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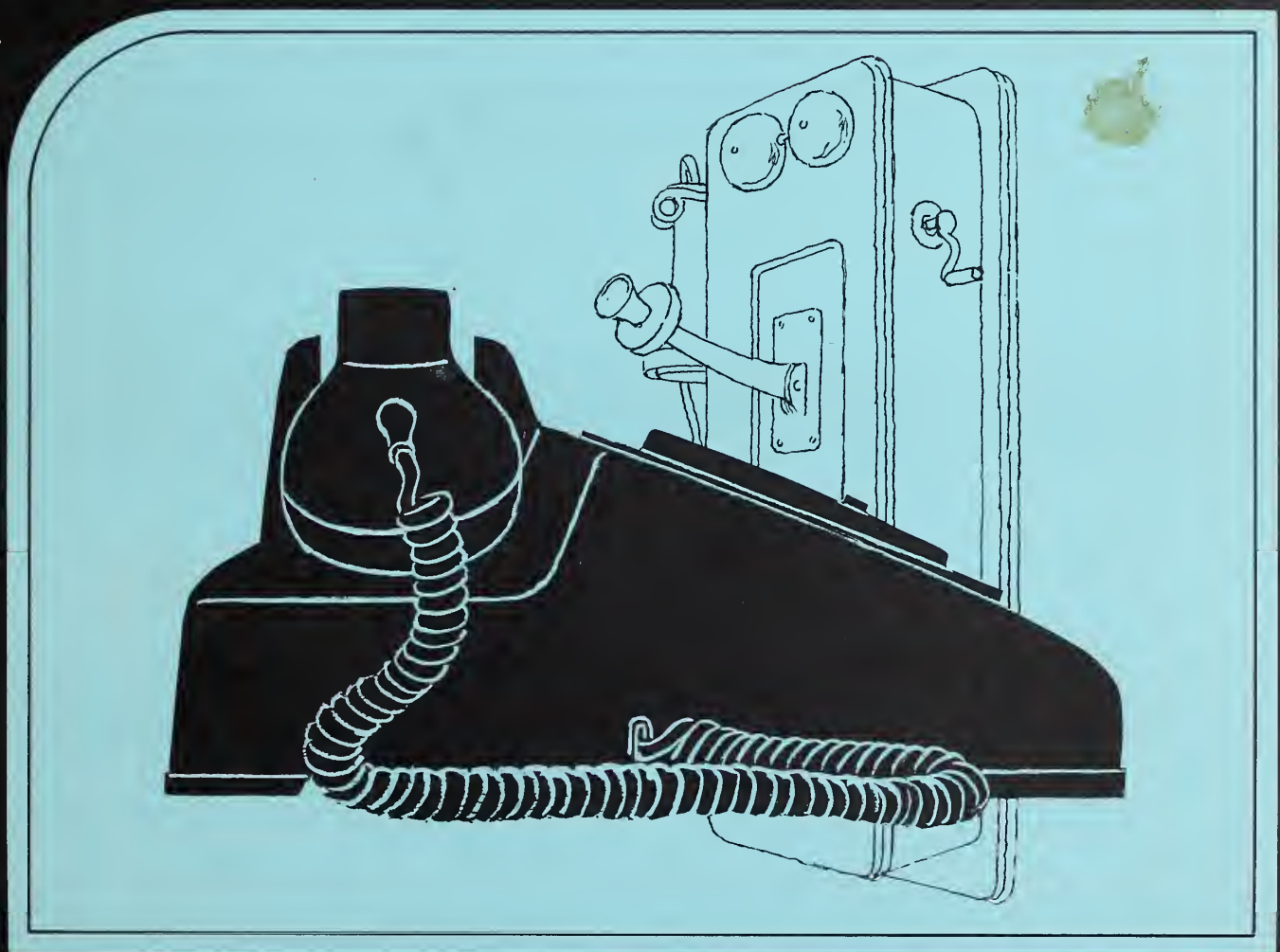
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Five Years of Progress . . .



RURAL TELEPHONE SERVICE



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CATALOGING

Foreword

IN 25 years, rural telephony has progressed from an antiquated, often unreliable service for little better than a third of our Nation's farm families, to a highly specialized, modern industry equipped to serve the total communications needs of rural America. Today's rural resident enjoys the same opportunities for good telephone service as does his cousin in the city.

Part of the credit for this amazing success story, we believe, goes to the availability of growth capital and technical assistance from the Rural Electrification Administration. REA specifications for the design of telephone equipment are recognized as standards throughout the industry, and construction techniques pioneered by REA have helped keep the cost of telephone service down for all rural people. Progress has been marked by close, mutually beneficial working relationships by REA with the telephone industry and telephone equipment manufacturers.

This program's greatest accomplishment, however, has been to show the world that rural people needed—and were willing to pay for—good telephone service. It demonstrates what can be done when rural people work with their Government in carrying out their shared responsibility of service to the community.



*David A. Hamil, Administrator
Rural Electrification Administration*

ALLEXANDER GRAHAM BELL first conceived the principle of telephone transmission in 1874, when he was only 27. He stated it this way:

"If I could make a current of electricity vary in intensity precisely as the air varies in density during the production of sound, I should be able to transmit speech telegraphically."

While working on another of his inventions the following year, Bell heard the "twang" of a steel spring over an electric wire. He and his assistant, Thomas A. Watson, knew the current transmitting that sound was strong enough to be useful. Bell gave Watson instructions for making the first telephone, and it transmitted speech sounds the next day.

On March 18, 1876, in Boston, they produced an instrument that carried the famous sentence: "Mr. Watson, come here, I want you." With those words, the telephone industry was born.

For the next two decades, until the Bell patents expired in 1894, the development of telephony was confined largely to cities. After the basic patents were released, the independent telephone industry began to develop throughout rural America. Both manufacturing and service organizations turned to the rural market. One company came out with a manual which told farmers how

"Mr. Watson,
Come Here ..."



Bell's first telephone used sulphuric acid as part of its transmission apparatus. Its receiver was a tuned reed.





A number of small family-owned companies turned to REA for financing. One was the Breezewood Telephone Company at Breezewood, Pa., operated by the Nave family.



Modern pushbutton phones have replaced the old magneto set in a number of rural homes. In Kamrar, Iowa, they did it in one giant step, with the help of an REA loan.



"Central" was a rural institution. Her board was crowded with messages—for the doctor, the lawyer, the sheriff. In a routine day, she might announce the birth of a baby, give first aid advice, and locate a couple of wandering children. This is Gladys Hanscom, long-time operator at the Poland Telephone Company, Poland Springs, Maine.

to develop their own telephone systems on a mutual or cooperative basis. Many farmer lines and mutual systems were developed during succeeding years.

Two forms of organizations popular in rural areas were "pure" mutuals, or nonstock "club" lines, usually without switchboard service. There also were mutuals which operated switchboards and generally were organized as capital stock companies. In addition, a number of small family-owned companies supplied rural service.

Single families often operated these small businesses in rural America. The women usually ran the switchboard in the kitchen and the men repaired lines and installed telephones.

By 1917, there were more than 53,000 telephone companies in the United States. Mostly small, better than 51,000 of these concerns had income of less than \$5,000 annually.

The most common telephone instrument was the magneto set. A big contraption, it usually hung on the wall, and often there were 20 or more subscribers hooked to the same grounded magneto circuit. To make a call, you first turned the generator crank a couple of times. This activated a "drop" in the operator's switchboard, signaling her that you wanted to make a call. She plugged into your line; you lifted the receiver and told her the number you wanted.

Private conversations, so important to subscribers today, were out of the question along the magneto line. But this didn't worry the users. Rural people looked upon the telephone as a news medium as well as a communications device. On many systems, "Central," as the operator was called, was the forerunner of the modern radio and television newscaster. Here and there, she rang all lines at 7 o'clock each evening to report the correct time, the weather forecast, market quotations, sports results and local and international news. She answered questions; she ran a locator service; she was the local message center. But the service was limited; as a rule, there was no operator on duty at night.

“Whoop and Holler” Better Than Nothing

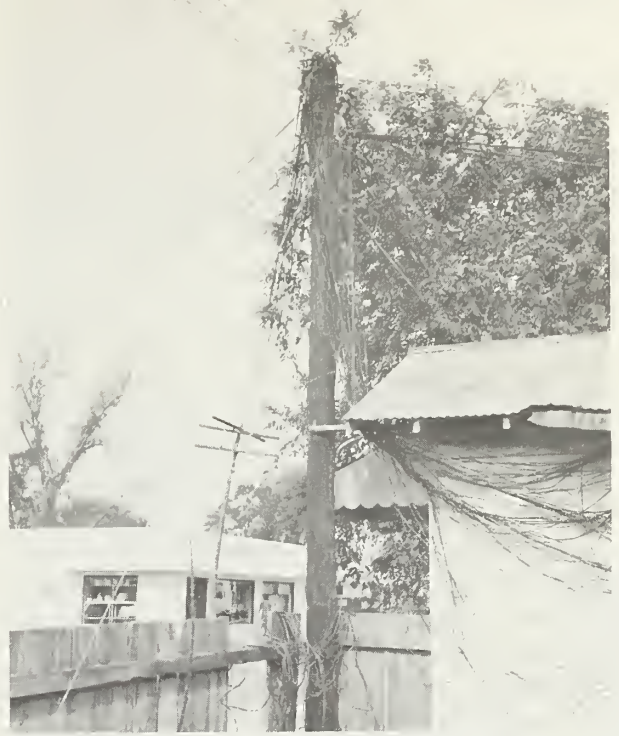
While a lot of people called their telephones “whoop and holler” sets, the truth is that they gave pretty good service when the lines were in good condition. Magneto systems continued to give some sort of service after years of neglect, even though lines often ran from fence posts to dead trees and sometimes through fence wire. Even with no maintenance at all—with the wire hanging on the ground and falling off the insulators—you might still hear what your friend had to say if he shouted loudly enough. It sometimes took several neighbors in succession to convey a message by hollering from one to another down the line.

After World War I, the number of farmer lines continued to increase. By 1927, when the high point was reached, there were some 60,000 mutual systems and other telephone organizations in the United States. But during the same period, these systems were deteriorating. Many failed to keep adequate accounts; a number of people were lax about paying bills; there were few maintenance men and little maintenance. Poor service became widespread in rural America.

With the depression of the thirties, lines went from bad to worse. Most mutuals stayed in business, however. They limped along, with operators sticking to their jobs despite low pay. Generally in the spring before farmers could work in the fields, the men would go together, cut rights of way and string wire, sometimes using mason jars for insulators. Farmers kept trying to make calls, and occasionally got through. Many lines deteriorated out of existence.

After the creation of the Rural Electrification Administration in 1935, electric lines frequently produced a humming noise on grounded telephone lines, and further reduced their usefulness. Many a small magneto system had to revamp its plant or be forced out of business.

By World War II, it was clear that rural telephone systems had reached an impasse. Farmer systems, which had started so hopefully at the turn of the century, were just about finished. Actually, there were fewer farmers with tele-



A hopeless tangle of wires enters the building housing the old manual board of the East Ascension Telephone Co. in Gonzales, Louisiana. REA financing helped replace this system with modern dial.



Wire on old magneto line is hooked to a fence, evidence that some farmers talked through their barbed wire.

phones in 1940 than there had been in 1920.

Many cities, on the other hand, were enjoying automatic dial service by 1940. Many telephone people recognized that the only way farmer lines would ever be made serviceable would be to eliminate the one-wire grounded service. But this presented a need for large amounts of capital not generally available to smaller companies. For no matter how sincerely a company wanted to extend and improve rural telephone service, the economic facts of life virtually barred any new development. Conventional financing had its own restrictions that practically prohibited the use of private capital by small companies.

Some people, even in the thirties, thought the Government would have to lend a hand. In 1939, John M. Carmody, then REA administrator, wrote an editor in North Carolina:

"Personally, I have long felt that there was a real opportunity for constructive assistance to rural people in the idea of Federal financing of farm telephone lines. It seems to me that rural people have just as much right to up-to-date communication as they have to modern power. There's no question in my mind that Government assistance will be required if the job is ever to be completed."

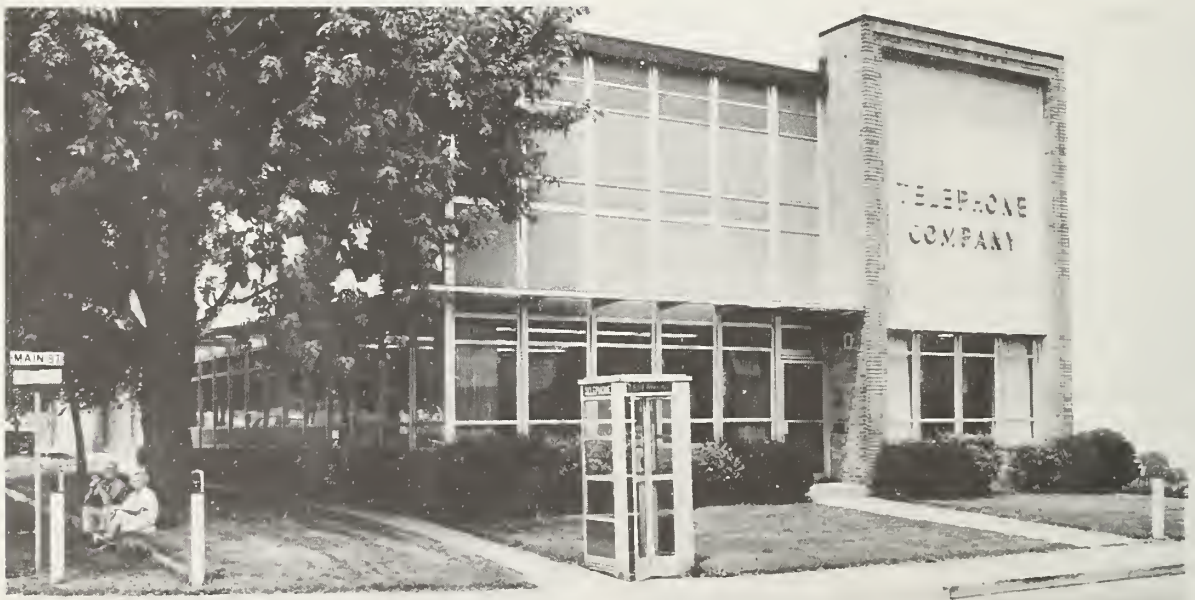
Congress Lends a Hand

Others agreed. In late 1944, Representative W. R. Poage of Texas introduced a bill to establish a Rural Telephone Administration, modeled after the already successful Rural Electrification Administration. Starting in 1945, both Representative Poage and Senator Lister Hill of Alabama introduced measures in each session of Congress to establish a rural telephone loan program.

Action came in 1949 on bills to amend the Rural Electrification Act, and make the telephone loan program a responsibility of REA.

During hearings, many witnesses testified to both the need and demand for rural telephones, for "area coverage," for a source of long-term financing to permit the change from magneto to dial. Many small town systems were sold for very little or given to the few larger companies with the only proviso being that they maintain service. It was pointed out that only about 38 percent of U.S. farms had any form of telephone service. It was shown that rural service was obsolete in many places, and that private and public agencies had failed to make long-term, low-cost credit available.

Before the Senate Committee, REA Administra-



Modern "Centrals" are located in up-to-date buildings—often equipped with meeting rooms for community projects.

tor Claude R. Wickard testified that farmers needed adequate telephone service even more than city people did.

He said, "With the possible exception of electric power, it is hard to conceive of anything that means more to the health, happiness, and economic well-being of farm people than good telephone service."

Some witnesses for the telephone industry, on the other hand, thought that a Federal telephone loan program would be unnecessary and unwise. Several thought REA would be unqualified to function in the telephone field, an area in which the agency had no experience. Others emphasized possible dangers in telephone loans to public bodies, and they raised the prospect of Federally financed competition with existing facilities. They pointed at possible duplication of lines.

These objections were considered carefully, and changes in the original bills were adopted by both the House and Senate. Changes affirmed the jurisdiction of State regulatory commissions over REA telephone borrowers and eliminated public bodies as possible recipients of telephone loans.* Another change gave a preference to existing telephone organizations.

But the view of the bill's sponsors—that rural systems needed some sort of long-term financing if they were to survive—won out. The telephone amendments to the Rural Electrification Act of 1936 were passed by Congress and signed into law on October 28, 1949.



Rural subscribers pay their bills, select a "decorator" telephone or make changes in the type service they want in pleasantly decorated reception areas.



Switchboards are used by some rural telephone systems to provide directory assistance and toll service.

A New Loan Program

A new era for rural telephony began with enactment of the REA telephone loan legislation. It was "declared to be the policy of Congress that adequate telephone service be made generally available in rural areas . . . to the widest practicable number of rural users of such service." The term "rural area" was defined as any area not included within a town or village having a population of more than 1,500.

The REA administrator was authorized to make self-liquidating loans, at an interest rate of 2 percent for a period up to 35 years, for the extension and improvement of rural telephone service.

Among other things, the new law provided that:

□ The REA administrator certify that each

telephone loan, in his judgment, would be repaid within the time agreed.

- Loans could be made for the acquisition of existing telephone lines or systems, where the acquisition served the statutory purpose of extending or improving rural telephone service.
- During the first year of the program, a preference would be granted to applications from telephone companies already in operation.
- A portion of a telephone loan could be used to acquire or construct facilities in nonrural areas, and outstanding indebtedness could be refinanced.
- Public bodies, such as municipalities or other governmental units, were not eligible for REA telephone loans.*
- Loan applicants would have to comply with applicable State laws and requirements.



Poles followed country roads in many instances, to bring service to the "widest practicable number of rural users."

Solving Unprecedented Problems

Establishment of the rural telephone loan program meant that a sizable task of learning, policy formulation, and procedural development had to be undertaken by REA. The nature of the rural telephone industry as it then existed presented some difficult problems that had to be solved before sound financing was possible.

Establishment of acceptable construction and equipment standards as a basis for long-term financing was a must. Procedures for determining that each loan would serve the widest practicable number of rural users, for developing feasibility standards as a basis for evaluating each loan, and for assuring adequate service at reasonable rates were requisite to the new program.

With a staff of three—an engineer, an information specialist, and a secretary—the REA telephone program began operations. Their job was to answer inquiries sparked by the new legisla-



Subscriber surveys, taken by local people, helped potential borrowers more accurately plan their financing needs.

tion. It wasn't long before the trio learned that nobody knew all the answers.

Should REA make 100 percent loans? If not, what equity should be required? Should loans be made for the full 35 years permitted by law? How could area coverage be accomplished? REA and the USDA legal staff had to find answers to many difficult questions before the program could go into operation.

In the first 6 weeks following approval of the legislation, REA received more than 700 requests for information about the program. About 600 of these came from existing companies which wanted to modernize their equipment or to extend their lines to additional subscribers; more than 100 letters were from new telephone organizations which proposed to operate along co-op or mutual, nonprofit lines.

Mobilizing and Training a Staff

REA faced the job of assembling a trained staff. Trained technicians, by and large, were obtained from the Bell System and telephone equipment manufacturers. In the postwar building boom, telephone companies and equipment makers were

DIAL TELEPHONE SERVICE IS HERE

SO EASY

SO QUICK

SO THRIFTY

SIGN UP NOW

RURAL ELECTRIFICATION ADMINISTRATION • U.S. DEPARTMENT OF AGRICULTURE

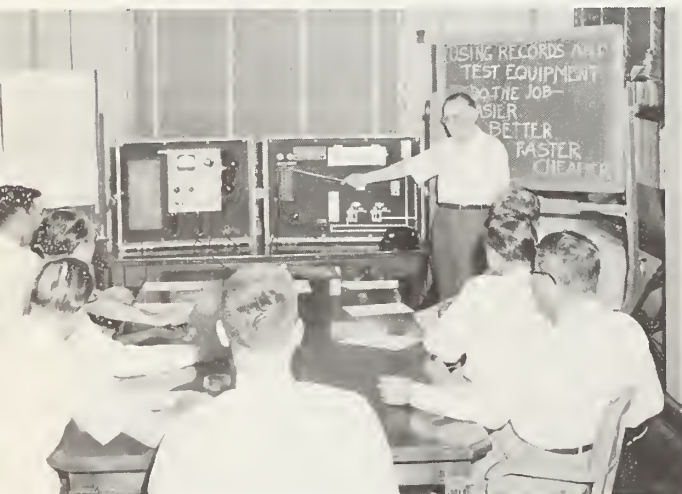
Calling rural people's attention to the new REA program was a first step. Colorful posters, prepared by the REA staff, helped spread the good news.

also recruiting trained men. Competition for personnel was keen. There was also the need for employees with experience in operating the small independent rural systems, since most Bell employees were knowledgeable principally in serving the larger urban areas. It was recognized early that many of the needs of rural companies were different from urban systems.

By employing from the industry and transferring personnel from its electric loan program, REA was able to provide a nucleus of a telephone staff. Services of a number of retired Bell and independent company employees also were acquired on a consulting basis. An on-the-job training program was inaugurated by REA to prepare newly hired engineers for the specialized problems of rural telephone system construction. By June 1950, with the program less than a year old, there were 142 full-time employees in the telephone program.

Establishing New Procedures

The top men at REA undertook a formidable task of self-education, formulating policy, and working out loan procedures. They knew that sound financing would depend upon how well they solved a number of pressing problems. Because dial service eliminated manual operations,



A staff of technical specialists was trained in REA with the help of retired Bell Company employees.



A "coffee-klatch" discusses the pros and cons of consolidation during the formative days of the Winnebago Co-operative Telephone Association. Electric co-op manager Glenn Bergland was the principal negotiator for mergers ultimately involving 67 small telephone companies.

was more convenient, and offered generally better service, REA decided to make loans to finance only dial service. The agency also adopted a minimum standard of eight-party service. Many existing farmer mutuals were too small to handle the cutover to dial operation. They would have to merge or consolidate with other small systems in order to establish more efficient operating units. Many new cooperative and commercial systems were formed in this fashion.

In Iowa, directors of the Winnebago Electric Co-op issued an invitation "to all directors and other interested members of rural mutual telephone companies to attend a discussion meeting."

Twenty-nine companies had 107 representatives at that first meeting in late 1949, and agreed to poll their member-subscribers on consolidation into a single cooperative. During the next few months, more and more mutual systems joined the affiliation, until in June 1950, the Winnebago Cooperative Telephone Association, representing the combined membership of 43 mutual telephone companies, was able to apply for an REA telephone loan.

REA recognized that commercial companies already in the business had a preference to loan funds under the Act, and would need to participate in the program if it was to be a success. Most of the rural areas had already been assigned to them by authority of State regulatory bodies.

Progress, however, is rarely accomplished without overcoming problems. Recalling the headaches of those early days, a Colorado manager said, "You could never imagine the problems of a small rural telephone system; you have to experience them to make them have meaning. Transition from magneto to unattended dial for an entire system is a pretty big deal. When we saw a prospect of REA financing, we were caught between two pressures. On the one hand, people wanted better and modern service. But at the same time, there was a certain resistance to the loss of the informality of the country line and the additional cost of service to our subscribers."

There were also rewards. Mrs. Virgie Walthall of Glasgow, Kentucky, described the coming of the new dial telephone to her farm house for a Louisville newspaper reporter. "All the neighborhood was astir. The countryside is humming like a hive. When rural acquaintances meet now, the question is 'Do you have yours yet?'"

"We got ours day before yesterday. It's a sleek new dial telephone I'm talking about, and who isn't? The long-awaited rural telephone system is working at last, working like a hive."

"When the telephone man came to give our phone the final touches, we waited, breathless, until he left. Then we made a dash for the dial. Receiver in hand (I got there first), I realized I knew no numbers to dial. We didn't have our directories yet. . . ."

"The new phones are really wonderful though. They give the house such an up-to-date look. And you can hear real plain over them. I can tell from the loud busy signal I always get."



Manager Lloyd G. Vaughan of the Florala Telephone Co., Florala, Ala., shows a subscriber how to reach a party on her new-fangled telephone. Florala was the first company to receive an REA loan, on February 24, 1950.



A September, 1950 celebration marks connection of first REA-financed telephone facilities by the Fredericksburg and Wilderness Telephone Company, Chancellor, Virginia.

Impact Felt Industrywide

PROBABLY the most significant contribution made by REA to the rural telephone industry was its ability to apply the expertise gained in the rural electric program in solving many telephone industry problems.

With nearly 6,000 separate companies going,



Characteristics of a wide variety of equipment offered by manufacturers to rural telephone systems are carefully reviewed by the REA technical staff.

for the most part, their divergent ways, the first steps were to look for common denominators which could be used in establishing overall guidelines. Job number one was to take a critical look at existing technology and sort out those concepts useful for rural system improvement. Then came the tasks of design, engineering, manufacturing, construction, and testing.

The concept of growth prevalent at the time was for a system to start out in a small town or farming community, and then "build out" to more remote areas as it became economically feasible to do so. Under such an arrangement, many systems "grew like Topsy." Charges for services were based on a mileage or zone basis. Multi-party magneto lines were the rule, and coded ringing—a series of long and short rings heard by everyone on the party line—was used to signal a call.

Going "First-Class"

REA had the option of "patching up" existing systems or re-designing them to meet modern standards. The area coverage principle, which had proven so successful in the electric program was written into the law which created the telephone program. Under this concept, borrowers' service territories were considered as a whole, as opposed to the practice of each line extension standing on its own merits. A uniform rate for the lowest grades of service was offered in place of mileage charges, and coded ringing was replaced by full selective ringing for multi-party service. This meant that only the subscriber who was being called heard his phone ring.

A major departure from current industry practice was the decision to move from magneto directly to dial service with a target of a maximum of eight-parties to the line. The unattended dial exchange was the first great advance in automation. Its installation cost more, but resulted in far more efficient service. During the early 1960's goals were revised to move from a maximum of eight parties to the line to four- and five-party service. Shortly thereafter sights were again raised and single party service became the next goal.

The Unattended Dial Exchange

First Great Advance in Automation,
Keeping Pace with Today's Needs

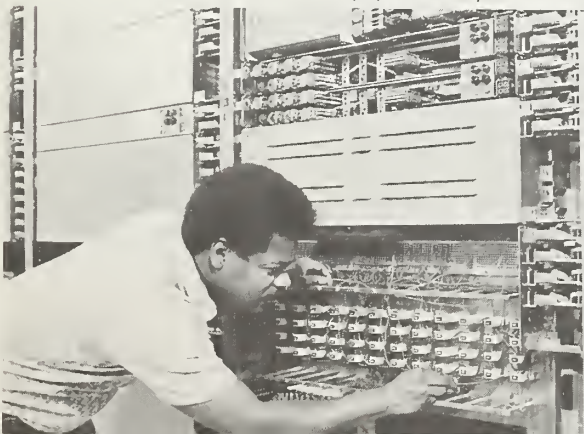


Early unattended dial offices could be quickly built to house basic equipment. They served as the link between subscribers' homes and the outside world.

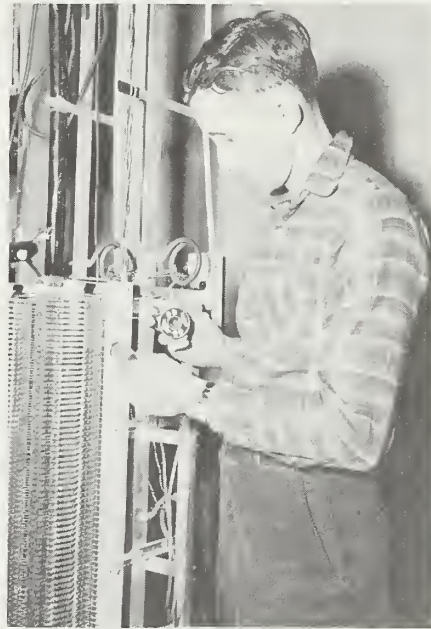
Inside, step-by-step type of equipment is utilized by most rural telephone systems, whereby each digit dialed by the subscriber triggers an electromechanical response, resulting in a connection.



As systems expand and subscribers require more sophisticated services, electronically-controlled switching equipment helps meet the need.



Modern exchange expresses growth in the size and quality of rural telephone service.



Wires from the subscriber's home are manually connected to the central office equipment.

Changes in subscribers' service requirements can be made electronically, thus eliminating tedious hand labor. The entire program is stored electronically, ready to be altered instantly whenever changes are required.





Billing and record-keeping chores are speeded, made more accurate with sophisticated office equipment.



Standardization is First Step

Experience in administering the electric program had demonstrated the value of standardized materials and construction techniques. Good management practices and maintenance of adequate records were also recognized as essentials.

Many small companies operated literally out of a cigar box. When receipts were collected, whatever funds were left over after paying the bills were taken home as wages for the owner-operator. Recordkeeping, to any real extent, was rarely done.

Before sound financing could become a reality, however, existing systems needed to be fashioned into efficient operating units, or new organizations formed where none existed. Consolidation or merger of many small companies and farmer lines was an obvious necessity, and frequently resulted in the nucleus for formation of a telephone cooperative.

Methods for making subscriber surveys and estimating the market for telephone service were developed, along with guidelines for managing, operating, and maintaining rural telephone systems. But above all, REA strove to stimulate the local community spirit. REA employees quickly adapted to the "local touch" and demonstrated in many ways that "Uncle Sam" was willing to lend a helping hand.

Telephone Operations Manual—REA went to the larger operating companies, to the Bell System, and to other Federal and State organizations to get ideas on staffing patterns, recordkeeping and accounting procedures applicable to the telephone field. An REA Telephone Operations Manual was prepared and sent to all telephone borrowers. Its purpose was to make available to telephone borrowers the benefits accrued from the accumulated knowledge and experience of the telephone industry, individual REA borrowers and the REA staff.

Organizing Assistance—Working closely with county agents and rural electric borrowers, the REA field staff assisted prospective loan appli-



Before rural systems could begin operating, they had to get organized. Rural people, frequently with the help of REA, held meetings to discuss their communications needs, and how they would fulfill them.

cants in preparing necessary paperwork. They were often called on to help rural people organize themselves into cooperatives or other entities so that they could qualify for an REA loan. They attended many rural school house nightly meetings to answer questions.

Upon receipt of a loan application, a "team" consisting of REA operations and engineering personnel, was frequently sent out to provide further assistance. Part of their job was to answer questions such as "How much will it cost?" and, "Will the Government take us over?"

Adequate Documentation Required—A considerable factor in the success of the telephone

program has been REA's insistence on adequate documentation for all its loans. To become eligible for a telephone loan, borrowers were required to prove they were legally organized and qualified to receive REA financing. They were required to make a survey of the proposed operating area to determine its subscriber potential and confirm that it was within a legal jurisdiction. They were also required to submit an initial design of the system for planning purposes to serve as the basis for construction plans and specifications when the loan was approved.

Basic decisions made by REA officials early in the program had a profound influence on the later development of the rural telephone industry.

Specifications to Keep Standards High

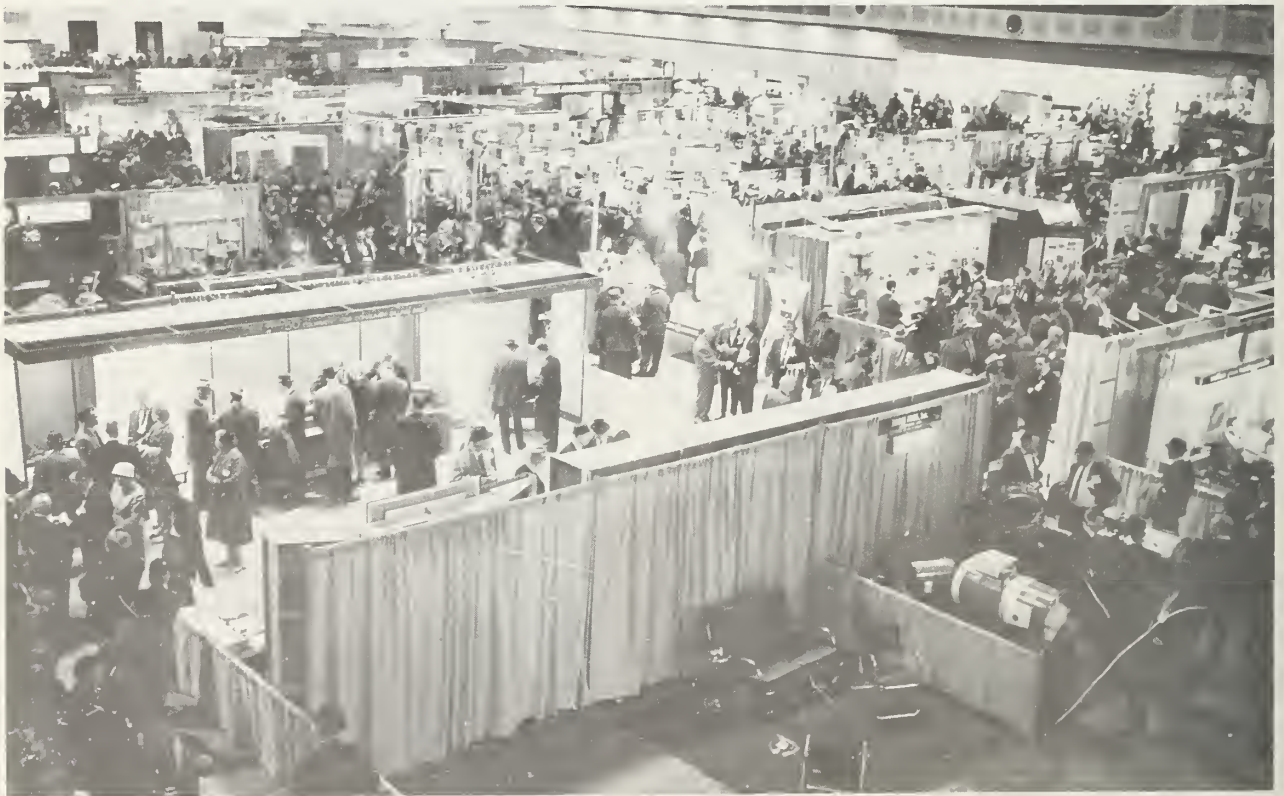
Acceptable Materials—A list of materials acceptable to REA for use on systems of telephone borrowers was prepared and sent to all telephone borrowers, systems' engineers and contractors, suppliers and telephone equipment manufacturers. Where industry specifications did not exist, REA staff engineers established them, after consultations and testing. Borrowers cooperated in field tests of products and materials.

Patterned after a similar list in use by REA electric borrowers, the telephone list of materials acceptable contained everything from lag screws to paystation telephone booths, and was used to promote uniformity and to present REA requirements in a concise manner.

Central Office Equipment—Standard technical specifications for central office equipment enabled

manufacturers of such equipment to bid on a truly competitive basis. The resultant standardization provided REA borrowers with automatic dial switching and other central office equipment at the lowest possible cost. Developed by REA engineers, these specifications represented a "first" for the independent telephone industry.

Telephone Engineering and Construction Manual—Introduced by REA in 1951, a manual embracing technical information on engineering and construction practices covering substantially every phase of telephony on REA borrowers' systems was compiled by REA engineers. This manual was the only complete publication of its type offering technical information on general telephony to the independent telephone industry. Continuously updated and kept current, it is still used by all REA borrowers, their engineers and contractors, by various Government agencies, and by foreign countries.



Standard technical specifications for nearly all items used in telephone system construction helps promote uniformity of products throughout the industry; permits equipment manufacturers to bid on a truly competitive basis. The latest industry offerings are displayed at trade shows.

Research and Training

Two major factors which forced attention on possible new developments in rural telephony were: (1) The need for equipment specifically designed to meet conditions of rural areas; and (2) pressure from rural areas for telephones "now." An increasing number of applications during the early days came from areas where it was not economically feasible to extend service with existing conventional telephone lines and equipment.

Without available manpower or laboratory facilities for research, REA had to resort to other methods. One was through contractual research projects. The other was to encourage manufacturers, through the incentive of new business, to bring out new equipment to meet REA borrowers' needs.

Early in 1952, the first telephone research contracts were signed by REA with telephone equipment manufacturers. They called for development of telephone carrier equipment for multi-party subscriber service, and for the development of low-cost, point-to-point microwave radio.

In November 1952 the first telephone engineering symposia were held in Washington, D.C., and in Cheyenne, Wyoming. Attended by some 80 engineers representing 48 consulting firms in the United States, they were designed to call atten-



Telephone engineering symposia sponsored by REA bring together technical personnel from throughout the industry to discuss new ideas, introduce new concepts.

tion to the specialized needs of rural telephone systems. These sessions, now held every 2 years, have grown to include over 1,600 participants and are open to managers, engineers and telephone craftsmen.



Self-teaching packets, consisting of slides with a tape cassette narration, are prepared by REA for use by borrowers' personnel. This one describes ways to measure the transmission quality of subscriber's telephone lines.

Keeping Costs Down



Keeping construction costs down was a major concern. REA sought ways to increase the signal-carrying capabilities of existing wires and cables, and to reduce the size of wire used in new construction.

WHEN REA entered the rural telephone field, the amount of physical plant required to connect widely scattered rural residences made the cost of rural construction prohibitive. Ways needed to be found to lower these costs either through the modification of construction practices or by the development of new types of equipment. This meant that all available technological developments must be exploited, and new ones devised, if service was to keep pace with the times. The 1950's became the decade of development, when REA engineers worked with manufacturers to produce equipment needed to fulfill these requirements. Contracts were awarded manufacturers to develop prototype equipment that was installed in selected telephone systems where extensive field testing resulted in varying degrees of success.

One way to keep construction costs down was to increase the signal-carrying capabilities of wires and cables. Another was to reduce the size of the wires and cables necessary to transmit signals. REA engineers decided to go both directions.

Prior to establishment of the REA telephone program Bell System engineers, working with REA electric borrowers, developed a power line carrier capable of transmitting telephone signals over electric lines. Although considered in the beginning of the REA program, the idea was discarded because it was expensive to install and maintain, and could not provide selective ringing on party lines.



Utilizing Electronics

In 1952, REA contracted for the development of telephone carrier equipment designed for multi-party subscriber service. Subscriber carrier enabled REA borrowers to serve sparsely settled areas over long distances from the central office at rates people could afford. With the application of electronic equipment, the wire formerly required to serve eight subscribers on a party line was made to serve up to 48 subscribers. Subscriber carrier also gave telephone systems a high degree of flexibility in the design of new plant and in the electronic reinforcement of existing plant.

Over the years, REA has been a leading proponent of subscriber carrier and other electronically derived systems, and worked closely with its borrowers and the telephone manufacturing industry to increase their potential. In 1957, transistorized subscriber carrier for open wire became available, and in 1961, the carrier technique was applied to buried cable.

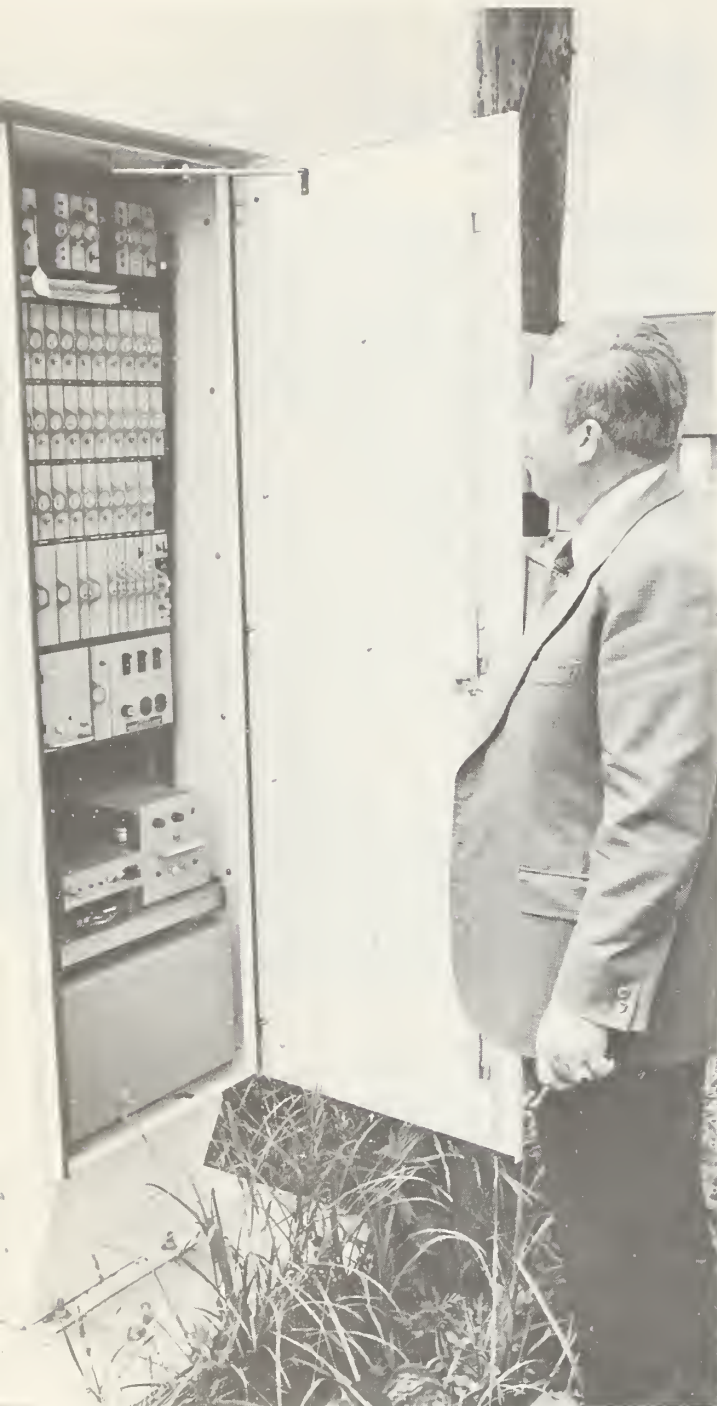
As REA telephone system design shifted from wire to cable type construction in the late 1950's, there was a need to minimize voice transmission losses. To do the job, REA developed the D-66 cable loading system which became a standard for rural telephone transmission.



The quality of transmission on rural telephone lines is measured by REA engineers during early tests of subscriber carrier equipment.



A telephone pedestal (numbers inscribed) permits connection of subscribers to underground telephone cables. The white cabinet contains subscriber carrier equipment which enables each pair of wires in the cable to be used for up to eight subscribers.



A PCM (Pulse Code Modulated) subscriber terminal can handle up to 36 subscribers over two pairs of wires.

In 1972, electronic subscriber line switching systems were introduced to rural telephony. Their use made it possible to serve large clusters of subscribers, such as subdivisions and small communities, over a minimum of cable wire pairs. By combining arrangements of this type with other electronic developments, rural telephone systems are now able to install fewer, but larger and more sophisticated, central offices to provide the most modern types of communications services.

Fine Gauge Design

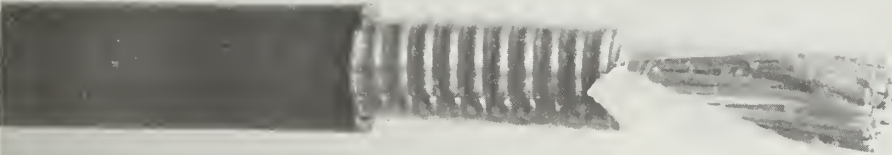
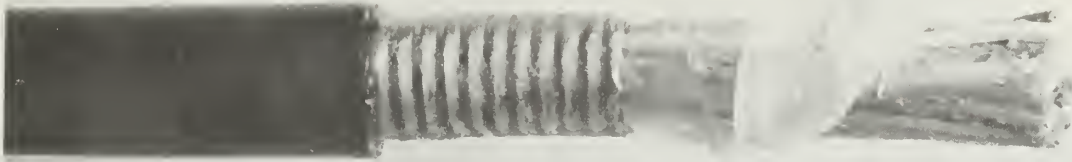
Significant reductions in the cost of constructing outside plant were made through the use of finer gauge cables. As a result of REA's fine gauge design first introduced in 1963, rural telephone systems were able to substitute 24 gauge cable even over long distances where 19 or 16 gauge conductors had formerly been required. Twenty-four gauge wire contains less than one-third as much copper as 19 gauge, and less than one-sixth as much as 16 gauge.

REA borrowers were able to accomplish these savings by trading off the advantages of the coarser grades of copper wire for the fine gauge wire supplemented with electronic devices. These electronic devices included long-line adaptors and loop extenders to increase the signaling range and transmission efficiency of rural lines. Low-cost voice frequency repeaters to amplify speech were designed to specifications developed by REA engineers.

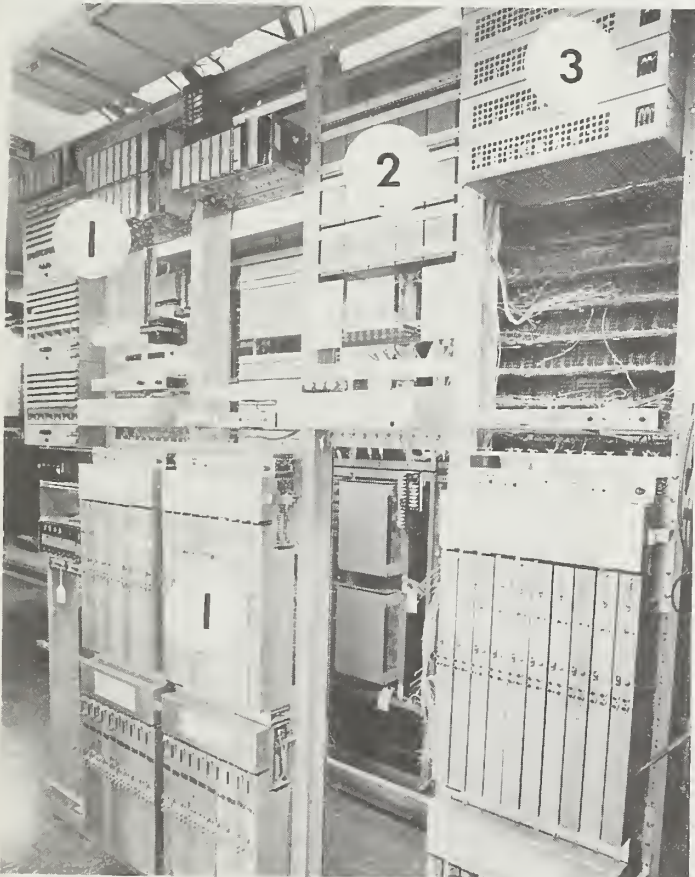
Construction techniques were carefully examined to determine if savings could be made during installation of telephone plant as well as through reduced maintenance.

Long-Span Construction

An early effort was to utilize the higher tensile strength wire as a means of reducing the number of poles required for aerial plant. Improved supporting equipment, developed by REA in conjunction with industry representatives, helped make this feasible. During heavy snows and ice storms, this technique permitted lines to stretch, rather than break, from the added weight.



Twenty-five pairs of 24-gauge wire (top) contain a third less copper than only 12 pairs of 19-gauge wire. The use of aluminum as a shielding material on the fine gauge cable can also help cut costs.



Maintaining good communications over finer gauge wires requires extensive use of electronic equipment. Reinforcement includes: (1) subscriber carrier; (2) voice frequency repeaters; and (3) loop extenders.



Burying telephone cables cuts construction costs, eliminates costly damage to lines from ice and wind storms.

Direct Burial

The introduction of buried plant in the late 1950's helped lower initial construction costs as well as significantly reduce maintenance expenses. It also made open wire construction obsolete. As originally conceived by the Bell System, the concept involved plowing of aerial-type cable in the ground. REA engineers pioneered in the development of plastic insulated cables which could withstand the rigors of direct plowing. New hardware accessories such as pedestals and splicing connectors were also developed to permit the construction of entire systems underground where they could not be harmed by tornadoes, ice or hurricanes. The development of a moistureproof mechanical type of splicing connector, under an REA contract, reduced costs almost 50 percent over soldering a twisted joint.

REA encouraged the development of plowing equipment with greater tractive power to permit increased depths and greater use of private rights of way. It also made possible plowing in rocky soils which formerly prohibited burying of cables. In 1973, approximately 95 percent of all outside telephone construction financed by REA was for buried plant.

Moisture problems, inherent in underground construction, were alleviated to a large degree by the introduction of grease-filled cables during the early 1970's. Air spaces within cables are filled with a petroleum substance, thereby increasing their resistance to moisture and lowering maintenance costs.



Markers indicate where the cable is!



In one operation, specially designed equipment plows, buries and covers underground telephone cables.



Fed through the blade of the plow, the cable is laid in a trench so narrow that little evidence shows after the plowing operation has been completed.



A narrow trench holds the wire pairs necessary to connect each subscriber to the larger cables.



Mobile dial telephone service helps the farmer, the salesman, the veterinarian, the busy subscriber.



Paging service, offered by many rural telephone systems, lets busy professionals "keep in touch" with their homes or offices. Pocket-size receiver (arrow) "beeps" when a subscriber has been called. He then goes to the nearest telephone to complete the connection.

Mobile Dial Service

REA's decision to promote the use of automated dial offices created problems for rural residents who wanted telephone service in their vehicles. Bell System customers at the time were able to use an operator to complete mobile telephone calls, but no operators were present in REA borrowers' automated offices. As a consequence, REA entered into a contract with a large manufacturing concern to develop a dial mobile radio suitable for borrowers' use. In 1957 the first such system ever developed was installed by an REA borrower.

Testing

To measure the capabilities of the wide variety of telephone equipment offered to REA financed systems, agency engineers, working closely with suppliers, the Bureau of Standards and others, developed testing procedures and designed and built testing facilities.

Since rural telephone systems are generally more severely exposed to damage from lightning

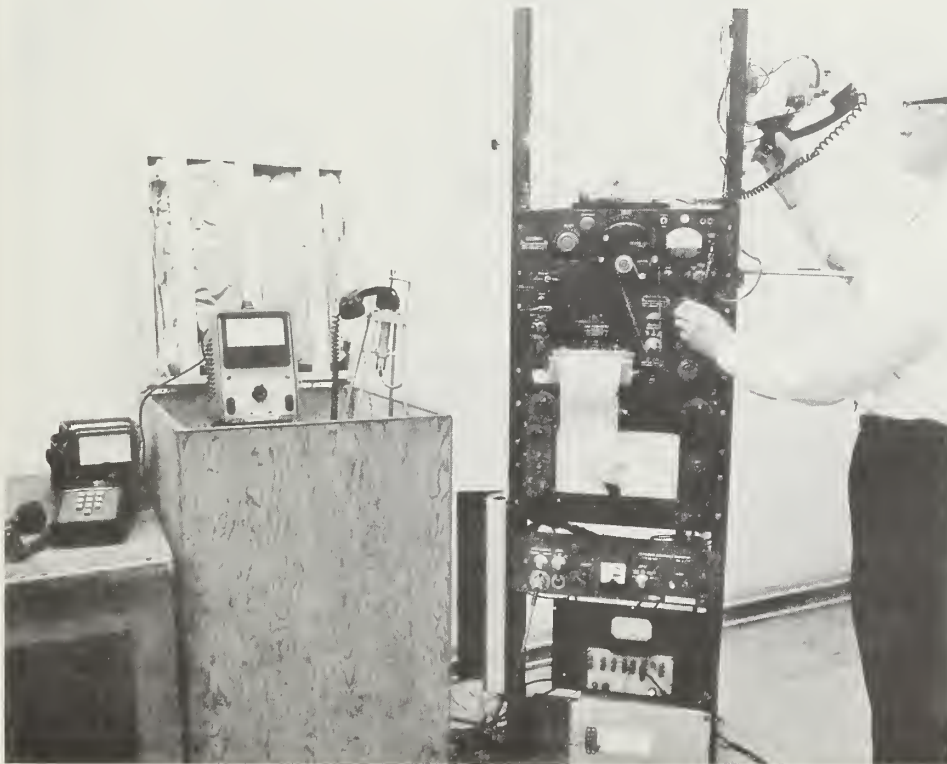
than urban systems, it was important that the equipment used be capable of withstanding lightning surges. REA engineers developed surge-withstand requirements for various items of equipment and designed and built a generator to simulate lightning surges. They worked closely with the Bureau of Standards in determining the breakdown characteristics of lightning arrestors. After extensive tests of many different types of lightning arrestors, an REA specification was issued to obtain the needed characteristics and performance.

To evaluate performance of the wide variety of telephone sets being manufactured, REA engineers established an accoustical testing laboratory and made extensive comparisons of all available sets. Results enabled the agency to weed out poorly designed sets and thereby assure that borrowers utilize only the best available telephone sets on their systems.

Samples of cable used by borrowers for underground construction are tested under a working agreement with Frankford Arsenal of the U.S. Army to monitor their quality and conformity to REA specifications.



The effect of a high voltage power line falling on telephone cable is simulated in the laboratory to test the effectiveness of borrowers' station protector equipment.



The acoustical response of a wide variety of telephone sets is tested, compared and evaluated by REA engineers.



The impact of modern telephone service on the rural community is impossible to measure. How does one place a value on a private conversation between friends?

HOW do you measure the success of the rural telephone program? Do you add up the total amount of REA telephone loans? Do you try to count the number of modern dial telephones installed in rural homes? Or appraise the financial stability of the hundreds of enterprises which provide modern communications to once isolated rural areas. From any standpoint, the industry's achievement is outstanding, and REA's record of assistance is impressive.

Three months after the telephone amendment was signed into law, REA had received 1,117 loan inquiries from 44 states. Here indeed was clear indication of the interest of farm and rural residents in achieving modern telephone service.

The first REA loan was approved on February 24, 1950, to the Florala Telephone Company of Florala, Alabama. In April 1950 the Emery County Farmers Union Telephone Cooperative of Orangeville, Utah, became the first cooperative to receive REA financing.

The processing of telephone loan applications proceeded as rapidly as the REA staff could handle them. By June 30, 1950, REA had made 17 telephone allocations totaling \$3.4 million, to bring telephone service to 9,848 new subscribers and improve the service for 6,989 existing subscribers. Applications for loans, however, continued to mount. At the beginning of fiscal year 1951 about 500 applications amounting to \$56 million were on hand in REA. Plans included in these applications would provide service to 143,000 subscribers and improve service for 116,000 subscribers.

Rural telephone companies converting to modern dial service reported that subscribers who had been averaging less than 2 calls a day on the magneto system were now placing up to 10 calls a day.

Electric co-op members made an all-out effort to get telephone service in their areas. Many worked in their spare time without pay to organize their neighbors up and down the rural electric lines into telephone cooperatives. Electric co-op leaders helped by publicizing the progress of the new telephone program in their newsletters. Many helped telephone co-ops prepare ap-

Program Progress



Joint-use of poles with electric suppliers was encouraged by REA as a cost-cutter. Many electric systems went farther and helped establish telephone systems.

plications for loans to REA, advised telephone co-op directors on important phases of the REA program, and made membership lists available for mailing and canvassing purposes.

On July 1, 1952, REA reorganized to provide better service for its borrowers. Separate divisions were created to concentrate on the telephone program. The change also meant a 50 percent increase in the telephone staff to expedite processing the heavy volume of telephone loan applications.

By the end of October 1952, loans had been approved for 216 telephone systems located in 39 states. Cutover to dial ceremonies became so numerous that they were grouped in the REA magazine by the month they were scheduled to occur. The December 1952-January 1953 issue of *Rural Electrification News* listed 16 scheduled cutovers; by the April-May issue, the list had grown to 34.

Both the number of borrowers and the amount of funds committed to telephone loans grew by leaps and bounds during the 1950's. The 1952 Annual Report of the REA Administrator showed a cumulative loan program of \$82.3 million to 190 borrowers.

By 1955, the number of borrowers had grown to 351 and the loan totals topped \$234 million.



Service outages and poor transmission—once accepted as part of rural service—are no longer tolerated.



By helping to develop the economic potential of the communities they serve, rural telephone systems build financial and operating strength—benefit all subscribers.

Five years later, REA was reporting cumulative loans of nearly \$700 million, with 705 borrowers located in 45 States.

By the mid-1960's, the need for growth capital by rural telephone systems began to outstrip the available supply of REA loan funds. At the end of fiscal year 1965, the dollar amount of loan applications on hand in REA exceeded the total funds loaned during the year by \$25 million. By the end of fiscal year 1966, this backlog of loan applications on hand was double the year's loan program, and it became necessary to employ more selectivity in analyzing loan needs of individual borrowers in order that the most pressing requirements of the program would be met.

In 1966, legislation was introduced in the Congress to establish a Federal Bank for Rural Telephone Systems to provide supplemental loan capital. Purposes of bank loans were to be the same as those governing REA 2 percent loans as well as to improve the efficiency, effectiveness or financial stability of borrowers' systems.

Bank loans were to be made at an "intermediate loan" rate of interest, reflecting the current average yield on marketable securities of the United States having comparable maturities, but with a 4 percent interest ceiling. Increased interest rates, it was felt, would thus provide a credit ladder by which borrowers would be able to advance to paying the full market cost of money for their financing.

Although the legislation failed passage, many of its ideas were later incorporated into a bill which resulted in the creation in 1971 of the Rural Telephone Bank.

The Rural Telephone Bank

In 1971, the Rural Telephone Bank was established by amendment to the Rural Electrification Act to provide a supplemental source of financing for rural telephone systems. An agency of the United States, the bank is managed by a governor and board of directors, some of whom are elected from among the bank's borrowers. The REA administrator serves as governor, and the 13-member



Operating procedures for the Telephone Bank were developed by an Advisory Committee of REA and USDA employees.



The Telephone Bank's board of directors includes representatives from the Federal Government, Bank stockholders and the general public. The REA Administrator serves as Bank Governor.

board includes representatives of the Federal Government, the bank's stockholders, and the general public. Three directors are elected by cooperative-type stockholders and three are elected by commercial types.

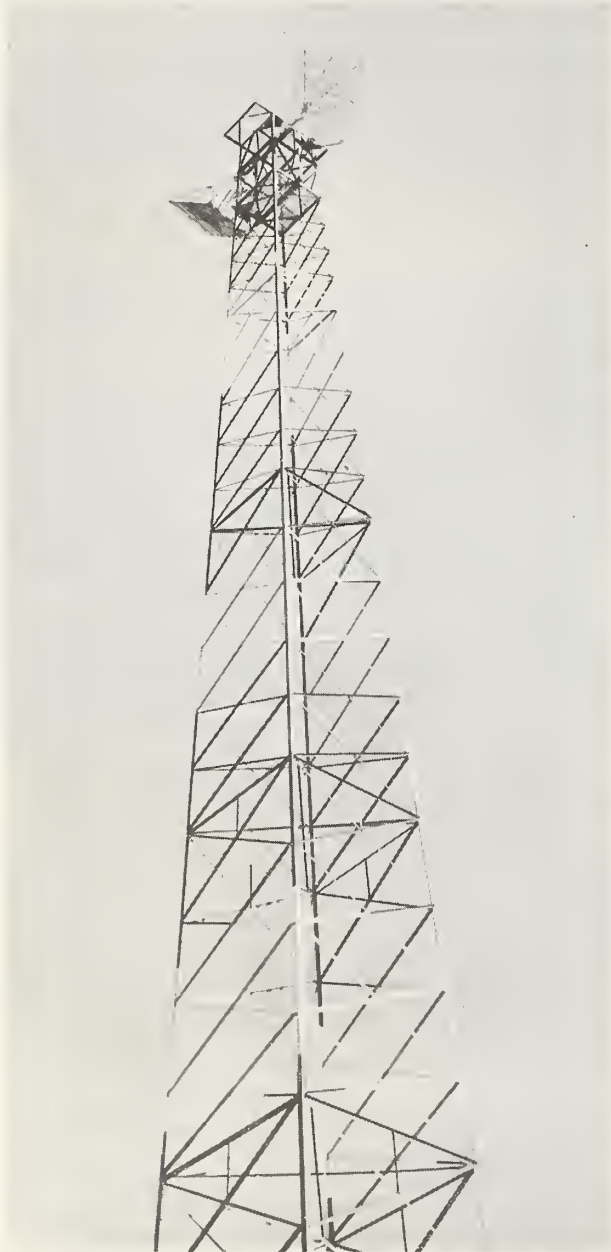
The bank has no staff of its own, but utilizes the facilities and staff of REA and other USDA agencies to carry out its program. Bank ownership is shared by the Federal Government with the bank's borrowers. Ultimately the bank will become completely borrower-owned and controlled.

The interest rate originally established for bank loans ranged from 4 to 8 percent based on bor-

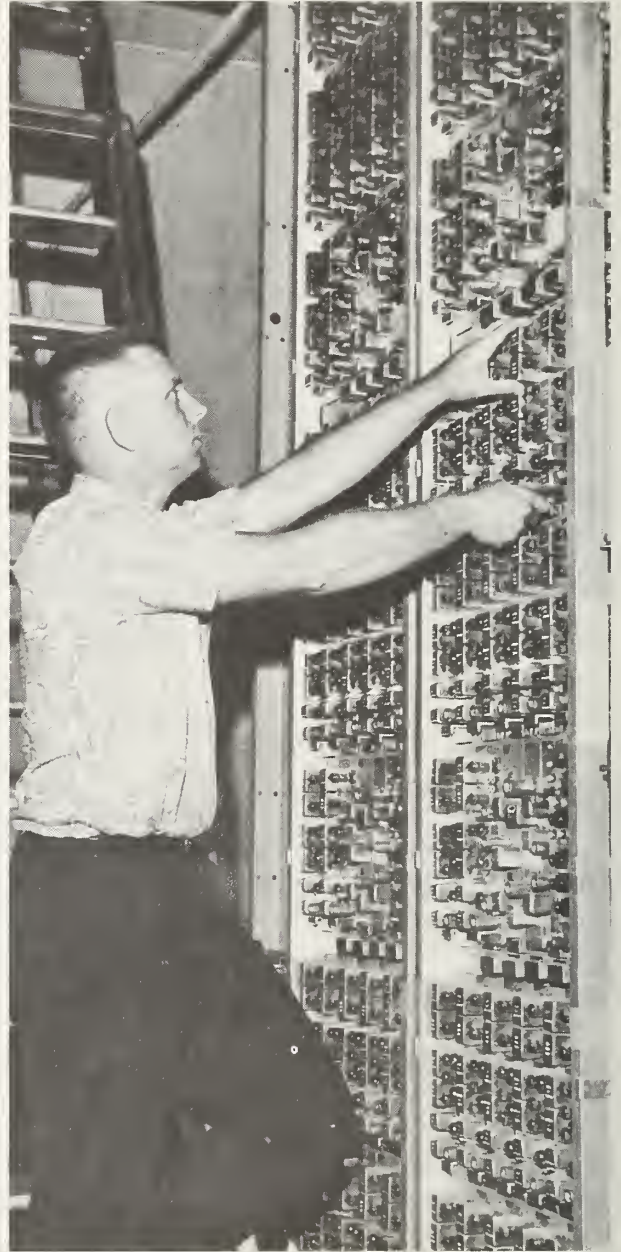
rowers' ability to pay. This was later changed to the bank's cost of money as determined by the governor.

Capital stock consists of three classes: Class A stock, to be purchased by the Federal Government (not more than \$30 million annually until \$300 million is purchased); Class B stock, to be pur-

chased by recipients of bank loans as a requirement; and Class C stock, available for purchase by entities eligible to borrow from the bank and organizations controlled by them. In addition to the sales of stock, the bank is authorized to obtain funds from the sale of its debentures and other evidences of indebtedness. These may be sold to the U.S. Treasury or in the money market.



Microwave relay is often substituted for cable to tie in rural systems with the world-wide telephone network.



Toll calls, automatically dispatched through Direct Distance Dialing equipment, make long-distance calling simple.

Public Law 93-32

On May 11, 1973, the Rural Electrification Act was again amended to expand the resources available for financing rural telephone systems, provide for insured and guaranteed loan programs at reasonable interest rates, and reduce the impact of the REA program on the Federal budget.

A revolving fund was established in the U.S. Treasury as a source of all REA loans. This fund will be replenished through collections on outstanding and future REA loans, and from the sale of borrower notes to the Secretary of the Treasury or the private money market. Limitations on the amounts authorized for loans may be imposed by the Congress annually.

Loans at three different interest rates are now available to rural telephone borrowers. REA loans carry interest rates of 5 percent and 2 percent, and Telephone Bank loans carry an interest rate pegged at the bank's cost of money.

The interest rate charged on a specific loan is determined by REA according to each borrower's qualifications. If a borrower meets the criteria for a Telephone Bank loan, the loan will be made by the bank.

To qualify for an REA loan at either 5 percent

or 2 percent, a borrower must have a projected average subscriber density of three or fewer per mile or be unable to meet the Telephone Bank's interest coverage test. Two percent loans are available for borrowers with an existing subscriber density of two or fewer per mile, or with an average gross revenue per mile of at least \$300 below the average for all telephone borrowers. Two percent loans are also available to borrowers meeting certain special criteria.

Civil Rights

REA policy with respect to civil rights is to recommend to those systems it finances that a positive approach be taken. Borrowers are encouraged to develop programs which will insure that no person shall, on the ground of race, color or national origin, be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination. These programs also apply to borrowers' employment practices. This encouragement stresses the "good business" aspects of civil rights efforts, rather than their requirement by law.

Although an REA policy statement on civil



The use of data sets and other specialized services increases as rural systems improve their service capabilities. Businesses are linked to computer centers for record preparation, billing and other operations.

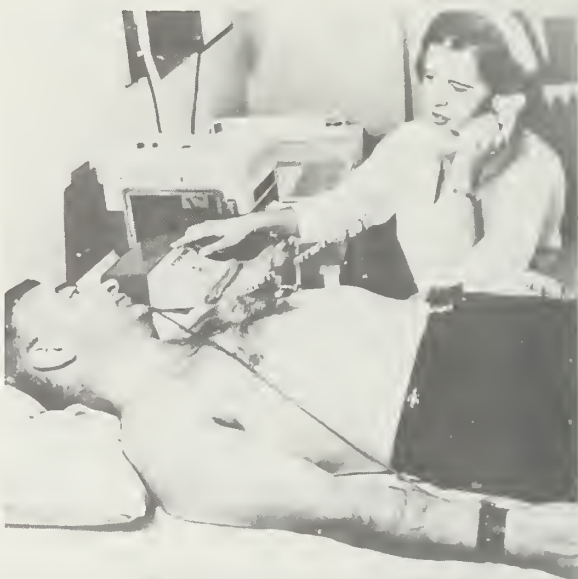
rights was first issued in 1965, it was not until 1970 that borrowers began to exhibit real progress. Even though there has not been as much progress as many in the program would have de-

sired, borrowers have indicated, through their actions over the past several years, an ever-increasing awareness of the benefits to be gained from positive civil rights programs.

As improved living conditions encouraged more people to move to rural areas, their demands for telephone service strained the capabilities of even the most efficient rural telephone systems. After 50 years of good service to its patrons, a magneto system in rural Virginia found itself in such a position. Designed to provide adequate service for about 100 phones, the company was struggling to accommodate nearly 700 subscribers over its single switchboard. With two operators working at a time—usually without lunch breaks and with considerable overtime—each phone call had to be taken on an emergency basis. Necessary repair parts had to be made by hand because most had been discontinued by manufacturers.

Some party lines served as many as 15 people. One circuit to a nearby trade center was kept busy 95 percent of the time, and over 70 percent of the calls made on the system were never completed. Of those that were, some callers were forced to wait as long as 45 minutes to get through.

An REA loan enabled this company to convert to single-party dial service, with provisions for at least 1,000 telephones.



Improved telephone service offers many benefits to the rural subscriber. "Live" electrocardiograms over regular telephone lines are now beyond the experimental stage.

Top REA officials in the Rural Telephone Program 1949-1974

Administrators



Claude R. Wickard
1945-1953



Ancher Nelsen
1953-1956



David A. Hamil
1956-1961



Norman M. Clapp
1961-1969



David A. Hamil
1969-Present

Deputy Administrators



George W. Haggard
1949-1951



William C. Wise
1951-1953



Fred Strong
1954-1958



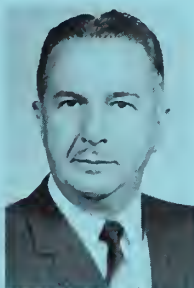
Ralph Foreman
1958-1961



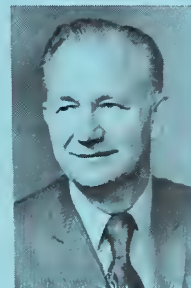
Richard A. Dell
1961-1966



Richard M. Hausler
1966-1969



Everett C. Weitzell
1969-1973



George P. Herzog
1973-1974



David H. Askegaard
1974-Present

Assistant Administrators— Telephone



J. K. O'Shaughnessy
1953-1957



Norman H. McFarlin
1957-1960



Frank Renshaw
1961-1973



Charles R. Ballard
1973-Present

