Chapter 4

PATENTS IN ACTION
(THE HISTORY OF THE BASIC TELEPHONE PATENT)

This chapter carries on an illustrative approach found most effective in lecturing, tying together a complete picture of the invention, entrepreneuring, business, and legal cycles often involved in innovation—and through the medium of the Bell Telephone Cases. This particular invention was selected because its technology is familiar to all types of readers and because almost everything that could happen did happen to Bell; except that he was saved by a single vote in the Supreme Court from the anonymity experienced by many current inventors.

By turning to a detailed study of the so-called Bell Telephone Cases, involving an invention understandable and intimately known by everyone [1], we can both tie together many of the various principles of patent law heretofore discussed, and set up a real laboratory experiment by which to observe the rather typical actions and reactions of American industry and business to independent innovation. In this way we can learn something about the intricacies and mysteries of patent litigation in the courts.

The Circumstances Underlying Bell's Invention

A little, first, about Alexander Graham Bell. He was not a native-born American [2]. This has some significance for what happened in this case. At the time here involved, only American citizens could file an intention, called a "caveat," and file later a patent application for an invention. If the caveat was seasonably followed by a patent application, the inventor could thereby obtain the benefit of the early date of the caveat filing. Had Bell been an American citizen with the right to file a caveat, certain alleged prior inventions by others could not have been asserted against his claim of prior inventorship. Bell had to wait until he had completed his inventive processes, at least theoretically, before he could file his application in the Patent Office.

Bell was born on March 3, 1847, in Edinburgh, the son of a teacher of elocution. At a very early age, he naturally became

interested in the problems of speech and lip reading and ultimately assisted his father, who was the professor of elocution at the University of London. When the latter was offered a position in this country, he sent his son, in his stead, to join the staff of the Boston School for the Deaf.

At this time, the Western Union Company, having bought up the small individual operating telegraph systems in the country, was in control of the country's first national communications chain. One of the problems that it was facing was that of the simultaneous transmission of a plurality of Morse-code messages over the same wires. Its engineers were heavily engaged in trying to solve this problem. Bell heard about it, became interested, and decided to set out to solve it. Fortunately, in his impecunious state, he met a Boston attorney, Gardner Greene Hubbard, who, becoming intrigued with the potential financial return from an invention that could solve this problem, agreed to supply funds with which Bell could carry on his researches.

The concept that Bell evolved related to the simultaneous transmission of a plurality of different tones, each carrying a different telegraph message. At the receiving end, a number of tuned reeds were provided, each tuned to one of the different tones. Bell reasoned that only the reed tuned to a particular tone would reproduce that tone, and so each message would be selectively received by its corresponding reed.

It is important for our purposes to remember that this multiple-telegraphy problem, called the "harmonic telegraph," was the concept that Bell set out to explore. This is important because it illustrates what often happens when an inventor or applied scientist sets out to solve a problem. Frequently, the investigator makes an accidental auxiliary discovery or observes some phenomenon he cannot explain. When given the freedom to drop the planned research goal for the moment and to explore this diversion, inventors have made far more important inventions than the original research project contemplated, devices that solved different and often more important problems. There is the serious question whether today, under government sponsorship of research, and even under the research policies of many industrial companies, the investigator would have that freedom to stop momentarily, to lay aside the original goal, and to explore the striking new channel.

Bell was joined in his experiments by Thomas A. Watson, and the two worked together in a garret, as the popular story has it, on the harmonic telegraph. One day Watson misadjusted a reed, so that instead of vibrating back and forth, to make and break an electrical circuit and thereby to reproduce the telegraphic dot-and-dash message, the reed became stuck fast in a closed-circuit position. Bell, being in the room at the time, heard something he had never heard before, a kind of muffled

tone of entirely different quality and clarity from the ringing tones of make-and-break reeds. He was puzzled as to how, in a completely closed circuit, the tone could be reproduced. This was perhaps the first inkling that communication results could be obtained other than by making and breaking electrical circuits. Here was a tone that was coming through when the circuit remained closed, the stuck reed apparently responding to current variations in the winding behind it. Mind you, Bell was still working on this harmonic-telegraph problem.

At this point, however, realizing the significance of this discovery, Bell went to Mr. Hubbard and requested permission to stop work on the harmonic telegraph, and to start investigating the problems inherent in speech reproduction. Mr. Hubbard, interested in the big bounty awaiting the first person to solve Western Union's problem of multiple telegraphy, was unable to see any future in a speech machine, and so repeatedly instructed Bell to continue on the harmonic telegraph and to forget esoteric speech problems. The record shows, however, that Bell slanted his work towards a speech machine, under the guise of a modified version of the harmonic telegraph.

On February 14, 1876, Bell filed a patent application. This application purported to cover the harmonic telegraph for simultaneously producing multiple-tone messages. The application clearly explained, however, that it covered also a machine that would reproduce vocal sounds. Bell put both inventions in one case. On March 7, less than one month later, the Patent Office issued the first Bell patent on that application. The patent number was 174,465. Note that it took Bell less than a month to get his patent. Contrast that with the several years that may be involved in issuing a patent today, particularly in the light of the events to be subsequently related, where others soon commenced to violate Bell's rights. At least Bell, unlike a present-day inventor, promptly obtained a patent that enabled him to try to enforce his rights, instead of having to sit back and wait in frustration. Here is the fortuitous circumstance that Bell obtained his patent promptly.

Bell's Basic Patent

Figure 2 reproduces part of the basic Bell patent relating to the original telephone, with Fig. 7 thereof illustrating a mouthpiece at A, into which the voice sounds were to be directed. There was a metal diaphragm a that would vibrate in accordance with those voice sounds. Behind the diaphragm a was an electromagnetic winding b that was connected in the following electrical circuit: from ground E, through a battery, to and through the winding b, along the line e, to a similar receiving winding f, and then back to ground again, at g. Thus there is provided a closed

circuit for the flow of electric current. In this patent, Bell explained that as the diaphragm a moved closer to and farther away from the winding b, in response to voice vibrations, the effect of its varying position, relative to the winding b, would be to induce, in this winding b, variations in the current flowing therein. By this technique, the exact undulations of sound produced by the voice can be converted into corresponding electric-current undulations or variations in the above-mentioned circuit. The receiving or reproducing diaphragm i would thus be attracted to and repelled from the receiving winding f, causing air in front of the diaphragm i to be correspondingly set into vibration, thereby to reproduce the original voice sound.

A. G. BELL.
TELEGRAPHY.

No. 174,465. Patented March 7, 1876.

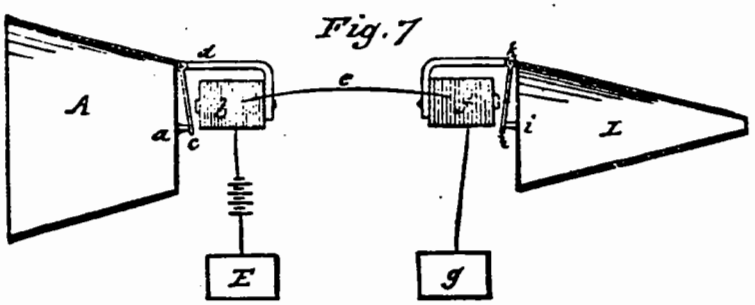

Figure 2. Part of Bell's original telephone patent.

Now this is the theory that Bell proposed in his patent. The evidence adduced in subsequent litigation involving his patent demonstrated that Bell had never made this device work for voice sounds until after he had received his patent. It is important to note, however, that he did have a valid theory of operation. More of this later.

His attorney presented two kinds of claims in the patent. It is to be recalled that one of the patentable classes of invention is a new piece of apparatus, which may be a new combination of old elements, operating in a new cooperative manner to achieve

a new result. It will be recalled, also, that the law permits the patenting of a new process or art or method, namely a new series of steps capable of performance with any of a host of different types of apparatus. The concept that Bell had evolved was a method wherein a continuous electric current was to be maintained, but whose value was to be changed in accordance with voice-sound undulations, and without interrupting the complete-circuit flow of the current. That, Bell asserted, was his new method. His attorney worded the claims in both method and apparatus form, and it is wise that he did so. It will be demonstrated shortly that, had he worded the claims in specific apparatus form alone, some of Bell's early competitors might have been free of the charge of infringement. But, having worded a broad claim to embrace the method also, the attorney provided the court with grounds for construing the infringing devices, which were pieces of apparatus different from Bell's, as falling within the scope of Bell's invention. To quote claim 5:

> 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.

Of course, the Patent Office would not let a claim like that be written today because of present-day requirements for recitations of structure in more precise form, nor would the courts be likely to sustain such a general wording. The Patent Office (and the courts) have become very ritualistic and formal. The important thing for our story, however, is that Bell's attorney obtained a patent both for the steps of the method and for a piece of apparatus.

Watson, working under Bell's direction, evolved the principle of substituting for this electromagnetic apparatus a permanent magnet. This simplified the commercial construction, and a second patent, No. 186,787, issued the following year, on January 30, 1877, principally for the improvement of a fixed magnet.

Bell, still struggling under the adverse conditions usually besetting the individual inventor and entrepreneur, did the natural thing. He went to Western Union, the party most interested in communications, and offered his basic patent for the telephone for $100,000. Western Union, in turn, consulted with the ablest scientific people and engineers and the best business minds of that day and came to the conclusion that there was no commercial future for an instrument that would reproduce voice sounds. Hence, it turned down Bell's offer [3].

It may be interesting to depart briefly from the main theme to point out that the supposedly ablest industrial, scientific, and

government people of our own day make similar unimaginative decisions over and over again. Where inventors formerly persisted and proceeded somehow on their own, as did Bell, in the true American tradition, and sometimes made a success of their inventions to the benefit of the country, the recent policies of our government, our industry, and our courts, as will be shown later, have tended to kill or at least hamper much of the incentive.

The Founding of Bell's Company—and the Pirates

In Bell's day, however, the American pioneering spirit still existed, and Bell, unthwarted, determined to promote his invention himself. He and his associates raised capital in Boston and formed the American Bell Telephone Company. Within a year or two, they were actually supplying instruments to the public. Having now embarked upon a business, as distinguished from a research venture, Bell needed to and did obtain practical improvement patents for commercially acceptable structures. And the demand for these crude telephone instruments was so great that the new company could not keep up with its orders.

Two short years later, in 1879 (once Bell had shown the way) the Western Union reversed its decision that there was no commercial future in the speaking telegraph toy, and it formed the American Speaking and Telephone Company. In typical free-enterprise fashion, stimulated by the fact that Bell had obtained a patent, Western Union employed two renowned inventors to work around what Bell had done and to avoid his patent [4]. The whole world is familiar with the names of Thomas Alva Edison and Elisha Gray, the men selected by Western Union.

Thomas Edison, upon his employment by Western Union, went to work to devise what we would today call a transducer for using the voice vibrations to affect the magnitude of the electric current far more effectively than Bell's did, and came up with the carbon-button microphone, which is still in use. Western Union, accordingly, treated Bell's patent as limited to armatures and diaphragms and put on the market its own telephone, using Edison's invention. This carbon-button microphone performed infinitely better than did Bell's crude electromagnetic device, so that the quality of the Western Union instrument was far above that of the American Bell Telephone Company's. One can begin to see the problem facing the latter company when customers could obtain a much improved instrument from its competitor.

To solve this, Bell's company decided to employ inventors other than Bell, in an effort to produce as good an instrument as Edison's carbon-button microphone. They therefore hired Emil Berliner, who had effected a filing in the Patent Office two weeks earlier than Edison's patent application for the carbon-button microphone. (And this was, of course, one of the reasons why

he was selected.) While Berliner did not invent a carbon-button microphone, he did devise a type of metal-contact microphone that could be termed a variable-resistance microphone. This was an apparatus operating upon a different physical principle (variable resistance) from that of Bell's inductive armature-diaphragm apparatus, and, if new, was entitled to independent patent protection. The significance of this is that, since variable resistance is also the principle underlying the operating of the Edison carbon-button microphone, if Berliner could obtain broad patent claims to a variable-resistance microphone, the Bell Company would have another tool with which to ward off Western Union's challenge.

The Patent Office set up an interference proceeding between Berliner and Edison to determine which one was entitled to the broad variable-resistance-microphone claims. It is interesting to observe that years later, when Berliner's patent finally issued, it had the effect of extending the basic "monopoly," as that term is popularly used, of the American Bell Telephone Company. The patent was attacked unsuccessfully upon the ground of extension of monopoly by the Attorney General [5], though later it was invalidated by the Circuit Court for the District of Massachusetts as anticipated by Edison's work [6].

The American Bell Telephone Company held the view that Bell's basic patent was very broad and was not restricted to any particular form of apparatus. Under such interpretation, of course, a telephone using Edison's improved transducer, the carbon-button microphone, would infringe the broad telephone claims of Bell's patent. Bell could not, therefore, stand by and sanction the Western Union infringement upon his patent. Claim 5 of the basic patent, quoted earlier, does not specify whether the electrical undulations similar in form to the vibrations of the air are caused by use of a variable resistance or by use of a magnetic armature circuit, but very broadly covers that they are made to do so. Thus, on the theory that this broad claim covered any way found to do this equivalent to Bell's disclosed magnetic armature-diaphragm apparatus, American Bell Telephone Company sued Western Union.

I have said nothing yet about Elisha Gray, who, like Edison, had been employed as an inventor by Western Union. One of the reasons for his employment was that on the very same day, February 14, 1876, that Alexander Graham Bell had filed his patent application for the basic patent, Elisha Gray, an American citizen, had filed in the Patent Office a caveat for a telephone. He had apparently independently conceived the idea of having a closed circuit and of varying the value of the current therein, in accordance with voice sounds. (See Figure 3.) As the voice vibrations moved a diaphragm a (Fig. 1) back and forth, a wire A was simultaneously inserted to varying depths into a conducting

water solution B. Hence, in theory, the resistance between the wire A in the water and the water solution B varied because there was more or less contact area between the wire and the water. This, then, was a variable-resistance device, moving back and forth in the same way as the air undulations, in an uninterrupted electrical circuit. But Gray did not follow up this caveat with a patent application, and his rights were accordingly lost. He was still useful to Western Union, however, because, whether or not he obtained a patent, Bell's patent could be invalidated if Gray had actually made the invention before Bell. There was also a charge of fraud raised in the Telephone Cases to the effect that word of Gray's caveat was passed to Bell's attorney, and that the latter supposedly arranged for Bell's application to be changed in the Patent Office to include Gray's variable-resistance principle, but the Supreme Court found no evidence at all of such fraud.

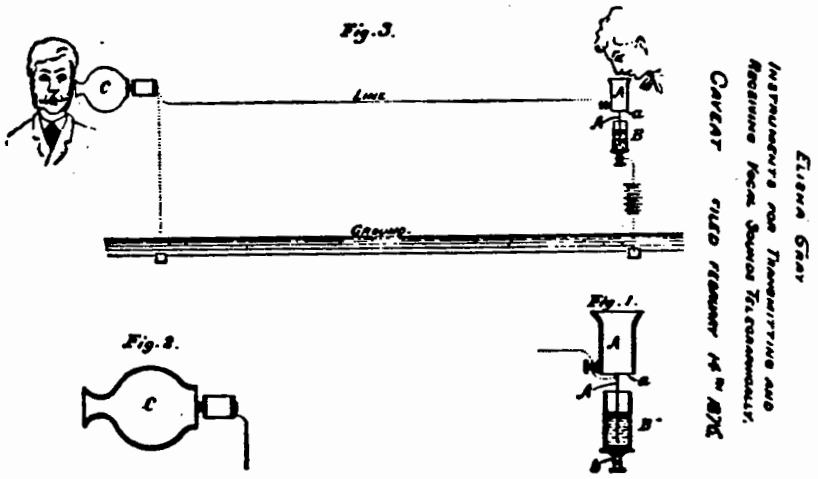

Figure 3. A part of Elisha Gray's caveat.

A great deal of testimony was taken in the suit between Bell Telephone and Western Union, and the attorneys for the latter advised their client that they thought Bell was going to win the case. Since they had an interference in the Patent Office, Edison v. Berliner, on the broad variable-resistance issue, and since they had this court litigation on the basic Bell patent, Western Union decided to see if a compromise could be reached. It should be added that, although Western Union had infringed Bell's claim 5, the Bell Company, on the other hand, could not operate commercially without using Edison's carbon-button microphone invention. In other words, the Western Union attorneys were sure they would lose their suit, but Bell was also

anxious to settle it to obtain the rights under Edison's invention.

Accordingly, a settlement was reached on the basis that, for a period of seventeen years, the American Bell Telephone Company would pay one-fifth of all its proceeds to Western Union, Western Union would give the rest of its stock of telephone equipment to the American Bell Telephone Company, and from that time on Western Union would not engage in the telephone business for the seventeen-year period. This, of course, was a business decision, forced perhaps by the patent difficulties. It certainly stands out, however, as one of the most fateful management decisions imaginable. Looked at with hindsight, it was responsible for the subsequent decline of Western Union.

Enters the Supreme Court

After the court litigation with Western Union was settled, other equally ambitious entrepreneurs, in the normal American tradition, sprang up all over the country, each setting up a small telephone company and proceeding along its own merry way in defiance of Bell's patent. Suits were thereupon brought against one Dolbear, a professor at Tufts College, against the Molecular Telephone Company in the southern district of New York, against the Clay Commercial Telephone Company, in the eastern district of Pennsylvania, and against the People's Telephone Company and the Overland Telephone Company, both in the southern district of New York. In each suit, Bell's patent was sustained. Finally, all these cases came up before the United States Supreme Court, which decided to consolidate them and to hear all the appeals at one time. These Telephone Cases are reported in a complete volume of the Supreme Court decisions, referred to as 126 U.S.

The defendants contested the validity of Bell's patent. They also denied infringement upon the basis that the latter's patent must be limited to what is shown in the patent, and none of the supposedly infringing telephones used the magnetic armature-diaphragm apparatus of the patent. I shall now examine how the Supreme Court treated these various defenses, and what its decisions were.

First of all, the reader may gain a picture of how close to the prior art important inventions often are, by learning that these defendants cited some fifteen different men who, they maintained, made this invention before Bell. They included a Philip Reis of Germany, the before-mentioned Elisha Gray and Thomas Edison, Professor Dolbear, and one Daniel Drawbaugh. The defendants also asserted that there were eight United States patents, six British patents, and a French one, all issued before Bell's basic patent and disclosing the same invention. The defendants alleged, further, that there were six United States patents, three British patents, and a Canadian one for the same

invention as Bell's second improvement patent, before mentioned. They cited some sixty-three publications before Bell's, including French, British, German, United States, Italian, and Irish publications, all supposedly anticipating Bell's concept. And in connection with the latter's second patent, they listed fifty-one publications to show that others had thought of the invention before Bell.

Now these were technical people, applied scientists, business people, and attorneys, who were advancing rational arguments; they were trying to persuade a court that Bell's contribution was anticipated. I proceed, therefore, to the details of these defenses and how the court handled them.

The first defense here involved is that Bell was attempting to patent a natural force, a scientific fact. He was purporting, in claim 5, to monopolize the scientific fact that, if one varies the electric current in the same way that the sound produced by the voice varies, speech will be reproduced. This, the defendants maintained, is a fact of nature to which our patent laws do not extend. And they cited a Supreme Court decision to support that principle, O'Reilly v. Morse (15 How. 62). In that case, Samuel F. B. Morse, the inventor of the telegraph, tried to claim all uses of electricity for transmitting intelligence from one point to another. The Supreme Court there held that an attempt to patent all such possible uses of electricity is too broad and is really an attempt to patent a force of nature. The court struck down Morse's broadest claim, claim 8.

So the defendants in Bell's suits, by analogy, argued that Bell's claim 5 gave him the monopoly of all possible ways of making these electrical currents correspond to the voice undulations, and, as such, represented merely a discovery of nature that was not one of those things that, under our patent laws, was susceptible to patent protection. As previously explained, a scientific discovery, per se, is not patentable under our laws.

What did the court answer? To quote from page 534:

> 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 'electromagnetism,' however developed, for making or printing intelligible characters, letters or signs . . . was void, because (p. 20) it was a claim for a patent for an effect produced by the use of electromagnetism, distinct from the process or machinery necessary to produce it.

The court continued that in Bell's case, on the other hand,

> 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.

The court was not unmindful of the fact that

> 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 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, it is true, show more clearly the great importance of his discovery, but it will not invalidate his patent.

Hence, concluded the Supreme Court, this is not a case where Bell is taking raw nature, the force of a battery, the force of a current, and trying to claim all uses of it for speech reproduction. This is a case, rather, where Bell is molding the current into something that was not there originally, and varying that current in accordance with the variations of air pressure produced by voice sounds. This is a method or process. It is not pure scientific discovery. It is, rather, the application of scientific discovery to a particular problem. It is the kind of invention that our patent laws cover.

The next defense advanced was that Bell did not really make his invention work until after his patent issued. It will be recalled that Bell had witnessed the experiment of the stuck reed, but that was not voice. He had not actually transmitted voice at that time, and, in fact, he did not succeed in doing so until after his basic patent issued. So, said the defendants, Bell did not really make the invention until after he had obtained the patent.

How did the court answer that? To quote from page 535:

> 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, but,

the court continued—and this is very important—

> 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, re-receive the words, and carry them to and deliver them at the appointed place.

The court concluded on that topic (p. 536):

> 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 practical way of putting it into operation. This Bell did.

Hence arises the rule of law, previously treated, that the filing of a theoretically operative patent application constitutes, in contemplation of the law, a constructive reduction to practice of that invention. An inventor does not need to wait until he can accumulate the several million dollars necessary to build a computer and test it. If he has some new principles that are worthy of protection and he can theoretically demonstrate their operability, he can obtain a patent.

The next defense advanced was that there was no infringement because, as earlier pointed out, claim 5 of the patent called for the apparatus "substantially as set forth." Bell set forth an electromagnetic armature-diaphragm microphone. The defendants maintained that they were not using those electromagnets. Professor Dolbear [7], for example, employed a microphone that appears to resemble what we would now describe as an electrostatic microphone, acting as a variable impedance in the circuit. This defendant's position was that his apparatus involved a different concept from Bell's disclosed apparatus, which was restricted to inducing current variations by moving the diaphragm nearer to and farther from the electromagnetic winding.

The court dealt with this defense of noninfringement as follows (p. 538):

> The patent is both for the magneto and variable resistance methods and for the particular magneto apparatus which is described, or its equivalent. (Italics mine.)

What the court is saying here is that, insofar as the method is concerned, it may be practiced whether one uses a magneto, meaning the Bell electromagnetic armature-diaphragm structure, or a variable-resistance device. The use of either device still involves the method of causing the electric current to vary with the voice-sound undulations. As for the apparatus, however, the court agreed that the apparatus described in the patent claim was only the magnetic armature-diaphragm apparatus that Bell disclosed, or its equivalent. While it is not clear, the court later appeared to imply that the variable-resistance device was also an equivalent of the "magneto." At any rate, it can be seen how important was the decision by Bell's attorney to insert the magic word "method," as well as apparatus, in the claim.

To continue with the court's analysis:

> 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 circumstance. Both forms of apparatus operate on a closed circuit by gradual changes of intensity, and not by alternately making and breaking the circuit.

It will be apparent hereinafter that the prior art came very close to Bell. The whole distinction was that, instead of keeping the circuit closed all the time, and varying the current in it, the prior-art inventors interrupted the circuit, by actual make-and-break switching, which was unable to reproduce complex waveforms, such as speech, although it could reproduce musical tones.

The court concluded (p. 539):

> Surely a patent for such a discovery is not to be confined to the mere means he improvised to prove the reality of its conception.

Hence, another important point of patent law. if an invention is a broad invention, a court should construe it broadly. If the advance is a pioneer advance, one cannot escape infringement by trying to obtain the same result in another equivalent way. This matter of range of equivalents returns again to the matter of the attitude of the court and its conclusion as to the scope of an invention. If a court considers that a real advance has been made, and that the defendant is using the substance of the invention, the range of equivalents may be broad. If, on the other hand, a court considers the invention to be narrow, it may find the somewhat different structures of the defendant to be noninfringing, by refusing to grant a substantial range of equivalent structures.

Now I come to the details of the prior art set up by the defendants as anticipating Bell's invention. One of the prior-art publications was that of Bourseul in Paris, in 1854. This, it should be understood, was twenty-two years before Bell's invention. Here is what the Supreme Court held that Bourseul had in mind (p. 542):

> As early as 1843 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 ". . . 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 connection with a battery, you have at a distance another disk which will simultaneously execute the same vibrations."

This operation is shown in Figure 4.

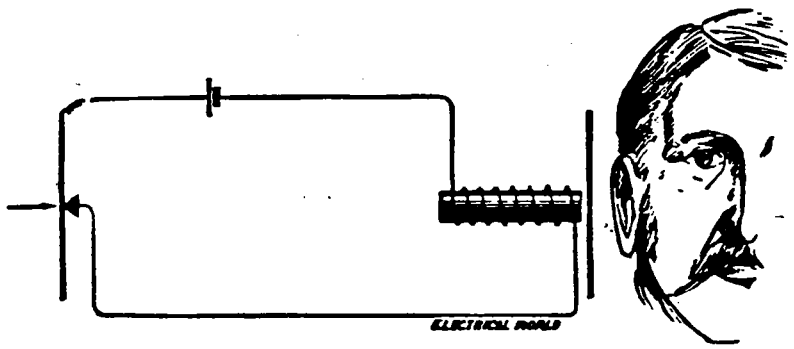

Figure 4. Bourseul's make-and-break concept.

Bourseul, however, was merely proposing a problem insofar as speech was concerned. He had everything there—almost. He was even proposing to use the principle of the telegraph to make the electric current vary the same way that the voice vibrations vary. But note that he had in mind making and breaking the electrical circuit.

The next prior art was that of Philip Reis of Germany, some fifteen years before Bell made his invention. Reis's work involved a device for reproducing musical sounds wherein a diaphragm moved back and forth in response to sound waves, and caused an arm correspondingly to move back and forth and make and break connection with an electric circuit. The Supreme Court invited attention to Reis's own description of his apparatus as involving a system wherein "each sound wave causes a breaking and closing of the current." Figure 5 illustrates the Reis construction, as shown in a paper of von Legat, embodying a diaphragm c that moves an arm e into and out of contact with a contact point d. The screw h can adjust the extent of this make-and-break adjustment. It could even produce Bell's kind of operation, if properly adjusted so that the circuit did not make and break, but gave rise to a variable-contact resistance phenomenon. This was proved by the experiments of Blake [8].

Professor Hunt [9] has an extremely interesting account of Reis's work in his book already cited. Here briefly is his conclusion, as a scientist, as to the nature of Reis's work.

> In spite of stout efforts to show the contrary, no evidence could be found in Reis's writings that he had ever contemplated

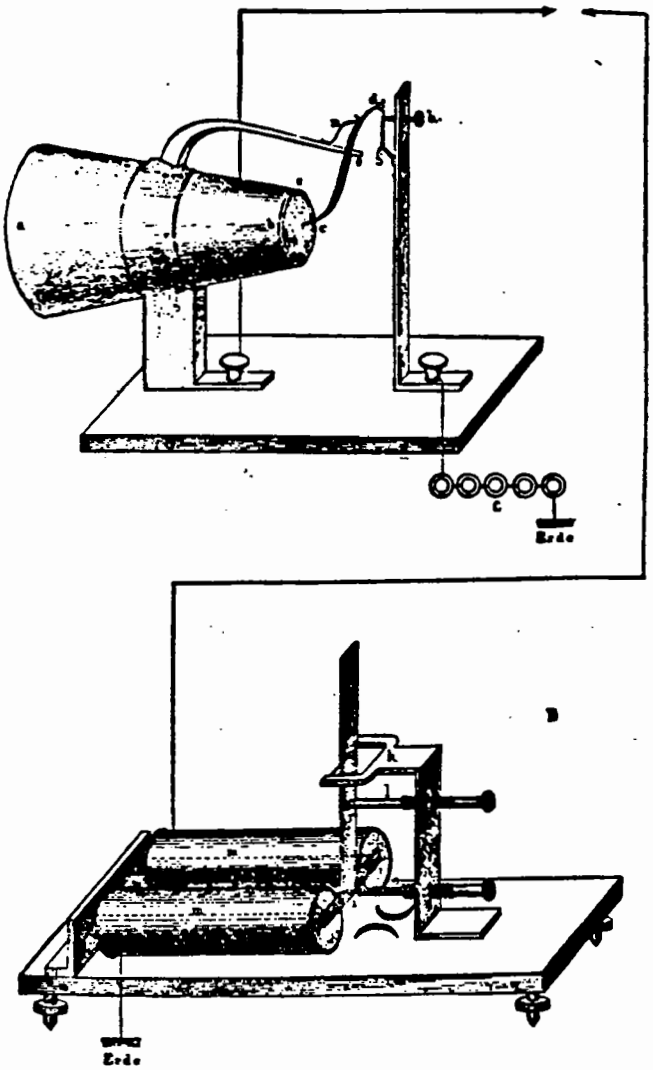

Figure 5. Philip Reis's construction.

any mode of operation of his transmitter other than one involving complete interruption of the current. What made this conclusion convincing was the additional fact that his receiver was so insensitive that it could not have produced an audible reproduction of speech even when his transmitter was in the rare condition of adjustment necessary for the production of an undulating current.

The Supreme Court summarized Reis's work as follows (p. 544):

> It was left for Bell to discover that the failure was not due 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 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.

So, the court concluded,

> 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.

Lastly, with regard to the alleged prior invention of Drawbaugh, the People's Telephone Company came upon this prolific inventor who, long after the event, was prepared to claim having built a large number of telephones before Bell. For some unexplained reason, he only had bits and pieces of them to show, none of which worked. But he produced some fifty witnesses, farmers and the like, all of whom swore that they had heard speech coming over these various instruments long before Bell made his invention. In view of other circumstances the majority of the court just could not believe this. While Drawbaugh had indicated that he did not have money to file patents and that he did not realize in time the significance of the invention, the court found that he had been able to raise money to file patents on other inventions, that he had gone with friends to a centennial exhibition at which Bell made a demonstration, and had seen Bell's instrument, but never claimed to his friends that he had already done the same. This distinct feeling of prior inventorship was apparently not brought out in Drawbaugh until after the People's Telephone Company had considered him as a possible champion by whom to defeat Bell. The majority of the court found that Drawbaugh did not make the invention before Bell, although three judges disagreed. So, by a 4-to-3 vote, two of the judges not participating, Bell's patent was sustained by the Supreme Court.

It may be relevant to point out that four days after delivering the majority opinion Chief Justice Waite died. What would have happened to Bell's patent without the persuasion of Chief Justice Waite? Suppose he had died a little earlier? Would there have been a 3-to-3 sustaining of the patent, or would no American schoolchild today know of Alexander Graham Bell?

Another point of interest is the reluctance of the courts to trust oral testimony, alone, with regard to dates of invention

and demonstrations [10]. If Drawbaugh had made the invention and had kept proper written records and models, these, together with the attestations of technically qualified witnesses, would undoubtedly have led the majority of the court to a different conclusion [11]. This is a lesson for the applied scientist and inventor on the importance of keeping dated records and models and having them witnessed by those who understand the invention.

Another interesting fact is that Bell's invention gave rise to a situation whereby, within the quarter of a century following it, more than 3000 patents are reported to have been issued for improvements relating to the telephone.

Supposedly informed and well-meaning people have sometimes attacked the patent system as discouraging invention, because the pioneer gets a basic patent and can, for a limited time, exclude others. The history of patents shows, however, that, far from discouraging invention, the system fosters and stimulates a myriad of new devices to get around the patent or to improve upon it, in order to bargain for an exchange of rights, as demonstrated above. Truly this accomplishes the end set forth in the Constitution "to promote the progress of science and useful arts."

It is of interest, also, to note the considered opinion of Professor Edward L. Bowles, of the Massachusetts Institute of Technology, who has made a deep study of the history of the American Telephone Company and its subsidiaries. Professor Bowles has reason to believe that the Telephone Company policy, with regard to equipment ownership, may well have resulted from the influence of the equipment-leasing policy of the United Shoe Machinery Corporation. It appears that, while Bell has sometimes been credited with altruism in establishing the policy of not requiring the telephone user to own his equipment, his financial backer, G. G. Hubbard, was a close associate of Gordon McKay, the former guiding light of the United Shoe Machinery Corporation and its policy of leasing, not selling, equipment.

How Would Our Present Supreme Court Probably React to Bell's Patent?

What might have been Bell's fate if he had to come before our Supreme Court today? We must assume, of course, that he had already obtained his patent, and had not already been worn out by interferences, in the Patent Office, with one or more large corporations. As I shall show, later, such corporations have been notorious for provoking interferences by unwarrantably reading into one of their thousands of applications on file in the Patent Office an invention of an outsider that has come to their attention, and that they fear they might want to use later.

We must also assume that the patent has issued relatively promptly, so that well-financed copyists have not already been able to put the enterprising inventor out of business.

For purposes of analysis, we shall refer to the classic Supreme Court decision, Jungerson v. Ostby and Barton Co. [12] The Supreme Court threw out a patent for an invention dealing with centrifuging wax into a mold for the purpose of intricately reproducing designs in jewelry and the like. It did this in the face of the fact that this invention had made possible novel results that had long been sought by the whole industry, that it was slavishly copied, once made known, and that it was the first technique ever to reproduce accurately and intricately this kind of jewelry. The Supreme Court held (p. 563):

> Jungerson's process is nothing more than a refinement of a method known as "cere perdue" or "lost wax" process, which was in use as early as the sixteenth century. The treatises of Benvenuto Cellini . . . .

The prior art, the Supreme Court said, has been there for over 400 years; all one had to do was use it!

Let us draw the parallel, in Bell's situation, to Reis's work some fifteen years before Bell, and Bourseul's writings some seven years before that, which told the world that, if one caused the undulations of the air produced by sounds to produce corresponding variations in electric current, and employed telegraph-type apparatus therefor, the telephone would be born. Does this not correspond to Cellini's telling the world in the sixteenth century that one can use wax molds for goldsmithing, and to what the Supreme Court, in the Jungerson case, termed the recognition, by those skilled in the art, of the necessity for making "molten materials fit snugly the intricate details of the mold"?

Jungerson's invention, the Supreme Court held, was merely "a refinement" of Cellini's method, including an application of centrifugal force thereto. Certainly Jungerson did not discover centrifugal force! Bell's invention similarly could have resulted, as before explained, merely by "a refinement" of Reis's apparatus by proper adjustment of Reis's screw h. Screw adjustments were certainly recognized before Bell!

The Supreme Court made a point of the fact that "those skilled in the art recognized and disclosed the necessity for the application of force"—though not, of course, of Jungerson's particular successful centrifugal-force action in this technique, a fact which, however, the court found to be "of no legal significance" (p. 566).

That no one before had ever produced Jungerson's long-sought result, despite Cellini's age-old teaching and the recognition that a force was required, was of no significance to the court. Why,

then, should the fact that no one had attained Bell's results, despite Bourseul's teaching, be of any more significance? Had not Bourseul himself "recognized and disclosed the necessity for the application of" electrical undulations that would correspond to the voice sounds?

The answer may lie in the dissent in the Jungerson case. Justice Frankfurter, adopting the words of dissent of Judge Learned Hand of the Court of Appeals below, pointed out (pp. 569-570).

> My point is that, if there is a new combination, however trifling the physical change may be, nothing more is required than that, to take the step or steps, added "invention" is needed, and the "invention," whatever else it may be, is within the category of mental activities and of those alone. . . . Indeed it is the very basis of the defense that for years all the elements lay open and available, and that nothing was needed but the paltry modification which has proved so fruitful. . . . What better test of invention can one ask than the detection of that which others had all along had a strong incentive to discover, but had failed to see, though all the while it lay beneath their eyes?

But the time has long since passed when we can afford to engage in pretenses. The real philosophy, it seems to me, is involved in Justice Jackson's honest appraisal in his dissent (p. 572).

> It is the strong passion in this Court for striking them [patents] down so that the only patent that is valid is one which this Court has not been able to get its hands on.

The reader is left to speculate whether Bell, before our present Supreme Court, would have had his patent sustained, whether, today, he would find backers who would invest in such a speculative, risky, and revolutionary business, knowing that ultimately it would probably receive this same kind of treatment at the hands of the court, and whether we could today build a private-industry American Bell Telephone system, with the remarkable advances and services it provides and which foreign government-owned telephone companies cannot begin to approach, let alone match.

Footnotes

1. Frederick V. Hunt, Electroacoustics, Harvard Monographs in Applied Science, No. 5, Harvard University Press and John Wiley & Sons, Inc., 1954, pp. 23-25.
2. The large number of basic inventions heretofore made by foreign-born Americans should give us cause for concern in the light of present-day security restrictions and their effect upon the encouragement of invention.
3. The technical and financial advisers to industrialist Chauncey DePew were instrumental in the later turn-down of an offer of a one-third interest in Bell's enterprise for the sum of $10,000.
4. History shows over and over again that, far from stifling progress, the granting of important patents causes industry to look for alternative approaches in an effort to avoid the patent, thereby further promoting the progress of the useful arts.
5. United States v. American Bell Telephone Co. & Emil Berliner, 167 U.S. 244 (1897).
6. 109 F. 976 (1901).
7. United States Letters Patents Nos. 239, 742 and 240, 518, issued April 5 and 26, 1881, respectively.
8. 126 U.S. 196.
9. Frederick V. Hunt, Electroacoustics, p. 28.
10. See also American Optical Co. et al v. Shuron Optical Co., 9 F. 2d 932, 936.
11. There is always a question, however, whether it is in the public interest to give effect to an alleged prior invention that is suppressed or concealed or put aside and ignored. Does this "promote the progress of useful arts"? See, for example, Mason v. Hepburn, 84 O.G. 147.
12. 335 U.S. 560.