference to more than one diaphragm. These diaphragms in all the instruments are of iron instead of some membraneous substance, as described in Bell, and therefore the diaphragm itself acts as the diaphragm and armature of Bell, which diaphragm and armature of Bell, as I have stated before, are connected and move together. In all of these exhibits this diaphragm is placed in front of one pole of a permanent magnet, and the magnets are surrounded by the ordinary spool with its coil of wire, and this wire is in practice extended from the wire coil of one station to the wire coil of the other station, the usual ground connections being made with the other end of the wire from each spool, as shown in

Bell's patent. Now, these diaphragms of Exhibits 6, 7 and 8 are placed in the same relation to the magnets that they are in Bell's apparatus, and when the diaphragm at the transmitting end is set in vibration by a word spoken to it, it causes what Mr. Bell calls electrical undulations in the circuit, which vary the power of the magnet at the receiving end, so that the diaphragm at the receiving end is set into vibrations, corresponding with those of the transmitting end, and consequently a word spoken at one end of the line or circuit to the diaphragm is audible to the ear of the operator at the receiving end, the sound at this last person's ear being produced by the vibrations of the diaphragm at the receiving end. The magnets are of different forms in all three of these instruments, and in Exhibits 6 and 8 of a form different from that shown in Bell's patent; but I do not understand that Mr. Bell's invention is limited to any special form of magnet, provided it is arranged and combined in an apparatus in such a way as to produce the same effect as it does in Bell's. In all these exhibits, as I have before stated, the diaphragms are of [illegible] but I do not understand that Mr. Bell's invention is limited to a diaphragm made of any special material so long as it is capable of being set into vibrations corresponding with the word uttered by the voice, or by the electrical undulations which vary the force of the magnet at the receiving end of the apparatus. Bell's diaphragm and armature are made of two pieces, but move and act together, and in the Exhibits 6, 7 and 8, the diaphragm and armature are the same piece, but both structures perform precisely the same duty in the apparatus, and acting in substantially the same way to perform it, although there is no doubt that the metal diaphragm gives a louder tone at the receiving end than the membraneous diaphragm. In Bell's apparatus, as specially described in his patent, the cores inside of the bobbin and coils become magnetic under the influence of a battery, while in the Exhibits 6, 7 and 8 the cores are permanently magnetic. The effect is the same in kind whether the magnetism of the core be produced by permanently magnetizing it, or by temporarily magnetizing it through the aid of a battery. And as I understand it, the electrical undulations which are caused by the motion of the armature of the transmitting diaphragm, and which undulations are the effective agents in causing the motion of the receiving diaphragm, are undulations which are due to the motion of the transmitting armature in front of the pole of a magnet, and not due to the effect of a battery, so that these electrical undulations are the same whether a temporary magnet or a permanent magnet be used as the core of the coils. The apparatus of Mr. Bell is the speaking telephone in its simplest form, and there are many refinements of construction found in these instruments 6, 7 and 8, which do not materially alter the mode of operation of the apparatus described by Bell. I do not deem it necessary to describe these niceties of construction and adjuncts to the apparatus, and state as the result of my examination of these contrivances, 6, 7 and 8, that they contain the invention referred to in the fifth claim of the Bell patent, Exhibit No. 1. All three of these forms of apparatus are operated in the same way as Bell's. A word is spoken to the transmitting diaphragm and sets it in vibration. The vibration of this diaphragm, which is both diaphragm and armature, in front of the magnet at the transmitting end, causes electrical undulations in the circuit, thus varying the force of the magnet at the receiving end, and this varying force of the magnet at the receiving end sets the diaphragm of the receiving end into vibrations corresponding to those of the transmitting diaphragm, this receiving diaphragm, therefore, giving out the same sound as that which was imparted to the transmitting diaphragm. I have not stated it before, and state it now, least it may lead to mistake, that the sounds heard at the receiving end are, in none of these instruments that I have tried, as loud at the receiving end as those that were uttered

at the transmitting end, and that they are also to my ear not quite so articulate.

Int. 8. Will you now turn your attention to the second patent of Mr. Bell, which has been produced in evidence, marked "Exhibit 2," dated Jan. 30, 1877, and numbered 186,787, and state whether you find described in it an apparatus for transmitting vocal sounds, and if so, whether you find described in it any modifications or improvements upon the apparatus referred to in your last answer, and what advantages, if any, you find which appertain to such modifications?

Ans. In Bell's patent, Exhibit 2, I do find described an apparatus for transmitting vocal sounds, and certain modifications and improvements upon the apparatus described in the Bell patent No. 1. In the instrument described in patent No. 2, the diaphragm is represented as made of metal, preferably of iron, and in my opinion an iron or metallic diaphragm is better than one made of membrane, because it is not susceptible to variations of its elastic condition by reason of the hydrometric changes of the atmosphere, and because its elasticity does not vary after use for a considerable time, while the membraneous diaphragm does so vary at the transmitting end, owing to the action of the breath upon it. Moreover, the metallic diaphragm gives out a louder sound at the receiving end than a membraneous diaphragm, when the sounds at the transmitting end are of equal loudness. This second Bell patent also describes a box, called in the patent a cover or sounding-box, which encloses that end of the diaphragm which is furthest from the speaker at one end or the hearer at the other, and thus prevents vibrations of the air, due to noises in the room or other causes, from affecting the vibrations of the diaphragm. It also describes what is called in the patent a speaking tube for conveying sounds to or from the diaphragm. And also it describes a magnet with a coil at the end of the bar, two modifications of which are represented in the drawing, one in Figs. 3 and 4, and another in Figs. 5 and 6, where the coils are only around that part of the magnet which is immediately adjacent to the pole or poles thereof, or, as in Figs. 5 and 6, are wound around pole pieces, that is, pieces of iron extending from that which is usually called the poles of the magnet. I do not understand that these particular forms of magnet are new by themselves; on the contrary, I understand that they were old forms of magnets, and differed in degree only and not in kind from magnets in which the coil extends over a greater portion of the magnet, whether the core be permanently or temporarily magnetic. He further describes in this patent the working of the speaking telephone by the use of a permanently magnetic core, instead of a core temporarily magnetized by the employment of a battery. As I understand from books, the location of the coil wire described in this patent is an advantageous one, more advantageous than when the coil covers a greater portion of the magnet in the usual manner, and it is certainly useful to dispense with the battery.

Int. 9. Will you refer to the defendant's telephones, Exhibits 6, 7 and 8, and state how far, if at all, you find them to embrace substantially any of the inventions which, as you understand it, are described in the patent last referred to, and are the subject of the 3d, 6th, 7th, and 8th claims?

Ans. The third claim, as I understand it, is to the combination of an iron or steel diaphragm with what the claim terms an electro-magnet, in such manner that the diaphragm can be either thrown into vibrations by the movement of the surrounding air or that it can be thrown into vibrations by the attraction of a magnet. When

the diaphragm is at the transmitting end, it is thrown into vibrations by the movement of the surrounding air, and when it is at the receiving end or is used as the receiving diaphagm, it is thrown into vibration by the attraction of a magnet. By the word "electro-magnet" in this claim I understand that the patentee means a magnet surrounded by a coil of wire, whether that magnet be a permanent magnet or be a core of soft iron, made magnetic by the action of a battery in the usual way. And I understand this for two reasons: first, because the combination of the two instrumentalities acts in the same way whether the core be permanently magnetic or temporarily magnetized, and second, because the patent itself calls a magnet having a permanently magnetic core surrounded by a wire an electro-magnet, the magnet *o* being described in one place as a compound permanent magnet provided with helices or coils of insulated wire, and the same magnet *o* being afterwards called an electro-magnet. All the forms of apparatus 6, 7 and 8 have iron diaphragms, and they all have electro-magnets in the sense in which that word is used in the third claim, and these two are so combined and supported that the diaphragm can be thrown into vibration by the movement of the surrounding air or by the attraction of a magnet. In my opinion, therefore, each of the exhibits 6, 7 and 8 contains the invention referred to in the third claim of Exhibit 2. The invention referred to in the sixth claim is the combination of the sounding box or cover with an electric telephone. This cover is shown in the drawing as covering up that side of the diaphragm which is nearest to the magnet. I have already described what I suppose to be the use of this cover, namely, to protect the diaphragm. In Exhibits 7 and 8 this cover is made apparently of hard vulcanized rubber or vulcanite, and in Exhibit 6, the cover or box is the wooden box in which the diaphragm and magnets are located when the apparatus is set up for use. Such being the construction of 6, 7 and 8, it is my opinion that they contain the invention referred to in the sixth claim of the Bell patent, Exhibit No. 2.

The seventh claim is to the combination of an electric telephone with a speaking or hearing tube for conveying sounds to and from the telephone. The description of the speaking tube is very meagre in the patent, but from the words "convey sound to and from the telephone," found in the claim, and from the words found in the patent itself, "E represents a speaking tube by which sounds may be conveyed to and from the plate A," and also on considering the drawings which show a small chamber in front of the diaphragm or

plate A, which chamber is absolutely essential in order that the tubular part of the contrivance may convey the sound waves to the diaphragm, it seems to me that the tube E really means the tubular orifice through which the sound waves are sent, in connection with the chamber at the end of that orifice where the sound waves act upon the diaphragm. If I be right in this opinion as to what combination is referred to in the claim, all the exhibits, 6, 7 and 8, contain the invention referred to in that claim, because all of them have a chamber extending over the front side of the diaphragm, into which the sound waves are transmitted through a tubular orifice, as will be apparent on removing the parts which compose the chamber from the diaphragm or the diaphragm from the chamber which encloses the diaphragm in front. If the Court shall consider that the words "tube E" refer only to the tubular pipe which conveys the sound waves either from the mouth to the chamber, or to the ear from the chamber, then I would find the combination described in the patent only in Exhibit 6.

As I understand the eighth claim of the patent, it relates to the combination of the iron or steel diaphragm with a permanent magnet and coils of wire surrounding the magnet when those coils or helices are upon the ends of those magnets, as represented in the drawings, instead of covering a great part of the body of the magnet as is usual. Now, in all three exhibits, 6, 7 and 8, there is an iron diaphragm, a permanent magnet, and a coil upon the end or ends of the magnet nearest the diaphragm. And when I say this I understand that these exhibits have the coils around what are commonly called pole pieces instead of around the ends of the magnets themselves. And I also understand that the patentee describes as one modification of the magnet a permanent magnet, to the poles of which are affixed pole pieces of soft iron surrounded by helices of insulated wire. The eighth claim, as I understand it, therefore, refers either to a magnet one or both ends of which are surrounded by a coil, or to a magnet having a pole piece or pole pieces surrounded by a coil upon the end or ends of said magnet nearest the iron diaphragm. In Exhibit 8 is really a compound magnet formed of six permanent magnets, and at the ends of these magnets, opposite the centre of the diaphragm, there is a cylindrical pole piece, which is surrounded by a wire helix. In Exhibit 7 there is a permanent magnet, shaped so as to work in some measure as a compound magnet, with two pole pieces, each surrounded by a helix, and each opposite to one of the diaphragms of that exhibit. In Exhibit 6 there is a permanent magnet, shaped something like a capital C, with two pole pieces, each surrounded by a wire helix, and each of these pole pieces is opposite the centre of one of the diaphragms of Exhibit 6. In my opinion, all the exhibits, 6, 7 and 8, contain the invention referred to in the eighth claim of the Bell patent, Exhibit No. 2.

Int. 10. Do you understand that by virtue of the permanent magnet the coils in the defendant's telephones can be used for transmitting vocal sounds without a battery upon the circuit?

Ans. I do.

Int. 11. Does Exhibit 6 embrace any other mechanism besides what you have referred to in your previous answers? If so, will you state generally what it is, and whether it forms any part of the speaking telephone itself?

Ans. It does embrace other mechanism, which does not form any part of the speaking telephone itself, but which serves to send calls by a bell from one station to another.

[*The plaintiff's counsel will not in this suit assert infringement by the use of the defendant's instruments produced under any other claims than those mentioned in the preceding direct examination.*]

[*Adjourned.*]

BOSTON, Jan. 27, 1879.

Cross Examination by CAUSTEN BROWNE, Esq., *of Counsel for Defendant.*

Cross-Int. 12. The apparatus referred to in the fifth claim of the Bell patent, Exhibit 1, is said to be for the purpose of transmitting sounds telegraphically by causing electrical undulations upon the line wire. In the body of the specification Mr. Bell says that such electrical undulations may be caused by increasing or diminishing either the power of the battery or the resistance of the circuit. Elsewhere in the same specification he says this: "In a pending application for Letters Patent, filed in the United States Patent Office, Feb. 25, 1875, I have described two ways of producing the intermittent current, — the one by actual make and break of contact, the other by alternately increasing and diminishing the intensity of the current without actually breaking the circuit. The current produced by the latter method I shall term for distinction's sake a pulsatory current." And he proceeds to say, "My present invention consists in the employment of a vibratory or undulatory current of electricity in contradistinction to a nearly intermittent or pulsatory current, and of a method of and apparatus for producing electrical undulations upon the line wire." Please examine the certified copy now handed to you of the pending application of Mr. Bell, above referred to by him, and state whether you find described there any and what way of "alternately increasing and diminishing the intensity of the current without actually breaking the circuit."

[*The certified copy referred to in the question is put in evidence, and marked "Defendant's Exhibit A, W.P. Preble, Jr., Examiner."*]

[*Objected to as referring to matter not opened in the direct examination.*]

Ans. The applicant says in this paper, which I have now seen for the first time, that this "result may be attained by alternately increasing and diminishing the intensity without absolute break in the continuity of the current," but he does not describe any apparatus or contrivance which will thus increase or diminish the intensity of the current without breaking the circuit.

Cross-Int. 13. Will the intensity of the current be alternately increased and diminished, without actual break of the circuit, by alternately increasing and diminishing the amount of battery power acting on the line wire?

[*Same objection.*]

Ans. It will.

Cross-Int. 14. When a cylinder, upon which are arranged bar-magnets, is made to rotate in front of the pole of an electro-magnet, is the intensity of the current alternately increased and diminished?

Ans. There will be differences in the current produced by such rotation. Whether they will be differences in the intensity of the current or the volume or power of the current, I am unable to say.

Cross-Int. 15. What is the difference between the intensity of the current and the volume or power of the current, and will you state why you are unable to say of which sort will be the differences in the current produced by such rotation?

Ans. I am not able to state with accuracy what the differences are between volume and power and intensity, and I am unable to say because I do not know of which sort will be the differences in the current produced by such rotation.

Cross-Int. 16. Is your inability to answer more positively due to the intrinsic difficulty or obscurity of the subject itself, as recognized by scientific persons, or is it due to the imperfection of your own knowledge of such matters?

Ans. Partly to the first cause and chiefly to the second, because I have forgotten what I knew about the subject, and have not had occasion lately to renew my acquaintance with it.

Cross-Int. 17. Mr. Bell says in his patent Exhibit 1, that if a cylinder, upon which are arranged bar-magnets, is made to rotate in front of the pole of an electro-magnet, an undulatory current of electricity is induced in the coils of the electro-magnet. Will not a pulsatory current of electricity be induced in the coils of the electro-magnet, according to your understanding of what a pulsatory current is and what an undulatory current is?

Ans. The only understanding that I have of the meaning of the words "pulsatory" and "undulatory" in this case is from Mr. Bell's own words in his patent. As I understand him, both pulsatory and undulatory currents, as he defines them, are variations in currents when the current is never broken, that is, as distinguished from an intermittent current made by alternately making and breaking the the circuit. And Mr. Bell draws a distinction between undulatory and pulsatory currents. As I understand his distinction, the pulsatory is caused by sudden changes of intensity, and the undulatory by gradual changes of intensity, analogous to changes in the density of the air occasioned by simple pendulatory vibrations. I should think that what he calls a pulsatory current could be induced in the coils of an electro-magnet, when a cylinder, upon which are arranged bar magnets, is made to rotate in front of its pole.

Cross-Int. 18. Do you believe there is any practical difference between pulsatory currents, so-called, and undulatory currents, so-called?

Ans. I do not. I say this because I am not able to define where one would begin and the other would end, although there may be results produced by comparatively slow undulation which could not be produced by rapid pulsation.

Cross-Int. 19. For the purpose of any operation described in this patent, do you believe there is any practical difference?

Ans. As I said before, I am not able to define where one begins and the other ends, and therefore I cannot say there would be any practical difference, although I can conceive that different effects might be produced by currents which change their intensity rapidly and by those which change their intensity slowly.

Cross-Int. 20. Do you believe that any such different effects are produced for the purpose of any operation described in the patent?

Ans. No, I don't. All that I do know is, that the changes of current produced by the vibration of one armature in front of its magnet will produce corresponding though smaller vibrations of the other armature in front of its magnet, the attractive force of the magnet at the far end being varied.

Cross-Int. 21. Do you believe it to be true that so long as the circuit is not broken, a much larger number of signals can be transmitted simultaneously on the same circuit when an undulatory current is employed, than when an pulsatory or intermittent one is employed?

Ans. I have no belief whatever on the subject, as I have never seen any experiments tried.

Cross-Int. 22. In the absence of experiments, and from your knowledge of the science and practice of electro-magnetism, what is your belief about it?

Ans. I say that I have no belief, but as far as I can judge, I don't think that a much larger number of signals could be transmitted by one kind of current than the other.

Cross-Int. 23. In transmitting speech is anything required to be reproduced except the pitch and the loudness of spoken sounds?

Ans. As I understand it, yes. The pitch is immaterial and the loudness is immaterial so long as the sound can be heard. The thing to be reproduced is the articulation, whatever quality that may be, in the sound wave.

Cross-Int. 24. Is an instrument which is, by its vibrations, capable of transmitting or receiving but a single note, capable of transmitting or receiving articulate speech?

Ans. I should say not, but I don't know. I had read a great many theories on the subject and seen the records of many experiments and diagrams of the sound waves produced by articulate speech, and after reading them I am unable to say, but I should think not.

Cross-Int. 25. Why should you think not?

Ans. Because I think that an instrument capable of receiving "but a single note" could not transmit or receive articulate speech.

Cross-Int. 26. Why not? What is required for the transmission of articulate speech which will not be done by an instrument capable of transmitting or receiving but a single note?

Ans. As I understand it an instrument which will not receive or transmit but a single note is an instrument which *must* vibrate a certain number of times a second, and with a certain rate of speed during each vibration. Now, most men speaking use different notes, and my idea, although it may be an incorrect one, is that articulation depends somewhat upon changes of speed of vibration during each vibration.

Cross-Int. 27. When the membraue referred to in the patent, Exhibit 1, of Prof. Bell is set in motion by articulate speech directed against it, does it vibrate throughout at a definite rate or does it vibrate in different parts at different rates?

Ans. I don't know.

Cross-Int. 28. What do you think about it?

Ans. I have not thought upon the subject. [It sufficed for me to know that the membrane at the other end so vibrated as to transmit the articulation to the ear of the listener.] [*Passage in brackets objected to as irresponsive.*]

Cross-Int. 29. I have not asked you in regard to any real or supposed facts submitted to your observation by anybody. I will ask you now to think upon the subject as you say you have not yet done, and say whether or not, in your opinion, the membrane, when set in motion by articulate speech directed against it, vibrates throughout at one and the same definite rate or vibrates in different parts at different rates!

Ans. If the word "rate" refers to the amplitude of the vibration in the same time, I should think that different parts of the diaphragm vibrated at different rates. If it refers to the rate per second of the vibration in different parts of the diaphragm, so that the surface thereof becomes undulatory, like the surface of the waves in water, I am unable, after thinking, to answer the question.

Cross-Int. 30. What is the shape of the membrane *a* mentioned in the Bell patent, upon which the sound vibrations converge by the operation of the cone A?

Ans. The acting part of it is circular, like the membrane of a drum or tambourine.

Cross-Int. 31. I used the word "rate" in the twenty-ninth question in the sense in which Mr. Bell uses it in his specification, and distinguish it from "amplitude" as he there distinguishes it. "[Rate', meaning the "rate per second of vibration." My question is whether or not all the filaments, which together constitute the stretched membrane, however different their length and tension, vibrate each and all at the same rate, or does the rate of each vary according to the tension?

Ans. I don't know. And I don't know that the diaphragm can be considered as made up of any particular arrangement of filaments.

Cross-Int. 32. I have drawn upon the deposition paper a circle representing that described by the circumference of the stretched membrane and have drawn across a part of it parallel straight lines marked 1, 2, 3, and 4. Do you think that that part or section of the membrane which lies in the long line from 1 to 1 vibrates at the same rate per second as does that part which lies in the short line from 4 to 4 when articulate speech is uttered in the cone A?

Ans. I don't know, and I am by no means certain that the diaphragm works as if it was practically divided up into different strings arranged in the way shown in the diagram. My impression is that a diaphragm vibrates from the circumference to the centre and *vice versa*.

Cross-Int. 33. Assuming that that impression is correct, that a diaphragm vibrates from the circumference to the centre and *vice versa*, are you still unable to say whether or not the membrane, when set in motion by articulate speech directed against it, vibrates throughout at a different rate in different parts?

Ans. I am.

Cross-Int. 34. If an armature vibrating at a definite rate is attached at its vibrating end to a membrane which vibrates at a rate different from that of the armature, will the armature and the membrane continue to vibrate each at its own rate?

Ans. I don't understand the question.

Cross-Int. 35. What do you not understand about it?

Ans. I don't understand how an armature vibrating at a definite rate can be attached to a point of a diaphragm which vibrates at a

different rate and the attachment continue.

Cross-Int. 36. Does the drawing Fig. 7, of the Bell patent No. 1 show the armature attached at its vibrating end to the membrane?

Ans. It does. At or near its vibrating end.

Cross-Int. 37. If the armature have a certain rate of vibration and the membrane have a rate of vibration different from that, will the attachment not continue?

Ans. It will not continue if the vibration at the centre of the membrane, at the point of attachment, be different from that of the armature. The other parts of the membrane might vibrate at different rates and the attachment still continue.

Cross-Int. 38. If the attachment *does* continue what will be the effect upon the armature vibration and the diaphragm vibration?

Ans. The armature will move with the central point of the membrane.

Cross-Int. 39. And at its own rate of vibration?

Ans. At whatever rate of vibration it may be put into by the voice, whatever that rate may be.

Cross-Int. 40. I am speaking of an armature which, when vibrated, produces by its own rule or rate of vibration but a single note or tone. Now if the rate of vibration of this armature be different from the rate of vibration of the membrane at its centre, where the armature is attached to it, and if the attachment continue will the armature vibrate at its own rate?

Ans. I understood you entirely differently, because Bell's patent nowhere speaks of the attachment of such an armature to a diaphragm, but on the contrary describes and represents an armature loosely attached or hinged at one end and attached at the other end to the centre of the diaphragm, so that it has not the properties of a reed or a tuning fork but may be vibrated at any speed, and acts as if it were a piece of metal without any spring in it. I have answered the former questions on the supposition that when you spoke of an armature as attached to a diaphragm, you spoke of it as Mr. Bell speaks of an armature attached to a diaphragm and not a different armature. I don't know that a diaphragm has any definite rate of vibration, as a tuning fork has. In fact, I believe the contrary and therefore, cannot make the suppose of the question, which I understand supposes a diaphragm having only one rate of vibration, like a tuning fork. How a diaphragm would operate, when its centre was fastened to one end of a spring, the other end of which was secured fast, and which would vibrate only at one rate of speed, I don't know.

Cross-Int. 41 (*de bene esse.*) You added to your answer to the twenty-eight, cross-interrogatory, "It sufficed for me to know that the membrane at the other end so vibrated as to transmit the articulation to the ear of the listener." I suppose you speak here of some trial you have witnessed or made. Do you?

[*Objected to on the ground that it is matter not opened in the direct examination, and if the counsel for the defendant sees fit to interrogate the witness on that subject, he must treat him as his own witness.*]

Ans. I refer to some trial that I have both made and witnessed.

[*The counsel for the defendant asks the counsel for the complainant whether he yields to the objection to the witness's statement put in brackets as part of the answer to the twenty-eighth question and will have that passage struck out, or whether he insists that it shall stand as part of the record.*

The counsel for the complainant says the counsel for the defendant may do as he pleases.

The counsel for the defendant inquires whether that means that the passage in question is to be struck out if he pleases.

The counsel for the complainant says that he did not bring the matter inquired of into the record, and does not propose to take any responsibility about its remaining there.

The counsel for the defendant asks if that is the only answer intended to be given to his question.

That is the answer of the counsel for the complainant.]

Cross-Int. 42 (*de bene*). When was this trial made or witnessed?

[*Same objection.*]

Ans. On the twenty-second and twenty-third days of this January.

Cross-Int. 43 (*de bene*). Where?

[*Same objection.*]

Ans. With one end of the line in this office and with the other end in a basement room in the rear extension of the same building.

Cross-Int. 44 (*de bene*). Where is the apparatus with which that experiment was tried?

[*Same objection.*]

Ans. I don't know except the line wire, and that is still in place.

Cross-Int. 45 (*de bene*). Do you know what was done with the apparatus after the trial was finished?

[*Same objection.*]

Ans. I don't know of my own knowledge. I saw the receivers and transmitters in this office on Friday last.

Cross-Int. 46 (*de bene*). Did you see or try more than one receiver or more than one transmitter?

[*Same objection.*]

Ans. I did. Three receivers and three transmitters.

Cross-Int. 47 (*de bene*). And did you see all three of each, here last Friday?

[*Same objection.*]

Ans. I can't be certain on that point. I remember having seen some of them and may have seen all of them.

Cross-Int. 48 (*de bene*). When you last saw them were they in the possession or custody of the counsel for complainant?

[*Same objection.*]

Ans. They were in the counsel's office.

Cross-Int. 49 (*de bene*). In whose custody?

[*Same objection.*]

Ans. I don't know, they were laying around.

[*Counsel for the defendant calls upon the counsel for the complainant to produce the receivers and transmitters mentioned by the witness for inspection and cross-examination, or else to consent to the striking out of the passage bracketed as in answer to the twenty-eighth cross-interrogatory.*]

[*The counsel for complainant states that he proposes at the proper time in his judgment to produce the instruments in evidence, and that the counsel for the defendant will then have ample opportunity to inspect them and to cross-examine the witness called to testify in relation to them but that he declines to produce them and allow the counsel for the defendant to inspect them and examine the witness* de bene *upon them and that he has no further answer to make in regard to the matter called out in cross-examination in answer to the twenty-eighth cross-interrogatory included in brackets.*]

[*The counsel for the defendant inquires whether, when the instruments are so produced, the opportunity will be given him of cross-examining Mr. Renwick in relation thereto.*]

[*The counsel for the complainant states that if he examines Mr. Renwick as a witness upon them, as he presumes he shall, the counsel for the defendant will then have an opportunity to cross-examine.*]

[*The counsel for the defendant gives notice that he shall object to the introduction in evidence of the instruments in question, unless Mr. Renwick is recalled for cross-examination upon them, and shall object to their introduction at all in rebuttal of evidence to be introduced in the defence.*]

Cross-Int. 50 (*de bene*). Were there several receivers and several transmitters respectively alike in the details of their construction?

[*Same objection.*]

Ans. No, not exactly.

Cross-Int. 51. Have you ever had occasion to examine a copy of the caveat filed Feb. 14, 1876, by Elisha Gray, describing certain improvements in the art of transmitting vocal sounds telegraphically?

[*Same objection.*]

Ans. I have seen what purported to be an account of it in a a book of Prescott's, I think.

Cross-Int. 52. I hand you now a copy of it with the proceedings at the Patent Office in regard to it (*the copy put in evidence marked "Defendant's Exhibit B., W. P. Preble, Jr."*), and ask you to read it, and say whether or not, in your opinion, it describes and represents a practical apparatus for the telephonic transmission of articulate speech.

[*Same objection.*]

Ans. I have never tried the apparatus described in this caveat, and therefore cannot speak with any positiveness as to whether it would or not transmit articulate speech, if constructed in accordance with the description and drawings. I should think it would not.

Cross-Int. 53. Why should you think it would not?

[*Same objection.*]

Ans. Because of the shape or form of the receiving vocalizing chamber *C* in the drawings and c in the description.

Cross-Int. 54. Any other reason?

[*Same objection.*]

Ans. No other reason if the apparatus be made in one of the ways described, with a conductor *b*, forming part of the circuit entering into the bottom of the vessel *B*.

Cross-Int. 55. What is it about the shape of the receiving vocalizing chamber which you think would prevent the apparatus from transmitting articulate speech?

[*Same objection.*]

Ans. Its large, egg-shaped cavity. I think that the various reflections of the sound waves in that cavity would tend to impair or destroy the articulation before it got to the ear of the listener.

Cross-Int. 56. You say in your answer to the fourth direct interrogatory, after describing the apparatus which you understand to be referred to in the fifth claim of the Bell patent No 1, "It is stated in the patent *in substance* as the result of this apparatus, that the motion of the armature at the transmitting end, due to the action of the human voice on the diaphragm, are copied by the armature at the receiving end, and consequently by the diaphragm attached to it, so that a sound similar to that uttered in the transmitting end is heard to proceed from the diaphragm at the receiving end." I wish you would quote from the patent the language which

in your judgment states this in substance.

Ans. "Another mode is shown in Fig. 7, whereby motion can be imparted to the armature by the human voice. A cone, A, is used to converge sound vibrations upon the membrane. When a sound is uttered in the cone, the membrane *a* is set in vibration, the armature *c* is forced to partake of the motion, and thus electrical undulations are created upon the circuit E, *b*, *e*, *f*, *g*. These undulations are similar in form to the air vibrations caused by the sound, that is, they are represented graphically by similar curves. The undulatory current passing through the electro-magnet *f* influences its armature *h* to copy the motion of the armature *c*. A similar sound to that uttered into A is then heard to proceed from *L*."

[*Adjourned.*]

BOSTON, Jan. 28, 1879.

Cross-Int. 57. In your answer to the fourth interrogatory, after describing what you consider to be the apparatus referred to in the fifth claim of the Bell patent No. 1, and after describing what you understand to be its operation you say it follows from this "that if a word be spoken in front of the transmitting diaphragm, that diaphragm will be set into vibration resulting from such enunciation of the word, that the receiving diaphragm will copy these vibrations, *and that the word will be heard by a person having his ear at the* diaphragm of the receiving apparatus," I should understand from this that you believe that an apparatus constructed as described and represented in the patent, and used in the manner there described, will transmit continuous articulate speech with practical success. Do you intend to be so understood?

Ans. The words quoted follow a sentence in which are these words: "It is stated in the patent in substance, etc." And the words quoted were a further description, or rather a description in different words, of the same effects that are stated in the patent, in substance, to be produced by the apparatus. As I understand the patent it states that continuous articulate speech will be produced by the apparatus, and I did know at that time, although I did not state it in my direct examination, that the apparatus described in the patent would, with practical success, which are the words of the question, transmit continuous articulate speech.

Cross-Int. 58. Then you answer my last question in the affirmative, do you not?

Ans. No. The language which you quoted was not intended to convey the idea that I had tried the apparatus practically. I did believe that it would transmit articulate speech continuously before the experiment was tried.

Cross-Int. 59. I think it cannot be doubted that I did not ask you whether you had tried the apparatus practically, or whether you meant to be understood that you had. I asked you whether, by the language which I quoted, you meant to be understood that you believed that an apparatus, constructed as described and represented in the patent and used in the manner there described, would transmit continuous articulate speech with practical success. What I want to find out is what you intended to convey to us by a certain answer. And I will now ask you to read the whole of your answer to the fourth question, and say whether you meant by that answer to say that you so believed.

Ans. I meant in that answer to describe the machine which was described in the patent, and to state the results which the patent states would flow from that machine. I did not mean by the answer to state any belief on the subject (although I had that belief). I meant merely to state what I derived from the patent itself.

Cross-Int. 60. Now please state whether you now believe (as I suppose from expressions you have used that you do) that an apparatus, constructed exactly in accordance with the description and drawings of the patent and used exactly as there directed, will transmit (by which I mean send from one end and deliver at the other) continuous articulate speech with practical success?

Ans. I do.

Cross-Int. 61. Do you have this belief as matter of deduction from what the patent tells you and shows you, or do you have it from any ocular or auricular demonstration?

Ans. I had the belief from what the patent told me, and from what I knew of practical telephones and from what I had read of them, and that belief became a certainty after I had seen the apparatus, seen it used, and used it myself.

Cross-Int. 62. Do you mean apparatus which you saw, saw used and used last week in this office?

Ans. Yes.

Cross-Int. 63. Do you suppose that apparatus to be still in this office?

Ans. I have no reason for any supposition, rather the contrary, the last remark being made with reference to all parts of the apparatus.

Cross-Int. 64. When did you last see the apparatus, and where?

Ans. I saw some, perhaps all, of the contrivances on Friday last. I have not seen any of the parts since except the line wire.

Cross-Int. 65. You say in substance that you have some reason for supposing that not all parts of the apparatus are here in the office. What parts do you suppose to be elsewhere, and where do you suppose them to be?

Ans. I did not state that I supposed them to be elsewhere. I have no supposition, as I before stated, where they now are. I did direct on Thursday evening, I think, two of the parts of the apparatus, I forget now whether receivers or transmitters, to be taken to the work shop of Charles Williams, Jr., in Court Street.

Cross-Int. 66. What is his business?

Ans. I should suppose, from what I saw in the shop, making magnetic and telegraphic apparatus generally.

Cross-Int. 67. Including telephones?

Ans. That I don't know. I saw no parts of telephones in process of construction.

Cross-Int. 68. Nor any completed ones, I suppose?

Ans. Yes, I did. I saw I don't know how many, four or five I should think, hung up on the wall of the office connected ready for use. Through one of them we talked to this office.

Cross-Int. 69. This office where we now are is the office of the leading counsel for the complainant, is it not?

[*The counsel for the defendant requests the counsel for the complainant to produce the apparatus referred to by the witness as the apparatus which he saw used, and used himself last week in order that it may be inspected, and the witness cross-examined upon it, in order to test the judgment which he has expressed in his direct examination as to the practical operation of that which the patent describes and represents.*]

[*The counsel for the complainant makes the same answer that he did yesterday to a similar request, and adds that he does not understand that the witness in his direct examination expressed any opinion upon the practical success of the instruments described in the patent except from what he found in the patent itself.*

[*The counsel for the defendant withdraws his objection to the bracketed part of the answer to the twenty-eighth interrogatory as irresponsive and repeats the above request.*]

[*The counsel for the complainant makes the same answer as before.*]

[*The counsel for the defendant gives notice that unless the apparatus is produced for the purpose of cross examination of this witness as above requested, he will move to suppress the deposition, and not waiving the right so to do, proceeds with the present cross examination as* de bene esse.]

[*The counsel for the complainant states that he did not examine the witness upon the apparatus which has been inquired about, and that in his judgment the counsel for the defendant has no right to cross-examine the witness upon them or to examine him at all upon than except as his own witness.*]

Cross-Int. 70. Have you had occasion to examine a pamphlet entitled "The Telephone. A lecture entitled Researches in Electrical Telephony by Prof. Alexander Graham Bell, delivered before the Society of Telegraph Engineers, Oct. 31, 1877. Published by the society, and edited by Lieut.-Col. Frank Bolton, C. E. Hon. Secretary, and William Edward Langdon, Acting Secretary, London: E. and F. N. Spon, 46 Charing Cross. New York: 446 Broome Street. 1878"?

[*Objected to.*]

Ans. No, but on looking over it I see that I have seen some of the drawings in it and some of the language in other places, — books and patents.

Cross-Int. 71. Have you read or looked over the book entitled "The Speaking Telephone, Talking Phonograph, and other novelties by George B. Prescott," Chapter 2, which purports to give in full a lecture delivered by Prof. Bell, Oct. 31, 1877, before the society of Telegraph Engineers?

Ans. I have looked over Prescott's book, reading parts of it. I do not think that I have read the whole of Chapter 2d. I do remember reading or having read to me that part of it which relates to curious phenomena observed in the use of telephones on the seventy-ninth, eightieth, part of the eighty-first pages. I also remember having read, either in this book or somewhere else, the statement in the last paragraph of the eighty-second page. And I have read in this book, or somewhere else, what is contained the sixty-eighth, sixty-ninth and part of the seventieth page, and perhaps further.

Cross-Int. 72. Referring now to the third claim of the Bell patent No. 2, I will ask you whether you understand that the functions of a metallic diaphragm in combination with an electro-magnet are in all respects the same whether it be vibrated by the movement of the surrounding air as when it is used as a transmitter or whether it be used in combination with the electro-magnet at the receiving end of the line?

Ans. No. The functions of the diaphragm at the transmitting end are to be vibrated by the sound waves and cause undulatory currents of electricity in the line wire by reason of such diaphragm being vibrated in front of the magnet. The functions of the diaphragm at the receiving end are to be vibrated by the varying attractive force of the magnet and by its vibrations to put the air in motion, thus conveying sounds to the ear. When the message is sent the other way, the receiving diaphragm becomes the transmitting one and performs its functions and *vice veasa*. And in their changed position each diaphragm, although the same diaphragm, performs the duties which were at first performed by the other.

Cross-Int. 73. Do you understand that for the purposes of the receiving end of the line, and when used only for receiving, the diaphragm may be made of a material which is not capable of inductive action?

Ans. The patent states that the instruments are to be such that the same instrument can be used both for a receiving and transmitting instrument, and therefore both diaphragms would have to be not only capable of inductive action but of being attracted by the magnet. Now, speaking generally, if an instrument is to be used as a receiving instrument, only the diaphrgam must be made of a material which will be attracted itself by a magnet or must have attached to it some material which will be attracted by a magnet.

Int. 74. Do you feel sure of this last?

Ans. That is my opinion. I had never seen a telephone with any material in it which would not be attracted by a magnet at the receiving end.

Cross-Int. 75. Are you aware that articulate sounds uttered at the transmitting end of a telephone may be heard at the receiving end by applying the ear directly to the electro-magnet at that end are without any diaphragm whatever at that end?

Ans. I am not aware of the fact myself. I have seen that statement, or something like it, made in some book.

Cross-Int. 76. Have you any opinion of your own as to whether it be a fact, or not?

Ans. I have not. Judging from some experiments on a phonograph I am induced to believe that the sounds heard in all telephones are produced by the diaphragm.

Cross-Int. 77. Will you please state a little more fully the nature of those experiments and the demonstration which they afforded?

Ans. The experiments consisted merely in examining the construction of a phonograph, in talking to it, and hearing it talked to, and then having the phonograph repeat what had been said to it, and in an examination with a very weak magnifier of the marks made in the tin foil by the style of the diaphragm of the phonograph. In that instrument there is no battery, no coil of wire, no line wire and no magnet, and there is a steel style or needle attached to the centre of the diaphragm, which, when the instrument is at rest, is in contact with a piece of tin foil, wound upon a cylinder, which

has both a revolving and an endwise movement at the same time. The diaphragm is like the diaphragm of an ordinary telephone, and when the diaphragm is thrown into vibration by the sound waves the end of the style furthest from the diaphragm makes wave-like impressions upon the moving sheet of tin foil. After a sentence has been repeated to the diaphragm it, with the style, is thrown backwards upon a hinge upon which it is mounted, and the cylinder of tin foil is shoved back longitudinally and moved angularly until a plain part of the tin foil is opposite the end of the style. The diaphragm with its style is then thrown forward so that the style again rests upon the tin foil, and the cylinder is both rotated and moved endwise as before. When the point of the style reaches the impressions that have been made by it, or rather when these wave-like impressions arrive under the point of the style, the style and consequently the diaphragm are by the movement of the tin foil thrown into vibration, and when the diaphragm is thus vibrated it repeats the sentence which had been spoken into it in the first place. The voice, if it may be so termed, proceeding from the diaphragm is like the voice proceeding from the diaphragm of the telephone, so far as my ear could judge, and the experiments demonstrated to me that the utterance heard at the receiving end of an ordinary telephone comes from the diaphragm, or in other words that the vibrations of that diaphragm are the causes of the sound that reaches the ear, and therefore that the sound heard from an ordinary telephone comes from the diaphragm and not from the coil or magnet because there is no coil or magnet in the phonograph.

Cross-Int. 78. Did you ever try the experiment of listening at the magnet of the receiving end of the telephone unprovided with any diaphragm at that end, to see whether the sounds uttered in the transmitting end issued from the magnet at the receiving end, although faintly?

Ans. No.

Cross-Int. 79. Is the vibration of the inducing diaphragm, at the transmitting end, an agent in the creation of the sound transmitted?

Ans. I should say no, but I will explain what I mean. The created sound is the sound that is heard at the receiving end. This sound, as I understand it, comes from or is created by the receiving diaphragm. The sound uttered at the transmitting end does not go to the receiving end.

Cross-Int. 80. The plate of iron or steel mentioned in the third claim of the Bell patent No. 2 is the plate A of the drawings, is it not?

Ans. It is.

Cross-Int. 81. In the specification of this patent, after a reference to what is shown in Figs. 4, 5, and 6, and perhaps others, it is said, "In lieu of the plate A in the above figures iron or steel reeds of definite pitch may be placed in front of the electro-magnet O" etc. As you understand the plate of iron and steel referred to in the third claim, may it be an iron or steel reed of definite pitch, and if not, will you refer to such passages of the specification as direct otherwise?

Ans. As I understand it, the words "plate A" in the third claim refer only to the diaphragm. I don't know that I can quote any particular passage except the claim itself which shows conclusively that this claim refers only to the diaphragm. But the specification as a whole conveys to me the idea that there are two things spoken of in the patent, one for transmitting musical tones and the other for transmitting articulate speech. And the third claim from its language, so far as I can see, refers to that form of the instrument without a reed which will transmit articulate speech by a diaphragm. The very sentence you quote from, after speaking of the reeds which may be placed in front of the magnet in lieu of the plate A, refers to the former patent, and to that part thereof which speaks of the employment of reeds only, by means of which signals can be transmitted by a system of dots and dashes represented either to the eye or the ear. And the words "in lieu of" convey to me the idea that the patentee distinguishes the reed from the diaphragm or plate A. I would say further that if the third claim includes the reeds it would be a claim to some of the apparatus shown in the former patent.

Cross-Int. 82. What is the language of the claim itself which you think, as I understand you, shows conclusively that the plate there mentioned is the diaphragm and only so?

Ans. The very particular and special words of the claim, "A plate of iron or steel" etc.; and the only plate spoken of in the patent or represented in the drawings is a diaphragm plate, represented in two of the drawings as fastened down upon a piece of wood having a round hole in it, so that the plate or diaphragm covers the hole.

Cross-Int. 83. Referring now to the sixth claim of the Bell patent No. 2, which is in these words, "the combination with an electric telephone, such as described, of a sounding-box substantially as herein shown and set forth," will you refer to all those parts of the specification in which you find a sounding-box or its construction or its office alluded to?

Ans. I quote from the patent: "A in said drawings represents a plate of iron or steel which is fastened at B and C, to the cover or sounding-box D." The drawings show a cubical sounding-box or cover containing a magnet, and with the diaphragm A covering a round hole in one end of the box. That's all that I see.

Cross-Int. 84. Have you ever tried the experiment of using the apparatus without any cover over the magnet, to see whether the apparatus did not work just as well without as with it?

Ans. I never did try the apparatus in that way.

Cross-Int. 85. Referring now to the seventh claim, which is "in combination with an electric telephone as herein described, the employment of a speaking or a hearing tube for conveying sounds to or from the telephone substantially as set forth," in which claim, as I understand you, you to think that "tube" means not only tube but orifice, will you explain wherein you think the speaking or hearing tube mentioned in that claim differs from the speaking tube which makes part of the familiar Rice telephone produced in 1861

or earlier, and illustrated on page 148 of Prescott's work?

Ans. What I did say is as follows: "The tube E really means the tubular orifice through which the sound waves are sent, in connection with the chamber at the end of that orifice, where the sound waves act upon the diaphragm." I think that the whole cavity which in my opinion constitutes the tube E (I mean from the place where the lips are applied to the diaphragm) differs from that of Rice for this reason, namely, that the box of Rice is so great in capacity, and extends so far downwards below the diaphragm, that it will not act practically to concentrate the effect of the air undulations upon the face of the diaphragm. My opinion is (I may be entirely in error) that the narrow chamber in front of the diaphragm tends to increase the action of the sound waves upon the diaphragm, so that the diaphragm is thrown into vibrations of greater amplitude than would be the case if such contracted chamber were not present in front of the diaphragm.

Cross-Int. 86. Do you consider the chamber on the inside of the orifice, where the sound waves act upon the diaphragm, as an essential part or auxiliary of the speaking or hearing tube?

Ans. I do of the speaking or hearing tube described in the patent, though I said that perhaps the Court might take another view.

Cross-Int. 87. In your answer to the eighth interrogatory you say, "I do not understand that these particular forms of magnet are new by themselves; on the contrary I understand that they were old forms of magnets and differ in degree and not in kind from a magnet in which the coil extends over a greater portion of the magnet, whether the core be permanently or temporarily magnetic." What forms of magnet do you refer to when you use the words "these particular forms of magnets"?

Ans. I mean forms of magnets such as are shown in the Bell patent No. 2, the peculiarity not being in the shape of the bar of iron or steel, which is shown of different shapes, but the peculiarity of form being in the fact that the helix is moved only round the pole or poles of the magnets or pole pieces applied to the end of the magnet.

Cross-Int. 88. When you say that such forms of magnets "differ in degree only" etc., degree of *what* do you mean?

Ans. Degree of mode of construction and consequent operation.

Cross-Int. 89. Degree of *what* consequent operation?

Ans. To vary their attractive force under the operation of electric or galvanic currents.

Cross-Int. 90. How and why do they vary such attractive [illegible] even in degree?

Ans. I do not know. I saw the fact stated in the bo[illegible] I referred, that under the operation of a given current and [illegible] given quantity of wire, the magnetic force would be greater if the helix were applied in the way described and shown in the Bell patent No. 2.

Cross-Int. 91. Do you know that that statement in that book is true?

Ans. No. I never tried any experiments to determine the truth of it.

Cross-Int. 92. What book was it?

Ans. "Traité theorique et pratique de Télégraphie Électrique, par le Cte M. Du Moncel. Paris, Gauthier-Villars, Imprimeur-Libraire. 1864."

HENRY B. RENWICK.

Attest: W. P. PREBLE, JR., *Examiner.*

[*The cross-examination is closed without waiving the right to move to suppress the deposition as reserved at the end of the sixty-ninth interrogatory.*]

Attest: W. P. PREBLE, JR., *Examiner.*

EXTRACT FROM DECISION OF H. E. PAINE, COM. OF PATENTS.

"He who first discovered the capacity of electricity as a vehicle for the quality as well as the pitch and strength of the human voice, and first devised a practical method for the variation of an electric current in a circuit, by means of the sound-vibrations caused by articulate speech, and for reproducing the same sound-vibrations at a remote point of the circuit, thereby delivering at that point the same words, with their pitch, strength and quality unchanged, and also devised means for carrying out this method, is entitled to protection, as against all subsequent inventors, both for his method and for his particular means.

"A subsequent inventor who discovers the same principle, and devises the same method, and invents different means for accomplishing the several steps in the method, will take his patent for his means, as for improvements, subject to the paramount patent of the first inventor."—BELL vs. E. GRAY, Mar. 6. 1879.

☞ The foregoing is not the decision of a Court, and there never has been a decision given as to who FIRST discovered the "principle" of transmitting spoken words by the polarity principle over telegraph wires, with the circuit CLOSED. A decision from the highest legal tribunal has never been rendered, but the time is near at hand for such proceedings as will settle the question so far as the United States is concerned in the original telephone discovery.

TELEPHONE PATENTS.

EXECUTIVE OFFICE AMERICAN SPEAKING TELEPHONE COMPANY, Western Union Building.

New York, February 19th, 1879.

TO THE PUBLIC:

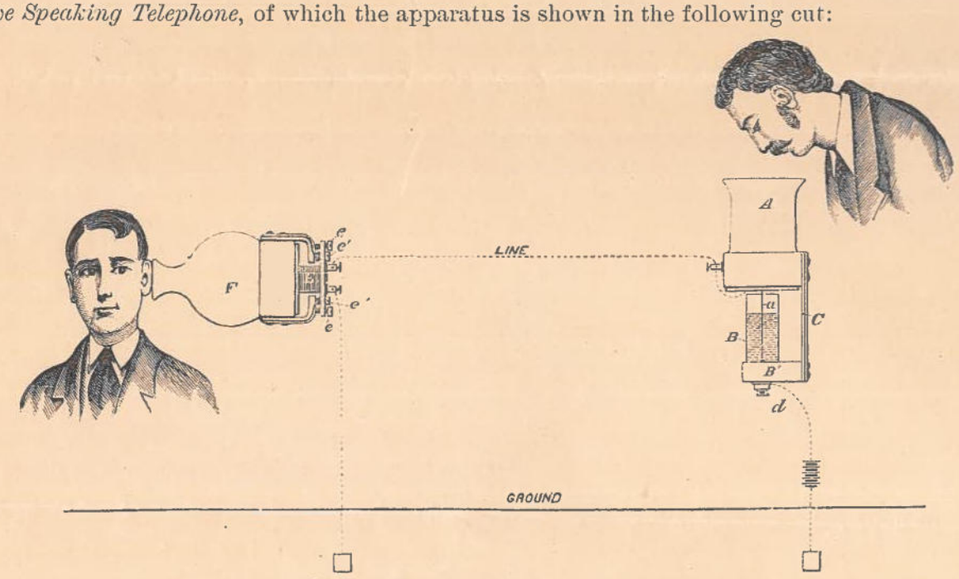
THE Bell Telephone Company, in an attempt to escape the disastrous consequences to its interests, of the re-issue to Mr. Gray, of certain patents on inventions of much earlier date than any patents issued to Mr. Bell for Speaking Telephones, has issued a circular to the public, which contains so many incorrect or irrelevant statements, as to make a reply to it proper, on the part of this Company.

First. It is alleged in the Bell circular, that "Mr. Bell received his first patent *on the Speaking Telephone*, March 7, 1876."

We answer, that Mr. Bell's patent of that date *contains no mention whatever of a speaking telephone* It is for an improvement in a system of multiple telegraphy, an invention of the same general character as several prior inventions patented by Mr. Gray. In his specifications for this patent Mr. Bell *makes no reference whatever to the possibility of transmitting articulate speech* by his apparatus. Moreover, the apparatus there described *never was a speaking telephone and is incapable of being made such.*

Mr. Bell in his lecture delivered in London October 31, 1877, says of it, that though his assistant declared that "he heard *a faint sound* from it," he himself "*was unable to verify this assertion.*"

Second. Mr. Gray, on the contrary, previously to the issue of Mr. Bell's first patent, *invented an effective Speaking Telephone*, of which the apparatus is shown in the following cut:



and filed his caveat, with drawings like said cut, in the Patent office to protect the same, February 14, 1876, nearly a month before Mr. Bell's patent was issued.

In the specifications accompanying this caveat Mr. Gray stated, that the object of his invention was "*to transmit the tones of the human voice* through a telegraphic circuit, and reproduce them at the receiving end of the line, *so that actual conversations can be carried on by persons at long distances apart.*" "The obvious practical application of my invention will be, *to enable persons at a distance to converse with each other through a telegraphic circuit, just as they would do in each others presence, or through a speaking tube.*"

Third. With regard to the patents re-issued to Mr. Gray, January 28, 1879, the Bell circular states that "there is no claim that the apparatus described could be used for transmitting speech, and the company cannot—under these re-issues—give the slightest protection to those who infringe the Bell patents." To this we answer, that the Gray patents cover the use of his apparatus as *receiving telephones*, and also the *novel art* of receiving speech through them. No transmitting telephone is of the slightest value without a *receiver* to take the message at the other end of the line. This Company denies that the Bell patents can be maintained *even as covering the use of a transmitting telephone;* that question is now in litigation between the two companies; but as against the earlier invention of Mr. Gray—now patented—the Bell telephones certainly cannot be used as *receivers*, and without the right to use a receiver, the Bell instruments are utterly valueless. The Bell circular further states that "we are advised by our counsel that the re-issues will undoubtedly be declared void by the courts, as not being for the same invention as that embraced in the original patent, and also that the claims will be so construed as not to embrace anything to be found in the instruments made by the Bell Telephone Co."

To this we answer, that the original patent on which these re-issues were granted was dated July 27, 1875, eight months earlier than Mr. Bell's first patent, *but the original application for a patent, with the same model and drawings on which the re-issues are now granted*, was filed in the Patent office by Mr. Gray *in June* 1874, *nearly two years before the issue of Bell's patent; that model was then, and is now, an effective telephone, and can be made efficient to transmit and receive articulate speech by simply duplicating the receiving instrument for a transmitter.*

The re-issued patents, therefore, describe nothing and claim nothing which had not been invented prior to June 1874, and for which patents might not have been taken at that date.

This Company is advised by counsel as eminent in patent law as any in the country, that the patents thus re-issued to Mr. Gray and which it now controls, *completely cover the Bell telephones and all other telephones now in use as receiving instruments*, and that no communication by telephone can be established or maintained, by Bell telephones or any other instuments now in use, without infringing said patents. Mr. Gray's first claim (in one of these patents, No. 8,559), is in these words: "I claim as my own invention. 1. *The diaphragm or disk of metal, capable of responding to all kinds of tones, vibrating in unison with the electro magneto included in the electric circuit*, substantially as setforth."

Every magneto telephone, whether transmitter or receiver, must contain a diaphragm electro-magnet with which it vibrates in unison, and when in use must be included in an electric circuit. Each of these conditions is found in the Bell telephones and the combination of all of them is indispensable to it.

Fourth. As to suits, this Company has brought suit for infringment of these patents against Mr. Williams, of Boston, who is said to be the sole manufacturer of the Bell telephones, and also against the New England Telephone Co., of Boston, the exclusive agent of the Bell telephones in the New England States.

It has thus challenged the Bell Company, in the state where it was chartered, and in the city where it has its home, to disprove the validity and controlling character of the patented inventions which it holds It has also brought a similar suit against the Law Telegraph Company of New York, the principal users in this city of the Bell telephones.

These suits will be prosecuted as rapidly as possible. Other suits against users of Bell telephones, in other cities, are in preparation and will be begun without delay.

Fifth. The statements of the Bell circular respecting passages in Mr. Prescott's book, Prof. Watson's account of what happened at the Centennial, what Mr. Gray is reported to have said in a lecture in Chicago, and what the Western Electric Manufacturing Co. did as agents of the Bell Telephone Co., all relate to matters wholly irrelevant to the issue pending between this Company and the Bell Company, which is, *to which of them belong the controlling inventions to the Speaking Telephone.*

☞ THE EDISON CARBON TELEPHONE, which is superior to all other telephones in use, *is the undisputed property of this Company*, and may be used by the public, under its authority, without even the fear of threats for infringement by other parties. All telephones in use as receiving instuments, are an infringement of Mr. Gray's patents and will be proceeded against as such.

THE AMERICAN SPEAKING TELEPHONE CO.

BY GEORGE WALKER,

PRESIDENT.