

GTE Automatic Electric

**Innovation In
Telecommunications**

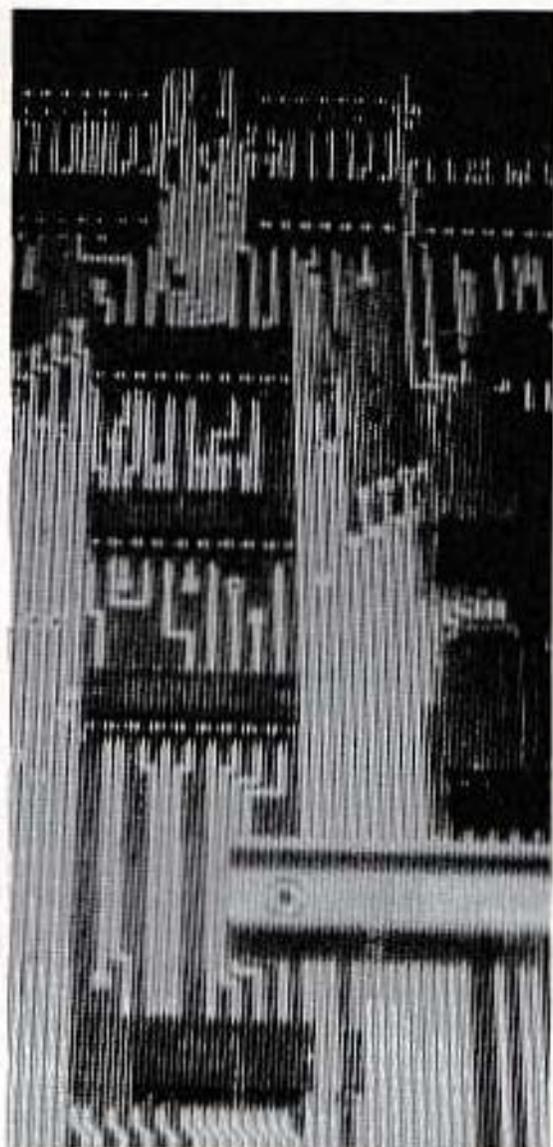


This Is GTE Automatic Electric

The telecommunications industry, though basically evolutionary in nature, has experienced such rapid change in recent years that frequent mention is now made to a telecommunications revolution. Digital switching techniques, expanded software design parameters, and integrated circuit technology have combined to create switching systems with features and services that were only dreams a short time ago.

GTE Automatic Electric is positioned at the forefront of this dynamic industry through a tradition of innovation and commitment to excellence. Our mission is to provide better communications in the years to come for all our customers — the nation's telephone companies, and the business and residential users of their services.

Following is an overview of our history as a pioneer in telecommunications, a brief look at our central office switching systems and the organizations in the company which have made our products possible, as well as a look at our parent company — GTE.



The "Strowger Automatic"

An Early History of GTE Automatic Electric

Our story began in 1889 when Almon B. Strowger, an enterprising mortician from Kansas City, encountered problems with the local telephone company. Strowger was convinced that local switchboard operators were failing to complete calls to him, and instead were connecting them to a competitor in town. Strowger vowed to devise a telephone system that would allow the calling party to control the equipment, completing connections without an operator.

On March 10, 1891, U.S. Patent #447,918 was issued to Strowger; a year later the world's first automatic telephone exchange was put into service in LaPorte, Indiana. Strowger's invention, which resulted in the dial telephone, marked an important chapter in the history of communications. Alexander Graham Bell, of course, is credited with inventing the telephone itself, but he had made no provision for interconnecting large numbers of telephones. It was in this area that Strowger's invention offered significant advantages.

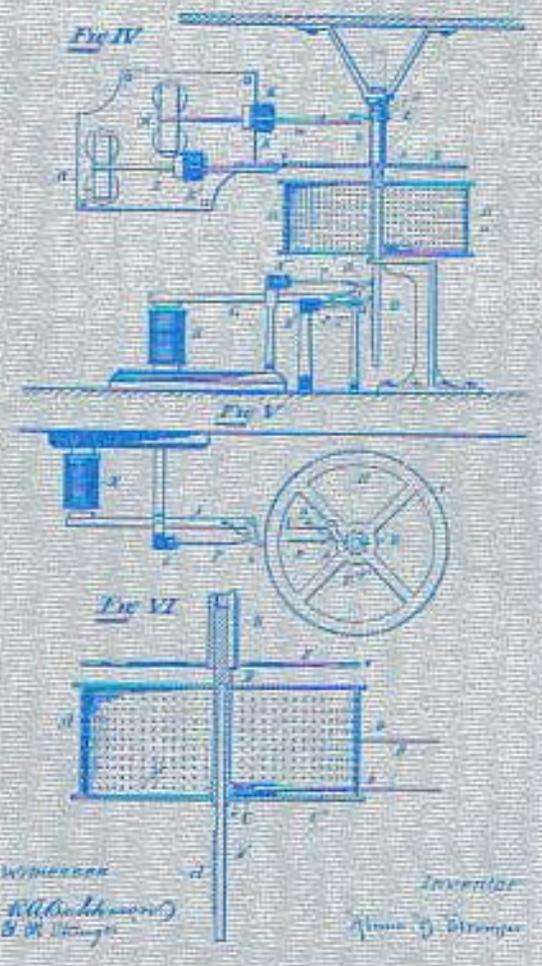
Like so many other great inventions, Strowger's switch was basically simple. Using electromagnets energized by electrical pulses

transmitted over the telephone line, the device activated a pawl-and-ratchet mechanism that moved a metal finger (now called a wiper) over a bank of contacts, each connected to the wiper. By sending the proper number of pulses, the caller directed the wiper to the specific contact connected to the desired telephone. The two telephones were thus connected electrically. By sending additional pulses over another wire, a bell rang at the telephone at the other end of the line.

Soon after his switch was patented, Strowger met Joseph Harris, and the two men joined forces to form the Strowger Automatic Telephone Exchange to further develop and promote the automatic system. The new company found its first markets among the "independents" — the companies formed to provide telephone service to small communities as Bell Telephone patents expired and new markets opened.



(No Model.)
A. B. STROWGER
 AUTOMATIC TELEPHONE EXCHANGE.
 No. 447,918. Patented Mar. 10, 1901.



The Strowger switch was not the only innovation of this rapidly moving young business. In 1896 Strowger engineers developed the rotary dial, which substantially reduced dialing errors.

In later developments, Strowger engineers were credited with the innovative principle of "transfer trunking" — directing each call through a series of switches, permitting expansion of a switching system to any required size. The application of this principle has made possible today's nationwide communications network.

The Strowger Automatic crossed the Atlantic in 1898, when a 200-line system was exhibited in London. The next year, a 400-line system was put into service in Berlin, with many international installations following.

The complex and congested communications network in London prompted another Strowger invention — "the director." This device could: (1) register the called number as the dialed impulses were received; (2) translate this number into the proper combination of digits and (3) send the digits to the Strowger switches. Development of the director made possible the automatic handling of "local" calls. But long distance or "toll" calls presented another problem, solved by the introduction of the Strowger Automatic Toll Ticketing System, first installed in Belgium in 1938. This permitted direct access to the DDD (Direct Distance Dialing) network.

Corporate History

The Automatic Electric organization was formed in 1901, and acquired from the Strowger company the rights to manufacture and sell Strowger equipment in the United States. That year, the company erected a six-story manufacturing plant on the west side of Chicago which housed the administrative offices, laboratories, sales, manufacturing and engineering operations. As the only manufacturer of dial equipment in the U.S. for many years, Automatic Electric single-handedly promoted "the Automatic" among independent telephone companies. And as the Strowger system proved itself in actual service, the company's efforts met with increasing success.

In 1955, Automatic Electric was purchased by the General Telephone & Electronics Corporation. At that time, GTE already had one other telephone manufacturing subsidiary, the Leich Electric Company of Genoa, Illinois. Leich, founded in 1907, produced a wide range of telephone equipment, including a relay-type dial switching system. Its product line dovetailed neatly with that of Automatic Electric; the two manufacturers could provide virtually all the equipment required by telephone companies in their exchanges and subscriber stations.

In April of 1956, GTE Automatic Electric broke ground for its current manufacturing plant in west suburban Northlake, about 20 miles from Chicago. The next year, all operations were transferred to the 160-acre site from Van Buren Street in Chicago.

That same year, GTE acquired Electronic Secretary Industries of Waukesha, Wisconsin, originators and manufacturers of telephone answering devices. This plant, along with the Leich plant, became manufacturing branches of GTE Automatic Electric in 1963. In 1981, the Waukesha plant was closed as part of an overall facilities consolidation; viable products were transferred to the Genoa plant.

GTE Automatic Electric now is a part of GTE's Communications Products Group, a multi-billion dollar world leader in developing and manufacturing a wide range of systems and equipment, from telephones and switching systems to products used in satellite and optical fiber communications.

Automatic Electric Products

A Tradition of Innovation

In today's rapidly expanding world of communications, customers demand creative approaches to their communications problems. While GTE Automatic Electric offers communications products and services to meet these diverse needs, we continually examine both our product line and customer service and support organizations to keep pace with changing technology and the creative applications of our customers.



Established as a pioneer in the early years of the telecommunications industry, GTE Automatic Electric today is engaged in the design and manufacture of sophisticated central office switching equipment using the most advanced design, engineering, manufacturing and testing techniques.

GTE Automatic Electric's most important new product for the 1980s is the GTD-5 EAX family of digital central office switching systems. The first of a generation of microprocessor-controlled systems, the GTD-5 EAX (Electronic Automatic Exchange) now is being sold in the domestic marketplace. An international version will be introduced in 1983.

General Telephone of California's central office in Banning was the first site for the GTD-5 EAX, which went into service in June, 1982. It is expected that four million lines will be in service nationwide by 1985.

The GTD-5 EAX features total modularity, which permits almost unlimited expansion to keep pace with subsequent growth or demographic change in the serving area. The modular concept allows telephone companies to economically tailor their telecommunications network to meet their needs



without costly alterations or duplication. The base unit of the GTD-5 EAX can serve up to 150,000 telephone lines.

Thanks to its advanced design, the GTD-5 EAX can service remote switching and line units, and multiplexer units, switching calls in more sparsely populated areas, while still providing centralized administration and billing. This concept enables telephone companies to achieve savings by eliminating duplication of equipment and personnel.

Employing stored program controlled machines, the GTD-5 EAX relies on its "memory" to provide advanced services and

features. Its memory can grow in modular stages up to 24 million words — virtually guaranteeing that the system will be current for many years to come.

The GTD-5 EAX has been built on the expertise GTE Automatic Electric gained with previous central office switching systems. With a history of setting standards in the telecommunications industry, the company has established a reputation for excellence in design, manufacture and installation of central office switching systems through the No. 1 EAX, the No. 2 EAX and the GTD-3 EAX.

The No. 1 EAX is a computer-controlled switching system for the large telephone central office, with a growth capability to 45,000 telephone lines. With the introduction of electronic stored program techniques, the system provided great flexibility in handling changing traffic requirements and offering a wide range of customer services. The first system was installed in 1972 in St. Petersburg, Florida.

Designed for the intermediate-size central office (up to 25,000 or 40,000 lines depending on the processor type), the No. 2 EAX was introduced in mid-1975 in Mahomet, Illinois. This system featured computer-controlled electronics and provided Centrex service, which eliminated the need for special equipment on the customer's premises.

Designed to handle up to 360,000 calls per hour, the GTD-3 EAX services toll, or long distance, telephone traffic. The system features a digital PCM (Pulse Code Modulation) non-blocking network, providing fully automated routing and centralized automated message accounting. The first system was placed into service in Rice Lake, Wisconsin in 1978.

In order to enhance GTE's position as a leader in the telecommunications industry, new developments are on the horizon.

Telephone company revenue-producing features such as Automatic Bill Calling, whereby credit card calls will be automatically verified and completed without operator assistance, and Home Extension Intercom, allowing the customer to call an extension telephone from another phone in the home, are just two of many services to be provided in the near future to those served by a GTD-5 EAX.

Other future features available on the GTD-5 EAX include a Remote Billing System Interface, allowing the telco data processing facility to collect billing information directly from the central office, via high speed data channel. And to help reduce maintenance costs, the Switchable Spare Line Card feature will permit a spare printed wiring card to be substituted for a faulty card, via CRT command, with no manual intervention.

Such innovations are helping position GTE as a major force in one of the fastest growing segments of world business — the telecommunications industry.

Toward Continued Leadership

The Automatic Electric Organization

As a major component of GTE's Communications Products Group and the largest manufacturer in GTE, Automatic Electric is paving the way for an even greater role in the fast-changing telecommunications industry. To meet this challenge, it is imperative that the company be organized to allow for the orderly flow of products from development through customer service, and to assure that the staff groups provide the most useful services to the line operations. To accomplish this team effort, Automatic Electric includes the following organizations:

Research and Development

GTE Automatic Electric's Research and Development organization is responsible for the design and development of advanced network switching systems. This group is faced with the formidable task of analyzing the needs of customers world-wide and responding with system designs to meet these requirements. From design concept to

working prototype, R & D engineers are involved in every phase of state-of-the-art telephone switching technology. Functional areas include system software and hardware design, circuit and device design, system test and integration, field support, and engineering services.

The R & D group has facilities in both Phoenix, Arizona, and Northlake, Illinois. The Phoenix operation, located in a 200,000-square-foot facility, is dedicated to software design and development. Hardware design efforts being carried out at the Northlake facility are closely coordinated with the Phoenix organization as well as with the manufacturing and marketing organizations to provide for a smooth introduction to customer-preferred products into the marketplace.

Manufacturing Engineering and Operations

In order to keep pace with the dynamic technological innovations in product and manufacturing processes in the telecommunications industry, a new approach to high quality, high volume production for state-of-the-art digital switching systems has been implemented at GTE Automatic Electric.

To maximize testing effectiveness at all levels, new product assurance/quality assurance philosophies and techniques have been developed. These programs employ sophisticated, versatile microprocessor-based equipment to perform comprehensive testing and inspection functions. New manufacturing technologies, coupled with state-of-the-art equipment and processes, are now in place to achieve the highest quality manufacture at high production levels.

In addition, human resource development programs have been implemented to address the unique needs and contributions of the people responsible for building quality into all GTE Automatic Electric products.

These new manufacturing and testing philosophies and processes, the expanded emphasis on human resource development and productivity, and the implementation of

new management strategies all underscore the strength of the company's new product manufacturing capabilities.

The primary focus of this heightened activity is the Northlake plant. As the company's major manufacturing facility, the Northlake plant totals nearly 2.2 million square feet — or 44 acres — all under one roof. About 1.3 million



square feet are used for manufacturing, including a 100,000-square-foot dedicated manufacturing facility, or "plant within a plant." Opened in 1981, this state-of-the-art production and testing area is dedicated to the company's newest digital product line — the GTD-5 EAX.

GTE Automatic Electric also maintains manufacturing space in Des Plaines and Genoa, Illinois. The 92,000-square-foot Des Plaines facility employs about 100 people whose main focus is electromechanical final assembly and refurbishment, as well as terminal entry equipment and modem modification and distribution. Des Plaines also houses a data products test facility.

In the fall of 1980, GTE Automatic Electric began full operation at its new manufacturing and engineering facility as part of the Genoa branch plant. Dedicated to producing hybrid microcircuits for electronic telephone switching systems, this 42,000-square-foot facility manufactures about 60 different types of microcircuits used in the GTD-5 EAX and other products. Additional production at Genoa includes correed relay and matrix card assembly, and transformer and relay coil production. These components go into the printed wiring cards used throughout GTE Automatic Electric switching systems. Other end products include: key telephone systems, the digital intercept recorder and recorder/announcers. Almost 1,200



employees work at the Genoa plant which covers a total of 360,000 square feet.

Marketing

GTE Automatic Electric products and services are marketed to the 19 domestic and international General Telephone operating companies, to more than 1,400 independent telephone companies and to the Bell System. Recent regulatory and technological developments have created dynamic changes in all of these markets, including intense competition and rapidly expanding new business opportunities. The selling organizations respond to these changes by structuring dedicated groups to focus on the highest potential business segments as they emerge. In addition, planning, communication and customer service activities provide critical support to the sales force in determining the needs of the marketplace.

Network Services and Support

This organization provides technical services to domestic and international customers and to the marketing and sales division in support of large network switching systems. The focus areas of systems engineering, installation, and customer training support our commitment to continued customer satisfaction with Automatic Electric products.



Supply

The Supply Division is commonly viewed as a "business within a business," operating as a separate profit center of GTE Automatic Electric. This organization, headquartered in Salt Lake City, Utah, buys and resells to both GTE and independent telephone operating companies and interconnect companies, telecommunication equipment and supplies manufactured by GTE and other vendors. In addition to its marketing and purchasing activities, the Supply Division operates a net-

work of regional distribution centers across the United States which supply thousands of products ranging from telephone cable and telephone instruments to entire tele-communications systems.

As a major revenue-producer for GTE Automatic Electric, the Supply Division forecasts continued growth in both the regulated and non-regulated markets in the years ahead.

Finance

As part of a billion dollar company, Finance has the complex task of developing, updating and interpreting financial information to GTE Automatic Electric management while assuring asset control. This organization works closely with other departments and branch locations in controlling costs and investment management; analyzing results; and assessing the financial implications of alternate strategies. In addition, Finance plans policies



and practices, and monitors and reports the company's short and long-term finance performance, to GTE as well as holders of Automatic Electric debt.

Information Management

The major objective of the Information Management organization is to provide effective handling, storage, retrieval and display of critical business information. The group administers the Salt Lake City, Phoenix and Genoa computer facilities, as well as the Northlake Data Center, one of the largest such facilities in the Midwest. Another goal of Information Management is the development of new business systems. The organization also focuses on office services, vehicle and other general administrative support, and documentation, sales and service, which provides printing, graphics and media support for all products and systems.

Human Resources

The mission of the Human Resources organization is to assist the general management team in effectively planning for, acquiring, deploying, retaining and developing employees. To do this, the department strives to create an overall work environment that encourages communication, teamwork and innovative ideas, while at the same time balancing the objectives of employees and line

management. Human Resources programs include: career opportunities through position posting and planning; increased utilization of female and minority talent; training and development; joint labor/management committees; and competitive compensation, relocation policies and benefits.

Other Staff Support Functions

Other organizations provide invaluable support to GTE Automatic Electric to assure that the company enhances its leadership role in the industry, maintains the support of its publics and conforms with governmental regulations.

The *Legal* staff monitors all corporate activities in the labor relations, operational and pricing areas to assure compliance with the law.

Public Affairs promotes effective communications between the company and its employees, and the company and the community, the media and legislators.

The *Strategic Planning* organization develops the policy and process for strategic and business plans, and coordinates the identification and analysis of new business opportunities critical to the continued success of GTE Automatic Electric.

The Parent Corporation:

GTE

GTE Automatic Electric's achievements in telecommunications represent just one highlight of its parent corporation's tradition of leadership. GTE Corporation is made up of more than 60 communications, products, research and service subsidiaries, making it one of the world's largest corporations.

Headquartered in Stamford, Connecticut, GTE has operations in 39 states and 18 countries abroad. These world-wide operations are part of the major components of GTE, described below.

Telephone Operations

The Telephone Operations Group consists of 19 domestic and international subsidiaries, serving more than 11 million customer lines and about 18 million telephones. These companies provide many types of communications services, ranging from telephone service for the home or office to highly complex voice and data services for industry and national defense.

Also part of this operating unit is the *GTE Directories Corporation*, which sells Yellow Pages advertising and produces directories worldwide; and *GTE Satellite Corporation*, which, in conjunction with AT&T's Long Lines Department, operates a communications satellite system.

GTE Data Services provides a variety of data processing services to GTE operating units through a network of 11 strategically located, computerized data centers.

GTE Communications Products

GTE Communications Products Group, of which Automatic Electric is the largest component, is a world leader in developing, manufacturing and marketing a wide range of systems and equipment, from telephones and switching systems to products used in satellite and optical fiber communications.



Besides *GTE Automatic Electric*, this organization includes *GTE Communications Transmission Systems* (Lenkurt) which covers the spectrum of transmission technology, including involvement in satellite and optical fiber communications, digital microwave radio equipment, and multiplex and data transmission systems.

GTE Sylvania Systems serves defense, government and other markets with customized products such as reconnaissance systems, intrusion detection equipment, laser and electro-optical devices and lithium battery power systems.

GTE Business Communications Systems is charged with the development, manufacture and marketing of telephones, key systems, PABXs and other telecommunications terminals.

GTE Microcircuits manufactures integrated circuit components used in electronic memory applications.

To provide product support on a global basis, *GTE Communications Products* includes two international organizations — one serving Europe, Africa and the Middle East; the other operating in Latin America and the Far East. These manufacturing and marketing groups insure that the company's products meet the specific telecommunications standards of countries abroad.



GTE Electrical Products

The third major operating component of GTE is the Electrical Products Group, producing more than 6,000 different types of lighting products under the Sylvania name, providing a broad range of precision materials and manufacturing a diversified line of electrical equipment. The group has 123 plants in the U.S. and seven affiliated companies overseas.

GTE Lighting Products produces consumer, industrial, commercial and photographic lighting products and fixtures.

GTE Precision Materials provides a wide variety of parts and materials to numerous product manufacturers, including specialty and refractory metals; high-purity chemicals; metal, plastic, precious metal, and ceramic parts and components; and custom circuit assemblies.

GTE Electrical Equipment manufactures and markets a diversified line of products including circuit breakers, switchgear, transformers, controls, baseboard heaters, variable speed drives, non-metallic electric switch and outlet boxes, and metal framing systems.

GTE Telenet Communications

GTE Telenet Communications operates a public "packet switching" network for data communications, markets data networks for customers' private use, and operates nationwide electronic mail service. This group also produces processors and software enabling



computers and terminals to be connected to packet switching networks.

As a part of Telenet Communications, *GTE Telenet Information Services* provides data-based and communications services for the investment and brokerage business.

GTE Laboratories

GTE Laboratories is involved in a broad range of disciplines including natural sciences, engineering, life and social sciences, with activities ranging from basic research, product development and new service concepts to product improvements and new manufacturing processes and techniques. GTE Laboratories supports all of GTE's operating units, seeking new frontiers to enhance GTE's technological leadership position.

Dedication to Excellence

Employees of the domestic and international GTE components currently total about 204,000, ranking GTE No. 8 among the nation's industrial and utility corporations; revenues and sales totaled approximately \$11 billion in 1981, ranking the corporation No. 27. With 1981 year-end assets totaling more than \$21.1 billion, GTE ranks No. 11 in this measure.*

This is GTE — a leading company in two of the fastest growing major industries in the world — communications and electronics.

And, through the use of innovation and ingenuity, inventiveness, imagination and dedication to excellence, GTE will be able to take full advantage of the opportunities and challenges of the changing world marketplace.

*Based upon a combination of *Fortune* magazine's Industrial rankings in the May 3, 1982 issue, and AT&T ranking No. 1 among utilities.



GTE Automatic Electric
400 N. Wolf Road
Northlake, Illinois 60164
(312) 681-7100



Switching &
Telephone Products

