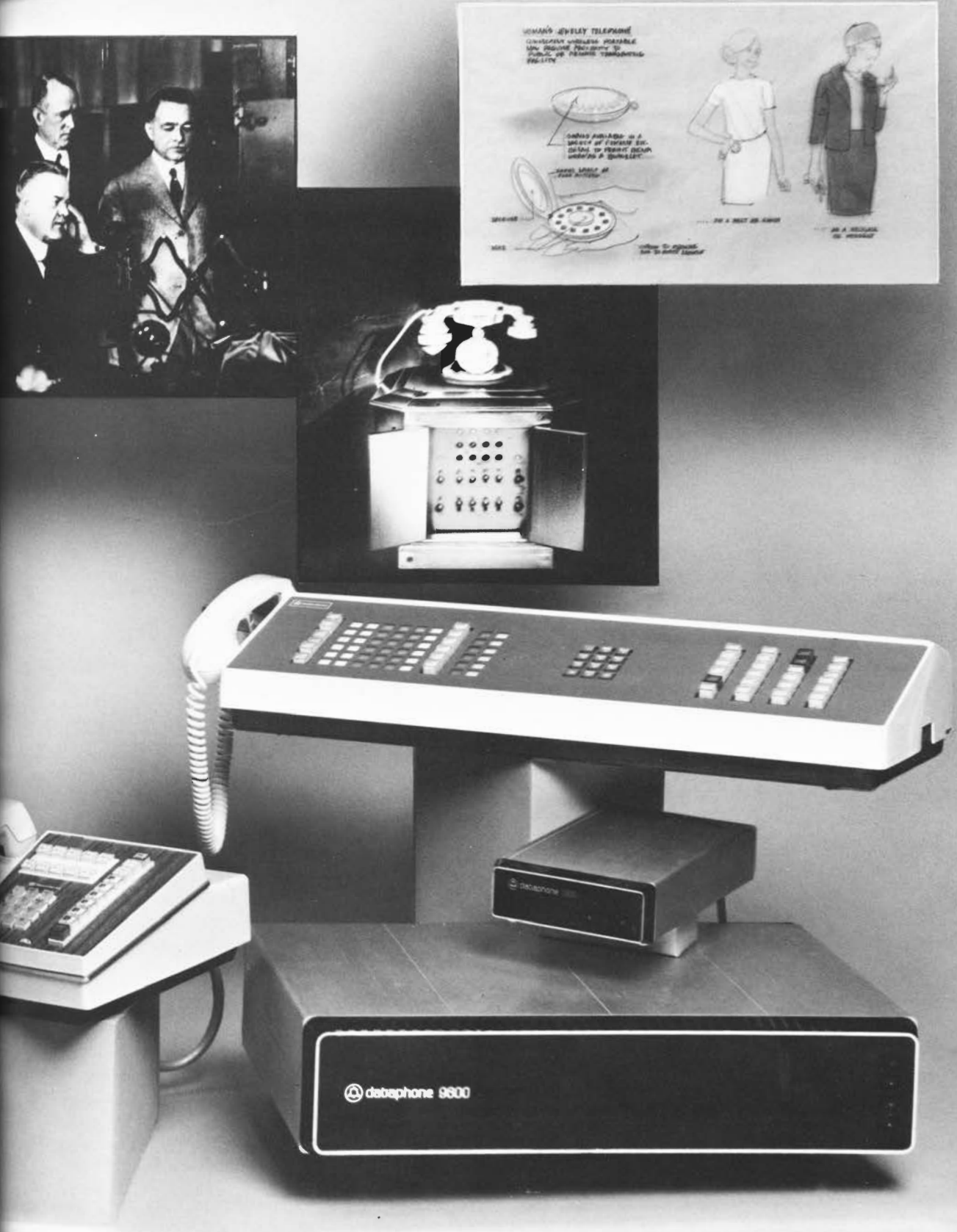
Alpha and Omega of the Network: Customer Products

J. W. SCHAEFE



In its first 50 years, Bell Laboratories has given an excellent account of itself in the customer products arena. It has put a tremendous variety of products literally into the hands of Bell System customers. The evolution of today's versatile business systems and residential sets is a history of innovation and dedication to good service.

WHAT IS THE "BELL SYSTEM" to our customers? It's the equipment—and the service that is its natural accompaniment—which they see and use in their own homes, factories, and offices. This terminal equipment, called customer products in telephone language, has characteristics quite different from much of the rest of the telephone "plant." It's on the customer's premises and hence it's highly visible, so it must have a pleasing appearance. Each customer pays for the full use of this kind of equipment, and since its use is shared with no one else, it is extremely cost-sensitive. Customer products are the telephone system's interface with its human users; consequently, the design of the equipment heavily involves human factors and is directly subject to changes in perceived needs. Further, it must be highly reliable, since getting craft personnel to its location makes repairs expensive—and can inconvenience the customer. Finally, today it is in direct competition with products from other sources, from mail-order houses, department stores, and well informed salesmen—so it's got to be good.

The Early Years

Since the day Bell Laboratories came into being, we have worked to make the Bell System's customer products the best. And Bell Labs came into being in the very midst of a boom. The climate of the 1920s was one of optimism and progress. Despite a semi-official government policy of political isolationism, foreign trade and travel increased. Automobiles and electric power were changing our way of life. Americans in both business and private life were stepping into a broader, faster-moving world, and it was inevitable that they would need—and demand—more and better communication facilities. It was the role of Bell Labs engineers to aid the Bell System to be one step ahead of these demands, by continually improving the telephone system they inherited from their predecessors at AT&T and Western Electric.

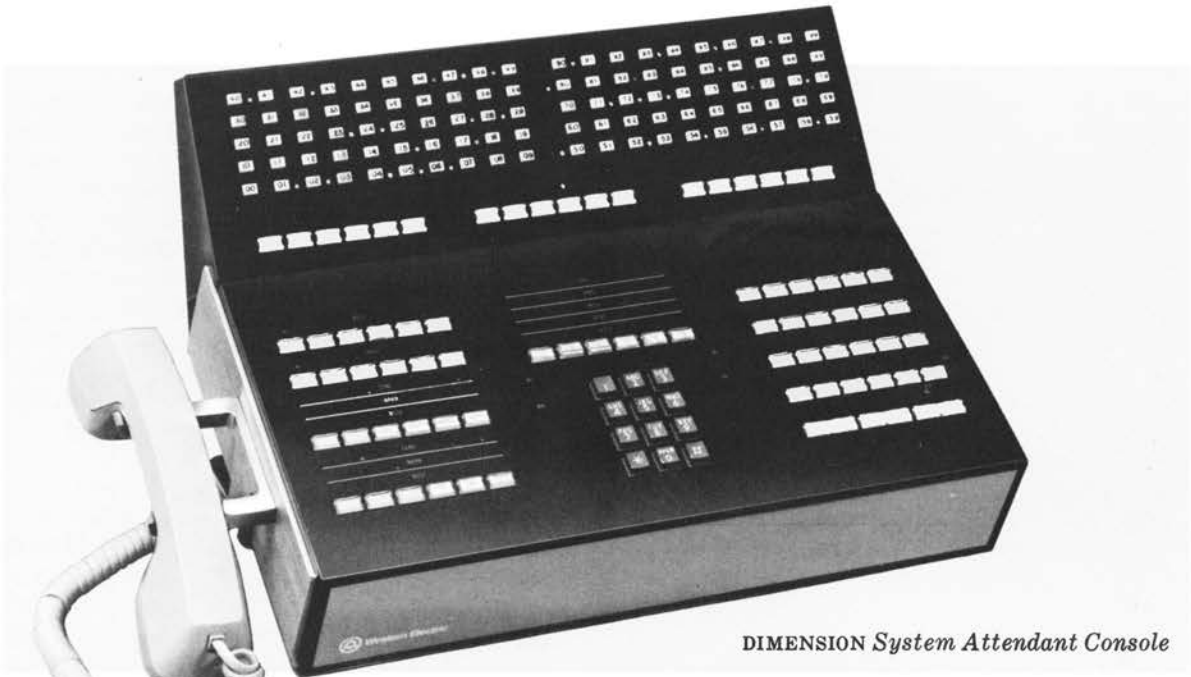
Desk Set, ca. 1920

In their efforts to anticipate and satisfy these demands, Bell Labs often saw solutions to problems outside the accepted definition of customer products. For example, during these early years they conceived new products, such as electronic hearing aids and talking motion pictures. Though much of the development was delegated to others, some of these non-telephone customer products were pursued to fruition and revolutionized daily life. (See "Extracurricular Adventures in Customer Products," page 21.)

Business people, in particular, were ready for improved, expanded telephone service and especially for new and better terminals. Except for some locally improvised wiring, they were limited to the single-line telephone; an executive needing more than one line would often have a battery of sets on his desk—and all these instruments actually afforded less service than is available today from one standard, six-button business telephone set. Now the Bell System offers a broad spectrum of products: private branch exchanges (PBXs) with many optional features, data sets, key systems, specialized telephone terminals, to name a few. In fact, our business in PBXs and key telephone systems has grown to the point where well over one million lines of Western Electric equipment are installed each year.

PBX: Communication Hub

Simply stated, a PBX is a switching machine on a customer's premises. It interconnects a number of telephones, permitting their users to call each other as well as the outside world, over relatively few lines to the Operating Company's central office. The PBX also includes an attendant's console to facilitate operation. Over the years, PBX service has evolved from manual through electromechanical to electronic switching. We have matched this



DIMENSION *System Attendant Console*

advance in technology with a variety of operating features for both PBX attendants and station-set users that make the interface between human and machine much simpler and more effective. Take, for example, the Bell System's latest customer switching system, the new DIMENSION* system (its technical name is CSS-201). This system has the flexibility of stored-program control and the advantages of modern, solid-state electronics. The initial machine serves customers with from 50 to 360 lines; ultimately Dimension systems will be able to satisfy those with up to 2000 lines. Its numerous features allow it to be customized to match specific needs. Installation and maintenance are simplified; for instance, built-in diagnostic programs help locate and identify troubles. The cabinet and consoles have contemporary styling and decorator options. The "human factors" that are incorporated in its design have made the console easier to use, even though the number of features far exceeds those of any other system. Light-emitting diodes (LEDs) tell the attendant at a glance the status of any call under console control.

This new system is a far cry from the first PBX that Bell Labs designed 50 years ago. The 740A, which made its debut in 1926, featured a cordless "turret," compact enough to be mounted on a desk. It used factory-wired switching equipment, thus reducing installation costs. Its first application, oddly enough, was not in the business community but in the residence of Edsel Ford, and its primary markets in the booming 1920s were large estates that needed many telephones and wanted equipment to harmonize with the luxurious decor of the times.

The "turret" is part of history now, but a good many of the other multiline systems that followed it are still in service. One is the 701A PBX, introduced in 1928 and still used today,

740A "Turret" PBX

*Trademark of the AT&T Co.

primarily for very large installations. It uses step-by-step switches which permit uniform installation and straightforward troubleshooting. Some of our early crossbar PBX systems, too, are still in service—the popular 755A, for instance, which first appeared in 1938 and bore witness to our continuing efforts in development despite the disastrously negative effects of the Depression. The 755A is a dial exchange handling 20 lines and was used with some of the first six-button telephone sets.

World War II diverted our resources to military development, but when it was over we returned quickly to the telephone business. One of the first products was the 555 PBX—a manually operated cord switchboard with a capacity of 20 lines and first to use plug-in units that minimize field maintenance and centralize repair.

Two PBXs in very different styles went into service in the 1950s. The post-war, revitalized economy, despite a sometimes up-and-down trend, was looking aggressively at the future and expansion was the byword of business. Customers wanted equipment with more versatility—but they wanted it smaller, too; office space translated directly into dollars. We responded first by designing the 756A crossbar PBX, for 20 to 60 lines, housed in two modular cabinets and featuring an attendant's console with pushbutton keys—the first such console since the "turret," small and attractive enough for table or desk-top mounting. For businesses anticipating future growth, we designed the 608A cord-type multiple switchboard, with flexibility as a major advantage: It can be used with or without dial equipment and can handle from 80 to 2400 station sets. The 608A, when it was introduced, occupied less space than former systems, offered new services, and had modern, decorator styling. Pushbuttons replaced the usual lever-type keys, and plug-in units were used for all cord relays.

Also during the 1950s, the application of Bell Labs' famous brainchild, the transistor, produced extraordinary advances in the art of telephony. Bell Labs began the development of electronic switching systems for central offices, and customer-equipment designers capitalized on the new technology to bring to a speed-conscious market the No. 101 ESS. This system has a common-control unit in the central office and can serve several business customers in the 80- to 2000-line size range with switching units on the customer's premises. These local switching units are controlled over data channels by the central-office control unit. The No. 101 offered more features than any other system of its day, including TOUCH-TONE® calling, speed calling, conference calling, individual call transfer, and other custom calling features. It is still one of our most deluxe business services.

The 800A and its successor, the 801A, were introduced in 1966 and 1971, respectively. They offer the small size and quiet operation of electronics in a customer-premises unit. Serving from less than 80 to 270 station lines, these PBXs use modular principles in system, circuit, and physical design, including hybrid integrated circuits mounted on plug-in cards, and can include a large number of features. A smaller model, the 805A, introduced in 1970, is an inexpensive electronic PBX for customers who require only basic dial service.

The need for a new, economical, medium-

Attendant Console for 812A PBX

size, general-purpose PBX prompted Western Electric to introduce the 770A in 1971. It has found widespread use throughout the Bell System. The 770A is a crossbar machine with an electromechanical common control. It offers an expanded complement of features, improvements in performance, and low cost.

The 812A PBX, introduced in 1972, is the first major system conceived and developed at Bell Laboratories' Denver facility. This was a tightly coordinated effort by Western Electric and Bell Labs and was accomplished in an extremely short development interval. This machine offers a full complement of features to customers requiring up to 2000 lines. It uses integrated circuits in its common control and miniature crossbar switches in its network. The 812A is enjoying a growing success with Operating Telephone Companies.

Our pace continues to quicken with the introduction of our most advanced customer switching machine, the new Dimension system mentioned earlier. The needs of business for future switching machines cannot be predicted accurately, but we certainly must continue to work to satisfy expanding requirements and to produce more versatile, trouble-free, economical communication equipment.

Before leaving this abbreviated story of PBX development, we should mention the PBX's sister service, called centrex. This system, introduced in 1961, brings to large customers services very similar to those of a PBX, but the individual stations are connected directly to the central office. The only equipment on the customer's premises are the stations themselves and attendant consoles with their associated control apparatus. Although a centrex system requires many more loops from the central office to the customer, the advantages in maintenance and the easy availability of features make it very attractive. Early in 1973 the Bell System introduced a simplified form of centrex (using the 50A Customer Premises System as the console equipment), extending the advantages of centrex service to businesses with a very small number of stations.

Another Plus: The KTS

A service closely related to PBX is the key telephone system, or KTS, in which more than one line is available at a telephone. Its name comes from the buttons, originally called "keys," with which users of these telephones perform switching operations. For many small

EXTRACURRICULAR ADVENTURES IN CUSTOMER PRODUCTS

In the early days of Bell Laboratories' existence, it was only natural that the expertise we gained through telephone research would result in pioneering contributions to other communications media. Inevitably, sideline pursuits would blossom, consistent with patent-license agreements and a self-imposed dedication to provide the world's best telephone system. In the climate of those early days, Bell Labs management visualized giving the public the benefit of any and all improved communication capabilities that grew out of telephone development. Wherever such systems or devices were clearly outside the telephone business, the cost of their development would be segregated and recovered through sale of the products or licenses to others so that their cost would not be borne by the telephone customer. And thus another form of "customer products" was born.

Bell Labs became involved in commercial radio design, specializing in high-powered transmitters, tubes, microphones, and loudspeakers—all manufactured by Western Electric. By 1926 there were 150 WE-equipped broadcasting stations. Hundreds of public-address installations had also been custom-engineered by this time.

These "diversions" outside the strict bounds of telephony were some of the first of a number of Bell Laboratories developments that had profound effects on the way of life of America and, indeed, of the Western world. For example, Bell System engineers designed the Orthophonic phonograph and, in 1925, Victor and Columbia were licensed to use its recording and reproducing developments. This reversed the declining popularity of the heretofore all-acoustically recorded and reproduced phonograph records, which had suffered from the public's enthusiasm for the new, more realistic quality of live radio. In time, these improvements, aided by the radio "disc jockey," restored

record popularity and revitalized the whole recording industry.

Without a commercial application in mind, Bell Laboratories also developed wire-line television, as an offshoot of efforts to add picture to sound for the telephone user. Its first public demonstration was in 1927 over a New York-to-Washington link. A natural parallel development, using many of the same principles, was to add sound to motion pictures—something others had been trying to do, without success, for many years. Unforeseen was the bear-by-the-tail situation that this would become for the Bell System.

The basic elements needed for this new endeavor, such as high-quality sound pickup and high-level sound diffusion in auditoriums, were already being applied in radio broadcasting and public-address systems before Bell Labs was established. AT&T and Western Electric scientists, who would become the staff of Bell Laboratories, had begun the development of electromagnetic disc recording and sound-on-disc movies. An ingenious motor-control system was designed that was, in many ways, a forerunner of the sophisticated "servo" systems of World War II. It admirably did the job of synchronizing camera and recorder, and projector and reproducer, when coupled with the clever and elaborate filtering mechanisms needed to make higher-frequency flutter undetectable at slow (33⅓ rpm) turntable speed. And, because loss of synchronization was still a definite hazard in the disc system for other reasons—the strong possibility of film breaks, for example—a backup sound-on-film system was developed simultaneously with disc.

By early 1924 talking motion pictures were ready for practical application with sound on either disc or film, although greater experience with disc tended to favor that medium for initial commercial trial. But it wasn't until 1926, the year after Bell Laboratories was formally established, that the motion-picture industry reluctantly accepted sound.

The big producing companies were not only uninterested; they were antagonistic. The business was already very profitable—why rock the boat and incur vast new expense for studios and theaters? Directors, artists, and producers felt that the silent picture was a pantomime art in its own right and should not compete with the live theater. Besides, a huge inventory of silent films existed whose value would depreciate to zero if made obsolete.

Finally, a Western Electric employee in the Pacific Coast Radio Division negotiated the first contract. He knew that Warner Brothers was in shaky financial condition and was losing ground to the other big producing companies, and he convinced them that pioneering "talkies" could be a lifesaver. They grasped at the straw, signed an agreement, and in April 1926 formed the subsidiary Vitaphone Corporation to produce the first sound picture.

In August 1926, "Don Juan," a silent picture with synchronized-disc musical scoring, was run in several specially equipped Warner theaters. It received good notices from the critics, but this use of sound was not dramatic enough to impress the public. It took another year to erect sound stages and produce "The Jazz Singer," released in October 1927. This time, synchronized singing and dialogue amply demonstrated the dramatic capabilities of the new medium. The success was huge, and the Hollywood panic was on.

To insulate itself, to some degree, from the peculiarities of the movie industry, and to avoid mixing the financing of commercial offshoots with the telephone investment base, in January 1927 the Bell System formed Electrical Research Products, Inc. (ERPI) to handle all facets of this obstreperous market. It became the Bell System's licensing agency and party to all contracts in the entertainment field. With the success of "The Jazz Singer," everybody wanted in, so by May 1928 ERPI had agreements with all the big producers and most theater chains for recording and reproducing equipment.

Competition was not absent. Fox equipped its theaters with Western Electric reproducing machines, but its new "Movietone" was recorded on other manufacturers' equipment. Others entered the market—GE, Westinghouse, and RCA among them. By 1928, as many as 230 companies manufactured and installed theater sound equipment, some of it quite marginal in performance.

The frantic pace of the "Keystone Cops" might be compared with that of the next two years, for tooling and manufacturing by Western Electric and for installation and refinement by ERPI, which had to hire and train hundreds of engineers. By the end of 1930, all major studios and 13,500 theaters in the United States were equipped for sound, the majority using WE installations. The recording disc was completely supplanted by the sound track on the motion picture film, even Vitaphone succumbing to the editing simplicity of film.

As the U.S. market saturated, effort turned to other parts of the world, and ERPI's "talking pictures" became as well known as American soda pop. Half of ERPI became a theater-service organization, which AT&T sold in 1934. The other half, contracting as the Depression deepened, turned

to developing commercial products, in addition to vastly improving sound-recording equipment and techniques. With Bell Laboratories consultants, ERPI advanced the technology of such diverse products as 16mm sound equipment, photoelectric and high-speed camera devices of several kinds, watch timing equipment, acoustic measuring instrumentation, vertical-cut (hill-and-dale) disc recording/reproducing equipment, and airport surveillance recorders.

There was often glamour and always variety associated with ERPI's activities. For example, a musical library, created to demonstrate the superior quality of vertical-cut discs, became the foundation of Muzak (wired sound in stores, restaurants, etc.). Industrial and educational pictures were produced to sell 16mm sound. ERPI even took over a bankrupt motion picture studio, manned it with key personnel, negotiated contracts with big independent producers, and operated as the top such facility in Hollywood for eight years.

Finally, in 1937, the Bell System eased out of all these sidelines, selling them off. ERPI was reduced to Hollywood R&D activities which were obligatory under its license agreements, and to foreign operations. In essence, the commercial-products era of the Bell System was fading. ERPI was finally dissolved after World War II, and by the 1950s our extracurricular adventures were over. In today's climate, a Bell System trespass along such forbidden paths is unthinkable, but the roller coaster ride it took was a glorious adventure for those who participated.

(This material was extracted from a paper by John G. Matthews, who began his Bell System career with ERPI in 1928 and joined Bell Laboratories in 1942. He retired in 1972.)

customers, a key telephone system can supply most of the PBX functions. Key systems are also used extensively with PBXs; most business offices use key systems to make their PBX lines more versatile.

Key telephone is one of the fastest growing segments of the business-communications market. Western Electric now builds about two million line circuits for key telephone systems annually. The impressive surge of interest in KTS came after World War II, but the Bell System was offering single-set, multifunction service long before that. As a matter of fact, in the 1920s telephone-company installers were making special wiring arrangements to give customers pick-up, hold, and signaling features for a number of incoming lines. To do this, Operating Companies standardized a number of wiring plans, each having a fixed number of lines and stations and a fixed set of operating features. As customer needs became more complex, more plans were added, and in the 1930s AT&T standardized about 30 such plans for the Bell System. However, those arrangements did not meet all customer requirements, and telephone companies continued to engineer plans of their own which were usually variations of the standard schemes. (The New York company, for instance, had hundreds of locally designed arrangements.) These plans tended to lack flexibility and made installation, change, and removal difficult and expensive.

In 1938 Bell Laboratories replaced the cumbersome wiring plans with a family of station-switching arrangements using telephones with built-in switching keys and standardized equipment and apparatus. In this, the 1A Key Telephone System, separate units with specific capabilities could be assembled to give a customer the desired features—and thus, the "building block," or modular, concept came into being. The 1A KTS was popular with the Bell System's customers and greatly simplified telephone-company operations. Later (after World War II), we improved the 1A system with the addition of illuminated buttons, or lamp signals.

The 1A1 Key Telephone System, which was brought out in 1952, extended the building-block flexibility of the 1A and made larger systems—over six lines—more compact, lower in cost, and easier to install. The 1A1 includes, among other features, two illuminated buttons, a winking lamp signal for lines being held, a dial intercom, and several factory-

wired packages of interconnected "Key Service Units" for various combinations of features.

The 1A2 System, a product of the 1960s, offers even more features, using solid-state devices and miniature relays in a modernized package. Today most of our key telephone customers use the 1A2; we have about 10 million such lines in service! And the ComKey* systems, introduced in 1973, bring together the most popular key-system features in packages that are wired and tested in the factory to further reduce installation costs. They also include many new features—voice signaling, for instance. ComKey systems can serve from 2 to 14 lines with up to 34 stations.

A still smaller system is aimed at the businesses that need four lines or less. For them, Bell Labs developed the Small Telephone System (STS), which offers key-system capabilities without the usual switching gear in a closet—everything is completely within the telephone sets. STS successfully completed field trials in 1974 and will become a system standard in the near future. The unit, designed with contemporary styling, has a "hands-free receive" feature and LED indicators for line status. This system is simple to install, and its smart packaging and popular features make it most attractive to small-business customers.

Bell Labs is developing further additions to 1A2 and the ComKey and STS telephone systems, as well as exploring new physical designs and new signaling systems—all aimed at anticipating and meeting the demands of a dynamic business community.

*Trademark of the AT&T Co.

A Station in the Small Telephone System (STS)

Model 2 Digital Subset

Newest: The Data Set

The youngest member of the Bell System customer-product line is the data set. Although conceptually the dial telephone was the first true data set, it was in the early 1960s that the Bell System introduced data sets as we now know them, and today Western Electric is producing over 100,000 sets per year.

The genesis of present-day data sets—and how they permit business machines to converse with each other over the Bell System's voice facilities—is a tale in itself and must be detailed elsewhere. Here we can only note that data communication is a descendant of telegraphy, which had its beginnings about a century ago with the adoption of the Morse code. By the time of Bell Labs' founding, the change from telegraphy to teletypewriters was well underway. The Bell System's early emphasis was on the provision of full-time, private-line service, with Western Union and others offering public message service. In 1931 the Bell System inaugurated a public, switched, teletypewriter network, called TWX. This service was sold to Western Union 40 years later at the direction of the FCC. Early TWX systems used dc signaling, but later ac carrier methods became the immediate forerunners of modern data communications.

209A (above) and 202S Data Sets

In the early 1950s, Bell Laboratories, responding to government needs, designed data-transmission systems for anti-aircraft direction and control. Some of the expertise applied to designing new systems for business came from those military developments. The Model 2 Digital Subset, brought out in the 1950s, was one early product of such effort—but today it seems like a big, clumsy box when compared to its modern, more versatile cousin, the 202S.

The name "DATAPHONE®" was first used for data sets that interface with the dial switching network in the same manner as a telephone. These sets transform the data into a format that permits transmission over voice facilities and, at the receiving end, reproduce the original form of the information.

The Bell System's 200 series data sets operate on voice channels at a variety of speeds, or data rates. The 202S transmits 1200 bits per second in asynchronous transmission; the 209A, 9600 bits per second. Even faster, the 300 series of equipment uses broadband facilities (wider bandwidth than a voice channel) to transmit data at rates up to 250 kilobits per second. The 400 series, which uses tone (i.e., voiceband parallel) signaling, trades off some of this high-speed capability for greater economy, serving businesses which originate relatively short messages.

The data sets now in service give only a glimpse of their potential. Today it is possible to transmit the text and control the printing of a newspaper by data signals from a remote location. In the foreseeable future, data sets may be used for a myriad of business and household monitoring tasks. Or they could give the customer the capability to control, via data signals, various functions of the home from a remote location (to turn on an air conditioner or adjust a furnace thermostat, for example). It would seem that data sets are destined to become an important part of our daily lives.

Soon, the Visual Telephone

Even though the transmission of voice and data signals has made tremendous strides in the past fifty years, another product being developed by Bell Labs, the PICTUREPHONE® Visual Telephone, has stimulated as much general comment and enthusiastic anticipation as any other member of the Bell System's product line.

The 2C Picturephone set, now in limited use in Chicago, can do much more than transmit the image of a person. Bell Labs engineers have developed modifications to the standard set so that it can accommodate any of the many commercially available lenses to com-

Mod 2C
PICTUREPHONE
Station

plement the fixed-focus lens of the standard Picturephone set to transmit such diverse images as 35-millimeter slides, electrocardiograms, charts, typewritten pages, and newsprint. The set can also be used to display data from a computer.

Herbert Hoover, the first user of video transmission, would be awed by today's developments. Hoover (then Secretary of Commerce) made the first video telephone call from Washington, D.C. to AT&T President Walter S. Gifford in New York in 1927 using equipment developed by Bell Labs. The Picturephone equipment of today is the direct descendant of that primitive system.

Bell Labs exhibited the first system to transmit and receive clear, recognizable pictures over ordinary telephone lines in 1956 before the Institute of Radio Engineers. By 1963 the advent of transistor technology made possible the development of a prototype Picturephone set suitable for commercial use.

This new Picturephone set drew enthusiastic crowds at the New York World's Fair in 1964, and that year the Bell System placed it into limited commercial booth service between New York, Chicago, and Washington, D.C. More modifications were made, new trials conducted, and by 1968 an improved "Mod II" was ready for experimental service between AT&T headquarters in New York and three Bell Labs locations. By then the Picturephone set could transmit face-to-face conversations and images of written or printed documents. It could also serve as an interface between man and computer (the computer being interrogated from a Touch-Tone set with the results displayed on the Picturephone screen). Refinements to the Mod II brought us to the 2C set which was introduced into commercial service in mid-1970.

Although it seems clear that the Picturephone Visual Telephone will eventually become an essential tool for business customers and a vital means of communication for everyone, the present slow growth of commercial service has made us realize that the introduction of such a radically new means of communication presents its own set of special problems. The combination of relatively high costs and the dependence of the usefulness of the service upon the number of people having sets has presented us with a dilemma in the start-up phase.

In an effort to understand how to make video telephone service a viable, growing service, a special marketing organization has been created at AT&T to explore the needs of different market segments for visual communication. With Bell Labs support by development of a variety of possible video telephone systems for market exploration trials, it is anticipated that the combined effort will result in the Picturephone Visual Telephone—perhaps with color images—becoming an important communications service in the future.

First Video Telephone Call

Desk Set ca. *1928*

"500" Type Desk Set

Core of the Bell System

In the final analysis, though, the beginning and end of the telephone network is the telephone set itself—and 100 million telephones are the interface between the Bell System and its users. To them, the telephone *is* the Bell System. Our continued effort to improve the telephone set has multiple goals: to improve voice transmission; to expand its capabilities in the kind of services it performs; to provide a selection of attractively styled telephone sets that meet the personal needs and tastes of their varied users; and to make each version as economical as possible.

Today's telephone sets can do much more than the handset which came into general use during Bell Labs' early years. The current sets do a better job of transmitting voice signals, and some have optional features to make them more useful—Touch-Tone dialing and automatic dialing of frequently called numbers, for instance. They also come in attractive styles and colors to complement their surroundings.

The "300" and "500" sets, introduced in 1937 and 1949, respectively, brought with them not only new styling but better transmission and improved dials and ringers. The Bell System's PRINCESS® telephone set, brought out first in 1959, introduced a new concept in styling, built around miniature components. TRIMLINE® telephone sets, now second only to the basic 500 set in popularity, brought even more attractive styling, made possible by further advances in the design of components. The modular telephone, introduced just a year or so ago, incorporates a plug-and-jack design to facilitate installation and replacement of cords and handsets. And the Bell System's new Design Line* telephones offer customers a number of decorator styles with the same proven components used in our other sets.

We have also developed special equipment for customers whose needs are special. Speakerphones offer hands-free and conferencing convenience for both business and residential customers. The Bell System introduced the 1A and 2A Speakerphones in the early 1950s, and the more generally used 3A model in 1958. These sets were adjuncts to the standard telephone. The new 4A Speakerphone combines the loudspeaker and telephone functions in a single unit and has markedly improved performance.

*Trademark of the AT&T Co.

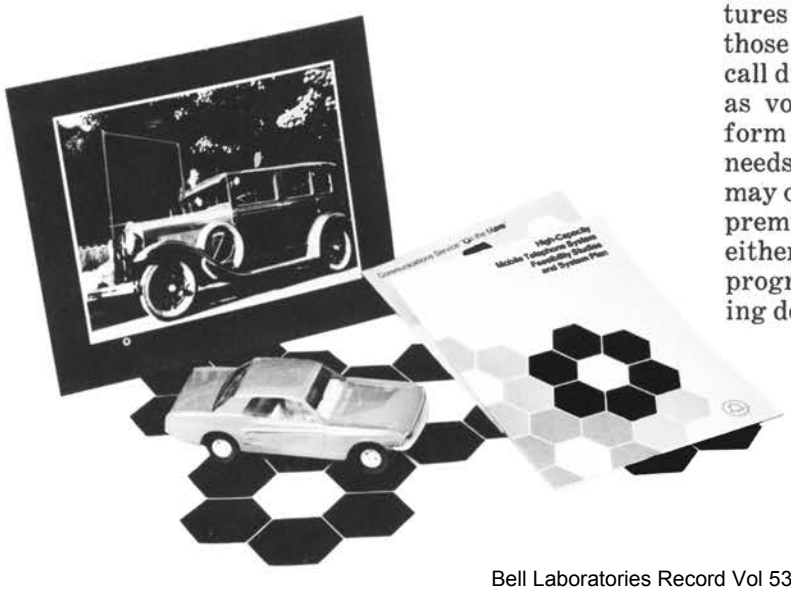
TRIMLINE *Telephone with* TOUCH-TONE *Dialing*

TOUCH-A-MATIC
Repertory Dialer

The first repertory dialing unit, the Card Dialer introduced in 1961, uses perforated plastic cards to "store" telephone numbers for future dialing. We advanced the design by using magnetic tape to increase storage capacity in the later CALL-A-MATIC® dialer. And the latest addition to this product line, the TOUCH-A-MATIC® repertory dialer, uses large-scale integrated circuits as the storage medium. This newest dialer, introduced in 1974, is much easier to use, has a lower initial cost than its immediate predecessor, and also promises much lower maintenance. It stores in its memory 31 telephone numbers plus a "last number dialed."

Mobile Service Too

Americans are always on the go—and the Bell System is offering a service that can go with them. We are now developing a greatly improved mobile telephone system using a radio link between our ground station and the customer telephone in an automobile.



Coming: High-Capacity Mobile Telecommunication System

The history of growth of previous mobile systems has been slower than that of our other customer products, because of limitations on frequency allotments. The Bell System first offered mobile service in 1946, but it was confined to a narrow frequency band containing only a few voice channels. Improved systems have been developed and offered during the intervening period, but always with only enough spectrum for just a few voice channels. However, in 1974 the FCC allocated 40 megahertz between 800 and 900 megahertz for the wire-line common carriers, and another 20 megahertz was held in reserve. Such a spectrum gives us the resource necessary to implement our long-delayed plans for a nationwide, universal service for millions of mobile customers.

Today the Bell System has about 35,000 mobile customers, with long waiting lists in every major city. The new system now being developed will offer mobile service with wire-line quality and at economical rates in literally millions of vehicles. We have a fast-paced development project now underway, with a field trial planned for 1978.

Wide Horizons

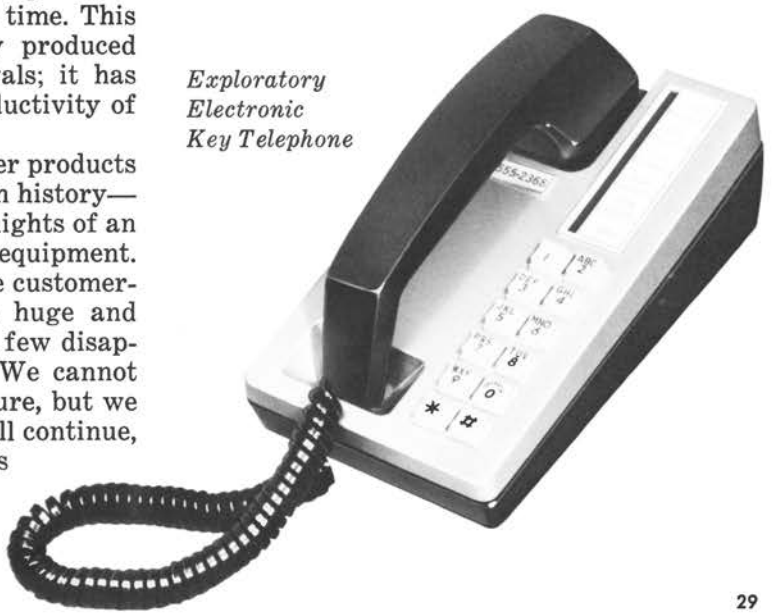
The telephone is destined to become even more common than it is today. In the future, people will not need to be tied to the wire-line network to stay in touch. Advances in electronics could lead to such innovations as a telephone that can be carried in a shirt pocket or purse. The new mobile-telephone system offers the means for such portable telephones to connect to the switching network.

Businesses will have switching systems with greatly enhanced flexibility and many new features. These systems will combine the features normally associated with PBXs, plus those of key telephone systems and automatic call distributors. They will handle data as well as voice, route calls expeditiously, and perform other services tailored to the customer's needs. This complete communication service may operate from a machine on the customer's premises or from a nearby central office. In either case, it will be controlled by a stored program which can easily be adapted to changing demands.

The many pressures on customer products in recent years has brought us much closer to our sister Bell System organizations. The Operating Companies are a constant source of information and consultation for us, and we work very closely with AT&T Marketing and Engineering departments to establish development programs and forecast needs. We integrate our design efforts closely with Western Electric to be sure that economical products can be manufactured in minimum time. This fruitful interaction has not only produced better products in shorter intervals; it has stimulated the creativity and productivity of Bell Labs engineers.

In this short story about customer products —a subject that has a long and rich history— we can only touch upon a few highlights of an extremely diversified category of equipment. It should be clear, though, that the customer-product field has evolved into a huge and rapidly changing business, with a few disappointments and many successes. We cannot predict the exact nature of its future, but we know the current growth trend will continue, and we will offer customer products that will help make life more productive, profitable, and pleasant.

Both the business community and the Bell System's residential customers are becoming more knowledgeable about the potential of communications, and more demanding in their desires for features customized to their needs. It is—as it has always been—the job of Bell Laboratories to anticipate these needs and to aid in the design and development of Bell System products and have them ready when the demands materialize. □



Exploratory Electronic Key Telephone