

the . . .
Story of
Western
Electric

MANUFACTURING AND SUPPLY
UNIT OF THE BELL SYSTEM

Western Electric Company, Inc.
195 Broadway, New York 7, N. Y.

the
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Western Electric

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What Sort of Miracle . . . ?

Automatically, almost without thinking, you reach for your Bell telephone. What sort of miracle permits your voice to reach out in space and find another voice thousands of miles away? Or, when you turn the dial, what makes it possible for you to be talking with a friend across the town in a matter of seconds?

The answer is found in a "formula" which blends three activities that are essential to good telephone service—research, supply, and operation. It is this formula that enables you to place a call to Australia or South Africa in a matter of minutes, or to be talking to your friend down the street in a matter of seconds. It is a formula that evolved from the birth of the telephone in a Boston attic and from the founding of a partnership in a Cleveland loft. It is a formula—in fact, the formula—by which private enterprise has been able to give this nation the best telephone communications in the world, at a cost so low that about two-thirds of all American families now have the convenience and protection of a telephone in their homes.

Telephone service now has been extended to the far corners of the earth. By picking up your Bell telephone in your home or place of business you can—under normal world conditions—be connected with any one of over 70,000,000 telephones in scores of countries. Here in the United States, birthplace of the telephone and home of the Bell

System, wires, cable and radio relay trace a giant network of voice-ways across the nation. Your Bell telephone is a key to lines leading to over 42,000,000 other Bell and connecting telephones in nearly every city, town and village in the country.

For three score years and ten—a lifetime!—Western Electric has helped to make possible this miracle of communications. Since early in 1882 Western Electric has been the element of supply in the Bell System formula. It is the manufacturer and supplier of the tools of telephone service.

Western Electric has manufactured millions of telephones, millions of miles of wire and cable, tens of thousands of manual and dial switching units, and the thousand-and-one other kinds of apparatus that go into the plant of the Bell System. It has purchased from thousands of other manufacturers the great variety of supplies that are used by the Bell System.

This booklet gives you a glimpse of Western Electric's contribution to the growth and development of Bell telephone service, and an idea of how the Company is blended with the two other elements of the Bell System formula—Bell Telephone Laboratories (research) and the Bell telephone companies (operation). First let's look at the structure of the Bell System itself to see how it is organized.

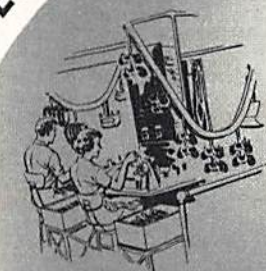
Organized for Action

“Mr. Watson, come here, I want you!”

This was a call for help. In 1876, while working on a telephone experiment in a Boston attic, Alexander Graham Bell had accidentally spilled acid on his clothing. Thomas Watson, who was working on the same experiment at the other end of a pair of wires in a separate room, rushed to Bell's side, crying, “Mr. Bell, I heard every word

Continued on Page 6

WESTERN ELECTRIC COMPANY

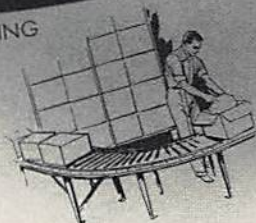


MANUFACTURING



PURCHASING

DISTRIBUTING



INSTALLING



FOR THE BELL SYSTEM

BELL TELEPHONE LABORATORIES



RESEARCH AND
DEVELOPMENT WORK
FOR THE
BELL SYSTEM

AMERICAN TELEPHONE AND TELEGRAPH COMPANY



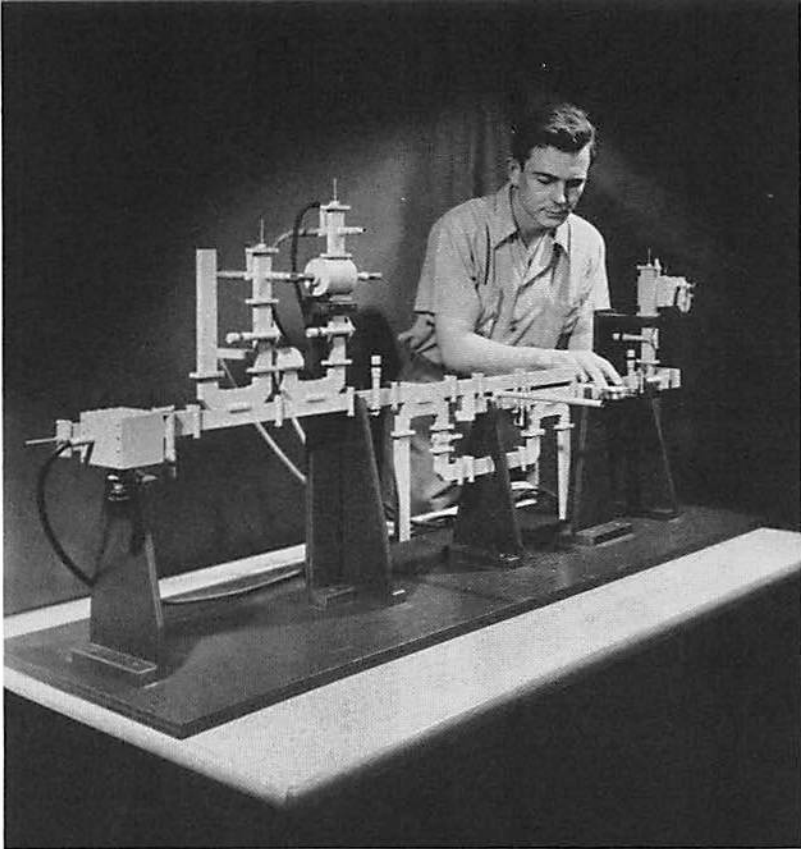
SERVICES TO
TELEPHONE COMPANIES
AND OPERATION OF
LONG-DISTANCE LINES



OPERATING TELEPHONE COMPANIES



PROVIDE TELEPHONE SERVICES
WITHIN THEIR TERRITORIES



Research is conducted by Bell Telephone Laboratories engineers, who create designs for new, improved equipment.

you said—distinctly!” The acid on Bell’s clothing was forgotten. Speech had been transmitted over the telephone for the first time.

The principles of the first Bell telephone were valid. Many of them are embodied in the instrument that carries your voice today. Similarly, the principles under which Bell and Watson worked were practical and farsighted. They were expressed in a contract signed just a few months after the birth of the telephone: “*The said Watson agrees that he will, from and after the fifth day of September next, devote one half of each day to adapting, perfecting, devising and manufacturing instruments . . . and introducing them to the public use.*”

“*Adapting, perfecting, devising*”—that, in essence, is the function today of the Bell System’s research unit, the Bell Telephone Labora-

tories. "Manufacturing"—that, of course, is a principal function of today's Western Electric Company. "Introducing to the public use"—that is the forefront, at least, of a description of what the operating Bell telephone companies do.

The close relationship of adapting, perfecting, devising, manufacturing and introducing to the public use apparently was recognized by the telephone's pioneers as essential to efficient, progressive service. Even in those early days Bell and his associates must have realized that the telephone business had to be organized along lines which were different from those of most other industries. Telephone calls, not telephones, were to be the product, and selling telephone calls is different from selling merchandise. A telephone call cannot be manufac-

Western Electric engineers devise economical techniques for manufacturing equipment from Laboratories' designs.



tured beforehand, to be sold later. Instead the customer has his telephone available at all times, and there must be an organization behind it at all times, ready to place whatever call the customer wants whenever he wants it. In the telephone business there must be constant relationship between the customer and his telephone company.

This continuing relationship between customer and telephone company must also exist between the telephone company and its manufacturing and supply unit. To meet the day-to-day demands of customers, the Bell telephone companies require very special services from their manufacturing and supply unit. That unit must specialize in supplying whatever equipment these companies need. The supply job must be done economically and speedily. And there must be an

W. E. makes and installs huge switchboards like this, is also purchaser and distributor for Bell System companies.

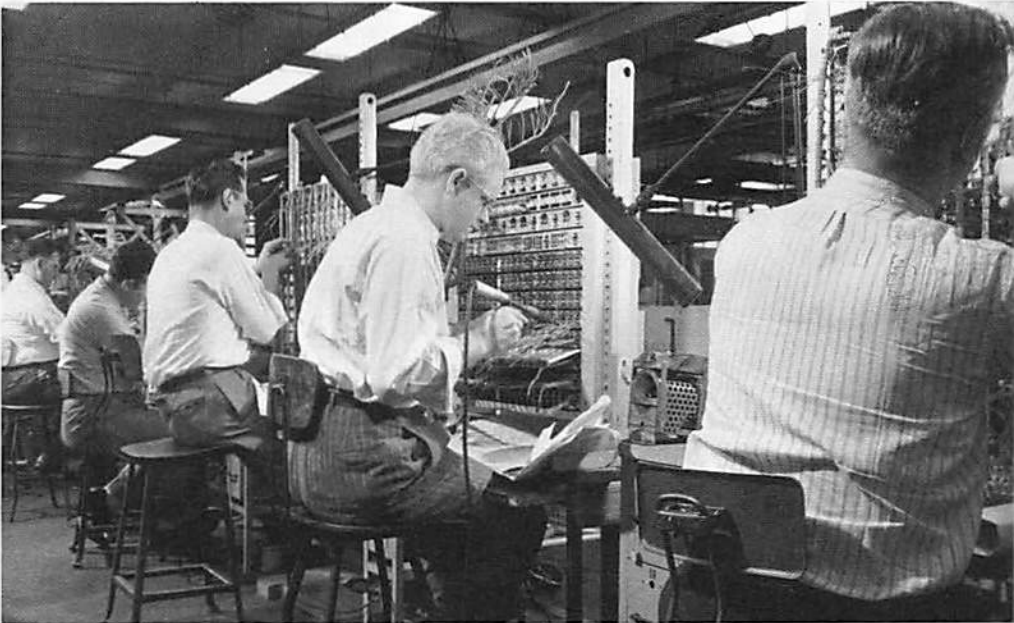


organization behind the manufacturing and supply unit working closely with it and the telephone companies—one that will invent and develop new ideas, create new technical methods, design new equipment. That organization is the Bell Telephone Laboratories.

And finally, there must be an organization to provide advisory services and to coordinate the activities of all the Bell companies so that your telephone service will be uniformly good wherever you are or wherever you direct your telephone call. This is the American Telephone and Telegraph Company.

The three essential elements of service that were suggested in the original Bell-Watson contract—*research*, *supply*, and *operation*—are as interdependent today as they were in the time of Bell and Watson.

Our biggest single manufacturing job is making complex central office switching equipment for dial-operated telephones.

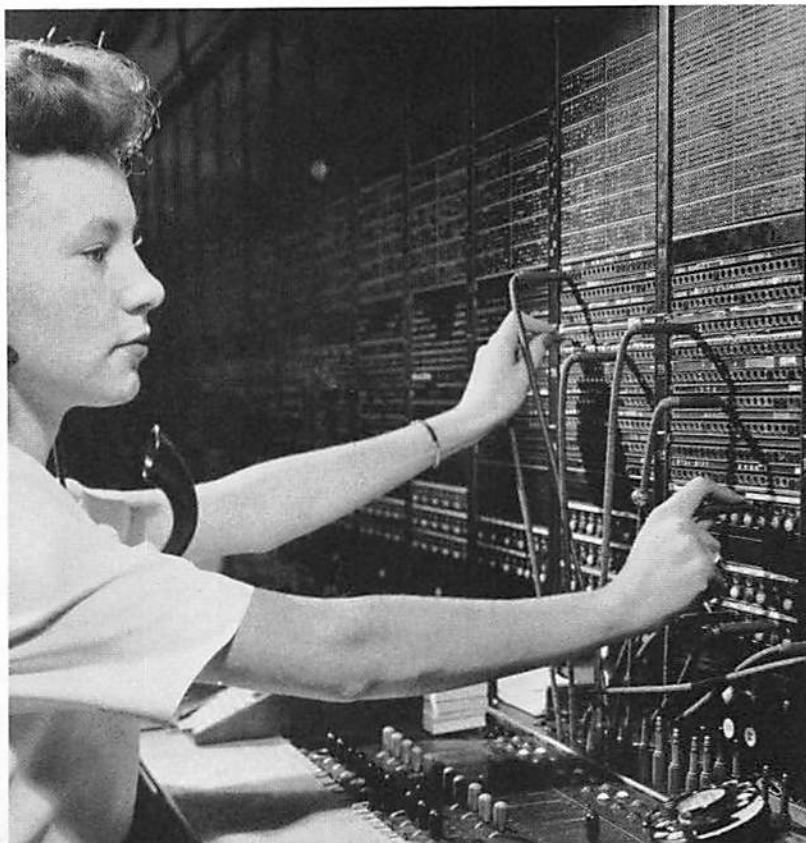


Visit any member company of the Bell System and you'll see all three at work. Let's quickly review these elements:

RESEARCH. The "*adapting, perfecting, devising*" of the Bell-Watson contract is performed today by Bell Telephone Laboratories, the world's largest research organization devoted to progress in the communications art. Here, research engineers work closely with the Bell telephone companies to translate the desire for constantly improved telephone service into creative ideas and designs. Western Electric then converts those designs into new and better telephone equipment.

SUPPLY. Watson's job of "*manufacturing instruments*" has grown to a full-time supply specialty for many thousands of Western Electric people. In today's telephone business, supply breaks down

It takes good equipment to provide good telephone service. Western Electric products help Bell operators do a good job.



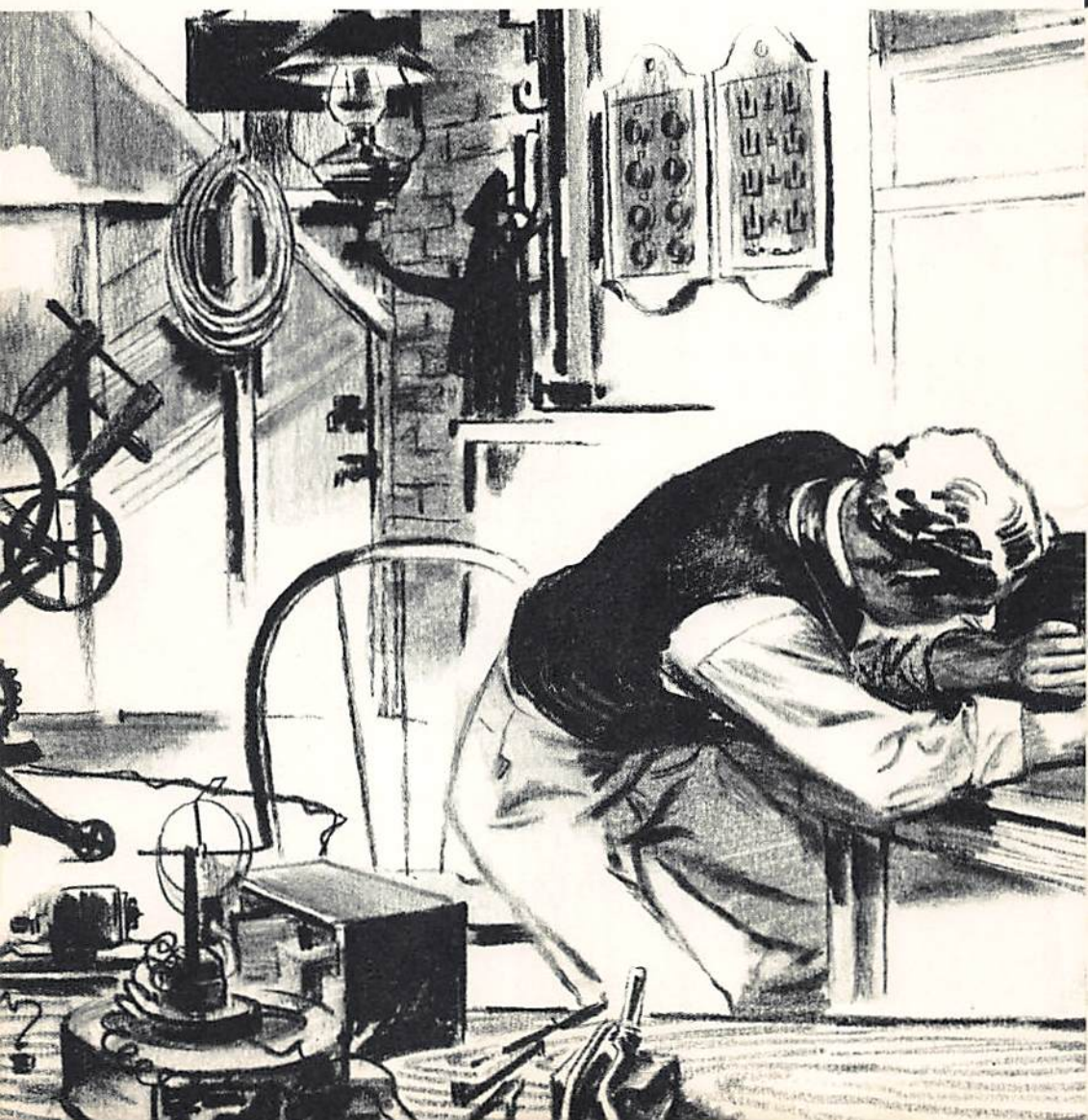
into four main tasks: *manufacturing, purchasing, distributing* and *installing*. Each of them is a big job. Western Electric works constantly with the Bell telephone companies in order to meet their day-to-day requirements for equipment and material and to fulfill their long-range requirements. It works constantly with the Bell Telephone Laboratories in order to put into immediate production new and better telephone equipment devised by the Laboratories.

Specifically, Western Electric *manufactures* to uniform standards of design and quality the great variety of equipment, cable and wire that goes into the Bell telephone network. It *purchases* from other sources materials and supplies not of its own manufacture that are needed by the telephone companies. In the *distributing* phase of its job, Western Electric maintains 28 Distributing Houses throughout the country for the warehousing of materials and supplies needed by the telephone companies and for the repair of worn equipment. It *installs* central office equipment for the telephone companies, completing in the field the assembly of the highly intricate switching mechanisms it manufactures in its factories. These are the closely related functions of supply.

OPERATION. "... *and introducing them to the public use*" was part of Watson's promise in the agreement he and Bell signed. Today the Bell System's job of making telephones available for public use and operating them in public service is undertaken by 22 associated Bell telephone companies and the American Telephone and Telegraph Company's Long Lines Department. These companies operate equipment designed by Bell Telephone Laboratories and manufactured by Western Electric. It is the *operation* of telephone service that is constantly in the minds of those who do the research and manufacturing for the Bell System.

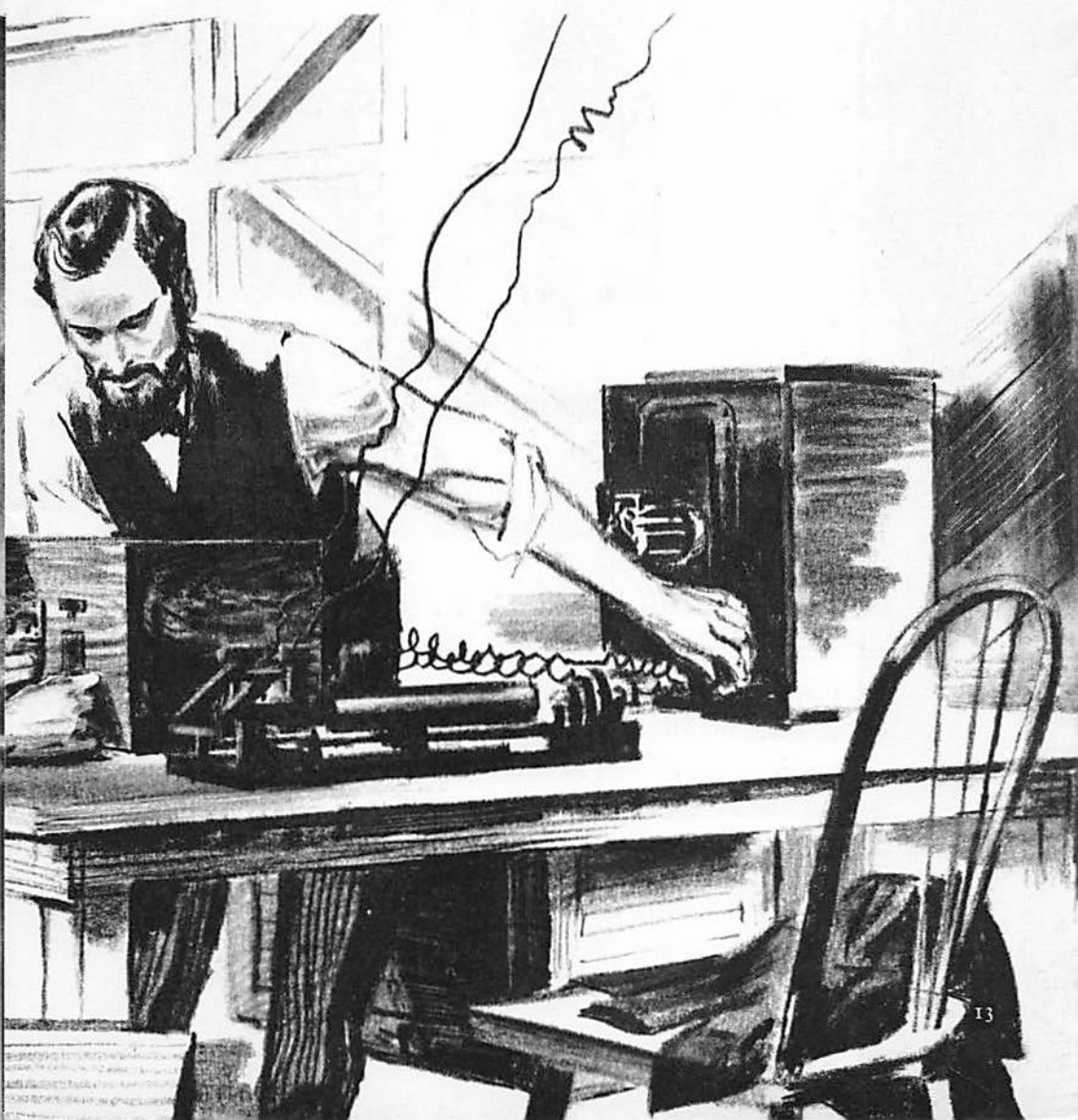
That, in brief, is how the Bell System is organized for action.

We've Been at it a Long Time



Western Electric has been in business for over three-quarters of a century. We have been a part of the Bell System since 1882.

The Company began in 1869 as the firm of Gray and Barton. Its founders were Elisha Gray, a college professor with an inventive turn of mind; Enos Barton, a former Western Union telegrapher; and





General Anson Stager, vice-president of the Western Union Telegraph Company.

In characteristic American fashion, the Gray and Barton firm first operated on a financial shoestring, but the partners had a firm grip on the main ingredients of business success—imagination, energy, determination, and the desire to give good service.

As befitted their financial resources, the partners set up a small shop, originally in Cleveland and then in Chicago. Their immediate goal was to establish a sound business reputation in the manufacture

and the repair of telegraph instruments and other electrical devices.

Soon the quality of their work and the integrity of their service attracted favorable attention and a growing number of orders from established business concerns. By 1872 the firm had grown into the \$300,000 Western Electric Manufacturing Company.

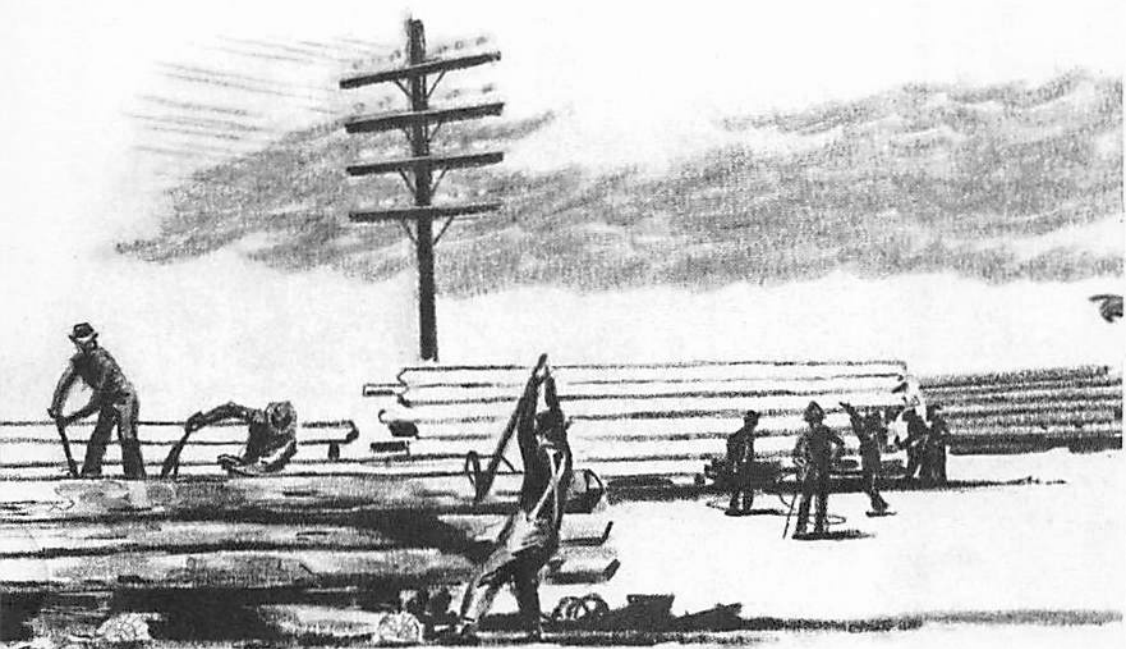
After the telephone was invented in 1876, the Western Electric Manufacturing Company became one of a half-dozen firms that were competing in producing the new instrument. Only five years passed before the Bell company saw the need for a reliable source of uniform equipment. Early in 1882 the Bell company acquired a controlling interest in the Western Electric Manufacturing Company and expanded it into the Western Electric Company. The firm had clearly demonstrated that its products were outstanding in design and workmanship, and that its staff placed service uppermost in its customer relations. In this way Western Electric became the manufacturing unit of the Bell System, and the Bell System gained a dependable source of telephone equipment.

In 1882 there were 90,000 telephones in the United States. Just one year later the number had grown to more than 123,000. The telephone industry was on the move, not only in its birthplace, the United States, but around the world. At home and abroad, wherever the name Western Electric appeared—on Bell telephones, on heavy power apparatus for industry, on electrical appliances for the household—it symbolized quality and reliability. By 1906, Western Electric was the largest electrical manufacturer and distributor in the United States, and eventually there were Western Electric plants in Belgium, France, England, Germany, Italy and Japan.

In the first years of the new century, Western Electric took on another job for the Bell System. Under *supply contracts* the various Bell telephone companies, which had been purchasing their supplies

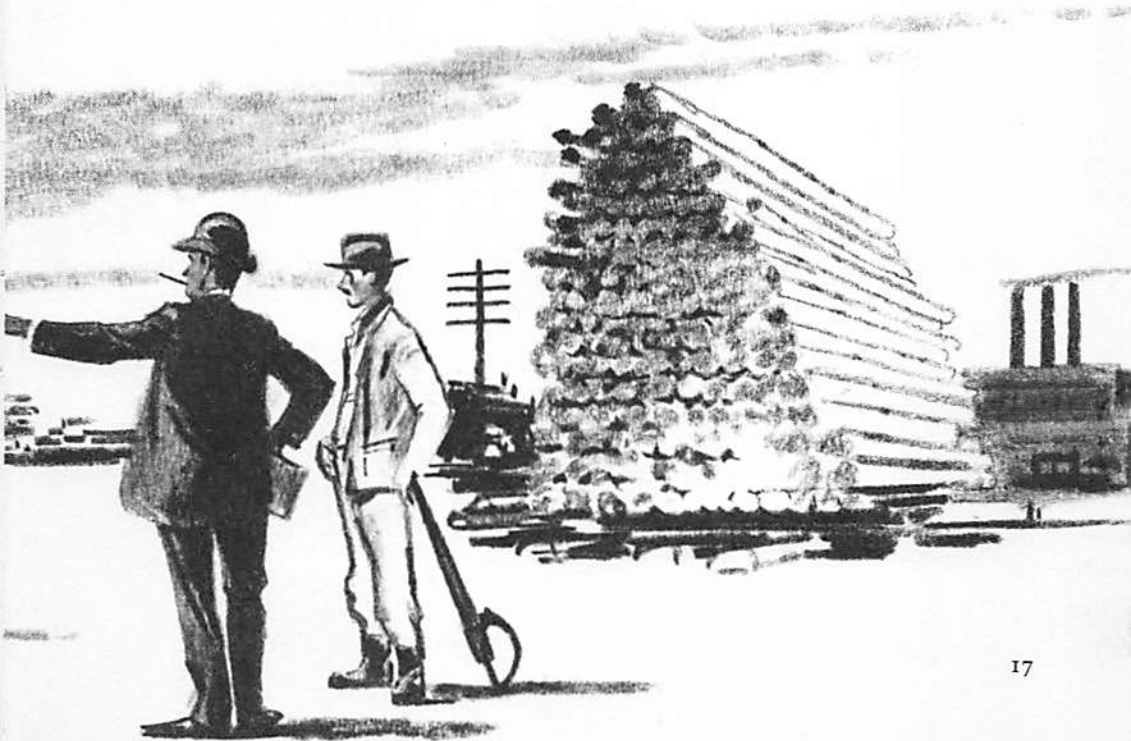
individually, joined their purchasing power with that of Western Electric. Under this arrangement the Bell companies achieved the benefits of quantity purchasing, as well as uniformity of design and quality in purchased materials. The supply contract also eliminated duplication of effort involved in the earlier practice by which each company purchased its own supplies. The economies of this arrangement were a major step toward the Bell System objective of more and better telephone service at low cost.

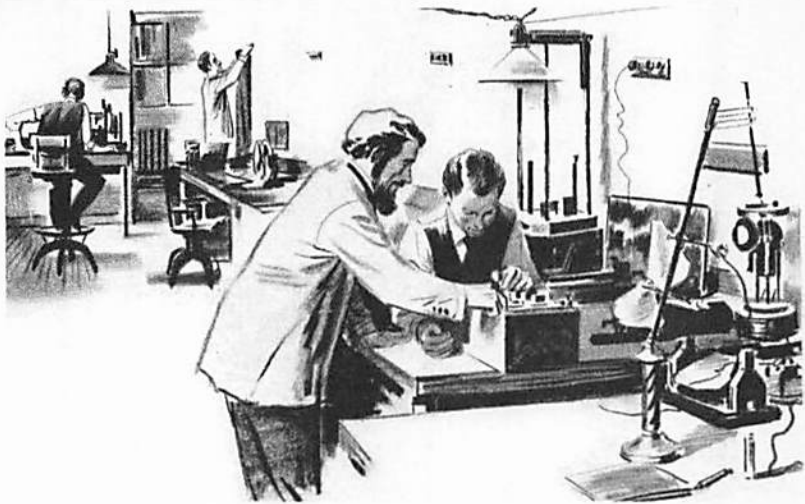
During those early years of the new century, when the first supply contracts were being signed, the number of telephones in the United States had grown to over 1,300,000, and the limit of America's requirements was not in sight. Western Electric expanded its manufacturing and purchasing programs. The first Western Electric Distributing House had been established in Philadelphia in 1901, and in the next few years other Houses were founded in major cities



from coast to coast. The company also mobilized a bigger force of installers to put new and larger Bell System central offices into service. By 1912 installation methods had been "streamlined" with modern techniques, such as adjustable scaffolding and temporary lighting, to aid the crews who were preparing new central offices for operation.

Gradually it became apparent that if the needs of America's telephone industry were to be met, the company must concentrate on its responsibility as the Bell System's basic source of supply. Its interests outside the country would have to be curtailed and its business outside the field of communications should be limited to those activities which evolved naturally from Bell System research. By 1925 Western Electric had sold its power apparatus and home appliance business, its foreign telephone business, and its electrical jobbing business. Through this action the Company gained a singleness of purpose.





Its activity could be more sharply focused on the four phases of its Bell System job:

- (1) to *manufacture* telephones and telephone apparatus.
- (2) to *purchase* supplies required by the Bell telephone companies.
- (3) to provide for the *distribution* of apparatus and supplies.
- (4) to *install* telephone central office equipment for the Bell telephone companies.

When Gray, Barton and Stager first pooled their resources and merged their talents in partnership, the research laboratory and the factory were one. Enos Barton was in charge of manufacturing and repair; Elisha Gray headed the research staff. From the beginning, research in the telephone art was recognized as a necessity in providing good telephone service. As the telephone business grew, research was undertaken by a few, then scores, then hundreds, and finally by thousands of specialists who worked in the engineering departments of Western Electric and A. T. & T.

All of these research engineers in Western Electric and A. T. & T. were working toward a common goal: more and better telephone service. Since all shared the same objective and often worked on common problems, it became apparent that great advantage could be de-

rived from the consolidation of research staffs. In 1925 the Western Electric research force was incorporated in a single research organization, the Bell Telephone Laboratories, owned jointly by Western Electric and A. T. & T. In 1934 A. T. & T. development and research engineers were consolidated with the Laboratories.

In the course of years Western Electric and the Laboratories have established a pattern of cooperation from fundamental research through to finished product. Engineers of the Laboratories devise new and better instruments of communications. Western Electric engineers match their efforts with new and better manufacturing methods, new and better ways of multiplying the laboratory model by hundreds or by thousands.

Today's progress in the art of telephony follows a pattern proved by long experience—from laboratory to factory to telephone company to the American people.





WESTERN ELE
MAKER OF BELL TEL

Atop the Hawthorne Works, oldest and largest of the Company's manufacturing units, a huge electric sign blazes into Chicago's night sky the legend "*Western Electric—Maker of Bell Telephones.*" It's a familiar landmark in Chicago, just as Western Electric is a familiar symbol throughout the nation.

Not all Chicagoans realize how much productive activity goes on beneath that sign, just as not all Bell telephone users fully appreciate

WESTERN ELECTRIC



the great amount and variety of complex equipment behind their telephones. Intricate switching apparatus makes it possible to connect your telephone with almost any other telephone in the world. Thousands upon thousands of miles of cable and wire, hundreds of repeater stations and carrier bays, and millions of little mechanical and electronic gadgets work in harmony to carry your voice.

It is Western Electric's Bell System job to manufacture not only

the familiar telephone set itself but most of the equipment and apparatus, wire and cable behind the telephone set.

Mass production, the technique of manufacturing a single product in great numbers—washing machines or automobiles, for instance—does not accurately describe Western Electric operations. *Quantity production of a great variety of items* is a more apt description.

During one recent year Western Electric factories made 28,000 different “codes” (kinds) of telephone apparatus and equipment items. Of these, 39 were made in quantities of over a million; 7,800 in quantities of 100 to 1,000; and over 7,500 in quantities of but one to nine each. Among the many items made in small quantities were certain types of coils, filters and rheostats.

Every item, whether it is produced in tens or millions, must be made so that it will fit precisely into place in the telephone network. It is significant that the telephone system is constantly changing. Older facilities are being replaced. Improvements are constantly being introduced. Yet every new part must work in harmony with every other new part and with older equipment.

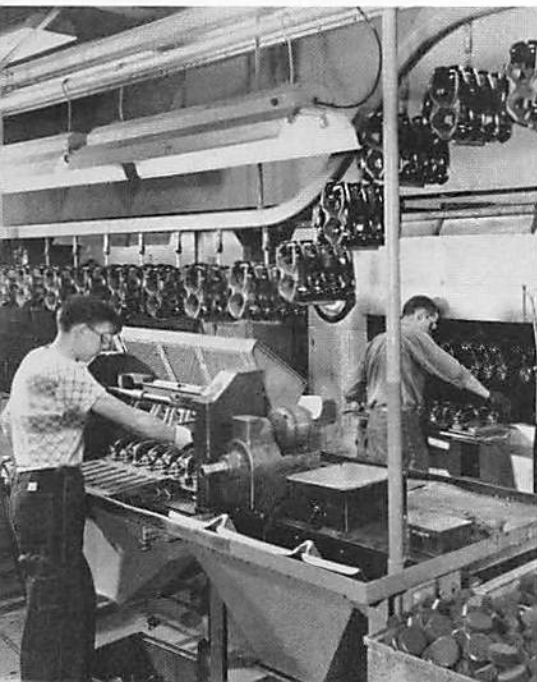
The nationwide integration of the telephone system requires close collaboration among the engineers who are responsible for the designing of telephone equipment, the manufacturing people who supervise the production of it, and the telephone company people who direct its operation. Western Electric management is in daily contact with Bell Laboratories scientists and with telephone company supervisors, all working together on the related problems of design, manufacture and operation. Cooperative management of this sort is distinguished from the usual business management in that all Bell System management activities—in the Laboratories, Western Electric and the Bell telephone companies—converge on the single

purpose of satisfying the public with high-quality, low-cost telephone service.

Just what is the specific task of the Western Electric manufacturing engineer? He translates a design into terms of practical quantity production. It is his job to devise ways and means of reproducing the laboratory model in whatever quantity America's telephone system demands. He must calculate the amount of raw material required, the number of workers needed, the skills they should bring to the job. He must specify and procure tools and machines for each manufacturing project, often designing special tools and machines for unique operations. He must establish the rate of flow from position to position on the assembly line, and coordinate that line's output with the output of associated assembly lines. Even after a production job is rolling his efforts are unceasing in the search for improved methods, tools and materials which will result in better products at lower cost.

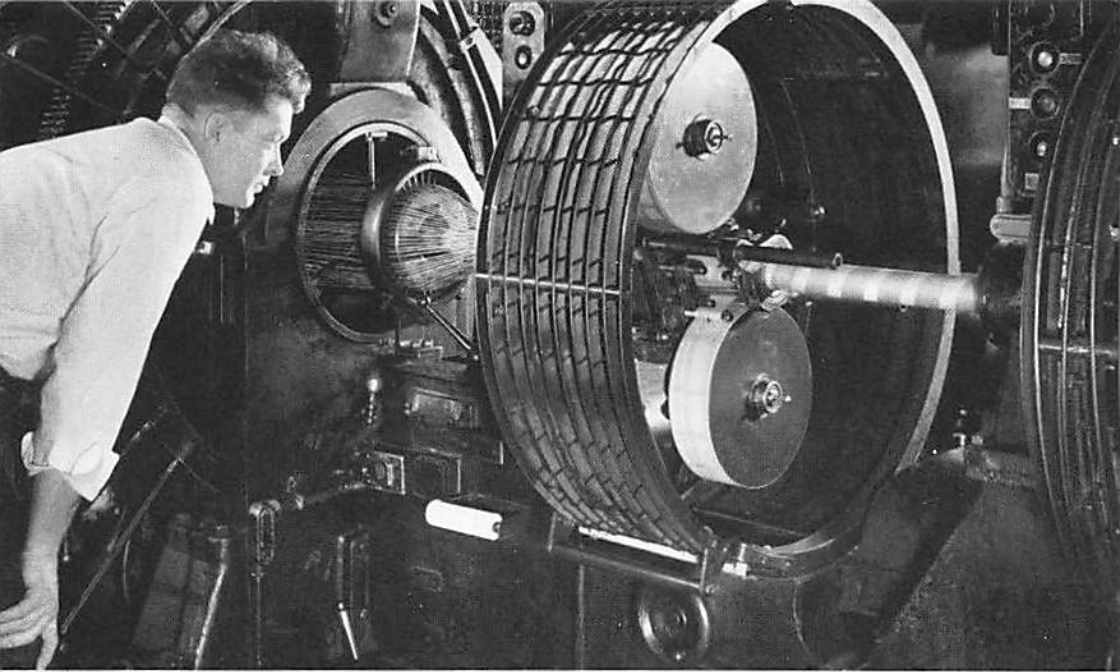
Western Electric's objective, like that of the Bell telephone com-

Familiar Bell telephone instrument is manufactured in new Indianapolis plant.



A principal job at Hawthorne Works is making dial central office equipment.





Production at Point Breeze Works is concentrated on many different varieties of cable and wire. This is a cable stranding machine.

panies, is service. Western Electric equipment is designed and produced for long-range service, not quick turnover. It must serve the customer day after day, year after year, and this means that quality and durability must be built into every product, large or small. In Western Electric quality and precision are synonymous. Manufacturing operations often involve closer tolerances than those required in watchmaking. In order to meet the exacting Bell System standards, the Company puts its equipment through rigid inspections and tests throughout the steps of production. But quality and durability result in more than just reliability; they lead to reduced maintenance costs and less frequent replacements over the years, all reflected in savings to the telephone-using public through keeping down the cost of rendering telephone service.

But what of the products themselves? What are they? Where are they made?

The telephone itself—the sort you have in your home or office—is

made in the Company's new plant in Indianapolis. The instrument contains more than 400 separate parts. The dial alone is a precision instrument containing over 100 parts. The base of the telephone set, handle, and the receiver and transmitter caps are produced by molding processes. The black, gleaming shapes move along undulating conveyor lines—one of the longest overhead conveyor systems in modern manufacturing operations.

At assembly stations along the conveyor system the deft fingers of Western Electric people add components of the set, such as the ringing mechanism and dial. The telephones move on then to the point where complete sets, fully inspected and tested, roll off the lines and are packed for shipment to Western Electric Distributing Houses, ready for delivery to telephone companies. The Indianapolis plant manufactures sets for telephone operators and special types of telephones for use in booths, in industry, in mines, and outdoors. It also makes a variety of special items of *station apparatus*, a term that means telephone equipment used on the customer's premises.

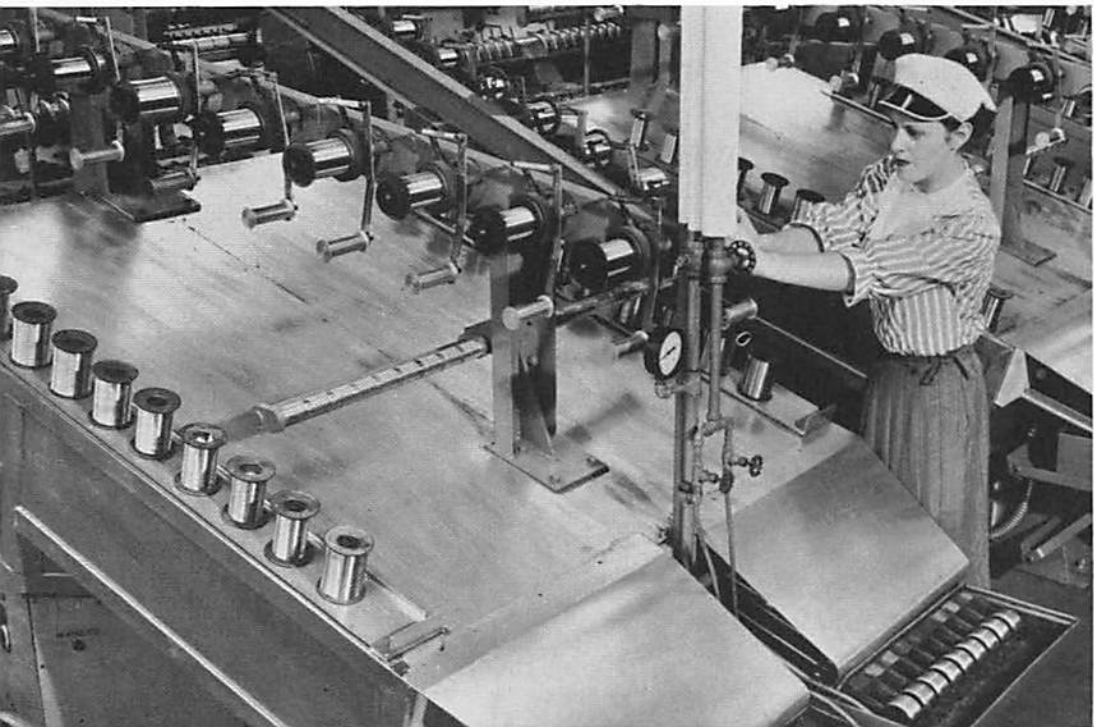
At the Point Breeze Works in Baltimore, the Company produces cable, wire, telephone cords for use on switchboards and on the customer's telephone, and special types of telephone equipment. Both wire and cable are made in other Company locations, but not in the variety and quantity produced at Point Breeze. Some of the wire is encased, singly or in pairs, in plastic or rubber insulation, but the great bulk of the Point Breeze output of wire is shipped as cable—encased in pulp or paper insulation, twisted, stranded, cabled and sheathed in coats of lead or plastic. Other cable cores are armored and treated for use under water or under the ground. At Point Breeze, too, Western Electric makes coaxial cable. Coaxial units about the thickness of a fountain pen are grouped in the cable—there may be four, six or eight units—and the cable can carry several hundred

telephone conversations at once or several television programs.

The Company's Tonawanda Plant near Buffalo, N. Y., makes the sort of cable that is used in switchboards, in telephone exchanges, and on business premises. Tonawanda is a large producer of wire, but the wire manufactured there is different from that produced at Point Breeze. It is the Tonawanda plant that "draws" most of the Company's fine-gauge wire (as small as $3/1000$ ths of an inch in diameter) for use in switchboards and for winding coils. Enamel and lacquer, also fabric and plastic insulations, form the protective coating for Tonawanda's wire.

Western Electric's biggest manufacturing job is making telephone central office equipment. At Hawthorne Works in Chicago and in its satellite shops in Lincoln, Nebr., and St. Paul, Minn., the Company builds *panel*, *step-by-step* and *crossbar* central office switching systems, masterpieces of mechanical and electrical ingenuity. These

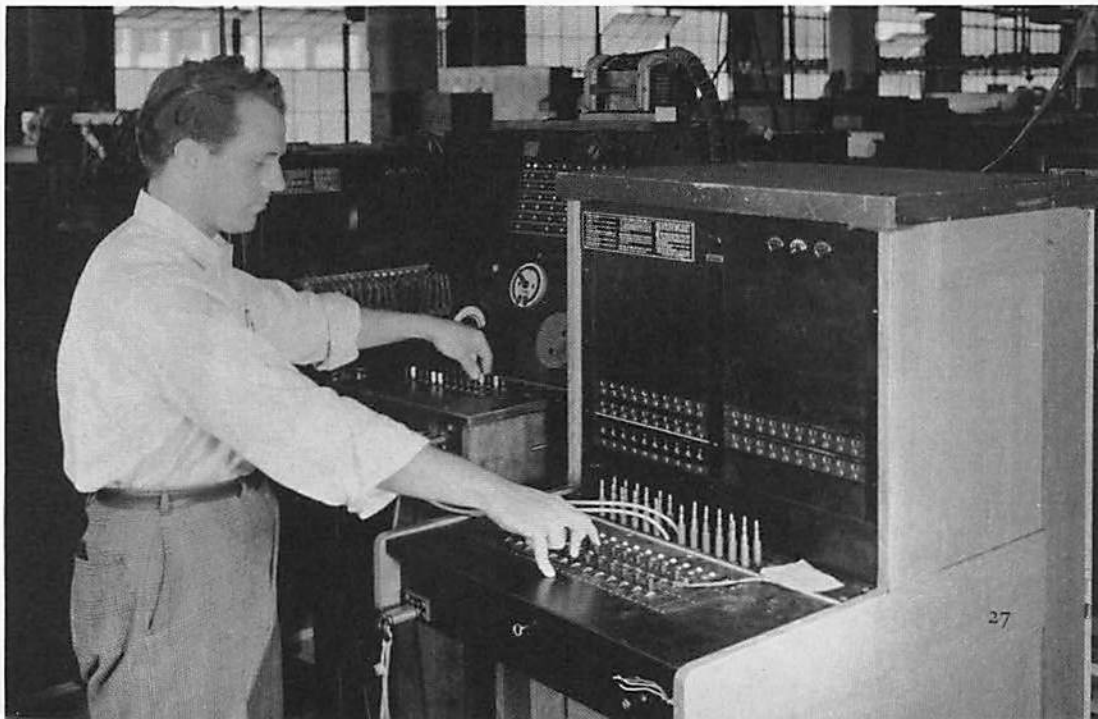
These machines in Tonawanda plant enamel magnet wire, used in coils, at capacity of 2,000 miles of wire per hour.

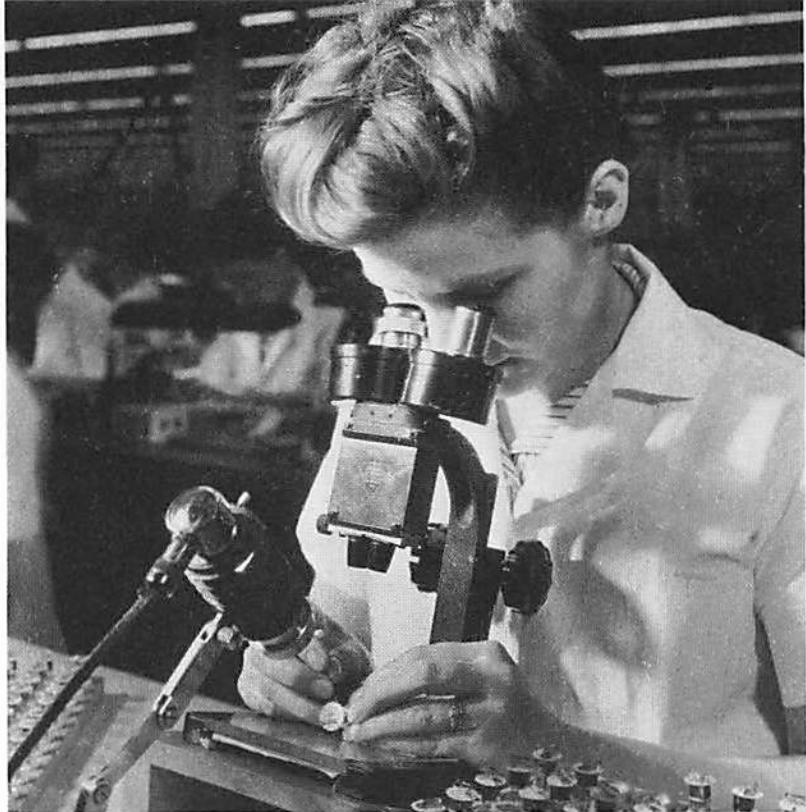


are the units that respond quickly and efficiently as your finger spins the dial of your telephone. Many other items of telephone equipment and apparatus are made at Hawthorne, and the plant is the home of Western Electric's rod mill, an important metal manufacturing center, where billets of copper are rolled into miles of rod, ready to be drawn down to copper wire.

Switchboards for non-dial telephone service are manufactured at Kearny Works in New Jersey. These boards range in size from desktop branch exchanges to the block-long boards in long distance central offices and the immense private branch exchanges that serve large manufacturing plants or entire government agencies. Employees of the Kearny Works also make the new No. 4 Toll Crossbar switching apparatus, which permits a telephone operator to dial directly the number you want in a distant city; repeaters which boost the strength of your voice as it travels on telephone lines; carrier

Testing PBX (private branch exchange) at Kearny Works, where production of non-dial switchboards is centered.





Above, inspection of electronic tubes in Allentown plant.
Below, checking radio-telephone equipment in Radio Shops.



equipment which puts many calls together so that they travel simultaneously on long-distance circuits; and radio relay apparatus by which telephone conversations or television programs are "beamed" from hilltop to hilltop between cities.

Telephone booths and central office furniture, such as chairs for telephone operators, are made in Queensboro Shop in New York, one of Kearny's satellite plants. Another Kearny satellite in Haverhill, Mass., produces coils of many varieties.

In a spotless, air-conditioned plant in Allentown, Pa., Western Electric makes many kinds of vacuum tubes and other sensitive electronic devices—resistors, varistors, thermistors, transistors and magnetrons—that have important uses in the telephone system or in equipment produced for the armed forces. At Allentown precision is commonplace even in commonplace manufacturing operations. Tolerances are often measured by one ten-thousandth of an inch. Tungsten wire, used in winding certain vacuum tube grids, is so fine that it is almost invisible.

In Winston-Salem, Burlington and Greensboro, N. C., Western Electric has factories for the production of equipment required by the nation's armed forces. This equipment is chiefly electronic in character and is generally similar to that which the Bell Telephone Laboratories-Western Electric team designed and manufactured in such large quantities during World War II (see Pages 52-55). In certain of these North Carolina shops, Western Electric has also been producing radio equipment for a variety of specialized applications in the Bell System.

These are only the major items made at Western Electric locations, but they indicate the great scope and variety of the Company's job as manufacturing unit of the Bell System.

From Pins to Poles

When Western Electric goes to market it buys from more than 24,000 business firms, large and small, in some 2,500 communities in all 48 states and in about a dozen foreign countries. It shops for over 30,000 different items—pins and pencils, trucks and metals, paper, pliers, machinery and motors, lumber, telephone poles. It shops for nearly everything needed by telephone company people for doing their many different jobs and by Western Electric itself for the manufacture of telephone equipment.

Centralized purchasing by Western Electric offers distinct advantages in Bell System operations. If each of the 22 operating telephone companies had to set up its own buying and warehousing organizations, the cost of operation to each company would be greatly increased, and that means that the cost of providing telephone service

Western Electric did the "shopping" for nearly all of supply items carried by this telephone company truck.

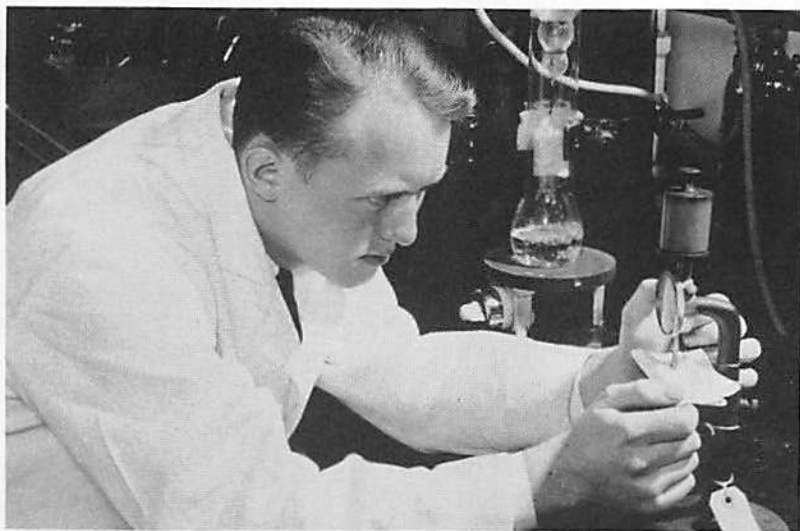


to the public would go up. Telephone bills are lower because Western Electric does the shopping for the Bell telephone companies. Raw materials and supplies which Western Electric purchases must meet uniform standards of quality. Resident and roving inspectors guided by a central staff of engineers examine purchases in suppliers' plants. Whatever is bought "fits" exactly into the Bell System's requirements.

The more than 24,000 business firms that sell to Western Electric benefit too from the Company's centralized purchasing. They sell in larger quantities under term contracts, so they are able to set efficient production schedules on a relatively even pace and to buy their raw materials economically.

In conducting its widespread buying operations Western Electric recognizes a dual responsibility: first, to buy at prices which are fair to the Bell System and to telephone *users*; and, second, to buy at prices which are fair to *suppliers* so that they can continue to be dependable sources of supply. This policy is a further demonstration of the "service motive" present in all Western Electric operations.

Purchases made for the Bell System companies must meet exacting standards. Supplies inspector checks textile sample.



Tale of Twenty-eight Cities



A Distributing House is like a "store"—it stocks the thousands of items needed to provide telephone service.

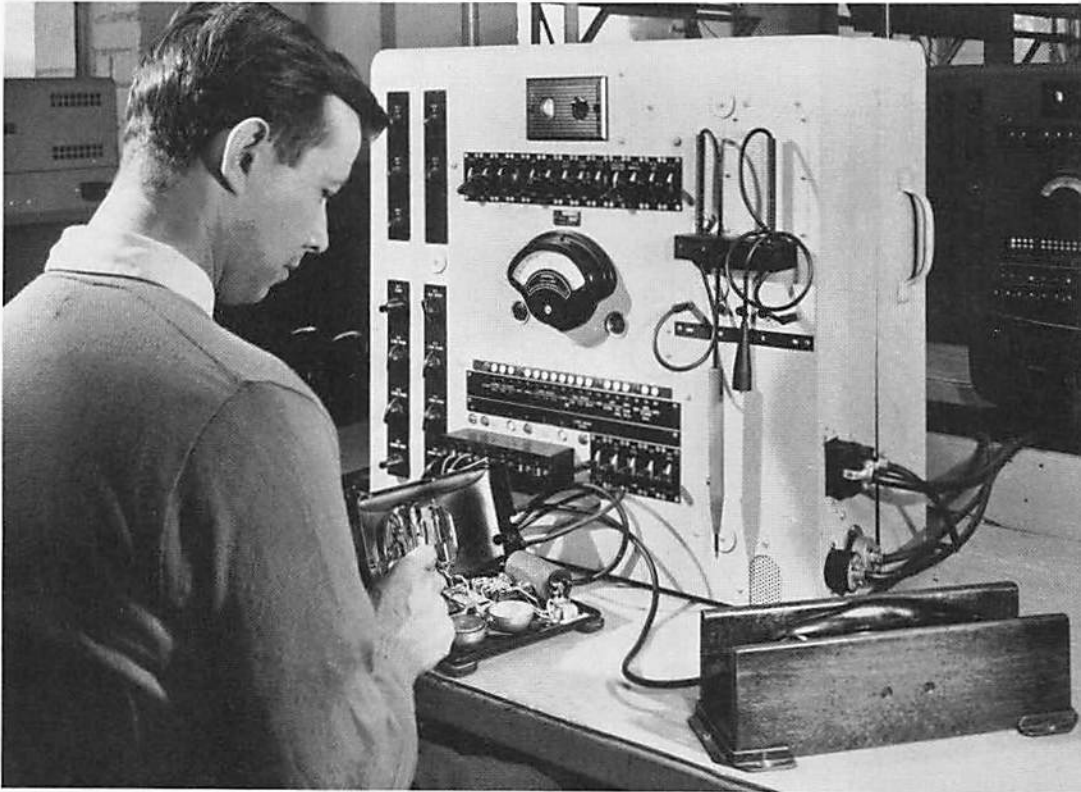
High pressure advertising, eye-catching displays, personable salesmen—that's the formula for successful selling in America's great retail stores. Western Electric also has "stores," but they employ no salesmen. They use no high pressure, no showcases, and no packages gayly wrapped to catch a housewife's eye. The telephone business is different. A Western Electric "store," known as a Distributing House,





Cable and wire stored for the telephone company form an orderly pattern in cable yard of Distributing House.

has one main customer—the local Bell telephone company—and none of the expense that normally would go into a sales program. The House furnishes the many tools of telephone service that Western Electric makes and buys. Day after day the House repairs worn telephone equipment promptly, renewing its previous high level of performance. Often, in the wake of disaster, it must quickly deliver great quantities of equipment which the telephone company needs to repair communications lines.



Testing a telephone. Distributing House repair shops help to maintain the high quality of Bell System service.

These Distributing Houses—there are 28 of them located strategically throughout the country—serve the local Bell telephone companies in their respective operating territories. They have two main functions, *warehousing* of supplies and the *repair* of service-worn telephone equipment.

If you were to visit a typical Distributing House, you would see reels of cable and wire stored in the yard outside. Freight cars are spotted on a siding. Trailer trucks are backed up to unloading docks,

and small electric trucks are moving incoming shipments to receiving areas. Meanwhile telephone company and commercial trucks are being loaded with supplies and equipment.

On the warehouse floor—there may be more than one—you'd see nearly 7,000 different items of telephone equipment stacked on racks or stored in bins. There are telephone sets, screwdrivers, paper clips and pins, safety belts and telephone hardware, headsets for the girls who have "the voice with the smile," and hundreds of miles of rubber-covered drop wire. Through the warehouse area a conveyor line moves along, carrying items ordered by the telephone company.

Another floor hums with the job of repairing telephone equipment. The Distributing House repair shop provides the local telephone company with factory repair in the field, saving time and the cost of sending equipment back to the factory. The repaired items range from telephone sets to switchboards and include Teletype-writers, mobile radio equipment, and telephone booths. Equipment not worth repairing may be shipped for reclamation to Nassau Smelting and Refining Company.

Distributing Houses perform another important service. Through them pass the orders which the Bell telephone companies place on Western Electric. Some orders are filled from local Distributing House stocks. Others are forwarded to the Company's Merchandise organization for scheduling in Western Electric's factories, and others are routed to the Supplies Service organization for shipment from suppliers on contracts arranged by the Purchasing Division.

Close relationship between Western Electric and the Bell telephone companies makes unnecessary the costly techniques of selling that prevail in other industries. The result is better supply service at lower cost to the telephone companies.



The Merchandise organization works closely with the Company's manufacturing locations, the Installation Division, and the 28 Distributing Houses. It is responsible for Western Electric "logistics"—*for getting the right amount of the right equipment to the right place at the right time*. It is the job of Merchandise to round up information on the quantities of telephone products—telephone instruments, switchboards, central office switching equipment, wire, cable—which the Bell companies require in the immediate future or a year from now. Merchandise passes on this information to the Manufacturing Division, warehouses the products that are manufactured. Then it funnels these products, as required, to the 28 Houses and the telephone companies. Merchandise plans ahead for emergencies and disasters. When storms hit the telephone network, an avalanche of equipment and supplies can be brought together quickly and rushed to stricken areas. Above is the train siding at Hawthorne Works, where many telephone products begin their journey to the operating telephone companies. Similar sidings are maintained at other Western Electric plants.



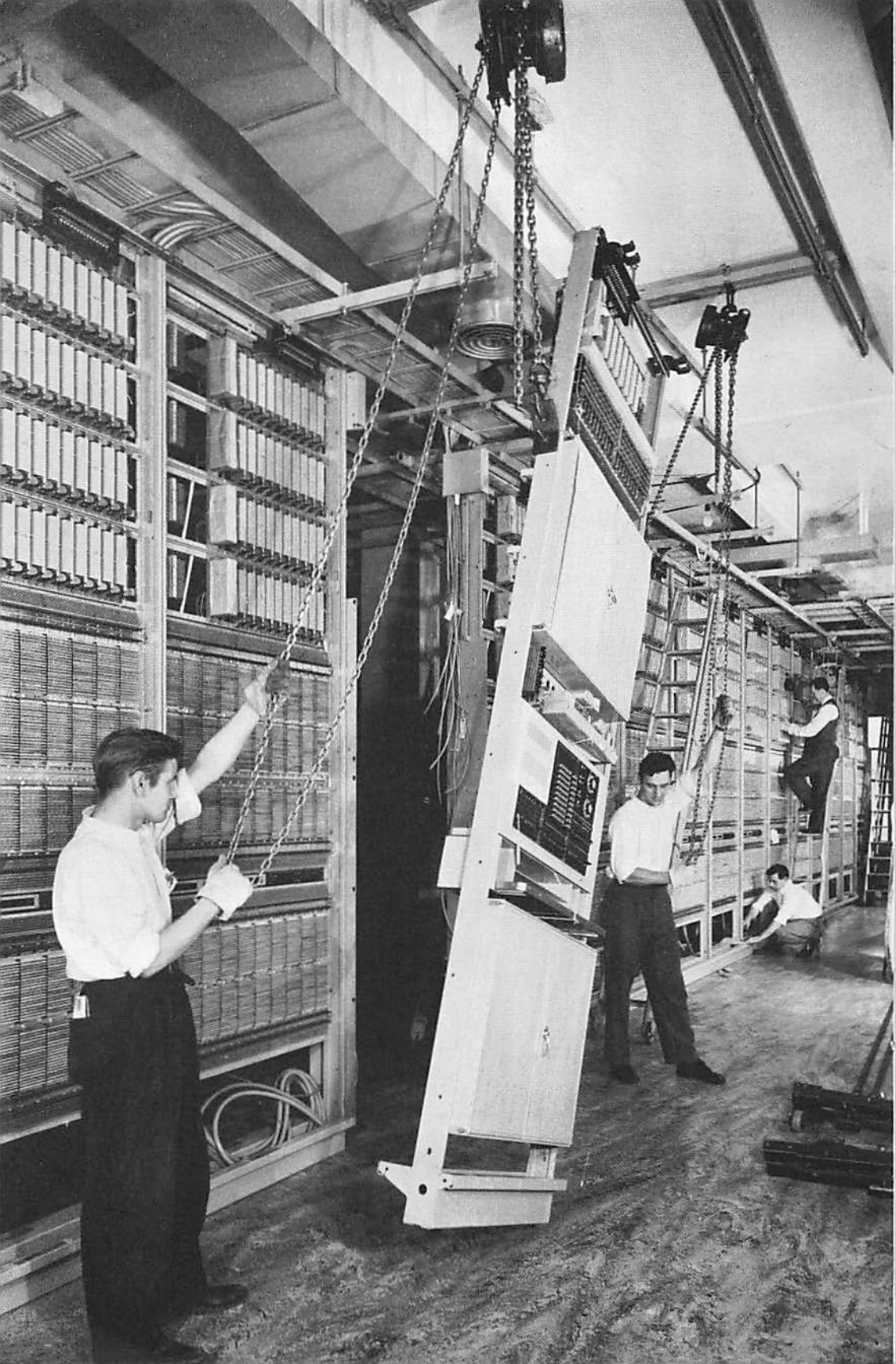
The Installation Service

Charlie Brady was a whiz. His era was the early 1880's when Western Electric was suffering growing pains. Charlie Brady was a one-man installation force—the first “equipment installer.”

In one corner of the old Clinton Street Shop in Chicago, E. G. Hovey, a one-man equipment engineering department, wrote specifications for switchboards. In another corner, Charlie Brady, galluses over his shoulders, built and wired boards to Hovey's specifications. Shop work completed, so the story goes, Charlie would shrug into his five-button coat, clap his bowler on his head and sally forth to install a switchboard on the customer's premises.

The fact that Charlie built the board, and knew its ins-and-outs from the floor up, helped both him and the customer. For Charlie, it meant that he could install the board easily and efficiently. For the customer it meant the advantage of a quick job and the assurance that the unit would meet its specifications. Also, Charlie would give the board a complete operational test before turning it over for use.

The same general idea, adapted to the size and complexity of Bell System operations, has held through the years. Western Electric builds central office switching equipment for the Bell telephone companies, and Western Electric also installs that equipment for the telephone companies. True, the Charlie Bradys are gone from the picture. No longer does a manufacturing man leave the plant to install



a switchboard on telephone company premises. Instead, Western Electric maintains a nationwide force of thousands of installers who are specially trained and experienced in the techniques of installing central office switching equipment. The advantages are the same as in the 1880's. The installation job is done quickly, efficiently and economically by the same company that makes the equipment.

Western Electric's installation service is an important link in the Company's function of providing central office switching equipment to the Bell System. Most of today's central office switching equipment is so large and complex that it can not be moved into a telephone exchange in complete units. It must be manufactured in sections and installed section by section. Because all sections are inter-related, positioning, wiring and testing must be done in the field.

Like Charlie Brady, today's Western Electric installer stands ever ready to furnish installation service on telephone company premises. His work is generally centered in one of 15 permanent Installation Areas covering 44 states. When one installation job is completed, the installer is assigned to another location, usually a telephone company central office. On small jobs, such as installing a switchboard in a small community, he may be teamed with only one or two other installers. On big jobs, such as installing a long distance toll center in a metropolis, he may be teamed with hundreds of installers.

Western Electric's installation force is an important and necessary asset in Bell System operations. Members of the force can be concentrated where the need for their services is most urgent. In time of emergency or disaster, Western Electric installers move in like shock troops to help restore damaged equipment.

Installation service is important link in providing switching equipment to telephone companies. At left, installers hoist central office frames.



Who are W.E.?



Western Electric is *people*—thousands of men and women of many skills, trades and professions working with the common purpose of providing constantly improving telephone equipment.

Our objective, like that of the telephone operator, the lineman, the research engineer, is service, more and ever better Bell telephone service for the American people.



Ours is a complex and comprehensive business. So it is not surprising that you find among us practically every occupation known to modern industry—from accountant to yardmaster. If just a few of us were to identify ourselves, here is what we might say:

We are inspectors in Maine checking the output and quality of pulp-base paper for next year's telephone directories.

We are manufacturing engineers in New Jersey working with the research engineers of Bell Telephone Laboratories and the operating engineers of the Bell telephone companies to develop new and improved ways of making telephone apparatus.

We are grid winding machine operators in Pennsylvania making essential elements of vacuum tubes that help to boost your voice along long distance lines.

We are lead press operators in Maryland turning out lead-covered coaxial cable to carry your telephone conversations and television programs from city to city and from state to state.

We are wiremen in Illinois wiring the circuits of central office switching equipment that will connect you quickly and automatically

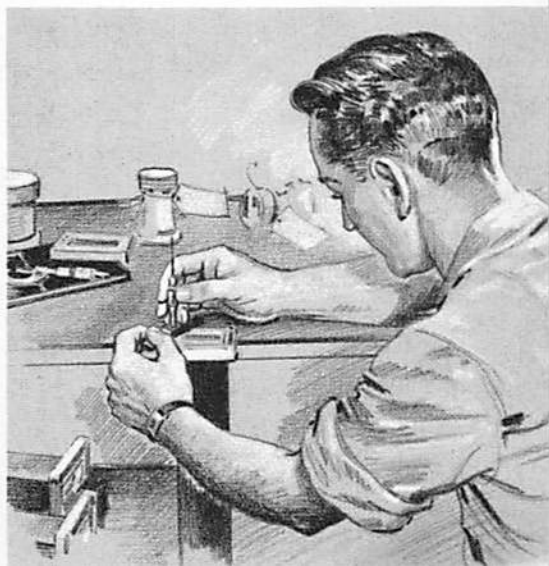
with your Bell telephone operator or with friends and neighbors in your community.

We are Distributing House stock selectors in Texas who fill the day-to-day orders of the Southwestern Bell Telephone Company for wire, insulators, telephone headsets and innumerable other items essential to telephone service.

We are installers in California installing new central office switching equipment that will help the Pacific Telephone and Telegraph Company to meet the public demand for more and more Bell telephone service.

We are buyers in New York City arranging for the purchase of telephone poles to carry the wires that carry your voice across the street or to distant cities.

Accountant, installer, doctor, guard, janitor, instrument maker, machinist, or secretary in Oregon, New York, Georgia, Wisconsin, Delaware, or Indiana, no matter what we do or where we do it, our jobs are all directed toward meeting Western Electric's responsibility as manufacturer and supplier for the Bell System.



Disaster



The ice storm struck first in a thousand mile swath from Pecos, Texas, up to Hannibal on the Mississippi. The freezing rain fell steadily, encrusting everything it touched with ice. For two days and nights the rain and sleet fell. It seemed that nothing could withstand the weight of ice. Trees crashed to the ground. Telephone wires sagged and snapped. Poles and crossarms splintered and toppled in a



mass of wreckage. Thousands of telephones went out of service.

Western Electric's instant reaction to the storm followed the pattern which has proved so effective in Bell System emergencies over the years. Within minutes of the first news of storm damage, Western Electric organizations had gone into emergency action. Within hours they had supplies—wire, cable, pole-line hardware—rolling into the storm area by train, truck and plane.

But the trouble had only begun! Telephone company repair crews had barely started the job of restoring service when another storm, and then another, struck the same general area. Snow, sleet, freezing rain driven by 50-mile winds heaped destruction on destruction.

When finally the sun came out, over \$11,000,000 worth of telephone poles, wire, crossarms and other equipment lay broken and twisted on the ground. This was the ice storm of '49—the worst ice and sleet disaster the four states of Texas, Oklahoma, Kansas and Missouri had ever known.

When disaster strikes, W. E. calls upon transportation companies to rush vital telephone supplies.

. . . in Western Electric plants, routine work is set aside, and emergency schedules are set up.



Western Electric was prepared for this disaster, just as it had been ready for the Baltimore fire in 1904, the San Francisco earthquake in 1906, the floods of 1937, the hurricane of 1938, the windstorm and blizzard of 1950, and many other emergencies. It was ready because its entire organization, set up to meet the everyday needs of the telephone companies, can suddenly be sparked into an emergency network. Through its nationwide distributing system it can pour supplies and materials from many directions into any disaster area in a minimum of time. And if an emergency involves damage to central office equipment, Western Electric installers can be assigned immediately to the disaster area to help restore service.

Important, too, is the fact that Western Electric telephone equipment is standardized—the same all over the country. Material from any territory will fit in a stricken area. From long experience all telephone company people are familiar with the supplies and equipment furnished to them.

... from long experience, Houses can anticipate what supplies are required in disaster area.

... by plane, train and truck, supplies are rushed on way to help restore telephone service.



During the great southwestern ice storm, supplies poured into the storm area from 72 cities and towns in 24 states. Suppliers were called at home at night or on Sundays and asked to rush shipments of materials on express trains, trucks or planes. Transportation lines were called upon for special routing, their fastest service. In Western Electric's manufacturing plants routine work was set aside. A week's work on supplies for the disaster area was sometimes compressed into 24 hours, a month's work into a week, to get badly needed material into the southwest—*fast*.

The kind of a job Western Electric does in time of disaster became traditional, long ago, with Western Electric people. Tomorrow, the next day, and the day after that, disaster may strike again. A fire in a central office? Flood? Hurricane? Earthquake? No one knows. But whatever comes, Western Electric's supply network will go into fast action at a moment's notice. Its people will know what to do.

... loaded with supplies from Western Electric, telephone company trucks serve disaster area.



... his tools and supplies are standardized. They "fit" telephone system in stricken area.



A TRADITION

Service in Disaster

The tradition of service to disaster-stricken communities goes far back into Western Electric's history—back to the time when there was no telephone and when the company's founders, Professor Elisha Gray and Enos Barton, made telegraph instruments and electrical signaling devices in a small Chicago shop. In 1871 when Chicago was almost destroyed by fire, supplies were rushed from the Gray and Barton shop while the two men supervised repair of Chicago's electrical installations and helped restore local telegraph facilities of the Western Union Company. This work led directly the following year to the incorporation and expansion of the business into the Western Electric Manufacturing Company.

In the Nation's Service





W. E. telegraph instruments were used by Army in Indian campaigns of 1870's.



In World War I, army depended upon field telephone units—made by W. E.

Western Electric's record as a major supplier of communications equipment for the United States government and the armed forces extends almost without break through the Company's history.

The Company's service to national defense began in the 1870's when Western Electric-made telegraph instruments clicked out the reports and dispatches of a blue-clad army that was fighting the Indian campaigns of the old frontier. In subsequent years the Company contributed numerous inventions and innovations to both army and navy, with the result that even before World War I our armed forces were equipped with efficient electrical and communications devices. Today radar, sonar, gun directors, and telephone equipment—designed or developed by Bell Telephone Laboratories and manufactured by Western Electric—serve the army, navy, and air force.

The effectiveness of the Bell Laboratories-Western Electric team has been recognized in the atomic age. Late in 1949, at the request of the U. S. Atomic Energy Commission, Western Electric took over operation of the Commission's Sandia Laboratory near Albuquerque, N. M., an important function of which is to bridge the gap between research and the manufacture of atomic weapons. The

In World War II, W. E.-made radio, telephones and Teletype systems helped coordinate world-wide combat.

Sandia Corporation, organized as a non-profit Western Electric subsidiary, is able to draw upon all divisions of the Company and Bell Laboratories for scientific, technical and managerial services.

Western Electric's capacity for volume production of complex military equipment was convincingly demonstrated in the first World War. During that conflict the Company supplied the government with equipment worth nearly \$32,000,000. In the short span of 17 months Western Electric engineered and developed ship-to-shore radio telephone equipment and submarine detector units for the navy, plane-to-ground radio telephone equipment and field telephone units for the army.

Later, peacetime America benefited. Equipment and techniques developed by Western Electric in wartime service were promptly applied to the Company's peacetime task of supplying more and better Bell telephone equipment.

After World War I, Western Electric continued to serve the government and armed forces whenever it was called upon to do so. When World War II exploded into global conflict, the Company was ready. Production of telephones and telephone equipment for the nation's communications system was cut back. Quickly Western Electric plants and factories plunged into the gigantic task of supplying electronic war gear to the armed forces of the United States and its allies. Only enough Bell telephone equipment was made to maintain and extend telephone facilities essential to the conduct of the war.

Radar was Western Electric's biggest war job. Dollar-wise, Western Electric supplied half the radar produced in the United States, over \$1,000,000,000 worth. All the big guns of the navy were aimed by Western Electric radar. But that was not all. Western Electric radio-telephone equipment linked Washington with overseas headquarters. Radio, telephone and Teletype systems, many of

them engineered and produced entirely by Bell Telephone Laboratories and Western Electric, joined headquarters with armies in the field. Western Electric radios served the army, navy and air force.

Complex gun directors, engineered and manufactured by the Bell Laboratories-Western Electric team, spotted enemy aircraft and guided the anti-aircraft fire. Sound-powered telephone units provided shipboard communications between decks. Western Electric loudspeakers bellowed orders on carrier flight decks and carried the voices of navy beachmasters directing landing operations. Western Electric-built sonar units protected the ships of the fleet and sent destroyers to depth-bomb enemy submarines.

Throughout its service to the nation, Western Electric has brought to its wartime work all the scientific knowledge and technical "know-how" available to it in the years of peace. Similarly, what the Company has learned in wartime operations has been adapted, in many instances, to the improvement of Bell telephone service. Now, in the midst of international tensions, the Company continues to supply the government and armed forces with special electronic products. Western Electric stands ready, at all times, to help strengthen the nation's voiceways or to provide the instruments for all-out defense.

During World War II, W. E. manufactured half of all radar made for armed forces.



Complex gun-directors, made by W. E.-Bell Labs team, helped down enemy bombers.



By-products of Telephony

Beginning with the invention of Alexander Graham Bell, the telephone instrument and its associated switching and transmission mechanisms have grown into one of the most intricate and far-flung facilities known to modern science. Into the design and construction of the telephone system have gone the painstaking efforts of many brains and many hands. And in the course of years these efforts have created many important by-products that are useful in a variety of non-telephonic industries.

Take, for example, the vacuum tube. For years after the telephone was invented, the necessity of amplifying the voice so that it could be heard during long-distance transmission was a difficult technical problem. The matter remained unsolved until 1912 when a young man named Lee DeForest walked into the engineering department of Western Electric carrying a flimsy gadget which he had made out of glass, wire and wax—a device that was to have the same stimulating effect on communications that the gasoline engine has had on transportation.

DeForest's vacuum tube was not suitable for Bell System use, but to the Bell System engineers who began work on its development it was a magic key to the vast unexplored field of electronics. By 1915 the vacuum tube had conquered the problem of long-distance telephony. Later it became the "heart" of many types of equipment in use today, such as public address systems, electrical sound recording, hearing aids, marine and police radio, aviation radio, transoceanic telephony, and commercial radio broadcasting. Progress in all these fields was pioneered by the Bell Laboratories-Western Electric team.

The Laboratories led the way in their development. Western Electric led the way in manufacturing.

It is the policy of the Bell System to make its inventions and developments readily available to others. Under patent license agreements, over 400 manufacturers are now using technical methods or are making products that stem, in whole or part, from the work of Bell System engineers. Brain wave machines, dictating machines, fire extinguishers, coil winding machines, electromedical equipment, sound pictures, devices for locating mineral and oil deposits—these are but a few of the products Bell System creativeness has aided.

The Bell System's policy of licensing its inventions and developments to others has, in turn, furthered the progress of telephony. The development of the vacuum tube by telephone engineers opened the way for other industries to exploit radio. In turn, radio techniques such as those employed for television became adaptable for telephonic uses. Net result:—improved telephone service.

The telephone industry pioneered many early developments in machine tools and synthetic materials. New tools, new plastics and textiles, new alloys and finishes—originally developed in Bell System research laboratories and in Western Electric plants—were applied and improved by engineers in other industries. Many of these developments are now helpful in achieving the Bell System's goal of constantly improved telephone service at the lowest possible cost.

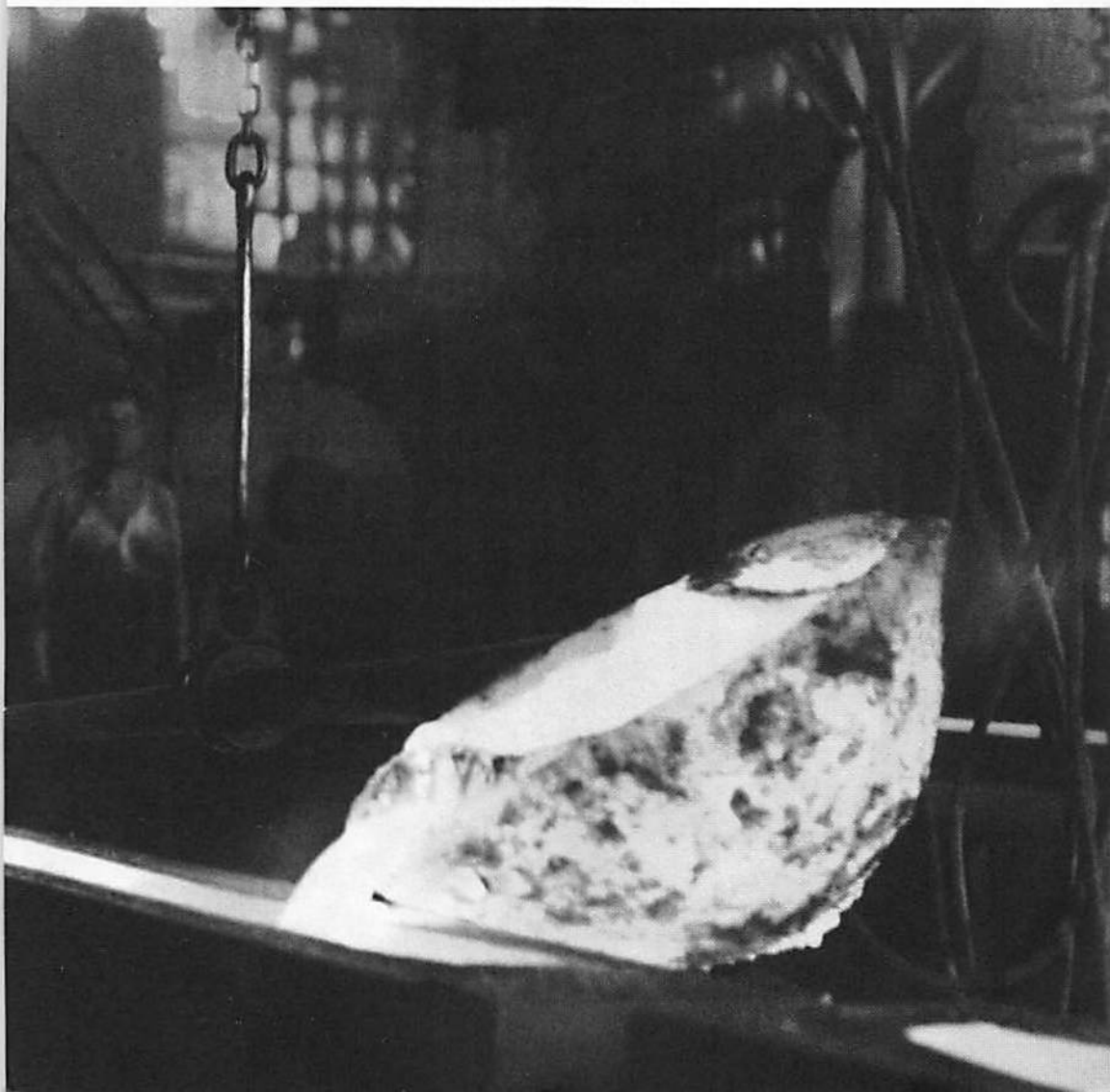
In short, the science of telephonic communications, in common with the other major departments of American technology, thrives on the interchange of ideas, inventions, developments, and skill.

PRINCIPAL SUBSIDIARIES

Nassau Smelting and
.....
Refining Company
.....



It's possible that a Pharaoh's bowl, a hammered urn from ancient Greece or a Babylonian amulet may be a part of today's Bell System network. Metal experts have estimated that a large percentage of all the copper mined since the world began is still in use. Thus many ancient trinkets and utensils, melted down and reshaped repeatedly over the centuries, may well form an infinitesimal part of the





Copper, reclaimed in Nassau's furnaces, will be returned to Western Electric plants, drawn into telephone wire.

huge supply of "secondary" metals used by the Bell System.

Secondary metals—metals reclaimed and refined from scrap—are an essential and economical part of Western Electric's production pattern. To centralize scrap reclamation and to assure the Bell System of a dependable supply of secondary non-ferrous metals—brass, bronze, copper, lead and solder products—Western Electric in 1931 acquired the Nassau Smelting and Refining Company, Inc., at Tottenville, Staten Island, N. Y.

Into Nassau each year pour many thousands of tons of scrap. Most of this is worn or damaged apparatus, wire and cable from the Bell telephone companies and scrap from manufacturing, installation and repair operations of the Western Electric Company. Over three-fifths of the non-ferrous metal content of this scrap is returned to Western Electric as copper and lead alloy raw materials. It is ready to be re-fashioned into new tools of telephone service. About one-sixth of the Bell System's entire annual copper wire bar requirements are met with electrolytic quality copper refined from reclaimed scrap. About one-fifth of the System's yearly lead requirements are supplied from the same source. Both copper and lead are reclaimed at a saving compared to the cost of new or primary metals obtained from their ores.

In addition to its day-to-day economic importance to Western Electric and the telephone companies, Nassau Smelting and Refining Company is exceedingly important in meeting the Bell System's needs for non-ferrous metals during periods when primary metals are in short supply. Nassau's salvage operations during World War II served the nation in the critical years when every pound of metal was vital to national defense.

Nassau Smelting and Refining Company is a further extension of Western Electric's constant effort to do its Bell System job better and more economically.

PRINCIPAL SUBSIDIARIES (Cont.)

Teletype Corporation

Back of every modern news broadcast, and often providing a rhythmic accompaniment, is a battery of Teletype machines which communicate by printed word the news of the world to radio stations and newspapers—one of many uses for this type of equipment.

Teletype equipment—sending or receiving units or combined sending-receiving sets—is an important supplement to Bell System telephone service. It provides transmission and instantaneous receipt of the printed word at one or many points simultaneously, using the same wire and cable network that carries your voice day by day.

The Teletype Corporation, a Western Electric subsidiary since

Many businesses with widespread operations are linked by Teletype networks. Switching center is heart of system.





Today's Teletype equipment automatically transmits messages to one or many points at rate of 75 words per minute.

1930, manufactures Teletype and similar equipment for the Bell System and other customers. Steady improvement in the speed and accuracy of Teletype machines is the constant concern of the subsidiary's own research and development staff, and a continuing program of development of Teletype systems is maintained by the Bell Telephone Laboratories.

Teletype apparatus is used on a nation-wide scale. It is operated by the Bell System for subscribers, and on a private-line basis by many organizations including railroads, airlines, bus and truck lines, news services, commercial telegraph and cable companies, government agencies, and industrial and business concerns.

Teletype systems were important in World War II, linking Washington with war theatre and field headquarters all over the world. Teletype products provide a further extension of Bell System service to the nation and its telephone-using public.

To Sum Up

This, then, is the story of Western Electric—it calls for many things and many activities, blended together, to create the miracle of telephonic communications. It takes people and equipment, inventiveness and technical skill. It takes experience, and, above all, the fundamental desire to be of service to the public and the nation.

The outward characteristics of Western Electric's job are apparent, if you stop to think about them, every time you make a telephone call. The instrument itself, the vast switching apparatus behind it, the almost endless miles of wire and cable, have come from Western Electric. Three generations of Western Electric people have devoted themselves to the task of helping to expand and improve this great network. Their craftsmanship, their many years of experience, their pride in quality and durability, are built solidly into every piece of equipment and apparatus that bears the Company name.

One reason why Bell System service is good today, reasonable in cost, and will grow better and more useful, is that Western Electric people and the things they make are blended into the 75-year-old Bell System formula that combines research, supply, and operation.

