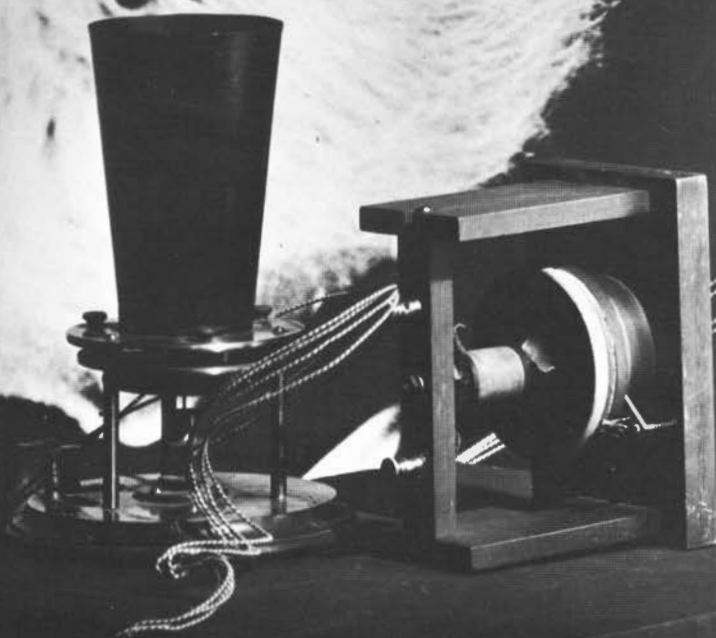


The Bell Sy



tem and the People Who Built It

The Early Days

W. H. Doherty

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OFFICE 410 CHAPEL STREET.
February 21, 1878.

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Although the telephone was originally looked on by many as a toy, its invention led to the establishment of a great industrial enterprise. The motivations behind people's actions in those early days have shaped the character of the Bell System of today.

THE BUSINESS OF THE BELL SYSTEM is based on science and technology. The short history presented here, however, is not so much concerned with technical things as with the motivations that led people to think and do as they did, starting from a single invention and establishing what was to become one of the world's most renowned corporate enterprises.

Looking back over the 92 years of telephone history and speculating on how things *could* have developed, there is a rather remarkable—almost uncanny—succession of events and judgments, where the right man came in at the right time, or someone was felicitously thinking in the right direction. Or the opposition guessed wrong. Or a calculated risk paid big dividends.

As is true of many revolutionary inventions, the telephone was *not* born into a world that was consciously and eagerly waiting for it. Considering that the spoken word has always been man's primary means of communication, it is difficult for us today, in a world that is keyed to speedy two-way communication over unlimited distances, to imagine that a century ago hardly anyone was even thinking of the voice as a thing that could start from here and be heard somewhere else. The voice was a fleeting thing, not to be transported anywhere, not to be stored anywhere. When a sound was uttered, it was immediately lost forever—except in people's memories.

For some thirty years before the telephone was invented, the telegraph had been developing at

a high rate in most civilized countries. It had transformed the operations of business, government, railways, and news agencies. It was the "last word" in speeded-up communication. By means of undersea cables, even continents had been interconnected. In Europe, the telegraph had developed under enthusiastic government sponsorship. In America, there was little government interest, but private sponsorship had moved in, with Western Union becoming large and powerful and taking over many of the smaller earlier companies. To the public, telegraphy was something miraculous. "What hath God wrought?" had been the first message tapped out from Washington to Baltimore in 1844. If a newspaper wanted to advertise its speed in collecting news, there was no better name for it to give itself than "The Daily Telegraph." For the speed of the telegraph was the speed of light. What more could one ask for?

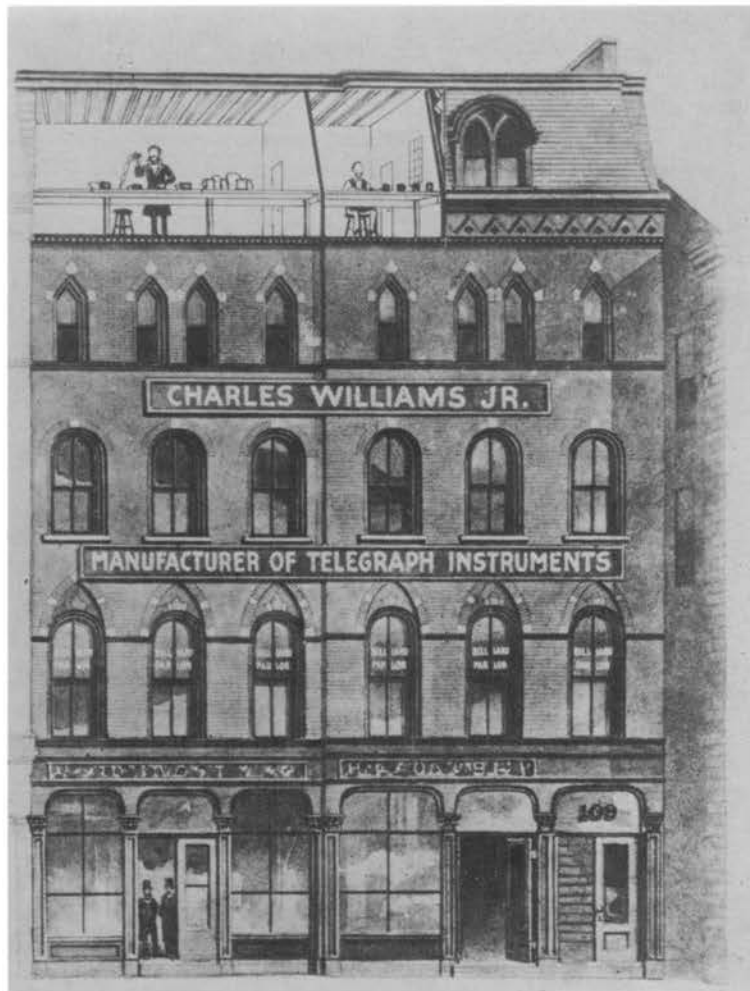
In that kind of climate, one can see how the spark that kindled the telephone business wasn't struck by an engineer, or a physical scientist, or a business man, but by a teacher of the deaf, a man whose primary dedication was to human speech—to giving the power of speech to people who couldn't speak, because they were deaf and couldn't hear anyone else speak. Of course, Alexander Graham Bell was impressed as much as anyone by the speed of the telegraph; but to his way of thinking, there was still the grave shortcoming that it didn't lend itself to man's basic and natural way of communicating, which is by talking: by instant two-way talking. Probably, to him, the cumbersome and time-consuming operations in transmitting and receiving and delivering telegrams were made even more conspicuous by the instantaneousness of the actual transmission over the wire.

Editor's note: This article, to be presented in two parts, is based on an orientation talk given to new technical employees at Bell Laboratories.

Bell was not what we would call an "electrical man." His training was predominantly in music and speech and elocution, and in the anatomy of the vocal organs and the hearing mechanism. He taught these subjects at Boston University. But the telegraph did have angles that intrigued him, such as the possibility of sending simultaneous messages over different channels. We would call that today frequency division multiplex. This led Bell to spend his evenings experimenting with tuning forks and vibrating reeds, adjusted to different pitches corresponding to the channels he wanted, and generating an interrupted current as they vibrated against the contacts. (There were no tuned electrical circuits in those days; mechanical resonance was old, but—hard to believe—the analogous electrical effect, with coils and condensers, was unknown!)

While he was experimenting with his vibrating reeds, Bell was turning over in his mind the idea that a current might be given the shape of a sound wave (today we would call it an *analog*). When one of his transmitting reeds by accident generated an undulating current—a sound-shaped current—instead of an intermittent current, and he heard the corresponding sound as he listened to the receiving reed, he realized that he was on the track. That was on June 2, 1875. By the following evening his assistant, Thomas Watson, had attached a parchment drumhead to one of the tuned reeds to make it follow an impinging voice wave, thus generating in the magnet coil a minute emf. While the actual words were not intelligible at the receiving end because the response was so feeble, and so modified by the natural resonance of the receiving reed itself, nevertheless the test left no doubt in the minds of Bell and Watson that a breathtaking invention was in the making. The next six to eight months were spent feverishly attempting to improve the responsiveness of the apparatus and eliminate the extreme resonant effects of the reeds to make intelligible transmission possible. It was during this period that Bell prepared a patent application.

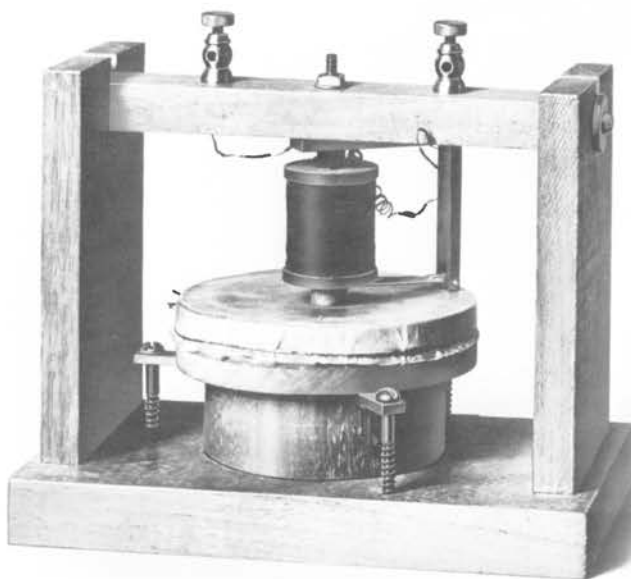
Bell, who was always low on funds, had been supported financially in his telegraph experiments by two Massachusetts gentlemen, Messrs. Sanders and Hubbard, under an agreement whereby they would share with him in the profits from any inventions he might make. Each of these men had a deaf child. They had come to know Bell through his work in teaching the deaf to speak. Yet they had not been interested in his ideas about a talking type of instrument. They had urged him to concentrate on the multiple telegraph as having



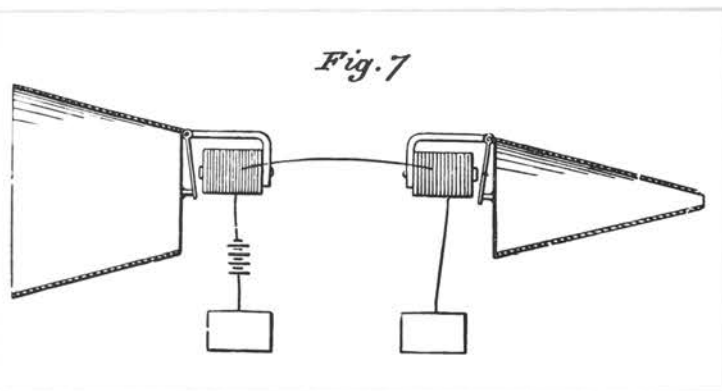
The birthplace of the telephone—109 Court Street, Boston, Massachusetts. On the top floor of this building, in 1875, Professor Bell first succeeded in transmitting sound by electricity.

more immediate promise of profitable returns; so that even in the excitement following his first breakthrough it was necessary for Bell to carry on with the telegraph experiments as well. The scene of these labors was the top story of a building on Court Street, Boston, occupied by Charles Williams, a manufacturer of telegraph instruments. Watson was a bright young machinist employed by the Williams firm.

Bell's patent application was filed in February, 1876, and the patent was granted a few weeks later. Presumably that was a normal interval in those days. The invention was described as an "Improvement in Telegraphy." The description included, in addition to the electromagnetic type of transmitter Bell had used, a suggestion for a variable resistance type used with a battery—the idea being to get more sensitivity. That same month, with a variable resistance transmitter involving a short piece of wire suspended from the diaphragm and dipping into water containing acid, the first intelligible sentence, "Mr. Watson,



First attempted telephone transmitter with its parchment diaphragm attached to the magnetized metallic reed. This instrument was used to transmit the first speech sounds electrically.



Alexander Graham Bell's Electric-Speaking Telephone, illustrating a transmitter and a receiver and a connection between. This illustration is copied from the figure in Bell's patent application. Patent No. 174,465 was issued to Bell on March 7, 1876.

come here, I want you!" was spoken over a wire from one room to another.

That was March 10, 1876. We could call that the birthday of the telephone. The ensuing months were very exciting for Bell and Watson as they combined their experimental work and further patent applications with a series of public lectures and auditorium demonstrations in which Bell, who included clever showmanship in his many talents, would impress large and incredulous audiences with his "electric-speaking telephone." There was also, in October of that year, a highly publicized trial of two-way telephoning over a private telegraph wire between an office

in Boston and a factory in Cambridgeport, two miles away. Bell and Watson recorded the actual words that were transmitted and received, and a Boston newspaper listed these in parallel columns the next day to show that most of the conversation was transmitted with substantial accuracy.

In the lectures which Bell gave, the audience would hear the voice of Watson shouting and singing into the transmitter in the attic laboratory in Boston. It was clever psychology to introduce singing, for no matter how bad a telephone is, it doesn't change the pitch, and in recognizing the tune, the people would think they had understood the words.

Bell and his financial supporters, Sanders and Hubbard, were so anxious to get some return on their investment that they offered to sell the key patents to the Western Union Telegraph Company for \$100,000. This offer was rejected. The telephone was still looked at by many as a toy of no practical value. Many years later, Watson stated that the rejection had been a blow to him, for he had had visions of a sumptuous office in the Western Union Building in New York, which he had hoped to occupy as Superintendent of the Telephone Department of the great telegraph company. But this was a disappointment from which he eventually recovered, for he said that two years later Western Union would gladly have bought those patents for \$25 million; while Watson himself, having been given a 10 per cent share in the business, became quite well-to-do in a very few years.

As Watson, under the supervision of Bell, began turning out a few telephone instruments, crude as they were but capable of fairly intelligible speech, their backer, Hubbard, who was an attorney, made a basic decision over the strong objections of his associates. This decision was that telephones should be leased and not sold, and that customers and agencies should be licensed to use them. It was a recognition of the true nature of the business as a *service* business. The customer's prime interest would be in the protection and maintenance of the integrity of his service. That was Hubbard's way of thinking—a way of thinking that contemplated the long run. Forty years later, Walter Gifford, president of AT&T, was to remark in public that there is no justification, in such a business as this, for acting otherwise than for the long run. And in retrospect we can see the fundamental importance of this policy and this way of thinking to the orderly progress of telephony. The development of the industry would have been chaotic indeed on any other basis.

The first advertisement for the telephone appeared in May, 1877. It stated that the proprietors were "prepared to furnish Telephones for the transmission of articulate speech through instruments not more than 20 miles apart. Conversation can be easily carried on after slight practice and with the occasional repetition of a word or sentence. On first listening to the Telephone, though the sound is perfectly audible, the articulation seems to be indistinct; but after a few trials the ear becomes accustomed to the peculiar sound and finds little difficulty in understanding the words."

The ad further stated that the terms for leasing two telephones would be \$20 a year; for business purposes, \$40 a year. Prices were also quoted on erection of a wire line between the two customers, but it was indicated that any good mechanic could construct a line, and the cost of wire and other necessary hardware for doing this was given. The ad was signed by Hubbard, and interested parties were to place orders with Watson.

We see from this that there was no proposal at that time in the nature of a central office for switching telephone calls. It was too early for that. The phones were simply leased in pairs. The two customers using them had a full-time private connection.

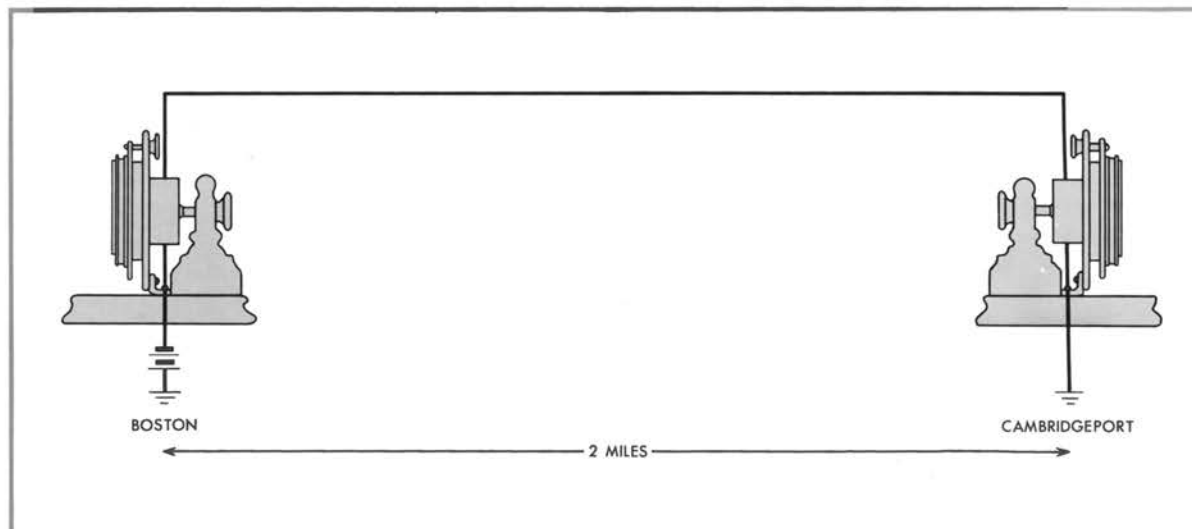
In May, 1877, E. T. Holmes, who owned a burglar alarm system in Boston, became interested in the telephone and ordered a number of instruments, beginning with Serial No. 6, for

attachment to the already existing wires of his system. His first operations were carried on a few weeks later. This was, in fact, the first telephone business in an operating sense. One can see what a nice way this was for getting started: the wires were already there, and the customers were there. To distinguish this from his burglar alarm activities, Holmes conducted it under the name of the Telephone Despatch Company. The instruments used were box-like in appearance and were of the electromagnetic type, the same instrument being used alternately for talking and listening. Holmes installed them on the premises of some of his burglar alarm customers without consulting them. In the case of one customer—a bank in Revere—the president of the bank resented this intrusion and insisted on its removal. Thus we have a record of the first telephone disconnect in the business.

By August, 1877—just three months after getting started—the Holmes company had connected 700 telephones—90 per cent of the total production up to that time—and had issued what was probably the first telephone directory and the first rate card.

Holmes at first used boy operators in his primitive switchroom, but soon found that they were too unruly and noisy and too inclined to profanity to make good telephone operators, and they were soon replaced by the opposite sex.

Other small and simple exchanges soon appeared, including one in a drug store in Hartford,



The circuit and instruments above were used by Professor Bell on October 9, 1876, in a highly publicized trial of two-way telephoning over a private telegraph wire between an office in Bos-

ton and a factory in Cambridgeport, Massachusetts. It was the first time that satisfactory and sustained conversation was carried on by electrical means between persons miles apart.

CITY HALL, LAWRENCE, MASS.

Monday Evening, May 28

THE MIRACLE

WONDERFUL TELEPHONE DISCOVERY TELEPHONE OF THE AGE

Prof. A. Graham Bell, assisted by Mr. Frederic A. Gower, will give an exhibition of his wonderful and miraculous discovery **The Telephone**, before the people of Lawrence as above, when Boston and Lawrence will be connected via the Western Union Telegraph and vocal and instrumental music and conversation will be transmitted a distance of 27 miles and received by the audience in the City Hall.

Prof. Bell will give an explanatory lecture with this marvellous exhibition.

Cards of Admission, 35 cents

Reserved Seats, 50 cents

Sale of seats at Stratton's will open at 9 o'clock.

Facsimile of the publicity given to one of Professor Bell's demonstrations—this one given on May 28, 1877, from Lawrence, Massachusetts, to Boston. The transmission covered a distance of 27 miles over a Western Union telegraph wire. One can see from the admission charge that Bell and his enterprise were beginning to make money even before they had any customers.

Connecticut, which permitted the proprietor, through a home-made switch, to make connections on request between doctors' offices and livery stables. The first exchange of a really commercial character went into service in New Haven in January of 1878. It provided for eight lines, serving 21 telephones.

Our history is not without romance; for, back at headquarters in Boston, a woman had entered upon the scene in the person of Hubbard's daughter, Mabel. Mabel was deaf, but was so charming that she captivated Bell, and they were married and sailed in August, 1877, for Europe, leaving Watson to handle further inventing and perfect-

ing and to supervise manufacture and inspection of telephones. By this time telephones were being made on more of a production basis in the Williams shop.

Bell, who had been born in Scotland and had lived in London before coming to America, spent more than a year in Europe promoting and lecturing about the telephone. A few of the sentences from the prospectus he presented to European businessmen show the remarkable prophetic vision of Bell (his way of thinking) at this very early stage:

"The great advantage . . . is that it requires no skill to operate . . . No translation by experts . . . It actually speaks . . . I believe, in the future, wires will unite the head offices of the Telephone Company in different cities . . . I believe that the Telephone Company can not only secure for itself a business of the most remunerative kind, but also benefit the public in a way that has never previously been attempted."

But the telegraph enjoyed such an entrenched position under the British and European Post Offices that this new competitor, the telephone, was not looked upon with great favor. Those small telephone companies that did spring up tended to be taken over, and the service merged in with the telegraph service, more as a supplement and a feared rival, so that telephone development lagged from the start and has never displayed, except in Sweden, anything like the vigorous enterprise that has characterized our American system.

Meanwhile, back in the U. S., the plot was thickening. Western Union, seeing little telephone companies springing up around the country under lease from the Bell organization, and realizing that it had missed the boat, proceeded to form some subsidiaries of its own, one of them the American Speaking Telephone Company, to engage in making and leasing telephones in direct infringement of the Bell patents. Western Union had acquired rights to an improved type of transmitter which at first gave it a technical edge. Its immense financial resources allowed expansion on a grand scale, causing consternation in the Bell headquarters. But fortunately, the farsighted Hubbard had been able to hire as General Manager of his newly formed Bell Telephone Company, Mr. Theodore N. Vail, who was to become one of the great management figures in the Bell System. Vail took off his coat and rallied the numerous small licensees around the country to fight Western Union's encroachments. In September, 1878, he brought suit against Western Union's subsidiaries. The validity of Bell's patents was so

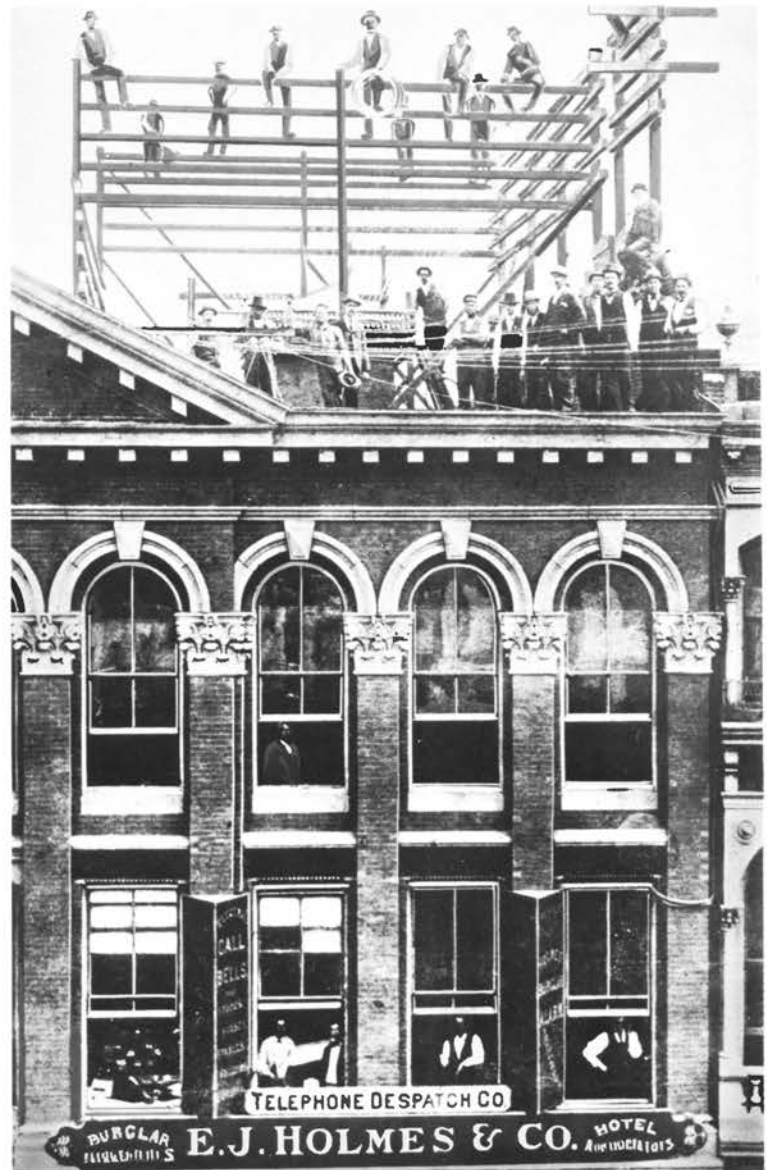
convincing that a settlement was arrived at a year later. As part of the settlement Western Union agreed to withdraw from the telephone business. The Bell Company agreed that it would not enter the public message telegraph field and that it would buy up Western Union's telephones (they totalled over 50,000) and the exchanges they had established. This posed a tremendous problem in capital acquisition for the Bell organization, but under the vigorous leadership of Vail it was accomplished.

The litigation with Western Union, thus concluded, was only one of some hundreds of suits that were successfully fought out during the 17-year lifetime of Bell's patents. Even Watson, trying to build up a small staff to handle technical problems and to inspect the product, had to be drawn in on some of the early litigation; but in his few overworked years he made enough inventions on improvements in the telephone to acquire some 60 patents.

In just a few years the system of local exchanges, tying together subscribers' lines, had become well established. The problem now arose as to how to interconnect these exchanges; for Vail saw clearly that the future of the business was in a nationwide interconnected system. To quote him, "This linking up of city to city, state to state, and nation to nation has greater possibilities than we know of yet." The first step in this direction was taken on June 2, 1880, when a telephone line from Boston to New York was authorized. This line was put into service on March 27, 1884. On May 9, 1883, lines were authorized from New York to Philadelphia and Washington, and from New York to Albany. These events marked the beginning of the Long Lines System.

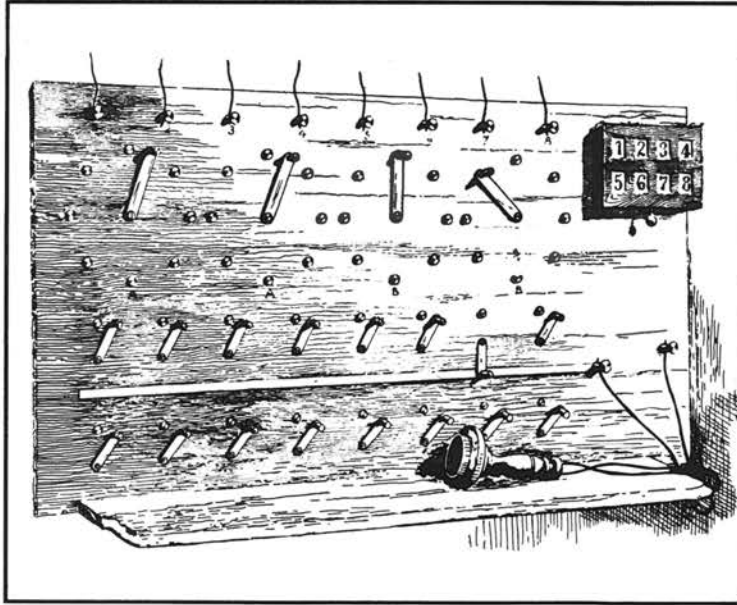
But the maximum capitalization permitted for the American Bell Telephone Company in Massachusetts was \$10,000,000—not nearly enough for constructing lines on so large a scale as was rapidly becoming necessary for interconnecting the exchanges of various cities. The conservative legislature refused to increase the authorized capitalization, making it necessary to organize a new company for building long lines.

It was financial problems, more than anything else, that led to a gradual evolution from the original informal agreement between Sanders, Hubbard, and Bell, which has been called the Bell Patent Association, through a series of successive steps and incorporations and absorptions (a little too complicated to discuss here), all of them in Massachusetts, but ending up with the creation in 1885 of the American Telephone and Telegraph



Home of the first telephone company at 342 Washington Street, Boston, Massachusetts. In May, 1877, Mr. Holmes, owner of a burglar alarm system, installed several telephone instruments on the premises of some of his customers, initiating the first telephone service. The company operated under the name of the Telephone Despatch Company. By August, 1877—just three months later—the Holmes company had connected 700 telephones and issued what was probably the first telephone directory.

Company as a New York corporation. It was set up originally to finance the establishment of long distance lines, but later (1899) it was to absorb the American Bell Telephone Company and become the parent company, the holding company, and the coordinating agent for the entire System as well as the operating agency (through its Long Lines Department) for interconnecting its subsidiaries. The term "telegraph" in the name of this company might be puzzling, since the Bell company had excluded itself from the public mes-



The first telephone switchboard, installed in New Haven, Connecticut, in January of 1878, served twenty-one customers over eight lines. The primitive switchboard used multiple contact switches and a magnetic annunciator or "drop" (shown in the upper right) to indicate that a connection was wanted.

LIST OF SUBSCRIBERS.

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OFFICE 219 CHAPEL STREET.

February 21, 1878.

Residences.	Stores, Factories, &c.
Rev. JOHN E. TODD.	O. A. DORMAN.
J. B. CARRINGTON.	STONE & CHIDSEY.
II. B. BIGELOW.	NEW HAVEN FLOUR CO. State St.
C. W. SCRANTON.	" " " " Cong. ave.
GEORGE W. COY.	" " " " Grand St.
G. L. FERRIS.	" " " " Fair Haven.
H. P. FROST.	ENGLISH & MERSICK.
M. F. TYLER.	NEW HAVEN FOLDING CHAIR CO.
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Office open from 6 A. M. to 2 A. M.

After March 1st, this Office will be open all night.

sage telegraph business. The term referred to its leased wire business; for telephone wires could simultaneously carry telegraph messages on a rental basis.

Thus, well before the turn of the century, the pattern had been set for the organization of parent company and operating subsidiaries that has carried on for 70 years. Wisely, the planners included in this pattern the manufacturing function. One of the major suppliers—the best and most reliable supplier—of telephones and switchboards to Western Union had been Western Electric Manufacturing Company of Chicago. With the settlement of the suit, that company was licensed to make telephones for the American Bell Telephone Company. The company was reorganized under a new name, the Western Electric Company, and soon became the official manufacturing unit of the Bell System. A paragraph in the Annual Report of American Bell for 1881 tells about that significant step:

"To obtain a permanent interest in the manufacture of telephones and apparatus, as well as to ensure the highest standards in the same, we have bought the plant and business of Charles Williams, Jr., of Boston, and an interest in the Western Electric Manufacturing Company, of Illinois, and propose to merge the two in a consolidated company, which will avail of the goodwill, business, and patents owned by that company, as well as our own, and secure an economical management for the whole of our manufacturing interests. We expect to make this an important and valuable part of our business."

The basic corporate structure of the Bell System at the end of the last century, as Vail put it together, is essentially the same as the structure we have today—the difference being only that the stockholders who own the company are in the millions instead of the thousands, the number of operating companies varies a little from time to time, and today the specific responsibility for research and development, as distinguished from manufacture and operations, is lodged in one company, Bell Telephone Laboratories.

Next month, Part Two will discuss events leading up to the formation of Bell Telephone Laboratories and the manner in which research and development have furthered progress in communication and shaped the character of the Bell System of today.

One of the first telephone directories, from an original in the possession of the Southern New England Telephone Company. This was a "classified" directory; that is, the customers were listed by occupation. There were no telephone numbers; the caller simply gave the operator the name of the party he wanted.