

The
BELL SYSTEM

*Its Organization and Service
as exhibited at a
Century of Progress Exposition*



AMERICAN TELEPHONE AND TELEGRAPH COMPANY

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T H E B E L L S Y S T E M

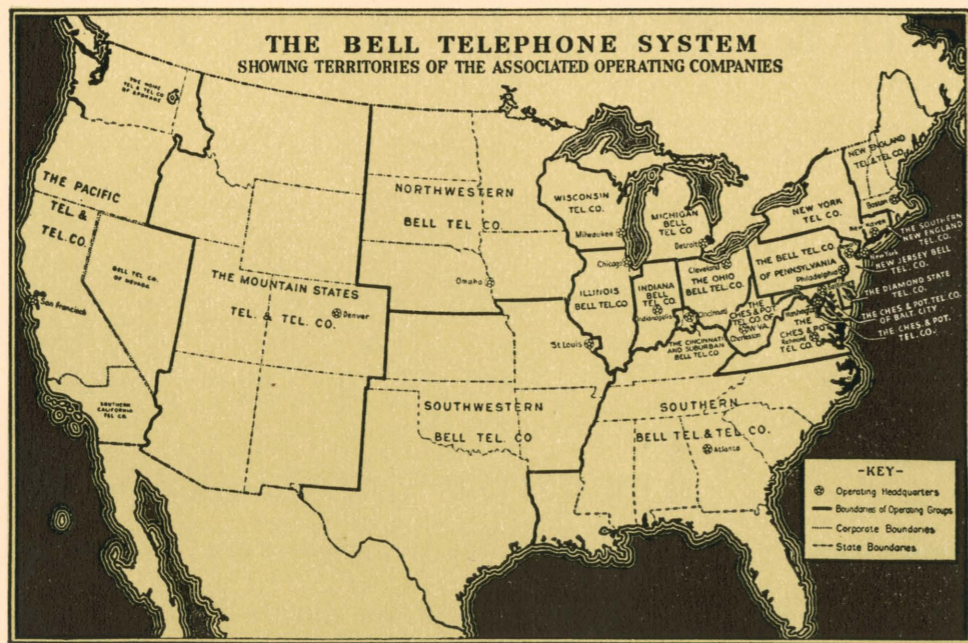
THE UNITED STATES has a unified telephone service that is nation-wide. Anyone anywhere can talk over telephone wires with practically anyone else even though the entire length or breadth of the country may separate them.

The Scope of Telephone Service

In addition, any user of this nation-wide service can be connected, upon request, with any one of 1,350,000 telephones in Canada, 96,000 in Mexico and 50,000 in Cuba; and can reach by wire and radio 10,500,000 telephones in Europe, 560,000 in Central and South America, 110,000 in Northern and Southern Africa, 450,000 in Australia, besides those of various island groups throughout the world, including Bermuda, Hawaii, the Philippine Islands, the Canary Islands, the Balearic Islands, the Bahama Islands and the Dutch East Indies.

From any part of the United States telephone connections can be established with a total of 30,000,000 telephones, or 92 per cent. of all the telephones in service in the world. All the trans-oceanic service has come in since January, 1927, when the radio-telephone circuit between the United States and Great Britain was opened.

Map No. 1



The Organization of the Bell System

The organization which makes possible this service of interconnection in the United States is the "Bell System," which comprises the American Telephone and Telegraph Company and twenty-four regional operating companies.

Although nearly all the telephones in the United States are connected with the Bell System, they do not all belong to the Bell System. Some 3,750,000 telephones, or about one-fifth of the total, belong to 7,000 other telephone companies and about 50,000 rural lines and associations. But the lines of practically all these other organizations are connected through switchboards with the lines of adjacent Bell System companies so that telephone service to any part of the United States is available to practically anyone.

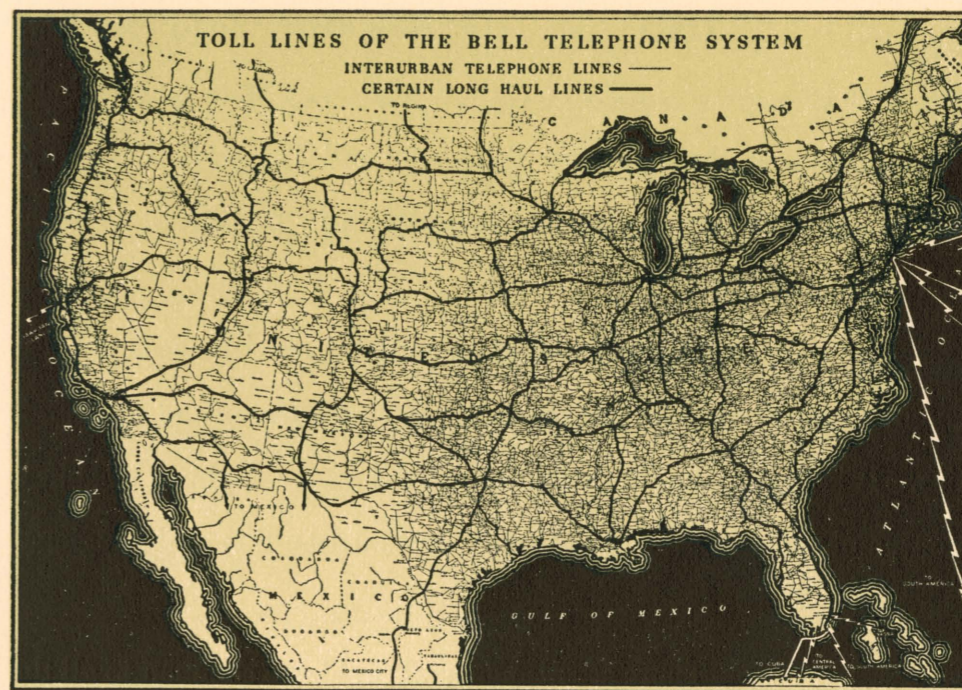
The areas in which the twenty-four Bell companies give telephone service through their exchanges are shown on Map No. 1.

These twenty-four companies are owned in whole or in part by the American Telephone and Telegraph Company, which also owns and operates the long distance lines that interconnect all parts of the country, as indicated on Map No. 2.

The American Company also owns the sending and receiving stations, as indicated on Map No. 3, whereby the United States is connected by radio-telephone with about 12,000,000 telephones overseas and with many passenger vessels while at sea.

No other nation approaches the United States in the extent of its telephone facilities. In 1932, despite the curtailment of the nation's business and social activities, there were approximately 77,000,000 telephone conversations daily in the United States. Four-fifths of these calls, or some 61,000,000, were handled by the Bell

Telephone Usage



Map No. 2

System and comprised 58,800,000 exchange or local conversations and 2,250,000 toll or long distance conversations. Nearly 16,000,000 other calls daily were handled by telephone companies not part of the Bell System but having wire connections with it.

Regional Telephone Companies

The regional operating companies of the Bell System are responsible for telephone service in the communities where they are established. Their function is to study and to serve local needs and requirements, present and future. Their policies and practices are shaped to this end. They are state or regional enterprises, operated and managed by local people intimately identified with the activities of the communities where they live and work. Every one of their exchanges is a local institution. Each company is organized and equipped to meet the operating telephone problems within its area, both local and long distance.

State and National Regulation

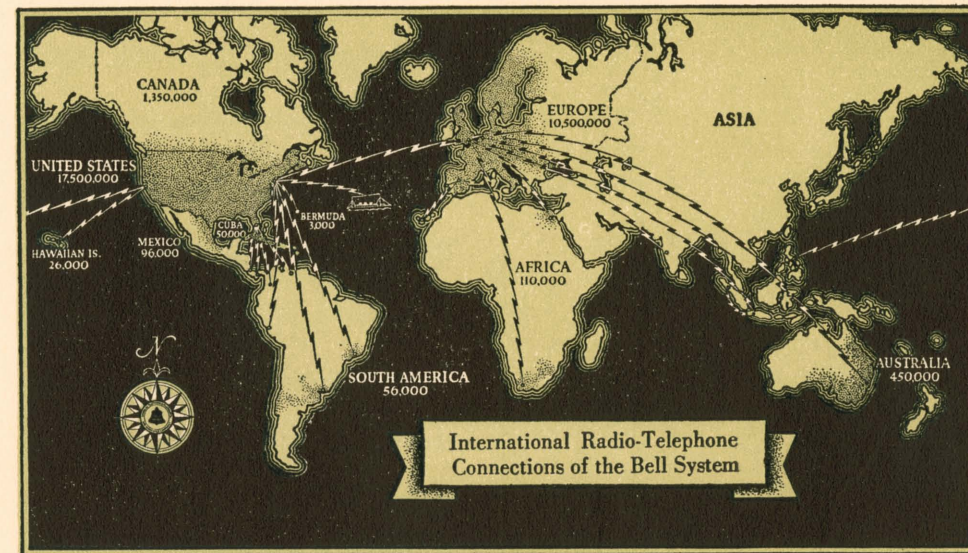
These regional companies operate under State laws and, as to local service, are subject to regulation by State commissions. They, as well as the American Telephone and Telegraph Company, are subject as to certain matters to regulation by the Interstate Commerce Commission.

Local Responsibility

The problem of meeting the service needs of local communities varies with the character and activities of the communities. It is the specific responsibility of the local telephone organizations, and requires the complete and constant attention of the regional companies.

There are also general problems common to all the

OVERSEAS TELEPHONE SERVICE OF THE BELL SYSTEM



Map No. 3

companies. That these may be handled economically and efficiently, the regional companies contract with the American Company for centralized services relating to them. This contractual relationship dates back to within a few years of the telephone's invention. It is an outgrowth of the original licensing arrangement whereby the first telephone companies secured instruments for the use of their subscribers. It was founded on the necessities of the business. It still exists for the same reason.

Centralized Service for Regional Companies

Through this arrangement the regional companies, in effect, combine together to employ the American Company to do for them the things which can be done better and more economically by a centralized organization.

To meet this responsibility the American Company has organized itself to perform services of research into and develop-

Functions of Central Organization

Exhibit 1A. Switchboard Operation



ment of better devices and material and operating methods. It also renders financial, legal, accounting and other assistance to the regional companies. A few illustrations will show how the American Company functions under this arrangement. To furnish financial assistance is one of its important services, particularly in periods of rapid growth, when vast sums are needed for plant addi-

tions and replacements. More than \$1,600,000,000 was advanced to the regional companies in the post-war years before construction activities slackened in the present decade. This amount is more than four times the original cost of the Panama Canal.

The Service of Research

Another service of the utmost importance is that enabling the regional companies to utilize every improvement resulting from the research and experimentation of its scientific workers in the Bell Telephone Laboratories and to keep track of scientific achievement in the world at large that might be beneficial to the telephone industry.

Thousands of patents protecting the results of Bell System research activity are owned by the American Company for the

benefit of all the operating units of the Bell System.

These results, of course, are expressed physically in the apparatus and equipment that the regional companies use to give service. They have been of enormous importance in improving the quality and reducing the cost of their service. Underground cables, for example, have been so improved that today 3,600 separately in-

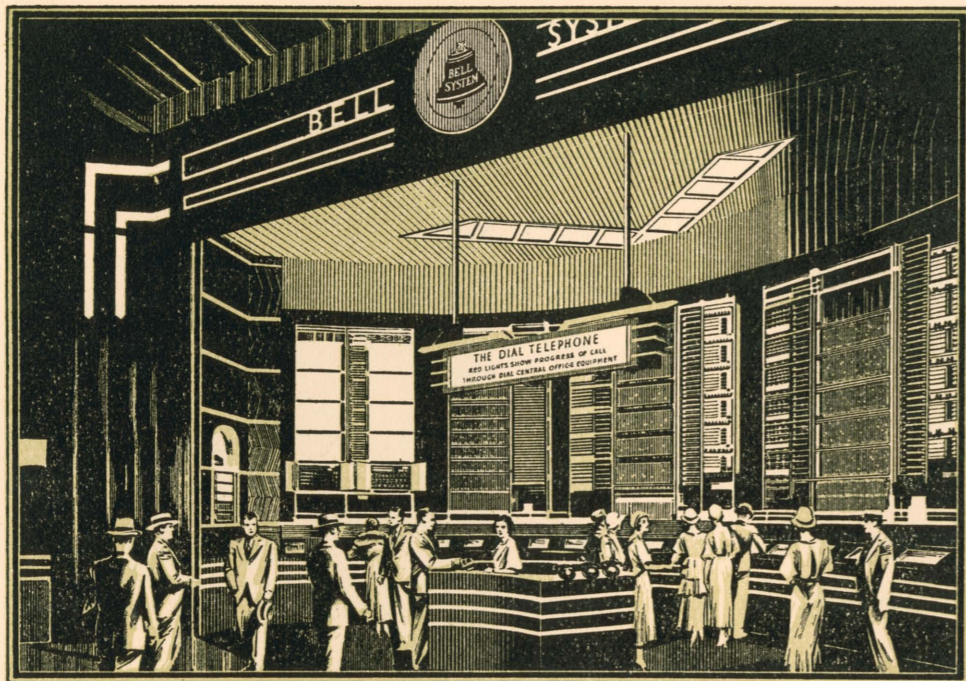
ulated wires can be put in a single cable less than three inches in diameter. Systems have been developed that permit the sending of many messages simultaneously over a single circuit. The visible results of telephone research are in the switchboards, cables and wire lines, loading coils, repeater tubes, telephone instruments—in the hundreds of physical details that combine to form the intricate plant necessary for the quick and clear transmission of speech. The invisible results are apparent to telephone users in the constantly improving quality of service. Through the research work carried on for the Bell System, new metal alloys have been discovered, new designs in apparatus have been achieved, the size and consequently the cost of numberless items of equipment has been reduced. Hundreds of



Exhibit 2A. Receiving Dialed Calls at Non-dial Switchboard

Results both Visible and Invisible

Exhibit 1. Dial Telephone Apparatus



millions of dollars have been saved by the regional companies because of it.

Standardization in Manufacturing

When telephone apparatus has been perfected in the Bell Laboratories, the specifications go to the Western Electric Company, which is both the manufacturing and purchasing department of the Bell System. Its function is to furnish apparatus and equipment of uniform standard as the regional companies may require it. It is also the System's purchasing agent and buys for the companies such supplies as it does not manufacture, the scale of its operations resulting in large savings. It maintains warehouses filled with reserve stocks that are immediately available to the companies when storm, fire, flood or earthquake make their quick replacement vital in the public interest.

The value of a fundamental policy is often given dramatic emphasis by an emergency. The importance of standardization in the Bell System was strikingly demonstrated a few years ago when the worst sleet storm ever experienced in the Middle West ravaged the Mississippi Valley. The storm swept north from Texas almost to the Great Lakes and disrupted communication services in a belt 150 miles wide.

Service Protection through Standardization

The disaster affected the territory of several regional companies of the Bell System as well as the American Telephone and Telegraph Company, whose long distance circuits, the main arteries of the country's nation-wide service, passed through the storm-swept region. Thousands of poles were broken. Thousands of miles of telephone wire, snapped by the weight of clinging sleet, were out of service, breaking the network of communication lines that not only served the people within the territory affected, but that reached out to hundreds of other cities to the East and to the West, extending to the two shores of the continent.

To restore the service that was of such vital importance to the nation was a gigantic task, far beyond the man power of the local telephone forces. As a result of Bell System standardization, however, it was possible to mobilize the resources of the System in men and materials and overcome the effects of the storm with a speed that to many observers seemed miraculous. From the Southeast, from New York, from Pennsylvania and Ohio, from the Northwest, the repair trucks immediately started rolling toward the stricken

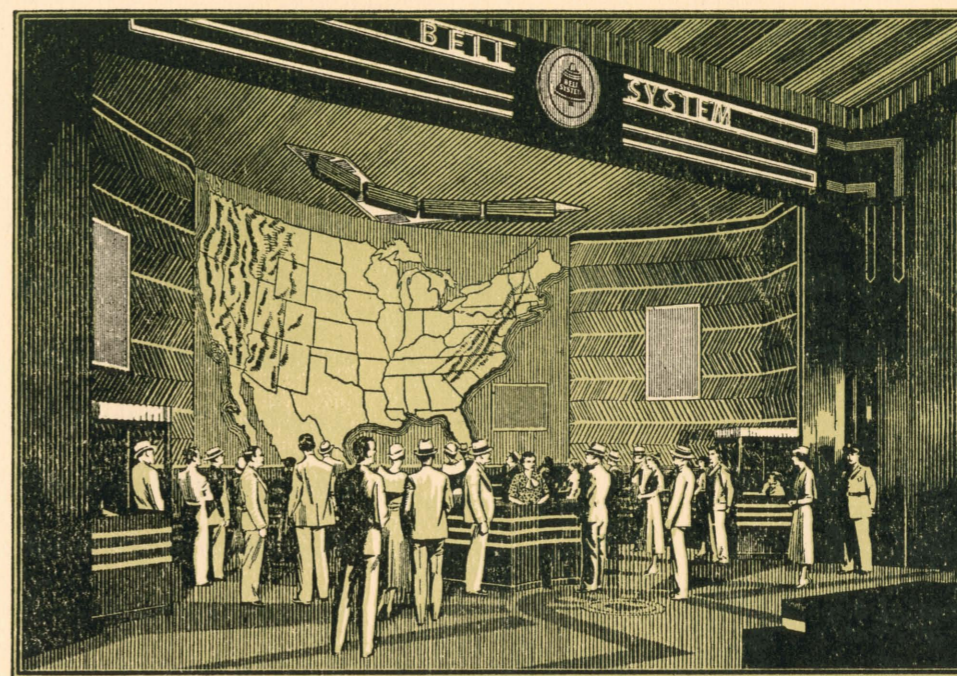
areas. Unaffected areas in the Middle West lent men to their sore-pressed neighbors. Almost before the storm had subsided, the local repair men, who had gone on duty at the first report of trouble, found groups of their fellows, whom they had never seen before, working side by side with them in the restoration of service. And while men were being mustered, the warehouses of the Western Electric Company had started shipments of tools, wire, poles, crossarms, and other needed equipment. It was because of standardized material, and standardized methods of using it, that such an emergency could be met at once.

Standardization of Apparatus

The fact that the United States requires a nationwide, unified telephone service is what makes standardization of apparatus, and a dependable source of supply, so essential. The facilities in places thousands of miles apart, and the facilities connecting these places, must be designed for harmonious operation together if the spoken message is to be delivered satisfactorily. Furthermore, the American public is mobile. It travels extensively, changes residence frequently. It expects uniformity of service, for the telephone is universal.

But the problem of apparatus is only one of the multitude of problems that the Bell regional companies share in common. There is a best way of doing everything and this best way applied to the innumerable details of operation is what they are constantly seeking to know.

Another service, therefore, that the regional com-



*Exhibit 2.
Long Distance
Demonstration*

panies engage the American Company to provide, though classified as "telephone engineering," is so broad in its scope as to include the entire range of construction, operation, maintenance and business practices. No single company could afford to make these studies for itself. All pay for it *pro rata*, just as they do for the American Company's other services, and so it is economically done for each.

The inventive minds of men in the operating companies constantly bring up new ideas either for equipment or operating practices. These and the similar ideas of the staff of the American Company are developed and tested by that staff and the results spread over the whole Bell System.

Every phase of telephone operation and activity is studied in behalf of the regional companies. The sole purpose of this

*A Centralized En-
gineering Service*

Exhibit 2B. Teletypewriter Switchboard



A General Staff for the Regional Companies

centralized work is the improvement of telephone service—not profit. The cost of this research and advisory service is more than the American Company receives for rendering it. The American Company functions in the manner of a General Staff, ready to provide expert assistance in solving any new problem that may arise, but is principally occupied in studies and developments that will anticipate problems.

One department of the American Company, for example, develops a new technique for the construction forces,—such as a new and economical method of laying cable and conduit, or details for installing armored cross-country cable underground without conduits. Another studies the System's collective experience in building and in central office design. Another, specializing in traffic matters, perfects operating practices that will cut many seconds from the time required for handling calls and that will further improve their accuracy. Another helps the regional companies to develop business practices and office routines. It studies markets, assists in

formulating promotional plans, and works on other administrative problems connected with the commercial side of the business. An example of its function is in the important service it has rendered to the regional companies, and through them to telephone users, in standardizing practices for directory compilation, production, arrangement and format.

Still another studies new accounting, statistical and financial office and budgetary problems encountered by the companies and makes available to them its recommendations.

The efforts of the regional companies, with the assistance of the American Company's staff, to improve service routines and practices throughout the Bell System have had the following important results in the last ten years:

The number of troubles in telephone plant has been nearly halved. The average telephone now experiences trouble only once in twenty-four months.

The number of local calls not answered by the



Exhibit 5. "Inverted Speech" Demonstration

Service Improvements

Exhibit 3. Stage for
"Acoustical Illusion"
Demonstration



operator within ten seconds has been reduced 25%. About 97% of local calls are now answered within this period.

The number of local service inaccuracies due to operation or to equipment has been reduced 50%; 99% of local calls are now handled without these inaccuracies.

The number of local calls not completed immediately has been reduced over 20%. The number of calls not so completed is about 17% of the total and the failure in nearly all of these cases is because of a busy line or because the called telephone does not answer.

The operating method which handles short haul toll calls in the same manner as local calls has been so extended that nearly 70% of all toll calls are now on this operating basis.

The speed of service in completing longer haul toll calls now averages 1.5 minutes, as compared with 9 minutes 10 years ago.

Cases of unsatisfactory transmission on longer haul toll calls have been reduced 65%. Less than 2% of these calls are now affected in this way.

The number of longer haul toll calls not completed has been reduced one-third. Over 91% of these calls are now finally completed, the failure to complete the remainder being largely due to the operators' inability to obtain an answer from the called telephone or to reach the person desired.

Much of the work of the General Staff must necessarily be done in close cooperation with the regional companies. Prob-

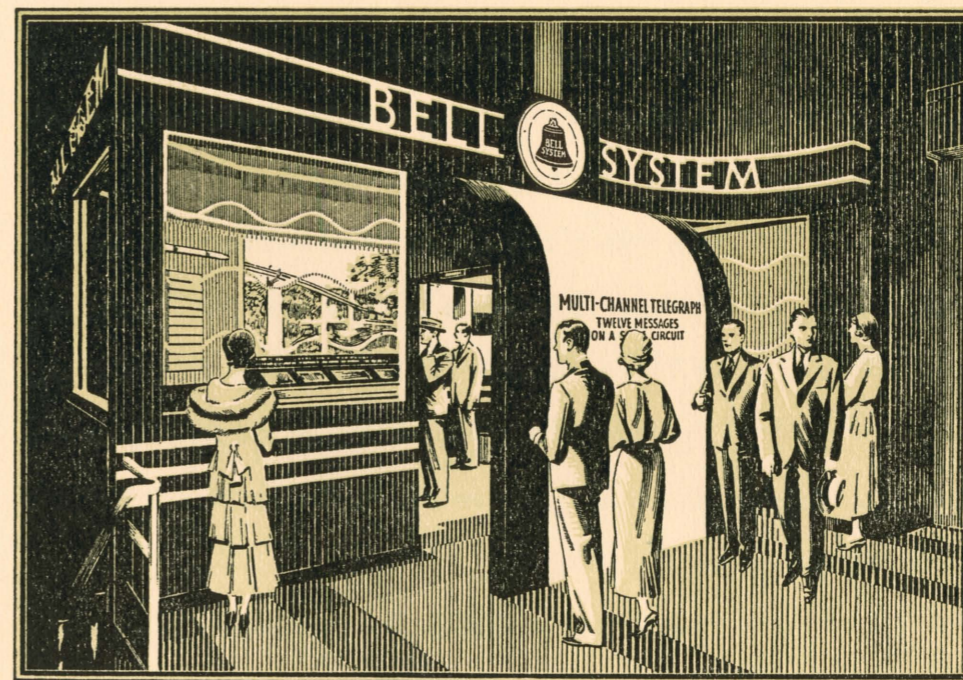


Exhibit 4. Multi-
Channel Carrier
Current System

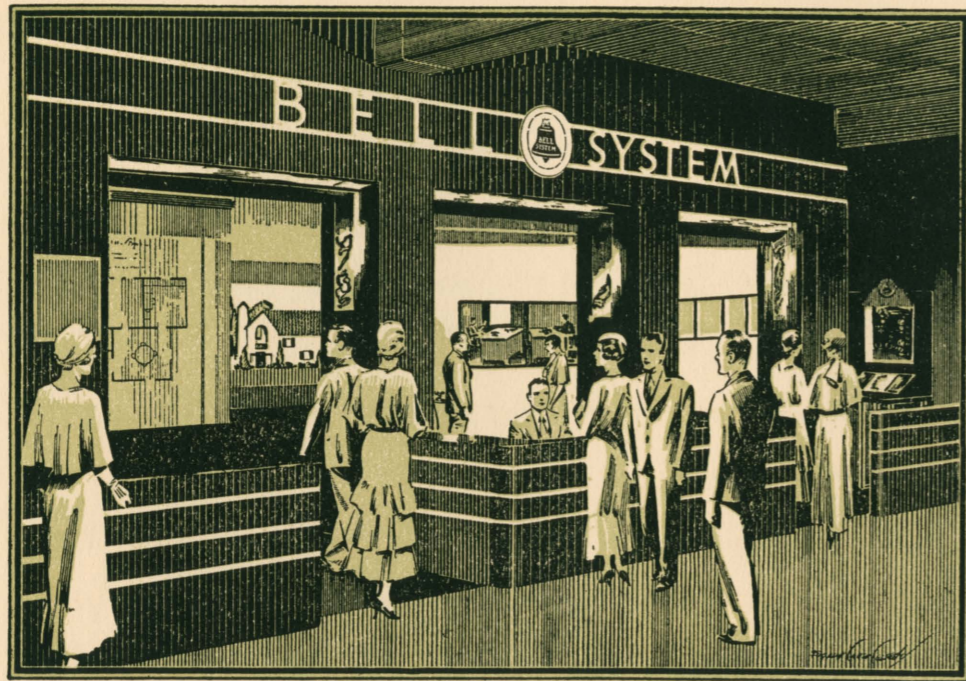


Exhibit 8. Convenient Telephone Equipment

lems and needs develop under actual service conditions and many improvements are suggested by the field forces. All suggestions must be studied carefully to determine the results that may be counted on under all conditions and it is also necessary to know the extent of the field of usefulness for any new method or device.

It is clearly more economical to have one General Staff working on problems of common interest. No single company could afford to study them adequately for itself save at prohibitive cost.

Thus briefly has been described the Bell System, a federation in structure but a unit in the operation of a telephone service for the nation.

The savings of hundreds of thousands of investors have furnished the far-flung facilities needed by the System to grow

with the country and to help the country to work and live.

Its physical assets must be large to be commensurate with its task. But its greatest asset, nevertheless, is the combined skill, energy and character of its employees. It is a great and loyal army that speeds the talk of the nation at the switchboards, that keeps the wires working in good weather or bad, that carries on in flood or earthquake because of the tradition that "the message must go through."

And governing the entire organization is a policy. It is a policy that has been demonstrated for decades but that was not formally stated until 1927, when Mr. Walter S. Gifford, President of the American Telephone and Telegraph Company, addressed as follows the convention of the National Association of Railroad and Utilities Commissioners in Dallas, Texas—

"There are today over 420,000 stockholders [at present about 700,000] of the American Telephone and Telegraph Company and no one of them owns as much as one per cent. of the capital stock. The business of this Company and its Associated Bell Telephone Companies, whose common stock is largely owned by this Company, is to furnish telephone service to the nation. This business from its very nature is carried on without competition in the usual sense.

"These facts have a most important bearing on the policy that must be followed by the management if it lives up to its responsibilities. The fact that the ownership is so widespread and

The Bell System's Greatest Asset

The Bell System's Fundamental Policy

An Obligation to the Nation

diffused imposes an unusual obligation on the management to see to it that the savings of these hundreds of thousands of people are secure and remain so. The fact that the responsibility for such a large part of the entire telephone service of the country rests solely upon this Company and its Associated Companies also imposes on the management an unusual obligation to the public to see to it that the service shall at all times be adequate, dependable and satisfactory to the user. Obviously, the only sound policy that will meet these obligations is to continue to furnish the best possible telephone service at the lowest cost consistent with financial safety. This policy is bound to succeed in the long run and there is no justification for acting otherwise than for the long run.

*No Incentive for
Maximum Profits*

“It follows that there is not only no incentive but it would be contrary to sound policy for the management to earn speculative or large profits for distribution as ‘melons’ or extra dividends. On the other hand, payments to stockholders limited to reasonable regular dividends with their right, as the business requires new money from time to time, to make further investments on favorable terms, are to the interest both of the telephone users and of the stockholders.

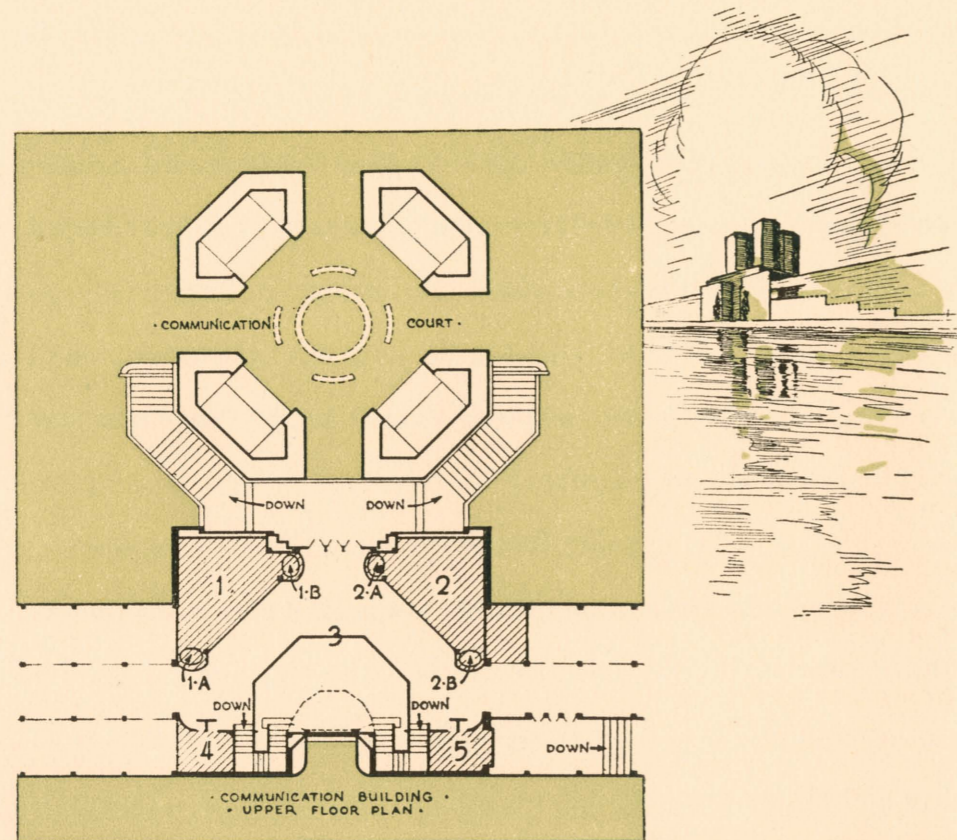
“Earnings must be sufficient to assure the best possible telephone service at all times and to assure the continued financial integrity of the business. Earnings that are less than adequate must result in telephone service that is something less than the best possible. Earnings in excess of these requirements must either

be spent for the enlargement and improvement of the service furnished or the rates charged for the service must be reduced. This is fundamental in the policy of the management.

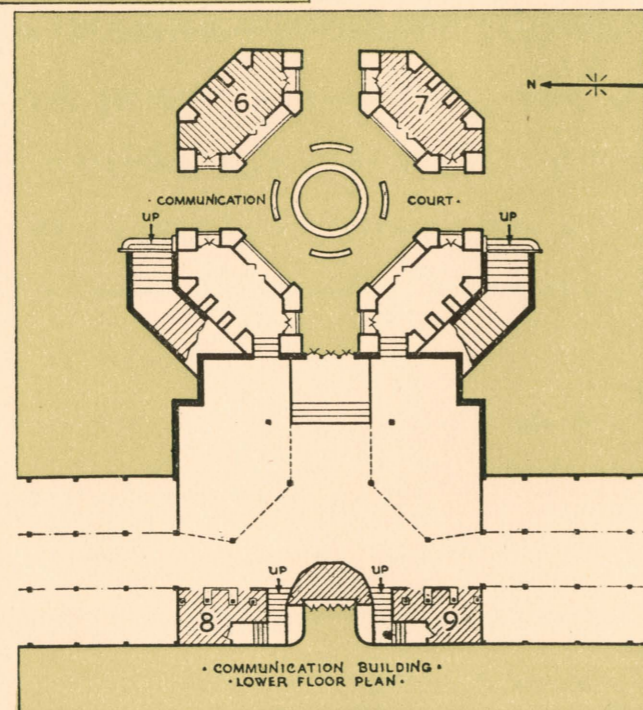
“The margin of safety in earnings is only a small percentage of the rate charged for service, but that we may carry out our ideals and aims it is essential that this margin be kept adequate. Cutting it too close can only result in the long run in deterioration of service while the temporary financial benefit to the telephone user would be practically negligible.

“Our policy and purpose are the same as yours—the most telephone service and the best, at the least cost to the public. Without overlooking the fact that we lack the big money incentive for maximum profits and the drive for improvement that results from active and strong competition, we believe the telephone company is organized to make continuous and effective progress . . .”

BELL SYSTEM EXHIBIT FLOOR PLANS



The numerals shown on these floor plans refer to the paragraphs on the following pages



THE BELL SYSTEM EXHIBIT

COMMUNICATION BUILDING

THE EXHIBIT of the Bell System is designed to show, through the demonstration of various instrumentalities, some aspects of the art of communication that have been developed from the principle discovered by Alexander Graham Bell. The units of the exhibit, with numbers that correspond with the floor plans giving their location, are as follows:

UPPER FLOOR

1. Visitors are invited to dial calls and watch the functioning of the switching mechanism that automatically routes a telephone call from one central office to another. Explanations of the operations involved appear on the reading shelf before the apparatus.
- 1A. A demonstration of the operations involved in handling local and long distance calls, at a typical position of a manual switchboard.
- 1B. A demonstration of the function of the operators' switchboard that is required in a dial central office to handle toll calls and to assist subscribers in emergencies or in other special situations.
2. A demonstration of the routine of handling long distance calls, and of the clearness of transmission to and from cities in every section of the United States.

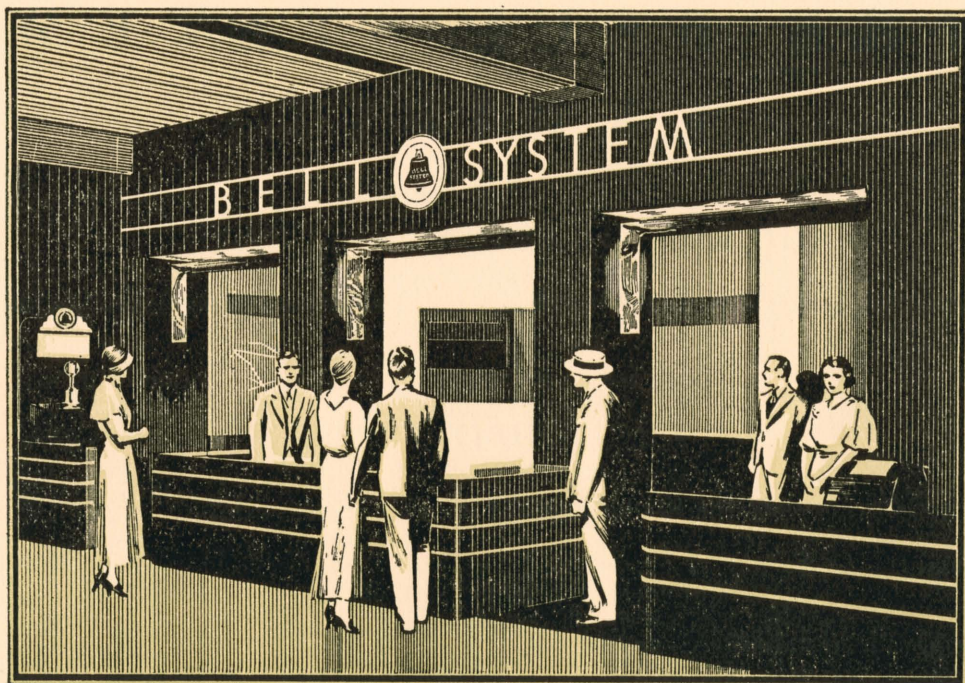
Dial Central Office Equipment

The Telephone Operator

The Dial Service Operator

Long Distance Telephony

Exhibit 9. Business Communication



Head receivers are provided so that visitors may overhear the responses of distant operators and the conversations carried on in the demonstration calls.

"Call Announcer" and "Call Indicator"

2A. Instrumentalities necessary in dialing lines served by a manually operated switchboard, one converting dialed impulses into spoken words and the other showing lighted numbers that the dialing has caused to flash before the operator.

Teletypewriter Switchboard

2B. A demonstration of the teletypewriter switchboard, at which users of teletypewriters are interconnected for the transmission of written information in either direction.

"Acoustical Illusion"

3. To experience this, visitors must use the special telephone equipment provided at the balcony rail.

Multi-Channel Carrier Current System

4. A demonstration of the simultaneous transmission, without interference, of twelve different messages on a single pair of wires.

5. A demonstration of the system employed to give privacy to the radio channel of the Bell System's overseas service, whereby speech is rendered unintelligible before its transoceanic transmission by radio and is restored to intelligibility after being received overseas.

"Inverted Speech"

LOWER FLOOR

6. Where visitors may hear a lifelike reproduction of their own voices.

The Hall of Electrical Echo

7. The headquarters of the Bell System exhibit.

Registration—Information

8. Equipment for home and office; modern methods of wiring for installations; amplifying telephones for those with impaired hearing.

Telephone Conveniences

9. Facilities for intercity communication; economical methods for business communications; teletypewriters and their usage.

Telephone Usage in Business

A TELEPHONE CHRONOLOGY

- 1876 First complete sentence transmitted by telephone.
First conversation by overhead line, 2 miles—Boston to Cambridge.
- 1880 30,872 telephones in the United States, all Bell owned.
Conversation by overhead line, 45 miles—Boston to Providence.
- 1881 Conversation by underground cable, $\frac{1}{4}$ mile.
- 1884 Conversation by overhead line (hard-drawn copper), 235 miles—Boston to New York.
- 1890 211,503 telephones, all Bell owned.
- 1892 Conversation by overhead line, 900 miles—New York to Chicago.
- 1900 676,733 telephones owned by or connecting with Bell System.
- 1902 First conversation by long-distance underground cable, 10 miles—New York to Newark.
- 1906 Conversation by underground cable, 90 miles—New York to Philadelphia.
- 1910 5,882,719 telephones owned by or connecting with Bell System.
- 1911 Conversation by overhead line, 2,100 miles—New York to Denver.
- 1913 Conversation by overhead line, 2,600 miles—New York to Salt Lake City.
Conversation by underground cable, 455 miles—Boston to Washington.
- 1915 First conversation by transcontinental line, 3,650 miles—Boston to San Francisco.
Speech transmitted for the first time by radio telephone from Arlington, Va., across the continent to San Francisco, over the Pacific to the Hawaiian Islands, and across the Atlantic to Paris.
- 1920 12,601,935 telephones owned by or connecting with Bell System.
- 1921 Conversation by deep sea cable, 115 miles—Key West, Fla., to Havana, Cuba. First conversation between Havana, Cuba, and Catalina Island by submarine cable, overhead and underground lines and radio telephone—distance 5,500 miles.
Extension of Boston-Philadelphia cable to Pittsburgh—total distance 621 miles.
- 1922 Ship-to-shore conversation by wire and wireless between Bell telephones in homes and offices and the *S. S. America* 400 miles at sea in the Atlantic.
- 1923 Successful demonstration of transoceanic radio telephony from a Bell telephone in New York City to a group of scientists and journalists in New Southgate, England.
First broadcasting of a presidential message to Congress, December 6.
Completion of Southern transcontinental line.
- 1924 First public demonstration of picture transmission over telephone circuits—New York and Cleveland.
- 1925 Completion of the New York-Chicago telephone cable—overhead—underground.
16,720,224 telephones owned by or connecting with Bell System.
- 1926 Successful test of two-way transatlantic radio telephony.
Completion of extension of New York-Chicago, all-cable telephone line to St. Louis.
- 1927 Telephone service by wire and wireless inaugurated between New York and London; later extended to all points in the United States and Great Britain.
Northern transcontinental telephone line formally opened.
First public demonstration of television by wire and radio.
Telephone service opened between the United States and Mexico.
- 1928 Transoceanic telephone service extended to principal countries of Western Europe.
- 1929 Ship-to-shore telephone service established.
- 1930 Transoceanic telephone service extended in Europe and opened to Argentina, Chile and Uruguay in South America, and to Australia via London.
Ship-to-shore service extended to additional liners.
Two-way television demonstrated by Bell engineers.

- 1931 Fourth telephone cable to Cuba opened.
Transoceanic service extended to Java, Sumatra, Bermuda, Hawaii, Canary Islands, Roumania and Brazil.
Teletypewriter exchange service inaugurated.
- 1932 Transoceanic service extended to South Africa, Siam, Balearic Islands, Egypt, Peru, Portugal, Bahama Islands, Venezuela and Colombia.
Ship-to-shore service further extended.
17,500,000 telephones owned by or connecting with Bell System.
- 1933 Transoceanic service extended to Canal Zone, Panama, Costa Rica, the Philippines, Palestine, Guatemala and India.
92% of world's telephones within reach of any Bell System telephone.
A telephonic system for high quality transmission and reproduction of orchestral music demonstrated by Bell System engineers.

BELL SYSTEM STATISTICS

	Dec. 31, 1920	Dec. 31, 1925	Dec. 31, 1930	Dec. 31, 1932
Number of Telephones†				
Manual Service.....	8,176,884	10,538,935	10,705,118	7,936,991
Dial Service.....	157,095	1,496,289	4,976,941	5,856,238
Total.....	8,333,979	12,035,224	15,682,059	13,793,229
Per Cent Dial Service to Total Telephones...	1.9	12.4	31.7	42.5
Number of Central Offices	5,702	6,017	6,585	6,778
Miles of Pole Lines.....	358,091	386,064	422,489	402,518
Miles of Wire				
In Underground Cable.....	15,748,000	30,483,000	50,225,000	52,883,000
In Aerial Cable....	5,885,000	10,672,000	20,785,000	22,742,000
Open Wire.....	3,744,000	4,319,000	5,238,000	4,866,000
Total.....	25,377,000	45,474,000	76,248,000	80,491,000
Per Cent Total Wire Mileage in Cable.....	85.2	90.5	93.1	94.0
Average Daily Telephone Conversations ‡.....				
Exchange.....	31,836,000	46,702,000	62,365,000	58,813,000
Toll.....	1,327,000	2,098,000	2,933,000	2,251,000
Total.....	33,163,000	48,800,000	65,298,000	61,064,000
Total Plant.....	\$1,363,826,000	\$2,524,906,000	\$4,043,422,000	\$4,188,749,000
Number of A. T. and T. Co. Stockholders.....	139,448	362,179	567,694	700,851

† Excluding telephones of connecting companies and connecting rural lines.

‡ For year ending December 31.

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