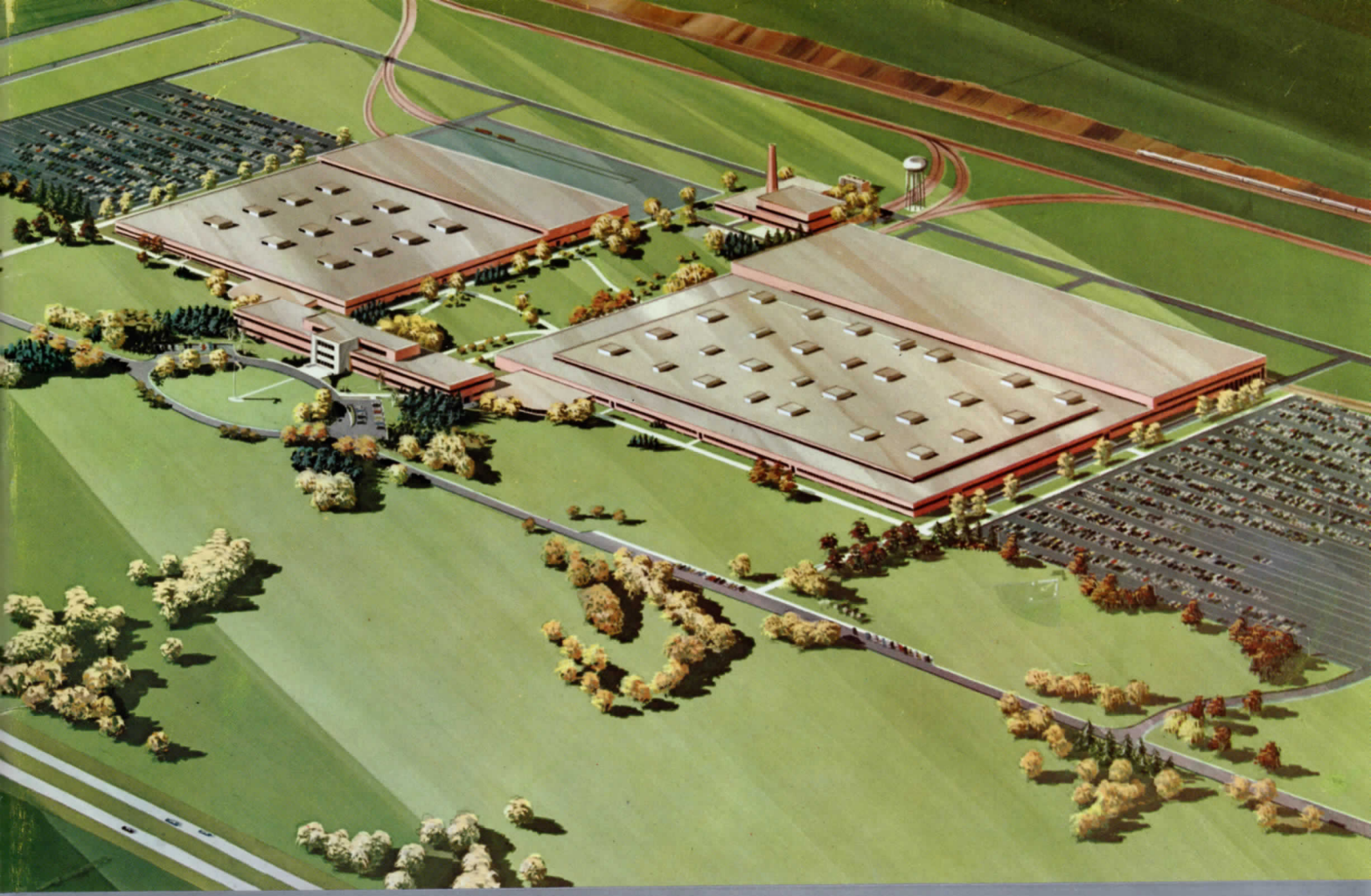


Welcomes to the Omaha Works, Omaha, Nebraska

Your Visit to WE

Groundwork for Production

In March of 1956, Western Electric announced the purchase of a 390-acre rectangle west of Omaha, near the town of Millard, as a location for a plant site. Three separate farms, their main houses and outlying buildings with fields that nourished corn, alfalfa and grazing crops, stood on the site. After the ground breaking on June 28, 1956, the buildings were swiftly removed, the fields graded. Giant earth-moving machines, working from dawn into the night under floodlights, moved four million cubic yards of earth in four months to prepare the land for construction.

The construction began on October 11, 1956 and was completed November 15, 1958 in a period of 25 months. The magnitude of the work is indicated by these quantities:

87,000 cubic yards of concrete
12,770 tons of structural steel
43,000 concrete block
2¾ million face brick
25,000 glass block
296,000 square feet glazed tile
42 acres paved parking area
4 miles concrete roads
2 miles concrete sidewalk
32 acres seeded to lawn

The Omaha Works consists of two manufacturing buildings, the cable plant to the west and the crossbar plant to the east, and in front of them a three-story office building. Along with two service buildings, there are some 40 acres under roof.

Nearly a century of manufacturing and engineering experience is behind the design of the Omaha Works. Its machinery, layout, and material flow is especially aimed at achieving top efficiency. For instance, the single floor construction of each plant provides the same time-saving and energy-saving benefits that most people enjoy in today's one floor ranch houses.

The Works is one of the larger manufacturing units of the Company. Its people—and the products they make—contribute an important ingredient to the Bell System formula for low-cost, dependable telephone service.

Automatically, almost without thinking, you reach for your Bell telephone, spin the dial and within seconds you are talking with a friend.

This miracle of communication is made possible through three activities—research, manufacture and operation. These ingredients are blended in the Bell System formula—*the* formula by which private enterprise has been able to give this nation the best telephone communications in the world, so that three-fourths of all American families now have the convenience and protection of a telephone in their homes.

In the Bell System formula, the Bell Telephone Laboratories provides the research; Western Electric the manufacture; and the Bell telephone companies the operations. The Bell Telephone Laboratories adapts, devises and perfects the tools of telephone service; Western Electric builds, purchases, distributes and installs the tools required to furnish telephone service; and the Bell telephone companies introduce the service to the public and operate the vast telephone communications network.

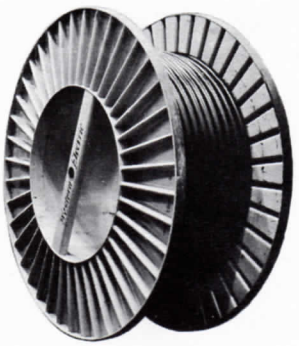
The close teamwork of research, manufacture, and operation is the combination that results in a more efficient, progressive telephone service at a reasonable cost. This triple combination is like a three-leg milking stool; it is impossible to say which leg is not needed. All three are necessary to maintain, to expand and to improve telephone service. Blending into this time-tested Bell System formula are the Western Electric people in Omaha and the products they make.

Maker of Cable

The telephone left Mr. Bell's Boston workshop in 1876. Featured as "Prof. Bell's Speaking And Singing Telephone", it appeared in lecture hall and church demonstrations as "instantaneous communication by direct sound". The audiences were fascinated. Their fascination turned to desire. Soon, at popular request, the telephone entered people's homes and offices.

Whenever the telephone went to work, it was escorted by wires, the electrical paths to and from the telephone central office. As more telephones were ordered, more wires were strung. The business uptrend of the new industry was charted against the sky. The horizontal lines of *new* telephone poles and the vertical lines of *added* crossarms told of the new industry's growth. Some staunch poles in crowded city districts held twenty-five crossarms, each shouldering a heavy canopy of wires.

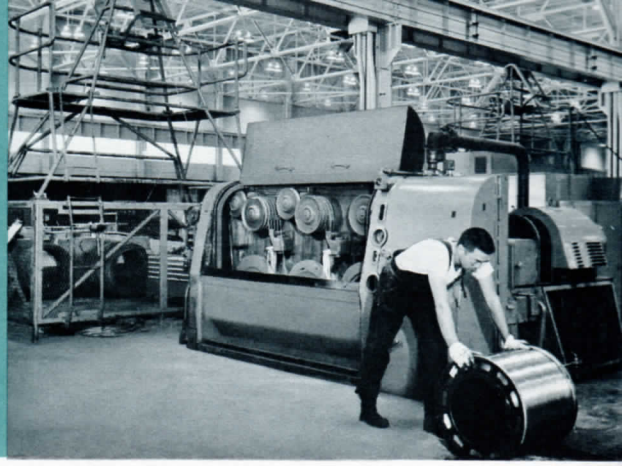
It seemed for a while that the infant industry would strangle in its wires. And that sleet, snow and ice would take a costly toll of these thin lines of communication. Then a solution was found. The wires were gathered together to form cable. In the cities, the cable was put below the ground.



A maker of this early telephone cable was the Western Electric Manufacturing Company. The Company was founded in 1869 by a college professor, a former telegrapher, and an executive of a large telegraph company. Their business was the manufacture and the repair of telegraph instruments and other electrical devices. Their goal was to establish a reputation for quality workmanship and to give good service. And they did.

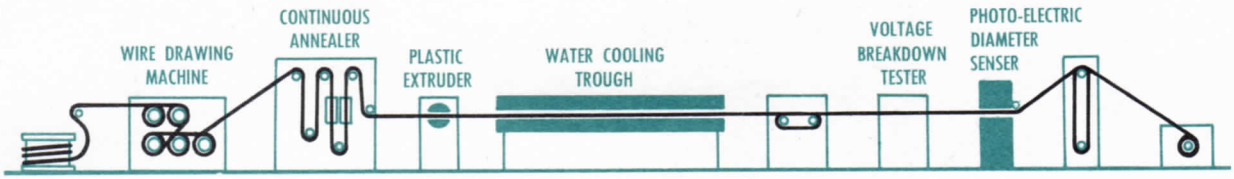
The Company was eight years old when the telephone was invented. Besides supplying the new industry with cable, it made telephone instruments as well. Because its products were so well made and dependable, it was selected to become a part of the infant Bell System in 1882. The word "manufacturing" was dropped from the Company's title, but never from its task. For over three-quarters of a century, the Western Electric Company has been the manufacturing and supply unit of the Bell System. Of all the products it builds, none is more essential to the improvement and growth of the nation's communications network than telephone cable.

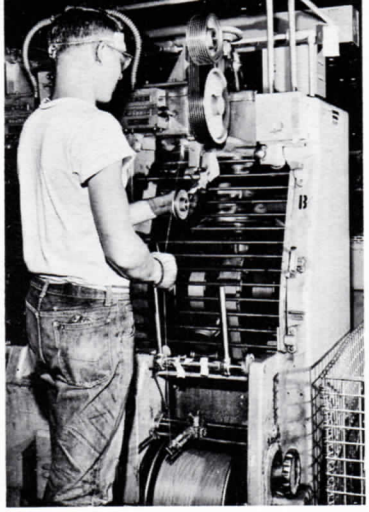
Cable making begins with the drawing of ¼″ copper rod down to slender wire. The rod is fed to the drawing machine in gulps of 240-pound coils. One coil is welded to another to form an endless length. Through the dies, four coils of copper rod draw out to fifteen miles of wire that is wound up at 75 miles per hour on a steel spool. The machine pulls the rod through twelve dies, each with a smaller and smaller trumpet-shaped hole, that squeeze the rod down to a fifth its size, or about 1/16″ in diameter which is equivalent to 14 gauge. The dies are made of tungsten carbide, one of the hardest alloys known.



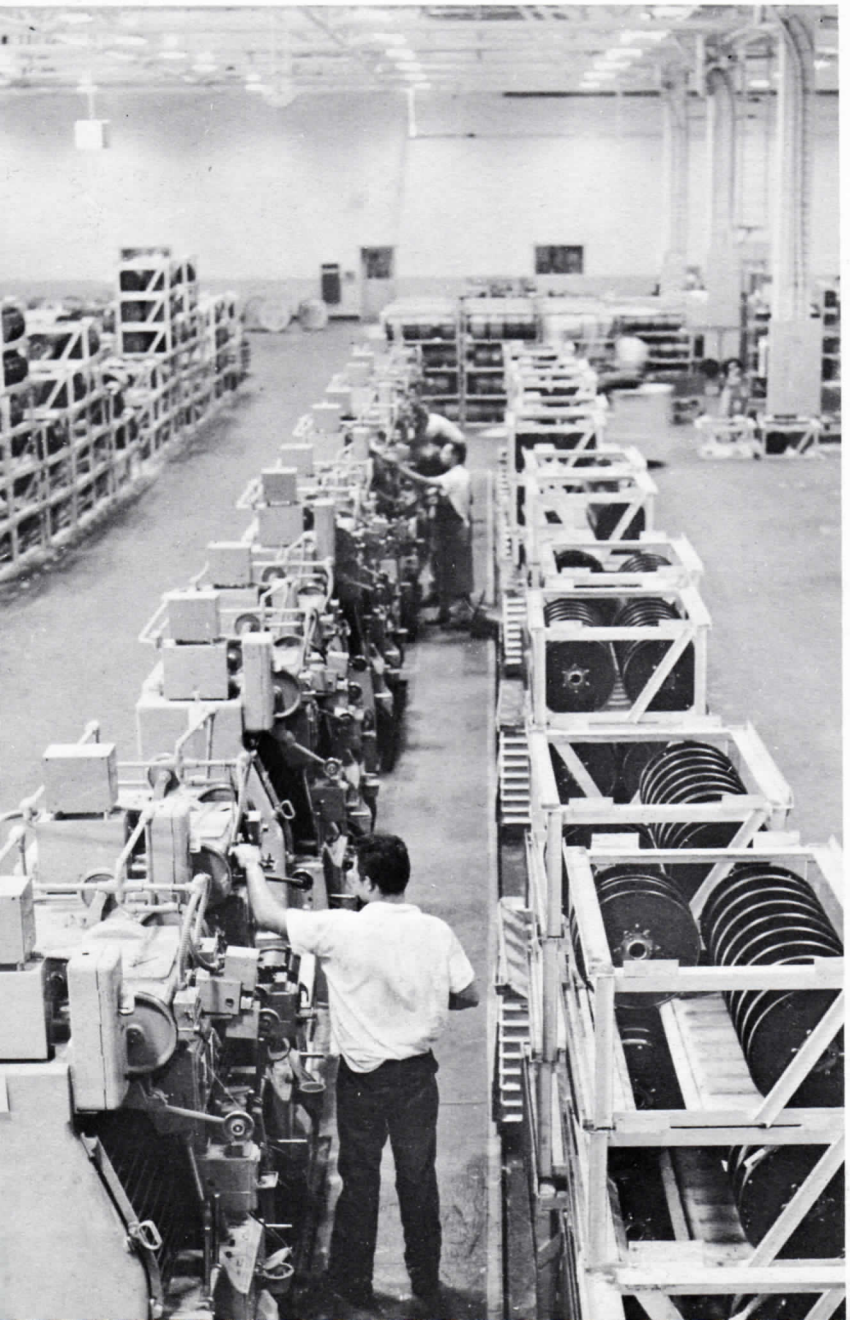
On the tandem wire drawing and insulating lines the 14 gauge wire is whipped off the supply spool and pulled through a series of diamond dies, drawing the wire down to the finer sizes used in telephone cable. Traveling at about 2000 feet per minute, the wire whirls about a set of capstans which heat the wire by electrical current to temper its hardness before it receives a skin of plastic. As the wire races through a die-head, a hot, soft plastic sleeve is formed about it, in either one of ten colors—red, yellow, black, violet, blue, orange, green, brown, slate, or white. The plastic sleeve hardens about the wire as it continues through a water trough, then the insulation is tested along its moving length for high voltage strength and correct diameter. Then the insulated wire is wound up on reels. When one reel is filled, the machine automatically cuts and transfers the speeding wire to an empty reel so that the line is kept constantly in operation.

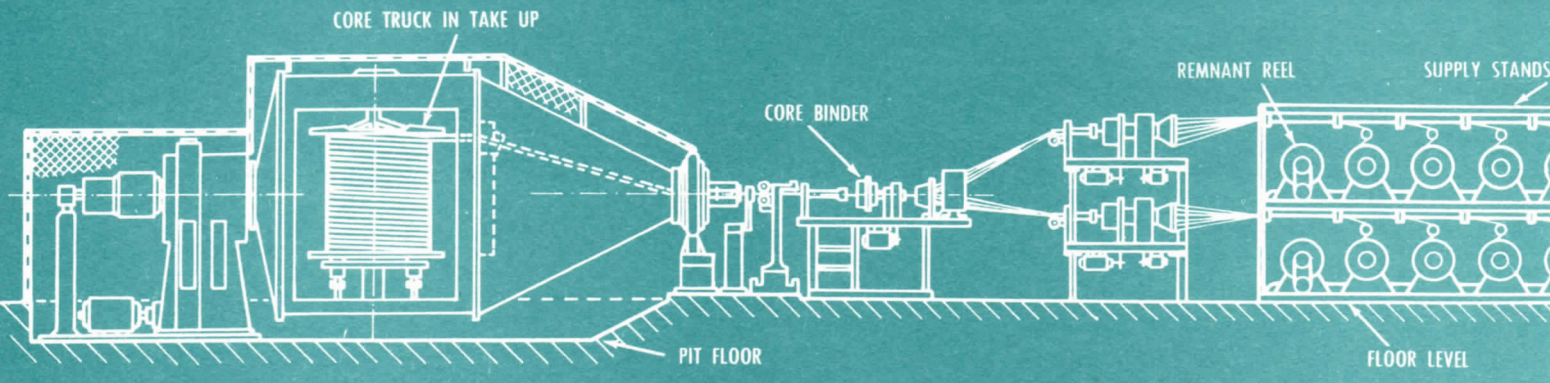
Wire insulating lines are fed their enormous daily diet of plastic, in the form of small granules, from mammoth rubber bags that hold 10,000 pounds of plastic. An electrical "inquiry" is sent to each machine hopper to check if it needs filling. If it does, the automatic feeding system goes to work. The plastic grain flows down from the black bags, nesting on supply stands, into a metal pipe leading to the extruding machine hopper. Heavy puffs from an air pump drive the plastic through the pipes into the hopper until it is filled. A variety of colors can be blown to any single line.

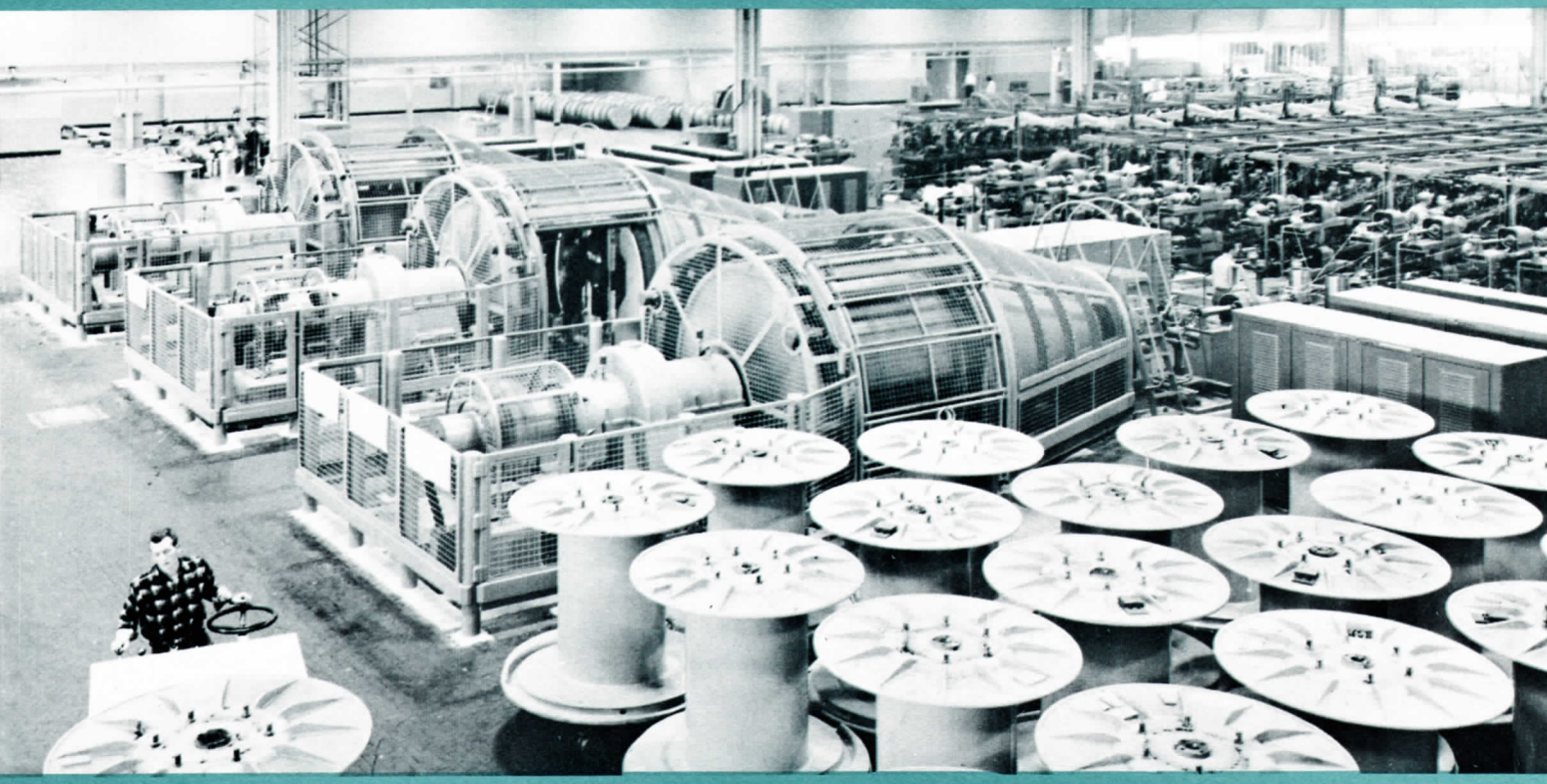

WIRE DRAWING MACHINE
CONTINUOUS ANNEALER
PLASTIC EXTRUDER
WATER COOLING TROUGH
VOLTAGE BREAKDOWN TESTER
PHOTO-ELECTRIC DIAMETER SENSER



At a whirlwind 500 feet per minute, insulated wires are twirled together in pairs on a twisting machine. Twenty-five color combinations are paired, each with a specified twist. Each pair of wires is given a twist of from two to five inches. Twisting is necessary to prevent interference in telephone conversations which would result if wire pairs were simply paralleled.

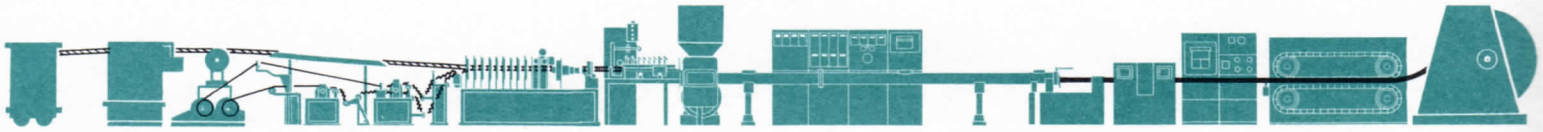


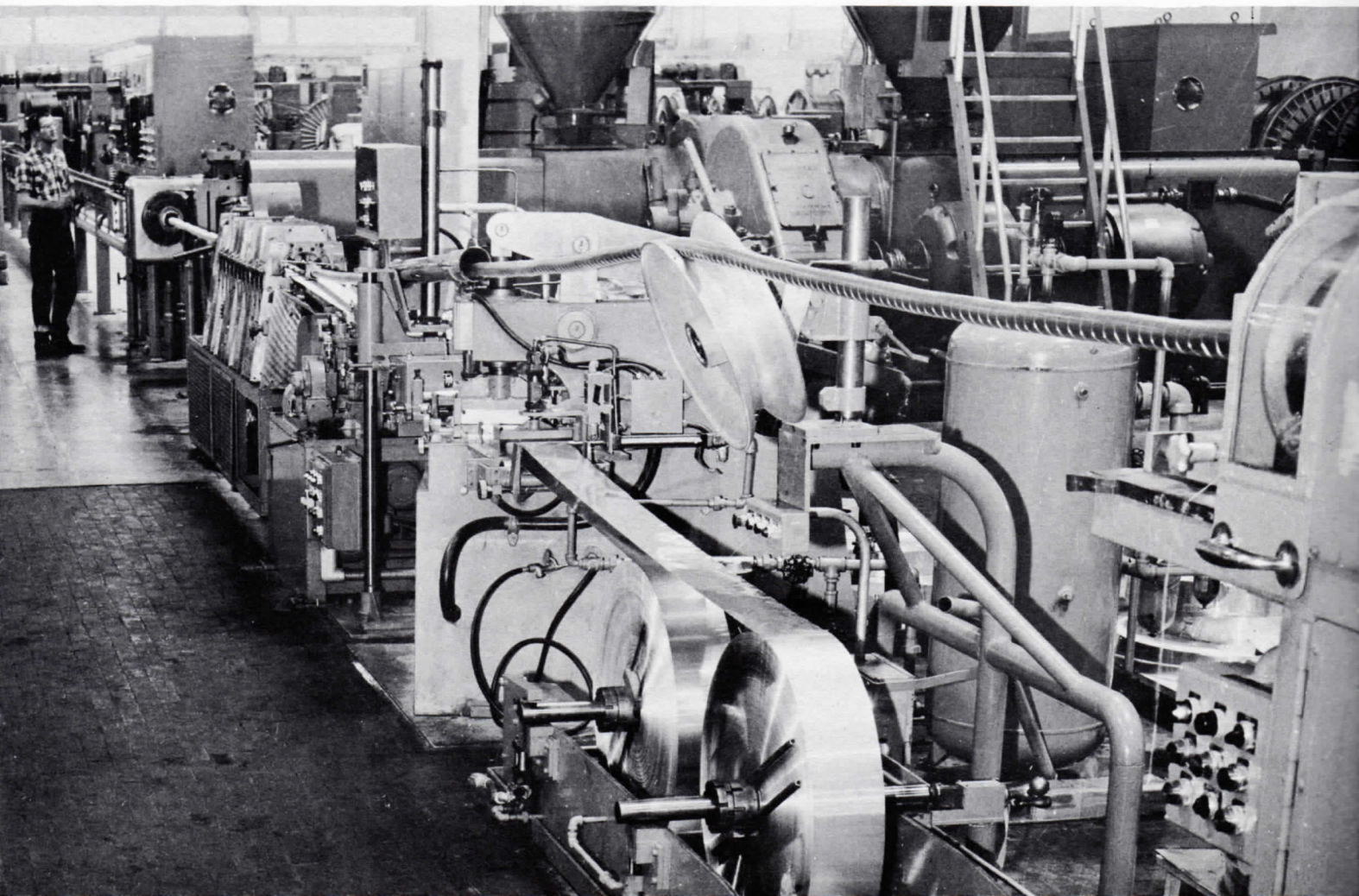


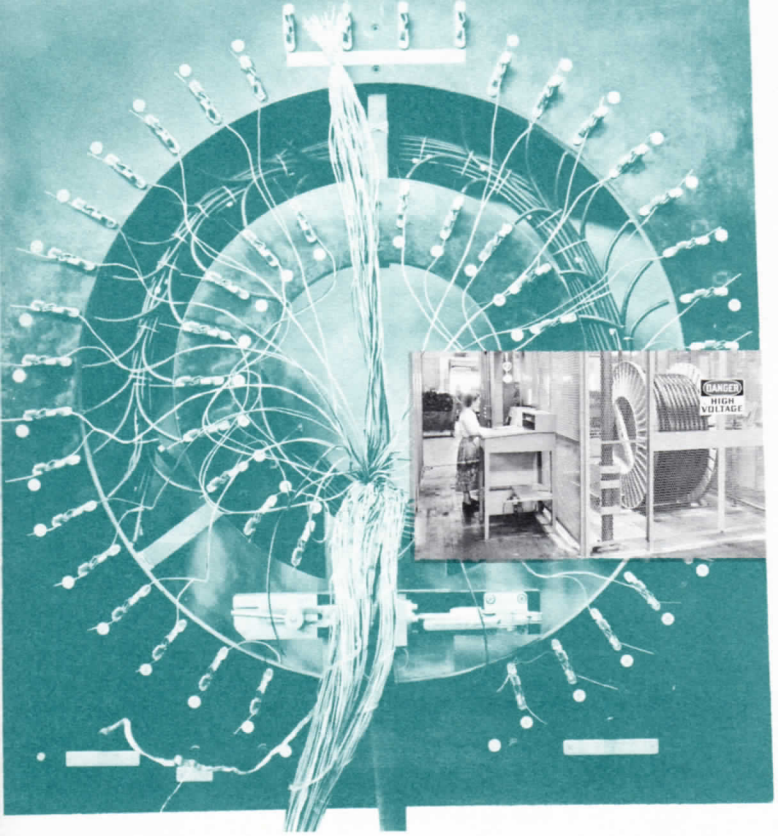


Paired wires are stranded together and formed into cable core in one continuous operation on stranding cabler machines. In one operation, the twisted pairs reel off supply spools, are grouped into "units", and bound with nylon yarn of different colors for identification. Next the units are grouped together and bound with nylon yarn into cable core before entering the giant take-up that holds a 3600 pound spool mounted on wheels, called a "core truck". The core truck revolves, pulling in the formed cable core and winding it up, while at the same time, it is tumbled end for end, giving a twist to the bundle of wires. Stranding cablers form cable core of 400 pairs in one pass. In two operations, 900 pair cable core can be formed.

Traveling through a 200-foot sheathing line, cable core is jacketed in layers of rubber tape and aluminum tape, and a black plastic "pipe" is formed around the shielded cable to complete the sheath. The sheath protects the bundle of conductors against moisture infiltration. Its other jobs are mechanical (to withstand stresses), electrical (to shield against lightning), and anti-corrosion (either in the air or underground). The take-up machine at the end of the sheathing line winds up the cable on a steel shipping reel. Cable sheathed in this way is called exchange cable and runs on overhead poles or under the ground from one telephone office to another, or connects the lines from your home to the telephone office.

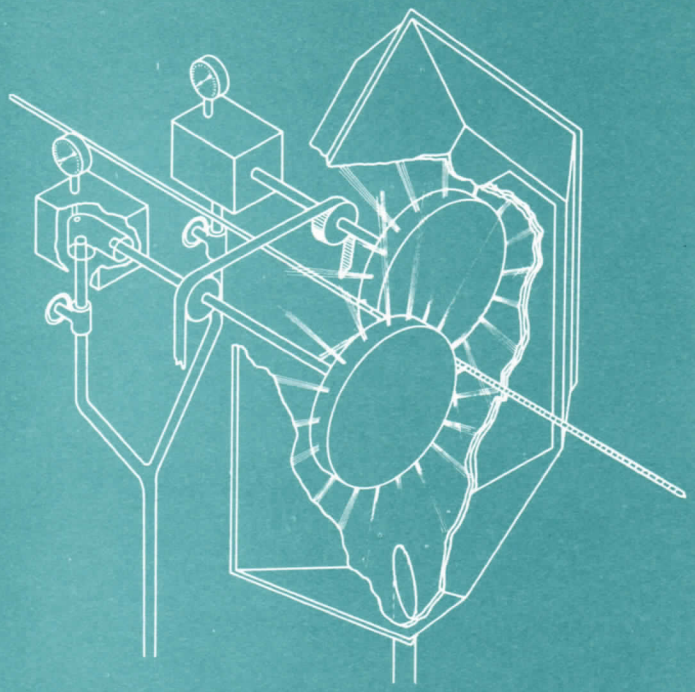




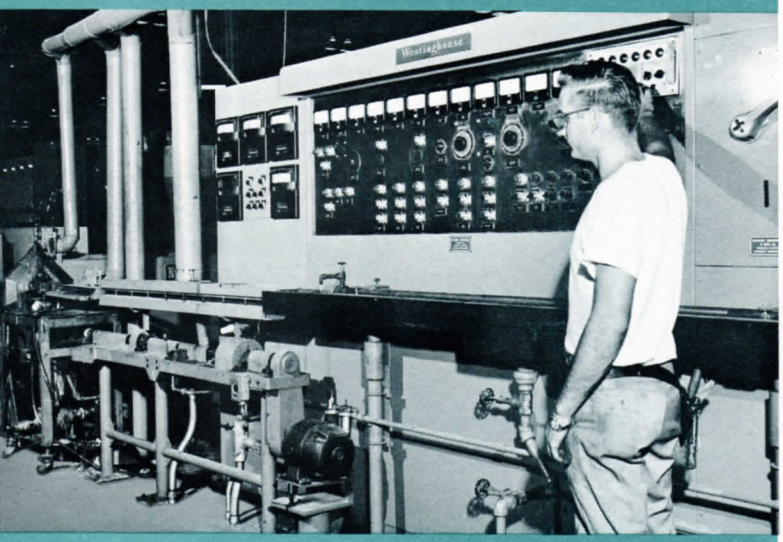


Fanned out, each insulated wire or conductor is clipped to the face of the testing board. Then electricity, up to 10,000 volts on heavier wire, surges through each conductor. Through this high voltage test any shorts from one wire to another will be detected and any wire grounded to the aluminum jacket will be discovered. There is only one passing grade: excellent.

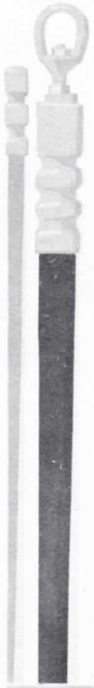
Some cable is armored to protect it from a hunter's gunshot, assaults of a builder's earth-moving equipment or the gnawing habits of gophers. On the cable armoring line, layers of asphalt impregnated paper, and liquid asphalt are applied over the regular cable sheath, as well as tightly twisted bands of steel. Over this, jute cord is wrapped and coated with asphalt. A white solution prevents cable coils from sticking on reel.



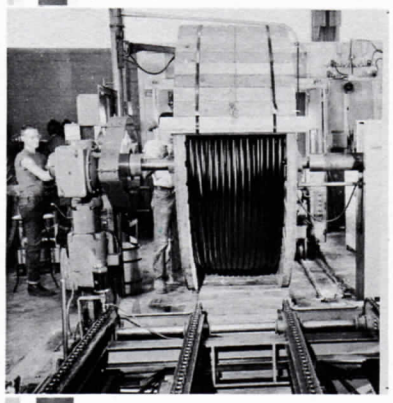
Wire is coded in telegraph-style of dots-and-dashes by spinning wheels spurting quick-drying ink.



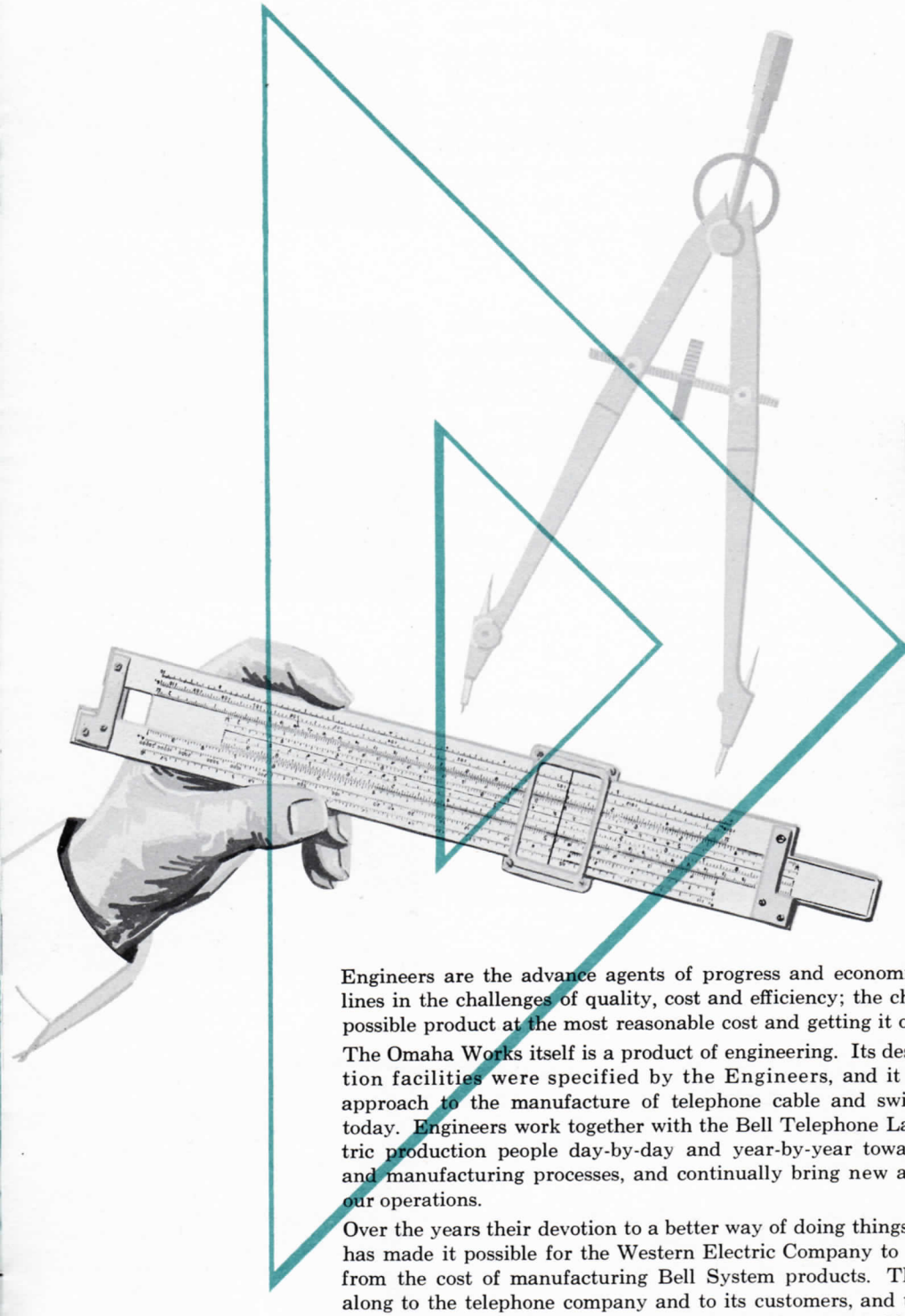
Switchboard cable used in telephone central offices and inside-wiring cable used with multi-line telephones are also made in the cable plant. These cables are made in practically the same way as exchange cable. One difference is that the copper wire is electroplated with tin so it will better bind with solder. Another is that the plastic insulated wire is coded in telegraph-style of dots-and-dashes with colored inks. Then there is a difference in the plastic used to make these indoor cables; it is fire resistant. For a final extra touch, a strong nylon cord is bundled with the wires so that the telephone installer can cut open the outer plastic jacket with a pull of the cord.

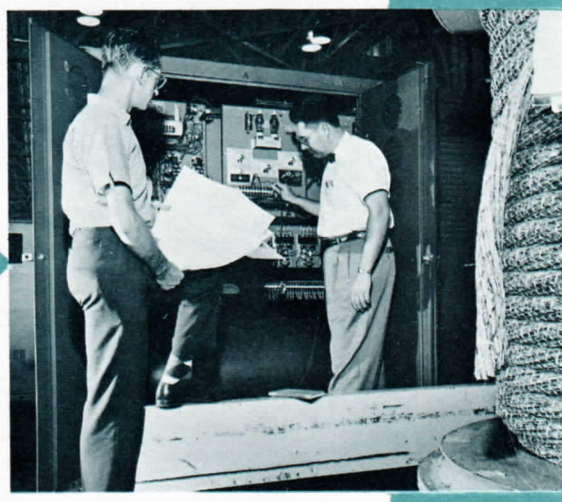


Before shipment, cable ends are capped with metal cans. The mouths of the cans are crimped against the cable sheath, forming a moisture tight seal. Cans with pulling-eyes are used on larger cable, and some small cable, to supply a strong grip when cable is pulled through underground conduit or over pulleys on telephone poles. Other sealing cans have valves, like those on automobile tires, so that nitrogen gas can be pumped into the cable to check for fractures in



the sheath. Next, the shipping reel with sealed cable is placed in a machine that semi-automatically wraps wooden lags about the reel. Employees bind lags on reels with metal straps. Then, the packaged cable is placed on a metal cradle that glides out to the cable shipping yard.





Engineers are the advance agents of progress and economic growth who man the front lines in the challenges of quality, cost and efficiency; the challenge of producing the best possible product at the most reasonable cost and getting it out on schedule.

The Omaha Works itself is a product of engineering. Its design, floor layout, and production facilities were specified by the Engineers, and it represents the most scientific approach to the manufacture of telephone cable and switching equipment that exists today. Engineers work together with the Bell Telephone Laboratories and Western Electric production people day-by-day and year-by-year toward improving product design and manufacturing processes, and continually bring new and greater efficiencies into our operations.

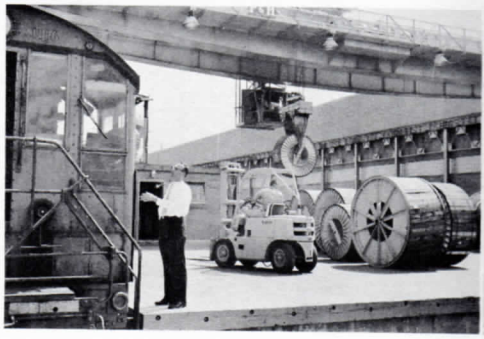
Over the years their devotion to a better way of doing things with savings in cost and time has made it possible for the Western Electric Company to shave over $10 million a year from the cost of manufacturing Bell System products. These economies, in turn, pass along to the telephone company and to its customers, and this accounts for the fact that the world's best telephone service is so good and so reasonably priced.

Purchasing Department

Their job is to buy. They issue thousands of purchase orders a month to "our partners in production", the suppliers of the materials and tools required for our manufacturing operations. This organization, extending throughout the network of manufacturing and distributing locations to headquarters in New York City, not only buys for W.E., but for all the telephone companies in the Bell System. They buy 150,000 different items from over 37,000 suppliers, more than 90 per cent of them in the "small business" category. Handling the Bell Family shopping list allows our highly trained people to buy in large quantities and permits greater standardization of materials and products. This gives the suppliers the chance to plan ahead and helps keep prices down.

Traffic Organization

Getting material where needed—when needed—and at the lowest possible cost is the job of the Traffic Organization. The traffic people direct and supervise all transportation—motor carrier, marine, railroad and air—required by the Omaha Works. They bring material and machinery from suppliers to here, move material between plants and route our finished products. Traffic also secures passenger reservations and arranges the movement of household goods for employees who are transferred. (No small job at a new Works.) They also assist Bell telephone companies on transportation problems such as the shipping and expediting of thousands of new telephone directories. With their knowledge of a "million" up-to-date details on routes, rates, classifications and carriers, the traffic people keep transportation costs at a minimum.

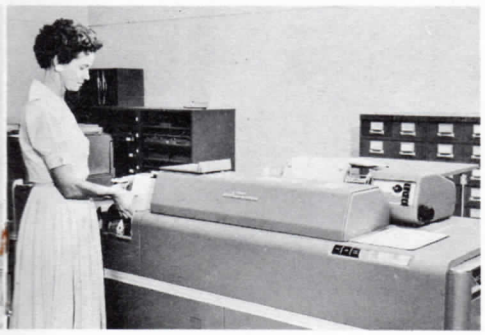


Personnel Organization

Their work concerns the employee from the day he is hired. They are responsible for assisting all organizations in their many personnel responsibilities. They administer the Company's Benefit Plan, one of the oldest and most liberal in industry, that provides financial help when an employee is sick, hurt on the job, retires or dies. They arrange for pay allowance for periods of military leave, and handle the Tuition Refund Plan that aids an employee in paying for college courses. Even an employee's safety is their concern, whether it means getting safety glasses for a person or a steel guard for a machine. Should a person let his safety guard down and get hurt, the medical staff of this organization is prompt to give treatment.

Merchandise Organization

They coordinate the Bell telephone companies' requirements for equipment with the manufacturing departments. The Bell customers place their orders for cable, apparatus and central office equipment with one of the Company's 32 distributing centers located throughout the country. Then the order is forwarded to the Merchandise people who plan future needs for equipment and place orders accordingly with the manufacturing people. When the equipment is completed, the manufacturing organization delivers it to Merchandise where it is stocked and shipped, when ordered, to the distributing centers. In other cases, the equipment that Merchandise orders must be custom-made to fit the needs of a particular community. When this tailored equipment is delivered to Merchandise, it is packed and shipped to a W.E. installing team for assembly in a telephone office.



Accounting Organization

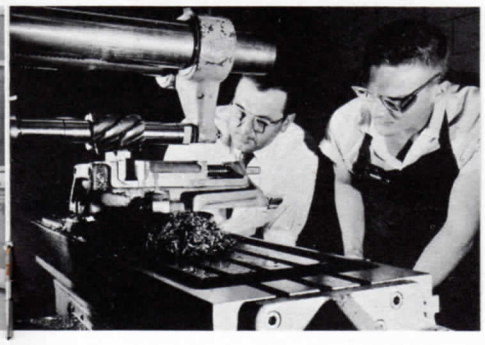
Their world is figures. The figures are signs of cost and price, production and people, material and hours. They pay suppliers and bill the Telephone Sales Organization. They add up the past and estimate the future — their budgets furnishing targets for tomorrow's performance. Their most popular product is a paycheck, which has as many sub-assemblies — taxes, social security, hospitalization, union dues, sickness absence, etc.—as do some products of the shops. As much as is possible, the accountants mechanize their operations, rendering their calculating to punch cards and programs arranged on magnetic drums, thus providing more time for minds to evaluate and analyze data. They also have a hand in developing the most efficient procedures for clerical work.

Works Service Organization

The Omaha Works is a community of over 4,000 people, with a fire department, a water department and a guard force. As it is with any community of this size, daily maintenance and service requires the skills and trades of carpenters, plumbers, glaziers, masons, matrons, locksmiths, cleaners, telephone operators and so on. Its fire alarm system is similar to the one used in the city of Omaha. The sixty red-bright boxes installed throughout the shops and offices contain telephones that connect directly to an emergency reporting switchboard located only a few steps away from where firemen and equipment are ready day and night to answer any fire call.

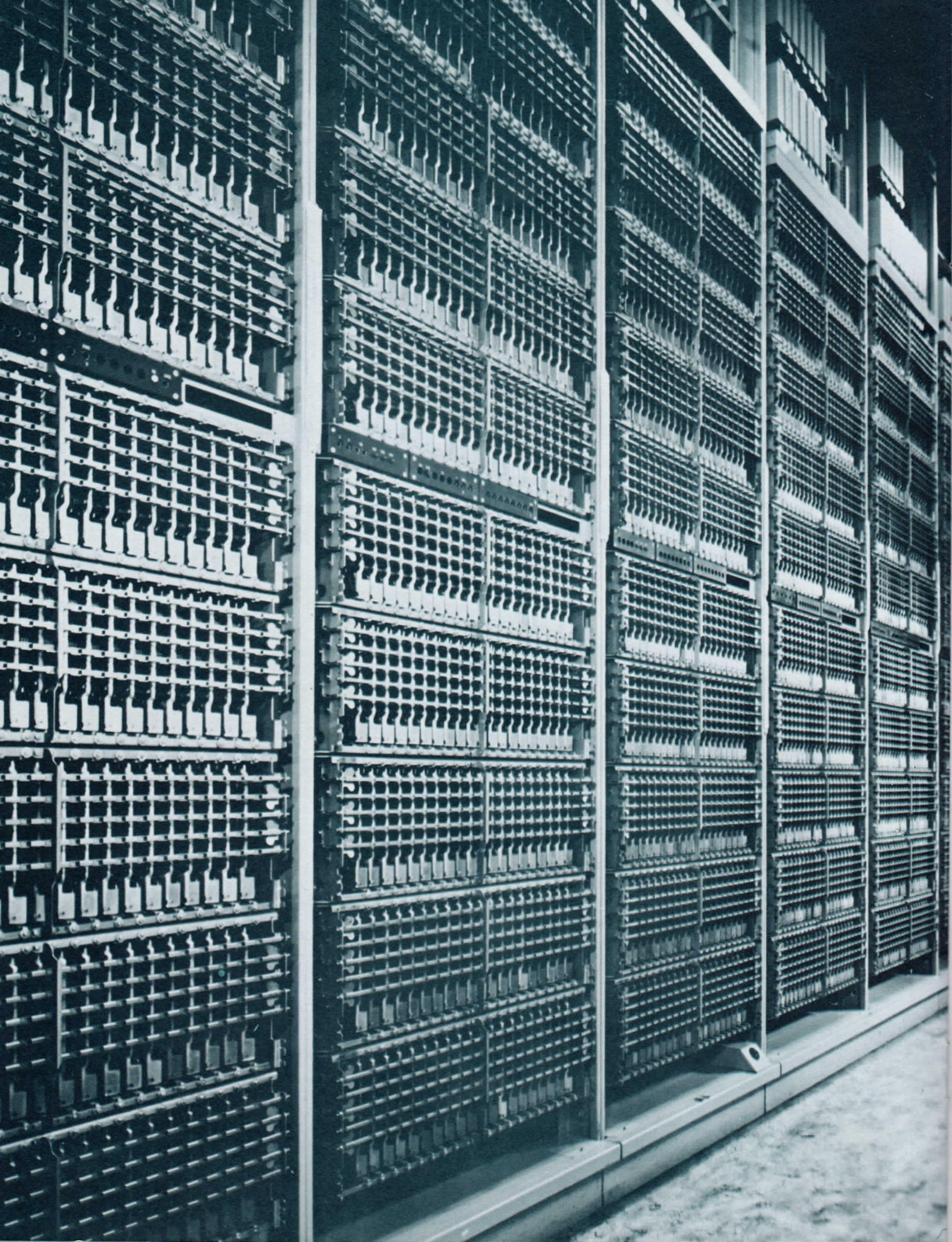
Weoma Club

Jumping for a basket, sliding to a base, and rolling a bowling ball are only a few actions that the Works' men and women do for exercise and enjoyment. Others enjoy the pleasures of landing a trout and flushing a pheasant. All these interests, and many more, are catered to by the Weoma Club, which promotes social, recreational and educational interests of its members—who are *all* the employees. The Club, sponsored by the Company and headed by the employees, arranges evening classes in vocational and first aid subjects and group activities as picnics, dances and fashion shows.



Builder of Skills

Building skills is as essential to an advancing industry as building products. Two trades—tool and die maker and machinist—are being built through formal training programs with a set curriculum, classes, texts and full-time instructors. The programs are for three and a half years, though trainees are given credit for certain previous experience. The trainees learn by production; there is no practice work. They make precision parts for the tools and machines of manufacture with the same degree of accuracy expected of more experienced tradesmen and their work must meet the same inspection requirements. Western Electric has been the builder of skills and trades for over fifty years, ever since its first formal training program began in Chicago in 1904.



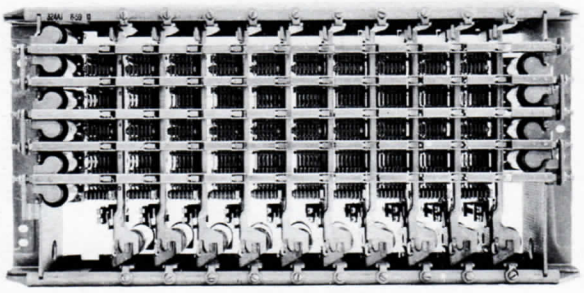
Maker of Dial Service

We may not be there when your telephone call comes into a central office, but the apparatus and equipment we make will be. Responding to your commands made by the spin of a dial, the intricate machinery will service your call at any hour. Even in the dead of night, if you stand among banks of telephone dial equipment, you can hear the equipment softly clicking as it responds to the electrical impulses sent by a dialing forefinger located blocks and even miles away.

When you dial, you tell *control equipment* the number you want, and the *control equipment* finds the proper path through the *switching network* and closes the necessary switches to complete that path. The *control equipment* has a great many parts, one of which is the relay. The bulk of the *switching network* is crossbar switches.

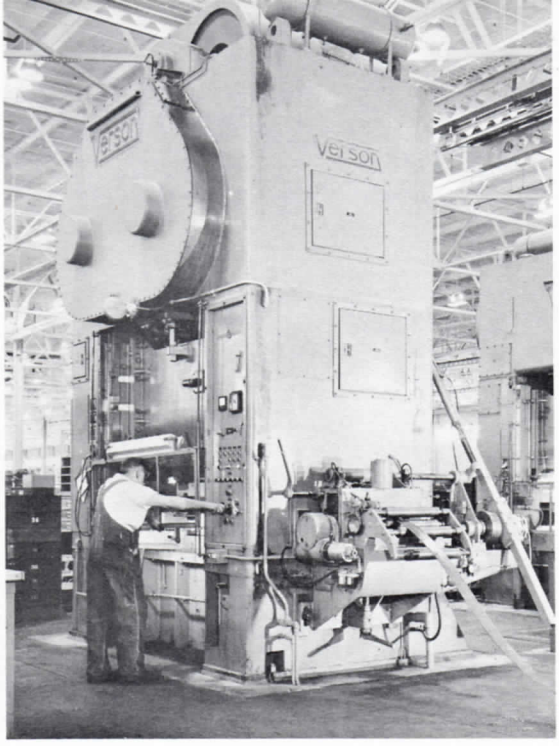
A *relay* is a combination of an electromagnet and switches. It is turned off and on by an electrical current. When the current is on, the relay will say "yes" and "make" some circuits, to other circuits it will say "no" and "break" them. Out of thousands of very rapid "yesses" and "noes" the call is routed through the network of relays and crossbar switches and the call is completed.

We make relays, many types, by the millions for the Bell System. We make the *wire spring relay,* a compact package of electromagnet, wire and plastic. Its delicate wire fingers, tipped with precious metal, rapidly snap closed and spring open to electrical pulses. Parts for this relay are made on some of the most automatic machinery in the Omaha Works. Then there is the *dry reed relay* that consists of two slivers of magnetic metal set very slightly apart in a gas-filled, sealed-glass tube. Placed in a magnetic coil, the metal contacts can flick together and apart, making and breaking a circuit, 250 times a second.

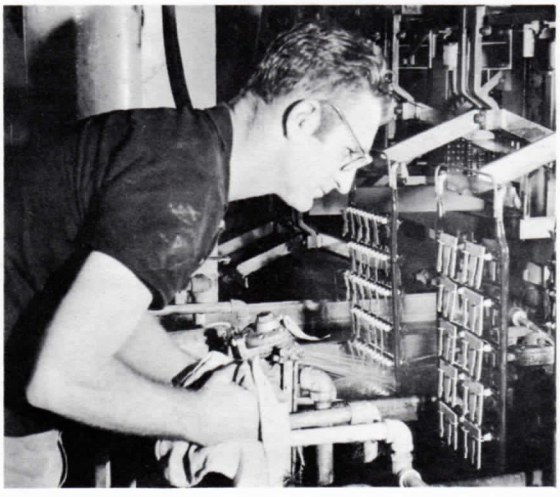


We make *crossbar switches* by the thousands for the Bell System. The crossbar switch is a rectangular unit (see illustration) with horizontal and vertical bars that cross each other. The horizontal bars hold a number of slender wire fingers that project into a pile-up of contacts mounted behind the vertical bars. Electromagnets can tilt the horizontal bars up or down, moving the wire fingers, and other electromagnets can pivot the vertical bars, closing the contacts. Everytime the bars are moved a connection is made; a wire finger is positioned, contacts are closed, and the wire is held in place making a circuit. The points of connection are called "crosspoints". Small crossbar switches have 100 crosspoints; the large switches 200. Through these crosspoints a talking-path is made from one telephone to another.

These telephone products are made in the 1,000,000 square foot Crossbar Plant. They are made so reliable, and work together so perfectly, that you take them for granted when you lift the telephone receiver and dial.

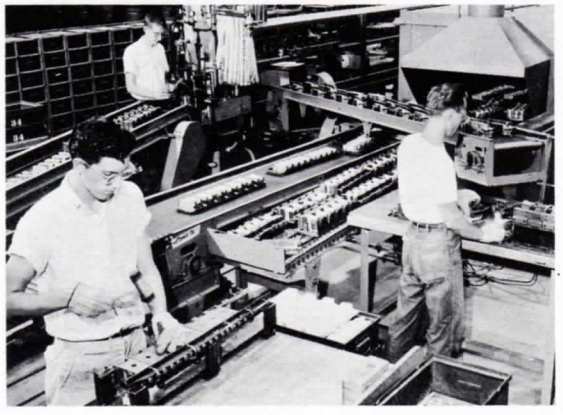


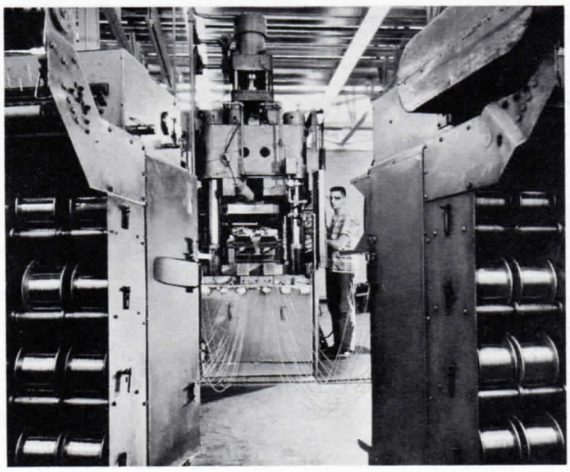
From sheets and ribbons of metal the shapes of communication are pressed. Almost every part in a crossbar switch and a wire spring relay is made in our shops. Parts—from brackets the size of a book of matches to skeletons for the stately 11½-foot frames that hold the dial equipment—are stamped to shape in mammoth machines that pack a 400-ton punch and by small presses that are set on benches rapping out parts at high speeds. Some complex parts are made on turret presses—at which an operator can select one of twenty-eight tools by the push of a button.



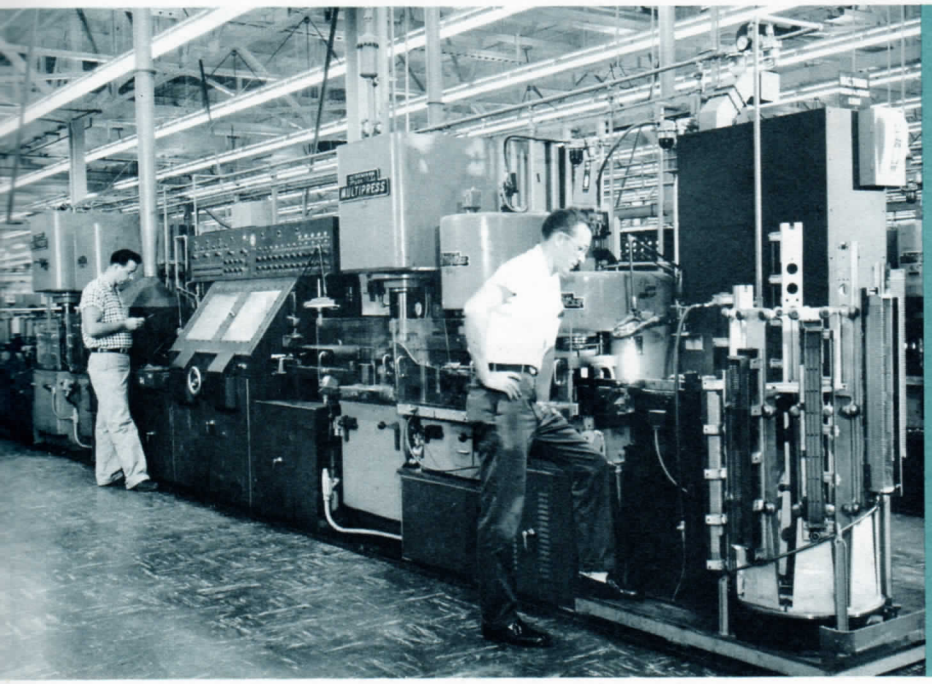
The surfaces of most metal parts are protected for long and better service by plating with copper, nickel, tin, zinc or chrome. Automatic plating machines handle the bulk of the finishing work. The metal parts are hooked, clamped or tied to racks that are loaded on an overhead conveyor. Without even the need for eyes to keep sentry, the conveyor carries the racks along, placing them in cleaning tanks, picking them up and placing them in plating tanks, until the parts are ready for service.

Ever hear of square wire? Well, many miles of wire —and *it* is square—are used in a year to make millions of cast resin *terminal strips.* First, the brass wire is coated with copper and tin so it will bind better with solder. Then short lengths of the wire, up to 300, are arranged in rows and clamped in molds. A precisely mixed batter of plastic is poured into molds and over the wires. Conveyed through a curing oven, the molds are heated and the plastic hardens. The plastic blocks, with wires or terminals protruding on two sides, are mounted on crossbar frames to provide an easy means of connecting wires.

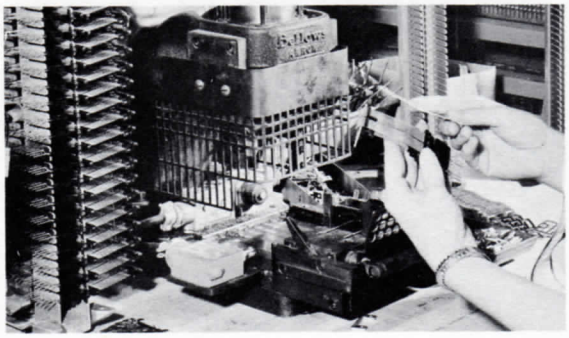




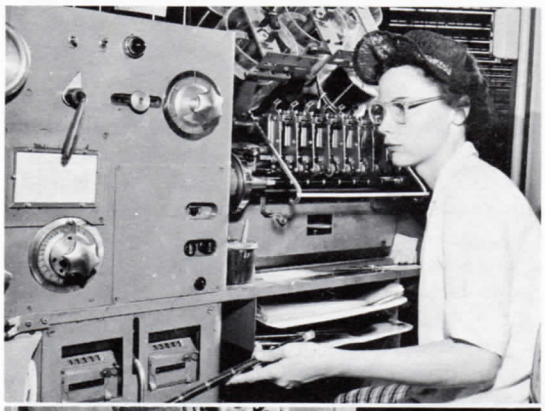
Have you ever tried to straighten wire? This was a problem the engineers had to solve in order to make the wire spring relay. Today, miles and miles of coiled slender spring wire is *straightened* as it comes off spools. A unique machine, containing two sets of dies rotating in opposite directions, handles 24 wires at a time. The wires flow straight to a molding press that forces a plastic compound around them to form individual wire spring "blocks". The blocks consist of wires, nearly five inches long, embedded in a palm of plastic that holds the wires in place and insulates them from each other.

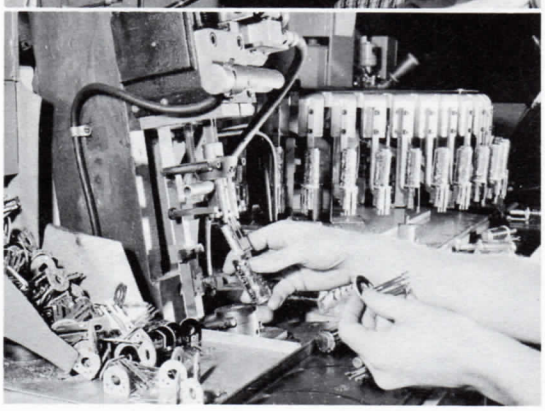


On the wire welding and forming *lines,* the blocks of wire and plastic pass, without the help of hands, through seventeen different machines. These lines are controlled by a complex series of master switches, resembling the popular conception of the control panel on a space ship, that can start or stop any operation as the wire blocks move from machine to machine. All the operator does is load blocks on one end of the line—they emerge at the other end with wires bent to form springs, a contact of precious metal welded on each spring, wire ends formed into terminals, and completed blocks stacked in carriers ready to be assembled into the finished relay.



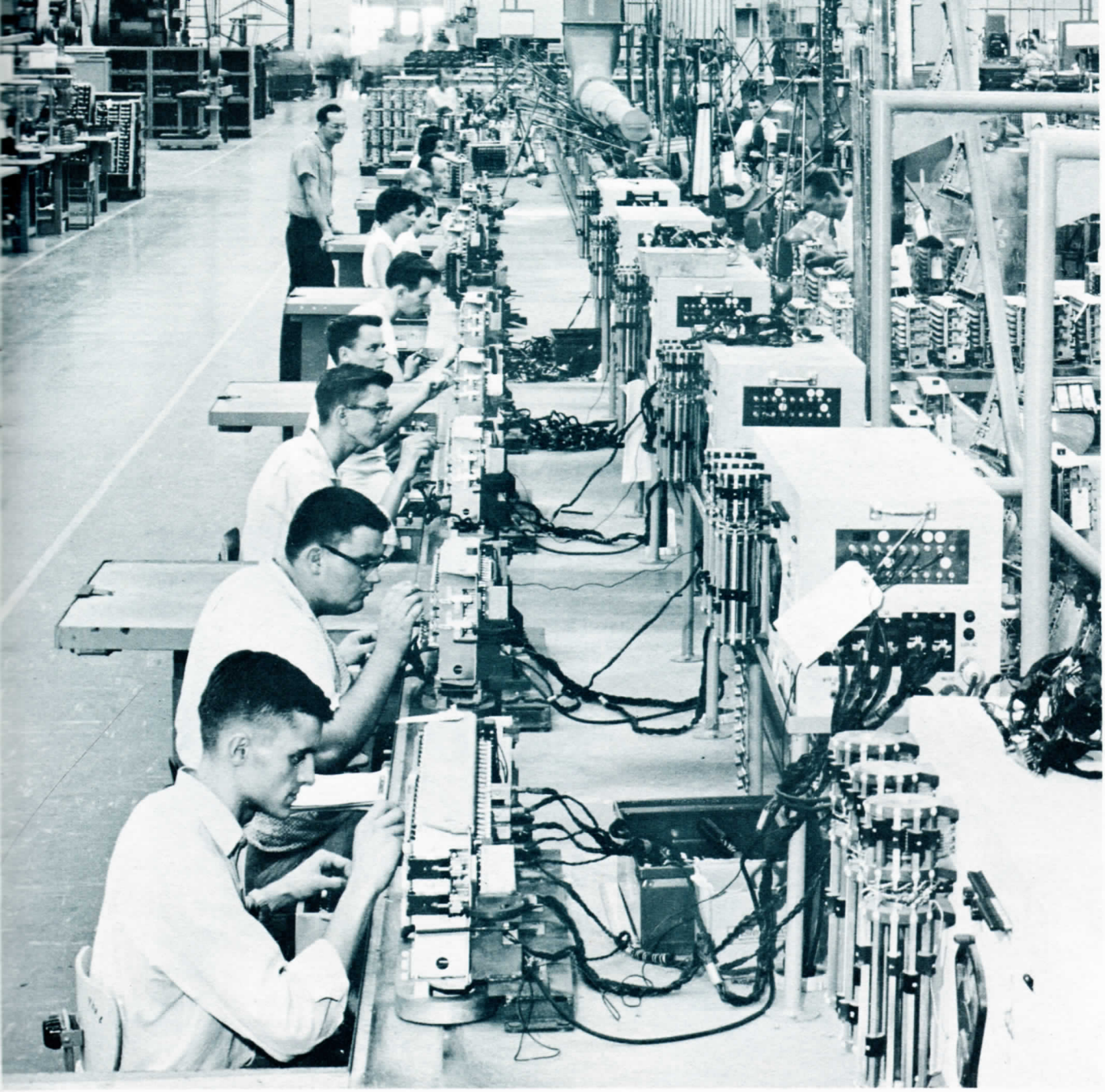
Women's hands assemble the wire spring relay. Upon an electromagnet assembly are placed the contact blocks—one stationary block of 12 thick wires is sandwiched between two movable blocks of 2 to 24 thinner wires. A press forces a simple U-shaped clamp to snap tightly about the assembled parts, binding them. The performance of every relay is carefully examined on rows of complex testing devices. If a relay fails to work properly even once during its service life through 100 to 200 million operations, it is considered a poor performer.



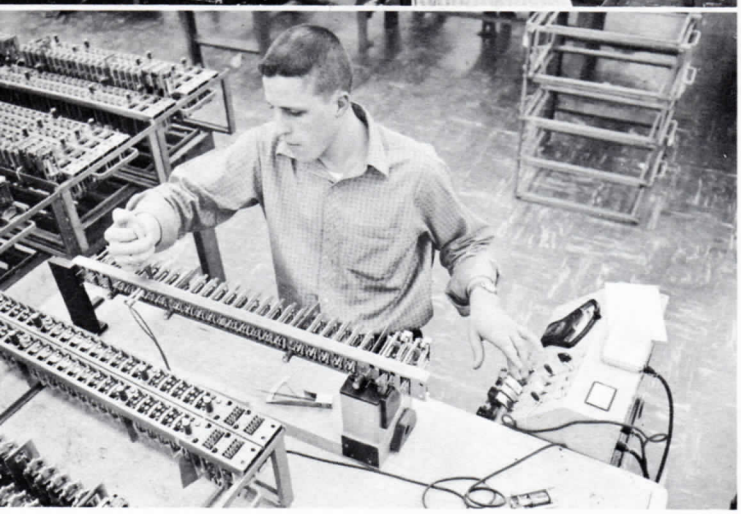


The muscle of modern dial equipment is the electromagnet. When electricity passes through its coil, the electromagnet opens and closes the switches and contacts. This device can also tilt and pivot crossbar switch units, and perform other mechanical tasks necessary to make telephone connections. The wire coils for the electromagnet are wound on a "stick" seven at a time. Semi-automatic machines direct the very fine, dark enamel wire back and forth over a course of about two inches on the twirling stick that winds the wire around and around from two thousand to seventeen thousand times. Between each layer of windings the machine places a sheet of celullose acetate for insulation. The coils are cut from the stick, the delicate leads are pulled and the coils are sealed by heat. Next, they are assembled with a core of soft iron, further sealed with a bath of acetone and then, under a large magnifying glass, the hair-like leads are soldered to spool heads.

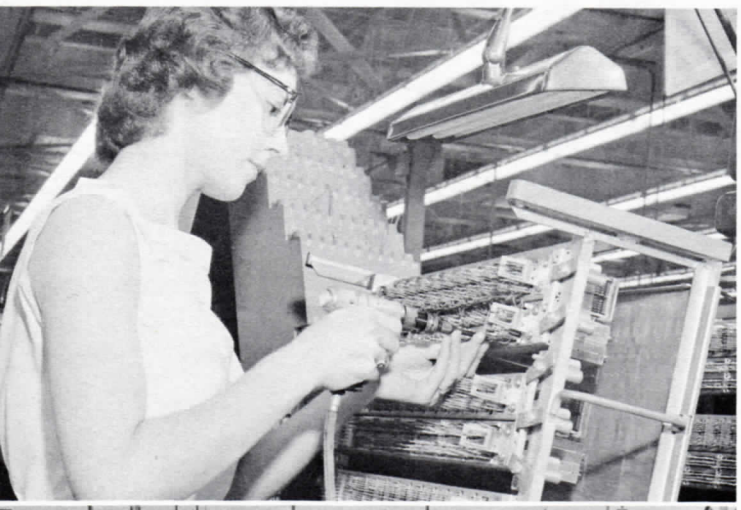
The servant of industry, the conveyor, adds its efficiency to the building and adjusting of *vertical units* for the crossbar switch. By a procession of carriers, moving steadily on a conveyor, women assemble the vertical unit, which is then transported through a machine that tin-dips the terminals, and then to the benches where women add the electromagnet to the unit. It is then carried to the adjusting benches through the graceful turns and gentle descents of a conveyor. The flat metal contact springs with their tiny palladium contacts which make the crosspoints or circuit path through the crossbar switch are carefully adjusted and given a 500-volt breakdown test. Then the unit is again taken upward and across to the crossbar switch assembly benches.



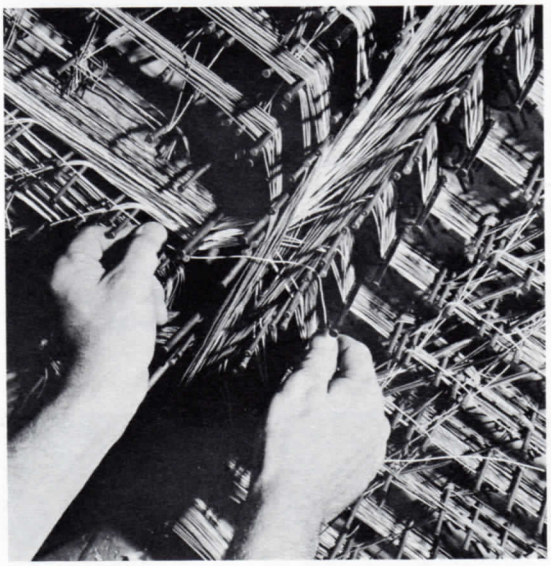
The assembly of the complex crossbar switch from piece parts, units, and many sub-assemblies, as well as wire and solder, is done on two 160-foot benches. As the vertical units flow down and across the mounting positions, they are removed from the conveyor and fastened on to a rectangular framework. The framework, filled with the vertical units, begins its journey to completion on a conveyor belt of steel. The crossbar switch takes on its lattice appearance with the addition of the horizontal bars with their slender wire fingers and their metal ears at each end that flick with the pull of magnets to tilt the bar. All of the crossbar switches are automatically "kicked-off" along the line for inspection, wiring, adjusting, and testing. When you consider that even the simplest switch has almost 4,000 parts and a really complex unit contains 7,520, it's no wonder it takes a lot of work to tune-up a switch that will perform for a long, long time.



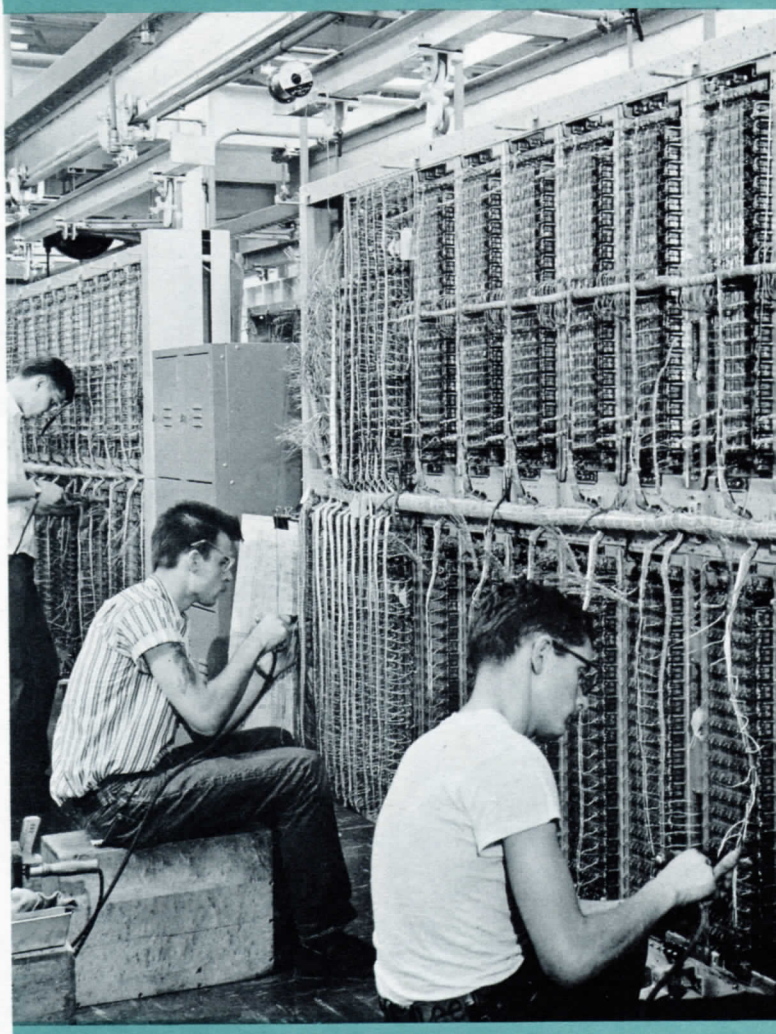
The small mechanisms of communication, the robots that respond to electrical impulses and control the telephone call through switching equipment, are mounted on sturdy U-shaped metal plates. With a whirr of an air-driven screwdriver, a small unit is fastened tight to its assigned place on a plate. Apparatus is coded for wiring by letter and number stamped in black on the channel of the plate where the wire terminals of the apparatus appear. The line of mounted mechanisms is then inspected, some tested and, where necessary, adjusted.



The plates, mounted with small apparatus, are fastened to stands before *wiremen* (almost all women) who connect the apparatus together with short lengths of wire. By looking at a drawing, an operator selects the correct wire from a supply stand holding a variety of lengths, all precut and their ends skinned of insulation. The operator wraps one bare end of wire (shiner) to a coded terminal and weaves the insulated length, through the maze of terminals bristling from the back of the plate, to the proper terminal where it is connected. Some connections are soldered, but most are solderless connections made by a wire-wrapping gun. The barrel of the gun containing a shiner is slipped over a terminal—the trigger is pressed and the bare wire is spun tightly about the terminal. It is fastened so tightly that soldering isn't necessary. This is quite a cost-saving on millions of connections.



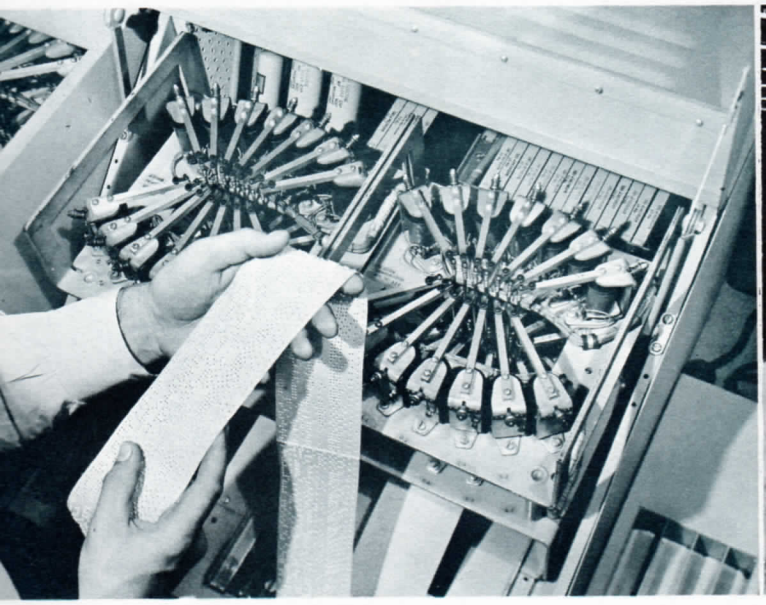
Men and not machines form the cable for crossbar equipment frames. *Cable formers,* following a wire running list, pull color-coded wires from overhead supply spools and lead them in devious ways over a tilted, nail-studded board. Wire by wire the cable is built up into a precise pattern. Some cables are made from only two dozen wires; other from over eight thousand. After forming, the cable is tied and the wire ends are cut. Some insulated ends are stripped to expose the bare wire. The formed cable will be connected to terminals on the back of the frame thereby interconnecting the apparatus.

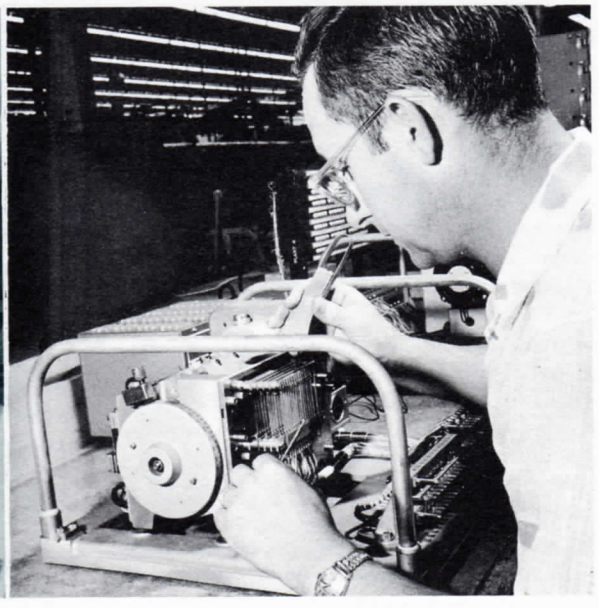


Upon sturdy, grey-painted frames are collected the products of the shops—mounting plates with columns of telephone mechanism, and crossbar switches with their lattice of vertical and horizontal units. The assembled apparatus is bolted down. Then the laden frame is lifted to the overhead monorail system of one and a half miles of track and 180 switches. A cable wireman rolls the frame on the track to a place where the pre-formed cable will join it. The attached cable reaches out like the veins of a leaf to touch the many points where the wireman wraps its bare ends to terminals to knit the rows upon rows of apparatus into circuits. The connections are inspected and apparatus is exercised by electrical tests before the frame is rolled along to packing and shipping.

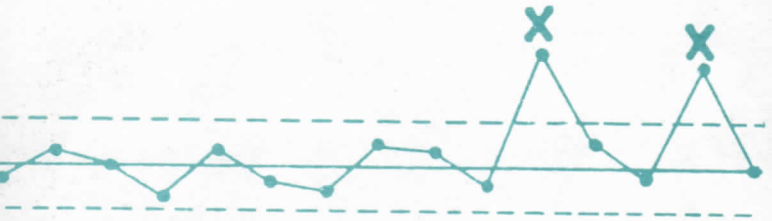
Every wire that links equipment into a circuit is *tested* and *inspected* by eye and electricity. Eyes will scan solder and solderless connections, using a tiny light and magnifying glass, or maybe a dentist's mirror, for a closer look. Electrical testing tools can be as simple as a bell and battery with two leads that "buzz" a wire. Or they are as complex as a test machine being directed by a perforated tape to send an electrical current through hundreds of circuits and visually report performance failures on a panel of lights. Almost every step in the building of a product is inspected. This is done to make sure that our Bell telephone customers get the best equipment in the world.

Building a miniature telephone central office into two modules, the height and depth of file cabinets, is the engineering feat accomplished in the *756A PBX* (Private Branch Exchange). Six vertical slides, filled with relays, crossbar switches and other electrical apparatus, can serve 40 or 60 telephone lines in a small business. In addition to regular switching service, it also provides special services such as: a conference circuit arrangement for as many as five persons, a paging setup that can be connected to a public address system over which anyone can page simply by dialing a number and speaking into the telephone transmitter, and a "camp-on" service which permits a call on a busy phone to "camp-on" the line and automatically cut through when the telephone is free.





One of the latest methods of telephone billing is *Automatic Message Accounting*. A. M. A. automatically records the calling number, as well as the called number, and the connect and disconnect times of a telephone call, by making perforations on a paper tape. Then this billing information on the paper tape is processed through machines that read the perforations and transcribe them into electrical information that is transmitted to calculators which produce customer billing. The machines that punch the paper tape and the machines that read the perforations are products of Omaha.



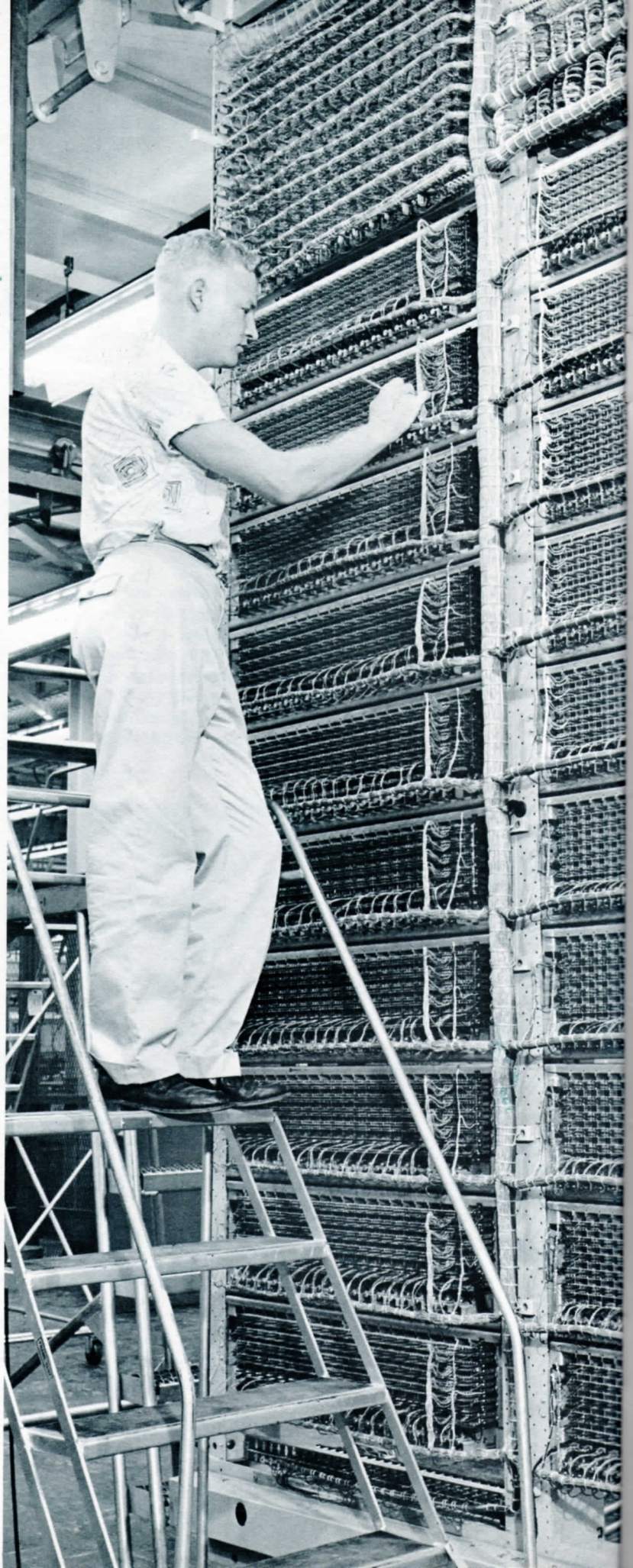
Quality and Guardians

Quality has a special meaning to our work. Each product is a part of something far larger than itself—the total plant of the Bell System. One weak link, one failure, might cause a major disruption of service. Therefore, the products must be of the highest quality.

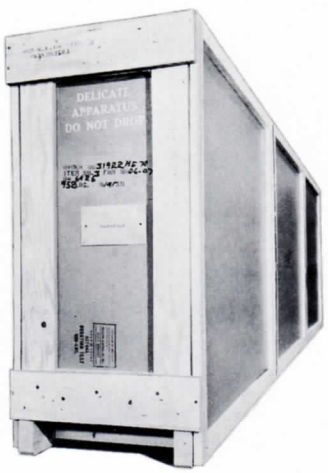
Safeguards have been set up to maintain our standards of quality. One is continual testing and checking during manufacture. Another is Statistical Quality Control, a system of mathematical analysis of product characteristics which helps achieve and maintain control of our manufacturing processes. Its key tool is the process control chart. These charts, with a solid line centered between two parallel broken lines, can be seen throughout the shops, mounted in front of machines, or hanging over assembly benches. The broken lines represent the limits within which product characteristics are to be held. Whenever *something* affects the process adversely, points may fall out-of-limits. The *something* could be a worn machine, bad piece parts or raw materials, an inexperienced operator, a change in processing methods, or a whole host of possible variables. Whatever it may be, the chart is a graphic means of detecting its presence and leading to its correction or elimination.

Still another safeguard is the audit of completed telephone products being shipped. This is done on a sample basis by the Quality Assurance Organization. The samples are thoroughly checked and defects discovered are assessed as to seriousness on a demerit basis.

All such safeguards can tell us only if quality is, or is not, present. They cannot put it there. To exist, quality must be *built in*. Quality is achieved by those who design a product, those who make the tools and machines to produce it, by those who assemble its parts and components. It is, therefore, everyone's job at Western Electric and everyone's achievement.



The completed crossbar frame may weigh more than 2,000 pounds, yet it is precision made and its small units are highly sensitive. So, the frames are carefully handled and packed for shipment with specially designed protective materials, metal straps, much lumber and many nails. Perhaps the name and address of the telephone company in your home town will be inked on the crate. Shipping is not necessarily the final step in our Bell System work. Many of our products are sold to customers in the form of a working telephone central office. Then the final step is the assembly of the equipment into an operating telephone switching office. This is done by the men of our Installation Organization which operates in 44 states from 14 area headquarters. One such headquarter's office is located in Omaha. The installer's task is to transfer the tons of inert equipment into a smoothly functioning telephone office.



Western Electric Company
INCORPORATED

PRINCIPAL MANUFACTURING, DISTRIBUTING AND INSTALLATION LOCATIONS

- ■ MANUFACTURING LOCATIONS
- ● DISTRIBUTING HOUSES
- ▲ INSTALLATION AREA OFFICES

Western Electric

MANUFACTURING AND SUPPLY UNIT OF THE BELL SYSTEM

Western Electric . . . a coast-to-coast network serving the United States Government and the Bell Telephone System.