Mr. Hill: Sent through a tumbler instrument; that was used as a transmitter. They were sent through a tumbler instrument, through F, as a transmitter; and that tumbler instrument, your Honors will bear in mind, was used in a horizontal position, set just as this tumbler sets on the table, so that it transmitted these words in that position and not in any other position.

[*Mr. Hill* closed by reviewing the objections which had been made on the other side to these experiments.]

Mr. Chief Justice Waite delivered the opinion of the court.

The important question which meets us at the outset in each of these cases is as to the scope of the fifth claim of the patent of March 7, 1876, which is as follows:

"The method of, and apparatus for, transmitting vocal or other sounds telegraphically, as herein described, by causing electrical undulations, similar in form to the vibrations of the air accompanying the said vocal or other sounds, substantially as set forth."

It is contended that this embraces the art of transferring to or impressing upon a current of electricity the vibrations of air produced by the human voice in articulate speech, in a way that the speech will be carried to and received by a listener at a distance on the line of the current. Articulate speech is not mentioned by name in the patent. The invention, as described, "consists in the employment of a vibratory or undulatory current of electricity, in contradistinction to a merely intermittent or pulsatory current, and of a method of, and apparatus for, producing electrical undulations upon the line wire." A "pulsatory current" is described as one "caused by sudden or instantaneous changes of intensity," and an "electrical undulation" as the result of "gradual changes of intensity exactly analogous to the changes in the density of air occasioned by simple pendulous vibrations."

Among the uses to which this art may be put is said to be the "telegraphic transmission of noises or sounds of any kind," and it is also said that the undulatory current, when created in

the way pointed out, will produce through the receiver at the receiving end of the line "a similar sound to that uttered into" the transmitter at the transmitting end. One of the means of imparting the necessary vibrations through the transmitter, to produce the undulations, may be the human voice. Articulate speech is certainly included in this description, for it is an "uttered" "sound" produced by the "human voice."

It is contended, however, that "vocal sounds" and "articulate speech" are not convertible terms, either in acoustics or in telegraphy. It is unnecessary to determine whether this is so or not. Articulate speech necessarily implies a sound produced by the human voice, and, as the patent on its face is for the art of changing the intensity of a continuous current of electricity by the undulations of the air caused by sonorous vibrations, and speech can only be communicated by such vibrations, the transmission of speech in this way must be included in the art. The question is not whether "vocal sounds" and "articulate speech" are used synonymously as scientific terms, but whether the sound of articulate speech is one of the "vocal or other sounds" referred to in this claim of the patent. We have no hesitation in saying that it is, and that if the patent can be sustained to the full extent of what is now contended for, it gives to Bell, and those who claim under him, the exclusive use of his art for that purpose, until the expiration of the statutory term of his patented rights.

In this art — or, what is the same thing under the patent law, this process, this way of transmitting speech — electricity, one of the forces of nature, is employed; but electricity, left to itself, will not do what is wanted. The art consists in so controlling the force as to make it accomplish the purpose. It had long been believed that if the vibrations of air caused by the voice in speaking could be reproduced at a distance by means of electricity, the speech itself would be reproduced and understood. How to do it was the question.

Bell discovered that it could be done by gradually changing the intensity of a continuous electric current, so as to make it correspond exactly to the changes in the density of the air caused by the sound of the voice. This was his art. He then

devised a way in which these changes of intensity could be made and speech actually transmitted. Thus his art was put in a condition for practical use.

In doing this, both discovery and invention, in the popular sense of those terms, were involved; discovery in finding the art, and invention in devising the means of making it useful. For such discoveries and such inventions the law has given the discoverer and inventor the right to a patent — as discoverer, for the useful art, process, method of doing a thing he has found; and as inventor, for the means he has devised to make his discovery one of actual value. Other inventors may compete with him for the ways of giving effect to the discovery, but the new art he has found will belong to him and those claiming under him during the life of his patent. If another discovers a different art or method of doing the same thing, reduces it to practical use, and gets a patent for his discovery, the new discovery will be the property of the new discoverer, and thereafter the two will be permitted to operate each in his own way without interference by the other. The only question between them will be whether the second discovery is in fact different from the first.

The patent for the art does not necessarily involve a patent for the particular means employed for using it. Indeed, the mention of any means, in the specification or descriptive portion of the patent, is only necessary to show that the art can be used; for it is only useful arts — arts which may be used to advantage — that can be made the subject of a patent. The language of the statute is, that "any person who has invented or discovered any new and useful art, machine, manufacture, or composition of matter," may obtain a patent therefor. Rev. Stat. § 4886. Thus, an art — a process — which is useful, is as much the subject of a patent, as a machine, manufacture, or composition of matter. Of this there can be no doubt, and it is abundantly supported by authority. *Corning* v. *Burden*, 15 How. 252, 267; *Cochrane* v. *Deener*, 94 U. S. 780, 787, 788; *Tilghman* v. *Proctor*, 102 U. S. 707, 722, 724, 725; *Fermentation Co.* v. *Maus*, 122 U. S. 413, 427, 428.

What Bell claims is the art of creating changes of intensity

in a continuous current of electricity, exactly corresponding to the changes of density in the air caused by the vibrations which accompany vocal or other sounds, and of using that electrical condition thus created for sending and receiving articulate speech telegraphically. For that, among other things, his patent of 1876 was in our opinion issued; and the point to be decided is, whether as such a patent it can be sustained.

In *O'Reilly* v. *Morse*, 15 How. 62, it was decided that a claim in broad terms (p. 86) for the use of the motive power of the electric or galvanic current called "electro-magnetism, however developed, for making or printing intelligible characters, letters, or signs, at any distances," although "a new application of that power" first made by Morse, was void, because (p. 120) it was a claim "for a patent for an effect produced by the use of electro-magnetism, distinct from the process or machinery necessary to produce it;" but a claim (p. 85) for "making use of the motive power of magnetism, when developed by the action of such current or currents, substantially as set forth in the foregoing description, . . . as means of operating or giving motion to machinery, which may be used to imprint signals upon paper or other suitable material, or to produce sounds in any desired manner, for the purpose of telegraphic communication at any distances," was sustained. The effect of that decision was, therefore, that the use of magnetism as a motive power, without regard to the particular process with which it was connected in the patent, could not be claimed, but that its use in that connection could.

In the present case the claim is not for the use of a current of electricity in its natural state as it comes from the battery, but for putting a continuous current in a closed circuit into a certain specified condition suited to the transmission of vocal and other sounds, and using it in that condition for that purpose. So far as at present known, without this peculiar change in its condition it will not serve as a medium for the transmission of speech, but with the change it will. Bell was the first to discover this fact, and how to put such a current in such a condition, and what he claims is its use in that condition

for that purpose, just as Morse claimed his current in his condition for his purpose. We see nothing in Morse's case to defeat Bell's claim; on the contrary, it is in all respects sustained by that authority. It may be that electricity cannot be used at all for the transmission of speech except in the way Bell has discovered, and that therefore, practically, his patent gives him its exclusive use for that purpose, but that does not make his claim one for the use of electricity distinct from the particular process with which it is connected in his patent. It will, if true, show more clearly the great importance of his discovery, but it will not invalidate his patent.

But it is insisted that the claim cannot be sustained, because when the patent was issued Bell had not in fact completed his discovery. While it is conceded that he was acting on the right principle and had adopted the true theory, it is claimed that the discovery lacked that practical development which was necessary to make it patentable. In the language of counsel "there was still work to be done, and work calling for the exercise of the utmost ingenuity, and calling for the very highest degree of practical invention."

It is quite true that when Bell applied for his patent he had never actually transmitted telegraphically spoken words so that they could be distinctly heard and understood at the receiving end of his line, but in his specification he did describe accurately and with admirable clearness his process, that is to say, the exact electrical condition that must be created to accomplish his purpose, and he also described, with sufficient precision to enable one of ordinary skill in such matters to make it, a form of apparatus which, if used in the way pointed out, would produce the required effect, receive the words, and carry them to and deliver them at the appointed place. The particular instrument which he had and which he used in his experiments did not, under the circumstances in which it was tried, reproduce the words spoken, so that they could be clearly understood, but the proof is abundant and of the most convincing character, that other instruments, carefully constructed and made exactly in accordance with the specification, without any additions whatever, have operated

and will operate successfully. A good mechanic of proper skill in matters of the kind can take the patent and, by following the specification strictly, can, without more, construct an apparatus which, when used in the way pointed out, will do all that it is claimed the method or process will do. Some witnesses have testified that they were unable to do it. This shows that they, with the particular apparatus they had and the skill they employed in its use, were not successful; not that others, with another apparatus, perhaps more carefully constructed or more skilfully applied, would necessarily fail. As was said in *Loom Co.* v. *Higgins*, 105 U. S. 580, 586, "when the question is, whether a thing can be done or not, it is always easy to find persons ready to show how not to do it." If one succeeds, that is enough, no matter how many others fail. The opposite results will show, that in the one case the apparatus used was properly made, carefully adjusted, with a knowledge of what was required, and skilfully used, and that in the others it was not.

The law does not require that a discoverer or inventor, in order to get a patent for a process, must have succeeded in bringing his art to the highest degree of perfection. It is enough if he describes his method with sufficient clearness and precision to enable those skilled in the matter to understand what the process is, and if he points out some practicable way of putting it into operation. This Bell did. He described clearly and distinctly his process of transmitting speech telegraphically, by creating changes in the intensity of a continuous current or flow of electricity in a closed circuit, exactly analogous to the changes of density in air occasioned by the undulatory motion given to it by the human voice in speaking. He then pointed out two ways in which this might be done: one by the "vibration or motion of bodies capable of inductive action, or by the vibration of the conducting wire itself in the neighborhood of such bodies;" and the other "by alternately increasing and diminishing the resistance of the circuit, or by alternately increasing and diminishing the power of the battery." He then said he preferred to employ for his purpose "an electro-magnet, . . . having a coil upon only one of

its legs," and he described the construction of the particular apparatus shown in the patent as Fig. 7, in which the electro-magnet, or magneto method, was employed. This was the apparatus which he himself used without entirely satisfactory results, but which Prof. Cross, Mr. Watson, Dr. Blake, Prof. Pope, and others testify has done, and will do, what was claimed for it, and transmit speech successfully, but not so well indeed as another constructed upon the principle of the microphone or the variable resistance method.

An effort was made in argument to confine the patent to the magneto instrument, and such modes of creating electrical undulations as could be produced by that form of apparatus, the position being that such an apparatus necessarily implied "a closed circuit incapable of being opened, and a continuous current incapable of being intermittent." But this argument ignores the fact that the claim is, first, for the process, and, second, for the apparatus. It is to be read, 1, as a claim for "the method of transmitting vocal or other sounds telegraphically, as herein described, by causing electrical undulations similar in form to the vibrations of the air accompanying the said vocal or other sounds, substantially as set forth;" and, 2, as for "the apparatus for transmitting vocal or other sounds telegraphically, as herein described, by causing electrical undulations, . . . substantially as set forth." The method, "as herein described," is to cause gradual changes in the intensity of the electric current used as the medium of transmission, which shall be exactly analogous to the changes in the density of the air, occasioned by the peculiarities in the shapes of the undulations produced in speech, in the manner "substantially as set forth;" that is to say, "by the vibration or motion of bodies capable of inductive action, or by the vibration of the conducting wire itself in the neighborhood of such bodies," which is the magneto method; or "by alternately increasing and diminishing the resistance of the circuit, or by alternately increasing and diminishing the power of the battery," which is the variable resistance method. This is the process which has been patented, and it may be operated in either of the ways set forth. The current must be kept closed to be used success-

fully, but this does not necessarily imply that it must be so produced or so operated upon, as to be incapable of being opened. If opened it will fail to act for the time being, and the process will be interrupted; but there is nothing in the patent which requires it to be operated by instruments which are incapable of making the break.

The apparatus, "as herein described," which is included in the claim, is undoubtedly one in which an electro-magnet is employed, and constructed "substantially as set forth" in the specification. One acting on the variable resistance mode is not described, further than to say that the vibration of the conducting wire in mercury or other liquid included in the circuit occasions undulations in the current, and no other special directions are given as to the manner in which it must be constructed. The patent is both for the magneto and variable resistance *methods*, and for the particular magneto *apparatus* which is described, or its equivalent. There is no patent for any variable resistance apparatus. It is undoubtedly true that when Bell got his patent he thought the magneto method was the best. Indeed, he said, in express terms, he preferred it, but that does not exclude the use of the other if it turns out to be the most desirable way of using the process under any circumstances. Both forms of apparatus operate on a closed circuit by gradual changes of intensity, and not by alternately making and breaking the circuit, or by sudden and instantaneous changes, and they each require to be so adjusted as to prevent interruptions. If they break it is a fault, and the process stops until the connection is restored.

It is again said, that the claim, if given this broad construction, is virtually "a claim for speech transmission by transmitting it; or, in other words, for all such doing of a thing as is provable by doing it." It is true that Bell transmits speech by transmitting it, and that long before he did so it was believed by scientists that it could be done by means of electricity, if the requisite electrical effect could be produced. Precisely how that subtle force operates under Bell's treatment, or what form it takes, no one can tell. All we know is that he found out that, by changing the intensity of a contin-

uous current so as to make it correspond exactly with the changes in the density of air caused by sonorous vibrations, vocal and other sounds could be transmitted and heard at a distance. This was the thing to be done, and Bell discovered the way of doing it. He uses electricity as a medium for that purpose, just as air is used within speaking distance. In effect he prolongs the air vibrations by the use of electricity. No one before him had found out how to use electricity with the same effect. To use it with success it must be put in a certain condition. What that condition was he was the first to discover, and with his discovery he astonished the scientific world. Prof. Henry, one of the most eminent scientists of the present century, spoke of it as "the greatest marvel hitherto achieved by the telegraph." The thing done by Bell was "transmitting audible speech through long telegraphic lines," and Sir William Thomson, on returning to his home in England, in August or September, 1876, after seeing at the Centennial Exposition, in Philadelphia, what Bell had done and could do by his process, spoke in this way of it to his countrymen: "Who can but admire the hardihood of invention which devised such very slight means to realize the mathematical conception that, if electricity is to convey all the delicacies of quality which distinguish articulate speech, the strength of its current must vary continuously, as nearly as may be, in simple proportion to the velocity of a particle of air engaged in constituting the sounds." Surely a patent for such a discovery is not to be confined to the mere means he improvised to prove the reality of his conception.

We come now to consider the alleged anticipation of Philipp Reis. And here it is to be always kept in mind that the question is, not whether the apparatus devised by Reis to give effect to his theory can be made, with our present knowledge, to transmit speech, but whether Reis had in his time found out the way of using it successfully for that purpose; not as to the character of the apparatus, but as to the mode of treating the current of electricity on which the apparatus is to act, so as to make that current a medium for receiving the vibrations of air created by the human voice in articulate speech at

one place, and in effect delivering them at the ear of a listener in another place. Bell's patent is not alone for the particular apparatus he describes, but for the process that apparatus was designed to bring into use. His patent would be quite as good if he had actually used Reis's apparatus in developing the process for which it was granted.

That Reis knew what had to be done in order to transmit speech by electricity is very apparent, for in his first paper he said: "As soon as it is possible to produce, any where and in any manner, vibrations whose curves shall be the same as those of any given tone or combination of tones, we shall receive the same impression as that tone or combination of tones would have produced on us." Bourseul also knew it before Reis, for, in a communication published in a Paris journal in 1854, he said: "Reproduce precisely these vibrations," to wit, the vibrations made by the human voice in uttering syllables, "and you will reproduce precisely these syllables."

Reis discovered how to reproduce musical tones; but he did no more. He could sing through his apparatus, but he could not talk. From the beginning to the end he has conceded this. In his first paper he said: "Hitherto it has not been possible to reproduce the tones of human speech with a distinctness sufficient for every one. The consonants are for the most part reproduced pretty distinctly, but the vowels as yet not in an equal degree. The cause of this I will attempt to explain. According to the experiments of Willis, Helmholtz, and others, vowel tones can be produced artificially, if the vibrations of one body are from time to time augmented by those of another, something as follows: An elastic spring is set in vibration by the blow of a tooth on a toothed wheel; the first vibration is the greatest, and each subsequent one is smaller than the preceding. If, after a few vibrations of this kind, (the spring not coming to a rest in the mean time,) the tooth wheel imparts a new stroke, the following vibration will be again a maximum, and so on. The pitch of the tone produced in this way depends upon the number of vibrations in a given time, but the character of the tone upon the number of swellings in the same time. . . . Our organs of speech

probably produce the vowels in the same manner, through the combined action of the upper and lower vocal chords, or of these latter and the cavity of the mouth. My apparatus reproduces the number of vibrations, but with an intensity much less than that of the original ones; though, as I have reason to believe, to a certain degree proportional among themselves. But in the case of these generally small variations, the difference between large and small vibrations is more difficult to perceive than in the case of the original waves, and the vowel is therefore more or less indistinct." And again: "I have succeeded in constructing an apparatus with which I am enabled to reproduce the tones of various instruments, and even to a certain extent the human voice."

No one of the many writers whose papers are found in the records claim more than this for Reis or his discoveries. Although his first paper was published in 1861, and Bell did not appear as a worker in the same field of scientific research until nearly fifteen years afterwards, no advance had been made, by the use of what he had contrived or of his method, towards the great end to be accomplished. He caused his instruments to be put on the market for sale, and both he and those whom he employed for that purpose took occasion to call attention to them by prospectus, catalogue, and otherwise, and to describe what they were and what they would do. In his own prospectus, which was published in 1865 and attached to the apparatus, he says: "Every apparatus consists . . . of two parts, the telephone proper and the receiver. . . . These two parts are placed at such a distance from each other that singing or toning of a musical instrument can be heard in no other way from one station to the other except through the apparatus." And, "Besides the human voice there can be reproduced (according to my experience) just as well the tones of good organ-pipes from F — c, and those of the piano." Albert, the mechanician employed to make the instruments in his catalogue published in 1866, enumerates among the things he has for sale "Telephone of Reis for reproduction of tones by electricity." In a work on electricity by Robert M. Ferguson, published by William and Robert Chambers, London

and Edinburgh, in 1867, it is said, in speaking of the telephone: "This is an instrument for telegraphing notes of the same pitch. Any noise producing a single vibration of the air, when repeated regularly a certain number of times in the second (not less than thirty-two), produces, as is well known, a musical sound. . . . A person when singing any note causes the air to vibrate so many times per second, the number varying with the pitch of the note he sings, the higher the note the greater being the number of vibrations. If we then by any means can get these vibrations to break a closed circuit, . . . the note sung at one station can be reproduced, at least so far as pitch is concerned, at another. Reis's telephone (invented 1861) accomplishes this in the following way," which is then described.

But it is needless to quote further from the evidence on this branch of the case. It is not contended that Reis had ever succeeded in actually transmitting speech, but only that his instrument was capable of it if he had known how. He did not know how, and all his experiments in that direction were failures. With the help of Bell's later discoveries in 1875 we now know why he failed.

As early as 1854 Bourseul, in his communication which has already been referred to, had said, substantially, that if the vibrations of air produced by the human voice in articulate speech could be reproduced by means of electricity at a distance, the speech itself would be reproduced and heard there. As a means of stimulating inquiry to that end he called attention to the principle on which the electric telegraph was based and suggested an application of that principle to such a purpose. He said: "The electric telegraph is based on the following principle: An electric current, passing through a metallic wire, circulates through a coil around a piece of soft iron, which it converts into a magnet. The moment the current stops, the piece of iron ceases to be a magnet. This magnet, which takes the name of electro-magnet, can thus in turn attract and then release a movable plate, which, by its to-and-fro movement, produces the conventional signals employed in telegraphy." Then, after referring to the mode in which speech

is transmitted by the vibrations of the air, he said: "Suppose that a man speaks near a movable disk, sufficiently flexible to lose none of the vibrations of the voice; that this disk alternately makes and breaks the connection with a battery; you may have at a distance another disk which will simultaneously execute the same vibrations."

That Reis was working all the time, from the beginning to the end of his experiments, upon the principle of the telegraph as thus suggested by Bourseul, is abundantly proven. Thus, in his first paper, after describing his cubical block apparatus, he says: "If now tones or combinations of tones are produced in the neighborhood of the block, so that sufficiently powerful waves enter the opening *a*, then these sounds cause the membrane *b* to vibrate. At the first condensation the hammer-like wire *d* is pushed back; at the rarefaction it cannot follow the retreating membrane, and the current traversing the strips remains broken, until the membrane forced by a new condensation again presses the strip . . . against *d*. In this way each sound wave causes a breaking and closing of the current. At each closing of the circuit the atoms of the iron wire inside the distant spiral are moved away from each other; on breaking the circuit these atoms seek to regain their position of equilibrium. When this happens, in consequence of the reciprocal actions of elasticity and inertia, a number of vibrations are produced, and they give the longitudinal sound of the rod. This is the case if the making and breaking of the current occur with comparative slowness. If they occur more rapidly than the oscillations of the iron core, due to its elasticity, the atoms cannot complete their course. The paths described become shorter in proportion as the interruptions are more frequent, but then are just as numerous as these. The iron wire no longer gives its longitudinal normal tone, but a tone whose pitch corresponds to the number of interruptions in a given time; this is the same as saying that the rod reproduces the tone impressed upon the interrupter."

Such was the beginning, and it was maintained persistently to the end as well by Reis as by those who availed themselves of what he was doing. To this the Reis-Legat apparatus

forms no exception, for in the paper describing it Legat says: "The operation of the apparatus described is as follows: When at rest the galvanic circuit is closed. When the air which is in the tube *a b* of the apparatus is alternately condensed and rarefied by speaking into it, (or by singing or introducing the tones of an instrument,) a movement of the membrane closing the smaller opening of the tube is produced, corresponding to such condensation or rarefaction. The lever *c d* follows the movements of the membrane, and opens and closes the galvanic circuit at *d g*, so that at each condensation of the air in the tube the circuit is opened, and at each rarefaction the circuit is closed. In consequence of this operation the electromagnet of the apparatus, in accordance with the condensations and rarefactions of the column of air in the tube . . . is correspondingly demagnetized and magnetized, and the armature of the magnet is set into vibrations like those of the membrane in the transmitting apparatus." We have not had our attention called to a single item of evidence which tends in any way to show that Reis or any one who wrote about him had it in his mind that anything else than the intermittent current caused by the opening and closing of the circuit could be used to do what was wanted. No one seems to have thought that there could be another way. All recognized the fact that the "minor differences in the original vibrations" had not been satisfactorily reproduced, but they attributed it to the imperfect mechanism of the apparatus used, rather than to any fault in the principle on which the operation was made to depend.

It was left for Bell to discover that the failure was due not to workmanship but to the principle which was adopted as the basis of what had to be done. He found that what he called the intermittent current — one caused by alternately opening and closing the circuit — could not be made under any circumstances to reproduce the delicate forms of the air vibrations caused by the human voice in articulate speech, but that the true way was to operate on an unbroken current by increasing and diminishing its intensity. This he called a vibratory or undulatory current, not because the current was supposed to actually take that form, but because it expressed with suffi-

cient accuracy his idea of a current which was subjected to gradual changes of intensity exactly analogous to the changes of density in the air occasioned by its vibrations. Such was his discovery, and it was new. Reis never thought of it, and he failed to transmit speech telegraphically. Bell did, and he succeeded. Under such circumstances it is impossible to hold that what Reis did was an anticipation of the discovery of Bell. To follow Reis is to fail, but to follow Bell is to succeed. The difference between the two is just the difference between failure and success. If Reis had kept on he might have found out the way to succeed, but he stopped and failed. Bell took up his work and carried it on to a successful result.

As to what is shown to have been written and done by Dr. Van der Weyde, it is only necessary to say that he copied Reis, and it was not until after Bell's success that he found out how to use a Reis instrument so as to make it transmit speech. Bell taught him what to do to accomplish that purpose.

So as to James W. McDonough. We presume that it will not be claimed that he is entitled to more than he asked for in his application for a patent, filed April 10, 1876, and there a "circuit breaker," so adjusted as to "break the connection by the vibrations of the membrane," is made one of the elements of his invention. The Patent Office was clearly right in holding that he had been anticipated by Reis.

The patents of Cromwell Fleetwood Varley, of London, England, granted on June 2, 1868, and the other October 8, 1870, were for "improvements in electric telegraphs." The objects of the invention covered by the first were "to cut off the disturbance arising from earth currents, to obtain a high speed of signalling through long circuits, and, should the conductor become partially exposed, to preserve it from being eaten away by electrolytic action;" and the object of the second was the "increase of the transmitting power of telegraph circuits, by enabling more than one operator to signal independent messages at the same time, upon one and the same wire, to and from independent stations." While this patentee in his specification says, "by my invention I superpose upon

the currents used for working the ordinary telegraphs rapid undulations or waves, which do not practically alter the mechanical or chemical power of the ordinary signal currents," and that "these undulations are made to produce distinct and independent audible or other signals so long as these undulations are produced, whether ordinary signal currents be flowing or not," it is apparent that he uses the terms "undulations" and "waves" in an entirely different sense from Bell, for his patent implies operation on the principle of the electric telegraph; that is to say, by making and breaking the circuit. A Morse key, or something equivalent, is to be used; and besides, in the descriptive portion of the patent, it is said: "When the current is flowing through the coils of the electromagnet the horns of the fork *k* are drawn apart and the spring *l'* loses its contact; then, as the attraction of the magnet ceases, the horns of the fork spring back; this remakes the contact, and so a continual tremor is communicated to the tuning fork." In short, there is nothing in any part of the specification to indicate that the patentee had in his mind "undulations" resulting "from gradual changes of intensity exactly analogous to the changes in the density of air occasioned by simple pendulous vibrations," which was Bell's discovery, and on which his art rests. Varley's purpose was to superpose, that is to say, place upon the ordinary signal current another, which, by the action of the make and break principle of the telegraph, would do the work he wanted.

Another alleged anticipation is that of Daniel Drawbaugh.

Bell got his patent March 7, 1876, and the fortunate accident which led to his discovery occurred June 2, 1875. Active litigation to enforce his patented rights was begun by his company on the 12th of September, 1878, with a suit in the Circuit Court of the United States for the District of Massachusetts, against Richard A. Dowd. This suit was defended by the Western Union Telegraph Company, and vigorously contested. The answer was filed November 4, 1878, setting up alleged anticipations by Gray, Edison, Dolbear and others. The record fills twelve hundred printed pages, but before a decision was reached the case was compromised and a decree

entered by consent. The litigation ended at some time in the latter part of the year 1879. The last deposition was taken on the 19th of September in that year.

The next contested suit was brought in the same court on the 28th of July, 1880, against Albert Spencer and others. An answer was filed in this case September 6, 1880, and depositions afterwards taken, some of those in the Dowd suit being used in this by stipulation. On the 27th of June, 1881, a decision was announced by Judge Lowell sustaining the patent, upon which a decree was entered.

On the 14th of November, 1879, Abner G. Tisdel filed in the Patent Office an application for a patent for "a new and useful improvement in speaking-telephones," and on the 18th of November, 1879, Frank A. Klemm also filed an application for a patent for "a new and useful improvement in telephone-transmitters." These inventions were transferred by assignment to Ernest Marx and Frank A. Klemm of New York City, Moritz Loth of Cincinnati, and Simon Wolf of Washington. On the 6th of March, 1880, these parties entered into a mutual agreement to the effect that "each and all of their interests in said improvements and inventions, and the letters-patent to be issued therefor, shall be merged and consolidated as common stock in a corporate body, under the laws of either of the States of Ohio, New York, or the general laws of the United States, relating to the formation of incorporations in the District of Columbia, or of such other States or Territories as may be found necessary hereafter." This agreement was recorded in the Patent Office March 10, 1880.

On the 6th of May, 1880, Edgar W. Chellis, a merchant of Harrisburg, Pennsylvania, M. W. Jacobs, a lawyer at the same place, and Lysander Hill, a lawyer then residing in Washington, in the District of Columbia, made an arrangement with Daniel Drawbaugh by which they were to become jointly interested with him in his alleged telephone inventions, each to have a quarter interest. Nothing was paid for this, but each of the parties was to have one-fourth of anything that should be realized from the enterprise. On the 24th of May, 1880, Simon Wolf, one of the parties interested in the

Klemm and Tisdel inventions, visited Harrisburg on business with Chellis in reference to telephone matters. On the 18th of May, four days before this visit, a patent was issued to Wolf and his associates upon the invention of Tisdel. While Wolf was in Harrisburg negotiations were begun with Chellis for a transfer of the Drawbaugh inventions to the owners of those of Klemm and Tisdel. These negotiations resulted in a conditional contract of the 22d of June, by reason of which Chellis, Jacobs, Hill, and Drawbaugh went to Washington, and there on the 21st of July, 1880, Drawbaugh, claiming to "have invented certain new and useful improvements in the transmission of vocal speech, and the apparatus to be used for such purpose, for which I am about to make application for letters-patent of the United States," assigned to Klemm, Marx, Wolf, and Loth "the full and exclusive right to the said invention as fully set forth and described in the specification prepared and executed by me, dated the 21st day of July, 1880, preparatory to obtaining letters-patent of the United States therefor," and he, at the same time, and by the same instrument, authorized and requested the Commissioner of Patents to issue the patent to his assignees, "each as assignee of one-fourth part." The specification referred to in the assignment has not been put in evidence in any of the cases. In the course of taking the testimony it was called for by the Bell Company, but the counsel for the opposite party refused to produce either the original or a copy from the Patent Office. The assignment was recorded in the Patent Office July 22, 1880, and in the official digest of assignments the following notation appears: "About to make appl'n. Spe'n dated July 21, 1880."

On the morning of July 22, 1880, the following appeared in the *Cincinnati Commercial*, a newspaper printed at Cincinnati, Ohio:

"TELEPHONE COMBINATION.

"*Special to Cincinnati Commercial.*

"WASHINGTON, D. C., *July 21.* — An application for a patent was filed to-day that, in consequence of its vastness of interest,

as well as wealth of prospect, renders it a subject of national interest. A company of leading business men has been formed, that has bought up all the telephone patents antedating those now in use, and known as the Bell, Gray, and Edison patents. The company is composed of leading business men from all parts of the country, Cincinnati being largely represented and interested. The cash capital of the company is $5,000,000, with headquarters in New York, and in about sixty days they will open up the telephone, which will certainly result in the driving out of all telephones in the market, save the ones they hold, or else the compelling the Gray, Bell, and Edison lines to pay the new company a munificent royalty. It appears from the testimony now on file and in the possession of the new company, which is conclusive and exhaustive, that the inventor of the telephone is a poor mechanic, living near Harrisburg, Pa., named Daniel Drawbaugh. Owing to his poverty, he was unable to push his patent on the market. The new company have secured and are sole possessors of this invention, antedating those now in use. They are also owners of four patents for telephones issued to Mr. Klemm, of New York. A large number of capitalists were here to-day to see the filing of the application, and they assert, with a positiveness that is almost convincing, that it will not be long till they have entire charge of the telephones, not only in this country but in the world, and that they will be able to establish lines by which messages can be transmitted for almost a song.

"Mr. Lipman Levy, of the law firm of Moulton, Johnson & Levy, of Cincinnati, was here to-day, in the interest of the Cincinnati parties, who, as already stated, are among the most prominent financial men of our city."

Afterwards, on the 23d of August, 1880, the following appeared in the *Journal of Commerce*, a newspaper printed in the city of New York:

"A New Telephone Company. — A company has recently been formed in this city with a capital of $5,000,000, for the purpose of manufacturing telephones. The company is to be known as The People's Telephone Company, and a number

of leading capitalists in this city and Cincinnati are interested in it. The telephones are to be manufactured under the patents of Frank A. Klemm and Abner G. Tisdel, and the application for patents of Daniel Drawbaugh, of Eberly's Mills, Cumberland County, Pa., filed July 21, 1880. It is claimed by those interested in the new enterprise that Drawbaugh is really the inventor of the telephone, and had completed one years before Professor Bell or any one else had manufactured one. He was, however, in very humble circumstances, and his neighbors who knew of his experiments looked upon him as a harmless lunatic. He continued improving his original telephone, and it is claimed that the one which the new company proposes to furnish is superior to any now in use. The company has fitted up a factory in Brooklyn, and in three months will be prepared to supply 1000 of the new telephones. As soon as operations are actively commenced, it is expected that legal proceedings will be begun against the new company by the Gold and Stock Telegraph Company, which holds most of the existing patents, and a long and interesting legal fight is anticipated."

On the 30th of August, 1880, the People's Telephone Company was incorporated under the general laws of New York, with an authorized capital stock of $5,000,000, for "manufacturing, constructing, owning, furnishing, letting and selling telephones, and the apparatus used therewith, under the inventions and patents of Abner G. Tisdel, Frank A. Klemm, Daniel Drawbaugh, and other inventions and patents which may hereafter be assigned to said company," and on the 4th of September, 1880, Klemm, Loth, Marx, and Wolf, in consideration of $4,999,550, represented by 99,991 shares of stock, assigned and transferred to that company all their interest in the Klemm, Tisdel, and Drawbaugh inventions, those of Drawbaugh being described as "the inventions in telephones made by Daniel Drawbaugh of Eberly's Mills, Cumberland County, in the State of Pennsylvania, for which application for patents was made on or about the 21st day of July, 1880, and which was assigned to us on the [twenty-] first day of July, 1880, as more particularly appears in a deed of assign-

ment recorded in the United States Patent Office in Liber W. 25, page 85, in the Book of Transfers of Patents."

For the assignment from Drawbaugh to Klemm, Marx, Loth, and Wolf $20,000 was paid in money to Chellis, Jacobs, Hill, and Drawbaugh, and they were also to have a certain amount of the stock of the proposed corporation when formed. What amount they actually got Chellis, who was sworn as a witness in the case, declined to tell, but he admitted it was large.

At this time, and in this way, the attention of the general public was called for the first time to the fact that Drawbaugh claimed to have anticipated Bell in the discovery of the telephone. Bell's success had been proclaimed more than four years before at the Centennial Exposition in Philadelphia. In the meantime inventions in aid of his discovery had been multiplied. According to the testimony of Park Benjamin, more than one hundred patents had been issued and indexed under the word "telephone." Numerous interferences had been declared and considered at the Patent Office. Gray, Edison, Dolbear, and others had either claimed for themselves, or others had claimed for them, priority of invention and discovery, and Bell had thus far been sustained as against them all. Blake had perfected his microphone apparatus, and Bell's patent had become a great commercial success.

The People's Company either began or threatened to begin operations under its charter, and on the 20th of October, 1880, the Bell Company brought suit against it in the Circuit Court of the United States for the Southern District of New York, to prevent any infringement of the Bell patents. In the bill it was alleged "that telephone exchanges now exist in more than two hundred and seventy-five towns and cities of the United States, and in every State thereof, and exist in substantially every city in the United States having more than 15,000 inhabitants, and in many smaller places;" "that there are now in use more than 100,000 electric speaking-telephones licensed by and paying royalty to" the Bell Company; "that the owners of said Bell patents, and those who now are or heretofore have been licensed by them, have devoted great

time and attention and large sums of money to the development of the telephone and the introduction thereof into extensive use, and to the proper construction of the most suitable telephone lines and systems and telephonic appliances, and have constructed many thousand miles of telephone lines for use with telephones owned by" the Bell Company, "and licensed by it for such use, and that nothing which the defendants, or F. A. Klemm, A. G. Tisdel, and D. Drawbaugh . . . have done has contributed in any substantial way to the development of the telephone or the introduction thereof into use." The bill then avers that Klemm, Marx, Loth, and Wolf, having become the owners of the Klemm and Tisdel improvements, and having heard that Drawbaugh "claimed that he had made some experiments relating to electric speaking-telephones, (which experiments, if made, were incomplete, imperfect, unfruitful, and long before abandoned,) entered into an arrangement with him to set up and claim that he was the first inventor of the speaking-telephone, and to make application for a patent therefor; and thereafter, alleging and pretending that said Drawbaugh was the original and first inventor of the electric speaking-telephone, and that electric speaking-telephones had not before such application been in public use or on sale for more than two years, with the knowledge and consent of Drawbaugh, they did, on or about the 21st day of July, 1880, induce him to make and cause to be filed in the Patent Office of the United States an application for a patent to issue to them as assignees of the said Drawbaugh, as the first and original inventor of the electric speaking-telephone, the said defendants well knowing at the time that electric speaking-telephones had been in public use by" the Bell Company and its licensees "for more than two years before said application." It was then further alleged that if Drawbaugh had ever made his pretended inventions they "have not been by him, or any one claiming under him, introduced into public use, and that knowledge thereof has been withheld from your orators and the public, except so far as they have been disclosed within the three months last past by certain newspaper publications."

To this bill the People's Company filed an answer in December, 1880, or January, 1881. The record does not show the precise date. In this answer it was said that Drawbaugh was "the original and first inventor and discoverer of the art of communicating articulate speech between distant places by voltaic and magneto electricity," and that "long prior to the alleged inventions by" Bell, Gray, and Edison he, "then and now residing at Eberly's Mills, constructed and operated practical working electric speaking-telephones at said Eberly's Mills, and exhibited their successful operation to a great number of other persons resident in his vicinity and elsewhere;" that his telephones, as then constructed and operated, "contained all the material and substantial parts and inventions patented" in the patents of Bell, and "also other important and valuable inventions in electric and magneto telephony, and were fully capable of transmitting, and were actually used for transmitting, articulate vocal sounds and speech between distant points by means of electric currents; that some of the original machines and instruments, invented, made, used and exhibited to many others long prior to the said alleged inventions of Bell, or either of them, are still in existence, and capable of successful practical use, and are identified by a large number of persons who personally tested and used them, and knew of their practical operation and use, in the years 1870, 1871, 1872, 1873, 1874, and both prior and subsequently thereto; that certainly more than fifty, and probably not less than one hundred, persons, or even more, were cognizant of said Drawbaugh's invention and use of said telephones, and of his claim to be the original and first inventor thereof prior to the alleged inventions of said Bell, or either of them; that said Drawbaugh, for more than ten years prior to the year 1880, was miserably poor, in debt, with a large and helpless family dependent on his daily labor, and was from such cause alone utterly unable to patent his invention, or caveat it, or manufacture and introduce it on the market; that said Drawbaugh never abandoned his said invention, nor acknowledged the claims of any other person or persons thereto, but always persisted in his claims to it, and intended to patent it as soon

as he could procure the necessary means therefor; that said Drawbaugh never acquiesced in the public use of said Bell, Gray, Edison, Blake or other telephones, nor in the claims of the alleged inventors thereof, nor gave his consent to such use." It is then said that Drawbaugh, after finding by experiment that his invention was capable of successful working, "conceived that its range and capacity for usefulness to the public might be very greatly enlarged; that many improvements of great value might be made and added to it, which, without departing from its principle, might increase its value to himself and to the public, and therefore set himself at work to discover and invent such improvements; that he discovered and invented some of said additional improvements prior to any alleged invention by Bell; and that notwithstanding his embarrassed and impoverished pecuniary condition, and his utter want of proper mechanical tools, materials, and appliances to conduct such work, he labored with all reasonable diligence to perfect and adapt his said improvements, and did finally, in due exercise of such reasonable diligence, perfect and adapt the same; and that in so far as the said Bell has incorporated such improvements in his said two patents, or either of them, he, the said Bell, has surreptitiously and unjustly obtained a patent or patents for that which was in fact first invented by Drawbaugh, who was using reasonable diligence in perfecting and adapting the same, and, therefore, the patent or patents of the said Bell therefor is or are invalid and void." It is then said that "the defendant in good faith, and relying upon its legal rights, . . . caused applications to be made and filed in the Patent Office for letters patent on the inventions of the said Daniel Drawbaugh, with the intention of procuring interference proceedings to be instituted, in accordance with the statute, against the patents of said Bell, and the pending applications of said Gray, Edison, and others, in order that said Drawbaugh may be adjudged by the Commissioner of Patents to be, as he rightfully is, the original and first inventor of the electric speaking-telephone, and may be adjudged entitled to receive a patent or patents therefor."

Opinion of the Court.

The People's Company began taking depositions on the 19th of April, 1881, but Drawbaugh himself did not appear as a witness until December 7, 1881. After that time others were examined, and when the proofs were closed between three and four hundred witnesses had been produced whose testimony was taken and put into the record to establish the priority of Drawbaugh's invention. This testimony, as is now claimed, shows the story of that invention to have been as follows:

"Early conception and experiments with the continuous current, 1862, 1866, and 1867.

"Tea-cup transmitter and receiver, 1866 and 1867.

"Tumbler and tin-cup and mustard can, ('F' and 'B,') 1867 and 1869.

"Improvement on 'B,' ('C,') 1869, 1870.

"Further improvement upon 'C,' and the more perfect magneto instrument 'I,' 1870, 1871.

"Mouthpiece changed to centre and adjusting screw inserted, (Exhibit 'A,') 1874.

"'D' and 'E,' perfectly adjusted and finished magneto instruments, January and February, 1875.

"'L,' 'M,' 'G,' and 'O,' from February, 1875, to August, 1876.

"'H,' August, 1876.

"'J,' 'N,' and 'P,' 1878."

This statement of the Drawbaugh claim we have quoted from the brief of counsel appearing in his behalf, and his success in the litigation has been placed, as we understand it, both in the answer and in the argument, on the truth or falsehood of what is thus set forth.

The letters "F," "B," etc., in the statement refer to exhibits in the cause, being certain instruments claimed to have been made and used by Drawbaugh in the progress of his work and preserved until now. The original tea-cup instrument was not produced, but Drawbaugh in his deposition gave what he said was a drawing, showing how it had been constructed. "F," "B," "C," "I," and "A" were neither of them in a condition for use when they were put in evidence, and no one of all the witnesses except Drawbaugh could tell

how they were originally constructed, or what the process was by which sound was transmitted when they were used. All any of the witnesses could say on that subject was that they had used one or more of the different instruments at Drawbaugh's shop, had heard sounds and sometimes spoken words through them, and that Drawbaugh told them the sound was carried on the wire by electricity. There was nothing whatever produced in print or in writing on the subject; not even a memorandum or a drawing of any kind. And there is nothing in the testimony to show that Drawbaugh ever told any one how his earlier instruments were made, or what his process was, until he was called as a witness in December, 1881, and explained it in his testimony. This was nearly twenty years, according to the present claim, after he had begun his experiments, nearly seven after he had made and used "D" and "E," "perfectly adjusted and finished magneto instruments," and more than five after "L," "M," "G," "O," and "H" had been constructed and kept in his shop. It was also nearly six years after the date of Bell's patent, more than five years after the success of his discovery had been proclaimed at the Centennial Exposition in Philadelphia, four after his process had got into public use, three after it had become an established success, and two after he had brought his first suit for the establishment of his rights against Dowd, who represented the Western Union Telegraph Company, to a successful termination.

Under these circumstances it becomes important to consider the conduct of Drawbaugh in reference to his alleged invention during this twenty years of eventful history as connected with the discovery and use of telephones. If his present claim is true his experiments began almost as far back as those of Reis, and he had in his shop at Eberly's Mills, within three miles of Harrisburg, telephones that were substantially perfect months before Bell, on the 2d of June, 1875, got the clue to his subsequent discoveries. It is conceded that "D" and "E," made, as is claimed, in February, 1875, are substantially as good magneto instruments as any Bell had used before December, 1881, and "L," "M," "G," "O," and "H," all of which it is

claimed were constructed by August, 1876, and some in February, 1875, are as good or nearly as good microphones as those of Blake, which were not invented until 1878. This is the theory of Drawbaugh's defence as it is set forth in the answer and in the argument, and by it his case must stand or fall. The claim is that the discovery of the process was complete, and that perfect telephones had been made and were in a condition for use a year and more before Bell got his patent.

Drawbaugh was, when he gave his deposition, fifty-four years of age, and had lived all his life at or near Eberly Mills, a small village near Harrisburg. He was a skilful and ingenious mechanic, and if he made "D" and "E," and the instruments which came after them, at the time it is said he did, he had good tools and good materials in 1875 and 1876, and was capable of doing the best of work. He was also somewhat of an inventor, and had some knowledge of electricity. According to the testimony he was an enthusiast on the subject of his "talking machine," and showed it freely to his neighbors and people from the country when they visited his shop.

The Centennial Exposition was opened at Philadelphia in May, 1876, and Drawbaugh visited it on the 17th of October, 1876, remaining four or five days. Before he went he had heard, as he says, that some one besides himself had invented a speaking telephone, which he had the impression was on exhibition there. If what he now claims is true, he had then on hand in his shop Exhibits "D," "E," "L," "M," "G," "O," and "H," all of them good instruments of their kind, and capable of transmitting speech, and some of them but just finished. Bell's apparatus had been exhibited to the Board of Judges in June before, and had attracted marked attention. The matter was much discussed in the public press, and yet it never seems to have occurred to Drawbaugh to take any of his telephones with him when he went, although they were small in size, and some, or all of them, could have been carried without serious inconvenience.

When giving his testimony he was examined in chief as to that visit, and this is what he said on the subject of telephones:

"Q. 386. Did you attend the Centennial Exhibition, at Philadelphia, in the year 1876? A. Yes, sir; I did.

"Q. 387. Can you give the date on which you went there? A. I can by reference to a book. It was October 17, 1876. The 17th was a day on which I dated a letter from Philadelphia, while I was there on that visit.

"Q. 388. How long did your visit there last? A. About four or five days, to the best of my recollection.

"Q. 389. Who went with you on that visit? A. Mr. George Leonard.

"Q. 390. Was that the only visit to the Centennial Exhibition that you made? A. Yes, sir; it was.

"Q. 391. At the time that you went there, or before that time, had you heard that somebody else besides yourself had invented a speaking telephone — or a telephone? A. Yes, sir; some time before that, I don't remember how long, but not a great while.

"Q. 392. When you went there, did you suppose it would be on exhibition there? A. I don't remember whether I had heard that it was on exhibition or not; but I got the impression some way that it was on exhibition.

"Q. 393. While you were there at the Centennial, did you see any telephones, or make an effort to see any there? A. Yes, sir; I made an effort and seen an instrument called a telephone, and supposed it to be the instrument spoken of — the one of which I had heard. I was looking and had made some inquiry, and was directed or came to a portion of the building where I saw on a counter some man's telephone, the name I don't remember. At that time, or several times that I called, there was no one there to attend to it. I spoke to another party that had something else on exhibition — I don't recollect what it was — just near by, and I asked him whether there was any one there to attend, or to show the instruments. I was informed then, there was no one there to show them.

"Q. 394. If you remember, please state what kind of an instrument it was that you saw there, and state what information you were able to obtain there regarding it and its mode of operation. A. There was a number of instruments placed on

to a raised portion — something like a shelf. That is, it resembled something like pigeon-holes, a box open in front, and each instrument at the back of it had an electro-magnet. The number of instruments I don't remember. I don't remember of counting them. If I am not mistaken, there may have been a dozen or more, perhaps; some were larger than others. I could not give you a much better description than that. I couldn't get any information about them. This attendant made some remarks about the instruments, but he didn't understand them, and couldn't explain them. I was several feet from where the instruments were. They were placed — it occurs to me — on a raised place like a shelf, just about high enough for a man to speak into; that is the way it looked to me. I did not go in behind the counter to examine them, although there was an opening to go in by, because I did not like to make too free, as there was no one there.

"Q. 395. Did you see any circulars lying around there referring to these instruments, or other advertisements of them? A. I don't remember about that; it may have been.

"Q. 396. What was your impression as to the character of the instruments, when you finally left them? A. I was impressed with the idea that they were instruments to telegraph by sounds. A certain sound to represent a certain letter of the alphabet. I am not certain how I got the idea, or whether any person told me that at the time, but that is the idea that I had. When I said certain sounds, I meant that sounds of a different pitch would represent different letters.

"Q. 397. Do you know whether that was 'Gray's Harmonic Telegraph' that you saw there or not? A. It didn't say 'telegraph;' I am confident it was called 'telephone.' I didn't see the working parts of the interior, except the electro-magnets. I took the name of the man and his address on a piece of paper, and put it in my pocket, but I don't know what became of it. I don't know whether it was 'Gray's Harmonic Telegraph,' or not.

"Q. 398. Did you see any tuning forks about it? A. I did not."

That was all he did during his entire visit to ascertain

whether any one besides himself had actually entered upon this then new and interesting field of invention and discovery. He spoke to no one about what he had done himself, and he made no special effort to find out whether that which was on exhibition was in any respect like what he had at home. Neither did he when he got home, so far as the records show, say anything to his neighbors or visiting friends about what he had seen or heard. He had apparently lost all interest in "talking machines."

Not so, however, with his other inventions. The testimony shows that during the early part of 1876, he was much occupied in building an electric clock, which he thought of exhibiting at the Centennial. This he did not do, however, but either just before he went to Philadelphia, or soon after, Rufus E. Shapley, a jeweller of Mechanicsburg, went by his invitation, or on his suggestion, to Eberly's Mills to look at the clock which he had made. Soon afterwards the clock was taken to Shapley's store in Mechanicsburg, and on the 8th of November, 1876, Drawbaugh by an instrument in writing transferred to Shapley a half-interest in the "clock I am getting up, the said R. E. Shapley to pay for patenting the same." Shapley had then two thousand dollars in money which Drawbaugh was anxious to have him invest in that business, and the clock was taken by him to his shop so that it might be examined with that end in view if it should prove to be useful. Some time afterwards it was taken back to Eberly's Mills, where it remained until April 1, 1878, or thereabouts, when a clock company was formed, and that clock, or another one substantially like it, was taken about the country for exhibition. For this Drawbaugh was paid five hundred dollars, with an interest in the profits, and on the 20th of September, 1878, he applied for a patent for "improvement in earth batteries for electric clocks," which was issued January 14, 1879, to the members of the clock company. The enterprise does not seem to have been productive of any great success.

In November or December, 1878, while this clock was on exhibition at Harrisburg, Drawbaugh was introduced to Edgar W. Chellis. He had with him at the time a "wooden model

of a faucet" that he wanted Chellis and another man to take each a third interest in. An arrangement was afterwards made by which Chellis got a two-thirds interest, he paying for it two hundred and fifty dollars, January 7, 1879. On the 14th of the same month Drawbaugh filed in the Patent Office an application for a patent for an "improvement in rotary measuring faucets," Chellis to have a two-thirds interest. After this application an interference was declared, March 29, 1879, between Drawbaugh and David A. Hauck, who had filed a conflicting application January 17. In his preliminary statement upon this interference Drawbaugh said that he had conceived the idea of his faucets and sketched them late in the fall of 1876; that he made a working model in the spring of 1877, and actually tested it then, but the Patent Office model was not completed until about the 1st of November, 1878. The case was closely contested, but finally decided in favor of Drawbaugh, January 15, 1880. The patent was granted to him and Chellis July 6 of the same year. In this contest Jacobs and Hill, who afterwards became interested in his telephone claims, appeared as the counsel of Drawbaugh.

On the 2d of July, 1879, Drawbaugh filed another application in the Patent Office for "improvement in water motors," Chellis to have in this also a two-thirds interest. Upon this application a patent was issued March 16, 1880.

It is impossible to believe, if Drawbaugh had in his shop, when he reached home from the Centennial, Exhibits "D," "E," "L," "M," "G," "O," and "H," or even "D" and "E" alone, that he would have set himself to work, in the first instance, at developing his clock enterprise, or perfecting his former conception of a measuring faucet, instead of making some effort to call the attention of his friends to his great discovery of the telephone, which he was in danger of losing by the patent which had been issued to another, and which he could not but have known was even then attracting the greatest attention. And in this connection it must be kept in mind that the theory of the defence is, as stated in the answer, that Drawbaugh had at that time fully perfected his invention, and that while at first he "conceived that its range and capacity

for usefulness to the public might be very greatly enlarged," he had, before the date of Bell's patent, "notwithstanding his embarrassed and impoverished pecuniary condition, and his utter want of proper mechanical tools," finally perfected his work. His conduct afterwards, therefore, is to be judged, not as that of one who was still in the midst of his experiments, and doubtful of the results, but of one who had arrived at the end and had completed his success.

No man of his intelligence, with or without the enthusiasm upon the subject which it is said he possessed, could have remained silent under such circumstances. As we have read the testimony, it is not even pretended that he took any of his instruments outside of his own village until May, 1878, when, as is claimed, he showed one to his friend Stees, in Harrisburg, whom he had known for years, and who was the first to use, and, in fact, was then using, a Bell telephone, in that place, upon a private line of his own between his office and his shops. This produced no results, and when afterwards, in January, 1879, Chellis was told that Drawbaugh had "a phonograph and a telephone that he had invented," he gave it no attention, because, to use his own language, "I was interested in the faucet and motor business, and wished to push them, and I did not think we could do much with the telephone, as Bell had a patent, and I did not know that he could antedate them." And again, when speaking of a conversation he had with Drawbaugh, he said: "I advised him to drop it — the telephone — as he could not antedate Bell. He said he did not know about that; that he had been working on it a good while. It was his way of expressing himself; when I would say, 'You can't antedate Bell,' he would say, 'I don't know about that; I have been working at it a good while.'" This, it must be remembered, was in 1879, after the telephone had become a success, and after it had been a year or more in use in Harrisburg, where Chellis lived. It is impossible to believe that either Chellis or Drawbaugh was ignorant of the approximate time of Bell's invention, which had been the subject of frequent newspaper comment from the time of its exhibition at the Centennial. The subject was often referred

to in the Harrisburg and Mechanicsburg papers, and it is not for a moment to be supposed that all of these various articles escaped their attention. Under such circumstances, if it were true that Drawbaugh had made his "D" and "E," as is now claimed, in February, 1875, he certainly would have said so, and would not have contented himself with so doubting an answer to Chellis's suggestion of his inability to antedate Bell as that which Chellis now says he gave.

Another important fact in this connection is one which is proved by the testimony of Andrew R. Kiefer, who, from 1863, had been division telegraph operator, having charge of the middle division of the Pennsylvania Railroad, and residing in Harrisburg. From 1867 to the winter of 1881–2 he was a member of a partnership firm in that place which was engaged in "the manufacture of burglar alarms, electric hotel annunciators, and fine electric work for the government — instruments for the Signal Bureau, patent models, &c." He had also, since 1876, kept a place for the sale of electrical supplies. He had known Drawbaugh certainly since 1876, and probably before. Drawbaugh met him on different occasions and talked upon electrical matters. In the course of their acquaintance Drawbaugh showed him an electrical fire-alarm apparatus and the works of his electric clock, but the subject of telephones was never alluded to between them until in the summer of 1881, when this occurred. We quote from Kiefer's deposition:

"In the summer of 1881 I took my wife out for a drive, and went over to see his [Drawbaugh's] works, never having seen them, and having promised to come and see him some time; my wife, not caring about going through the shop, remained in the carriage, and I went through alone with Mr. Drawbaugh. He showed me through the shops and introduced me to Mr. Chellis, and showed me parts of the water motor and some other things of his getting up. On account of my wife's being in the carriage alone I did not stay long. As I stepped into, or was just in the carriage, Mr. Drawbaugh said, 'I forgot to show you my telephone.' I did not get out again to go and see it, and I drove away without seeing it, expecting to see it again, but I have never got over to the shop since."

This was after the suit of the Bell Company against the People's Company was begun, and of course after the matter got into the hands of Chellis and his associates. It is no answer to the criticism of Drawbaugh's conduct in this particular to say, as was said in argument, that "one reason why he did not speak or apply to every man with whom he had personal acquaintance, was that he was ridiculed by his neighbors; that his invention was considered a humbug by them, and of no commercial value." Bell's success was proclaimed in the Harrisburg Patriot as early as February 26, 1877, and the days of ridicule were then past. If Drawbaugh had at that time in his shop the machines which it is now claimed were all complete as they now are by August, 1876, and most of them before, there cannot be a doubt that he would have taken them to some place where they could be tried, and show that they would do what he had all along claimed for them. All he had to do, at any time after he came back from the Centennial, was to take any pair of his little instruments to his friend Zeigler or his friend Stees at Harrisburg, attach them to a line wire, and show what he had. They were men who could appreciate his achievement, and help him if it was, as he now says it was, a success. It would certainly have been easier then, within two years of the time the first of them were made, and within a year of the date of Bell's patent, to show that he "antedated" Bell, than it was three years afterwards, when he was brought into the controversy through the instrumentality of his associates, not, as must be evident to all, to get a patent for himself, but to defeat that of Bell. And in this connection it is specially significant that the application which it is claimed was made for a patent on the 21st of July, 1880, and the specification of his invention which was then written out, have been purposely and designedly kept out of the case, although their production was demanded. They were written before this suit was begun, and it is impossible to believe that they would have been withheld, at least upon the call of the opposite party, if they were in all respects consistent with the subsequent developments of the case. The excuse given by counsel at the time, that they

were "in the secret archives of the Patent Office," and "if produced and published in this cause would possibly invite the filing of contesting applications, and result in interference and additional litigation, besides unnecessarily prolonging the taking of testimony here and increasing the expenses," we cannot accept as satisfactory, especially as in the answer it was said that one object of filing the application was to procure "interference proceedings to be instituted against the patents of Bell, in order that Drawbaugh may be adjudged by the Commissioner to be, as he rightfully is, the original and first inventor."

We have not overlooked the depositions that have been taken in such large numbers to show that Drawbaugh was successful with "F," "B," "C," "I," and "A," before "D" and "E" were made. They have been studied with care, and if they contained all the testimony in the case it would be more difficult to reach the conclusion that Drawbaugh's claim was not sustained. But in our opinion their effect has been completely overcome by the conduct of Drawbaugh, about which there is no dispute, from the time of his visit to the Centennial until he was put forward by the promoters of the People's Company, nearly four years afterwards, to contest the claims of Bell. He was silent so far as the general public were concerned, when if he had really done what these witnesses now think he did he would most certainly have spoken. There is hardly a single act of his connected with his present claim, from the time he heard, before going to Philadelphia, that some one else had invented a telephone which was on exhibition at the Centennial, that is not entirely inconsistent with the idea even then of a complete discovery or invention by himself which could be put to any practical use. It is not pretended that what he did was done in private. He had influential friends with ample pecuniary resources, ready to help him in bringing out his inventions when they promised success. He easily got aid for his clock and for his faucet. The news of Bell's invention spread rapidly and at once, and it took but a few months to demonstrate to the world that he had achieved a brilliant success. If it were known at Eberly's

Mills alone that Drawbaugh had been doing the same thing for years in his shop there — and it certainly would have been known all through the little village if it had actually been done — no one can believe that the public would be kept in ignorance of it until four years afterwards, when a "special" from Washington "to the Cincinnati Commercial" announced a "Telephone Combination" to have entire charge of the telephones, not only in this country, but in the world," that could transmit messages "for almost a song."

But there is another fact in this case equally striking. As has already been seen, "F," "B," "C," and "I" were in no condition for use when they were produced and put in evidence. They were mere "remains," and no one but Drawbaugh himself could tell how they were made or how they were to be used. He undertook to reproduce some of them, especially "F" and "B." This was in the latter part of 1881, while the testimony was being taken. The Bell Company proposed that they should be tried to see if they would do what the witnesses said had been done with the originals, which the "remains" show must have been exceedingly primitive in their character. The testimony also shows that when they were originally used by or in the presence of the witnesses, no particular care was taken in their adjustment. They were lying around in the shop or standing upon shelves. Some say that when experiments were made they were held in the hand or allowed to stand on the table. Many testify to satisfactory results, and Drawbaugh himself said in his deposition: "I would have persons in the cellar reading printed matter — some advertisement or something — and I could hear the words that were read; and at other times I would go down into the cellar and read something, and coming up they would repeat the words to me that I had read."

The proposition of the Bell Company was accepted, and the reproductions were tried in March, 1882, under the most favorable circumstances. Three days were occupied in the test, and it is substantially conceded that it was a failure. Occasionally a sound was heard and sometimes a word, but "it would not transmit sentences." At the time of these experiments "F,"

which was the transmitter, was placed on a table, and used as Drawbaugh said it was originally. Two years afterwards other reproductions were presented, differently constructed and used in a different way, and these would "talk," but they were neither made nor used in the same way as the originals. To our minds the result of the second experiments conclusively showed that the original instruments could not have done what the witnesses supposed they did, and that what they saw and heard was produced by some other means than an electric speaking telephone. We do not doubt that Drawbaugh may have conceived the idea that speech could be transmitted to a distance by means of electricity and that he was experimenting upon that subject, but to hold that he had discovered the art of doing it before Bell did would be to construe testimony without regard to "the ordinary laws that govern human conduct." *Atlantic Works* v. *Brady*, 107 U. S. 192, 203. Without pursuing the subject further we decide that the Drawbaugh defence has not been made out.

Another objection to Bell's patent, put forth in the oral argument of Mr. Hill, and in the printed brief signed by him and in that signed by Mr. Dixon, is, that his application as originally filed in the Patent Office did not contain his present fourth claim, or any description of the variable resistance method, and that all which now appears in the specification on that subject, including the fourth claim, was surreptitiously interpolated afterwards.

Bell's application was filed February 14, 1876, and afterwards, during the same day, Elisha Gray filed a caveat, in which he claimed as his invention "the art of transmitting vocal sounds or conversations telegraphically through an electric circuit," and in his specification described the variable resistance method. The precise charge now made in the printed brief of Mr. Hill is, that "Mr. Bell's attorneys had an underground railroad in operation between their office and Examiner Wilbur's room in the Patent Office, by which they were enabled to have unlawful and guilty knowledge of Gray's papers as soon as they were filed in the Patent Office," and "that an important invention, and a claim therefor, were

bodily interpolated into Bell's specification, between February 14, 1876, and February 19, 1876, by Pollok, in consequence of the guilty knowledge which the latter already had of the contents of Gray's caveat before the declaration of interference with Gray on February 19th."

So grave a charge, made in so formal a manner, is entitled to careful consideration. It involves the professional integrity and moral character of eminent attorneys, and requires us to find from the evidence that after Bell swore to his application on the 20th of January, 1876, and after the application thus sworn to had been formally filed in the Patent Office, an examiner, who got knowledge of the Gray caveat put in afterwards, disclosed its contents to Bell's attorneys; that they were then allowed to withdraw the application, change it so as to include Gray's variable resistance method over Bell's signature, and over the *jurat*, and then restore it to the files, thus materially altered, as if it were the original; and all this between February 14 and February 19.

Although much stress was laid in argument on the fact that what purported to be a certified copy of the specification of Bell, as found in the file wrapper and contents printed in the Dowd case, differed materially from the patent, the cause of these differences has been explained in the most satisfactory manner, and we entertain no doubt whatever that the specification as now found in the patent is precisely the same as that on which the order to issue was made. If any alterations were made it was all done before February 19, and the fair copy which is now found on the files of the Office is precisely as it was when the order for the patent was granted. Not a shadow of suspicion can rest on any one growing out of the misprint of the specification in the Dowd case.

All that remains, therefore, on which to rest this serious charge is, that in a paper handed by Bell to George Brown, of Toronto, describing his invention, and which was intended to be used in England to secure a British patent, what is now claimed to be an interpolation in the American application is not to be found. It is but right to say that during the whole course of the protracted litigation upon the Bell patent, no

argument was ever presented based on this discrepancy until the brief of Mr. Hill was filed in this court on the 18th of January, 1887, six days before the argument in these appeals was begun. So far as we are advised nothing had ever before occurred in the cases that seemed to make it necessary to prove when the variable resistance method or the fourth claim was put into the American application, or why it was left out of the paper handed to Brown. It seems always to have been assumed until the cases got here, that because it was in the American patent it was rightfully there. Certainly there is nothing in the pleadings in any of the cases to direct attention to the materiality of this fact.

A comparison of the paper handed Brown with the American application shows that they differ in more than thirty different places besides those which relate to the variable resistance method and the fourth claim. The differences are generally in forms of expression, thus indicating that one was written after the other and evidently for the purpose of securing greater accuracy. The paper handed Brown was clearly a rough draft and not a fair copy, for the record shows that it bore on its face the evidence of many erasures and interlineations. Bell says in his testimony that he began writing his specification in September or October, 1875, and wrote and rewrote it a number of times, finally adopting that mode of expression which seemed to him the best to explain his invention and the relation which one portion bore to another. He visited Brown in Canada in September and again in December, 1875. The arrangement was made between them on the 29th of December, at this last interview, by which Brown was to interest himself in getting out British patents. Other inventions besides the telephone were included in the contract entered into for that purpose.

Bell returned to Boston on the 1st of January, and immediately set himself to work to complete his specification. He had it done so that it was taken to Washington by Mr. Hubbard about the 10th of that month, and delivered to Pollok and Bailey, the attorneys. It was then examined by the attorneys, found correct, and a fair copy made and returned

on the 18th to Bell in Boston for his signature and oath. It was signed and sworn to in Suffolk County, Massachusetts, January 20, and immediately returned to the attorneys. Afterwards Pollok met Bell in New York, and it was again gone over with care by the two together. No change whatever was made in it at that time, and Pollok took it back with him to Washington.

On the 25th of January, 1876, Bell met Brown, who was then on the way to England, in New York. It is now assumed that the paper which Brown took to England was handed to him then, and because the variable resistance method and the fourth claim were not in that, it is argued that they could not have been in the American specification at that time. But no one has said when the paper was actually handed to Brown. Bell says he cannot tell, but that it must have been after he made his contract with Brown on the 29th of December. As the American specification was signed and sworn to five days before the interview with Brown on the 25th of January, and the paper of Brown differs from it in so many particulars besides that now in question, it would seem to be clear that the paper was a copy of some former draft which Bell had made — possibly one taken to Canada in December — and not of that which was perfected afterwards. As the specification which had been prepared and sworn to was a fair copy, without erasures or interlineations, the fact that the paper handed Brown was not a fair copy would imply that it was not intended to be an exact transcript of the other. At any rate, the bare fact that the difference exists under such circumstances is not sufficient to brand Bell and his attorneys and the officers of the Patent Office with that infamy which the charges made against them imply. We therefore have no hesitation in rejecting the argument. The variable resistance method is introduced only as showing another mode of creating electrical undulations. That Bell had had his mind upon the effect of such a method is conclusively established by a letter which he addressed to Mr. Hubbard on the 4th of May, 1875, and which is found in the Dowd record, introduced into the Overland case by stipulation. Its insertion in his final draft of his

specification is another proof of the care with which his work had been done.

In the case of the Clay Commercial Company objection was made to the sufficiency of the proof of the incorporation of the American Bell Telephone Company and of its title to the Bell patents. Upon the first point the proof was, 1, a special act of the general court of Massachusetts, entitled "An act to incorporate the American Bell Telephone Company," which authorized certain persons therein named and their associates to organize themselves under the provisions of c. 224 of the acts of 1870, and the acts in amendment thereof, for telephone purposes; and, 2, a certificate of the Secretary of the Commonwealth in the form required by § 11 of c. 224, that certain persons, among whom were the most of those mentioned in the special act, were legally organized and established as an existing corporation under the name of the American Bell Telephone Company. This section made such a certificate "conclusive evidence of the existence of a corporation" organized under that chapter. The authority granted by the special act to the persons named to organize as a corporation in this way, gave them the authority to select a corporate name, and also made the statutory certificate conclusive evidence of their corporate existence.

The objections to the proof of title are not, in our opinion, well taken. We do not deem it necessary to add to the length of this opinion by referring particularly to the testimony on that point.

This disposes of all the cases so far as the patent of March 7, 1876, is concerned. It remains only to consider the patent of January 30, 1877, about which but little has been said either in the oral or printed arguments. Apparently it received but little attention by counsel or the court in either of the cases below. In the Dolbear case, it was by consent excluded from the decree, and of course is not presented by that record in this court. In all the other cases the patent was sustained, and the Clay Commercial Company was adjudged to have infringed the third, fifth, sixth, seventh, and eighth claims; the Molecular Company the sixth, seventh, and eighth, but not the fifth; the People's Company the fifth, sixth, and

eighth; and the Overland Company the third, fifth, sixth, seventh, and eighth. From the decree in favor of the Molecular Company as to the fifth claim the Bell Company has appealed.

In the case of the Clay Commercial Company it was alleged in the answer that the substantial and material parts of the things described and claimed were described and claimed in a prior British patent taken out by or for Bell, dated December 9, 1876, and that, inasmuch as the American patent does not bear the same date with the foreign patent, and is not limited to expire therewith, it is void. This point has not been pressed in the argument here, and in our opinion it has been settled by the decision of this court in *O'Reilly* v. *Morse*, 15 How. 62, 112, and impliedly by that in *Siemens* v. *Sellers*, 123 U. S. 276, at the present term, that the effect of § 4887 of the Revised Statutes is not to render invalid an American patent which does not bear the same date as a foreign patent for the same invention, but only to limit its term.

The patent itself is for the mechanical structure of an electric telephone to be used to produce the electrical action on which the first patent rests. The third claim is for the use in such instruments of a diaphragm, made of a plate of iron or steel, or other material capable of inductive action; the fifth of a permanent magnet constructed as described with a coil upon the end or ends nearest the plate; the sixth of a sounding box as described; the seventh of a speaking or hearing tube as described for conveying the sounds; and the eighth of a permanent magnet and plate combined. The claim is not for these several things in and of themselves, but for an electric telephone in the construction of which these things or any of them are used. Hence the fifth claim is not anticipated by the Schellen magnet, as was decided in the Molecular case below. The patent is not for the magnet, but for the telephone of which it forms but part. To that extent the decree in that case was erroneous.

It follows that the decree in each of the cases, so far as it is in favor of the Bell Company and those claiming under it, must be affirmed, and that the decree in the Molecular case,

so far as it is against that company on the fifth claim of the patent of January 30, 1877, must be reversed and a decree directed to that extent in its favor. It is consequently so ordered.

Mr. Justice Bradley, with whom concurred Justices Field and Harlan, dissenting.

Mr. Justice Field, Mr. Justice Harlan and myself are not able to concur with the other members of the court, sitting in these cases, in the result which has been reached by them. Without expressing an opinion on other issues, the point on which we dissent relates to the defence made on the alleged invention of Daniel Drawbaugh, and applies to all the cases in which that invention is set up. We think that Drawbaugh anticipated the invention of Mr. Bell, who, at most, is not claimed to have invented the speaking telephone prior to June 10th, 1875. We think that the evidence on this point is so overwhelming, with regard both to the number and character of the witnesses, that it cannot be overcome. As this is a question of fact, depending upon the weight of the evidence, and involves no question of law, it does not require an extended discussion on the part of those who dissent from the opinion of the majority, — which is very ably drawn, and presents the case with great clearness and force. On the point mentioned, however, we cannot concur in the views expressed.

The essence of the invention claimed by Mr. Bell is, the transmission of articulate speech to a distance, by means of an electrical current subjected to undulations produced by the air vibrations of the voice. There are two modes (as yet discovered) by which these undulations may be thus produced. In one they are produced by interposing in the circuit a substance whose electrical conductivity may be varied by the concussions, or vibrations of the air produced by the voice. This is called the variable resistance process, because the electrical current is subjected to the variable resistance (or conductivity) of the substance thus interposed. By the other