

WE

JANUARY 1969

WESTERN ELECTRIC 1869 1969
100
CENTURY OF PROGRESS





Western Electric: we make Bell telephones.

We also make things for the network that keeps your calls from getting stuck in traffic.



The Bell System telephone network has plenty of traffic too. The number of phone calls increased last year to over 300 million a day. But, in case you haven't noticed, your call to almost any place in the country goes through faster than ever before.

At Western Electric we have a hand in keeping up this smooth service. We make and supply cable and call-switching equipment that keeps

millions of routes open throughout the Bell network. It's the most advanced communications network in the world. And last year alone, we added over 2 million more dialing lines.

That's why when you are traveling by phone, your call almost never hits a stop sign or a red light.



Western Electric
MANUFACTURING & SUPPLY UNIT OF THE BELL SYSTEM



contents

- It All Started in Cleveland** 2
Western Electric: a century of change
- We're Still on the Late Show** 8
'Don Juan' sounds a beginning
- Bustles to Mini-Skirts** 12
Styles change, and so does womanpower
- Telegraphs and Guidance Systems** 16
Since frontier days, a review of defense
- 1869** 20
It was a year to remember
- Those Were the Days!** 23
With modern appliances, housework's a breeze!
- There Are People Inside Those Buildings** 27
The Hawthorne Studies and questions they answered
- 200 Years of Memories** 30
Four men recall 'way back whens'
- Briefs & Sidelights** 32

ON OUR COVER: An 1882 Magneto Wall set, the first phone built by Western Electric, and the modern Trimline® telephone mark 100 years of progress as Western Electric celebrates its centennial year.

FOR EMPLOYEES OF THE WESTERN ELECTRIC COMPANY, INC., 195 BROADWAY, NEW YORK, N. Y. 10007, P. A. GORMAN, PRESIDENT, H. S. CODY, JR., SECRETARY & TREASURER

Clifton C. Field—editor
Rudy Marzano—managing editor
Val Flesch—associate editor
Dick O'Donnell—associate editor
Bertha Shepherd—editorial assistant

Henry Hoyer—art editor
Tom McQuillen—design
Bernard Aumuller—photography
Ernest J. Dougherty—production



Western Electric
MANUFACTURING AND SUPPLY UNIT OF THE BELL SYSTEM



In a small loft (below) in Cleveland, partners (l to r) Anson Stager, Elisha Gray, and Enos Barton opened a small model shop. That shop became Western Electric Company, celebrating its centennial anniversary this year.



Western Electric: a century of change

IT ALL STARTED IN CLEVELAND

by Irv Sternberg

Western Electric will be one hundred years old on November 18, 1969. Looking back over a century of incredible change, the company's history may be separated into three distinct periods. From its inception in 1869 until it joined the Bell System in 1882, it was primarily a small shop engaged in producing electrical devices. After joining the Bell System, it took the lead in diversifying and broadening communications in America but continued its activities in the electric equipment field. After 1925, it limited its role to that of manufacturing and supply unit of the Bell System, its chosen course for the future.

But one hundred years ago, this is how it all began . . .

On an early fall night in 1869 in Cleveland, a light shone from three windows on the top floor of a four-story loft at 93 St. Clair Street.

Beyond the windows, a boyish looking man of 27 with a thick crop of hair sat on a stool in front of a sloping desk. Carefully, he jotted entries in a ledger.

The room he worked in was twenty-five feet wide and crowded with a half

dozen foot lathes. During the day the lathes were busy fashioning fire and burglar alarm equipment, telegraph supplies and some rather odd looking devices invented by a dreamy-eyed professor of physics. Now it was late evening, and the lathes were silent.

The young man at the desk, Enos Barton, had come from upstate New York where, as a boy in Lorraine, he had become fascinated with telegraphy. At seventeen he had become a telegraph operator in nearby Watertown and later chief telegraph operator in Rochester. It was the post-Civil War period. Dozens of young inventors were exploring new ways to put electricity to use, and seeking reliable machine shops where their designs could be produced in model form. Young Barton saw the potential in such shops.

With the help of his widowed mother, who mortgaged the family farm, Barton raised some \$900 and purchased a half interest in the tiny model shop in Cleveland.

Barton's partner at the time was George Shawk, a craftsman. Their best customer was a 34-year-old inventor, Elisha Gray, a tall, genial man with long hair. Gray had worked his way through Oberlin College to become a non-resident physics lecturer at his alma mater and at Ripon College in Wisconsin. But his first love

was tinkering at his work bench on his inventions. After several months, Gray bought Shawk's interest and became Barton's partner. Soon the shop's workmen were spending even more time on Gray's inventions.

As Barton scratched notes in the ledger, he thought about the suggestion he and Gray had made to General Anson Stager, a prominent businessman whose capital, reputation and business acumen could be a strong asset to the infant firm of Gray and Barton. They had offered Stager a partnership in the new firm. But would he accept?

Stager, like Barton, had come from New York. Born in Chapinville, he had become an apprentice printer in Rochester and at 21 had taken charge of a telegraph office in Lancaster, Pa. During the Civil War, he had served as Lincoln's chief of U.S. Military Telegraphs.

A few days later Barton and Gray were summoned to Stager's office.

"My counsel tells me," he said, "that the only protection I have on my investment is my faith in your character and abilities."

Then he smiled. "I have the faith."

Not long after, on November 18, 1869, the three men signed an agreement whereby each contributed about \$2,500 to form an equal partnership. The firm continued to be known as

Gray and Barton, but from that day it was destined to become the Western Electric Company.

The new partnership soon moved to Chicago, where the firm survived the disastrous fire of 1871 and established itself as a dependable, quality supplier of electrical equipment, replacing and installing much of the equipment lost in the catastrophe. With business increasing, the firm reorganized as the Western Electric Manufacturing Company in 1872 and named Stager as its first president.

Gray resigned from the company in 1874 to devote all his time to electrical research. Although associated with the firm for only five years, his invention and development of the telegraph printer, the answerback call box of the American District Telegraph System, and an electrically controlled signal board were important in the company's history.

By 1876 the company name had become well established in the electrical equipment field, and at the Centennial Exposition held that year Western Electric won five first-class awards for devices of its own manufacture.

Another event occurred that year that was to shape the future of the company: a patent was issued to an inventor, Alexander Graham Bell, for an instrument he had conceived. It was called the telephone.

In August, 1877, the company hired 19-year-old Charles Scribner whose invention—a telephone repeater—had come to Barton's attention. Two years later Scribner filed for a patent on the jackknife switch, his first important invention for Western Electric. Before retiring in 1916 he was to become the company's first chief engineer and founder of the Engineering Department—forerunner of Bell Telephone Laboratories. Eventually he held more than 440 patents, exerting tremendous influence in telephony. Thomas Edison described him as "the most industrious inventor I have ever known . . . his imagination seemed boundless."

Scribner was an uninhibited man.

Called into Barton's office one day, he perched on his boss' desk and began to idly swing his leg.

Barton eyed Scribner's informality.

"Charles, what are you doing?"

"Nothing," replied his aide.

Barton, looking upset, pressed on.

"And what is your assistant doing?"

"Helping me," said Scribner.

The men were good friends, however, and in the course of business traveled together. On one trip to Europe, they had concluded their work and were speeding to the port to board ship for home. But they arrived to see the ship sail out of the harbor. Barton stood there, staring and thinking thoughts he would never utter aloud. But the less inhibited Scribner unleashed a stream of observations that suited the occasion. It seemed to satisfy Barton, too.

"Thank you, Charles," he said.

Years later Scribner recalled his boss as the "dynamic and guiding spirit (who) steered the company so that it took up the new and discarded the old at the opportune time."

Although Stager was the first company president, he left the actual management of the new firm to Barton. That experience was essential; in a few years, Stager would be dead and Barton the president—at a crucial time in the young company's history.

Events of 1881 and 1882 were turning points for the new firm. In March of 1881, Western Electric purchased a controlling interest in the Gilliland Electrical Manufacturing Company, an Indianapolis firm making telephones for the American Bell Telephone Company. A few months later, Western Electric Manufacturing Company was incorporated as Western Electric of Illinois and the next year WE became the manufacturer and supplier for American Bell Telephone.

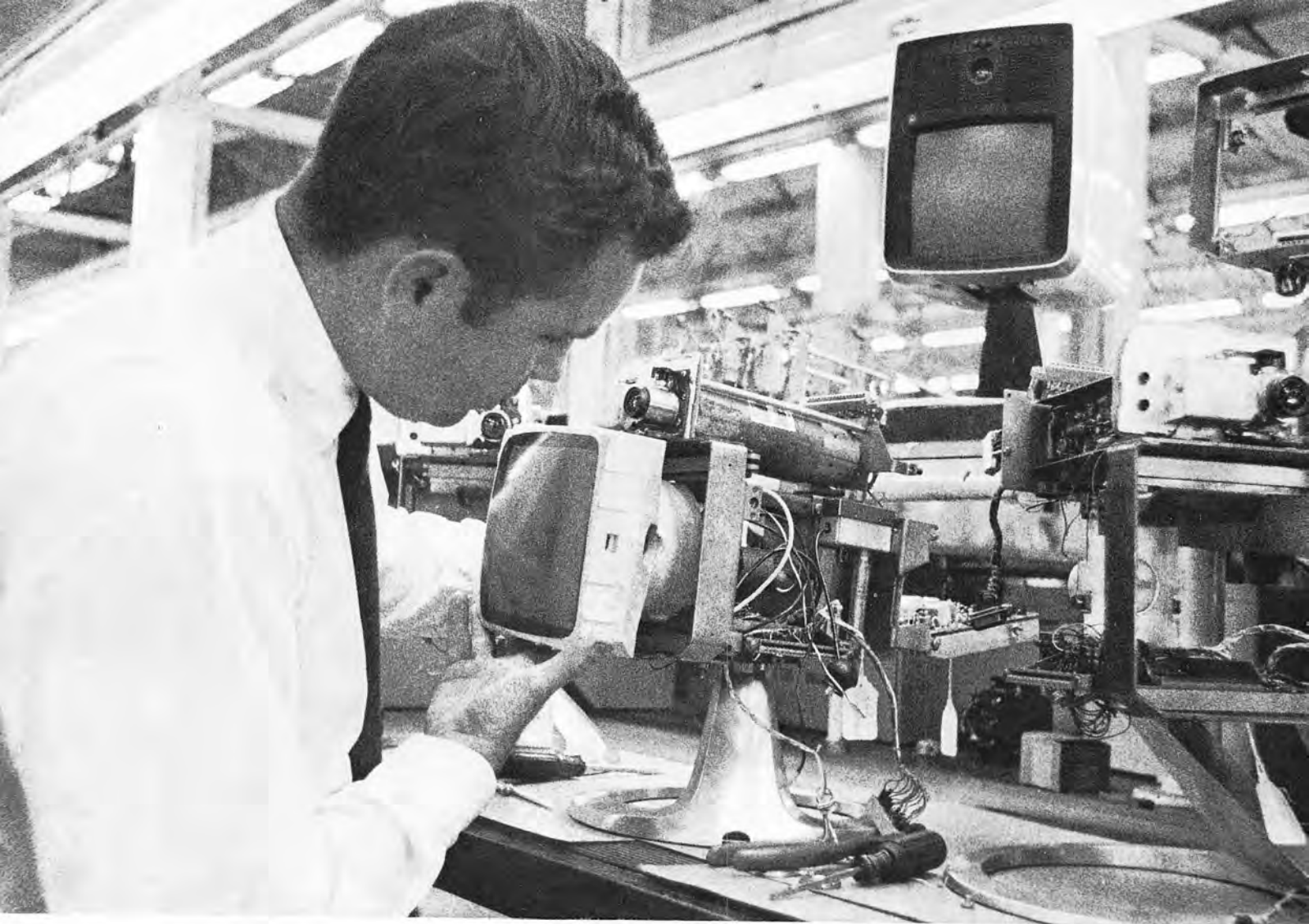
Western Electric's association with American began a new era of innovation and growth for the company.

In the late 1800's and early 1900's, Western Electric developed the magneto wall set, opened its first New York facilities and installed in Worcester, Mass., the first multiple switch-





Occasions of all types make up a company's history. Some of Western Electric's include (above left) a 1900 central office installation in Portland, Oregon, (above right) 1914's first transcontinental telephone lines, (left) construction on the Hawthorne Works in 1906, and (above) station WEA in 1922, one of the first commercial broadcasting stations.



Other milestones in WE history are (r) the first transistor in 1947, (l) wartime assembly work, and (above) today's Picture-phone® set.

board with automatic signals, a development which revolutionized telephone switching systems. The company introduced dimensional drawings for piecework, established specification and quality standards, initiated personnel records, trained college graduates, opened its first distributing houses and—in 1904—occupied the plant that has become the granddaddy of all Western Electric manufacturing locations, the Hawthorne Works. This was all a prelude to the vital role WE would play in building a voice bridge across the U.S.

In the early 1900's, the development of transcontinental telephone service was stymied by the lack of a repeater that could amplify the human voice in a manner superior to the mechanical repeaters then in use. The man who would find the solution to



this problem was Dr. Harold Arnold, a 27-year-old scientist when he was hired by WE in January, 1911.

The following year Arnold witnessed a demonstration of the audion, a device invented in 1906 by Lee De Forest, a former WE employe. Arnold, who had been working on the problem of long distance telephony, realized the audion could be used as a commercially successful telephone repeater. Within six months, Arnold had made the first high vacuum tube, which not only revolutionized the communication art but led to the development of entirely new industries—radio broadcasting, phonographs, sound motion pictures, and television. On January 25, 1915, the first transcontinental telephone line—New York to San Francisco—was formally opened.

The period from World War I to the

Great Depression saw Western Electric produce the world's first plane-to-ground radio telephone, develop a sound motion picture system, loud speaker systems, and multiplex printing telegraph systems. It installed a 500-watt transmitter for radio station WEAJ in New York City.

Early in 1925, in order to concentrate on its primary job for the Bell System, Western Electric sold its European manufacturing subsidiaries to the International Telephone & Telegraph Company and disposed of its electrical supply business to the newly established Graybar Electric Company, named after Elisha Gray and Enos Barton.

By now the company had passed its half-century mark. With 40,000 employees and sales of \$300 million annually, it had grown and prospered during one of America's most exciting times. But it faced the challenge of maintaining its position in industry during the difficult years to come—years that saw a depression, a second world war and an explosion of technical knowledge in the postwar period.

By the late 1920's, the telephone had become part of the American scene. In 1927, Western Electric introduced the first desk set, combining receiver and transmitter and establishing a basic design that evolved years later into the Princess®, Touch-Tone®, and Trimline® telephone sets. But with the nation on its knees during the depression, progress in commercial telephony was virtually halted. It was not until after World War II that the demand for new services unleashed a boom in the telephone industry and challenged Western Electric to meet the demand.

To satisfy the public's needs and desires, the telephone became a decorative as well as functional instrument. It blossomed forth in colors, changed its shape and promised a host of new services. To improve long distance service Western Electric built and installed radio relay systems (the first coast-to-coast television was carried over a WE-installed system in 1951) and produced the "perfect

product"—submarine cable repeaters made to perform without repair for 20 years.

Technical developments occurred at a hectic pace. Production of transistors, the first synthetic quartz crystals, thin film circuits, electronic switching systems and the first known industrial use of the laser were modern achievements in the company's pursuit of better communications.

During this period, the company continued its role, too, as an important contributor to the nation's defense. During World War II, it produced vast quantities of communications equipment needed by our armed forces around the world. WE-built radar and gun director equipment was followed after the war by further efforts in warning systems, missile guidance systems and complex new military communications networks.

Today, as it nears its centennial, the company employs almost 170,000 men and women who produce thousands of items of communications equipment in 16 major manufacturing locations. It annually purchases over \$1.6 billion in goods and services for itself and other companies in the Bell System from 45,000 suppliers throughout the nation. Its sales exceed \$3.7 billion.

Last year the company opened the world's largest communications cable plant in Phoenix, began large-scale production of aluminum cable in Baltimore, and was named prime contractor for the Government's Sentinel anti-ballistic missile defense system. It also broke ground for two unique building complexes.

In Hopewell Township, New Jersey, the company will open its Corporate Education Center which will consolidate all its training programs. And near Greensboro, North Carolina, the company will share a research and engineering center with Bell Telephone Laboratories which will serve as headquarters for the Sentinel project.

Last year was an important one for Western Electric. But this year will be more so. It will always be thus, at least for the next hundred years. **WE**

Western Electric and the movies

We're still on the LATE SHOW

by Dick O'Donnell

Remember those great old movies? Humphrey Bogart as Duke Mantee in "Petriefied Forest"—remember that?

Or Gary Cooper as Captain McGregor in "Lives of a Bengal Lancer"—remember that one?

And then there was W. C. Fields as Mr. Micawber in "David Copperfield"—remember that?

You don't remember! Well, Western Electric does. When you're coming up to your hundredth birthday, you remember a lot of things you were connected with over the years. One of the most memorable was our association with the motion picture industry. You see, it was Western Electric and Bell Telephone Laboratories that finally brought sound to the silver screen and changed the character of motion pictures for all time.

On the evening of August 6, 1926, Warner Brothers presented its Vitaphone production, "Don Juan," starring John Barrymore and Mary





Cameras roll for "Romeo and Juliet" with (l to r) Reginald Denny, Leslie Howard as Romeo, Basil Rathbone, and John Barrymore.

Astor (with Myrna Loy and the ever-popular Montagu Love in supporting roles). "Don Juan," using equipment designed and built by Bell Laboratories and Western Electric, marked the advent of sound in motion pictures. It wasn't really a "talkie," since it had no spoken dialogue, but it did have synchronized sound effects and music.

The first talkie appeared exactly 14 months later, on October 6, 1927, starring Al Jolson as "The Jazz Singer." Apart from the songs, the movie had only a few lines of spoken dialogue, but it was enough to convince the world that talking motion pictures were at last a reality.

Ironically, Western Electric didn't start out by trying to break into show biz. It just happened that equipment we had developed for long distance telephone communications was equally and ideally suited for producing talking movies. For years, people had been fascinated by the prospect of making pictures talk. As early as 1894 Thomas Edison had tried it with his Kinetoscope. The device worked, but the public wasn't interested in it. A former employe of Edison's, Eugene Lauste, demonstrated a sound process in 1907, but again there was no market for it. And there were other attempts—Synchroscope, Cameraphone, Photokinema, Phonofilm—but the results were the same. They were never more than passing novelties in which the public soon lost interest.

The reason early efforts failed was that they lacked the equipment needed to produce talking pictures of acceptable quality. They lacked a high-quality microphone capable of transmitting a wide range of sound frequencies and of being used at a distance from the performer; they lacked a good amplifier and electrical recorders and reproducers; they lacked a quality loudspeaker system; and they lacked a proper system for synchronizing sound with picture.

Then, in 1912, a former Western Electric engineer named Lee DeForest visited the Western Electric Engineering Department with an audion tube he had invented. DeForest believed the tube could be

developed into the amplifier, or repeater, that the Bell System needed to conquer the problem of long distance communications. From that tube, WE's H. D. Arnold produced the first high vacuum tube, key to the age of electronics. The Engineering Department at 463 West Street in New York City then began work on the repeater project, which included the development of a wide range of associated apparatus. To test the quality of this apparatus, Western Electric needed recording and reproducing equipment of higher quality than was available. This led to fruitful experiments in recording sound on film and disc.

At the same time that work was going forward on the long distance repeater system, another Western Electric engineer, E. C. Wente, was busy working on a microphone capable of transmitting a wide range of sound frequencies. The result of his work was the condenser microphone, the familiar "mike" of the early days of radio and recording.

By 1916, after less than four years of cooperative research, Bell System scientists had produced an impressive array of engineering achievements. They had perfected the high vacuum tube, which was successfully used in transcontinental service in 1915; they had advanced the art of recording sound on film and disc; they had constructed improved electrical reproducers for the wax-disc phonograph; and they had developed the condenser microphone. All of these elements were essential to the production of quality talking pictures, a fact not overlooked.

On June 24, 1916, WE's I. B. Crandall reported: "I see no reason why a method for producing talking pictures of fair quality cannot be developed." It was a tempting prospect. Unfortunately, it had to be put off as the Bell System was called upon to arrange a vast mobilization of the nation's communications facilities in preparation for the country's entry into World War I.

Following the war, Western Electric developed the public address system, another element essential to the production of talking pictures.

In 1922, Western Electric's E. B. Craft produced the first electrically recorded talking picture, which was exhibited that October at Yale University. The success of this venture led to the production of "Hawthorne," the first industrial sound picture. That film featured the use of a perfected synchronizing system.

By 1924, all of the elements were there. The problem was to sell Hollywood on the idea of talking pictures, and Hollywood was not buying. The idea was rejected by practically every major producer, and for compelling reasons. Talking pictures were considered passing fads, like the 3-D movies of a later era, and simply not worth the investment. Furthermore, movie producers had large inventories of silent films that had cost millions to produce, and great stables of actors and actresses who knew no other dramatic technique than pantomime. Also, if talkies did catch on, the cost of converting studios and theaters would be staggering. Talking pictures could be a costly failure or an expensive success, and either way the producers wanted none of it.

In 1925, however, the Warner Brothers studio became interested in the new process. At that time, the studio was in desperate shape and needed something new to pick up receipts at the box office. Warner Brothers threw all of its resources into the development and production of a talking picture. The first was "Don Juan," followed by "The Jazz Singer." After that, Hollywood had no choice. The public clamored for talkies and producers scrambled to acquire the necessary equipment to satisfy them. The talkies were in, this time to stay.

Part of the reason for their success was that the time was ripe. Box office receipts had been sagging and profits were down as audiences lost interest in the silents. But a major reason for the success was the quality of the sound. For the first time, audiences were offered, not a promising laboratory experiment, but a fully-engineered, working system.

In the ensuing years, Western



Many early films used Western Electric-Bell Laboratories-designed sound equipment. Among them were (clockwise from top): "Ceiling Zero" with James Cagney and June Travis, "Captain Blood" with Errol Flynn, "Don Juan," the first Vitaphone production, and "All Quiet on the Western Front" starring Lew Ayres and Raymond Griffith.

Electric continued producing sound equipment for the motion picture industry through its subsidiary, Electrical Research Products Incorporated. Then, in 1937, ERPI withdrew from the field and licensed other manufacturers to produce the equipment.

Today, Western Electric is retired from show biz, but if you watch the Late Show regularly, every so often you'll see the Western Electric trademark. It appeared on the list of credits of a lot of memorable motion pictures.

Hey, how about Clark Gable and Charles Laughton in "Mutiny on the Bounty"—maybe you remember that one? **WE**







WESTERN ELECTRIC
COMMUNICATIONS

WOMEN AT WESTERN
**FROM BUSTLES
TO MINISKIRTS**

THE girls have come a long way since Sarah Adlum walked up to a work bench and started winding her first coil magnet for the newly formed Western Electric Manufacturing Company.

The year was 1873, and Sarah was the first woman hired by the firm just four years after it had been founded to make burglar and fire alarms and other electrical equipment. Today, as it celebrates its centennial year, the Company is better known as Western Electric, the manufacturing and supply unit of the Bell System.

Sarah broke with a lot of tradition when she joined Western Electric. It was a period when proper young ladies worked largely as teachers or in charity fields, if at all. But now, 96 years later, that's all changed. The U. S. Department of Labor says nine of ten women will hold jobs sometime during their lives, most of them for substantial periods. Forty-one percent of all women work today, making up 37 percent of the nation's total work force. And while on their jobs they've shattered the myth that the working woman is an embittered, defeminized spinster. Today's working gals are chic, feminine and one of every three is married.

This percentage is accurately reflected at Western Electric, where women employees number 54,000, about one-third of the company's total employees. The ladies fill clerical, secretarial, production, scientific and professional jobs, including highly responsible management positions—like those held by Virginia Dwyer and Bonnie Small.

As the corporate economist at the company's New York headquarters, Miss Dwyer's analyses of economic trends help the Company to make decisions that could have far-reaching effect on its business. And 50 miles away at the Engineering Research Center near Princeton, Miss Small is responsible for production systems.

The national trend toward "womanpower" in the job market has always been readily apparent at Western Electric. Before 1900 there were less than 100 females and they rarely worked in the same departments with men. Most were employed at coil winding and insulating machines.

After the turn of the century, however, the bustle gave way to the more maneuverable full skirts, and women were successfully filling other jobs, including

inspecting and assembling. Soon they were not only working drill and punch presses, but also reading blueprints for cable forming and wiring jobs.

And they were asserting their equality in other ways, too. The Hawthorne Club, a men's social organization founded in 1911 at the Company's Hawthorne Works, accepted its first woman member in 1915.


By the mid-twenties, Milly was certainly modern. Now she was shortening her skirts, bobbing her hair, and writing articles for the "Western Electric News" entitled, "The Kind of Wife I Want My Boss To Have." But even Milly didn't think of working as a career. It was just a way of asserting her independence for a while before she married. Young women worked for a year or two, but, overall, the percentage of women employees at Western Electric, as in other companies, didn't increase very much. The average age of a woman employee was 23 years; her average service was 2½ years.

By World War II, however, with most of the men overseas, Milly replaced her husband or brother in almost every area of the labor market, comprising 20% of Western Electric's work force; by the end of June, 1943, women outnumbered male employees for the first time in the Company's history. And by August of the following year, when Western Electric's peak wartime employment totalled 97,416, women made up 54% of the work force.

Last year almost seven and a half million telephone sets rolled off WE's assembly lines in plants at Indianapolis and Shreveport. And over half of the 10,000 employees on those lines were women.

Stella Campbell, who hires many of the women who work at Indianapolis Works, thinks women are generally better than men for this type of work. "Women have greater dexterity. They have smaller hands, and can handle small parts easily. And they're much speedier than most men would be on certain jobs," she says.

In January, 1957, Jennie McGreevy of Hawthorne's miscellaneous central office apparatus department completed 50 years of service—the first woman to complete a half century with Western Electric, and the second woman with fifty years in the Bell System.

Today's working women have found a world in business as well as the home. At Western Electric, where womanpower has come a long way from the days of Sarah Adlum and her starched crinolines, the girls have always been mighty welcome. 



Since the days when a few women assembled 1910 desk sets (l), times have changed. Today, women comprise a third of the Company roll and make sophisticated equipment like transistors at Allentown and the Trimline® telephone (above) at Indianapolis.



TELEGRAPHS and GUIDANCE SYSTEMS

Our service to the U.S. dates from frontier days

There was a rustling among the birds in Franz Josef land, that series of islands clustered within the Arctic Circle. They were yellow-billed loons, usually found singly or in pairs. But on this day they were huddled in flocks, disturbed by a sharp change in the weather.

It was a typical low pressure wave which started as a small disturbance south of the Franz Josef islands when a wayward westerly, pushed north out of European Russia by the jet stream, collided with the cold damp air rising from the icy waters of the Kara Sea.

A major storm was brewing, but no one knew it. In a few days it would show up in weather forecasts throughout North America, but on the day of its birth only the birds were aware, and afraid.

Later that day, a U.S. Air Force sergeant tensed as he sat staring at a radar screen in his DEW-Line station on the Greenland Ice Cap. He was just one of the hundreds stationed on the Distant Early Warning Line stretching 6,000 miles from the Aleutians to Iceland and Europe but at that moment he was the northernmost eye of our Air Defense Command. An "unknown" had appeared on his screen.

The sergeant's reaction was smooth and automatic. He flashed word to the North American Air Defense Command in Colorado Springs that an unknown,

large and flying fairly low, was on a course that would take it across Greenland, down past Hudson's Bay to the heartland of the United States.

At Colorado Springs men watched a large map in a room two stories high and 30 by 60 feet in size. A yellow "alert" showed on the map lights, signifying that an unknown was approaching our warning system. Within minutes, however, they went back to normal routine. The unknown proved to be a large flock of birds, apparently driven from their regular nesting grounds by an Arctic storm.

But it could have been something else. It could have been a hostile bomber group probing our defenses. Either way, the DEW-Line had again done its job, quickly, smoothly, unerringly. Not even a flock of birds can approach our air space without being tracked and identified.

This 6,000-mile line of radar stations was built through a joint effort of the Army Corps of Engineers and civilian construction teams under the direction of Western Electric engineers in one of the largest and most intricate defense jobs ever undertaken by the company. And this covers a lot of ground, for WE has been doing such jobs, at the government's request, since the days of the frontier wars in the 1870's. Through the years the government has selected us for these projects because of our competence, experience, and our ability to bring together the vast resources of the Bell System. On the frontier it was WE telegraph instruments used by the Army.

Then during the Spanish-American War, WE-built telephones were starting to become standard equipment with many of our military units.

During World War I an entirely new military problem arose: how to communicate with the fragile little airplanes that were flying daily sorties over the Western Front. Western Electric's answer was a radio developed for ground-to-air communications.

"For the first time," says a 1917 account, "airplanes in flight were directed from the ground or by the commander in the leading airplane, and reports and directions were given and received in clear speech."

Further work along this line resulted in voice radio between warships, ship-to-shore radio telephone that linked the Navy's fleets to headquarters, radio for the Army's tanks, and electronic detection devices for locating big guns and enemy planes.

During World War II, the Company produced more than half the radar equipment used by Allied forces. Besides new radio, telephone and teletypewriter systems, Western furnished the Army and Navy with a gun aiming system developed by Bell Laboratories. This electronic robot tracked oncoming planes by radar, aimed anti-aircraft guns after computing distances and trajectories, and then fired the guns. At sea they dealt with attacking aircraft, and helped aim the Navy's guns at surface craft.

In undersea warfare, Western Electric sonar equipment picked up the sounds of the Nazi "Wolfpacks" dur-

Within the Arctic Circle, a DEW Line station, part of a 6,000-mile chain, maintains its constant vigil.



They are listening to outer space in the above Jet Propulsion Laboratory antenna station in the Mojave Desert, while a Titan rocket leaves Cape Kennedy. Right, pilot wears 1930 helmet for air-to-ground radio.





President Wilson tests a WE-designed ground-to-air radio telephone on the White House Lawn in 1918.

ing the Battle of the North Atlantic and of Japanese submarines in the Pacific. In addition, large quantities of our mines and torpedoes were equipped with WE electronic guidance systems. In the closing days of the war, WE radar bombsights were aboard the B-29's in their all-out air offensive against the Japanese home islands.

The war's end proved to be just a brief pause in the Company's defense work. Since the start of the Cold War there hasn't been a time when Western hasn't been involved in a major project at the government's request.

Perhaps the most significant work has been the production of systems for guiding rocket-powered missiles from the ground. A series of Nike missile systems, called successively Ajax, Hercules and Zeus, were developed by Bell Laboratories for the Army. The Ajax and Hercules systems, both produced by Western, were deployed

around many U.S. cities for anti-aircraft defense. Zeus, intended to destroy attacking intercontinental ballistic missiles, has evolved into the Spartan missile, one of the essential elements of the new Sentinel Anti-Ballistic Missile System which Western Electric is now producing as leader for an industry team.

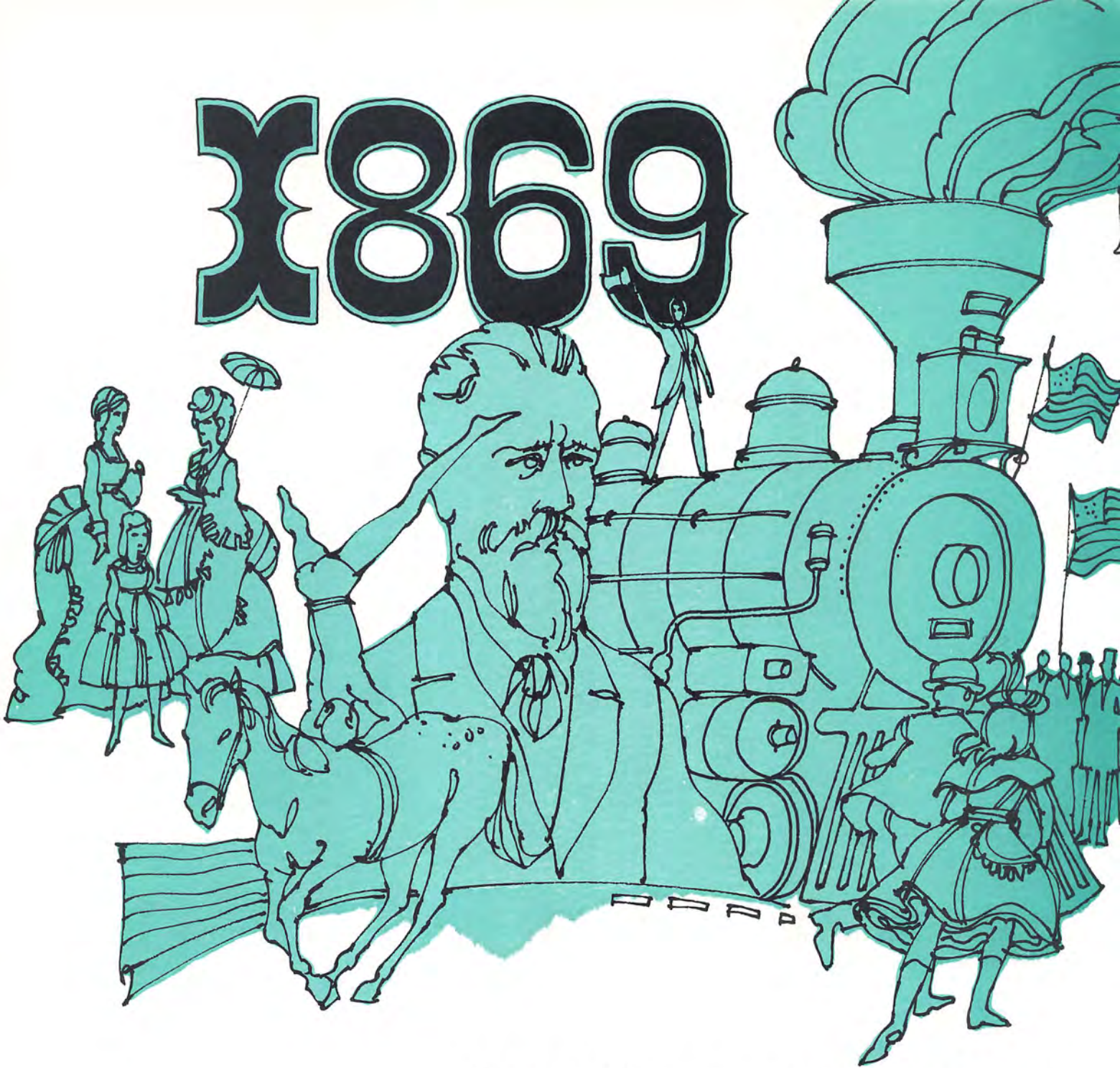
In the cold weather regions, WE followed up its DEW-Line construction with "White Alice," a network which brought modern long distance telephone and telegraph communications to Northern Alaska, and linked the Ballistic Missile Early Warning System stations in Greenland and Alaska, plus England, to the Colorado Springs command center.

In today's race for outer space, Western Electric is playing a central role. With know-how gathered from years of guidance system research and production, WE has helped the Air

Force and National Aeronautics and Space Administration launch spacecraft and has manned tracking stations in Florida and California. A globe-circling chain of Project Mercury communications stations, also built by an industry team headed by Western Electric, is now in use for the Apollo moon missions. Even at the dawn of the Space Age, WE transistors were aboard America's first satellite, Pioneer I.

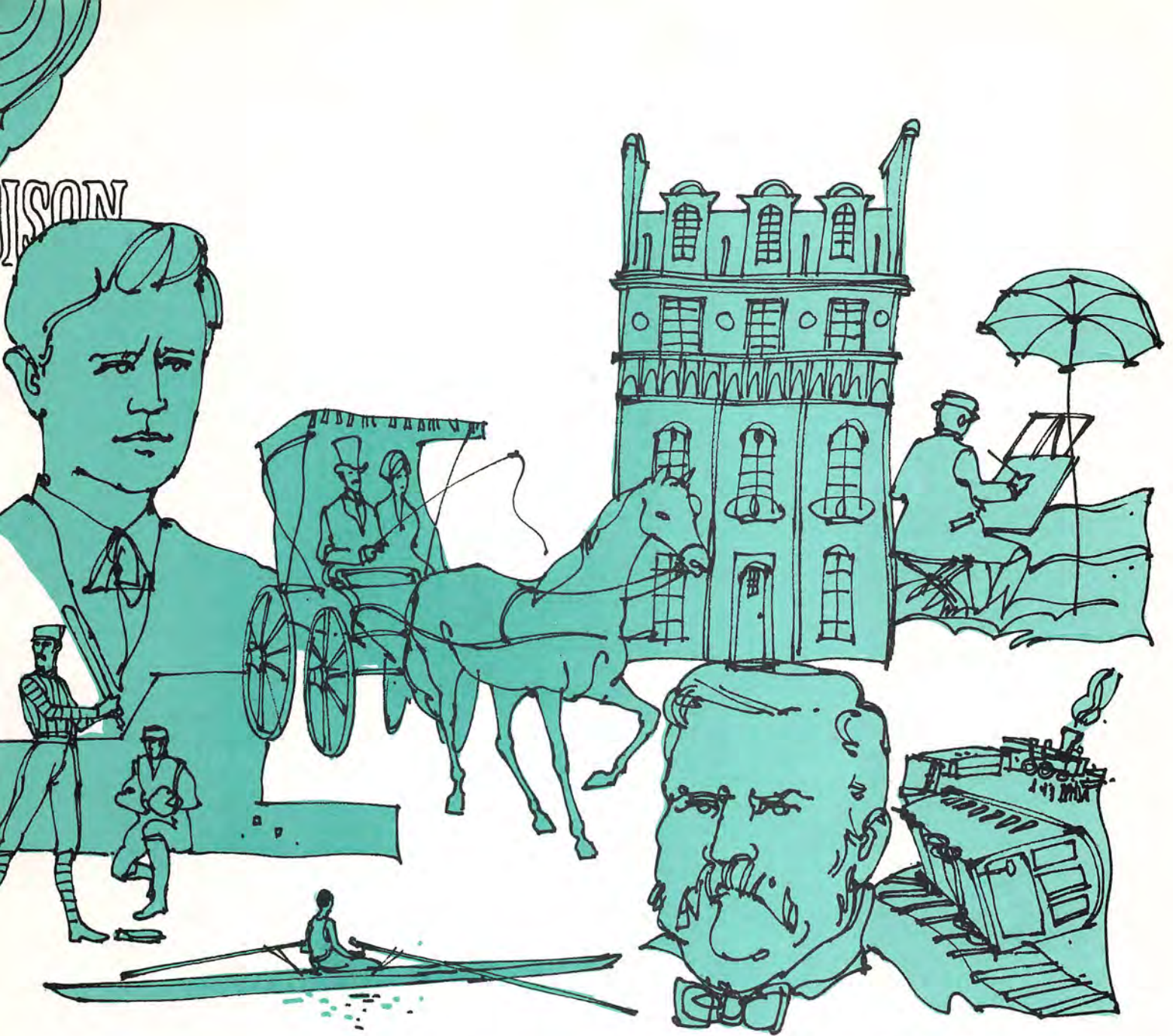
Thus, from the days of the frontier, through two global wars, to today's policy of deterrence, Western Electric has been a vital part of our country's defense. Yesterday it was the Arctic and the fringes of outer space. Tomorrow, the moon, and beyond. **WE**

1869



A year that marked the beginning
of college football, professional baseball
and Western Electric

by Barry Beckham



We have no record of what Messrs. Gray, Barton and Stager did or said right after they signed papers and shook hands to form Western Electric four years after the Civil War had ended. But, because of the age in which they lived, it's a good guess that one of them said something like "Let's get back to work."

Termed the era of reconstruction by historians and "The Gilded Age" by Mark Twain, this period was one of new enterprises, of expansion. Railroads were begun, industrial growth was tremendous; immigration was heavy and ever more people were moving to large cities. Prosperity was obvious in almost all sectors of a growing economy.

It was a time of invention. Farm-

ing was made easier when James Oliver came up with his chilled steel plow. Jim Westinghouse, four years younger than 27-year-old Enos Barton, was granted a patent for his air brake. His research was sparked by a train wreck he had seen near Schenectady. William Davis, a fish-market owner in Detroit, received a patent for the first railroad refrigerated car, built in 1869. Thomas Edison was also at work. His electric voting machine, not to be used in a major election until 1892, and designed originally to record the vote of legislative bodies, was invented in 1869. The housewife wasn't forgotten either. James McGaffey of Chicago was awarded a patent that year for the vacuum

cleaner, which he described as a sweeping machine.

At Promontory Point, Utah, the Central Pacific's Jupiter, whose tracks had been laid by Chinese workers, met the Union Pacific's "119," whose tracks had been placed by Irish immigrants. Governor Leland Stanford of California drove a golden spike into the last tie. The engineers of the two trains exchanged bottles of champagne and a one-word telegraphic message, "Done," was flashed all over the country which now could be crossed in one week.

Immigrants were pouring into the country and the big cities were swelling. During the year of WE's birth, more than a quarter-million

immigrants arrived. Chicago had a population of 299,000. New York City had nearly reached the million mark. About 25 out of every 100 people in America lived in big cities.

For their reading, many Americans turned to Europe. It was not an auspicious period in American letters, for no novel of importance had been written since the end of the Civil War. For those interested only in plot, dime novels and yellowbacks about Indian fighters were standard fare. Harriet Beecher Stowe's series of sketches, *Old Town Folks*, was popular, and so was Mark Twain's *Innocents Abroad*, a collection of satirical travel articles published in 1869. Other popular authors were Bret Harte, Joaquin Miller, George Washington Cable, James Russell Lowell and Oliver Wendell Holmes.

For art, Americans of the late '60's liked Winslow Homer, painter of seascapes and forests; Philadelphia-born Thomas Eakins, who specialized in boating and prizefighting scenes; and the romantic and mystical Albert Ryder. The new Corcoran Art Gallery in Washington, D.C., was the start of the great public art collections that were forming during the period.

For the price of a pair of shoes today, one could buy a stylish overcoat in 1869. A pea-jacket, popular at the time, sold for \$10.00. Little boys wore kilts and boots with tassels; girls wore Garibaldi suits. Women went for the crinoline skirt, and they usually wore horizontally striped stockings, Empire bonnets and shawls. Men sported tailor-made suits of sooty broadcloth.

The amusement fads of the day were croquet and the velocipede or bicycle. The circus, usually a one-ring affair, was experimenting with two rings. For 17 months, Niblo's Theater in New York City showed the Black Crook—otherwise known as the Parisian ballet—reaping a

\$200,000 profit. Beer gardens and rathskellers abounded as stage girls wearing satin slippers and roses in their hair kept male spectators cheering (and beering). A big attraction of New York City was the Atlantic Garden, holding 2,500 people and offering shooting galleries, billiard tables, and something called an orchestrion band. Most places of amusement were closed on Sunday.

In the homes, elaborate decorations and ornaments were in vogue. One found ornamental bowls of alabaster called "tazza," as well as portieres, lambrequins and what-nots. Base-burners with red coals and a ground glass globe with kerosene were standard items in the better homes.

Most families made their own bread. At a typical breakfast, Gray, Barton and Stager might have eaten 12 vegetables. Pie was often served for breakfast and a typical Sunday morning meal in New England consisted of buckwheat cakes, baked beans and pork.

On November 6, 1869, just a couple of weeks before Western Electric's founding, captain William Leggett led his 25-man Rutgers team against captain William Stryker's Princeton tigers in the first intercollegiate football game. They used a round, rubber ball that might be batted with the player's hands or kicked. No running with the sphere was allowed and a goal was scored when the ball was kicked under the crossbars. Princeton won the hour-long fray, 6-4.

The first professional baseball team, the Cincinnati Red Stockings, was established. The team embarked on an eight-month tour to pay for the players' salaries. George Wright, shortstop, received \$1,400; Asa Brainard, the pitcher, \$1,100.

There is no information on who first said it, but sometime during the year, the term "battery," describing the combination of pitcher

and catcher, was used. It comes from telegraphy, where the transmitter and receiver form a battery.

Congress, near the end of February, adopted the 15th amendment, giving the "right to vote regardless of race, color or previous condition of servitude." As late as 1868, only four states outside of New England and New York had granted suffrage to Negroes. At this time, women were allowed to vote only in Wyoming Territory.

Although no American president had yet travelled overseas, there were a few events outside the United States that attracted the attention of the American press and public in 1869. On November 16, 6,000 foreign guests gathered to watch fireworks, a squadron of yachts and the official opening of the Suez Canal. Under construction for ten years, this link between the Orient and Europe was to revolutionize communications and travel. Earlier in the year, Henry M. Stanley, directed by publisher James Bennett of the New York Herald to find the Scottish missionary Livingstone, in the African interior greeted the explorer with the words, "Dr. Livingstone, I presume?"

On Black Friday, September 24, panic gripped Wall Street when Jay Gould and James Fisk tried to corner the gold market by bidding up the price from the usual \$133 in greenbacks for \$100 of gold to \$162 in greenbacks. Their corner collapsed because the treasury released unexpectedly four million dollars worth of gold. Hundreds of men, looking for a price rise to possibly \$200, were ruined.

So 1869 was typical of the fast-changing years after the Civil War. To survive them, one had to be aware of the complexity and enormity of the changes. Certainly, Barton, Gray and Stager had this awareness. They realized and met the challenge of change. **WE**



THOSE WERE THE DAYS!

by Val Flesch

Time was a lady could turn dreary housekeeping tasks into pure simplicity with these ultra-modern Western Electric appliances. The vacuum, promises a 1915 ad, is "the new model, small and light, just \$32.50 including a nozzle extension."

The lady's sewing machine is the last word in electric household conveniences; her washer is perfection in construction and simplicity.

The housewife has a choice of other labor-saving devices, too: an iron at \$5, a fan, a dishwasher-tabletop priced at \$55, a percolator at just \$12.50, a hair dryer, home interphones at \$15 a pair, a toaster, and a warming pad at just \$6.50.

All the appliances, as demonstrated by Josette Antoniato, Aida Mangual, and Mary Ann Thiem, were sold until 1925 and guaranteed by Western Electric. Picturing Miss Liberty in 1915, a Western Electric ad assures: "Electricity has brought to women a new freedom, a release from the drudgery of housework. It's the New Enlightenment."

"This new model vacuum," Josette knows for sure, "is so designed that the full power of air is used."



"Why go on with the old-fashioned washboard way?" Josette arranged for a free home trial.



"With a hair dryer, no need for a curling iron," Mary Ann.

For Aida, "a sewing machine you can actually carry in one hand."



"If you have a problem," Mary Ann, "let an iron solve it."

photos by Len Stern and Dave Thomas



"Provide her with the increased comfort of a vibrator." Aida would be tickled.

THE
HAWTHORNE
STUDIES
PROVED



there are
people
inside
those buildings

by William L. Brown

To many in industry and the academic world, the achievement for which Western Electric is best known had nothing to do with communications technology. It dealt with the intangible and once mysterious study of what motivates people to work. The classic findings, many of which now seem self-evident, stem from the widely known Hawthorne Studies.

They began in 1924 when the Research Council of the National Academy of Sciences sponsored experiments at WE's Hawthorne Works to learn more about the effects of lighting on workers' output.

During three years of experimentation, the intensity of illumination was increased and decreased and the effect on output was observed. The results were puzzling because in no case did the increase or decrease in production relate to the increase or decrease in illumination. At one point, lighting was reduced until it was about equal to moonlight, but the girls maintained their efficiency throughout. In fact, they said they became less tired than when working under bright lights.

Obviously, the study was getting nowhere as far as learning about proper lighting was concerned, so the Research Council gave it up. But meanwhile, intriguing questions had been raised. It had become apparent that human factors had been more important than how bright the lights were.

The next step involved putting a smaller group of workers under closer control and observation in the hope that some of the factors responsible for the changes in output would be revealed. The idea of the second study was to discover the optimum working conditions. Thus, six female telephone relay assemblers became immortalized in print.

The special six started working together in April, 1927. They were put in a separate room, free of the pressures and disruptions of a large work group. An observer was with them to record their reactions, and a counter was placed at each work

position to keep track of the output.

The experiment continued for five years. Every few weeks some kind of change was made. Rest periods and hot lunches were scheduled, and then taken away. The length of the working day was altered from time to time. Saturday morning work was eliminated, then put back.

Meanwhile, every kind of record was meticulously kept—each girl's output moment by moment, the quality of their work, the room's temperature and humidity by the hour. The hours each girl slept at night were recorded voluntarily by them, and they agreed to periodic health examinations. But no one factor correlated with any other; in fact, overall output consistently rose, even in the face of changes in working conditions that researchers felt should have had adverse effects on both morale and output.

The researchers then realized that they were dealing with a *team* that had developed its own leadership and group spirit. They learned early that the social or human relationships among the operators themselves were apparently more important than anything else. Even a simple change—such as who sat next to whom—affected output.

The observers also saw that morale was an important factor. These girls had been singled out for a purpose the company considered important; the “brass” was interested in their daily production, interested in whether they felt tired at the end of the day. Thus, the attitude of management, as reflected in the changes introduced, had changed the attitude—and the output—of the girls more than had the changes in work conditions.

As the study progressed, the management was ready to use any findings that seemed to have been sufficiently tested.

The most important of these was that rest periods were beneficial. Beginning in 1928, therefore, rest periods were gradually introduced throughout the plant in those areas where repetitive work was performed. Analysis of the results

showed that there was no decrease in production.

Further “test room” experiments were undertaken and a new approach tried. It was reasoned that if a positive change in employee attitude could prove so valuable, it would be worthwhile to find out what unfavorable attitudes existed toward the company and see what could be done to change them. A large-scale program of confidential interviews was held starting with 1600 people in the Inspection Branch. By July, 1929, the interview technique had itself become a new exploration. Hawthorne's researchers developed what is now known as the non-directive technique. Employees, given the chance to talk freely and in complete confidence, simply opened up. It was noted immediately that almost all of these employees said they felt better for having gone through the experience.

By the end of 1930, more than 21,000 employees had been interviewed. Nor was this the end of the experiments. In November, 1931, still another was designed. Researchers began studying a group of workers to learn more exactly how the workers' own social or informal organization operated to establish norms and to control the output of every member. Observations continued for half a year, and the data collected, added to that previously amassed, provided the raw material for that classic text on human relations: “Management and the Worker.”

William J. Dickson, now Assistant Manager, Personnel Research, at headquarters, with the collaboration of Professor F. J. Roethlisberger of Harvard, re-analyzed the data resulting from the Hawthorne experiments. After three years' work, they condensed the results of these studies to 600 pages—the definitive study on the human world inside a modern industrial plant.

More important even than any of the specific findings, Dickson feels, was the new approach to the industrial worker that the Hawthorne studies suggested. In the '20's, the



After analyzing data, William J. Dickson emphasizes the importance of mental attitude on work output.

factory was largely the province of the efficiency expert with his stop watch, and the engineer with his slide rule; science could provide the worker with the tools, and pay was the incentive. Yet the Hawthorne studies showed that, given the same tools and pay, a different mental attitude could mean an increase in output of 20 or 30 percent. That was more than enough to make industry take notice.

The Hawthorne studies made great contributions in specifics like rest periods, length of work hours, supervisory and management training programs, counseling, vocational guidance, personnel administration and the like.

But it is in the intangible realm of attitudes and approach to problems that the studies have been most significant. Today, industry starts with the assumption that industrial man does not live by stop watches and comparative pay scales alone. What the Hawthorne studies brought home to the business world was a new emphasis on the employees' needs, a deeper understanding of the human factors involved.

WE



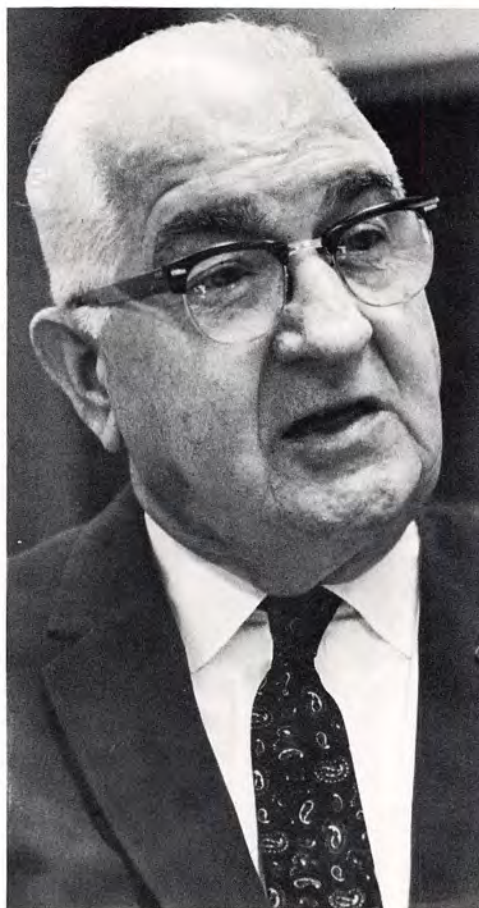
The relay assembly operation of the Hawthorne Studies is still active though much modernized. Mary Volango, at extreme right in each photo, still works as a relay assembler.



by Lea Wait

Four men with

200 YEARS OF MEMORIES



Four employees, William Jankowski (upper left), Andrew Kelly (above), Charles Darcey (upper right) and John Pawlek (right) have much in common. As a 50-year man, who is still on the job, each has been an eyewitness to many changes within WE.

In 1918 World War I ended, Mary Pickford signed a million-dollar film contract, and four fourteen-year-old boys went to work for the 50-year-old Western Electric Company.

Today, those four—Andrew Kelly, Charles Darcey, William Jankowski, and John Pawlak—are still on the job. As Western Electric celebrates its hundredth anniversary, they celebrate their fiftieth.

Thirty-five Western Electric men and women have been able to boast similar records, but, today, only these four are active employees. Kelly and Darcey work at Headquarters; Pawlak and Jankowski are at Hawthorne.

The year they joined the company the first automatic switching office was being installed and company engineers were working on radio transmitters, phonographs, and other general electrical equipment. Hawthorne, where John Pawlak's first job was testing switchboard cords, was the only manufacturing location.

"I guess the most radical changes we've seen have been in equipment," reminisces Andy Kelly, now a wage practices specialist. "It's a long way from the old rural mailbox No. 1 step-by-step to today's complex electronic switching."

Department chief Charlie Darcey agrees. "In my job as a supply inspector from 1929 to 1945, I had to

examine everything from phonograph needles to automotive equipment. Now of course, purchasing deals with far more complex supplies, including computers."

"There's been another big change, too," requirement analyst Bill Jankowski points out. "As the company has expanded and become more complex its personnel have changed too. We have a lot more minority group employees today, and a lot of management positions are being filled by younger men."

"It gives the company a newer image," adds Pawlak, a section chief in the Power Panel and Common System Shops. "A company this size has to stay with the times, and that doesn't just mean using more electronic equipment and building more plants. It means integrating all types of people with all types of ideas and skills. That's how we got where we are today."

Andy Kelly remembers with nostalgia the many hectic days he spent as an installer, restoring service to disaster areas like Dubois, Pennsylvania, whose central office building was razed by fire in 1921, and Sharpsburg, Pennsylvania, where service had to be maintained during the Pittsburgh floods of 1937.

"But through every crisis Western Electric people seemed to stick together and work it through. During the Sharpsburg floods, I remember, we were in round-the-clock contact with people in Kearny who supplied us with whatever equipment we needed almost immediately. That's one of the most important things about working with Bell System people; there's a group identification, and the entire community works together."

Of the four men, two started as messengers, earning \$8 a week. But Charlie Darcey started near the top. His first boss was AT&T President Theodore Vail. As one of Vail's office boys, Darcey had his own mahogany desk on the 26th floor at 195 Broadway, where his job included running errands and making a scrapbook of newspaper clippings about telephones.

"It was a good job," Darcey re-

calls. "Mr. Vail was a very jolly man—full of fun. And I got to read all the comic sheets in case there was a cartoon about a telephone."

Another highlight of Darcey's career was the first broadcast of radio station WEA, whose studios were first located at 463 West Street in New York. Since he had drawn up the electrical circuit layout for the station, Charlie was invited to hear announcer Graham McNamee put the station on the air in 1922. Western Electric's first standard transmitter was first used at WEA, where WE helped to refine the techniques of the infant broadcasting industry.

All four men finished high school by studying at night and taking special examinations, and all four also went through some form of higher education. On an average, each spent ten years in night school. "And that was in the days before tuition refund," Jankowski recalls. "I spent fifteen years going to high school, and then taking courses at Northwestern University, at night."

For all four, work at Western has been something of a family affair. Jankowski's wife was once a secretary in engineering at Hawthorne, and his daughter is now a secretary with the methods department. John Pawlak and his wife met while both worked in the old cost department, and one of his daughters worked as a secretary at Western Electric until she married an engineer with Bell Labs. Charlie Darcey has a son-in-law who is with the transportation department at Oklahoma City.

But Andy Kelly has the record for family Bell System service. His brother retired three years ago after a lifetime of installation work in Pittsburgh. His sister was an assistant chief operator at Bell of Pennsylvania, where his wife also worked as a secretary. And both of his sons have worked for Western Electric, one of them a fellow Pioneer at Bell Labs in Holmdel.

Fifty years with Western Electric? "Oh, it hasn't been that long," smiles John Pawlak. "Just think of the next fifty!"

WE



BRIEFS

WE's Montgomery Plant in Illinois recently completed manufacture of 100 data couplers that will allow the direct electrical connection of customer data equipment to the telephone network. The couplers were made on a pre-production basis so that equipment manufacturers would have an early opportunity to determine how they would design their own modulating and demodulating apparatus to connect to the coupler.

Deaf people may one day be able to communicate by using the buttons of the Touch-Tone telephone. Bell Laboratories is experimenting with a technique that employs the tones generated by the buttons to activate a visual display of letters and numbers on a small screen. Even though two phones are connected, the buttons will still generate tones without interfering with normal switching operations.



The above centennial logo will be used throughout the year as a distinctive symbol to visually tie together our varied 100th anniversary projects.

Western Electric is supplying a new model Call-a-Matic® telephone for the Bell System that can store up to 250 or 500 individual telephone numbers, depending on the model. Any number can be called automatically simply by pressing a call button. The numbers can either be typed or written on an easy-to-see directory. Parts for the phone are made at Western Electric's Indianapolis, Baltimore and Kearny Works. The sets will be available to all Bell telephone companies early this year.

Sandia Laboratories has found another application for the laser. The Laboratories is using the concentrated light beam to detect the existence of foreign particles in the air of clean room environments. Air samples are drawn into the beam at the rate of ten cubic feet a minute. Any particles in the airflow will scatter the light and cause it to strike the face of a photosensitive tube. The monitor can detect particles as small as 1/75,000 of an inch long.

Bell Telephone Laboratories is developing a new solid state light source no bigger than a shirt button. The miniature lamp requires no more electricity than it takes to operate a telephone circuit. Instead of giving off heat as excess energy, the lamp gives off a bright ruby light. In its first application, it will illuminate the plastic buttons of Touch-Tone® dials.

WE's Merrimack Valley Works in Massachusetts is planning to manufacture equipment for the proposed L-5 cable carrier system between St. Louis and Los Angeles. L-5, which is now under development by Bell Laboratories, will have the capacity for carrying about 90,000 simultaneous telephone conversations on a 22-tube coaxial cable.

Consider the Alternatives

There's a new 'Battle of Britain' shaping up—over London's phone books. The government wanted to eliminate the present four A-D, E-K, L-R, and S-Z books and provide a customer one of 36 neighborhood directories. Then began the protests. What if a person moved to another neighborhood? "Call Directory Inquiries," said the British Post Office. But that can often take a 30-second to 10-minute wait. There also may soon be a 12-cent charge for getting a 'difficult' number. More protests. Then the govern-

ment considered all the protests and also considered a concession—giving all 36 books to those who requested them. That meant a 3-phone family would need 108 phone books. The government is now said to be reconsidering its entire plan.

Somebody Goofed

When lawmakers in one mid-western state needed a complete list of services to be covered under a new tax bill, what did they do? Just what most shoppers do. They turned to the Yellow Pages, where they found all their listings—with one exception. The Yellow Pages. Somebody forgot the obvious listing, an oversight that was promptly corrected.

Way Back When

... the Ma Bell image began, she wasn't a Bell at all. She was Mother Barton, the mother of Enos M. Barton, who mortgaged her farm in upstate New York so her son and a partner could go into business. That business eventually became Western Electric.

... in 1921, the Company made the first commercial purchase of an item not even remotely connected with telephone production—the first band-aid. The inventor demonstrated his gauze and tape samples to WE officials, who liked the idea. The inventor's 'unit first aid dressing,' today's band-aid, went into mass production a short while later.

... the first records were available in 1914, WE shipped 542,000 telephones. By 1968, that number was over 8 million.

Can't Beat It

The Bell System's tic-tac-toe machine, located in Chicago's Museum of Science and Industry, does not cheat. But some visitors insisted that the machine wasn't playing fair. A check proved that the machine did, indeed, suffer a human trait—a memory lapse. Every so often, it seems, the device was simply erasing an 'X.' The culprit was a speck of dust in the machine's memory system, which made it forget that the space, already used by an opponent, was filled. A good cleaning cleared up the problem. Now no one can beat the device, even when it plays on the level.



For years the telephone has been a favorite vehicle of song writers. There are classics like the two above, along with such other old-time hits as "The Telephone March," the rousing "Telephone Gallop," and, who



can forget "Hello Central, Give Me Heaven." A later era's salute was titled "Help Me Telstar." As for the future, we might look forward to something like an updated version of an oldie—perhaps it will be "Hello ESS."



Western Electric

What's in a trademark? The original Western Electric slanting signature has two origins: an 'electric' effect deemed appropriate to our name, and the tapering thorns of the hawthorn bush. The Hawthorne Works, too, derived its name from the same bush, which had given its name to a street in a Chicago suburb which was laid out in 1869, the same year Western Electric was founded. Artist William Elcome, who patented the signature for WE in 1910, stated that his design was achieved by "application to the letters and characters of the hawthorn bush . . . so as to give an electric effect."

MOVING? NOTIFY YOUR SUPERVISOR OF CHANGE OF ADDRESS

BULK RATE
U. S. POSTAGE
PAID
Chicago, Illinois
Permit No. 4025

WESTERN ELECTRIC COMPANY
195 Broadway
New York, N. Y. 10007